arius Newsletter

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Editorial

International tension over the nuclear fuel cycle continues to grow. There are widespread concerns over the security of fuel manufacture. As we often and perhaps painfully continue to remark, finding international solutions for the back-end is equally important in both the long and the short term, but is generally overlooked. The international fuel cycle initiatives in the USA and Russia that would solve these problems are developing gradually, feeling their way towards a means of attracting widespread international support. This will not be easy, but, at present among the projects that could eventually provide international solutions for spent fuel and nuclear waste management, they have the most resources devoted to them – once again we find ourselves concentrating on their potential impacts in a series of four news items.

Our Topical Article returns to a well-known but little talked of issue that may point to how we manage our hazardous wastes in the future: nuclear waste is not the only material that merits geological disposal as the optimum solution.

Neil Chapman
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Arius Internal News

2007 Assembly of Members

The 2007 AoM took place in Baden on 9th March 2007. The Management Executive was able to report on a successful year in 2006, with significant progress being made in promoting the concept of shared multinational repositories and much effort being invested into getting the SAPIERR-2 project started up. Members used the opportunity to exchange information on the status of waste management in their countries and to discuss the potential impact of recent world-wide developments such as the Global Nuclear Energy Initiative (GNEP) mentioned in a further news item. Plans for the work programme in 2007 were presented, discussed and agreed, along with the budget.

SAPIERR-2 up and running

The SAPIERR-2 project started on November 1st 2006 and the first project meeting took place in Baden on 29th November 2006. The official EC Coordinator is COVRA from the Netherlands. COVRA will work closely with Arius, which has been responsible for the specification of work packages, and will coordinate the evaluation of their results. The core team of participants and work package leaders includes representatives from organisations in 8 countries: Italy, Lithuania, Netherlands, Slovakia, Slovenia, Spain, Switzerland, and the UK. In addition, a SAPIERR Interest Group (SIG) is being established to strengthen ties to the numerous organisations in other countries that would like to follow the progress of the project.

The objective of SAPIERR-2 is to propose a **practical implementation strategy** and **organisational structures** that will enable a group of countries to create a formalised, structured organisation that could be established from 2008 for working on shared EU radioactive waste storage and disposal activities. The SAPIERR-2 objectives are:

- The development of an organisational framework and a project plan to facilitate debate on the establishment of a modestly sized, self-sufficient, European Development Organisation (EDO) that can work in parallel with national waste agencies.
- To make further studies of key issues related to economics, design, public and political attitudes and the safety and security of shared storage and disposal facilities.
- To achieve and document the consensus on a preferred way forward that could take place after 2008.

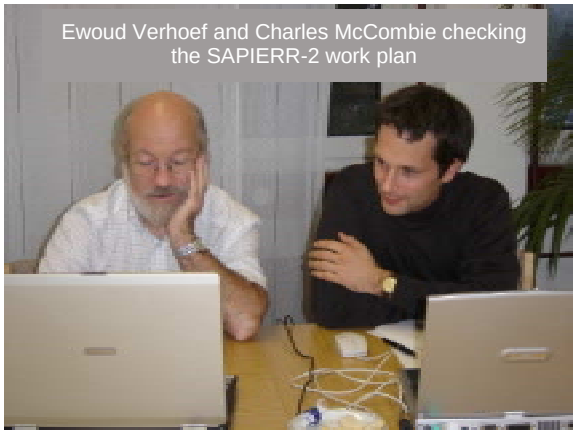
The six main technical work packages within the project and the responsible organisations are:

- preparation of a management study on the legal and business options for establishing an EDO (ENEA,Italy)
- study of the legal liability issues of international waste transfer within Europe (Decom,Slovakia)
- study of the potential economic implications of European regional stores and repositories (Arius, Switzerland and Galson Sciences, UK)

Attendees at the SAPPIER-2 inaugural meeting, Baden, Switzerland (March 2007)

- first considerations of the safety and security impacts of implementing regional repositories (SAM, UK)
- survey of public and political attitudes towards regional stores and repositories and of approaches to involving communities in decision making Enviros, Spain)
- development of a strategy and a project plan for the work of the EDO (Arius, Switzerland)

The immediate tasks of an EDO would be agreeing a progressive, slow, staged strategy that would lead to the definition of potential host countries and eventually, to potential storage or repository sites, and, in addition, defining a parallel science and technology programme that could be addressed by the EDO after its initiation.



Ewoud Verhoef and Charles McCombie checking the SAPIERR-2 work plan

The next meeting of the SAPIERR project participants will be in the Netherlands on 6th – 7th June 2007 and will primarily be considering progress on the study of the legal liability issues of international waste transfer within Europe (which will be close to completion) and the economics, safety and security and political and public issues of shared solutions.

International News

New European Survey on Attitudes to Nuclear Issues

In November 2006, the EC Directorate General for Energy within the Directorate for Nuclear Energy launched a Eurobarometer study on European public opinion on nuclear safety. It follows two former studies on radioactive waste carried out in 2005[1] and 2001[2].

The latest survey, published in February 2007, covers both the wider theme of nuclear issues in general and the topic of nuclear safety in particular. In this short item, we extract some aspects most relevant for waste management. Unfortunately, the question posed in the two previous surveys concerning the acceptability of multinational waste disposal was not posed in the latest version. This means that the development of national views on this issue cannot be followed up further; in 2005, opinions were still rather negative, but significantly more positive than in the 2001 data (see Newsletter No.1).

