# Thai Industrial Standard
# Chemical Laboratory Safety Management System Part 2: General guidelines: Principles, Systems and Practical Techniques

## 1. Scope

1.1 This industrial standard specifies requirements for chemical laboratory safety management system to develop a safety management system for the laboratory.

1.2 This industrial standard does not cover the requirement for radioactive materials and biological materials.

## 2. Definitions

For the purposes of this document, the following terms and definitions apply as TIS 2677, part 1, and

2.1 Laboratory safety officer:

A person or a group of people with competence and assigned to monitor and evaluate laboratory safety performance.

2.2 Hazardous waste:

Waste in the form of solids, semi-solids, liquids and gases which have properties, or contaminated with hazardous substances then exhibits one or more other properties, as follows: explosive, flammable, oxidizable, peroxidizable, corrosive, illness-causing, radioactive and highly toxic (such as carcinogens, irritants, allergens, mutagens and teratogens).

2.3 Incident:

Undesired event that does result in an accident or near miss.

2.4 Near miss:

Undesired event that could result in an accident.

2.5 Sanitary system:

Sanitary system for buildings and laboratory. The system consists of two main subsystems: water supply system such as cold water system, distilled water system, hot water system etc., and drainage and wastewater treatment systems such as sewage system, rainwater drainage system,

ventilation system, and wastewater treatment system (for both waste water and chemical contaminated wastewater) etc.

## 3. Guidelines for implementation

### 3.1 Laboratory Safety Policy

Top Management should set a laboratory safety policy as an integral part of their corporate policy. The laboratory safety policy should take into account the following principles:

(1) participation of workers by consulting with the workers, collecting and proposing information to top management for making decision.

(2) documentation, approval and distritbution to workers and interested parties.

#### 3.1.1 General Principles.

To have effective and efficient laboratory management and to implement laboratory safety measures in accordance with the 7 elements of the laboratory safety management framework systematically, planning, implementation, monitoring, evaluation, and management review based on data should be done continuously and consistently.

#### 3.1.2 Safety Management Process

Top Management should demonstrate leadership in implementing laboratory safety management system by communicating to all workers and encouraging the cooperation through safety management organization structure. Top Management should monitor and evaluate the process periodically such as follow up meetings on the system implementation or reporting the performance. Nevertheless, safety operations should be approved by the safety management organization structure.

Top Management should set a laboratory safety working committee consisting of experienced personnel from various backgrounds, to establish laboratory safety management systems.

A laboratory safety working committee should make safety culture within the organization.

### 3.2 Planning

#### 3.2.1 Risk Management

The organization should set laboratory risk management plan with elements and details as follows:

(1) goal, objectives, responsible person, budget and time-frame for the activities;

(2) working team should be persons from relevant function. The plan should be approved by safety management structure prior to implementation;

(3) laboratory risk managemnt activities may be an activity or a continuous process. The activities should be monitored, revivewed and make relevant person;

(4) laboratory risk management activities may be cooperated with other activities and/or be cooperated with other activities within the organization;

(5) systematic methods and tools for risk assessment and there are elements that cover the laboratory safety issue for assess and manage risk by using checklist as a tools (see Appendix A. for sample of laboratory safety checklist);

(6) methods of analysis and evaluation of performance and effectiveness of risk management;

(7) clear performanace report to the organization's management for review;

(8) manager of the laboratory should consider risk management activities, monitor, provide resources, including participating to review the risk management process.

3.2.2 Legal and other requirements

The organization should establish procedure to identify and access legal and other requirements. These requirements are taken into account in laboratory safety management. They should include standards or guidelines set by professional associations or international organizations.

When identifying legal and other requirements, the relevant clauses should be identified and the relevant acitvities and functions defined. How they are applied should be defined in the relevant procedure and communicated to the relevant functions.

The laboratory should assign a responsible person and determin the frequency to monitor the changes of legal and other requirements to ensure that they are up-to-date.

3.3 Implementation and Practice

3.3.1 Responsibility and authority

Top Management should realize that the effectiveness of laboratory safety management system requires the support and acceptance of relevant personnel. Knowledge and experience of personnel will be a valuable resource for the improvement and

implementation of the laboratory safety management system. At a minimum, 2 levels of hierarchy of responsible should be appointed, as follows:

(1) Safety management representative

Safety management representative should be approved by top management.

Top Management or person assigned to direct and control laboratory will be a chairman of safety management of the organization. The authority and responsibility could include:

(1.1) supervise laboratory safety management system and maintain in accordance with this standard;

(1.2) report the performance to top Management for review and used as a basis for improvement of the laboratory safety management system to comply with the policy.

(2) Laboratory safety officer

Laboratory safety officer is appointed by top Management or organization's safety management chairman. This person should be a member of the safety management committee. The authority and responsibility includ:

(2.1) planning and implementing laboratory safety management, which could at least include;

(2.1.1) orientation and training of relevant personnel,

(2.1.2) monitoring the operations to meet safety requirements,

(2.1.3) perform internal audit and performance evaluation that may affect safety,

(2.1.4) maintain the effectiveness of the system, including management review,

(2.1.5) Prepare and respond to emergency situations.

(2.2) setting policies and systems for access of non-laboratory staff such as cleaning worker, maintenance contractor and visitors, for the safety of personnel and property;

(2.3) stopping any unsafe activities.

3.3.2 Chemical management

Guidelines for chemical mangement should cover the following:

(1) chemical data management, and chemical directory could include the following:

(1.1) provide chemical record system with chemical details, at least include chemical identification, CAS No., hazard identification, quantity, storage, date of receipt and expiration date. These data maybe kept in hard copy or digital media,

(1.2) record chemical transfer, receiving and withdrawing, and keep it up-to-date in the defined report,

(1.3) utilize data for management.

(2) Safety Data Sheet, SDS;

Provide safety data sheet at point of use or at the laboratory. The data should be comprehensive, up-to-date and easy to access.

