Risk Assessment in Uşak University Laboratories

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ABSTRACT

Laboratories are working areas that enter the dangerous workplace class and contain many risks. These risks can be listed as chemical, biological, physical and ergonomic. Chemistry laboratories, especially in the universities, are the areas where many students and academicians carry out their experimental studies. Although academics are more conscious and cautious about the possible risks, it is not possible to make the same assumption for students. Therefore, especially the risk assessment of university laboratories is very important.

In this study, risk analysis was done in Uşak University chemistry laboratories. The L-type matrix (decision-making matrix) has been used because it can be assessed quickly by a single researcher based on different severity levels. As a result of the examinations and observations made, the possible and potential risks that may arise from these dangers were tried to be determined independently in four chemistry laboratories. In the risk analysis prepared, 48 risks were determined for four laboratories and the risks and their severities were determined and the risks were graded. When the risks are grouped according to their grades, 12 high-grade risks, 30 medium-grade risks and 6 low-grade risks were identified, and these risks and preventive measures were presented in the study.

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INTRODUCTION

Occupational health and safety is the performed studies in order to eliminate or reduce the effects of the situations that the employees encounter in the workplace and affect their health negatively and to improve the existing health and safety conditions. In the occupational health and safety approach, the basic steps of risk analysis are the identification of the dangers that exist or may have the potential to occur in the work environment, the determination of the risks that may arise from these dangers, the grading of risks and the determination of precautions. All these studies are based on protecting the health of the employee and are carried out to ensure that he or she is in a healthy and safe working environment (Occupational Health and Safety Law No. 6331, 2012, Occupational Health and Safety Risk Assessment Regulation, 2012).

Laboratories are defined as "places where experimental studies, tests, analysis and observations are made using various tools and devices within a field of science or working area" (Laboratory Services Module, 2015). Due to the activities carried out in the laboratories, it is classified as hazardous workplaces with the NACE code 72.119.01 (Notification on Workplace Hazard Classes Regarding Occupational Health and Safety, 2012). Laboratory studies are enable students to develop research and problem solving skills. In addition to these, it is known that it contributes to students' use of their hands and communication skills. On the other hand, awareness of the negativities and dangers that may occur during these studies is provided by laboratory safety studies (Hafstein & Lunetta, 2004). The whole studies conducted to determine the dangerous situations that may occur for students and teachers during laboratory studies, to take precautions and to provide a regular laboratory environment is called laboratory safety (Aydoğdu & Şener, 2016). Academic stuff and students gain detailed information and experience about the dangers and structures of the substances they synthesis or work with during their education and professional life. Working in a safe condition is part of the job and it is as important as learning new information and techniques. During the education of students, the following skills should be given importance (Canel, 2002);

- Working safely without creating danger with chemical substances.

- To protect himself and his colleagues from dangers.

- To be responsive and sensitive to environmental pollution.

In the chemistry laboratory, the dangers affecting human health can be classified under 5 sub-headings. These are (Karabulut, 2016);

Chemical risks: Chemicals are the source of most of the hazards in laboratories. Toxic gases and vapors, chemicals released from containers by spillage or splashing could be caused poisoning, respiratory problems, allergies and even cancer. Acid or bases exposed by contact or inhalation may also cause irritation of the skin, eyes or trachea.

Biological hazards: Chemical agents, viruses, bacteria, fungi and parasites commonly found in chemistry laboratories can cause various diseases.

Risks arising from explosive substances: Situations that cause explosion or fire are experiments performed in closed systems, studies with high-pressure gases, experiments carried out in vacuum environments and autoclaves.

General hazards: Tripping or slipping due to improper floor, cuts and injuries due to broken glass materials, hair or clothing stuck to the centrifuge or mixers, vibration and noise caused by the centrifuge or mixers in the laboratory can be listed under the heading of general hazards.

Ergonomic hazards: prolonged standing or bending, repetitive movements such as continuous pipetting, ergonomically unsuitable stools or chairs negatively affect the musculoskeletal system.

Accidents that may occur in the laboratory can cause serious damage due to their location in the university (proximity to classrooms and corridors). Most of the accidents that happen in these areas are caused by human mistakes. Human mistakes are meant by lack of knowledge and attention. Another factor that disrupts safe working is wrong habits. Individuals who work carefully early in their professional life may tend to follow safe working rules less as they gain experience. Some examples of accidents occurring in laboratories can be listed as follows (Canel, 2002);

- 0.5 ml cyclohexanone and 30% hydrogen peroxide mixed in a glass tube to obtain cyclohexanone peroxide. As a result of its heating, it reacted and the tube was shattered and caused facial and hand injuries. Eyes are not damaged due to the protective glasses. Therefore, caution should be taken during experiments with glass tubes.

