

Republic of Croatia

NATIONAL REPORT
ON IMPLEMENTATION OF
THE OBLIGATIONS UNDER THE
JOINT CONVENTION ON THE SAFETY
OF SPENT FUEL MANAGEMENT AND
ON THE SAFETY OF RADIOACTIVE
WASTE MANAGEMENT

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Section A. Introduction

The Republic of Croatia signed the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) on 9 April 1998, and ratified it on 5 February 1999.

According to the Constitution of the Republic of Croatia, article 134, “international treaties, signed and ratified in accordance with the Constitution... are part of the national legislation of the Republic of Croatia”. By this article of the Constitution, all requirements of the Joint Convention can immediately be interpreted as extensions or modifications of the national law, until the recently undertaken development of national legislation incorporates them directly into the present or new laws and subordinated regulations. This process is well under way, but not yet completed.

Even at this transition period, the national regulatory framework in the field, as well as the national policy and practices, reasonably well reflect the recognized international standards and good practices, and thereby also the requirements of the Convention. But they still need considerable improvement, in particular towards more rational organization and internal consistency.

Both the Croatian legislation on spent fuel and radioactive waste management, and its implementation, have been decisively influenced by several country-specific developments in the last two decades.

Croatia has inherited the entire regulatory framework in this field from the former Socialist Federal Republic of Yugoslavia (SFRY), in which it was a constitutive republic. This legislation was a comprehensive and up to date set of laws and regulations from the early eighties, addressing particularly well the safety and protection issues raised by the first nuclear power plant (the NPP Krško in Slovenia), built at that time as the joint project of the republics of Slovenia and Croatia. A similar project was planned in Croatia as well, but these plans have been abandoned in the meantime.

However, after Slovenia and Croatia had become sovereign states, the joint NPP Krško project gradually developed into a prominent bilateral issue. It has been resolved only recently, by a negotiated agreement which reasserted the fifty-fifty ownership with fully shared responsibilities, and specified further project management.

In the meantime, only small quantities of radioactive waste from research, medicine and industry have accumulated in Croatia, and they are kept in temporary storage facilities with appropriate safety arrangements. National waste management strategy for this inventory has not been developed beyond that point.

Under the circumstances, development of the national regulatory framework in this field had not been among the first priorities of the newly formed state. Still, towards the end of nineties, a novation of the framework was initiated, starting from the radiation protection basic law and extending to related regulations, with intention to separate radiological protection concerns from nuclear safety issues. Insofar, radioactive waste management has been only mildly affected by the changes, but more specific regulations are pending.

The Slovenian-Croatian agreement on the NPP Krško came into force on 11 March 2003. Its article 10 requires that the two governments “ensure efficient joint solution” for the NPP decommissioning and RW&SF disposal, “both in economic and

environmental protection regard”. In order to achieve that, “RW and SF disposal program” and “Decommissioning program”, both “compliant with the international standards”, will be prepared “in co-operation with the NPP, by the expert organizations appointed by the contracting parties”. These bilateral programs should be prepared within a year, then approved by the governments appointed Bipartite Commission, and subsequently revised at least every five years. The programs are additionally subject to the approval by the Slovenian nuclear safety authority.

“The NPP Krško site may be used for interim storage of radioactive waste and spent fuel until the end of lifetime”. This provision clearly relaxes the requirement on the program proposals to be approved in the next year, in particular regarding the unspecified issue of how complete and final they should be. But if the contracting parties do not reach agreement on joint disposal by the end of the NPP lifetime, it is their obligation to complete the removal of all RW&SF from the NPP site within two years after that date, in this case, however, taking “one half each” (article 10). Finally, in the article 11 the contracting parties declare their obligation to ensure financing of the decommissioning and disposal programs “in equal parts”. If joint disposal is not agreed upon, each government will independently finance those disposal program activities which are not of common concern.

It is understandable from the above considerations that the national spent fuel and radioactive waste management strategy is yet to be fully developed, depending on the arrangements with Slovenia. Presently, it is expected that the NPP Krško waste and spent fuel will be managed in as yet unspecified joint project. Under these circumstances, the following approach has been selected for the report preparation:

- (a) Description of radioactive waste management facilities and waste inventories, as well as of policy and practices, will be limited to the waste produced in Croatia. The NPP Krško waste and spent fuel will not be addressed, and spent fuel issues shall generally not be considered.
- (b) Provisions of the national regulations will be outlined as they stand at this moment. Temporary issues of internal consistency and completeness shall not be extensively elaborated, as the regulatory framework is under intensive review, whereas in practical applications these issues are resolved by systematic adherence to the internationally recognized standards and recommendations.

Section B. Policies and Practices

Spent fuel

Spent fuel management has not been practiced in Croatia. The NPP Krško spent fuel management policy is expected to be soon defined in a joint project with Slovenia.