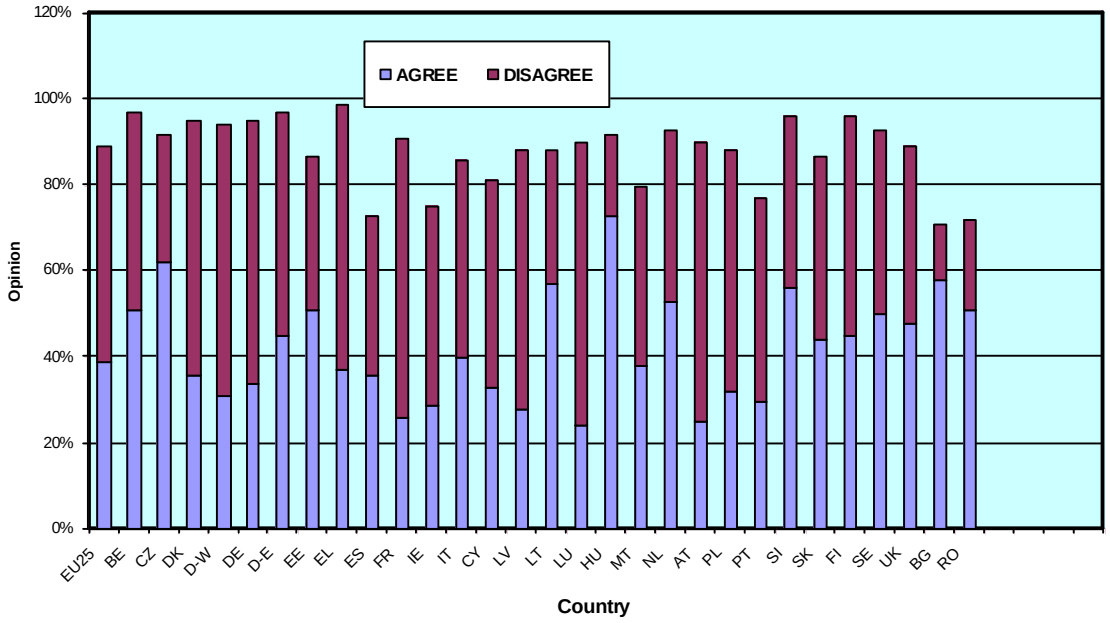
An overarching question concerned nuclear power in general. Interviewees were asked to agree with one of the following statements:

- The advantages of nuclear power as an energy source outweigh the risks it poses;

[1] Special EB 227: Radioactive Waste in http://ec.europa.eu/public_opinion/archives/ebs/ebs_227_en.pdf

[2] Special EB 165: Europeans and Radioactive Waste in http://ec.europa.eu/public_opinion/archives/ebs/ebs_165_en.pdf

Can waste be safely disposed of?



- The risks of nuclear power as an energy source outweigh its advantages.

More than half (53%) agreed with the latter and around a third (33%) with the former. 6% thought that neither statement was true and 8% were "Don't Knows". The fears about nuclear power appear to be connected primarily with the threat of terrorism, the possible misuse of radioactive materials and the unresolved question of radioactive waste.

Looking in detail at the last of these factors, the survey asked people to respond to the following question: To what extent do you agree with the statement that the disposal of radioactive wastes can be done in a safe manner? Respondents were asked to indicate whether they totally agreed; tended to agree; tended to disagree or totally disagreed. The sobering results were as illustrated in the figure above.

The interesting observations that the survey compilers make on these figures are as follows:

- Final management of radioactive waste has been a subject of debate in many countries. Exactly half of EU citizens do not believe that there is a safe way to carry out the final disposal of radioactive waste while 39% believe that a solution exists.
- In 12 out of 27 countries a comparative majority believes that there is a safe solution for the final management of radioactive waste. These are all countries that have nuclear power plants in operation, with the exception of Estonia.
- The highest levels of disbelief in safe management of waste are expressed in Luxembourg (66%), France (65%) and Austria (65%).
- At the time this survey was carried out, there were five countries where a principal decision has been made on the management of radioactive waste: Germany, France, Finland, Sweden and Luxembourg. This does not, however, seem to affect the results.
- Interestingly, in France and Germany over 60% of citizens do not believe that radioactive waste can be managed safely, despite the existence of government decisions on disposal of radioactive waste and the high share of nuclear power in electricity production in these countries.

In the Eurobarometer poll on radioactive waste, carried out in 2005, 38% of EU citizens who were opposed in principal to nuclear energy claimed that they would be more supportive if the problem of the final management of radioactive waste was solved. Another finding of the 2005 study was, however, that Europeans are not very familiar with the topic of radioactive waste. This latter finding is reinforced by the most recent study.

The 2007 survey reveals clearly that the difficult task of communicating the safety of waste disposal to the European public has not yet been overcome, even for purely national programmes. For Arius, the challenges are, of course, greater. If trust in national programmes is generally so low, then politicians may tend to postpone the issue or else lay emphasis on national solutions that avoid the more subtle questions concerning multinational cooperation in this sensitive area.

Global Nuclear Energy Partnership Strategic Plan

In January 2007, the USDOE published its *"Global Nuclear Energy Partnership Strategic Plan: GNEP-167312, Rev 0"*. This brief document provides a timely

and useful overview of the GNEP vision and of how DOE intends to implement this. The three goals of GNEP are:

- wider-scale use of nuclear energy;
- decreasing risks of proliferation and nuclear terrorism;
- addressing the challenges of disposal.

These are all of great importance for global environmental, safety and security.

The plan concentrates strongly on technological issues associated with enhancing the US capabilities for undertaking key fuel cycle activities. This is obviously important to the USA because of the national expertise that has been lost over the past decades due to the earlier political decision to pursue only the direct fuel cycle option and the later economic considerations, which led to continuing with this approach.

The incentives for again taking up the development of advanced fuel cycles are now multiple. Concerns over climate change and energy security have led in the USA, as in many other countries to the wish to expand carbon-free nuclear electricity production. Simultaneously, concerns about the security of the nuclear fuel cycle have grown, due to non-proliferation requirements and to the rise of terrorism in a scenario with worldwide growth of nuclear power. Thus, there is interest in new fuel cycle technologies and in spent fuel management approaches that can address such concerns. In some quarters in the USA, there is believed to be an additional benefit from re-introducing (through GNEP) fuel reprocessing technologies that can reduce the volumes of HLW to be disposed of. This might postpone for a long time the need for a second repository in the USA.

The key security aspects of GNEP, involving concentration of sensitive nuclear activities (especially enrichment) in a few countries that would then act as fuel suppliers to others, are however, global issues. The proposed approaches can only work if the world can be divided as required into Tier 1 suppliers of nuclear fuel services and Tier 2 countries that are only nuclear power users. The current strategy is however, very weak on one key point – how to win the support of other nations and thus achieve the success in the area of enhancing global security.

The USDOE Strategic Plan does claim that *"the GNEP vision has been well received by the international community"* – but it continues with the qualifying phrase *"particularly among the leading fuel cycle states".* Here lies the crux of the problem. Support by such states is relatively easy to achieve; GNEP will restrict the market for fuel cycle services in a way that helps the Tier 1 countries. However, GNEP can work on the hoped for global scale only if the "P" for partnership includes also the smaller or the new nuclear programmes around the globe – that is those countries that are to be prevented from having fuel cycle facilities (enrichment and reprocessing), which are their right under the current NPT that they have signed up to.

