Evaluation of Nuclear safety procedures in some Iraqi universities

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Abstract. Human has known danger since God created him and resorted to many ways to face the risks risk management is of great importance in confronting them. Therefore, human is always seeking to use modern scientific methods to face those risks. Research is continuing to find these methods, especially after the scientific and technological progress witnessed by the world, Which led to the emergence of new risks not known to human, including the risk of the use of nuclear materials and equipment. that require safety measures and security in order to face any incident, whether intentional or unintentional. Regulations have been issued to deal with these materials and agreements have been signed on them and has been issued several bulletins and periodicals to spread the culture of security and safety of nuclear, which have become part of the CBRN team's national and ministerial team, which have undertaken to develop a strategy and plan of action for the proper use of nuclear materials and equipment, through this he paper will outline the main functions of the CBRN ministerial and national teams.

Keywords: evaluation , procedures , safety , nuclear , Iraqi

Introduction :
Iraq and the United Nations signed the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), where Iraq pledges to be a non-nuclear-weapon State and not to be a direct or indirect part or mediator for the transfer, manufacture or acquisition of any nuclear weapons or explosive devices Other means and not to provide special or special fissile material or fissile material or any equipment or material specially designed or prepared for the processing, use or production of special fissionable material to any non-nuclear-weapon State for peaceful purposes unless such materials are subject to INFCIRC / 172) and the Protocol (INFCIRC \ 172 \ Add.2) in accordance with the provisions of the third paragraph of the Treaty and not to distort the use of nuclear energy for peaceful use of nuclear weapons or explosive devices [1]. Iraq has had to abide by these agreements in addition to other agreements in the field of chemical and biological field and the risk of their use as weapons, and we will focus on this research on the nuclear side and the tasks that the CBRN team is aware of CBRN (1)

For the purpose of identifying the tasks that the CBRN team looks forward to, we have to understand the following two axes:
1 - The first axis: the status of legislation and controls that dominate the circulation of nuclear materials and nuclear resources (open and closed) and the role of the three regulatory bodies in that where we find that:

A - Nuclear material (uranium) has become the responsibility of the National Control Authority / Nuclear Section.

B - Closed nuclear sources, which is the responsibility of the Iraqi Authority for the control of radioactive sources.

C - Open nuclear resources are the responsibility of the Radiation Protection Center. These bodies have put the requirements that would grant them permission to use nuclear materials and sources. For example, the Iraqi Authority for the Control of Radioactive Sources has developed requirements for obtaining possession for the use of sources.

1. Emergency Plan (according to a special form on the organization's website).

2. Nuclear Safety Plan (according to a special form on the organization's website).

3. Storage plan of sources (according to a special form available on the organization's website).

This is done annually and periodically. The subject is monitored through inspection committees that assess the radioactive levels of the sources, their inventory and security requirements, and the continuous work of these bodies for monitoring and control.

2 - The second axis: Despite all what has been adopted by the regulatory bodies, but we find gaps in the work needs to evaluate and correct in order to raise the level of security and nuclear safety. Therefore, it should take the appropriate means to support the work of the three supervisory bodies. This means that the work of the questionnaire in the field of nuclear work which enable us to identify the gaps and to work on them through the statistical indicators that come out of this questionnaire.

1. As is well known, there are software programs in the field of biological and chemical that help in this, we have suggested this questionnaire and we are developing in order to fill the gaps that we find in the security and nuclear safety measures that will help us as a team CBRN to abide by them to control the material and not to use them badly, in order to use them to serve the community, especially in the medical and industrial field and its development (3, 4).

### Description of the questionnaire

The questionnaire included two axes the first one about safety and included (40) questions, about personal nuclear safety (20 questions), safety in the section (10 questions) and safety in the college (10 questions). The second axis, which includes 20 questions about personal and institutional security. The sample consisted of (38) PhD and MA students working in Iraqi public and private universities, including 5 universities (Baghdad, Mustansiriya, Iraq, Nahrain, Qadisiyah), which included 9 faculties (Science and Education) Science) in which primary and upper nuclear physics laboratories are located. In the statistical analysis, a tripartite lyceum was used. This scale is described by grade and means that the answer is yes (1.67) and the answer is (1.67-2.33) and the answer is (2.33-3).