(3) chemical storage could include the following:

(3.1) provide chemical storage chart, taking into account the potential hazards of storing chemicals such as chemical incompatibility, safety storage, and warning sign at chemical storage area,

(3.2) provide label with details and characteristics of chemicals and the potential hazard which can be referred to international systems such as Globally Harmonized System (GHS),

(3.3) install barrier at chemical shelf,

(3.4) set chemical control measures for preventing physical and fire hazards. These measures need to be monitored and recorded regularly to ensure the safety operation,

(3.5) provide measures and equipments to respond the case of chemcial spills with consideration the volume and hazards, and provide any equipments to respond other emergency situation such as fire and ignition from the chemical,

(3.6) keep harmful liquid chemical, for example : acidic or alkaline chemicals, below eye level, keep firmly large containers at ground level and easy to carry, and use secondary container to prevent and mitigate in case of spill,

(3.7) provide an appropriate and well-ventilated area to store compressed gas and cryogenic material,

(3.8) provide equipment for holding gas cylinder such as a chain,

(3.9) keep flammable gases and liquids away from heat and ignition source such as sunlight and motors,

(3.10) keep a minimal amount of flammable gases and liquids in the laboratory,

(3.11) keep the flammable liquid in a closed container,

(3.12) store flammable liquid in the explosion-proof refrigerator,

(3.13) install electrostatic prevention system for metal containers that are used to store large amount of flammable liquid,

(3.14) provide adequate ventilation system for chemical storage room.

(4) Chemical handling could include the following:

(4.1) follow the safety data sheet,

(4.2) use appropriate container and cart, and wear suitable personal protective equipment when transporting chemicals,

(4.3) close the chemical container lid while transporting chemicals,

(4.4) separate container for each chemical while transporting incompatible chemicals.

(4.5) use shockproof material when transporting chemicals.

3.3.3 Hazardous waste disposal

Guideline for waste disposal should cover the following:

(1) waste data mangement could include the following:

(1.1) provide recording system for reporting data of waste generated and waste disposal, and ensure the data is up-to-date,

(1.2) provide report format that is composed of type and amount of waste,

(1.3) utilize data for management.

(2) Waste handling could include the following:

(2.1) separate hazardous waste from general waste,

(2.2) use appropriate waste containers for types and hazards and provide labels that identify types and hazards for each waste,

(2.3) separate waste by type in specific storage area that is appropriate to the type of hazards,

(2.4) set the amount and retention time for storage of the waste,

(2.5) provide layout for waste storage,

(2.6) provide adequate ventilation for waste storage area.

(3) Waste disposal could include the following:

(3.1) waste that contains no toxic chemicals and hazardous waste that has been treated can be disposed as non-hazardous waste,

(3.2) hazardous waste that cannot be treated must be treated by outsource permitted by authorized agency,

(3.3) set measure to reduce waste or reduce degree of toxicity of waste before disposal.

(4) Reduction of hazardous waste:

Set measure to manage source of the hazardous waste include reducing the use of chemical and use substitute materials that are less harmful.

3.3.4 Physical characteristics of the laboratory.

Guildlines on physical characteristics of the laboratory should cover the following:

(1) architecture;

(1.1) ensure inside and outside environment do not cause harm,

(1.2) separate laboratory space from non-laboratory space,

(1.3) provide space and ceiling height of laboratory room and other room that are suitable to operation, number of operators, types and quantity of the equipment and tools,

(1.4) provide surface of floor, wall and ceiling with suitable material for the operation, and provide regular maintenance,

(1.5) provide suitable size and appropriate quantity of openings (doors-windows) which can be controlled accessibility and easy-to-open in case of emergency,

(1.6) provide area and interior information including floor plan, current location, fire escape route, and emergency equipment location.

(2) interior design: furnitures, tools and equipments

(2.1) provide access control system or access control device to operate furnitures, tools and equipments,

(2.2) provide furnitures, tools and equipments appropriate to need and capability of workers,

(2.3) set appropriate location and space for lab table,

(2.4) provide and maintain other accessories such as chemical hood, laminar flow hood in good condition.

(3) structural engineering;

(3.1) ensure inside and outside environment do not cause harm, no structural damage and no crack in pillars or beams,

(3.2) provide building structure that can support building load (dead loads and live loads) and has capability of fireproof and fire resistance, and designed for response emergency situation,

(3.3) inspect and maintain building sturcture regularly.

(4) electrical and lighting engineering;

(4.1) provide sufficient light, suitable for the environment and the type of work,

(4.2) design power system to provide sufficient power to all types of load. Total current should not exceed capacity of metering equipment of the unit,

(4.3) use certified standard electrical equipment, outlets, and sockets. The power supply is installed in the appropriate area,

(4.4) install grounding and have electrical control system for each laboratory, and install suitable overcurrent protective device such as fuse, circuit breaker,

(4.5) install emergency lighting in adequate quantity and at suitable area,

(4.6) inspect and maintain electrical and lighting system regularly.

(5) sanitary and environmental engineering;

(5.1) provide suitable cold water system that has layout and piping system conform to standard, and no leakage.

(5.2) separate wastewater systems from chemicals contaminated wastewater, and provide suitable wastewater treatment prior to discharge to public area.

(5.3) inspect and maintain sanitary system regularly.

(6) ventilation and air-conditioning system;

(6.1) provide suitable ventilation for the operation and environment of the laboratory,

(6.2) install air conditioning at the suitable location and adequate for the operation and environment of the laboratory,

(6.3) in the case that natural ventilation is not adequate, mechanical ventilation should be provided in the areas where tasks generate toxic gases and odor,

(6.4) inspect and maintain ventilation and air conditioning system regularly.

(7) emergency and communmication systems;

(7.1) provide manual fire alarm system and fire detectors.

(7.2) provide means of egress and marking that conform to standard,

(7.3) provide portable fire extinguishers.

(7.4) provide water-based fire protection system, standpipe and hose type,

(7.5) inspect and maintain fire protection system regularly,

(7.6) provide emergency communication system such as office phone, mobile phone, internet and wireless systems.

(7.7) inspect and maintain emergency and communication systems regularly,

(7.8) display information labels such as laboratory name, laboratory supervisor(s), and any other specific information of the laboratory including symbols or universal symbols indicating danger or related symbols as required by law.

