

Contents

Editorial	1
Arius Internal News	1
International News	3
International Meetings	5
Topical Article	
o <i>Nine Requirements for Credibility</i>	9
Publications	11
Upcoming Conferences	12

Editorial

Our last Newsletter was almost five months ago, in May, and much has been happening over the summer. Owing to this interval, issue No. 11 of the Newsletter is rather longer than usual. Two themes dominate the following pages – the shared, regional disposal model, as exemplified by the SAPIERR project whose final stages are being reported on in Brussels next month, and the ‘add-on’ multinational model, as exemplified by the current Russian proposals to offer spent fuel storage, as discussed at length in our Topical Article. Arius is working on both these models for international waste management facilities. The late summer also saw unexpected support for a third model – an international repository provided as a service by a non-nuclear power nation. This came in the form of very direct proposals from Bob Hawke, ex-Prime Minister of Australia.

Finally, Arius would like to add its congratulations to the many that have been proffered to Mohammed ElBaradei and the IAEA, winners of this year’s Nobel Peace prize. Readers of our Newsletters will have seen frequent references over the last couple of years to the support given by the Director General and the Agency to multinational solutions as a means of strengthening worldwide nuclear security and helping the numerous small Member States of the IAEA. We report in this issue on further concrete proposals, which they have made this very month.

Neil Chapman
Baden

Arius Internal News

Upcoming Assembly

The next extraordinary Assembly of Members will be held in Brussels on 10th November 2005, the day after the SAPIERR final project workshop. Members

wishing to attend should contact Arius now to register for the Assembly, if they have not already done so.

Arius President makes strong statement on regional repositories

In *World Nuclear Review*, week ending 23rd September 2005, Arius President Hans Codee said that now is the right time for Europe to start discussing the idea of a small number of regional repositories for high-level waste that could possibly be overseen by the United Nations. Europe should build two or three pan-European deep geological repositories instead of pursuing the “absurd” idea of separate repositories for different countries, said Dr Codee who is the managing director of COVRA, the Netherlands’ central organisation for radioactive waste management. He pointed to the example of the US, where the proposed Yucca Mountain repository in Nevada would store radioactive waste from nuclear power plants and defence programmes. That waste is currently stored across 43 states in an area roughly the same size as Europe.

Dr Codee said it was too early for the Netherlands to make any decision on the site of a possible national repository, although he did confirm the only two options would be in clay or salt. “*The Netherlands does not have enough money for its own repository at the moment and we also need time to gather enough waste to justify a repository,*” said Dr Codee. As was documented in Arius Newsletter No. 7, The Netherlands’ existing radwaste policy is for all categories of waste to be stored above ground for at least 100 years until final disposal within the country or “within an international framework” can take place. Dr Codee said many countries with small nuclear programmes would only be able to afford direct disposal if “regional solutions” are created. The cost of building a national repository in the Netherlands is estimated at 1.3 billion euros (1.6 billion US dollars). Money is being set aside in a capital growth fund gathered from producers of radioactive waste on the “polluter pays” principle. Unlike other radioactive waste management organisations, COVRA accepts ownership and full liability for all the waste it receives.

