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REGULATORY CONTROL OF RADIATION SOURCES AND RADIOACTIVE MATERIALS IN THE CZECH REPUBLIC

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Abstract. The paper describes legal and regulatory provisions for radiation protection and safe use of sources of ionizing radiation in the Czech Republic with special emphasis on aspects of bringing activities under regulatory control and releasing them from it. It covers the development of a new legal framework, the work of the regulatory body, an overview of sources in use and provisions to achieve effective regulatory control of facilities and releases of radioactive material into the environment. Also, it describes reported unusual events with a proposed scheme for their classification and evaluation.

ENABLING LEGISLATION

Owing to political and economic changes in the Czech Republic, the entire legislative system is undergoning extensive reconstruction.

There have been substantial changes in legislation and organization of the State's regulation of radiation protection in the past three years, which also affect the system of accountancy and control of practices involving radiation sources. Act No. 18/1997 Coll., the "Atomic Act" was approved by the Czech Government in December 1996, by Parliament on January 24, 1997 and came into force on July 1, 1997. In parallel with the Atomic Act, twelve follow–up implementing decrees were prepared by the State Office for Nuclear Safety (SONS).

The Atomic Act and these decrees are based on the internationally adopted principles and recommendations in nuclear safety and radiation protection:

- IAEA IBSS, No. 115/1994,
- ICRP Report No. 60/1990,
- EU Directive 96/29/EURATOM, etc.

The Atomic Act and decrees impose strong obligations not only upon users of sources and licensees, but upon whoever:

- performs any activity introducing sources of exposure or exposure pathways,
- extends exposure to additional people;
- modifies the network of exposure pathways from existing sources so as to increase the exposure or the likelihood of exposure of people or the number of people exposed.

The licensee, owner of source or operator shall:

- proceed in such a manner that radiation protection is ensured as a matter of priority,
- ensure that the practices are justified by benefits outweighing their risks;
- maintain a level of radiation protection where the risk to life, health and the environment will be kept as low as reasonably achievable,
- intervene if the exposure could approach levels of acute damage to health or if such measures are expected to provide more benefit than harm; and
- keep exposure of people below the prescribed limits.

Under the national legislation, SONS established a system of authorization — notification, registration, licensing — of different practices involving radiation sources, e.g. transport, import, export, distribution, usage, storage, disposal, with clearly declared:

- responsibilities of persons involved in the practice,
- requirements for ensuring radiation protection, including the security of radiation sources, record keeping of inventory and movement, and notification of unusual events.

Since, any manufacture repair, import, export, acceptance, storage, decommissioning, disposal and other activities with radiation sources, including practices involving natural sources, are activities leading to exposure, a licence issued by SONS in accordance with the legislation is required. All licensees intending to perform practices leading to exposure should handle, assess, monitor or investigate sources in accordance with the radiation protection requirements.

THE REGULATORY AUTHORITY

By governmental decision and in accordance with Act No. 85/1995 Coll., the regulatory/supervisory bodies controlling nuclear safety and radiation protection have been integrated into the State Office for Nuclear Safety (SONS). The province and authority of the Ministry of Health, the Chief Health Officer of the Czech Republic and the Regional Officers of Hygiene Service in the area of radiation protection passed to SONS.

SONS is the regulatory body responsible for governmental administration and of uses of nuclear energy and ionizing radiation and of radiation protection. The authority and responsibilities of SONS are stipulated by Act no. 18/1997 Coll. on Peaceful uses of Nuclear Energy and Ionizing Radiation (Atomic Act). This new legislation necessitated organizational changes. Within SONS, three divisions headed by deputy chairmen and one independent department were established:

- Division of Nuclear Safety
- Division of Radiation Protection
- Division of Management and Technical Support
- Department of Emergency Preparedness.

Regional centres of SONS have been established. The National Radiation Protection Institute serves as the technical and research budgetary support organization of SONS.

SONS shall carry out the following duties:

- State supervision of nuclear safety and radiation protection, and management of radioactive waste, spent fuel, nuclear materials, physical protection of nuclear facilities;
- licensing and inspection;
- evaluation and regulation of occupational, medical and public exposure due to a practice or source within a practice, i.e. normal and potential exposure;
- determination of limits, constraints, guidance and clearance levels;

- co–ordination of a national radiation monitoring network and assurance of international exchange of information on radiation levels; and
- advice to decision makers on a local and governmental level on protective measures in the case of a nuclear or radiological accident.