3.3.5 emergency preparedness and response

Guidelines for preparedness and emergency response should cover the following:

(1) emergency management and response;

(1.1) identify potential emergency situations,

(1.2) provide standardized equipment for response to emergency situation such as emergency eye wash and emergency shower in the laboratory,

(1.3) provide emergency supplies and first aid kits that are available and readiness for access in the case of emergency such as glass cut wound, skin burn,

(1.4) provide antidotes specified to the hazard of laboratory operation.

(2) emergency preparedness and response plan;

(2.1) establish emergency preparedness and response plan including a practical first aid procedure and a responsible person assigned. Emergency response equipments are provided. Staff and related personnel understand how to respond to the emergency situation,

(2.2) conduct emergency response drill at least once a year.

(2.3) inspect emergency response tools and equipment regularly to ensure readiness such as emergency eye wash, emergency shower,and inspect and re-supply medical supplies for emergency situation,

(2.4) inspect building and surrounding area regularly for emergency response such as assembly area, ladder and fire escape routes,

(2.5) arrange for preliminary response measures to mitigate the consequence of emergency situation and respond to emergency situation (chemical spill, flood, fire) for example,

(1) cleaning equipment at accessible location.

(2) adequate and suitable absorbent to the type of chemicals such as vermiculite to absorb liquid hazardous substances etc. Replace used supplies and deteriorated equipment, and inspect periodically,

(3) check emergency response equipment at planned intervals regularly to ensure availability, quantity, and accessibility,

(2.6) provide emergency communication systems that cover the following;

(1) notification to internal and external agencies,

(2) alert notification,

(3) evacuation,

(4) inspection and maintainance of emergency communication systems regulary,

(5) Test of communication system, for example, no change in telephone number, radio frequency is available, and alarm is operable.

(3) The use of personal protective equipment, PPE;

Selection of personal protective equipment (PPE) should be based on the operations ,type and amount of chemicals used in the laboratory and the result of risk assessment.

(4) code of conduct for Laboratory should include;

(4.1) safety regulation could include;

- wearing suitable lab gown,
- always wearing shoes that have toe cap and heel cap in the laboratory,
- washing hands before leaving laboratory area,

- no working alone in the laboratory area,
- avoid activities that cause risk of getting expose to chemicals such as face makeup,
- no storing or eating food and drink in laboratory area,
- no smoking in the laboratory area,
- no storing unnecessary items or accumulated trash in laboratory area, walkway and entrance hallway.

(4.2) equipment operating and chemical handling regulation could include;

- regulation for working with highly hazardous substances.
- sign board at the equipment operating, including name and phone number of the operator.
- locate tools and equipment on laboratory table at designated area, and keep them clean, and locate any tool or equipment that is likely to cause smoke, vapors, high temperatue steam, odor and toxic in appropriate areas.

(4.3) regulation for visitor could include;

- assignment of responsible person,
- Visitor data,
- safety brief, safety caution or safety training before entering laboratory,
- the use of appropriate personal protective equipment prior to entering laboratory.

3.3.6 Educating and initiating consciousness

Guidelines for educating and raising awareness should cover the following:

(1) provide knowledge to all staff including transporter and cleaners about safety practices relevant to their jobs,

(2) establish training plan, including initial training for new personnel and re-fresh training for current personnel, by requiring everyone to review safety instructions and related procedures prior to start the job, and retain the training record

(3) ensure that safety training plan includes content covering fire prevention and preparedness and chemical safety based on risk assessment and behavioral factors,

(4) establish evaluation system to assess that everyone understand the information provided.

3.3.7 Document managerment

Guidelines to manage documentation required by the safety management system to ensure they are up-to-date and ready to use should cover the following:

- Define process to issue, amend, review, verify, and approve documents, as well as process to obsolete them by authorized person as stated in Clause 3.3.1;
- establish master list of documents and process to distribute the documents;
- provide the latest version of document at points of use, and identify current revision status of documents. The obsolete documents should be removed unless there is measure to prevent unintended use;
- ensure that the documentation of the laboratory safety system can describe the main elements of the management system and their interaction, and reference to related documents;
- establish adequate documentation which take into account the risk assessment in order to manage laboratory safety management system effectively. These documents can be in form of hard copy or digital media and accessible for workers.

Example of these documents could include:

(1) safety manual with contents include:
   - scope of management system,
   - requirements or standard reference,
   - organization structure, authority and responsibility,
   - objectives and goals of the laboratory with indicators (optional),
   - procedures required by the standard,

(2) emergency preparedness and response plans;

(3) operation and maintenance manuals of tools and testing equipments;

(4) user and maintenance manuals of personal protective equipment (PPE);

(5) procedures related to the followings:
   (5.1) regulations for visitios or contractors,
   (5.2) health surveillance,
   (5.3) preparation and implementation of risk management,

(5.4) control inventory that cover chemicals and hazardous substances identification as well as requirement of label description, handling and disposal.

(5.5) handling of hazardous materials,

(5.6) preventive measures of mis-using highly hazardous materials,

(5.7) training and recording,

(5.8) receiving, controling and distribution of materials, including safety data sheets,

(5.9) decontaminating and maintenance of equipment,

(5.10) emergency preparedness and response.

(6) Incident records, reports and investigations.

Record is a type of document prepared in accordance with the requirements, and as necessary determined by laboratory in order to effectively plan, implement and control the risk.

3.4 Monitoring and evaluation of compliance

Guidelines for monitoring and evaluation should cover the following:

(1) monitor and evaluate the compliance of all activities in the laboratory safety management plan, and determine whether objectives are achieved;

(2) monitor and evaluate the compliance of the laboratory safety management system by using the result of deficiency from plan, nonconformity record, accident and near miss report. These data should be analyzed their cause(s) to conduct correction and corrective action in order to prevent recurrence;

(3) provide annual health checkup to workers and monitor workplace according to the risk at least once a year.

The organization should keep result of monitoring and evaluation of compliance as the management review input.

3.5 Management review

Top Management should consider the results of performance monitoring and evaluation of compliance include internal and external issues such as the change in the organization structure, existing guideline on the safety management available within the organization, best practice and performance in the other organization, amendments of legal requirement, the introduction of new

technology etc, for assessing opportunities for improvement and for continual improving the laboratory safety mangement system.