The following table shows the questionnaire questions:

| The first axis | Weight | Opinion | The weight of the paragraph |
|---------------|--------|---------|----------------------------|
| Personal safety | Yes 92.3, No 5.1, sort of thing 2.6 | 1.10 |
| 1 Do you work in a laboratory with radioactive sources | | |
| 2 Do you carry a film Badge during working | 28.2, 66.7, 5.1 | 1.77 |
| 3 Are films being watched | 15.4, 59, 25.6 | 2.10 |
| 4 Are you covered by the Radiation Benefits Grant Act | 25.6, 74.4 | 1.74 |
| 5 Have you been checked annually | 20.5, 74.4, 5.1 | 1.85 |
|   | Question                                                                 | Yes (%) | No (%) | Not Applicable (%) | Axis Rate |
|---|--------------------------------------------------------------------------|---------|--------|--------------------|-----------|
| 6 | Is there a follow-up from the laboratory officer about this              | 46.2    | 41     | 12.8               | 1.67      |
| 7 | Is there a follow-up from the head of department about this              | 35.9    | 59     | 5.1                | 1.69      |
| 8 | Is there a follow-up from the college official about this                | 28.2    | 66.7   | 5.1                | 1.77      |
| 9 | Do you wear work waistcoat during work                                   | 69.2    | 20.5   | 10.3               | 1.41      |
|10 | Do you wear gloves during work                                           | 33.3    | 56.4   | 10.3               | 1.77      |
|11 | Do you wear glasses during work                                          | 5.1     | 92.3   | 2.6                | 1.97      |
|12 | Are there enough tweezers to carry radiation sources                     | 61.5    | 28.2   | 10.3               | 1.49      |
|13 | Did you measure the dose in the laboratory                               | 69.2    | 28.2   | 2.6                | 1.33      |
|14 | Do you know what you mean 0.5 mSv per hour for you                       | 71.8    | 12.8   | 15.4               | 1.44      |
|15 | Do you have experience in reducing potions                               | 74.4    | 10.3   | 15.4               | 1.41      |
|16 | Have you participated in a workshop about this                           | 71.8    | 25.6   | 2.6                | 1.31      |
|17 | Is there a lecture about safety procedures in the laboratory             | 87.2    | 12.8   | 0                  | 1.13      |
|18 | Are you the one who does the lecture                                     | 66.7    | 25.6   | 7.7                | 1.41      |
|19 | Do you have an idea of personal safety procedures                       | 84.6    | 7.7    | 7.7                | 1.23      |
|20 | Are personal safety procedures sufficient                                | 33.3    | 28.2   | 38.5               | 2.05      |
|   | Total axis rate                                                          |         |        |                    | 1.58      |
|21 | Are there any devices for measuring potions in the laboratory            | 66.7    | 17.9   | 15.4               | 1.51      |
|22 | Are you doing this?                                                      | 33.3    | 61.5   | 5.1                | 1.72      |
|23 | Is there a program to raise awareness of nuclear safety in the laboratory| 66.7    | 17.9   | 15.4               | 1.49      |
|24 | Is there a nuclear safety official inside the laboratory                  | 66.7    | 30.8   | 2.6                | 1.36      |
|25 | Do you follow safety procedures in the laboratory                        | 66.7    | 25.6   | 7.7                | 1.41      |
|26 | Is there sufficient radiation shielding within the laboratory            | 71.8    | 17.4   | 10.3               | 1.38      |
|27 | Is there a safety program in the laboratory                              | 59      | 23.1   | 17.9               | 1.59      |
|28 | Have the measuring devices been calibrated in the laboratory             | 35.9    | 33.3   | 30.8               | 1.95      |
|29 | Do regulatory institutions follow your safety in the laboratory          | 38.5    | 30.8   | 30.8               | 1.92      |
|30 | Is there a program to maintain the equipment in the laboratory, including dose measures | 23.1    | 38.5   | 38.5               | 2.15      |
|   | Total axis rate                                                          |         |        |                    | 1.648     |