Currently, the only real incentive being offered to the Tier 2 countries is *"reliable access at reasonable cost to fuel for civil nuclear power reactors".* However, they have no guarantee that the costs will be reasonable and – perhaps more importantly – still no guarantee of security of supply. The US consent over transfer and use of US origin nuclear materials provides an example that has not always been positive for small countries. For these, US controls have had negative impacts in various cases in the past (e.g. delays in shipping fuel for countries like Switzerland, ban of reprocessing for South Korea, etc). Why should small countries now welcome a new regime that creates, even more firmly, a two tier status in the nuclear world? Unless the USDOE also engages the small countries in discussion and unless it can offer greater incentives than at present, there is little or no incentive for them to buy in to the GNEP initiative.

Currently, for enrichment, fuel fabrication, reactor construction and reprocessing there is already a sufficiently competitive market. No activities in these areas have been blocked or slowed due to a lack of willing vendors. With GNEP, this competitive market can only shrink. What extra incentives are being offered? The most tangible additional service offer is the take back of spent fuel – and this has not been emphasised or explained in detail. It could in principle be extremely attractive, since deep geological repositories for limited amounts of wastes are very expensive and are also difficult to site, for both technical and societal reasons. Removing the disposal problem from small nuclear programmes could outweigh the possible disadvantages that GNEP might bring them.

But can GNEP remove the problem? Currently the stated principles include *"taking back spent fuel for recycling"*. The text is silent about whether the HLW resulting from recycling will be retained by the recycling service provider. Recycling wastes from customers were previously retained in the case of the UK, France and Russia – but all of these subsequently altered this policy due to public and political pressure. Will the USA (and other Tier 1 GNEP countries) be able to accept foreign HLW for final disposal? This question will certainly cause intense debate further down the GNEP line.

The situation concerning radioactive wastes or spent fuel is, in fact, even more problematic than this. Small countries with existing, modest inventories of spent fuel will have little incentive to send future spent fuel arisings to a foreign recycler if they have to implement a national deep repository anyway. Moreover, even those countries that initiate civilian nuclear programmes under a GNEP agreement for returning spent fuel will have small quantities of other long-lived radioactive residues from activities in power production, research and industry – and these must also be disposed of in a geological repository.

In summary, the back-end issues associated with GNEP are so open that no global impact can be guaranteed at present. The USA can still build its proposed new fuel cycle facilities and hope in this way to keep its technologists busy and even to postpone the uncomfortable questions about a second

repository. However, to achieve the laudable global environmental and security goals, the back-end must be directly addressed. The overdue discussions to be held must include not only the Tier 1 service suppliers but also the potential Tier 2 service users.

Over the past several years, there have been various initiatives aimed at coordinating the waste management strategies of small nuclear programmes in countries that are interested in the possibility of using shared multinational repositories. Examples are the Arius Association with member organisations from a number of small countries, the SAPIERR project on regional European repositories funded by the EC, informal meetings of Latin American countries, diverse discussions involving East Asian countries. A key component of the GNEP strategy will continue to be very weak or absent unless DOE gets directly involved in communicating with the relevant persons and helping to support the key organisations that include potential Tier 2 GNEP states.

Russian Developments in its Global Fuel Cycle Initiative

Although it is the largest supplier of natural gas to other countries, Russia is aggressively expanding its domestic nuclear programme – and also consolidating plans to expand the nuclear services provided across the globe. In Russia, there are five reactors under construction and due for completion by 2012. Five further reactors are then planned to replace some existing plants, and 15 further reactors are planned to add new capacity by 2020. This will increase the country's nuclear power capacity from its present 21.7 GWe up to 50 GWe by about 2020. In addition, Russia plans to supply nuclear power plants, enrichment services, and reactor fuels. A key question that is still hotly debated is whether the services will extend to disposal of HLW.

To provide an improved framework for its activities, in February 2007 Russia's President, Vladimir Putin, signed a federal bill that allows for the formation of a state-owned holding company for all enterprises involved in the civilian nuclear sector, to be known as Atomprom. It does not apply to the military nuclear industry. The bill was adopted by the State Duma on 19th January and approved by the Federal Council on 24th January. The changes are part of Putin's strategy to reorganise the country's nuclear industry in order to boost nuclear energy production and strengthen Russia's presence in the global nuclear market.

The Russian global initiatives are being progressed to improve the international framework. On 25th January 2006, President Putin announced an initiative to develop a Global Nuclear Power Infrastructure (GNPI) capable of providing access to the benefits of nuclear energy to all interested countries in strict compliance with non-proliferation requirements. Establishment of a network of international NFC centres (INFCC), including enrichment services, under IAEA safeguards will become a key element of such an infrastructure.

Specific proposals for action have been already been put forward. Sergei Kirienko, head of Russian Federal Agency for Atomic Energy, has announced a first step towards Russian multinational facilities - the establishment of a so-called International Enrichment Centre. This would be located at the Angarsk Electrolysis Chemical Combine Federal State Unitary Enterprise, a nuclear facility with experience in the enrichment of uranium and the production of fuel for nuclear power stations. The concept is that the enrichment centre would be established by the governments of interested states, using the form of an intergovernmental agreement or a joint venture. The prices for services will be consistent with world market rates, but there would be no access to the enrichment technology by participants or shareholders. Russia will implement IAEA safeguards and begin operation as soon as there are is a sufficient number of countries willing to participate.

For a disposal-oriented organisation like Arius, it is interesting to note the potential follow-up stages of GNPI-INFCC implementation that are mentioned by Russia. These include organising a *"timely solution of SNF management issues by reprocessing and the disposal of residual waste within the framework of international NFC centers with the use of modern fast reactor and spent fuel management technologies"*. Currently, however, there are no details given about the potential return of spent fuel to the INFCCs.

The Russian Presidential initiative builds upon G8 policies on curbing the spread of sensitive nuclear technologies and is a practical input into the implementation of the G8 accords reflected in the Declarations on Non-Proliferation at the summits in 2005 and 2006. Further detail of G8 agreements in this aea are given in an accompanying article.