# Appendix A.

## Sample of safety survey in the laboratory

The information described is a guideline for surveying, collecting and evaluating factor related to safety of laboratory by using 'Checklist'. The organization may have different approaches or methods to implement this survey. More details can be found in the laboratory safety assessment manual (refer to the appropriate methods).

## ESPReL Checklist

## 1. Safety management system

The purpose is to assess the commitment at policy level to the important of laboratory safety. The organization should establish policy, action plan, safety organization structure and responsibility. The objective output can be announment, appointment of director and/or action plan from participation of relevant function.

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory set security policy in the following levels?<br>☐ university or department;<br>Defined document : .....( attach file)<br>☐ faculty or division;<br>Defined document : .....( attach file)<br>☐ department or agency;<br>Defined document : .....( attach file)<br>☐ laboratory;<br>Defined document : .....( attach file)<br>☐ others. (enter name of the agency.....)<br>Defined document : .....( attach file) | | | | |
| 2. Does laboratory set safety plan in the following levels?<br>☐ university or department;<br>Defined document : .....( attach file)<br>☐ faculty or division;<br>Defined document : .....( attach file)<br>☐ department or agency;<br>Defined document : .....( attach file)<br>☐ laboratory;<br>Defined document : .....( attach file)<br>☐ others. (enter name of the agency.....)<br>Defined document : .....( attach file) | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 3. Does laboratory set safety management structure in the following levels?<br>☐ university or department;<br>Defined document : ……..( attach file)<br>☐ faculty or division;<br>Defined document : ……..( attach file)<br>☐ department or agency;<br>Defined document : ……..( attach file)<br>☐ laboratory;<br>Defined document : ……..( attach file)<br>☐ others. (enter name of the agency…..)<br>Defined document : ……..( attach file) | | | | |
| 4. Does laboratory assign personel with safety responsibility in the following areas?<br>☐ chemical management;<br>Name and title of the assigned person<br>☐ waste management;<br>Name and title of the assigned person<br>☐ physical characteristics of laboratory, equipments and tools;<br>Name and title of the assigned person<br>☐ hazard prevention and correction;<br>Name and title of the assigned person<br>☐ providing basic knowledge about laboratory safety;<br>Name and title of the assigned person<br>☐ record management and documentation;<br>Name and title of the assigned person<br>☐ others, specify. …<br>Name and title of the assigned person | | | | |

# ESPReL Checklist

## 2. Chemical management system

To assess the status of chemicals in the laboratory. The organization should establish system to manage chemical in the laboratory includes documentation, chemical storage, chemical transportation and unused substance handling that can track chemical movement and control chemical risk. One most important for chemical management system is 'Chemical Inventory', without it, the effectiveness of management and handling chemical will not be possible. When chemical information is summarized and reported periodically, they can be used to mange risk, share chemicals, and support management and allocate budget.

### 2.1 Chemical Information Management

#### 2.1.1 Record System

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is chemical information recorded in form of?<br>☐ document;<br>☐ electronic media. | | | | |
| 2. Does structure of the chemical information consist of the following?<br>☐ bottle ID;<br>☐ chemical name;<br>☐ CAS no.;<br>☐ Hazard classification;<br>(specify standard system ….)<br>☐ bottle volume;<br>☐ chemical volume/weight;<br>☐ grade;<br>☐ price;<br>☐ location;<br>☐ received date;<br>☐ open date; | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| ☐ supplier;<br>☐ manufacturer;<br>☐ expiry date;<br>☐ others, specify…. | | | | |

2.1.2 Chemical inventory

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is there record of chemical receiving? | | | | |
| 2. Is there record of chemical withdrawal? | | | | |
| 3. Is data updated regularly?<br>Specify the frequency of the audit and revise the database. | | | | |
| 4. Is there report of the movement of chemicals in the laboratory, at least it should include the following topics.<br>■ Chemical name<br>■ CAS no.<br>■ hazard classification<br>■ chemical volume/weight<br>■ storage location<br>Specify an example of report ……(attach file) | | | | |

2.1.3 Clearance

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory set guidelines for clearance as follows:<br>☐ Unused chemicals;<br>Specify process, method, or frequency…<br>☐ expired chemicals as label identified;<br>Specify process, method, or frequency…<br>☐ expired chemicals by condition? | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| Specify process, method, or frequency… | | | | |

2.1.4 Using information for management

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory set process for using chemical information to:<br>☐ assess risk;<br>Specify how to use.. (or attach file)<br>☐ allocate budget;<br>Specify how to use.. (or attach file)<br>☐ share chemicals.<br>Specify how to use.. (or attach file) | | | | |

## 2.2 Chemical Storage

2.2.1 General requirements for storing chemicals

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is Chemical storage categorized according to chemical incompatibility?<br>Specify the name of the standard system and sample chemicals. | | | | |
| 2. Does laboratory keep solid chemicals away from liquid chemicals both in chemical storage room and laboratory? | | | | |
| 3. Is chemical storage at shared area identifed the following:<br>☐ chemcal name and responsible party;<br>☐ Name of the responsible party for each cabin;<br>☐ hazard symbol? | | | | |
| 4. Does laboratory store chemicals safely at the exact location and not place chemicals on the corridor? | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 5. Is there a sign indicating the area where hazardous chemicals are stored? | | | | |
| 6. Is there control system for special chemical?<br>Specify sample chemical and methods of control… | | | | |
| 7. Does laboratory not use the hood as storage area for chemicals or waste? | | | | |
| 8. Does laboratory not place chemical container on table and shelf permently? | | | | |

**2.2.2 Requirements for storing flammable substances**

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory keep flammable substances away from heat source, ignition source, flame, spark and sunlight? | | | | |
| 2. Does laboratory keep flammable substance in laboratory in a containers with capacity not exceed 20 L (carboy)? | | | | |
| 3. Does laboratory keep flammable substance in laboratory in the amount of less than 10 gal (38 L)? If the amount is more than 10 gal (38 L), is it stored in storage cabinet for flammable liquid container? | | | | |
| 4. Does laboratory store highly flammable substances in the hazardous storage containe or explosion-proof refrigerator?<br>Specify sample of highly flammable substances… | | | | |