At present, 45 inspectors fulfil the duties of regulatory authority in radiation protection. The authority of the inspectors is stipulated in the provisions of the "Atomic Act"

- Inspectors are authorized to enter the workplaces where practices are carried out or where the equipment, objects and materials under the supervision are located and to demand the necessary documents and information;
- In the case that inspectors discover deviations from approved documentation, especially from monitoring pogrammes or emergency plans, they are authorized to stipulate the time period within which the licensee shall take necessary measures, and a schedule for remedial actions. If these deviations jeopardize radiation protection, inspectors can impose immediate revocation of the licence;
- Inspectors are authorized to order a technical audit, check or test of equipment, machines or systems if this is necessary for proving compliance with the radiation protection requirements;
- Inspectors are authorized to verify the professional competence of workers

A new system enabling experts from all regions to be engaged was applied within SONS inspection activities in 1998. This system improved the efficiency of the activities even with the limited number of 45 radiation protection inspectors.

Inspections are divided into two classes: **inspections performed by the SÚJB Regional Centres** (RCs), where inspectors only of the RC affected are engaged, and specialized inspections performed by specialized inspection teams comprising inspectors from various regions. Inspections of this kind are carried out for such types of ionizing radiation sources and workplaces handling them where attaining a higher level of unification of the radiation protection practice within the whole country (e.g. for workplaces handling significant and very significant unsealed ionizing radiation sources) and the use of expertise of specialists in other regions are desirable. This system is complemented with **inspections performed by ad hoc inspection teams,** particularly for time–consuming and intricate inspections at workplaces handling very significant radiation sources.

The inspection assessment system uses four rating categories based on the following criteria:

I. Radiation source handling procedures fully comply with legislative requirements;
II. Formal deficiencies exist, not affecting the radiation protection level;
III. Deficiencies exist, requiring corrective measures to be adopted or the activity to be limited or suspended;
IV. Deficiencies exist such as call for licence withdrawal.

Overview of ionizing radiation sources and workplaces handling ionizing radiation sources

The process of privatization in the economy after 1989 brought about discontinuation of the national system of ionizing radiation source accountancy. Therefore, SONS began setting up a new ionizing radiation sources registry. As the first step, an extensive inventory of ionizing radiation sources and institutions possessing them was carried out.

The scope and demanding nature of the work associated with the execution of state administration and supervision in radiation protection is illustrated in the tables describing the numbers of ionizing radiation sources and workplaces where such sources are handled.

In accordance with Act No. 18/1997, ionizing radiation sources are divided into five classes with regard to the increasing extent of possible damate to human health and the environment: insignificant sources, minor sources, simple sources, significant sources, and very significant sources. The higher the source class, the more stringent and extensive are the requirements placed on radiation protection provisions; the licensing procedure is more complex and requires deeper professional knowledge. Supervisory activities are also aimed primarily at the potentially most hazardous sources, for which the inspections should be more frequent, extensive, and detailed.

The following institutions are classed as **workplaces with very significant ionizing radiation sources**:

- Institutions operating nuclear reactors and related technologies, notably the Dukovany nuclear power plant with its four power reactors, Nuclear Research Institute in Řež with two research reactors and the Faculty of Nuclear Sciences and Physical Engineering, and the Czech Technical University in Prague with one teaching reactor.
- Institutions operating large industrial irradiators, notably a workplace for food irradiation (spices in particular) belonging to the company Artim Praha s.r.o., and a workplace for radiation sterilization of medical material, owned by the company Biostér Veverská Bitýška a.s.
- Institutions handling major quantities of radioactive substances (very significant unsealed radionuclide sources), notably workplaces of the companies Cesio Praha s.r.o. and Isotrend Praha s.r.o.

Workplaces handling unsealed radionuclide sources

	Institutions handling significant ionizing radiation sources (Category III workplaces under Regulation 184/97)	Institutions handling simple ionizing radiation sources (Category I and II workplaces under Regulation 184/97)
Medical and veterinary applications	16	130
Industry	0	16
Other applications (research)	11	146
Total	27	292

The risk of radioactive substances being dispersed at the site or leaking into the environment exists at workplaces handling unsealed radionuclide emitters. The potentially possible maximum activity at the site is thus a significant parameter with regard to the hazard and to record-keeping. Therefore, the category of workplaces handling significant ionizing radiation sources (significant workplaces) includes such workplaces as fall in Category III under Regulation No. 184/1997, whereas workplaces in Category I and II handling unsealed sources are classed as workplaces with simple ionizing radiation sources (simple workplaces).