Based on items in the GNS Newsletter and IAEA Bulletin 48/1 2006

U.S.A and Russia Develop Action Plan to Enhance Global and Bilateral Nuclear Energy Cooperation

In December 2006, U.S. Secretary of Energy Samuel W. Bodman and Russian Federal Atomic Energy Agency (Rosatom) Director Sergey V. Kiriyenko submitted to Presidents Bush and Putin a joint work plan that will provide a framework for further bilateral cooperation in the development of nuclear energy technology and deployment. The plan was completed and signed by both parties during the week of December 11th 2006, as part of an agreement that stemmed from the G8 Summit in St. Petersburg, Russia, in July of that year.

The Report, *Joint Working Group on the Development of a Bilateral Action Plan to Enhance Global and Bilateral Nuclear Energy Cooperation*, details principal areas of cooperation as well as short-term cooperative focus areas, underscoring that both countries see a strong need and role for the expansion of safe, emissions-free nuclear power. In addition, the report discusses the two nations' common vision for the structure of the global nuclear energy system of the future, and for discouraging the spread of sensitive nuclear fuel cycle technologies through comprehensive nuclear fuel services.

Principal areas of cooperation in nuclear science and technology outlined in the report include:

- the development of exportable small-and-medium power reactors;
- use and design of fast reactors;
- development and demonstration of new nuclear fuels for fast reactors and processes for their fabrication;
- development and demonstration of advanced methods for the recycling of spent nuclear fuel and transmutation;
- developing methods for providing international nuclear fuel cycle services; and
- development of nonproliferation and safeguard concepts, methodology and technology.

In early 2006, Presidents Bush and Putin each presented initiatives concerning global nuclear energy expansion, aimed at pursuing sustainable development in the world and concurrently addressing non-proliferation issues in a reliable manner. The initiatives are from the USA the Global Nuclear Energy Initiative (GNEP) and from Russia the Fuel Cycle Initiative (FCI).

The Working Group that has been established is at a high level. Its membership is comprised of representatives from the U.S. Department of Energy, DOE's National Nuclear Security Administration, the U.S. Department of State, representatives from leading national laboratories, and the Russian Federation's Rosatom, Rostekhnadzor nuclear oversight service, Ministry of Foreign Affairs, and the Ministry of Defence. It will be co-chaired by U.S. DOE Assistant Secretary for Nuclear Energy Dennis Spurgeon and Rosatom Deputy Director Nikolay Spasskiy.

The Group will also be supplemented at the technical level by an expert team comprised of appropriate representatives of DOE and national laboratories participating in the Global Nuclear Energy Partnership (GNEP) programme and representatives of Russian organizations engaged in the implementation of President Putin's Fuel Cycle Initiative.

The Department of Energy seeks to complete work on similar work plans as soon as possible, and as appropriate, with other key partners sharing GNEP goals. This was underscored by U.S. Deputy Energy Secretary Clay Sell in Moscow in March 2007. He stated that his visit included talks on coordinating nuclear fuel sales to discourage additional nations from producing highly enriched uranium. The nuclear fuel suppliers involved in the initiative could include China, France, Germany, Japan, Russia, the United Kingdom and the United States. Further to this, Russian Federal Atomic Energy Agency head Sergei Kiriyenko is scheduled to visit Washington in May for talks on the fuel project.

In the Arius context, a key question is how both initiatives will address the issue of spent fuel or HLW ultimately ending at many sites around the world and posing a security and proliferation threat. This is addressed in separate items devoted to recent developments in both countries.

The Growth of G8 Consensus on the Necessity for Global Cooperation in the Nuclear Fuel Cycle

In the developed world today, many of the key global concerns are addressed annually at the major conferences of the G8 Group. This is an unofficial forum of the heads of the leading industrialized democracies (Russia, the U.S., Britain, France, Japan, Germany, Canada and Italy), in which the European Commission also participates. The forum was designed to harmonise attitudes to international problems. The member states account for 49% of global exports, 51% of industrial output, and 49% of assets in the International Monetary Fund. Discussions of the heads of state and government are held behind closed doors, with G8 "Sherpas" (personal representatives of leaders) being the only outsiders.

The G8 also has working and expert groups and task forces. Those of most relevance in the nuclear area are the High Level Group on Non-proliferation, the Global Partnership Senior Officials Group, the G8 Non-proliferation Experts Group (with a plutonium subgroup), and the Nuclear Safety and Security Group.

In this item, we look back over the more than 30 years of G8 summits and trace the increasing emphasis on concerns about the misuse of nuclear materials and the growing conviction that coordinated international efforts are necessary to address these concerns.

Already at the **1977 London** meeting, the participants committed to meeting the world's energy needs and to making peaceful use of nuclear energy widely available, while avoiding the danger of the spread of nuclear weapons. To this end, they set up the international fuel cycle evaluation (INFCE), which subsequently examined all aspects and also looked at opportunities for multinational cooperation. The understanding on these objectives was reaffirmed at the **1978 Bonn** and the **1979 Tokyo** Summits. At the **1980 Venice** meeting, a G8 statement on the vital contribution of nuclear power to a more secure energy supply was followed by specific comments on the back-end of the fuel cycle. *"We will continue to give the highest priority to ensuring the health and safety of the public and to perfecting methods for dealing with spent fuels and disposal of nuclear waste. We reaffirm the importance of ensuring the reliable supply of nuclear fuel and minimizing the risk of nuclear proliferation".*

Statements at the **1981 Montebello** summit reflect the realisation that, **i**n most of the G8 countries, progress in constructing new nuclear facilities was slow and that a key reason was the need to encourage greater public acceptance of nuclear energy, and to respond to public concerns about safety, health, nuclear waste management and non-proliferation. There was also a commitment to further efforts in the development of advanced technologies,

particularly in spent fuel management. Subsequent meetings did not address nuclear issues at any length until the **1989 Paris** summit where, for the first time, it was formally recognised that that nuclear power also plays an important role in limiting output of greenhouse gases

From the mid nineties, increasing attention was devoted to nuclear issues. The **1996 Lyon** meeting emphasised the necessity of further progress in the establishment of relevant domestic legislation and in the enhancement of the international regime of nuclear liability as well as in the preparation of an international convention on the safety of radioactive waste management. In the same year, there was a special Moscow Summit on Nuclear Safety and Security and the commitments made there give an absolute priority to safety in the use of nuclear energy were reaffirmed at the **1997 Denver** meeting. Special mention was made of the conclusions of the group of experts set up to study Plutonium Management. This group concluded that the most timely and technically viable option was the consumption of plutonium as mixed-oxide (MOX) fuel in nuclear reactors and, as a complementary option, the immobilization of plutonium in glass or ceramic form mixed with high-level radioactive waste. Subsequently the 2nd option was dropped. This issue of plutonium management was put to the Non-Proliferation Experts Group so that it could discuss arrangements for coordinating and implementing efforts.