**2.2.3 Requirements for storing corrosive substances**

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory keep bottles of corrosive substances (both acid and base) at the ground level? | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 2. Does laboratory keep acid in corrosive storage cabinet and appropriated secondary container?<br>Specify type of cabinet and secondary container…. | | | | |

2.2.4 Requirements for gas storage

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory keep gas cylinder with suitable holder? | | | | |
| 2. Does laboratory provide cylinder valve guard/cap for unused gas cylinders? | | | | |
| 3. Does laboratory provide area for storing empty cylinders and unused gas cylinders? And is that area install label identified the gas name? | | | | |
| 4. Does laboratory keep gas cylinders away from heat source, ignition source and not obstructing main traffic? | | | | |
| 5. Does laboratory keep oxygen gas cylinders away from fuel tank, flammable gas and combustible material at least 6 m, or is there fire resistance wall installed?<br>Specify distance or fire resistance material…. | | | | |

2.2.5 Requirements for storing oxidizers and peroxide–forming materials

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory keep oxidizing agents and peroxide–forming materials away from heat, light, and ignition source?<br>Specify example of oxidizing agents and peroxide–forming materials available in the laboratory and storage locations. | | | | |
| 2. Does laboratory keep oxidizing agents in glass container or in inert container? | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 3. Does laboratory provide suitable cap for oxidizing agent container? | | | | |
| 4. Does laboratory provide suitable cap for peroxide–forming materials container? | | | | |
| 5. Does laboratory monitor peroxide reaction regularly? Specify frequency of the monitoring. | | | | |

2.2.6 Requirements for storing high reactivity substances

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is there warning sign at cabinet or storage area (for example, label "high reactivity agent – do not use water"? | | | | |
| 2. Does laboratory keep agent that can react water away from source of water in the laboratory? Specify examples for agent that can react water in the laboratory and storage locations. | | | | |
| 3. Does laboratory inspect storage condition of the reactive agent regularly? Specify frequency of the inspection. | | | | |

### 2.2.7 Packaging and Labeling

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory store chemicals in suitable containers by type of chemical? | | | | |
| 2. Are chemical containers suitable labeled? | | | | |
| 3. Does laboratory inspect chemical container and label regularly?<br>Specify inspection procedure, or frequency or date of the last inspected. | | | | |

### 2.2.8 Safety Data Sheet, SDS

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is SDS kept in the format of?<br>☐ Document;<br>☐ Electronic. | | | | |
| 2. Is SDS kept in place where everyone can access when needed or when emergency situation occurred?<br>Specify location of the SDS…. | | | | |
| 3. Does SDS contain all 16 topics as international standard? | | | | |
| 4. Does laboratory provide SDSs of all hazardous chemicals in the laboratory.<br>Specify quantity of hazardous chemicals in the laboratory… | | | | |
| 5. Is SDS up-to-date?<br>Specify frequency of revising or date of the last updated … | | | | |

## 2.3 Chemical transportation

### 2.3.1 Chemical transportation within laboratory

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does person who transporting chemicals use suitalble personal protective equipment? Specify example of personal protective equipment… | | | | |
| 2. Does laboratory close the lid of the chemical containers tightly before transporting? | | | | |
| 3. Does laboratory use cart installed bun when transporting many chemicals together? | | | | |
| 4. Does laboratory use basket or secondary container when transporting chemicals? | | | | |
| 5. Does laboratory use shockproof material when transporting flammable liquid chemicals? | | | | |
| 6. Does laboratory use rubber bucket when transporting corrosive substances such as acids and solvents? | | | | |
| 7. Does laboratory keep incompatible chemicals in separate containers during transporting? | | | | |

### 2.3.2 Chemical transportation outside laboratory

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory use suitable secondary container and transporting equipment during transporting chemical? Are they safe, rigid and installed bun to prevent chemical containers falling down? | | | | |
| 2. Does laboratory use cart installed bun to prevent chemical containers falling down? | | | | |
| 3. Does laboratory keep incompatible chemicals in separate containers during transporting? | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 4. Does laboratory use elevator when transporting chemicals and hazardoud substances between floors? | | | | |
| 5. Does laboratory use absorbent or shockproof material during transporting?<br>Specify absorbent or shockproof material used… | | | | |

## ESPReL Checklist

### 3. Waste management system

Waste Management System is the system to assess status of waste management in the laboratory, including information system, classification and waste handling, prior disposal/treatment that can track the movement. This information will be useful for managing waste, assessing risk from hazardous waste, and supporting to allocate budget for management.

### 3.1 Waste Management

#### 3.1.1 Recording system

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is waste information recorded in form of:<br>☐ document;<br>☐ electronic media. | | | | |
| 2. Is structure of the waste information consists of the following?<br>☐ responsible person;<br>☐ bottle ID;<br>☐ type of waste;<br>☐ waste volume/weight;<br>☐ input date;<br>☐ storage room ;<br>☐ storage building;<br>☐ others, specify… | | | | |

#### 3.1.2 Reporting

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is Waste information reported?<br>Specify sample report.. (attach file) | | | | |
| 2. Is there a clear format report? Does report consist at least of the following topics: | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| ▪ type of waste;<br>▪ waste volume/weight? | | | | |
| 3. Is waste disposal reported?<br>Specify sample report.. (attach file) | | | | |
| 4. Is data updated regularly?<br>Specify frequency of revising or date of the last updated … | | | | |

**3.1.3 Utilization of information for management**

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is waste information used for:<br>☐ risk assessment;<br>Specify the process… (or attach file)<br>☐ allocating budget for disposal?<br>Specify the process… (or attach file) | | | | |

