продовольственной безопасности / Е. Г. Моисеев // Аграрное и земельное право. – 2009. – № 8. – С. 50-55.

6. Ушачев И. Г. Анализ зарубежного опыта регулирования вопроса обеспечения продовольственной безопасности / И. Г. Ушачев, А. И. Пащенко, В. И. Тарасов // Аграрное и земельное право. – 2009. – № 2. – С. 4-10.

7. Файзуллин Г. Г. Роль государства в обеспечении продовольственной безопасности: международно-правовой аспект / Г. Г. Файзуллин // Право и государство. – 2008. – № 8. – С. 72-76.

8. http://www.fao.org

UDC 347.77: 347.79

Sabol J., Šesták B.,
Faculty of Security Management, Police Academy
of the Czech Republic in Prague, Czech Republic

ENVIRONMENTAL NPP RELATED RISK ASSESSMENT AND ITS COMMUNICATION TO THE PUBLIC

Abstract

The paper discusses some specific aspects associated with the nuclear power plants (NPPs) normal operation as well as the impact of potential incidents and accidents which may result in a radioactive contamination of the surrounding and even distant locations. The results of monitoring of environmental activity concentration of selected radionuclides, including the level of accompanying external exposure, are assessed in terms of consequences to members of the general public. Some data illustrating the impact of the Chernobyl and Fukushima nuclear accidents are also outlined. In addition, the importance of the dialogue between relevant national authorities and the public has been stressed since the educated public perceives the nuclear risk more realistically than the public lacking any knowledge of nuclear technology.

Introduction

Radiation and nuclear based technologies are widely used in many fields of medicine, industry, science and other areas where they proved to be uniquely beneficial modalities. This is especially true in producing electricity in nuclear power plants where nuclear reactor is a powerful source of energy. The reactor core sits inside a steel pressure vessel, so that water around it remains liquid even at the operating temperature of over 320°C. Steam is formed either above the reactor core or in separate pressure vessels, and this drives the turbine to produce electricity. The steam is then condensed and the water recycled. Except for the reactor itself, a NPP works like most coal or gas-fired power stations.

The pressure vessel and the steam generator are housed in a massive containment structure with reinforced concrete about 1.2 metres thick. This is to protect neighbours if there is a major problem inside the reactor, and to protect the reactor from external assaults (fig. 1). Nuclear energy supplies about 11% of the world's electricity (fig. 2). Today 31 countries operate more than 440 nuclear power reactors.

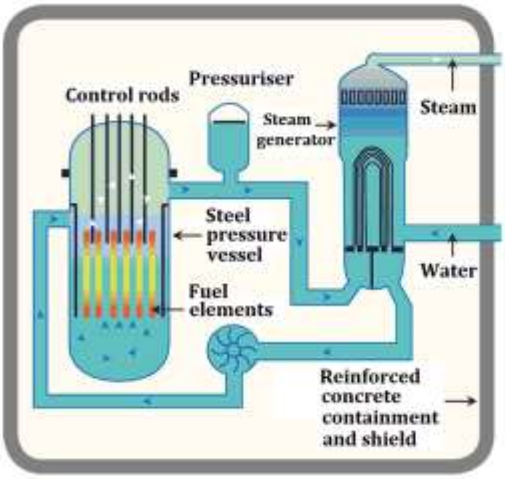

Fig. 1 What is in the containment.

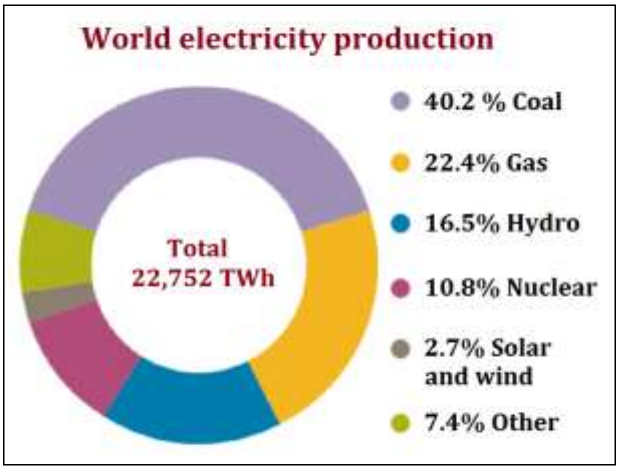

Fig. 2 Share of nuclear produced electricity.

Nuclear safety and security

Nuclear safety can be defined as the achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation and radioactive hazards. On the other hand, nuclear security is characterized by the prevention and detection of and response to, theft, sabotage, unauthorized access, illegal transfer and other malicious or terrorist acts involving nuclear material, other radioactive substances or their associated facilities. This covers not only NPPs, but also all other nuclear facilities, the transportation of nuclear materials, and the use and storage of nuclear and radioactive materials for medical, power, industry, and military uses.