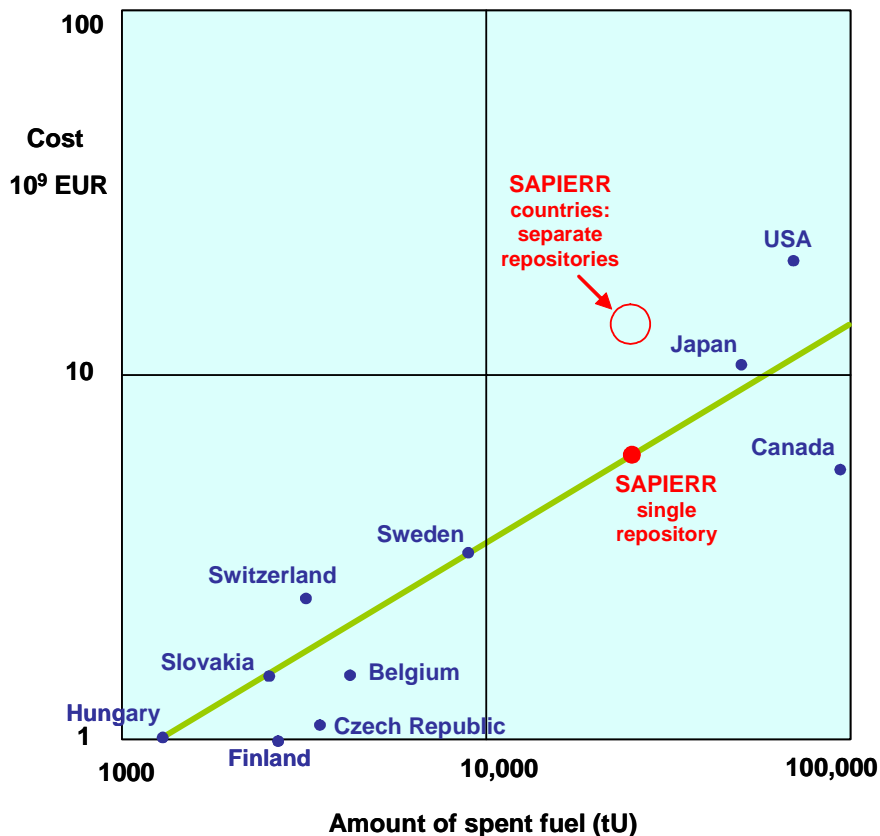
SAPIERR FINAL WORKSHOP

Wednesday November 9th 2005

European Commission
rue du Champ de Mars, 21 Brussels
0930 – 1630

Registration 0830-0930

REGISTER YOUR ATTENDANCE WITH ARIUS



A figure reproduced from the SAPIERR 'Options and Scenarios' report, giving an empirical indication of the possible cost savings of a European regional repository for spent fuel from the SAPIERR project member countries – about 8 billion EUR (6, rather than 14 billion EUR). See www.sapierr.net for the full report.

SAPIERR nears completion

Previous Newsletters have reported on the SAPIERR project, initiated under the 6th Framework Programme of the European Commission. It is carried out by a consortium of DECOM Slovakia and Arius and was launched on 1st December 2003. The project brings together countries in Europe with an interest in investigating the possibilities for shared repositories for spent nuclear fuel / high-level radioactive waste, and in particular those countries with small nuclear power programmes that do not have the resources or the full range of expertise to build their own repositories.

A significant achievement of this project is that 21 organisations from 14 countries (Austria, Belgium, Bulgaria, Croatia, Czech Republic, Hungary, Italy, Latvia, Lithuania, The Netherlands, Romania, Slovakia, Slovenia and Switzerland) agreed to take part in the SAPIERR working group and they have all provided input to the project. At the end of last year, the consortium put together two technical reports – on inventories of radioactive wastes in the SAPIERR countries and on legal aspects of a regional repository. These reports have been used as a basis for producing a third report on options and scenarios for European regional disposal, which includes recommendations for future research & development in the EU. All the documents are available on the project website (www.sapierr.net).

The first two technical reports describe in detail the inventories of spent nuclear fuel, high-level waste and long-lived intermediate-level waste, radioactive waste management policies, storage facilities, national programmes for repository development and their cost aspects, as well as the legislative framework in the individual countries represented in the SAPIERR working group.

The final report recommends ways of moving forward in the EU towards implementation of shared repositories. Of course, as has been clearly demonstrated by the timescales needed for development of purely national disposal programmes, the development of multinational facilities will be a gradual, staged process.

Opportunities for discussion and debate on the SAPIERR findings and recommendations will be provided to a wide audience at the SAPIERR closing Workshop, to be held in Brussels on 9th November 2005 (the day preceding the next Arius Assembly of Members, also in Brussels).

The agenda for the SAPIERR meeting is shown on the following page. As noted in the box on the first page of the Newsletter, any persons interested in attending should get in touch with the Arius secretariat.

Agenda for SAPIERR Seminar

- Registration (08:30-09:30)
- Opening addresses (describing EC and IAEA support for multinational)
- SAPIERR project overview
- Legal aspects of European regional repositories
- Inventories of waste for deep geological disposal in SAPIERR countries
- Lunch break
- Options and scenarios for European regional repositories
- Brief presentations of other relevant initiatives (Arius, IAEA, CATT)
- Open discussion
- Possible follow-up project(s)
- Overall conclusions and recommendations for further work
- End (16:30)

.....and SAPIERR-2 is proposed

Arius has submitted a proposal to the EC for a continuation of the SAPIERR initiative. The SAPIERR-2 project would have the clear objective of developing the feasibility studies of SAPIERR (2003-5) into a practical implementation strategy and organisational structures that will enable a formalised, structured organisation to be established in 2008 for working on shared EU radioactive waste storage and disposal activities. Participating EU Member States would be able to use these structures as, when and if needed for the furtherance of their individual national policies. Participation in the SAPIERR-2 project will be of interest to Member States that:

- would prefer to be joint users of a shared regional repository;
- are pursuing a dual track approach before deciding on a national or a regional strategy;
- have chosen a national strategy for themselves, but are prepared to help other EU States seek a regional solution.

