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INSTITUT  
DE RADIOPROTECTION  
ET DE SÛRETÉ NUCLÉAIRE

Director General

IRSN/DIR/2013-00004

Fontenay-aux-Roses, 16 January 2013

Madam Allison M. MACFARLANE

USNRC - NUCLEAR REGULATORY COMMISSION

Chairman

Commission Washington

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UNITED STATES OF AMERICA

Subject: 20<sup>th</sup> issue of *IRSN Update*"

Dear Madam MACFARLANE,

It is my pleasure to send you a copy of *IRSN Updates* 20, the first issue for 2013, and with it to join the *IRSN Updates* team in wishing you all the best in the New Year.

A high point in IRSN's international activities in 2012 was our participation in the ministerial conference organised by the Japanese government and the IAEA in Japan in mid-December 2012, featuring the presence of Delphine Batho, French Minister for Ecology, Sustainable Development and Energy, helping us to make progress in numerous other nuclear safety and radiation protection initiatives throughout the year.

For example, IRSN worked to strengthen its ties and expand cooperation in nuclear safety research, particularly with its Japanese partners, with the Japan Nuclear Safety Energy Organization (JNES) and Fukushima University foremost among them. At the same time, the Institute increased its contribution to European nuclear safety and radiation protection research platforms, including SNETP, NUGENIA and MELODI. In conjunction with its ETSO partners, IRSN also developed projects to spread nuclear safety and radiation protection knowledge and culture by developing technical guides and new training and tutoring programmes dispensed by ENSTTI.

Training experts and harmonizing technical assessment approaches for nuclear facilities based on the exchange of best practices constitute challenges as well as paths for progress in the field of nuclear safety and radiation protection for which IRSN will continue to harness its resources in 2013.

Hoping you enjoy this issue of *IRSN Updates*, I remain

Sincerely yours,

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Encl: 1



*For IRSN, 2012 was an intense year marked by the widely recognized need to respond to lessons learned from the Fukushima Daiichi disaster. This means in particular reinforcing the robustness of nuclear facilities, improving preparedness for managing a major nuclear crisis, including communication with the public, accelerating harmonization of nuclear safety assessment practices through an expanded ETSON network, laying down strategic calendars for European research with sharper focus on the knowledge to be developed in safety and radiation protection, and contributing to implementation of the IAEA's global action plan. In this spirit, IRSN took part in the international ministerial conference held December 14 to 17 in Japan, where ministers and experts from over thirty countries debated issues involving nuclear safety and radiation protection. In a speech on improving risk management in accident situations, I took the opportunity to reaffirm IRSN's commitment to supporting its Japanese partners in their efforts to overcome the Fukushima Daiichi accident consequences. This commitment has resulted notably in a cooperation agreement between the Institute and the Fukushima University in the field of environmental impacts analysis. The editorial team of IRSN Updates joins me in wishing you the very best in the coming year.*

**Jacques Repussard,**  
Director General  
Institut de radioprotection  
et de sûreté nucléaire

## [ Research ] ASTEC, an international reference in nuclear reactor core meltdown accident modeling

IRSN and GRS are jointly developing the ASTEC software system dedicated to nuclear melt-downs in the different types of reactors currently in operation. The late-January meeting of the ASTEC Users Club in Aix-en-Provence in southeastern France bolsters its position as an international reference and consolidates its scope of applications, which has progressively been extended to include most types of reactors, existing and future.