The nuclear power industry has improved the safety and performance of reactors, and has introduced new, strict and safer reactor designs. Despite this, however, a perfect safety cannot be guaranteed. Potential sources of problems include human errors or violation of safety instructions (Chernobyl) and external natural events that have a greater impact than anticipated (Fukushima). Under normal operational conditions the NPPs radioactive releases are rigorously controlled and their impact on the exposure of the population and radioactive contamination of the environment are limited to such levels which can only result in exposure well below of natural radiation background (about 3 mSv/y). For example, the average annual exposure received by the public of the Czech Republic, operating two large NPPs Temelín and Dukovany, is less than 8 μSv. In fact, such small exposure is comparable with the dose received by a passenger flying from Prague to London (on board, due to elevated intensity of cosmic radiation at high altitudes, dose rate is around 4 μSv/h).

Consequences of nuclear accidents at Chernobyl and Fukushima

These nuclear accidents are considered to be the most sever emergency events in history of the use of nuclear energy for peaceful purposes. One unit 4 at the Chernobyl NPP complex was destroyed while at Fukushima three units were affected (fig. 3).

Chernobyl *Fukushima*

Fig. 3. Chernobyl and Fukushima NPPs before and after the accident.

The impact of individual NPP accidents in terms of radioactivity released into the environment is shown in fig. 4. The size of land area severely contaminated by Cs-137 was 10 times smaller around Fukushima compared to Chernobyl. The differences are also reflected in the composition of the discharged radionuclides as well as in the pattern of the ground contamination. Volatile radionuclides (such as Te-132¸I-132, I-131, Cs-134 and Cs-137) contributed to the gamma exposure from the ground deposition in the Fukushima area, whereas a greater variety of radionuclides contributed significantly around Chernobyl. When radioactivity deposition occurred, the radiation exposure rate near Chernobyl was estimated to have been 770 μSv h−1 per initial Cs-137 deposition of 1 MBq m−2, whereas it was 100 μSv h−1 around Fukushima. Estimates of the cumulative exposure for 30 years are 970 and 570 mGy per initial deposition of 1 MBq m−2 for Chernobyl and Fukushima, respectively.

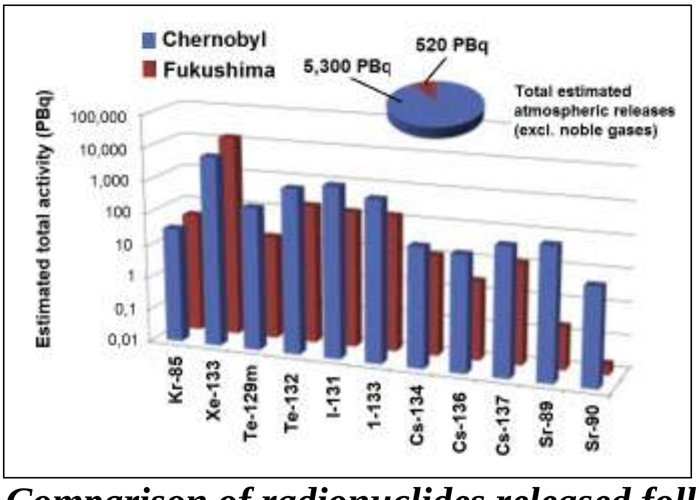

Fig. 4 Comparison of radionuclides released following Chernobyl and Fukushima accidents.

Perception of nuclear related risk

In general, any risk reflects a measure of danger or threat associated with some processes or systems where we have to distinguish between the probability and impact related to such situation. The risk of an occurrence with low probability and high impact may be similar to the risk associated with the event characterized by high probability and low severity (fig. 5).

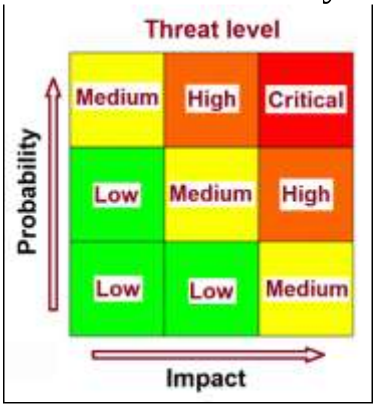

Fig. 5 Impact of the accident vs. its probability.

Within the range of risks studied it is widely recognised that perception of nuclear risks, whether nuclear power, disposal or transport of waste, facility siting, or accidents, invokes the greatest levels of fear and dread. This is mainly due to the different perception of the specific risk among members of the public and experts. It is therefore desirable to educate the public so that it assess the risk realistically in prospective with other risks. Risk communication is the process of informing people about potential hazards to persons, property, or community. Scholars define risk communication as a science-based approach for communicating effectively in situations of high stress, high concern or controversy.

Conclusion

Monitoring campaigns after both accidents reveal that the environmental impact of the Chernobyl accident was much greater than that of Fukushima. Both the highly contaminated areas and the evacuated areas are smaller around Fukushima and the projected health effects in Japan are significantly lower than after the Chernobyl accident. This is mainly due to the fact that food safety campaigns and evacuations worked quickly and efficiently after the Fukushima accident. In contrast to Chernobyl, no fatalities due to acute radiation effects occurred in Fukushima. The relevant authorities, together with mass media, should take proper measures to ensure that the public is adequately inform about real and potential risk associated with the use of nuclear technologies. This is the only way how to convince the public to cooperate efficiently with rescue teams in mitigating the impact of the accident.