The principal deliverables of the project would be:

- A proposal for an organisational framework and project plan to underpin the establishment of a modestly sized, self-sufficient European Development Organisation (EDO) that can work in parallel with national waste agencies from late 2008.
- Further studies of key issues related to economics, design, geological environment and the safety and security of shared storage and disposal facilities.

The proposal was submitted for the 11th October deadline with a start list of seven organisations from six countries (Arius, Switzerland; ARAO, Slovenia; DECOM, Slovakia, COVRA, Netherlands, ANDRAD and CITO, Romania; RATA, Lithuania). The intention

is to expand this list with other organisations, whose contribution to the SAPIERR-2 project can be purely through in-kind efforts. This approach allows wide participation and can provide a valuable forum for exchange of views. Any other organisations interested in participation are encouraged to contact Arius, since expansion is possible throughout the proposal negotiations.

International News

Renewed discussion in Australia in international repositories

This September, Australia's former Labour prime minister, Bob Hawke, stated publicly that Australia should consider hosting an international repository for radioactive waste. He suggested that Australia should abandon its 'three-mines' policy on uranium and promote itself as a safe place for the world's nuclear waste. The proposal was that the money raised could go towards funding environmental problems such as salinity and to the Aboriginal communities affected by the waste grounds. Mr Hawke's view is that:

"Australia has the geologically safest places in the world for the storage of waste. What Australia should do, in my judgement, as an act of economic sanity and environmental responsibility, is to accept the world's nuclear waste..... We could revolutionise the economics of Australia if we did this."

The reactions were, of course, mixed. Federal Health Minister Tony Abbott supported Mr Hawke's suggestion, describing it as "visionary". He also pointed out, however, that it was politically difficult, especially since at present Australia cannot even get agreement on where to put a repository for its own wastes and has recently had to change the law to allow a facility to be imposed upon the Northern Territories. The federal Science Minister, Brendan Nelson, says there is some merit in Mr Hawke's call for Australia to store the world's nuclear waste but that his views could have been better directed. The current Labor leader, Kim Beazley, has laughed off the idea as not being party policy.

Greenpeace, not surprisingly, found Mr Hawke's proposal disappointing and the view of the Total Environment Centre was that it does not address problems of long-term radiation risks, security and transportation.

Others coupled the suggestion to the issue of Australia's position as a major uranium producer. Simon Mann, the Australian general manager of AREVA's subsidiary Cogema, said there was "probably ... a moral obligation for Australia to accept waste material" if it wanted to export uranium. He told a parliamentary inquiry into the development of a non-fossil fuel energy industry that Australia had large volumes of uranium and the potential to have seven of the world's top 20 uranium mines.

Some scientists also took a position on the issue. The National President of Scientists for Global Responsibility thought that the idea is based on sound reasoning. Dr Vincent Cusack from the Centre for Social Research at Edith Cowan University, who has studied the concept of multinational repositories (see 'Publications' below), agreed that it was a visionary suggestion. Others including Professor Aidan Burn, head of the physics department at the ANU, also said the idea is well worth consideration. He stated that:

"...the control of that material can be done and I think Australia is one of the places that should consider storing nuclear waste".

After the first round of reactions, Mr Hawke's call was rejected by deputy opposition leader Jenny Macklin on security and environmental grounds. Anthony Albanese, Labour's environment spokesman, called Mr Hawke's comments a silly proposal, while industry spokesman Stephen Smith said Australia should steer clear of the nuclear fuel cycle. But Mr Hawke has continued his campaign and called for emotions to be put aside in the name of progress. His call for an open debate in Australia on all nuclear issues has also been supported by Martin Ferguson, who is responsible for Labour's energy and mining policy,

Security of fuel supply and spent fuel take-back is the way to prevent the spread of nuclear weapons

Mohamed ElBaradei, this year's Nobel Peace Prize winner (along with his International Atomic Energy Agency), repeated a message that the most effective way to stop the spread of nuclear weapons is for the international community to guarantee the supply of nuclear fuel to countries that agree not to produce it themselves. He was speaking at a meeting this month of the Nuclear Threat Initiative, the Washington-based organisation founded by former US Senator Sam Nunn and Ted Turner to help prevent the spread of nuclear, biological and chemical weapons.