Over the past decade, ASTEC has earned its status as an international reference in the simulation of core meltdown accidents in pressurized water reactors – including the Russian-designed VVER – with the help of the SARNET network<sup>(1)</sup> in particular. Today, no fewer than 36 organizations use ASTEC, and three major events have just strengthened its position as the leading reference in this type of software: the selection of ASTEC by JRC/IET<sup>(2)</sup> for use in its core meltdown accident research laboratory, China Nuclear Power Engineering's decision to acquire a five-year commercial user license for ASTEC, and the beginning of the Code for European Severe Accident Management<sup>(3)</sup> project of the 7<sup>th</sup> FRDP. The modular nature of ASTEC allows its scope of application to be extended to a wide range of reactors such as boiling water reactors, to enable a detailed analysis of the Fukushima Daiichi accidents and of the IPHWR<sup>(4)</sup> for collaboration with India's BARC.<sup>(5)</sup> ASTEC is already being applied to naval propulsion reactors, but will benefit from certain improvements following IRSN-led development work as part of an agreement with the CEA/DAM.<sup>(6)</sup> For accidents in other types of reactors, ASTEC is being used to model accidents involving the ingress of air or water into the vacuum vessel of fusion facilities such as the ITER and is being adapted for sodium-cooled fast reactors as part of the 7<sup>th</sup> FRDP project entitled Joint Advanced Severe Accidents Modelling and Integration for Na-Cooled Fast Neutron Reactors coordinated by IRSN.

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## [ Safety ] IRSN experts help optimize IAEA regulations for the safe transport of radioactive materials

The IAEA has just published its revised radioactive materials transport regulations, with the active participation of IRSN and French nuclear safety authority ASN.

Nuclear safety and radiation protection for radioactive materials transport are governed most notably by technical and organizational requirements presented in the regulations prepared under the coordination of the IAEA and revised periodically to take into account advances in technology, operating experience and changes in radiation protection data and principles. IRSN is making a significant contribution to this process through its own proposals and reviews of proposals from other member states. Two crucial improvements were made to the latest revision. The first aims to reduce the risk of a criticality accident<sup>(7)</sup> if different consignments of packages containing low quantities of fissile materials are inadvertently combined. The second, initiated by IRSN, provides for strengthened package design requirements to ensure compliance with applicable dose rate limits even when the radioactive content of the packages has reached the maximum level, independently of monitoring checks carried out prior to shipment. For the next revision cycle, starting in 2013, IRSN will propose a new set of modifications to take into account lessons learned from the Fukushima Daiichi accident.

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## [ Radwaste ] Earthquakes and long-term safety of geological disposal: status report on international knowledge spearheaded by IRSN

At the end of November, IRSN organized an international technical meeting on the impact of earthquakes on the long-term safety of geological disposal facilities containing high- and intermediate-level, long-lived radioactive waste (HL & IL-LLW).

In most countries concerned by the long-term management of HL & IL-LLW, deep geological disposal is now considered to be the reference solution. An evaluation of external events likely to have an impact on a geological repository's containment capability is needed to assess its safety. The impact of earthquakes on the geological environment surrounding the repository after it has been closed remains an open issue. The meeting on this subject was attended by some 40 experts from 22 nuclear safety organizations and academic or applied research organizations. Together, they drew up the status of knowledge in this area and identified key scientific points which warrant further studies and sharing at the international level. One of these is the evaluation of seismic loads at a depth of several hundred meters and the impact of earthquakes on hydraulic flows in the host rock of the repository or in surrounding aquifers.

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## PICTURE OF THE MONTH



In the presence of Dephine Batho, French minister of Ecology, Sustainable Development and Energy, Jacques Repussard, director general of IRSN and Osamu Nittono, President of Fukushima University, signed on 17 December a memorandum of understanding aimed at sharing scientific information and data and engaging in joint research projects involving scientists from both institutions.

## JUST PUBLISHED

### Overview of Generation IV (Gen IV) Reactor Designs

This review of generation IV reactors led by IRSN is a follow-up to a document initially published in 2007. It addresses each of the different reactor designs in more detail from the point of view of safety and radiation protection, taking into account the main lessons learned from the Fukushima Daiichi accident.

■ Document downloadable at:  
www.irsn.fr/Gen-IV-EN

- (1) Excellence network specialized in research on severe nuclear reactor accidents.
- (2) Institute for Energy and Transport of the Joint Research Centre of the European Union, located in Petten (the Netherlands).
- (3) Coordinated by GRS working closely with IRSN, this project brings 17 partners together to improve the modeling and functionality of the ASTEC software for severe accident management.
- (4) Indian Pressurized Heavy Water Reactors (developed by India).
- (5) Bhabha Atomic Research Centre.
- (6) Military applications division of the French Alternative Energies and Atomic Energy Commission.
- (7) Uncontrolled fission chain reaction.
- (8) IRSN has already provided JNES with its fire safety baseline.
- (9) The services consist of the validation of safety system operations in Chinese reactors in accident conditions.