At the **2000 Okinawa** meeting, it was explicitly recognised that an international financing plan and a detailed project plan had to be developed and that, for coordinating these, a multilateral framework was necessary. This marked a shift towards emphasising the necessity of involving the international community outside of G8 itself. The stated goal was to *"expand our co-operation to other interested countries in order to gain the widest possible international support, and will explore the potential for both public and private funding*".

This led to extensive measures being organised in Canada at **the 2002 Kananaskis** summit. The G8 agreed on a set of six non-proliferation Principles aimed at preventing terrorists - or those who harbour them - from acquiring or developing nuclear, chemical, radiological and biological weapons; missiles; and related materials, equipment or technologies, and called on other countries to join in implementing these Principles. A new Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, was established, with a commitment to raise up to US$ 20 billion to support such projects over the following ten years. The measures were a direct reaction to the terrorist attacks in the USA on September 11th 2002. With respect to nuclear safety and security, the partners agreed to establish a new G8 Nuclear Safety and Security Group by the time of the next Summit.

This was done before the **2003 Evian** meeting, by which time substantial sums had already been pledged by Partners towards their Kananaskis financing commitments. The Global Partnership's initial geographic focus was agreed to be on projects in Russia and a number of specific co-operation projects had moved into a concrete phase. For example, agreement had been reached on a programme to end Russian production of weapons-grade plutonium and on acceleration of efforts to secure Russian fissile material and nuclear warheads, while significant progress was noted in the negotiations on international support for Russia's plutonium disposition programmes. Risks from non-power nuclear applications were also recognised. The radioactive sources from beneficial applications in medicine, agriculture, research, and industry, if poorly protected, *"can pose a real threat because they could be manipulated by terrorists to construct a radiological dispersion device or a dirty bomb"*.

The following year at the **2004 Sea Island** summit, the status of the overall G8 Action Plan on Non-proliferation was reviewed, with special attention given to issues connected with transfers of enrichment and reprocessing equipment and technologies, and with steps needed to strengthen the International Atomic Energy Agency. The Global partnership had been extended beyond Canada, France, Germany, Japan, Italy, United Kingdom, United States, Russia, and the European Union to include also Finland, the Netherlands, Norway, Poland, Sweden and Switzerland and thereafter to Australia, Belgium, the Czech Republic, Denmark, Ireland, the Republic of Korea, and New Zealand. All of these countries had made financial commitments.

The concerns about the spread and possible misuse of nuclear technologies had until this time resulted principally in proposals for restrictions to be put on emerging nuclear countries. It was finally recognised that carrots as well as sticks are needed Consequently at the **2005 Gleneagles** summit, the following statement was issued:

> *"We believe that strengthened conditions on the supply of sensitive technology should be accompanied by new measures to ensure that those states which forgo the nuclear fuel cycle and meet all nuclear non-proliferation obligations enjoy assured access to the market for nuclear fuel and related services. ….. We will work together with all interested partners for a way forward which provides genuine access while minimising the risks of proliferation."*

The G8 members also welcomed the efforts of the Expert Group on Multinational Approaches to the Fuel Cycle, established by the Director-General of the IAEA, and also the newly proposed Global Threat Reduction Initiative. The stage was now set for real initiatives that would achieve the dual aims of allowing the spread of nuclear power and minimising security concerns.

Accordingly, at the most recent **2006 St. Petersburg** summit**,** the energy, environment and security issues were all addressed. The statement was made that "*ensuring sufficient, reliable and environmentally responsible supplies of energy at prices reflecting market fundamentals is a challenge for our countries and for mankind as a whole*. The G8 undertook to develop low-carbon and alternative energy, to make

wider use of renewables and to develop and introduce innovative technologies throughout the entire energy sector. Taking care of sensitivities in countries like Germany, the group preceded discussion of the nuclear issue by the statement that *"Those of us who have or are considering plans relating to the use and/or development of safe and secure nuclear energy believe that its development will contribute to global energy security, while simultaneously reducing harmful air pollution and addressing the climate change challenge".* When addressing the back-end aspects, the G8 expressed its intention to make additional joint efforts to ensure reliable access to low enriched uranium for power reactor fuel and spent fuel recycling, including, as appropriate, through multilateral mechanisms.

By then, the specific proposals that had been put on the table included the Russian initiative on multinational centres to provide nuclear fuel cycle services (GNPI) and the initiative of the United States on the Global Nuclear Energy Partnership (GNEP) and also the initiative tabled at the IAEA by France, Germany, the Netherlands, the Russian Federation, the United Kingdom and the United States regarding a concept for a multilateral mechanism for reliable access to enrichment services for nuclear fuel. The first two of these initiatives are being actively worked on, as described in accompanying articles in this Newsletter.

Nuclear Power and Fuel Cycle Debate Continues in Australia

The intensive Australian debate on nuclear issues continued to heat up at the end of 2006 with the publication of a special report by the Standing Committee on Industry and Resources of the House of Representatives in the Parliament of Australia. The lengthy title of the 300 plus page report is *"Australia's uranium - Greenhouse friendly fuel for an energy hungry world: A case study into the strategic importance of Australia's uranium resources for the Inquiry into developing Australia's non-fossil fuel energy industry"*. Of specific interest to Arius are the many comments made on the waste disposal issue. Many of the persons and organisations that gave evidence to the committee emphasised that suitability of Australia for siting a safe, remote geological repository.

Based on what it heard, the Committee concludes that, by virtue of its highly suitable geology and political stability, Australia could play an important role at the back-end of the fuel cycle in waste storage and disposal. They recognized that a waste management industry could be of immense economic value to the Australia and that its implementation could also involve the development of sophisticated technologies and skills. Operation of such a facility in Australia could also have global non-proliferation benefits.