Radioactive waste management policy

Long-term radioactive waste management policy has not yet been developed; so far the policy has been limited to keeping the accumulated waste in temporary storage. Only preliminary steps have been taken towards development of a LILW repository.

Radioactive waste management practices

Only small quantities of waste from medicine, research and few industrial applications have been managed in Croatia. The waste which could not be disposed of as communal waste after a brief on-site delay storage, is presently stored in two facilities described in the Section D.

Radioactive waste categorization

The regulation on radioactive waste defines solid, liquid and gaseous radioactive waste. For the solid radioactive waste, the categories I, II, and III are defined in the following table:

Radioactive waste category	Specific activity A_{sp} (Bq/m^3)	Waste category description
I. High level	$A_{sp} > 5 \cdot 10^{14}$	high beta/gamma, and significant alpha activity, high radiotoxicity, significant heat power (requires cooling)
II. Intermediate level with alpha emitters	$5 \cdot 10^{14} > A_{sp} > 5 \cdot 10^9$	medium beta/gamma, and significant alpha activity, medium radiotoxicity, low heat power
Intermediate level with beta/gamma emitters	$5 \cdot 10^{14} > A_{sp} > 5 \cdot 10^7$	medium beta/gamma, negligible quantity of alpha emitters, low/medium radiotoxicity, insignificant heat power
III. Low level with alpha emitters	$5 \cdot 10^9 > A_{sp}$ $\frac{A_i}{IK_i} \geq 1$	low/medium beta/gamma, low alpha, low/medium radiotoxicity, insignificant heat power
Low level with beta/gamma emitters	$5 \cdot 10^7 > A_{sp}$ $\frac{A_i}{IK_i} \geq 1$	low beta/gamma, insignificant alpha, low radiotoxicity, insignificant heat power

The fractions A_i/IK_i in the III. category compare the measured radionuclide concentration with its allowed concentration, i.e. with the “derived limit for drinking water”.

Section C. Scope of Application

Regarding the obligations under Article 3:

- (a) Croatia has not declared reprocessing to be part of spent fuel management;
- (b) Croatia has not declared any waste that contains only naturally occurring radioactive material and does not originate from the nuclear fuel cycle as radioactive waste for the purposes of the Convention; and
- (c) Croatia has not declared any spent fuel or radioactive waste within military or defense programs as spent fuel or radioactive waste for the purposes of the Convention.

Section D. Inventories and Lists

Spent fuel facilities and decommissioning of nuclear facilities

No spent fuel or waste from nuclear cycle is presently in the Croatian territory or under its effective jurisdiction. Also, there are no spent fuel management facilities.

No nuclear facilities are presently in operation or being decommissioned.

Radioactive waste management facilities

There are two storage facilities in Croatia, both located in the city of Zagreb, within national research institutes.

Only the Institute Ruđer Bošković (IRB) store is active, accepting Croatian radioactive waste which needs to be stored. The Institute for Medical Research and Occupational Health (IMI) store is closed; a substantial part of its inventory consists of radioactive sources from lightning rods.

Radioactive waste inventory

All radioactive waste stored in Croatia originates from medicine, research and industrial applications in the country. The entire quantity does not exceed several tens cubic meters.

No radioactive waste has yet been disposed of into any repository.

Waste inventory lists are currently under review by the Ministry of Health.

Section E. Legislative and Regulatory System

As mentioned in the Introduction, the Croatian regulatory framework in this field is under review, and in this process all necessary steps will be taken for full implementation of the obligations under the Joint Convention. But even at this stage, the partly reformed framework relatively well meets these obligations. The present system of laws and regulations is briefly outlined below.

In 1991, after the dissolution of the SFRY and the proclamation of independence, the Republic of Croatia passed the Constitutional Decision on Sovereignty and Independence, Part III of which stated that all the laws concluded by the SFRY, would be valid on the territory of the Republic of Croatia if they were not in contradiction with the Constitution of the Republic of Croatia and its legal system. At

present, a significant proportion of the Croatian radioactive waste management legal framework is still based on laws and regulations from the former state.

The basic laws

At the moment, three laws constitute the basis for the radiation protection, radioactive waste management and nuclear safety regulatory framework:

1. *The Law on Protection against Ionizing Radiation* is the Croatian law adopted in 1999 (“New Croatian law”);
2. *The Law on Protection against Ionizing Radiation and on Special Safety Provisions for Use of Nuclear Energy* is the former SFRY law from 1984 (“Old SFRY law”); and
3. *The Law on Measures for Protection against Ionizing Radiation and for Safety of Nuclear Objects and Facilities* is the law adopted in 1981 by the former Croatian republic within SFRY (“Former republic law”).

The 1981 law specified mainly the authority to be exercised in this field by the former republic within the Yugoslav Federation, and was not affected by the 1984 revision of the basic SFRY law. Its portions which were retained in power are still relevant for the identification of the regulatory body for radioactive waste and spent fuel management.