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## [ Safety ] IRSN and Japanese TSO JNES outline the future of their collaboration in safety research

A delegation from IRSN took part in two seminars organized last autumn by the Japan Nuclear Energy Safety Organization (JNES), the Institute's Japanese counterpart and an associate member of the ETSO network of European TSOs, with the goal of discussing current collaboration in fire risk and deepening collaboration in areas of mutual interest related to severe accidents in light water reactors.

During the seminar on severe accidents, the focus was on understanding the sequence of events in the Fukushima Daiichi accident and simulating the accident with computational software. A collaborative program under development involves improving systems to filter releases, cool a damaged core, determine iodine and ruthenium chemistry, and cool fuel assemblies in the spent fuel pool in the event of an accident.

The seminar on fire risk strengthened collaboration between IRSN and JNES in the area of safety assessment and regulations. In the short term, the Institute will perform a review of fire protection guides and methods of assessing associated risks, currently under development by JNES.<sup>(8)</sup> In addition to JNES's participation in the OECD PRISME 2 project, collaboration in research is to include issues related to the suspension of radioactive materials in the event of a glove box fire in spent fuel recycling and reprocessing facilities and electrical equipment malfunctions caused by smoke.

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## [ Cooperation ] New horizons for Franco-Russian cooperation in nuclear safety and radiation protection

This past autumn, the Director General of IRSN held discussions in Russia about the Institute's cooperation with the Russian nuclear safety authority, its technical support groups and several research institutes. During these discussions, the safety of facilities in the post-Fukushima context and the management of a major nuclear crisis were addressed.

In particular, Jacques Repussard met with leaders of the Russian federal atomic energy agency Rosatom, the safety authority Rostechndzor, the TSO Scientific and Engineering Centre for Nuclear and Radiation Safety (SEC NRS), the Nuclear Safety Institute of the Russian Academy of Sciences (IBRAE) and the nuclear power company Rosenergoatom.

This series of meetings sought to increase cooperation between IRSN and these different organizations now that Russia has become a member of the NEA. In this spirit, it was agreed to concentrate on priorities of mutual interest, starting with the reinforcement of safety objectives in the post-Fukushima context – in light of the Complementary Safety Assessments performed in France and the European stress tests – and with preparations at the national level to manage a major nuclear crisis situation in terms of both policy and operational resources. Other discussions included the training of future generations of experts, spent fuel and radioactive waste management in connection with new reactor designs, radiation protection for workers, the transport of radioactive materials, and studies to validate computational codes.

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## [ AT A GLANCE ]

IRSN submitted ten proposals in response to the latest Euratom call for research projects, some of which concern setting up agencies to manage the future European projects as part of the new EU research policy entitled "Horizon 2020".

Technical assistance from IRSN to the Vietnamese safety authority VARANS for the construction of the first reactor – a Russian-designed VVER – in the Vietnamese nuclear power program. Through a contract with the European Commission managed by Riskaudit, a subsidiary of IRSN and GRS, the Institute is contributing to the assistance being

provided VARANS for the development of safety regulations and associated guides as well as to the transfer of reactor safety assessment methods in preparation for reactor construction authorization.

Use of the VIKTORIA reactor coolant loop in connection with services to the engineering company Bertin. Already used as part of a joint research project by IRSN and VUEZ, a Slovak engineering company, the VIKTORIA loop has just been used for services relating to the assessment of the safety system impacts of chemical effects produced during the reactor coolant recirculation phase in a situation

involving the long-term management of a loss of coolant accident (LOCA).<sup>(9)</sup>

Organization of an international workshop by IRSN on November 12 and 13 in Paris at the initiative of the European Radioecology Alliance and the European excellence network STAR for an exchange of views on the first strategic radioecology research agenda. Some 110 participants from research organizations, civil society, operators and international organizations expressed broad agreement with the agenda and formulated recommendations to be taken into account in its next version.

**IRSN**

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Update

*Chairman*