The developments in the global nuclear scene that were considered by the Committee covered various topics in which Arius personnel have been, or are currently, involved. These include not only the technical development of high isolation repository concepts suited to arid environments such as those in Australia, but also specific initiatives such as the MNA study of the IAEA (where Arius supplied disposal related information) and the US GNEP initiative, where Arius is also involved in discussions on back-end implications (see associated Newsletter article). It is, therefore, worthwhile quoting in full the specific recommendations given by the Committee to the Government in order to help give added value in an Australian nuclear fuel cycle:

Recommendation 12:

Value adding — fuel cycle services industries, nuclear power, skills and training in Australia

The Committee recommends that the Australian and state governments, through the Council of Australian Governments:

- *examine how Australia might seek greater beneficiation of its uranium resources prior to export and encourage such a development, while meeting non-proliferation objectives proposed in initiatives such as the US Global Nuclear Energy Partnership (GNEP) and the International Atomic Energy Agency's (IAEA) proposed multilateral approaches to the nuclear fuel cycle;*
- *examine the possible establishment of fuel cycle facilities (for example, uranium conversion and enrichment plants) which, in accordance with the IAEA's recommendation for such facilities to be operated on a multilateral basis, could be operated on a joint ownership, co-management or drawing rights basis with countries in the region intending to use nuclear energy in the future;*
- *examine whether, in light of the advances in spent fuel management proposed in the GNEP initiative, there is in fact a potential role for Australia in the back-end of the fuel cycle;*
- *in the event these proposals are adopted, develop a licensing and regulatory framework, that meets world's best practice, to provide for the possible establishment of fuel cycle services industries and facilities in Australia; and*
- *having established an appropriate regulatory regime, remove legislative impediments to the establishment of nuclear fuel cycle facilities in Australia and, specifically, repeal or amend:*
    - *Section 140A of the Environment Protection and Biodiversity Conservation Act 1999, and Section 10 of the Australian Radiation Protection and Nuclear Safety Act 1998. [these sections forbid licensing of a nuclear fuel fabrication plant; a nuclear power plant; a an enrichment plant or a reprocessing facility]*
- *The Committee further recommends that such examination take account of full life cycle costs and benefits of the proposed facilities.*

Most recently, Prime Minister John Howard has commented that he sees nuclear energy, nuclear science and nuclear power to be part of Australia's future. He made these remarks when he opened Australia's new Opal research reactor in late April.

Developments in Swiss Repository Siting Policy

In January 2007, the Swiss authorities at the Energy Office published a revised draft of the sectoral plan defining a national policy for siting repositories. Several aspects of the plan are of relevance for all countries planning geological disposal. In an Arius connection, it is also of interest to note the introductory comments in the document concerning international disposal options. Before looking at these comments, some particularly striking aspects of the national siting policy are briefly highlighted here so that they can be compared and contrasted with procedures in other national or multinational disposal concepts.

First, it is noted in the plan that all Swiss radioactive wastes are to be disposed of in geological repositories; i.e. the near surface facilities implemented in numerous other countries are not considered for Switzerland. For the deep repositories foreseen for both LLW and HLW a staged siting procedure is proposed, with multiple potential siting regions at the 1st stage and at least two potential sites for each repository type. This fixed pre-definition of numbers of sites at each stage has not proven very successful in other programmes.

Another speciality is that a compromise between pro- and anti-nuclear forces has led to the proposal that the repository license applications are restricted to designs that do NOT assume any waste from future nuclear plants. The criteria for down-selecting sites sensibly give top priority to safety related issues. Unusually, however, a quantitative comparison of predicted long-term doses is required before final selection – with differences of a factor over one hundred being deemed significant, unless both predictions are below the very low value of 0.0001 mSv/a.

An interesting aspect for all repository programmes concerns the compensation or benefits that host regions and communities will receive. Special bodies are to be set up to propose these and the waste owners have to provide the necessary funding – but neither specific amounts nor procedures for agreeing these are detailed.

Final notable points are that the Government itself intends to take prime responsibility for all communications with the media and the public and also for management of all decision-relevant documentation, including data on the sites.

As mentioned above, a further unusual aspect of the draft document is that the issue of national or multinational disposal is discussed at the outset. The document makes clear that Swiss (radioactive) wastes are, in principle, to be disposed of in Switzerland, but acknowledges that multinational options have been much discussed, also by international organisations like the IAEA. It goes on to state that the Federal Council has never seen these as a realistic option and claims that “no multinational solutions acceptable to Switzerland” are presently in sight. The conclusion is that disposal options in Switzerland are to be moved ahead now – but that waste owners may still participate in a future international solution, should an acceptable one arise.

The draft document does not record the facts that:

- Swiss Law allows exceptions for import or export of radioactive wastes (under very strict conditions);
- individual Ministers and government officials have, in the past, come out in favour of multinational solutions, specifically for the modest quantities of Swiss HLW;
- the Swiss Science Ministry financially supported the SAPIERR-1 project of the EC on regional repositories in Europe.

None of these points, of course, argues against an active national disposal programme as part of a prudent dual-track strategy for a small country.

International Meetings

Diverse Participants in Talks on Russian International Initiatives

Two meetings to take place shortly in Europe illustrate the interest created in many countries by the current Russian proposals concerning internationalisation of the fuel cycle.

The first is a *“Workshop on Internationalization of the Nuclear Fuel Cycle”*, organised by the US National Academies and the Russian Academy of Sciences. This will take place in late April in Vienna and is the successor to earlier meetings in Moscow and in Vienna. Arius was represented at both of these (see Newsletter No.11 for a report on the most recent of these). The second meeting is an initiative of the chief regulator in Finland. It is titled *“Workshop on Multinational Co-Operation Concerning Back End of the Nuclear Fuel Cycle”* and will be held in mid-May in Helsinki.

The scientifically oriented Vienna workshop is co-chaired by Dr. John F. Ahearne, Director of the Ethics Program, Sigma Xi, the Scientific Research Society and Academician Nikolai P. Laverov, Vice President, Russian Academy of Sciences. It includes perspectives from a number of potential Tier 2 countries in an international nuclear framework. Senior representatives will give the views of Bulgaria, Indonesia, Egypt, Armenia, South Africa, Australia, Argentina, Brazil, and the Republic of Korea. This will be complemented by a Russian presentation on *“Perspectives solicited from other Academies of Science”*. Time will then be allowed for discussions based on the presentations.

