## Charting a Nuclear Future for the Czech Republic

NucNet | Page 504

After the tender process for new reactors at Temelín was cancelled last year, Czech utility and nuclear operator ČEZ is starting "a broad discussion" with the government on when and where to build new units.
NucNet interviewed Petr Zavodsky, director of nuclear power plant construction at ČEZ. He joined ČEZ in 1994 as an independent verification and validation specialist for safety systems software at the Temelín nuclear power station.
In June 2015, the Czech Cabinet approved a national action plan for the long-term future of nuclear energy, including plans to build new nuclear units at the existing Temelín and Dukovany sites. The plan is for at least one new reactor at Dukovany and Temelín, with a probable total of four new reactors in the long term at the two locations. Priority for construction of the first reactor will be given to the Dukovany site, where the first of four reactors currently operating will probably be shut down in 2035.

## Why Miracles Come from Nuclear? Nuclear Communications Beyond Energy

John Barrett | Page 507

Public-opinion research in Canada reaches the following conclusion: The more people know about nuclear energy, the more they accept it. How very tempting, then, to unleash a flood of facts that will reach the public, educate them, and convert them to nuclear advocates.
But there are some good reasons why we cannot do that and expect to succeed. To our industry, which comprises more scientists and engineers than perhaps any other industry, the facts are clear. We understand radiation and how to manage it. We understand risk and how to manage it. However, there are large gaps between scientists and the general public in how they evaluate issues.
So how are we to respond to a public that doesn't necessarily trust us, and that views our technologies with dread? I have found – through numerous exchanges with informed audiences as well as the general public – that fear-mongers need not win the day. If we can counter the public's sense of fear with a sense of hope, or opportunity, of progress, we can perhaps turn things around. And nuclear technologies offer a great deal of hope.

## Argentina: Nuclear Power Development and Atucha 2

Mauro Nogarin | Page 509

In 2014, nuclear energy generated about 5,257 GWh of electricity or a total share of 4.05 % of the total electrical energy of about 129,747.63 GWh kWh produced in Argentina and there has been a trend for this production to increase. Argentina currently has a nuclear production capacity of 1,010 megawatts of electrical energy. However, when the Atucha 2 nuclear power plant is completed and starts commercial operation, it will add 745 megawatts to this electrical production capacity.
There are two sites with nuclear power plants in Argentina: Atucha and Embalse. The Embalse nuclear power plant went into operation in 1984. At the Atucha site, the Atucha-1 nuclear power plant started operation in 1974. It was the first nuclear power plant in Latin America. Construction of Atucha-2 started in 1981 but advanced slowly due to funding and was suspended in 1994 when the plant was 81 % built. In 2003, new plans were approved to complete the Atucha 2. I summer 2014 the plant went critical for the first time. The construction was completed under a contract with AECL.

## The 14th AtG Revision – Late, with Fewer Contents, But Coming!

Christian Raetzke | Page 511

On 27 May 2015 the German Federal Cabinet adopted the draft of the 14th amendment to the Atomic Energy Act (AtG); the amendment should pass the legislative process by the autumn of this year. The purpose of the amendment is the implementation of the EU Directive 2011/70 on Establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste from the July 19, 2011. The amendment is discussed for years and the deadline allowed for the implementation (August 23, 2013) has long since expired. In this respect, it may be of special interest what will finally regulated by the law now and what not (or still not).

## Implementation of Passive Autocatalytic Recombiner System as a Hydrogen Mitigation System in Korean Nuclear Power Plants