-After drying the silver perchlorate formed as a result of the reaction in the desiccator, an explosion occurred while discharging with a spatula and resulted in death and resulted in death while discharging with a spatula. The properties of the chemicals used should be well known.

- Contrary to the laboratory rules, vaporized hydrogen cyanide caused the student's death as a result of one student pouring waste material containing

cyanide into the sink, and then another student pouring hydrochloric acid into the same sink. Care should be taken while removing waste materials from the laboratory environment.

- Chemicals with easy combustion properties were placed in the household refrigerator and the steam leaking from the containers mixed with the air in the refrigerator and explosive atmosphere occurred. The refrigerator thermostat, which opened automatically, was a source of ignition and caused an explosion. It should be noted that an ignition source may occur anywhere in the working environment.

Due to all these risk factors, Uşak University Laboratories were chosen as a field of study and examined in terms of Occupational Health and Safety. Risk analysis was performed using 5x5 L type matrix method for 4 selected laboratories and recommendations were made to reduce the risk levels as a result of the analysis.

MATERIALS AND METHODS

The L-type matrix is a quantitative research method in which cause-effect relationships are evaluated. This method is the most preferred risk analysis method in the occupational health and safety sector since it is simple and can be performed by one person. This method is the technique in which the probability of an event and its effect after it is realized is analyzed as a binary variable. The risk score is obtained by multiplying the probability and degree of severity and written in its place in the table. The values between 1-5 are given for probability and severity values (Table1 and Table2). The risk score is obtained by multiplying the probability and severity values. If the risk score is less than 8, this risk is at an acceptable risk level. If the risk score is equal to 8 and less than 15, it is at medium risk. If the risk score is equal to 15 and less than 20, it is at a high risk level, and finally if the risk score is greater than 20, it is at an unacceptable risk level. If the risk is at the highest level, the study is stopped and cannot be started without taking precautions (Özkılıç, 2005; Selçuk & Selim, 2018).

Risk Score = Probability x Intensity

Table 1. 5x5 L-Type Matrix method intensity assessment table (Özkılıç, 2005)

Level	Intensity	Score
Insignificant	No Loss Of Working Hours – First Aid Only	**1**
Minor	No loss of working days – First Aid or medical treatment	**2**
Moderate	Accident with working day loss - minor injury	**3**
Major	Limb Loss, Severe Injury - Long-Term Treatment	**4**
Catastrophic	Death, Environmental Disaster	**5**

Table 2. 5x5 L-Type Matrix method probability assessment table (Özkılıç, 2005)

Level	Probability	Score
Very low	Rare (Once a year)	**1**
Low	Unlikely (Several Times a Year)	**2**
Medium	Possible (Once a month)	**3**
High	Likely (Once a week)	**4**
Very high	Almost certain (Everyday)	**5**

Table 3. 5x5 L-Type Matrix method risk assessment table (Özkılıç, 2005)

Level/ Intensity	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Very low 1	NEGLIGIBLE 1	LOW 2	LOW 3	LOW 4	LOW 5
Low 2	LOW 2	LOW 4	LOW 6	MEDIUM 8	MEDIUM 10
Medium 3	LOW 3	LOW 6	MEDIUM 9	MEDIUM 12	HIGH 15
High 4	LOW 4	MEDIUM 8	MEDIUM 12	HIGH 16	HIGH 20
Very high 5	LOW 5	MEDIUM 10	HIGH 15	HIGH 20	EXTREME (Unacceptable) 25

Explanations of the risk scores are given below;

1 Point: Considered as unimportant. They are acceptable risks that do not matter much.

2-6 Points: Considered as bearable. It is a tolerable risk group that requires attention in the long period of time. However, existing controls should be maintained and it should be checked.

8-12 Points: Considered as intermediate level. These are the risks that are important and need to be taken precautions in the short term. Actions should be initiated to reduce the identified risks.

15-20 Points: Considered as important. It is an extremely important risk group that requires immediate action.

25 Points: Considered Unbearable. It is a risk group in which starting work is not accepted without taking any precautions.

RESULTS

The risk analysis data obtained by examining the chemistry laboratories of Uşak University are given in Table 4. Although the four laboratories studied are different from each other, four separate risk analysis tables prepared for this study are presented as a whole in a single table because of many common risks. The hazards and risks obtained by examinations and observations are evaluated taking into account in similar studies and the precautions to be taken are given in this Table.