The initiator and chair of the Helsinki Workshop is Jukka Laaksonen from STUK, the Finnish regulatory body. The initiative in no way reflects on Finnish

national waste disposal strategy, which aims to implement a purely Finnish repository in a relatively short time. These discussions target implementation and legal issues, with the direct involvement of Rosatom. The schedule includes extensive presentations from the Russian side on current spent fuel management and on the status of Russian legislation concerning spent fuel import. This should be followed by talks on the management of waste from western European reprocessing facilities and overviews of Finnish disposal practices, which are amongst the foremost in the world. The programme then includes presentations of relevant IAEA activities, including work on safeguards and on multinational approaches. A talk on Arius work will then round off the input needed for the planned group discussions on the possible means for multinational co-operation in technical development of the fuel cycle back end.

These events – and the multiple parallel GNEP discussions in the USA - illustrate the ever-increasing interest in multinational cooperation and shared solutions to spent fuel management.

Topical Article

Separate Worlds?

Ewoud Verhoef, COVRA, Netherlands

Introduction

Virtually all industrial activities produce waste that can have negative long-term environmental effects. Since radioactivity is everywhere around us - the soil we live on, the air we breathe, the food we eat and the humans we love- some of this waste is radioactive. The label 'radioactive' has a negative connotation. Living species did not develop a sense to detect radioactivity and, hidden from our senses, it is not well understood and considered dangerous. Its management requires, therefore, special attention: dedicated waste management organisations and infrastructure. Radioactive waste and non-radioactive waste are regarded as separate worlds. Historically, regulations for processing and disposal of radioactive and non-radioactive waste within the European Union have been kept strictly separate. Although more recently, some member states allow the co-disposal of very small amounts of radioactive material with chemotoxic wastes.

Common issues

Despite of perceived differences, many of the issues are common to non-radioactive and radioactive waste management. Moreover, the distinction between what is radioactive waste and what is not, is not always easy to make, particularly in the case of low and intermediate level waste. The management philosophy for both categories of waste is the same: prevent waste generation, if that is not possible minimize and recycle waste, and if that is not possible isolate waste and dispose of it in an environmentally safe manner. The disposal of both radioactive and non-radioactive wastes requires periods of aftercare, varying from a few years to hundreds of thousands of years (or even for ever for some chemical wastes and heavy metals). Both can pose an equal risk to human health and the environment. Both are regarded as complex, politically loaded and emotionally charged issues that are often neither well structured, nor well understood. In both fields, emotions sometimes run high, from local opposition to discussion in the European Parliament.

Figure 1: Only a small part of waste is radioactive (example from the Netherlands).

Europeanization

Understanding the common issues in radioactive and non-radioactive waste enables the radioactive waste debate to be conducted in a wider context. In this paper, the technological, economic and administrative developments in the municipal waste infrastructure in the Netherlands and its public management are compared to the radioactive waste infrastructure. While the waste market for non-radioactive waste has rapidly been 'Europeanized', European co-operation on and trade in radioactive waste has remained a sensitive issue. The Europeanization of non-radioactive waste is the result of progressive tightening of environmental standards and focus on waste minimization and recycling. This has lead to increased capital intensity, increased scale of the disposal installations and increased economy of scale. The municipal waste case, as described here, shows that these developments can change the market from a local to a European scale in a few decades. The high environmental standards for disposal and the focus on waste minimization and recycling may lead to comparable administrative, technical and economic developments in radioactive waste management.

Municipal waste in the Netherlands

The municipal obligation to manage household waste led to the construction of many small open municipal landfills. The first municipal solid waste incinerator (MSWI) was built in the sixties as an alternative to such landfills due to problems with space requirements for landfills in the densely populated Netherlands. With the introduction of Lansink's

ladder[3], the growth in waste led to capacity problems at the end of the eighties.

Source separation of vegetable, fruit and garden waste (VFG) was introduced in the nineties. It not only reduced the waste flow by 15-25 per cent but also increased the average calorific value of waste. In addition, the MSWI infrastructure was expanded and modernized to match the waste supply and meet the advanced environmental codes. The Landfill Ban caused a further shift in waste from disposal in landfills to incineration. In 1993 13 million tons of waste was disposed of in landfills; in 1998 only 7.1 million tons went to landfills. Despite expansion of the MSWI infrastructure this caused capacity problems, and led to the disposal of part of the combustible waste in landfills due to capacity shortage.

Municipal to provincial scale

The first scale-up of waste treatment was connected to this shift. In the sixties most municipalities had their own landfill. Problems with planning and stricter environmental legislation in combination with the shift towards incineration increased the scale of landfills, and reduced the number of (municipal) landfills. The construction of MSWIs also became also too expensive for the individual municipality due to strict environmental legislation, in particular with respect to tightened emissions standards and the larger scale of incineration facilities. To fulfil the waste treatment obligation, and cover themselves against the participated increase in waste treatment costs, the municipalities participated in the construction of the new waste incineration facilities. On advice of the government and the provinces they concluded long-term supply contracts also. This scale-up also involved an administrative shift from the municipalities to the provinces and was concluded when the provinces obtained a legal instrument to control the internal waste flows, the Provincial Environmental Regulation.

Provincial to national scale

The study of the national Committee on waste management (the Committee Epema, named after its chairwoman) revealed in 1996 that the provincial administrative scale was still too small for an optimal use of the disposal capacity. The Committee advised to remove the provincial boundaries for disposal of waste. The primary reason to apply the control of waste at national level was the required scale for waste disposal. In addition, this would simplify the anticipated shift to European waste administration.

In particular the Single European Act (1987) and the Maastricht Treaty (1992) have put the environment high on the EU agenda. Waste management has become an integral part of environmental protection and a challenge that cannot be solved in a sustainable way by individual countries. As a result, European and international developments in the area of waste policy increasingly determined the possibilities and developments of national policies. Market forces have become the leading principle for recovery within the EU. The European Regulation on the supervision and control of shipments of waste within, into and out of the European Community (1993) offered only limited grounds for objecting to the import and export for recovery. As a consequence, the waste disposal model in the Netherlands, best characterized as a type of national concession system, was put under pressure.

Figure 2: An international geological disposal for hazardous waste already exists in Germany.

[3] Lansink's ladder is an hierarchically ordered list of methods to manage waste: prevention, reuse (of products), recycling (of materials), incineration (with energy production) and landfill as the last option. Lansink's ladder coincided with and was bolstered by the European Commission's Directive on Waste in 1975. The motion on Lansink's ladder was tabled and passed in the parliament in 1979, to become official policy in 1981 and a law in the Environmental Management Act (1989, 1994).