The new Croatian law updated concepts and requirements of radiation protection, but did not address nuclear safety at all, explicitly retaining in power those segments of the two older laws which regulate safety of nuclear facilities.

The intention of the new law was to be concise and to reflect the most relevant international recommendations, in particular the *ICRP Publication No. 60* and the general requirements of the IAEA Safety Series No. 115 *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources* (“The BSS”).

The new Croatian law consists of 54 articles in ten chapters: general provisions, principles of radiation protection, requirements for the practices, exposures, sources, emergencies, radioactive waste, supervision and authorities including the establishment of the Croatian Institute for Radiation Protection and the Commission for Radiation Protection, penalties for offences of the provisions, transitional and final provisions.

The basic principles of justification of practices, optimization of protection and safety, and of limitation of individual doses are explicitly formulated as the provisions of the law. Authorization for all practices with ionizing radiation is obligatory except for excluded or exempted sources of ionizing radiation. The conditions and procedure for authorization are formulated as the provisions of the law, as well as the principles for exemption.

Primary responsibility for implementation of prescribed measures has the user, the person or legal entity who obtained the authorization for conducting certain practice. The import of radioactive waste in the Republic of Croatia is explicitly forbidden.

According to the new Croatian law, ministry of Health is the Competent Authority for radiation protection. In order to ensure more effective implementation of radiation protection, pursuant to the *Law on Health Care*, the Croatian Institute for Radiation

Protection (CRPI) has been founded, a medical institute for providing expert assessment and other expertise in the field of radiation protection, and for keeping and maintaining records on the sources, source users and radiation workers. Minister of Health can designate legal entities to perform certain tasks according to special approval if they meet prescribed conditions.

Supervision and enforcement of the radiation safety measures is the responsibility of the Sanitary Inspection Department of Ministry of Health, pursuant to the *Law on Sanitary Inspection* and according to the new Croatian law.

Radioactive waste management is addressed in a very brief section of the new Croatian law, which empowers the Minister of Health to prescribe all the relevant regulations based on most recent internationally recognized standards and recommendations. A number of regulations subordinated to the law have been adopted in the meantime, including the new regulation on the limits of exposure (which will be mentioned below). However, new regulation on radioactive waste management is not yet completed (so the old one is listed below).

Besides, the new Croatian law designated most waste management facilities as nuclear facilities. Therefore, they will remain subject to the old laws and their subordinated regulations until these are replaced. The old regulations which are most relevant to spent fuel and radioactive waste management are related to the article 61 of the old SFRY law, and the latter is explicitly retained in power “in the part pertaining to nuclear safety”.

The old SFRY law deals with radioactive waste management and disposal in a rather prescriptive way, through provisions designed for nuclear facilities in general and primarily focused on the nuclear power plant safe operation. The subordinated regulations did later address waste disposal more specifically, but have retained considerable parallelism with the concepts of NPP operations safety.

The most important subordinated regulations

Most regulatory requirements on radioactive waste and spent fuel management are contained in three regulations subordinated to the old SFRY law:

- *The Regulation on Conditions for Location, Construction, Testing Operations, Start-up and Operation of Nuclear Facilities*, from 1988 (“Regulation on facility development”);
- *The Regulation on Preparation and Contents of Safety Reports and Other Documents Required to Determine Safety of Nuclear Facilities* (“Regulation on safety reports”), also from 1988, but sequel to the regulation on facility development; and
- *The Regulation on Procedures for Collecting, Accounting, Treatment, Final Disposal and Release of Radioactive Waste Materials into Human Environment*, from 1986 (“Regulation on radioactive waste”).

The waste categorization in the Section B is reproduced from this old Regulation on radioactive waste. Since its update is due soon, the issue of regulating radioactive materials as radioactive waste is not addressed here, as the new regulation will in that respect take due account of the objectives of the Joint Convention.

Although the above old regulations address nearly all aspects of waste and spent fuel management facilities, most details of radiological protection are specified in a 1999 regulation which is subordinated to the new Croatian law:

- *The Regulation on Limits of Exposure to Ionizing Radiation and on Conditions for Exposure in Emergency Situations and for Interventions in Case of Accident* (“Regulation on exposure limits”).

This regulation supports the new Croatian law by providing the dose definitions and the limits of exposure, all taken from the BSS and their schedules. Among the points in which it differs from the respective old regulation, it should be noted that it does not specify dose constraints for potential exposures from technical sources (so that now ICRP recommendations remain the only guidance for “the appropriate fraction” of the primary dose limit to be used for the safety assessment radiological criteria).

Other elements of the legislative and regulatory framework

In addition to the basic framework outlined above, a number of other legal acts have some bearing on the national practices in radioactive waste and spent fuel management.