Chang Hyun Kim, Je Joong Sung, Sang Jun Ha and In Seon Yeo | Page 512

Ensuring the containment integrity during a severe accident in nuclear power reactor by maintaining the hydrogen concentration below an acceptable level has been recognized to be of critical importance since Three Mile Island and Fukushima Daiichi nuclear power plant accidents. Although there exist various mitigation measures for hydrogen risk, a passive autocatalytic recombiner (PAR) has been emphasized as a viable option for the mitigation of hydrogen risk under the extended station blackout conditions due to its passive operation characteristics for the hydrogen removal. To enhance the capability of hydrogen control, the hydrogen mitigation system with various types of PARs has been implemented for all nuclear power plants in Korea. This paper presents an implementation procedure of PAR system and the analysis results to determine the location and capacity of PAR in OPR1000. Various accident scenarios have been adopted considering important event sequences from a combination of probabilistic methods, deterministic methods and sound engineering judgment. A MAAP 4.0.6+ with a multi-compartment model has been used as an analysis tool with conservative hydrogen generation and removal models. The detailed analyses have been performed for selected severe accident scenarios including sensitivity analysis with/without operations of various safety systems. The possibility of global flame acceleration (FA) and deflagration-to-detonation transient (DDT) has been assessed with sigma (flame acceleration potential) and 7-lambda (DDT potential) criterion. It is concluded that the newly designed hydrogen mitigation system with twenty-four (24) PARs can effectively remove hydrogen in the containment atmosphere and prevent global FA and DDT.

## IAEA Assistance in the Development of New Research Reactor Projects

Andrea Borio Di Tigliole, Ed Bradley, Anastasia Zhukova, Pablo Adelfang, Amgad Shokr and Danas Ridikas | Page 517

A research reactor (RR) project is a major undertaking that requires careful preparation, planning, implementation and investment in time, money, and human resources. In recent years, the interest of IAEA Member States in developing RR programmes has grown significantly, and currently, several Member States are in different stages of new RR projects. The majority of these countries are building their first RR as a key national facility for the development of their nuclear science and technology programmes, including nuclear power.
In order to support Member States in such efforts, the IAEA in 2012 published the Nuclear Energy Series Report No. NP-T-5.1 on Specific Considerations and Milestones for a Research Reactor Project. To provide further support, the IAEA also published a document to assist Member States in the preparation of the bid invitation specification for the purchase of a RR.
The IAEA will also continue to provide assistance for human resources development of the Member States establishing their first RR, and to facilitate sharing

experience and knowledge among Member States through its programmatic activities including expert mission services, technical meetings, training courses and workshops addressing relevant technical and safety topics.
This paper presents the IAEA assistance and services provided to the Member States considering new RRs, with particular emphasis on those establishing their first RR, including elaboration on the services mentioned above.

## Numerical Investigation on Coolant Temperature Fluctuation in the Upper Plenum of PWR with Different Outlet structures

Xiangbin Li and Bin Liu | Page 520

In order to reveal the fluctuation mechanism of the coolant temperature, we simulated the transient flows in the upper plenum of PWR with different outlet structures by means of Large Eddy Simulation (LES) approach, and compared the data with measured ones. It is found that the numerical results were in good agreement with the experimental ones. At all cases, the power spectral density distribution of the larger temperature fluctuation on the outlet region is more concentrated in the low frequency part. And, the temperature distribution is more influenced by the outlet position: 1) From the entrance to the middle plane corresponding to the center line of upper plenum outlet, the temperature fluctuation amplitude is larger at the peripheral and central section than at other regions; while from the middle plane to the top, the whole temperature fluctuation slows down gradually; 2) The larger temperature fluctuation occurs near the exit position and the outside region, and the influenced area is expanded from the entrance to 3/4 height of the upper plenum.

## Thermal-hydraulic Analysis for Reactor Vessel Upper-head Small Break LOCA using SPACE code

Minhee Kim and Seyun Kim | Page 527

A small break loss of coolant accident (SBLOCA) in upper-head of a reactor vessel at OPR1000 was analyzed using SPACE code, which is an advanced thermal-hydraulic system analysis code developed by the Korea nuclear industry. To assess the capability of SPACE code, upper-head SBLOCA with full plant safeguards was simulated, and compared with results of MARS-KS code. Reasonably good agreement with major thermal-hydraulic parameters was obtained by analyzing the transient behavior. Based on the observed thermal-hydraulic features, simulations with the failure of partial plant safeguards were conducted to analyze the safety and performance of OPR1000. Effects of failure to scram and high-pressure safety injection (HPSI) were investigated, and safety assessment was evaluated according to operator actions. Comparative study without any emergency core cooling systems (ECCS) was also conducted to judge the severity of the break location. From the results, this indicated that SPACE code has capabilities to simulate upper-head SBLOCA, and OPR1000 was evaluated to have sufficient safety margin with the application of proper emergency operating procedures.