**The section**

|   | Question                                                                 | Yes (%) | No (%) | Not Applicable (%) | Axis Rate |
|---|--------------------------------------------------------------------------|---------|--------|--------------------|-----------|
|31 | Is there a committee to measure potions within the college               | 28.2    | 64.1   | 7.7                | 1.79      |
|32 | Is there a program to raise awareness about the dangers of radioactive sources | 53.8    | 23.1   | 23.1               | 1.69      |
|33 | Are you doing this?                                                      | 30.8    | 46.2   | 23.1               | 1.92      |
|34 | Is there a program for nuclear safety procedures in the college         | 30.8    | 48.7   | 20.5               | 1.9      |
|35 | Are nuclear safety procedures personal                                  | 64.1    | 23.1   | 12.8               | 1.49      |
|36 | Is there a follow-up to the film card by the college                     | 20.5    | 69.2   | 10.3               | 1.97      |
|37 | Is there a follow-up of blood tests by the college                       | 15.4    | 71.8   | 12.8               | 1.97      |
|38 | Is there a follow-up to the shielding procedures by the college         | 23.1    | 66.7   | 10.3               | 1.87      |
|39 | Is there a follow-up program to maintain the equipment and laboratories in the college | 12.8    | 38.5   | 48.7               | 2.36      |
|40 | Is there a CBRN committee in the college                                | 30.8    | 66.7   | 2.6                | 1.72      |
|41 | Are there specific people to learn about radioactive sources and have been recommended | 76.9    | 1.31   | 1.31               | 1.31      |
|42 | Are all staff specialized in nuclear physics                            | 64.1    | 1.51   | 1.51               | 1.51      |
|43 | Do electronic locks are used for the laboratory                         | 2.6     | 2.03   | 2.03               | 2.03      |
|44 | Do regular locks are used to save radioactive sources                   | 92.3    | 1.1    | 1.1                | 1.1       |
|45 | Is there a record of radioactive sources                                | 89.7    | 1.26   | 1.26               | 1.26      |
|   | Question                                                                 | Mean | SD 1 | SD 2 | SD 3 |
|---|-------------------------------------------------------------------------|------|------|------|------|
| 46 | Is there a record of the movement of radioactive sources               | 5.1  | 1.97 | 1.97 | 1.97 |
| 47 | Is there a protection program in the laboratory (camera control ... etc.) | 87.2 | 1.18 | 1.18 | 1.18 |
| 48 | Is there an official responsible for the conservation of radioactive sources | 92.3 | 1.08 | 1.08 | 1.08 |
| 49 | Do you have an idea of the regulatory authorities on radioactive sources | 64.1 | 1.13 | 1.13 | 1.13 |
| 50 | Do you have an idea of the controls on the use of radioactive sources  | 82.1 | 1.49 | 1.49 | 1.49 |
| 51 | Have you participated in a seminar, lecture or workshop on the security of radioactive sources | 74.4 | 1.51 | 1.51 | 1.51 |
| 52 | Are you the one who did this (lecture, discussion, etc.)                | 33.3 | 1.28 | 1.28 | 1.28 |
| 53 | Do you have an idea about radioactive transport controls                | 71.8 | 1.26 | 1.26 | 1.26 |
| 54 | Is there a follow-up (monitoring) of the presence of radioactive sources in the laboratory | 66.7 | 1.9  | 1.9  | 1.9  |
| 55 | Are physical protection procedures sufficient in the section            | 30.8 | 1.41 | 1.41 | 1.41 |
| 56 | Are physical protection procedures sufficient in college               | 25.6 | 1.46 | 1.46 | 1.46 |
| 57 | Is there an official to protect radioactive sources in the department  | 76.9 | 1.87 | 1.87 | 1.87 |
| 58 | Is there a special cabinet for radioactive sources                     | 25.6 | 1.92 | 1.92 | 1.92 |
| 59 | Do you have an idea of the regulatory authorities on radioactive sources | 64.1 | 1.31 | 1.31 | 1.31 |
| 60 | Have you participated in a symposium, lecture or workshop on the security of radioactive sources | 97.4 | 1.03 | 1.03 | 1.03 |