Table 4. Table of Risk Assessment

Score	Unit	Hazard	Hazard Source	Risk	Exposure/ Affected	Assessment Of Risk				Precautions To Be Taken To Maintain An Acceptable Level	Photos
						P	I	Risk Score			
						Probability (1-5)	Intensity (1-5)	Risk = P X I	Importance Level		
1	All Lab.	Fire	Absence of fire extinguishers	Early intervention may be delayed in the event of a possible fire hazard.	Academic stuff and students	4	5	20	High	Fire extinguishers should be placed in the interior of the laboratory and plates indicating the locations of these tubes should be hung.	
2	All Lab.	Electricity	Lack of insulating mats suitable for current in front of electrical panels.	Risk of getting caught in electric current, electric shock, injury and death from electrical leakage.	Academic stuff and students	4	5	20	High	An insulating mat should be placed in front of the electrical panels.	
3	All Lab.	Electricity	The front of the panel is not empty.	Electric shock, fire, delay of early intervention.	Academic stuff and students	4	5	20	High	The front of the electrical panels in the laboratory should not be filled with any material up to the ceiling. Extension part of the bench under the Electrical Panel should be removed and an insulating mat should be placed on the floor.	
4	All Lab.	Irregularity of crossing paths	Scattered leaving of stools in the lab in the transitions between benches.	It can cause tripping and falls during transpassing.	Academic stuff and students	3	2	9	Medium	After the lessons in the laboratory, excess stools can be collected in an empty corner. Thus, unnecessary space is not taken.	
5	All Lab.	Lack of local ventilation system	Lack of local ventilation to immediately remove poisonous and toxic gases from the interaction of chemicals used.	Respiratory irritation, poisoning.	Academic stuff and students	3	3	9	Medium	A local ventilation system should be installed in the appropriate part of the laboratory.	

6	**All Lab.**	Difficulty accessing to the eye shower	Positioning the eye shower on the wall part of the counter and leaving other tools in front of it	Eye irritation, eye loss.	Academic stuff and students	**2**	**3**	**6**	**Low**	Eye shower access should be placed in an easier spot and no other items should be placed in front of it.	
7	**All Lab.**	Failure to provide adequate ventilation	Inhalation of dust and odors from chemicals used in the laboratory.	In case of inhalation of the dusts in the laboratory and odors from the chemicals used, various health problems may occur.	Academic stuff and students	**3**	**3**	**9**	**Medium**	It is important to remove harmful dust and chemicals from the laboratory by regularly venting the working area at regular intervals.	
8	**All Lab.**	Absence of MSDS charts of chemicals	Accidents may happen as a result of students taking the course not knowing the necessary information about the used chemicals	Unconscious use, injuries	Academic stuff and students	**3**	**4**	**12**	**Medium**	MSDS charts are forms prepared for information purposes for each chemical. Documents include not only the nature of the chemicals, but also the methods of disposal in the event of an accident or the hazards that may arise when mixed with other chemicals. MSDS charts of the chemicals used must be requested by the supplier company and kept in the laboratory.	
9	**All Lab.**	Flooding	Lack of water drain under the body shower for use as a result of chemical exposure	Falls and injuries due to slippery ground	Academic stuff and students	**2**	**3**	**6**	**Low**	A drain should be made for the water that will flow under the body shower.	
10	**All Lab.**	Chemical disposal	Lack of drain for the water to be used during the removal of any chemicals that may spill on the laboratory floor.	Chemical residue in the laboratory and slippery ground	Academic stuff and students	**3**	**3**	**9**	**Medium**	A drain should be put to the appropriate area for cleaning the laboratory floor.	
11	**All Lab.**	Waste disposal	Lack of different garbage for waste that may come out during laboratory experiments	Injury during waste removal	Cleaning staff	**3**	**3**	**9**	**Medium**	Different bins should be placed for laboratory and domestic wastes, broken glass and chemicals.	
12	**All Lab.**	Chemical mixtures	Chemical mixture preparation	Chemicals contact with eyes, inhalation, ingestion, and skin irritation	Academic stuff and students	**3**	**3**	**9**	**Medium**	Warning signs about the use of personal protective equipment should be posted on the walls of the laboratory and could be seen from every angle. Spare personal protective equipment should be kept in the laboratory in case you forget it while coming to the laboratory.	