**3.2 Waste storage**

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory separate hazadous waste from general waste?<br>Specify example of segregated waste… | | | | |
| 2. Is there the criteria for waste classification?<br>Specify the criteria … (attach file) | | | | |
| 3. Does laboratory allocate waste according to the criteria specified in No. 2? | | | | |
| 4. Does laboratory use suitable waste container according to type of waste?<br>Specify sample of waste and containers used… | | | | |
| 5. Is correct and suitable label attached at each type of waste containers? | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 6. Does laboratory inspect waste container and label regularly? Specify inspection frequency or date of the last inspected. | | | | |
| 7. Does laboratory fill waste not more than 80% of the container's capacity? | | | | |
| 8. Is there specific areas/locations for storing waste? | | | | |
| 9. Is there suitable secondary container for waste bottle? Specify example of secondary container used… | | | | |
| 10. Does laboratory separate waste container for incompatible waste? | | | | |
| 11. Does laboratory keep waste container away from emergency equipment? | | | | |
| 12. Does laboratory keep waste container away from heat, ignition sources and flame? | | | | |
| 13. Does laboratory keep flammable waste in laboratory in the amount of less than 10 gal (38 L)? If the amount is more than 10 gal (38 L), is it stored in storage cabinet for flammable liquid container? | | | | |
| 14. Does laboratory set maximum quantity of waste allowed to be stored in laboratory? Specify maximum quantity of waste stored…. | | | | |
| 15. Does laboratory define duration for waste retention in laboratory? Specify the duration…. | | | | |

### 3.3 Reduction of waste

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory set guideline or measure to reduce waste in laboratory? Specify document… (attach file) | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 2. Is chemical reduced?<br>Specify example method of reducing chemical… | | | | |
| 3. Is substitute agent is replace with present chemical?<br>Specify example of replacing substitute agent… | | | | |
| 4. Is waste reduced by:<br>☐ reuse;<br>Specify method and example of waste reduced… (or attach file)<br>☐ recovery/recycle?<br>Specify methods and and example of waste reduced… (or attach file) | | | | |

### 3.4 Waste treatment and disposal

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory treat waste prior discard?<br>Specify method for treatment… (or attach file) | | | | |
| 2. Does laboratory treat waste prior disposal?<br>Specify method for treatment… (or attach file) | | | | |
| 3. Is waste disposed by licensed company?<br>Specify the name of the company… | | | | |

## ESPReL Checklist

## 4. Physical characteristics of laboratory, equipments and tools

This checklist can be used to assess the appropriateness of physical infrastructure, equipment and tools within laboratory that related to safety of laboratory. It should be recognized that they are hard to be fulfilled because the structure may be the existing and not design for specific laboratory activity. This survey include the information of architectural and engineering, site survey, materials used, transportation, electrical system, ventilation system, utility system and emergency response.

### 4.1 Arthitecture

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is inside and outside environment not caused harm? | | | | |
| 2. Does laboratory separate laboratory space from non-laboratory space? | | | | |
| 3. Is space and ceiling height of laboratory room and other room suitable to operation, number of operators, types and quantity of the equipment and tools?* | | | | |
| 4. Is surface of floor, wall and ceiling made by suitable material for the operation, and provide regular maintenance?* | | | | |
| 5. Does laboratory provide suitable size and appropriate quantity of openings (doors-windows) which can be controlled access and easy-to-open in case of emergency? | | | | |
| 6. Does laboratory install vision panel at the door? | | | | |
| 7. Is there windows can be opened for ventilation, locked and easily opened in the case of emergency? | | | | |
| 8. Is clearance width not less than 0.6 m for general corridor and not less than 1.50 m for indoor walkway? | | | | |
| 9. Are corridor and area adjacent to entrance hall unobstructed? | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 10. Is exit pathway free of danger areas and free of various equipment that may pose risk such as chemical storage cabinets, hoods etc.?* | | | | |
| 11. Does laboratory separate passage way to laboratory from the main passage of the building?* | | | | |
| 12. Does laboratory provide area and interior information including floor plan, current location, fire escape route, and emergency equipment location? | | | | |

* Consult specialist if any questions.

**4.2 Interior architecture: furnitures, tools and equipments**

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory provide access control system or control device for access furnitures, tools and equipments? | | | | |
| 2. Are furniture, tools and equipment that higher than 1.20 m, installed holders or strong support base? Is shelf and floating cabinet fixed with anchors or assembled to the building or wall? | | | | |
| 3. Is furnitures, tools and equipments appropriate to need and capability of workers?* | | | | |
| 4. Does laboratory set appropriate space and location for the table?* | | | | |
| 5. Does laboratory provide at least a basin for each location of the laboratory? | | | | |
| 6. Are accessories such as chemical hood, laminar flow hood in good condition? Does laboratory conduct maintainance regularly? | | | | |

* Consult specialist if any questions.

### 4.3 Structural Engineering

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is there no structural damage, no crack along the pole and beam? Do exterior and interior laboratory conditions cause harm (exterior conditions include surrounding or adjacent areas to the building, interior condition is the building areas that closed to the laboratory)?* | | | | |
| 2. Can building structure support weight of the building (weight of operators, equipment and tools)?* | | | | |
| 3. Is building structure capable of fire resistantance, including retainable the assembly in emergency situation (capability to endure the damage of building when emergency situation occured for a period of time that allow people to evacuate)?* | | | | |
| 4. Does laboratory inspect the condition of the building regularly? Does laboratory conduct maintenance at least once a year?<br>Specify frequency or date of the last inspection… | | | | |

* Consult specialist if any questions.

### 4.4 Electrical Engineering

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is there sufficient light, suitable for the environment and the type of work?* | | | | |
| 2. Does laboratory design power system to provide sufficient power to all type of load?* | | | | |
| 3. Does laboratory use certified standard electrical equipment, outlets, and sockets? Is power supply installed in the appropriate area?* | | | | |
| 4. Does laboratory provide grounding system?* | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 5. Does laboratory not provide extension cord? | | | | |
| 6. Does laboratory provide individual electrical control system for each laboratory? | | | | |
| 7. Do suitable overcurrent protective devices such as fuse, circuit breaker can be used? | | | | |
| 8. Does laboratory install emergency lighting in adequate quantity and at suitable area? | | | | |
| 9. Does laboratory provide electrical generator as an emergency power supply system?* | | | | |
| 10. Does laboratory inspect and maintain electrical and lighting system regularly?<br>Specify frequency or date of the last inspection… | | | | |

* Consult specialist if any questions.

### 4.5 Sanitary and Environment Engineering

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory provide suitable cold water system that layout and piping system conform standard, and no leakage?* | | | | |
| 2. Does laboratory separate wastewater systems from chemicals contaminated wastewater, and provide suitable wastewater treatment prior discharge to public?* | | | | |
| 3. Does laboratory inspect and maintain sanitary system regularly.<br>Specify frequency or date of the last inspection… | | | | |

* Consult specialist if any questions.

