# CONSIDERATIONS TO ENHANCE PUBLIC UNDERSTANDING OF THE RADIOACTIVE MATERIALS MANAGEMENT

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**Abstract**

Recently, many countries start to promulgate their nuclear program all over the world. The negative issue facing those newcomers is public apprehensions about the management of nuclear and radiological activities, that any failure in their management may cause harmful radiological consequences affect directly to human health and environment. The misunderstanding of the public is considered a big challenge especially in the first stage of establishing NPP. Therefore, it is very important to increase public awareness towards the management of nuclear and radioactive materials especially the more dangerous materials nuclear spent fuel (NSF) and high-level radioactive wastes (HLRWs) during storage, operation, disposal, and transport. Public should persuade that the national nuclear security regime could cover all the nuclear security requirements and the implementation of nuclear security measures receive the attention warranted to protect nuclear and radioactive materials, also the existing security systems and measures carry out its purpose in acceptable and satisfactory level. On the safety side public should convince that all safety measures will apply to safe worker, public and environment from any radiological consequences. All that will allow them to trust about their national nuclear security and safety regime and the implementation of its requirements. To enhance the public well understanding towards this critical issue there are some considerations should be taken to turn their apprehension to trust about both national safety and security managements of NSF and HLRW.On the other hand these public apprehensions act as an initiator to the government to develop efficient national policies to manage these critical issues. Also, the study discusses the role of state and organizations to enhance public understanding of the management of nuclear and radioactive materials NSF and HLRW.

## 1. INTRODUCTION

Radiophobia is an important reason for the public apprehensions about the management of nuclear and radioactive materials. The public misunderstanding about the highly dangerous if not immediately deathly of any level of radiation is creates a public fear within the community. While hazards resulted from using and disposal of chemicals or biological agents or their malicious attacks on related productions, facilities and activities could claim a disaster and many numbers of wounded and distortions in many cases higher than comes from radiological attacks. As an example, chemicals include highly toxic substances may use as cleaning materials in our houses, pharmaceuticals and other substances help us combat dangerous and diseases. Radioactive materials haven't the same public awareness of their benefits; however, their wide usage in detecting and treating cancer and other diseases [1]. Sure, radioactive materials are the targets of terrorists for sabotage or theft to be used in radiological weapons which are similar to nuclear weapons. Thus, radiological terrorism can be one of important reason of the public radiophobia [2]. Radiophobia considers a first negative issue faces newcomers after starting promulgating their nuclear power program. Public have concerns about any proportional malicious acts my happened and also about any failure in the management of such dangerous materials which may cause harmful radiological consequences affect directly to human health and environment. These public apprehensions about the dangerous of radiation, and management of nuclear and radioactive materials is regarding to the misunderstanding of the public about the security of the nuclear and radiological activities [3,4]. Therefore, the government should start to address public concerns about the establishing nuclear security program on their country, especially before beginning to establish the nuclear program. State should start to enhance public understanding about the real conception of the nuclear and radioactive facilities management and enhance their understanding about the application of safety and security systems on nuclear and radioactive facilities, which provide high level of protection of environment and public from any radiological consequences and also securing these materials from any type of threats; theft or sabotage. The correct understanding of those systems and there effective

implementation will persuade public about the safety and security of the nuclear projects, which may let them encourage the establishing the nuclear program in their countries. On the other hand these public apprehensions act as an initiator to the government to develop efficient national policies to manage these critical issues. Also, members of the public are capable of developing reasoned policy preferences about these critical issues. This study provides a roadmap for improving public understanding of the security of radioactive materials and activities with an emphasis spreading of an effective security culture, including role of state in establishing a clear policy to enhance a public well understanding of benefits and risks of radioactive materials, security management by utilizing media and direct approaches for public communication.

## 2. ROLE OF THE STATE

Governments need to play an important role in establishing clear policy in order to strengthen public well understanding of benefits and hazards of nuclear and radiological materials and activities as following steps:

- Establish a systematic long-term public well understanding program in the State nuclear policy, and identify the organization's responsibilities to implement these programs; this will be the most appropriate strategy for maximum effectiveness and fulfil the well understanding of the public,
- These programs should include the simplified explanation about the benefits of nuclear power program in the country and also the type of risks and what is the state policy in resolution of such those risks;
- Spreading a nuclear security culture between public and defining the general outlines of the national nuclear security regime;
- Establish guidelines for public to protect personnel, family and their property from the effects of a nuclear power plant before, though, and after any security events;
- Give special attention to public awareness about nuclear power and to find rapid resolutions to all risks and try to explain and understanding those type of risks;
- Organizing media approach for improving public well understanding include publication of booklets and pamphlets, production of video tapes, and arrangements for various presentations for public through media, and accessibility of nuclear plant information; and
- International cooperate with the other nuclear countries to spread the best practices in their nuclear program will encourage public confidence about the implementation of the nuclear program.