13	**All Lab.**	Chemical solutions	Chemical mixture preparation	Inhaling harmful gases while preparing chemical solutions	Academic stuff and students	**4**	**3**	**12**	**Medium**	For convenient preparation of solutions, local ventilation should be placed in the appropriate part of the laboratory. Mixtures and solutions should be prepared in this section. Masks, glasses and gloves should be used when working with chemicals.	
14	**All Lab.**	Fire	Absence of fire detectors	Property damage, injury, death.	Academic stuff and students	**4**	**5**	**20**	**High**	Fire detectors should be installed inside the laboratory. Smoke detectors play an important role in early detection of fire.	
15	**All Lab.**	First aid supplies	Expiry date of the materials in the first aid cabinet, inability to intervene in case of any injury or improper handling with expired materials	Infection risk	Academic stuff and students	**3**	**4**	**12**	**Medium**	The materials in the first aid cabinet should be renewed and checked at regular intervals to prevent such a situation again.	
16	**All Lab.**	Bench disorder	Unused equipment and items left on the benches	It may cause minor injuries while working on the bench.	Academic stuff and students	**4**	**1**	**4**	**Low**	Laboratory devices and items should be put into cabinets after their use, and bench tops should be left empty whenever possible.	
17	**I.F.A.L.**	Cables	The extension cable attached to the refrigerators is stuck between the refrigerator and the wall.	It may cause electrical leakage due to the wear and tear of the cable.	Academic stuff and students	**3**	**4**	**12**	**Medium**	More distance should be kept between the wall and the cabinet to prevent the cable from getting stuck. More devices should not be connected to extension cables at the same time.	
18	**I.F.A.L.**	Irregular stacking	Mixed and irregular stacking of chemicals and samples placed in the refrigerator	When a chemical is asked to be taken from the refrigerator, it can cause spill and break to the unstable samples and chemicals stored in glass containers.	Academic stuff and students	**5**	**2**	**10**	**Medium**	Shelves inside refrigerators should be shared by academic stuff. By this way, confusion and accidents are prevented.	
19	**I.F.A.L.**	Waste disposal	Leaving bottles on the hose ends to accumulate waste from the laboratory equipment	It can cause snagging while walking and waste spills by breaking bottles.	Academic stuff and students	**4**	**2**	**8**	**Medium**	It should be ensured that the waste discharge is drilled into the bench, not into the bottle located on the ground, and the hoses pass through these holes and are transferred to the bottles located on the benches.	
20	**I.F.A.L.**	Using a display device	Looking at the computer screen for a long time	Eye disorders	Academic stuff and students	**3**	**3**	**9**	**Medium**	Regular eye examinations should be performed.	

21	**I.F.A.L.**	Using a display device	Because computers are located on experimented high benches, they create ergonomic problems caused by posture disorders.	The occurrence of physical health problems.	Academic stuff and students	**4**	**3**	**12**	**Medium**	A separate desk for computers and chairs suitable for ergonomic sitting should be provided.	
22	**I.F.A.L.**	Chemical exposure	Chemical bottles found on the experimental devices are poured into computers located on the same counter as the devices.	Electric shock	Academic stuff and students	**2**	**4**	**8**	**Medium**	For computers, there must be separate work desks from the counters where the devices are located.	
23	**I.F.A.L. - F.T.L.**	Electric	Contact of water that may leak from the geyser with an electrical switch nearby.	Electric shock	Academic stuff and students	**4**	**4**	**16**	**High**	The geyser should be moved to a another place that will not cause a risk.	
24	**I.F.A.L.**	Lack of warning signs	Absence of warning signs for P.P.E. which used in the laboratory.	Accidental injuries	Academic stuff and students	**3**	**3**	**9**	**Medium**	For each P.P.E., warning signs should be hung so that they can be seen from all over the laboratory.	
25	**I.F.A.L.**	Electrical cables	Devices and computers ' cables are left unevenly behind the counter.	Electric shock, injury	Academic stuff and students	**3**	**3**	**9**	**Medium**	Electrical cables must be enclosed in a protective cable box. .	
26	**I.F.A.L.**	P.P.E.	Leaving personal protection P.P.E. indiscriminately in the lab.	Accident, injury	Academic stuff and students	**3**	**3**	**9**	**Medium**	Personal protective equipment that is not properly maintained may pose a risk in itself because it loses its protection. For this reason, PPE should be stored properly and care should be taken to clean it.	
27	**I.F.A.L.**	Pipette	Use of pipettes by mouth.	Chemical ingestion, poisoning	Academic stuff and students	**3**	**4**	**12**	**Medium**	Pipette by mouth should not be used. Puar should be used.	
28	**I.F.A.L.**	Injectors	Leaving injectors on the table.	Injury	Academic stuff and students	**3**	**2**	**6**	**Low**	Injectors should not be reused. For those used, waste bins where cutting tools are collected should be kept and collected in it. In this way, it prevents cleaning workers from getting injured while collecting garbage.	