### 4.6 Ventilation and Air-Conditioning Engineering

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory provide suitable ventilation for the operation and environment of the laboratory?* | | | | |
| 2. Does laboratory install air conditioning at the suitable location and adequate for the operation and environment of the laboratory?* | | | | |
| 3. In the case that natural ventilation is not adequated, does laboratory provide mechanical ventilation in the area the operation generated toxic and odor. | | | | |
| 4. Does laboratory inspect and maintain ventilation and air conditioning system regularly?<br>Specify frequency or date of the last inspection… | | | | |

* Consult specialist if any questions.

### 4.7 Emergency Response and Communication System

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory provide manual fire alarm system? | | | | |
| 2. Does laboratory provide fire detectors such as heat detector or smoke detector? | | | | |
| 3. Does laboratory provide means of egress and marking that conform standard?* | | | | |
| 4. Does laboratory provide portable fire extinguishers? | | | | |
| 5. Does laboratory provide water-based fire protection system, standpipe and hose type? | | | | |
| 6. Does laboratory provide water-based fire protection system, sprinkler system (according to building regulations) or equivalent?*<br>Specify system used …. | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 7. Does laboratory provide emergency communication system such as office phone, mobile phone, internet and wireless systems? | | | | |
| 8. Does laboratory inspect and maintain emergency and communication systems system regularly?<br>Specify frequency or date of the last inspection… | | | | |
| 9. Does laboratory display information labels such as laboratory name, laboratory supervisor(s), and any other specific information of the laboratory including symbols or universal symbols indicate danger or related symbols as required by law? | | | | |

* Consult specialist if any questions.

## ESPReL Checklist

## 5. Hazard prevention and correction system

Safety management is the important part of creating safety culture, start which concept that what is risk factor, laboratory operator must know what substance using, do people in the same area work risky?, what is the physical risk?, is there risk assessment? Then manage the risk by prevention or mitigation include appropriate communication the risk. This checklist will give the idea and make awareness the risk management. Risk reports are useful for budget allocation because they can be managed on the basis of actual data. Emergency preparedness and response is a part of safety management as a preventive measure such as layout of the working area, exit routes, emergency response equipments including plans to prevent and respond the emergency situation which means initial action and notification. General safety regulation is defined as personal safety as well as minimum operating procedures of each laboratory.

### 5.1 Risk management

#### 5.1.1 Hazard identification

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory survey hazard from the following issue:<br>☐ chemicals/materials used;<br>Specify last date of the survey…<br>☐ tools or equipments;<br>Specify last date of the survey…<br>☐ physical characteristics of the laboratory?<br>Specify last date of the survey…<br>☐ Others, specify… | | | | |

#### 5.1.2 Risk assessment

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory assess risk in the following levels:<br>☐ personel; | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| Specify example of the process, method or document….. (attach file)<br>☐ project;<br>Specify example of the process, method or document….. (attach file)<br>☐ laboratory?<br>Specify example of the process, method or document….. (attach file) | | | | |
| 2. Does risk assessment include the following topics:<br>☐ chemical used, stored, and disposed<br>☐ health consequence from working with chemical;<br>☐ exposure route;<br>☐ working area/physical;<br>☐ tools;<br>☐ work environment;<br>☐ electrical system in the workplace;<br>☐ laboratory activities;<br>☐ activities that cannot be done together in the laboratory? | | | | |

5.1.3 Risk treatment

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Are there the risk prevention in the following topics:<br>☐ certain areas for high risk activities;<br>Specify the area…<br>☐ process for decontamination the area after the operation is finished? | | | | |
| 2. Are there the risk reduction in the following topics:<br>☐ changing work process to reduce exposure; | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| Specify work process changed…<br>☐ coordinating with organization responsible for risk management;<br>Specify name of organization…<br>☐ enforcing safety regulations and/or practice in the laboratory;<br>Specify announcement or document…<br>☐ regular evaluating/monitoring risk management?<br>Specify frequency… | | | | |
| 3. communication risks by:<br>☐ lecture, meeting, discussion;<br>Specify dates or relvant document…<br>☐ sign, symbol;<br>Specify examples of sign/symbol…<br>☐ brochure, manual?<br>Specify name of brochure, manual… | | | | |
| 4. Does laboratory provide physical and medical examination planning for laboratory operators in the following:<br>☐ annual general heath check up;<br>☐ planned physical and medical examination based on the risk factors.<br>Specify 1. example of risk factor that required the examinations<br>Specify 2. frequency of the examination…<br>☐ Warning symptom – When found that laboratory operator shown abnormal symptom related working with chemical, material, tools or laboratory equipment.<br>Specify example of symptom that needs to be conducted the examination …. | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| ☐ when encounter incident such as chemical spill, chemical leak, explosion or incident caused exposure to hazardous substance?<br>Specify example of event that needs to be conducted the examination … | | | | |

5.1.4 Risk management report

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is there risk management report at the following levels:<br>☐ personnel;<br>Specify risk assessment report particularly related to personnel… (attach file).<br>☐ Project;<br>Specify risk assessment report particularly related to personnel… (attach file).<br>☐ Laboratory?<br>Specify risk assessment report particularly related to personnel… (attach file). | | | | |

5.1.5 Utilization of risk management report

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory use Information from risk management report for:<br>☐ educate, introduce, train to operator;<br>Specify process to communication to relevant parties…<br>☐ evaluate, review and plan to improve risk management<br>Specify how information was utilized…<br>☐ allocate budget for risk management?<br>Specify how information was utilized… | | | | |