- Among them, the most relevant are other regulations subordinated to the old SFRY law or the new Croatian law.
- In addition, some other acts affect implementation of these laws and their regulations.
- Finally, the ratified international conventions and treaties, as well as the bilateral agreements, should also be considered as constituents of the national framework in a broader sense.

All the above items are presented in the Annex I on the regulatory framework. Although they address some general aspects of radiological protection or nuclear safety, or their specific implementations, they are generally not discussed in this report.

Regulatory body

Based on the provision of the old SFRY law and the former republic law, and on the provisions of the *Law on Organization on Field of Activities of Ministries and Other Governmental Bodies*, the Ministry of Economy is the designated regulatory body entrusted with the implementation of nuclear safety legislative and regulatory framework and provided with authority to fulfil its assigned responsibility. The Department of Energy inside the Ministry of Economy is provided with financial/human resources adequate for the extent and scope of nuclear safety problems in Croatia.

As mentioned earlier, the Ministry of Health, with its Sanitary Inspectorate, is the regulatory body for general radiation protection matters.

Also, the cited law on governmental organization assigned the waste management in general to the Ministry of Environmental Protection and Land Use, but without any reference to radioactive waste in particular. Finally, the Ministry of Internal Affairs, with its Civil Protection, is responsible for emergency preparedness.

Since the new Croatian law has designated “facilities for treatment and disposal of radioactive waste” and all facilities for management of “materials from nuclear fuel cycle” as “nuclear facilities” (article 2), it follows that they are subject to the safety provisions of the old basic laws, with the implication that the Ministry of Economy is the regulatory body for the safety of nuclear facilities for radioactive waste and spent fuel management.

However, it should be noted that:

- present radioactive waste storage facilities in IRB and IMI are not included in the article 2 definition of nuclear facilities; and
- the article 35 of the new Croatian law specifies that the Minister of Health will prescribe “conditions and mode” of radioactive waste management, but no regulations pursuant to this article have been completed yet.

The above account of the present regulatory framework indicates that the regulatory body which is required by the Joint Convention is not unambiguously designated and/or that its functions are not adequately independent. The following improvements in this respect are necessary:

- Regulatory authority for all practices and facilities in radioactive waste and spent fuel management should be more clearly and consistently established.
- Efficient separation between the functions of the ministries as regulatory bodies and their functions concerned with the promotion of nuclear applications should be achieved before the beginning of actual Croatian involvement in nuclear energy program and related waste management activities.

To address these issues, in May 2001 the Subcommittee for Nuclear and Radiation Safety was established as a part of the Committee for Land Use and Environmental Protection of the Croatian Parliament. The Subcommittee reviewed and elaborated relevant issues of nuclear and radiation safety and made proposals for the improvement of the present status, especially for the reconstruction of the regulatory body (i.e. the reorganization of governmental administration), in the light of the IAEA recommendations (made during review of the new Croatian law) and of the proposals made in the environmental protection part of the Strategy of Development of Croatia in the 21st Century.

About the Article 19 specific requirements

Although it is still a mosaic of new and old regulations, the Croatian regulatory framework adequately meets most requirements which should be addressed in this section of the report. The points which need improvement have been discussed in the preceding paragraphs.

General radiation protection provisions and requirements on practices have been described in the above brief account of the new Croatian law. Specific provisions on licensing, control, reporting and enforcement of safety for the spent fuel and radioactive waste management facilities (referred to in the Article 19 of the Joint Convention) are provided by the old SFRY law and its regulations. At the highest level they are formulated for nuclear facilities in general.

In the old SFRY law the overall licensing system for nuclear facilities is divided into four steps:

1. the site license (articles 28-31),
2. the construction license (article 32),
3. the commissioning license (articles 33, 34), and
4. the start of operation license (article 35).

Licensing requirements are more precisely defined in the regulation on facility development, which is divided into the following sections:

- (i) General provisions,
- (ii) Conditions for siting of a nuclear facility,
- (iii) Conditions for construction of a nuclear facility,
- (iv) Conditions for commissioning of a nuclear facility,
- (v) Conditions for start of operation and use of a nuclear facility, and

App: Methodology for preparation of the quality assurance program.

The old SFRY law requires a report on all site analyses before site licensing, then a Safety Analysis Report (SAR) for a construction license, updated SAR for commissioning and the final SAR for the operation license.

The regulation on safety reports specifies that SAR is the basic licensing document for nuclear installations. The SAR shall be supplemented during the lifetime of the facility with any new data and with analyses of all changes which may be undertaken. The regulation defines three categories of changes to the SAR. For the first category a notification to the regulatory authority is required after the completion of the modifications. For the second category a notification to the regulatory authority is required before implementation. For the third category an approval by the regulatory authority is required before implementation.