Sealed radionuclide sources

	Significant ionizing radiation sources	Simple ionizing radiation sources
Medical and veterinary applications	74	1422
Industry	250	3527
Other applications (research)	20	909
Total	344	5858

In sealed radionuclide sources, the radioactive substances are well encased, and the sources have been tested so that dispersion at the site and/or leak into the environment should be virtualy impossible under predictable conditions. Sealed radionuclide sources can be handled as units which are countable and fall under mandatory accountancy and record–keeping schemes. The figures representing the numbers of individual simple sealed radionuclide sources are not identical with those representing the numbers of devices where such sources are handled (a facility can handle more than one source, and the number of sources handled by an institution can even be variable; e.g. in brachytherapy).

There are more than 150 thousand minor sources in the Czech Republic, mainly calibration sealed sources and smoke detectors. Obtaining a licence is not mandatory for the use of minor sources of ionizing radiation, particularly in ionization smoke detectors: under Act No. 18/1997 it is sufficient to notify the SÚJB, which keeps records of such sources.

The notifying duty does not apply to the use of **insignificant ionizing radiation sources** because such sources do not pose any health or environmental hazard. Therefore, such sources are not included in the national registry either.

Clearance from regulatory control

The radiation protection system in the Czech Republic deals with the clearance from the regulatory control of airborne, liquid and solid wastes containing very low levels of radioactive materials.

Without a licence from SONS, it is possible to use outside a workplace with ionizing radiation sources, to release into the water flow or into the air, to deposit for waste disposal or in other ways to discharge into the environment only materials, substances and objects containing the radionuclides or being contaminated by them in such measure, for which some of the following conditions hold:

- In any calendar year, the average effective dose for the critical group of the population does not exceed 10 μSv and at the same time the collective effective dose does not exceed 1 Sv;
- During the discharge of solid substances and objects into the environment, neither the sum of the parts of mass activities of individual discharged radionuclides and clearance levels for the mass activity of appurtenant radionuclides given in regulations nor the sum of the parts of area activities of individual discharged radionuclides and clearance levels of area activity of appurtenant radionuclides given in regulations is not greater than one;

- During the release into surface water, with the exception of releases from workplaces with the very significant sources, the sum of products of volume activities of individual released radionuclides and conversion factors h_{ing} for the intake of these radionuclides by the ingestion by the adult member of the public is not greater than 10^{-4} Sv.m^{-3} ,
- During the release into the air, with the exception of release from workplaces with very significant sources, the sum of products of volume activities of released individual radionuclides and conversion factors h_{inh} for the intake of these radionuclides by the inhalation by an adult member of the public is not greater than 10^{-6} Sv.m^{-3};
- During the deposit on waste disposal, the sum of products of mass activities of individual deposit radionuclides and the conversion factors for the intake of these radionuclides by the ingestion by adult members of the public is not greater than 10^{-4} Sv.kg^{-1}, the sum of parts of area activities of individual deposit radionuclides and clearance levels of area activity of appurtenant radionuclides given in regulations is not greater than one and the deposit is performed in a such way that it does not cause in the distance from the surface of disposal the increase of a dose–rate equivalent of more than 0.1 μ Sv/h against the original natural background in the given locality, nor the overall dose–rate equivalent 0.4 μ Sv/h,
- During a release into public drainage, with the exception of release from very significant sources, the sum of products of volume activities of individual released radionuclides and conversion factors for the intake of these radionuclides by the ingestion by the adult member of the public according is not greater than 10^{-2} Sv.m^{-3}.

On the basis of a licence issued by SONS, there is possible to permit only the release of materials, substances and objects containing the radionuclides for which average effective doses for the relevant critical group of population do not exceed 250 μSv per year.

Sometimes a release from regulatory control can be allowed under certain conditions. The system of accountancy and monitoring of movement of conditionally cleared contaminated materials is currently being established in the Czech Republic.