Figure 3: Radioactive waste is processed and stored at a central facility in the Netherlands

National to European scale

The conditions for open borders were first laid down in the legislative proposal for changing the Environmental Management Act (2000), which foresaw that by around 2005 the borders with neighbouring countries would be opened for incineration as a form of disposal. In the explanatory memorandum for the legislative proposal, a condition is made that these countries must have the same provisions available for incineration. According to the memorandum, the self-sufficiency principle would remain applicable only to the disposal of waste on landfills. With a ban on landfill of combustible waste in Germany in June 2005, these conditions have been met. On 1st of January 2007 the borders of the Netherlands opened for trade in combustible waste.

The trend towards a European market is not limited to municipal waste. Similar trends can be seen for almost all wastes. European waste management started locally and over the past decades developed to a national scale. Now, a common market for recovery and some forms of disposal exists, including incineration both as recovery and disposal. Interestingly also the geological disposal of hazardous waste has also gone international. Germany has salt mines in which both German and foreign hazardous waste is disposed of (Zielitz and Herfa-Neurode).

Radioactive waste policy

Self sufficiency has remained the leading principle in radioactive waste policy. However, stricter environmental standards for radioactive waste increase costs, while in many countries waste minimization and recycling lead to reduced supply of waste for disposal. Do these developments herald the Europeanization of the radioactive waste market as well, particularly for smaller nuclear programmes such as the Netherlands?

Central Organisation for Radioactive Waste

Waste is really an aggregate term for a large variety of materials. The only common denominator of these materials is that they are discarded after their useful product lives. Similarly, radioactive waste is generated in all sorts and shapes. As a consequence of the self-sufficiency principle, each country needs to have an extensive infrastructure which can process all these sorts and shapes into manageable and uniform packages. In addition, sufficient storage space is required, and finally a disposal site.

Well before the Committee Epema, the Netherlands opted for one central processing and storage facility to have the required scale of operations. The associated central organization for radioactive waste, COVRA, has a wide spectrum of processing facilities including a super compacter for volume reduction of solid waste, a cement facility for conditioning of waste, a kiln incinerator for organic liquids, grate furnace for animal carcasses etc. COVRA has a physical, chemical and biological waste water treatment, special provisions for high level waste and storage buildings for different kinds of waste. This enables the safe conditioning and storage of all types of radioactive waste generated in the Netherlands.

Processing

The general rules and principles of waste management should apply as much as possible to radioactive waste, including Lansink's ladder. Effective policy with respect to prevention and reduction has resulted in a declining supply of radioactive waste. Because of strict nuclear energy and environmental legislation, facilities for the processing of radioactive waste are capital intensive.

Figure 4: Dutch spent fuel is reprocessed in France

The small volume of low and intermediate level waste that has to be processed leads to overcapacity. Many of the facilities are used just a few weeks per year. Further reduction of the waste supply can result in larger overcapacity and increasing costs of the waste processing. It is therefore not unthinkable that a further decrease of radioactive waste will put self-sufficiency in the processing of radioactive waste under pressure.

The national scale is already too small for some types of waste processing in the Netherlands; part of the waste is processed abroad. Radioactively contaminated metal can only be recycled abroad (Sweden and Germany). The radioactive waste resulting from the recycling, e.g. slag, is transported back to the Netherlands and stored at the COVRA site. Most of the high level waste is processed abroad (France). With only a small supply of spent nuclear fuel, reprocessing is commercially impossible in Netherlands. The waste produced in reprocessing abroad is transported back to the Netherlands and stored at COVRA.

Storage and Disposal

Europeanization of storage seems less likely. Because of the modular lay-out of the storage facilities at COVRA, an decreasing supply of waste will not result in capacity problems or strong increase in costs. Hence there is no (economic) reason that in the future multinational facilities for the storage of radioactive waste will be necessary. For geological disposal of radioactive waste in countries with small nuclear programmes, the situation is different. In those countries the volume of waste is often too small to justify or finance a national repository. Long-term storage to accumulate enough waste and financial resources or sharing of repositories are the only alternatives. Even for countries with larger nuclear programmes co-operation and sharing could be attractive. A shared repository not only pools technical and financial resources, but also provides a wider choice of suitable geological formations and guarantees international supervision. Different countries, including the Netherlands, therefore co-operate in exploring possibilities for an international solution for radioactive waste.

Conclusion

Radioactive waste and non-radioactive waste management are not separate worlds, many of the issues are common. Radioactive waste is just a small subset of the waste produced in Europe, which is in turn a piece of the still larger resource management puzzle. Understanding this, allows the radioactive waste debate to be conducted in a wider context. In the face of increasingly global economic competition, the European internal market has gradually shifted from nationally oriented to European. Whether Europeanization is a continuing process that will eventually lead to a full European market is a matter of some debate. However, environmental care, including waste management, transcends national boundaries and will require at least a European approach. Increasing environmental standards and the focus on waste minimization and recycling call for a European scale of waste management. As a result most of the non-radioactive waste market and legislation is European. Increased capital intensity, increased in scale of the disposal installations and increased opportunities to realise economies of scale may also put the national radioactive waste management models under pressure. In particular

countries with smaller nuclear programmes may have to rely on a European market to process and dispose of radioactive waste at acceptable prices.

Upcoming Conferences

This section of the newsletter highlights upcoming conferences that are specifically relevant to Arius activities and objectives.

May	
16th – 17th	US and Russian Academies of Sciences: Internationalisation of the Nuclear Fuel Cycle, Vienna, Austria ***Arius represented***
16th – 17th	STUK-Rosatom-IAEA Workshop on Multinational Cooperation in the Back-End of the Nuclear Fuel Cycle, Helsinki, Finland ***Arius presentation***
June	
11th – 12th	Radioactive Waste Management, London, UK ***Arius presentation***
11th – 14th	GNR2 - Global Nuclear Fuel Reprocessing & Recycling, Seattle, USA
September	
2nd – 6th	ICEM'07, Bruges, Belgium ***Arius presentation***
5th – 7th	World Nuclear Association 32nd Annual Symposium, London, UK
9th- 13th	Global 2007 - Advanced Nuclear Fuel Cycles & Systems, Boise, USA
16th – 19th	European Nuclear Conference, Brussels, Belgium
18th – 19th	IAEA General Conference and Scientific Forum, Vienna, Austria