In its lengthy annexes, the regulation on safety reports clarifies the concepts and elaborates the provisions of the regulation on facility development. The annexes very prescriptively delineate the form and content of SAR for successive stages of facility development, each of them for a specific type of nuclear facility, including the spent fuel and radioactive waste disposal facilities.

The regulation on facility development also addresses the obligation of a licensee to monitor and analyze the level of nuclear safety, whereby he must take into account the experience of other nuclear facilities and new technological developments. Any changes of technical specification should be subject to independent evaluation, and approved by the regulatory authority.

The enforcement of safety provisions and of conditions of license is provided for by the old SFRY law, which contains a chapter on inspection and enforcement. It gives specific authority to the inspectors to order the operator of the facility to remedy the deficiencies found. They can also stop the construction or operation of the facility if all safety prerequisites are not met.

Section F. Other General Safety Provisions

Safety provisions of the Joint Convention articles 21-26 are generally delineated in the new Croatian law, and further specified by the old SFRY law and its regulations.

Responsibility of the license holder

The article 4 of the new law broadly defines sources of ionizing radiation to include, among other, radioactive materials and waste, as well as nuclear facilities and all materials from the nuclear fuel cycle which are not exempt from the regulatory control. The Minister of Health gives authorization for practices involving the sources (article 24). Radioactive waste management is included among the measures for protection against ionizing radiation (article 9).

The person or legal entity which was granted the authorization for the practice bears “*the responsibility and the expenses for implementing the measures for protection against ionizing radiation*” (article 28 of the new Croatian law). Inspection, enforcement and penalties are provided for in later articles.

The old laws and regulations contain similar provisions, but they specify more details. One of the retained articles from the old SFRY law (article 45) requires that “the users of nuclear facilities or other sources”, together with the relevant state or local bodies, provide for the radioactive waste disposal. The subordinated regulation on radioactive waste requires (article 8) that all entities which produce radioactive waste must collect, classify, etc. and ensure treatment, transport and storage of the waste.

Operational radiation protection

The new Croatian law and its regulation on exposure limits provide for radiation protection in all practices involving sources of ionizing radiation. Although they do not separately address spent fuel and radioactive waste management, they closely follow the BSS recommendations on radiation protection, both in general approach and in specific limits.

In addition, spent fuel and radioactive waste management facilities are subject to the old laws and their regulations. For their operation license, or earlier in their development, safety analyses and reports are required to demonstrate that they will meet all operational radiation protection provisions.

Other provisions of this section

Other general safety provisions of this section are met by the Croatian regulatory framework in a similar manner as in the above two paragraphs: by new radiation protection acts on a general level, and by the old acts as specific requirements for nuclear facilities.

Human and financial resources are among the general responsibilities of the license holder. Post-closure institutional control arrangements are required in the final SAR before operational license for disposal facilities. Decommissioning arrangements for nuclear facilities (where applicable) are also required before operational license.

Quality assurance is particularly extensively elaborated in the regulation on facility development.

In addition to general requirements on emergency preparedness for nuclear facilities in the country, the Ministry of Economy (Department of Energy) has introduced a Technical Support Center for the case of nuclear accident, and developed a Manual which includes all the necessary specific elements of preparedness in the event of a nuclear accident (especially at the Krško NPP and at the Pakš NPP).

Section G. Safety of Spent Fuel Management

Croatian legislative and regulatory framework contains basic provisions for the safety of spent fuel management, although no spent fuel has yet been managed in Croatia, and no facilities for its management have been planned.

Most of the provisions for spent fuel are included either among general requirements on safety of nuclear facilities, or within more specific radioactive waste management requirements.

Section H. Safety of Radioactive Waste Management

Overview

The specific requirements of the Convention articles which should be reported on in this section are generally met by the provisions of the three laws and four regulations described in the Section E.

However, there is no dedicated regulation in the present Croatian framework which comprehensively and specifically addresses radioactive waste management in the manner described in this section of the Joint Convention. Instead, the requirements are met somewhat indirectly, i.e. they can be deduced from two lines of regulatory provisions:

- One line is provided by the general requirements on measures for protection against ionizing radiation in the new Croatian law and its regulations. As noted in the Section E, these measures reflect the BSS recommendations, and include radioactive waste management as an important requirement, but otherwise rarely address specific aspects of the waste management itself.
- The other line of regulatory provisions comes from the old SFRY law and subordinated regulations. They address nuclear facilities and related practices in much detail, but as much as possible (sometimes perhaps beyond the appropriate) they are formulated for all these facilities in general. Radioactive waste management facilities are singled out only occasionally.

Specific provisions

Siting of the proposed facilities, their design and construction, as well as the safety of their operations, are extensively dealt with in the old SFRY law and its regulation on facility development, as described in the Section E. All the Joint Convention requirements pertaining to these activities, which are common to the safety of nuclear facilities in general, are met by these provisions.