Under these policy directions, every possible measure has been taken to restore public confidence and strengthen public well understanding of the necessity for nuclear power plants.

## 3. BENEFITS AND RISKS

Radioactive materials are used throughout the world in many widespread applications for a variety of peaceful, medical, and industrial purposes. These applications can include industrial radiography, oil well logging, medicine, research and education, and military. These applications have benefits in: Killing bacteria in food, medical supplies, and equipment; Treating cancer and other diseases; Mapping underground sources of water and prospecting for oil and gas reserves. While nuclear materials are less spread than radioactive materials, they mainly used in operating nuclear power plants for electricity generation. Nuclear plants considered the main source of electricity in many countries due to its huge amount of electricity production which could cover the country electricity requirements. Also, nuclear materials could be used in research reactors for many research and development activities, also preparation of many isotopes for medical and industrial purposes. The principal problems in public misunderstanding of nuclear power are the misunderstanding of reality of radiation its benefit, hazards sources and radiation protection, extreme fear of reactor accidents, viewing high level waste disposal as an unsolved problem, and failure to understand risks. Thus, these risks should be discussed and explained to the public in clear and simple way. First the risks may be classified as following.

### 3.1. Radiation risks

The danger of radiation is a quantitative question, but the public does not understand quantitative treatments. They will not be convinced about that there is a normal background couldn't affect harm to human and environment and such that background are already around us in atmosphere, water, building materials such as concrete, cement, ceramic and so on. Also the harmful radiation might be happened from scanning devices which contain radioactive sources more than the nuclear power plants due to the more effective safety system in nuclear plants which rapidly shutdown in any failure in operation. The obvious solution to this dilemma is to compare exposures from nuclear energy problems with those we get from natural sources or from medical X-rays. Scientists normally do this, but the media and anti-nuclear activists never do. Media only talk about the effect of radiation exposure on public while the first issue in the reactor was the operation in a safe condition. The media announce, and the public believes, that any failure in function of the nuclear plant's safety system has a high probability of causing a disastrous accident. But the media never mentioned that the much radiation releases may get every day from unsafe and unsecured radioactive sources. This is just one of many problems in media coverage of radiation by spreading the illogical dangers of radiation, and that leads to the public's fear of radiation is much greater than realistic [5].

### 3.2. Reactor accidents

Perhaps the most serious problem in public understanding of reactor accident risks is failure to appreciate the value and the benefits of both security and safety systems which established and designed to protect the facility, materials, individuals, public and environment from any radiological consequences. Security system depends on the four main elements deterrence, detection, delay and response. Security system was designed to prevent any type of threats unauthorized removal and sabotage, it also includes several layers of protection if the malicious attack actually happened, the detection systems will recognize the adversary and delay system will decelerate them until response force stops the attack. Security system contain backup plan "contingency plan" if any failure happened in the designed system. Also security system designs under the principle of "defense in depth" for more security measures around the radioactive and nuclear materials storage and the vital area in the reactor. It is important for us to make the public understand that security system resist any external and internal adversary. Also, there is a safety system to protect the reactor during the operation process. And there are many safety procedures in emergency plan to prevent any bad radiological consequences can occur if several systems failure [6].

### 3.3. Nuclear spent fuel and high-level radioactive waste management

Nuclear spent fuel (NSF) storage and high level waste disposal issues cause public concerns because of their perceived risks. There are safety precautions applied in nuclear power plant to protect the spent fuel storage. The aim of these precautions is to prevent any risk of criticality as although the fuel assemblies are spent, that the fuel still contains more fissile uranium-235 (approximately 1%) than natural uranium. The spent fuel management begins with a period in storage in a pool. A depth of a few meters of water in the pool is enough to protect against the extreme radioactivity. Furthermore, water is resistant to radiation. It is an excellent coolant, able to absorb the heat released by fuel assemblies. Then the oldest fuel assemblies were removed from the pools and stored dry, inside thick-walled casks that protect against radiation [7]. Also, high level radioactive waste (HLRWs) management strikes fear into the public However, not a single fatal accident relating to transportation, storage of high level radioactive waste and spent fuel has occurred. By comparison, there are three different types of wastes from coal burning, each of which causes over a thousand times as many deaths. These are air pollution; chemical carcinogens like arsenic, cadmium, etc.; and "radioactive wastes", uranium, thorium, and radium, which eventually generate radon gas with its large potential for damage to humans [8].