5.2 Emergency preparedness and response

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Are there following items available and accessible for emergency respsonse:<br>☐ emergency eye wash;<br>☐ emergency shower;<br>☐ first aid kit;<br>☐ sorbent material;<br>☐ emergency spill kit. | | | | |
| 2. Is there emergency response plan?<br>Specify emergency plan document… | | | | |
| 3. Is emergency response drills appropriate for the organization conducted?<br>Specify frequency or scheduled time for drill or date of the last drill… | | | | |
| 4. Does laboratory inspect area and location to ensure the readiness of emergency response?<br>Specify frequency or date of the last inspection… | | | | |
| 5. Does laboratory regularly inspect/test the following emergency equipment/tools:<br>☐ testing emergency eyewash;<br>Specify frequency or date of the last test …<br>☐ testing emergency shower;<br>Specify frequency or date of the last inspect/test …<br>☐ inspecting and replacing emergency response supplies;<br>☐ inspecting sorbent material;<br>Specify frequency or date of the last inspect …<br>☐ inspecting emergency spill kit. | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| Specify frequency or date of the last inspect … | | | | |
| 6. Is there process to respond emergency situation in the following topics?<br>☐ internal communication;<br>Specify communication process …<br>☐ การแจ้งเหตุภายนอกหน่วยงาน extternal communication;<br>Specify communication process …<br>☐ alarm;<br>Specify alarm process …<br>☐ evacuation?<br>Specify evacuation process… | | | | |

**5.3 General safety regulation**

**5.3.1 Personal safety**

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Is there personal protective equipments, PPE, suitable for laboratory activities in the following:<br>☐ face protection;<br>☐ eye protection;<br>☐ hand protection;<br>☐ foot protection;<br>☐ body protection;<br>☐ hearing protection;<br>☐ respiratory protection? | | | | |

**5.3.2 Individual laboratory regulation**

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Are there rules/regulations for safety in laboratory?<br>Specify name of document …. (attach file) | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 2. Do laboratory operators comply with rules/procedures in the following topics:<br>☐ keeping tools and equipments on laboratory table orderly and clean;<br>☐ wearing suitable laboratory gown;<br>☐ keeping hair tied and tidy while operating;<br>☐ wearing closed toes and heals at all times in laboratory;<br>☐ installing signboard at the equipment operated with operator's name and phone number;<br>☐ washing hands every time before leaving the laboratory;<br>☐ no keeping food or beverages in the laboratory;<br>☐ no eating food and not drinking beverages in the laboratory;<br>☐ no smoking in the laboratory;<br>☐ no wearing gloves and laboratory gown outside operating area;<br>☐ no working alone in the laboratory;<br>☐ no allowing children and pets in the laboratory;<br>☐ not using wrong tools or equipment;<br>☐ no permitting other activities not related to the operation;<br>☐ no keeping clutter in the laboratory? | | | | |
| 3. Are there rules/regulations for control visitors as follows:<br>☐ assigning responsible party for leading to the laboratory;<br>☐ providing training or introduction before entry laboratory; | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| ☐ ensuring visitors wear suitable personal protective equipment before entry laboratory? | | | | |

## ESPReL Checklist

## 6. Providing basic knowledge about laboratory safety

Creating safety in the organization should be developed all level/function of personal by educating, maintaining the basic safety knowledge. Althrough the organization are well safety management, but the personal is lack of knowledge, skill, and awareness it will cause harm and damage. Providing the training will help them understanding and able to work in laboratory or with chemicals safely as well as to mitigate risks of accidents.

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory provide basic knowledge to top management on safety management system?<br>Specify 1. name or position of the executives who attend training course.<br>Specify 2. course/topic and date (if any) that the course is conducted. | | | | |
| 2. Does laboratory provide basic knowledge to top management in relevant law?<br>Specify 1. name or position of the executives who attend training course.<br>Specify 2. course/topic and date (if any) that the course is conducted. | | | | |
| 3. Does laboratory provide basic knowledge to laboratory supervisor in the following topics:<br>☐ relevant law;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ safety management system;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ chemical management system; | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| Specify course/topic and date (if any) that the course is conducted.<br>☐ waste management system;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ chemical and waste directory;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ risk assessment;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ physical characteristics of laboratory and safety;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ emergency preparedness and response;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ อุปกรณ์ป้องกันส่วนบุคคล personal protective equipment;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ safety data sheet;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ safety signage?<br>Specify course/topic and date (if any) that the course is conducted. | | | | |
| 4. Does laboratory regularly provide basic knowledge to laboratory operators in the following topics:<br>☐ relevant law; | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| Specify course/topic and date (if any) that the course is conducted.<br>☐ safety management system;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ chemical management system;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ waste management system;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ chemical and waste directory;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ risk assessment;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ physical characteristics of laboratory and safety;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ emergency preparedness and response;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ personal protective equipment;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ safety data sheet;<br>Specify course/topic and date (if any) that the course is conducted. | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| ☐ safety signage?<br>Specify course/topic and date (if any) that the course is conducted. | | | | |
| 5. Does laboratory provide basic knowledge to cleaning staff in the following topics:<br>☐ emergency preparedness and response;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ personal protective equipment;<br>Specify course/topic and date (if any) that the course is conducted.<br>☐ safety signage?<br>Specify course/topic and date (if any) that the course is conducted. | | | | |

## ESPReL Checklist

## 7. Record management and documentation

Data collection and management will not be efficient if lack of record system and operating procedure. Document report should be formed as lesson learn and data for improvement. Documentation should be a system that can trace back when the responsible person changed, and for learning as well as for continual improvement.

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| 1. Does laboratory systematically manage data and document as follows:<br>☐ catergory system;<br>Specify example of catergory name of document….<br>☐ storage system;<br>Specify process and methods used ….<br>☐ receiving-releasing and tracking system;<br>Specify process and methods used ….<br>☐ review and update system?<br>Specify example of name of document and name of reviewer and frequency of the document review…. | | | | |
| 2. Are the following documents available in the laboratory or in the location that everyone can access them?<br>☐ policy, plan, and safety management structure document;<br>☐ laboratory safety regulation and procedure;<br>☐ Safety Data Sheet (SDS);<br>☐ Standard Operating Procedure (SOP);<br>☐ laboratory accident report;<br>☐ Analytical report/ lesson learned record;<br>☐ hazardous waste information and disposal report;<br>☐ curriculum vitae and qualification; | | | | |

| Topic | Yes | No | Not applicable | Don't know/ no information |
|---|---|---|---|---|
| ☐ safety training record;<br>☐ medical history record;<br>☐ laboratory safety assessment record;<br>☐ physical environment, equipments and tools maintenance record;<br>☐ safety knowledge article;<br>☐ operation manual? | | | | |