29	**I.F.A.L. - F.T.L.**	Broken glass materials	Continued use of broken materials.	Injury	Academic stuff and students	**3**	**3**	**9**	**Medium**	Broken glass materials should not be used. It must be removed from the laboratory environment so that it does not cause injuries.	
30	**I.F.A.L.**	Mislabeling of chemicals	Changing the inscription on the methanol bottle by not methanol.	Accident, injury	Academic stuff and students	**3**	**4**	**12**	**Medium**	Bottles of chemicals should not be used for each other. Labels with specific warning signs for each chemical should be affixed, and care should be taken not to stick hand-written paper to bottles. Improper use of chemicals can lead to confusion and accidents..	
31	**F.B.L.**	Unlabeled experimental studies.	Lack of labels on the date of preparation of their solutions and what their content is.	Chemical exposure	Academic stuff and students	**3**	**2**	**6**	**Low**	Yapılan çalışmalar sonrasında ürünlerin üzerlerine ne zaman üretildiği ve içeriğinde ne olduğunu belirten etiketler yapıştırılmalıdır.	
32	**F.B.L. - F.M.L. - F.T.L.**	Dropping material from shelves	The shelves are narrow and there is no elevation at the ends to prevent materials from falling.	Chemical exposure, injury	Academic stuff and students	**4**	**2**	**8**	**Medium**	Elevations should be made to prevent materials from falling on the edges of the shelf.	
33	**F.B.L.**	Putting laboratory devices on the ground	Placing unused devices on the laboratory floor.	Falling, injury, property damage	Academic stuff and students	**3**	**3**	**9**	**Medium**	To protect both devices and students, devices should be stored inside cabinets that are safer than on the ground.	
34	**F.B.L. - F.M.L.**	Fume cupboard	Open the cover of the fume cupboard.	Vapor or dust to the eye due to vacuum.	Academic stuff and students	**3**	**3**	**9**	**Medium**	The cover of the fume cupboard should be opened carefully. Before opening, glasses should be worn and warning signs should be hung near the device for these hazards.	
35	**F.B.L. - F.M.L. - F.T.L.**	Hot material	Hot materials removed from the study oven.	Burning	Academic stuff and students	**4**	**3**	**12**	**Medium**	Heat resistant gloves should be used. Instructions for use in ovens heat-related warning signs or signs should be hung.	
36	**F.B.L. - F.M.L.**	Possibility of material drop	Irregular and overlapping of the materials contained in the dish.	Injury	Academic stuff and students	**3**	**2**	**6**	**Low**	No more material should be placed in the dish than it can take. Overlapping materials can slip and fall, causing injuries.	

37	**F.B.L.**	Heavy Metals	Heavy metal waste box on the counter	Chemical exposure, injury	Academic stuff and students	**3**	**3**	**9**	**Medium**	Chemical waste should be disposed of in separate waste bins that should be present in the laboratory. It should not be kept on counter tops. Empty bottles of chemicals should also not be left on the floor at the edges of the door..	
38	**F.M.L - F.T.L.**	LPG tubesi	Gas leak	Explosion, fire, injury	Academic stuff and students	**3**	**5**	**15**	**High**	The laboratory should not be abandoned without checking that the gas cylinders are closed or not. A gas alarm must be in tle labs. An excessive number of LPG tubes should not be kept. Appropriate instructions should be found where the gas cylinders are located..	
39	**F.M.L**	Gas burner	Burning of materials on the bench.	Fire, injury	Academic stuff and students	**3**	**5**	**15**	**High**	Gas burner must be placed that do not have shelves on top. Instructions for the use of gas burner should be hung in the appropriate places where they can be seen.	
40	**F.M.L - F.T.L.**	P.P.E.	Leaving P.P.E. irregular in the working environment.	Accident , injury	Academic stuff and students	**3**	**3**	**9**	**Medium**	Personal protective equipment that is not properly maintained may pose a risk in itself because it loses its protection. For this reason, P.P.E. should be stored properly and care should be taken to clean it.	
41	**F.M.L**	Collapse on the ground	A collapse on the lab floor.	Fall, injury	Academic stuff and students	**3**	**3**	**9**	**Medium**	During the transport of chemicals, it is important that the passage paths are empty and the floor is regular, smooth. Floor collapse should be repaired as soon as possible.	
42	**F.M.L**	Gas leak	A warning is written on the expectation that there is a gas leak.	Explosion, flare	Academic stuff and students	**3**	**5**	**15**	**High**	Broken gas burner must be removed from laboratory benches to avoid use.	
43	**F.T.L.**	Chemicals	An irregular presence of chemicals on the bench.	Chemical exposure, injury	Academic stuff and students	**3**	**3**	**9**	**Medium**	Chemicals should be stored on separate shelves in cabinets with ventilation in accordance with their chemical structure. It should not be left in a laboratory environment after the labstudy is finished.	