### Results, Procedures and Functions CBRN:

The statistical analysis program SPSS, Version 24, 2016, IBM was adopted. The stability and the validity test of the questionnaire were conducted. The amount of the Cronbach's alpha factor was approximately 0.667, which means that it has a high degree of stability. This factor increases to 0.92 if we delete the certificate element. The frequency tables showed that more than 88% of those who conducted the questionnaire were the specialty of nuclear physics and 5.1% were the specialty of medical physics. But if we look at specialization, the society that conducted the questionnaire consists of 61.5% of PhD degree and 35.9% of msc degree and 2.6% of ba degree. With regard to career service, 75% have a career service of less than 20 years. It is controversial that although the study population included more than 92.3% of radiation workers, the proportion of users of the bag did not exceed 30%, which may be due to lack of resources or weak equipment. And 15% went to follow these films. And that 75% of the staff does not receive radiation allocations, which is one of the simplest rights and is not subject to the annual examination. As for periodic examinations, 74.4% are not subject to periodic examination. Follow-up to safety procedures is weak in terms of sections or classes. With regard to awareness of risks and the implementation of courses and scientific knowledge statistical data indicate that the cadres at a good level of occupational risks and nuclear safety measures.

Statistical studies in terms of the study axes showed a significant value in terms of the safety axis, while there was no significant value for the security axis. Follow-up laboratories:

### Statistical tests:

1. Make Kay square of independence between each of the variables of the descriptive study variables by the status of null hypothesis H0 There is no relationship between the variables.
2. Alternative Hypothesis H1: There is a relationship between variables.
If the moral value is less or equal to 5%, we reject the null hypothesis and accept the alternative hypothesis

- Calculate the correlation coefficients between all the security axis and the axis of nuclear safety to study the relationship between the axes or not.
- Conducting the Independent T Test between the study axes.

**Conclusion and recommendations:**
1 - The results have been obtained indicate the effectiveness of some of the measures taken by the three regulatory bodies, and need to follow up in others to increase their effectiveness. The questionnaire showed some of them, in addition to the gaps identified.
2 - Activating the law of granting radiation allocations to those working in nuclear physics laboratories from professors and technicians, and assigning the prevention center to follow up, including the annual inspection.
3 - Continue training courses, workshops and seminars in the field of security and nuclear safety, and coordinated should be with the ministerial and national team.
4. Establish a training center for the CBRN in the Ministry to raise awareness and respond to minor CBRN incidents before they are exacerbated, and the trainee is given a certificate.
5. Provide the necessary financial allocation for the work requirements of CBRN committees, units, divisions and teams.
6 - Working on the development of this questionnaire by increasing the number of questions about the details of the work more and the procedures in place in the laboratories.
The References:

[1] Law of the National Control Commission on the Manufacture of Nuclear, Chemical and Biological Weapons No. 48 of 2012. 2012.

[2] Mahdi, Khaled Hadi; Saeed; Ahmed Mohammed, Khalil; Hassan Shaaban, Jassem; Ous Hilal, Abdul Razak, Directory of Radiation Sources. Unknown place: University House for Printing, Publishing and Translation, 2016.

[3] Haider Hashim, Abbas Mohammed Ahmed, Ghada Ghalib. National Bio Risk, standardized operating procedures (SOP) FOR Iraqi Bio and Health Laboratories. s.l. : Ministry of science and technology, 2015.

[4] Lisa Moran and Tina Masciangioli, "Chemical Laboratory Safety and Security," National Academy of Sciences, 2010.