Both spent fuel and radioactive waste management undergo to conduct safety and security procedures, inspections and enforcing both regulations to ensuring that facilities are safe and secure. Thus, public should persuade that the national nuclear safety and security regimes could cover all the nuclear safety and security

requirements and the implementation of both measures receive the attention warranted to protect NSF and HLRWs in acceptable and satisfactory level.

## 4. UNDERSTANDING RISK

The public does not understand theory of probability very well. The solution to this problem is to convert risks into explanation of the positive side which increase their safety influence, talking about the implementation of the safety and security systems in the facilities will turn their fear to trust about the national nuclear safety and security regime which will manage, organize and control all radiological activities during storage, operating process and transport all over the country. Spreading safety and security culture in public through media and with direct communication will help in well understanding of risks and enhance their confidence about the safety and security management [9].

## 5. MEDIA APPROACH TO PUBLIC

It is difficult to reach a completely change of the public convictions on safety and security of the present nuclear reactors, and it is more useless to try to change their attitude. The best approach might be to make media approach for spreading that the State carry out its role by establishing an effective nuclear safety and security regimes and establish regulatory authority that obligate the nuclear or radioactive facilities to design, implement and develop safety and security systems according to the regulatory requirements. Thus, the power reactors are very much safe and secure and the media should disseminate these ideas through publication of booklets and pamphlets, production of video tapes, and arrangements for various presentations and interviews through media, and accessibility of nuclear plant information for public. Also establishing different guidelines for safety and security issues for public will make them trust about the national nuclear safety and security management [10].

## 6. COMPLETING NATIONAL NUCLEAR SECURITY REGIME

States should accelerate in completing their national nuclear security legislation and regulatory framework as early as possible; Defining the expected threats on the radiological facilities; These procedures should include enforcement measures for obligating radiological and all open access facilities to achieve the regulatory requirements; Nuclear security regulatory framework should be continuous updated for any extraordinary events which may need any modification in the regulatory requirements[11,12]; The legislative and regulatory framework should cover: authorization procedures for handling, management and disposition of nuclear and radioactive materials; The regulatory requirements for securing each category; The regulatory framework should state the role and responsibilities of all organization deal with the nuclear and radioactive materials like competent authority, technical support organization, operator and other stakeholders to void conflict between authorities. Completing the national security framework will organize the roles and responsibilities of each authorities or organizations dealing with nuclear and radioactive materials which avoid conflict that will reflect on the public trust about their national security management. Also defining the role and responsibilities will enhance spreading nuclear security culture through media and public communication for raise the awareness of public about the security of nuclear and radioactive materials. All that will enhance public confidence about the national nuclear security regime [13].

### 6.1. Security management of nuclear and radiological facilities and activities

It is important to note that nuclear facilities in general and nuclear power plants in particular, can be considered to be well protected against terrorist attacks. They have good security systems and procedures, and they are designed to protect persons, property, society, and the environment from malicious acts involving nuclear and radiological facilities that could cause unacceptable radiological consequences. The nuclear security system controls the security of the nuclear and radiological facilities [11, 13].

## 7. CONCLUSION

This study discusses the public apprehensions about the risks in management of nuclear and radioactive materials, and highlights the benefits of nuclear and radioactive materials in industry, healthcare and electricity generation. These public fears about the implementation of the nuclear program in their countries is regarding to the misunderstanding of the public about the safety and security management of the nuclear and radioactive materials and facilities. To enhance the public well understanding towards this critical issue there are influence factors to turn public apprehension to trust about their national safety and security regimes. Public should persuade that the national nuclear safety and security regimes could cover all the nuclear and radiological requirements to implement nuclear safety and security of nuclear and radioactive materials during storage, operation, disposal and transport. The implementation of the both systems in acceptable and satisfactory level should receive the attention warranted to protect all nuclear and radioactive materials, public and environment from any radiological consequences and allow public to trust about the national nuclear safety and security regimes and the implementation of their requirements. Also, this study provides a roadmap for improving public understanding towards the management of nuclear and radioactive materials facilities, and activities: including role of state to establish a clear policy to enhance a public well understanding of benefits and risks of radioactive materials and facilities, NSF management, and HLRW Disposal, safety and security management and media approaches for public communications.

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