44	**F.T.L.**	Failure to see warning signs	The signs are not visible due to the presence of a blackboard in front of the warning signs that hang against Laboratory hazards.	Injury	Academic stuff and students	**3**	**3**	**9**	**Medium**	Because the writing board is wheeled, it can be easily moved to another location. The blackboard should be taken somewhere else that will not block the boards.	
45	**F.T.L.**	Laboratory hygiene	Dirty lab floor.	Chemical exposure, injury, falling	Academic stuff and students	**3**	**3**	**9**	**Medium**	Laboratories should be cleaned regularly.	
46	**F.T.L.**	Rusty nail	Finding rusty nails under a deionized water device.	Tetanus, stinging, injury	Academic stuff and students	**3**	**4**	**12**	**Medium**	Rusty nails should be removed from the laboratory.	

ABBREVIATIONS:
I.F.A.L.: Instrumental Food Analysis Laboratory
F.B.L.: Food Biotechnology Laboratory
F.M.L.: Food Microbiology Laboratory
F.T.L.: Food Technologies Laboratory
P.P.E.: Personal Protective Equipment
MSDS: Material Safety Data Sheet

RESULTS AND SUGGESTİONS

In this study, 5x5 L type matrix method was used for the determination of hazards in the environment and the risks that may arise from these dangers in a public university Chemistry Laboratories. However, in order to reduce each identified risk to an acceptable level, measures that can be taken in accordance with the legislation have been recommended.

As a result;

A total of 48 risks were identified, including 12 high-level risks, 30 medium-level risks and 6 low (acceptable) levels of risks. Among these identified risks, serious problems such as especially deficiencies in emergency management, lack of waste management, keeping chemicals in inappropriate conditions and non-compliance with electrical panels, lack of material safety data sheets are highlighted. In this article, some recommendations have been made to eliminate these deficiencies and for creating a healthy and safe laboratory environment. These advise are listed below for the Chemistry Laboratories (Özkılıç, 2005; Kürkçü ve ark., 2011; Laboratuvar Güvenlik Kılavuzu; Ersoy ve Kaya, 2019).

- A laboratory safety policy should be generated and laboratory responsible persons should be identified and authorized for security issues within the framework of this policy. Also, a laboratory hygiene plan should also be created and checked whether it is being implemented.

- The chemicals should be stored and labeled under different appropriate physical conditions depending on their type. For each chemicals, MSDS must be supplied for and placed within the reach of everyone.

- Waste management procedures should be created, and everyone who can be in the laboratory should be informed about these rules. The waste from each laboratory should not be confused with each other when being removed from the environment. Chemical waste should not be dumped in the sink.

- Personal protective equipment should be dressed from the moment of entry into the laboratory, not only when working. Attention should be paid to the cleanliness of personal protective equipment.

- Urgent action plans should be prepared and everyone, including students, should be informed about these plans.

- In the laboratory enough fire extinguishing tubes should be kept and position in accordance with the legislation.

- For each equipment in the laboratory, instructions must be written and hung in visible places.

- Emergency and eye showers should be located in easy-to-access areas and periodic control should be made.

-Since most of the chemicals are toxic, flammable, corrosive and reactive, the more they are stored, the higher the risk they will have. Therefore, care should be taken to ensure that they are stored at the minimum required level.

- Laboratory assistants should be educated on subjects such as what materials are in the medicine cabinet, how to intervene in simple injuries and how to use fire extinguishers.

- Since laboratories are the environments where serious studies take place, jokes etc. that will disrupt the order and cause danger movements should be avoided.

- Laboratory materials should not be taken out of the laboratory in any way, and materials such as food and beverages should not be brought into the laboratory environment.

- An apron must be worn during laboratory studies, and open shoes should not be worn against the danger of spilling chemicals.

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