Furthermore, in a few articles of the regulation on facility development some requirements are specifically formulated for the radioactive waste management. Article 2 describes near surface disposal for LILW, article 15 lists general requirements on site characteristics for such repository, while article 23 specifies main requirements on disposal facility design. Article 24 introduces a rather stringent requirement on the near surface repository design, namely that it “must grant the prescribed safety” without active maintenance after a 5 year transitional period

following the facility closure. Article 40 addresses the waste form for LILW disposal, limits the concentration of long lived alpha emitters and prohibits disposal of waste with other hazardous properties. Article 41 somewhat superficially and schematically distinguishes between disposal of LILW and of high level waste. Finally, the article 49 specifies the requirements on the closure of a LILW repository.

Safety assessment of facilities is addressed in some detail in the old SFRY law, and further elaborated in its regulation on safety reports. Safety report is defined as “a document with information on a nuclear facility and its environmental impact, design of the facility and analysis of possible accidents as well as measures needed for diversion of hazards and minimization of effects of accidents on general population and workers in nuclear facility”.

Contents and form of the safety reports are formally outlined in great detail in the annexes of the regulation on safety reports, and its annex 4 is devoted to radioactive waste disposal. It is a rather lengthy and prescriptive text, in many respects comparable to the IAEA 1995 TECDOC “*Preparation of safety analysis reports (SARs) for near surface radioactive waste disposal facilities*”. The annex 4 alone would effectively suffice to ensure safe siting, design, construction, operation and closure of a radioactive waste repository.

Successive safety reports during repository development are based on the safety analyses of increasing complexity, which are described in the chapter 4 of that annex. Probabilistic analyses are required before the operation license. Closure arrangements are described in the chapter 13, which together with the chapter 4 specifies that duration and scope of the post-closure active institutional control will be determined from the results of safety analyses. The regulation on safety reports also clarifies that the five-year transitional period after the repository closure (introduced in preceding regulations) is the period for verification of safety (as predicted by safety analyses), and that institutional control begins after that period.

The old regulation on radioactive waste classifies the waste, defines waste categories, sets limits on waste release into the environment, specifies requirements on waste collecting and record keeping, and briefly outlines technical provisions on waste management facilities. However, it does not systematically address the general safety provisions (Joint Convention article 11), but it is expected that this will be corrected in the pending new regulation on radioactive waste.

Application in current practices

While it cannot be claimed that every single Joint Convention requirement has been given an appropriate weight in the current national provisions, this need not have adverse effects on the actual safety. In the present and planned radioactive waste management practices, guidance is sought in the RADWASS program of the IAEA, as recommended by the BSS (and therefore by the Convention as well). This was effectively required by the old regulations (even before the Joint Convention), which specified that new developments and international recommendations in the field should continually be analyzed and observed during a nuclear facility planning and establishment.

Implementation of this approach can best be seen in the preliminary preparations for the establishment of a LILW repository in Croatia. The preparations have been going on for more than a decade, and included a thorough site-selection process which

resulted in designation of the Trgovska gora region for the potential repository site in the national land use plan. Based on the available data on the location, and on rather generic design of near surface disposal facilities, a preliminary safety assessment report was completed in the year 2000. Finally, during 2002, a safety analysis plan was prepared for the prospective repository on Trgovska gora.

The safety analysis plan is a comprehensive document which can be used as a basis for the entire repository project development from this point on. It was prepared after a thorough analysis of the national regulatory requirements, international conventions and recommendations, and of good practices in this field. It assumes the safety assessment iterative approach as recommended in the IAEA RADWASS program and applied in the IAEA sponsored ISAM project. The plan is an example of the approach in which national regulatory requirements are interpreted and complemented by reference to the best contemporary international standards.

Section I. Transboundary Movement

The new Croatian law bans any import of spent fuel and radioactive waste. Apart from full commitment to binding international instruments, no other particular issues of transboundary movement needed to be specifically addressed in the Croatian regulations.

Section J. Disused Sealed Sources

General provisions

Safety of disused sealed sources is generally ensured by the regulatory provisions for radioactive waste management.

According to the *Regulation on the Conditions and Measures for Protection Against Ionizing Radiation in Practices Involving Radioactive Sources* (issued in 2000, under the new Croatian law), the authorization for use of any source will be granted only if all measures for protection against ionizing radiation are ensured. Also, the regulation specifies that spent sealed sources are radioactive waste. As noted in the Section F, radioactive waste management is included among the measures for protection against ionizing radiation required by the new Croatian law.

No regulatory provisions are needed for reentry of disused sources to be returned to the manufacturer.

All spent radium sources from medical applications in Croatia have been collected, conditioned and properly stored.

Spent radium sources management

Several years ago a thorough search followed by characterization and conditioning of all radium sources in Croatia was undertaken. Data on the sources provided by regulatory body, found in radiological histories, in hospitals records etc., were investigated and altogether 299 sources were collected, with approximately 1400 mg of Ra-226.