## 46th Annual Meeting on Nuclear Technology: Key Topic Enhanced Safety & Operation Excellence | Sustainable Reactor Operation Management – Safe, Efficient, Valuable

Erwin Fischer | Page 533

Summary report on the following Topical Session of the 46th Annual Conference on Nuclear Technology (AMNT 2015) held in Berlin, 5 to 7 May 2015:

- Sustainable Reactor Operation Management – Safe, Efficient, Valuable (Erwin Fischer)

The other Sessions of the Key Topics

- "Outstanding Know-How & Sustainable Innovations",
- "Enhanced Safety & Operation Excellence"

and

- "Decommissioning Experience & Waste Management Solutions"

have beencoverd in atw 7 (2015) and will be covered in further issues of atw.

## Fifth Review Meeting of the Contracting Parties to the Joint Convention

Peter Brennecke | Page 539

The 5th Review Meeting of the "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management" was held at International Atomic Energy Agency (IAEA) Headquarters in Vienna on 11 to 22 May 2015. Sixty-one of sixty-nine Contracting Parties with more than 700 delegates and the OECD/NEA as an observer attended the meeting.
Within this regularly scheduled meeting every three years it is checked in which way the contracting parties meet the objectives of the Joint Convention, i.e., the respective national radioactive waste management policy and its implementation is critically reviewed, the respective reached safety level discussed and – where necessary – improvements suggested.
As a result the Contracting Parties in particular concur that the 5th Review Meeting encouraged constructive exchanges and sharing of knowledge. Some highlights of good progress and significant accomplishments since the 4th Review Meeting include, e.g., the implementation of national policies, strategies and programs for spent fuel and radioactive waste management or the construction and commissioning of storage facilities and repositories for spent fuel and radioactive waste.
The 6th Review Meeting of the Contracting Parties to the Joint Convention will be held at IAEA Headquarters in Vienna on 21 May to 1 June 2018.

## 60th year atw: Deep Storage of Radioactive Waste from a Geological Point of View

Helmut Venzlaff | Page 542

For a deep storage of radioactive waste geologists gave their preference to salt prior to other rock complexes such as clay or granite. Major deposits from pure rock salt are particularly suitable to safely seal radioactive wastes from the biosphere because due to their plasticity they are free from fissures in which liquids and gases could circulate and because their thermal conductivity is higher than of other rocks. The geological stability of salt domes can be shown by their geological evolution. Thus the salt dome in Gorleben was formed 100 million years ago and is older than the Atlantic, the Alps or the ascent of the low mountain range. During this long period it survived ocean floods, mountain formations, earthquakes, volcanism and ice ages without considerably changing its shape. There are no geological reasons, why it should not remain stable during the next million years.

## Africa's Developing Nuclear Landscape Holds Potential for Investors

John Shepherd | Page 558

Africa is continuing to draw interest from potential nuclear investors as more of the region's nations consider the prospects for launching civil nuclear programmes. Much of the interest has been driven by South Africa, which announced its intention to push ahead with building a new fleet of nuclear power plants more than two years ago. South Africa's Department of Energy said it aims to select a "strategic partner or partners" for its planned new nuclear programme by the end of fiscal year 2015. The country's existing twin-unit Koeberg is the African continent's sole nuclear power plant, but expectations are high that this will change.
According to 'The World Nuclear Supply Chain: Outlook 2030', released at the start of this year by the World Nuclear Association, Africa and Latin America could see investments of $ 20 billion (€ 18.2 bn) and $ 14 billion, respectively over the next 15 years.