Mr ElBaradei said that if a country meets objective, apolitical, non-proliferation criteria it should be assured the supply of nuclear fuel. Under the scheme, Non-Proliferation Treaty signatory countries that do not already have nuclear weapons would agree to a moratorium (e.g. 10 years) on producing nuclear fuel but would not give up the right to produce fuel permanently. Countries receiving fuel from international suppliers would not subsequently retain possession of the spent fuel but would have to send it back to the suppliers.

The concept was also discussed last month at the IAEA annual general conference. The huge security value in internationalising the fuel cycle has been discussed in previous issues of this Newsletter (and in an Arius paper to the WNA annual symposium last year) and was the subject of the recent 'Multilateral Approaches' report of the IAEA. The Topical Article in this issue of the Newsletter addresses the specific prospect of Russia taking back spent fuel and what would be needed to make this feasible.

Asian regional radwaste database

According to the Japanese newspaper, the *Asahi Shimbun*, next year Japan proposes to establish an Asia-wide database on the safe disposal of radioactive waste. The intention is to help countries in the region to upgrade radioactive waste management practices. There is particular concern about how China and India deal with radioactive waste and Japan could play a leading role in sharing information on control systems and personnel training.

The proposal comes from the Nuclear and Industrial Safety Agency (NISA) of the Ministry of Economy, Trade and Industry (METI). To begin with, a working group in charge of disposing of radioactive waste would be set up within the IAEA Asian Nuclear Safety Network. China and South Korea are expected to join the network, along with other nuclear power countries such as Indonesia and Vietnam. India and Pakistan are also said to have expressed interest.

The database will include information on radioactive waste disposal problems, including data on how Japan, South Korea the United States and European countries handle their wastes. Visiting experts would also be available to network countries.

For Arius, these developments are of direct interest since the Association supports all kinds of collaboration that can increase safety and security in waste management. The European efforts to explore the possibilities for regional repositories may well lead to parallel efforts in other regions of the globe, including both Asia and Latin America.

Research reactor fuel returns to Russia

Fourteen kilograms of unirradiated, high-grade research reactor fuel has been returned to Russia by the Czech Technical University, Prague. The fuel will be down-blended for use in power reactor fuel manufacture. The transfer is in the framework of the 2004 Russia – U.S.A. intergovernmental cooperation agreement on return of Russian nuclear fuel from research reactors to Russia and is the eighth operation of its kind. To date, new Russian high-grade fuel has also been returned by Bulgaria, the Czech Nuclear Research Institute, Latvia, Libya, Romania, Uzbekistan, and Yugoslavia.

UK Nirex continues its attacks on multinational solutions

Although the UK has at present no official view on the suitability of geological disposal for radioactive wastes, the national organisation Nirex has repeatedly aired its very negative opinions on shared disposal concepts. The latest example is in a review done by Nirex of a paper prepared for the UK CoRWM committee by the company IDM, with input supplied by Arius staff. The paper itself and the Nirex review are both available on the internet at <http://www.corwm.org.uk/>

Even in its summary, Nirex makes clear that its document is less of a review than a statement of its own views on international disposal. The immediate accusations are that the negative aspects are not addressed and that the ethical aspects are not addressed "to the extent required to give a balanced view". In fact, both of these issues are raised right at the start of the original paper. Nevertheless, Nirex devotes 5 bullets in its comments on "balance" to laying out its own position. The most repeated assertion of Nirex is that international disposal is "unethical" and references are given to two publications of the Managing Director that put this view. Nirex omits, however, to reference a paper with the opposing view published specifically by Nuclear Engineering International, in the same issue, and as a companion to the Nirex article.

Nirex also fails to acknowledge that its views on the ethical aspects are extreme when measured against those of the international community. International organisations like the EC, the IAEA and many national programmes have supported the concept of regional or international repositories. No other waste management organisation is on record as having fundamental ethical objections. Even in Sweden, where the strongest concerns have been expressed over possible negative impacts on the national programme, the agency SKB acknowledges that shared repositories are a sensible goal for small countries.