The sources were of different forms (needles, tubes, plates) and all came from medical applications. They were collected in Zagreb and conditioned in the Institute Ruđer Bošković. The sources were first packed into stainless steel containers (approximately 50 mg of radium in each container), which were then welded and bubble tested. Stainless steel containers (in bundles of 10) were placed into three lead containers. The lead containers were packed into standard 200 l drums filled with concrete, two containers in one drum, and the third container in another drum. Drums were properly marked.

Characterization and conditioning of the sources were done by the IAEA approved procedure and supervised by the Agency. Presently, the drums are at the IRB radwaste store. Their long term future is still not decided.

Additional information on the conditioning campaign is provided in the Annex II.

Section K. Planned Activities to Improve Safety

As already indicated in this report, the most important safety issues are:

- long-term policy of spent fuel and radioactive waste management has not yet been developed;
- regulatory framework needs improvement, in particular regarding dedicated regulations on spent fuel and radioactive waste management; and
- regulatory body should be more clearly designated and relieved of possible conflict of interests.

The issues will soon be addressed in the context of the regulatory framework current update.

Annex I on the Regulatory Framework

In addition to the laws and regulations listed in the Section E, a number of other legal acts have some bearing on the national practices in radioactive waste and spent fuel management.

Regulations not listed in the Section E

Most relevant are the other regulations subordinated to the old SFRY law or the new Croatian law:

- ◆ Regulation on education, experience, examination and certification of personnel conducting specific work at the nuclear installation (*Off. Gaz. SFRY No. 86/87*);
- ◆ Regulation on material balance areas and the mode of keeping records accounting for nuclear raw materials and nuclear materials as well as to the submission of data contained in such records (*Off. Gaz. SFRY No. 9/88*);
- ◆ Regulation on the conditions, methods, premises and intervals of systematic environmental radiological monitoring (*Official Gazette No. 86/00*);
- ◆ Regulation on the conditions and measures for the protection against ionizing radiation in practices involving radioactive sources (*Official Gazette No. 84/00*);
- ◆ Regulation on the health conditions, criteria, content, methods and intervals of maintaining of the records about medical surveillance of persons who operate sources of ionizing radiation (*Official Gazette No. 76/00*);
- ◆ Regulation on the conditions and manner of obtaining the professional qualifications as a precondition for work with the sources of ionizing radiation (*Official Gazette No. 67/00*);
- ◆ Regulation on the methods and time intervals of the surveillance of the sources of ionizing radiation, personnel monitoring, monitoring of exposure of the patients, on maintaining records and registers and on reporting (*Official Gazette No. 63/00*);
- ◆ Regulation on the conditions for authorization of legal entities to perform specific expert practices in the field of ionizing radiation protection (*Official Gazette No. 108/99*).

Other laws

Several other laws are either related to nuclear safety or to the implementation of the three basic laws from the Section E:

- ◆ The Law on Third Party Liability for Nuclear Damage (from 1998)
- ◆ The Law on Sanitary Inspection (from 1999)
- ◆ The Law on Protection from Natural Disasters (from 1997),
- ◆ The Law on Organization and Field of Activities of the Ministries and Other Governmental Bodies (from 1999 and 2000),
- ◆ The Law on General Administrative Procedures (from 1991),
- ◆ The Law on Criminal Procedure (from 1997, 1998 and 2000),

- ◆ The Law on Transport of Hazardous Material (from 1993),
- ◆ The Law on Internal Affairs (from 1991, 1992, 1994, 1998 and 2000).

Conventions, treaties and bilateral agreements

Furthermore, based on the Croatian Constitution, all announced and ratified international treaties also constitute an integral part of Croatian legislation and can be applied directly. So the following international legal instruments, to which Croatia is a party, should be mentioned as a part of Croatian legislative framework in this field:

- ◆ Statute of the International Atomic Energy Agency,
- ◆ Agreement on the Privileges and Immunities of the International Atomic Energy Agency,
- ◆ Vienna Convention on Civil Liability for Nuclear Damage,
- ◆ Convention on the Physical Protection of Nuclear Material,
- ◆ Convention on Early Notification of a Nuclear Accident,
- ◆ Convention on Assistance in the Case of a Nuclear Accident of Radiological Emergency,
- ◆ Convention on Nuclear Safety,
- ◆ Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention,
- ◆ Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Finally, the bilateral agreements in this field also constitute a part of the national legislative and regulatory framework:

- ◆ Agreement Between the Republic of Croatia and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons;
- ◆ The Protocol Additional to the Agreement Between the Republic of Croatia and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons;
- ◆ Agreement Between the Republic of Croatia and the Republic of Slovenia on the Early Exchange of Information in the Event of a Radiological Emergency;
- ◆ Agreement Between the Government of the Republic of Croatia and the Government of the Republic of Hungary on the Early Exchange of Information in the Event of a Radiological Emergency.

Bilateral agreements between Croatia and Slovenia/Hungary on the early exchange of information in the event of a radiological emergency prescribe that both parties are obliged to support each other in protective measure implementation. In the case of radiological emergency, relevant information such as the type of accident, time of its occurrence, location, cause of the accident, source term data, effective height of radioactive release, weather conditions etc, should be exchanged between appropriate national authorities without any delay.

Agreement Between the Republic of Croatia and the Republic of Italy on the Early Exchange of Information in the Event of a Radiological Emergency is in preparation for signature, and the content is foreseen to be similar to the agreements with Slovenia and Hungary.

Annex II on Disused Sealed Sources

The IAEA report

The IAEA mission report IAEA-CROAT-01/97, by the IAEA Waste Technology Section, contains a detailed description of the Croatian operation of spent radium sources conditioning. Reproduced here is the closing page of the report:

Spent Radium Conditioning Operation Zagreb, Croatia, 13-17/10/1997

The conditioning of the spent radium sources in Croatia was carried out by an IAEA contracted team from Research Center Seibersdorf, Seibersdorf, Austria. The counter part from the Croatian side was Ruder Boskovic Institute. The operation has been carried out successfully and according to the approved technical procedure. This has been performed to the full satisfaction of the counter part and the Croatian Regulators Authority.

The total inventory was 1316 mg (298 sources, 49 GBq) and has been conditioned in two drums that were given the code CRO.ZAG.01 and CRO.ZAG.02. They are now in possession of the counter part at Ruder Boskovic Institute and under the control of the national regulatory body:

At the end of the operation, the working area including the hood and all of the equipment was confirmed to be clean of any contamination.

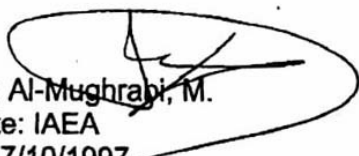
Name: Neubauer, J.
Institute: ARCS
Date: 17/10/1997



Name: Vekić, B
Institute: RBI
Date: 17/10/1997



Name: Al-Mughrabi, M.
Institute: IAEA
Date: 17/10/1997



Instead of the entire IAEA report, a brief summary of the conditioning operation, which was prepared by APO d.o.o. at the end of the operation, is reproduced below.

A brief description of spent radium sources conditioning in Croatia

October 13-17, 1997

1) Conditioning was organized by the Croatian authorities:

It was carried out at the Institute Ruđer Bošković, and involved two bodies assembled for the job:

1. A “political” coordination with representatives from:

Ministry of Health,
Ministry of Economy,
Ruđer Bošković Institute,
Institute for Medical Research and Occupational Health, and
Hazardous Waste Management Agency;

2. An executive team (collecting, transport, preparation of the storage facility, and conditioning of the sources) with representatives from the same institutions.

2) Supported and supervised by the IAEA.

3) The actual conditioning was carried out by an Austrian team.

The team from Forschungszentrum in Seibersdorf applied the procedure approved by the IAEA, which is well described in extensive documentation. The equipment used was brought in from Austria.

4) Preparations by the Croatian side included:

- a) determining the locations of all spent radium sources;
- b) collecting all the sources;
- c) characterization of the sources;
- d) segregation in quantities of approx. 50 mCi; and
- e) preparation of the workplace, drums with concrete filling, radon dosimetry, and dosimetry of all persons involved.

5) In the last phase 7 persons involved:

- a) 2 experts from Seibersdorf;
- b) 4 person from the Ruđer Bošković Institute (1 directly on sources transfer and packing in capsules, 2 technicians and 1 administrative, keeping records on procedures);
- c) 2 experts from the IAEA; and
- d) 1 person from Hazardous Waste Management Agency (APO d.o.o.).

6) Everything was well documented and publicized.

On a video tape, photographed and in writing. Public was informed about the type and extent of the activities performed. HINA, the national news agency was notified, and HRT-1 and HRT-2, the main TV channels, reported on activities. Several interviews for national newspapers were given.

7) Total of 299 sources were conditioned.

Activity conditioned was approx. 1360 mCi. Three lead containers were filled in with capsules, and stored into two standard 200 liter drums. One capsule was filled in with some radium contaminated soil (approx. 1 mCi).

8) None of the potential difficulties were encountered, either:

- with welding quality (bubble test as quality control); or
- with contamination, although considerable number of conditioned sources were leaking due to lost integrity of capsules (very good preparation and very strict procedures of sources transfer, as well as good ventilation); increased level of radon in ventilation filters was reported later; or
- with doses received by persons directly involved with source packing in capsules, with welding, testing welding quality and with transfer of capsules in lead containers (as measured with portable dosimetry systems, pending analysis of TLD and film dosimetry done in parallel).

9) Conditioning was finished one day ahead of schedule.