In fact, the repeated assertion of lack of balance results not from the text but from the extreme viewpoint of Nirex itself. This viewpoint is also illustrated in an earlier technical note that Nirex prepared for CoRWM on waste management options – including the international repository option. This note failed to mention the strong support of the IAEA (highlighting instead local reaction to one of the many positive statements of the Director General); it ignored completely the positive stance of the European parliament and the EC; it neglected to point out that a total of 14 European countries are cooperating in the SAPIERR project on regional repositories; and it omitted or misrepresented the views of various national authorities on this subject.

Nirex makes comments on transport that mix inherent national problems of acceptance with international issues. The provocative Gorleben example of massive opposition to transport of spent fuel is a result of German opposition to nuclear power in general and has little to do with international issues. Similarly, Nirex's repeated stress on local opposition to multinational repository siting neglects the fact that there is usually opposition to ANY repository siting! The catastrophic failures of siting programmes in countries such as the UK, Switzerland, Spain and France were not connected in any way to the issue of multinational disposal. Australian political reluctance to consider a multinational HLW repository is at least matched by the huge opposition of Australian States to hosting a national low level waste facility.

Nirex further points to the "principle" of self-sufficiency and asserts that "any state which has had the benefit

of nuclear technology" should dispose of its own waste. This ignores the fact that self-sufficiency is not applied to other parts of the nuclear fuel cycle (or elsewhere). Small countries rely on large ones for fuel supply, reprocessing etc. Many countries – including the UK – rely on others supplying the uranium (and thus bearing the largest negative environmental burdens in the fuel cycle). The UK government, as opposed to Nirex, has in the past accepted wastes from other countries and has recognised that exchange or transfer of wastes can be advantageous if it leads to better environmental solutions.

In summary, Nirex has used the review of the work of others as a vehicle for re-stating its own, extreme position on this issue, a position that exemplifies the unfounded fears of some national organisations that the existence of multinational solutions might reduce the resources being allocated to their own programmes.

In the light of earlier articles in this Newsletter on the enormously high-profile initiatives being taken to promote the security opportunities of internationalising the nuclear fuel cycle and providing international solutions for the back-end, the Nirex position on 'ethics' seems perversely out-of-step with reality.



The IAEA Multilateral Approaches report, published earlier this year. External support on disposal issues was provided to the author group by Arius. It is a 'must read' document, with concepts that underpin many of the issues and meetings reported on in this Newsletter.

Japanese contaminated soil goes to USA

The Japan Atomic Energy Agency (JAEA) was launched at the beginning of this month and had to deal with a waste problem from one of the two predecessor organisations from which it was formed, the Japan Nuclear Cycle Development Institute (JNC). This was in the form of 3,000 tonnes of radioactively contaminated soil from a facility in Tottori Prefecture.

About 290 m³ of the soil was shipped to the USA for refining this month. The remainder must be removed by May 2006, according to a court order – otherwise 50,000 JPY per day compensation must be paid to the local communities.

International Meetings

Later in this section, the two international meetings of this summer that were explicitly focussed on the topic of shared storage and disposal are described at some length. To begin with, we review a range of other meetings during the second half of this year, including a series of international conferences on nuclear waste management in general, in which Arius has been involved. It is striking that the topic of multinational cooperation is now a standard issue that is addressed at such meetings.

In Europe, papers were presented at the large **ICEM Conference in Glasgow** in September on the status of Arius and on the SAPIERR project. Earlier in the year in an **Eastern European Regional Meeting in Bulgaria**, Christina Necheva, an Arius individual member, co-authored with Arius and presented a paper on *"The importance for Bulgaria of Multilateral Approaches to the Back-end of the Nuclear Fuel Cycle"*. In October, Christina Boutellier of Arius presented a report on *"Multi-national Geological Repositories: Ethical, Legal and Political/Public Aspects"*, at the **International Nuclear law Association in Portoroz, Slovenia** with the co-authors including Irena Mele of ARAO.

Outside Europe, interest in regional approaches is also increasing in other regions of the world, specifically Asia and Latin America. In June Ian McKinley, an individual member of Arius, co-authored and presented an invited paper at the **AOGS Conference in Singapore**, entitled *"Shared facilities for storage and disposal of radioactive wastes: the Asian context"*. In July, organisers of the **Asia Pacific Nuclear Power Conference in Hong Kong** invited Arius to present a keynote paper on *"Global Perspectives on High-Level Waste Management"* and this led to an animated discussion on regional initiatives. In October, the major **IAEA Safety Conference in Tokyo** included an invited presentation on the SAPIERR project and also a panel discussion in which the multinational concept figured prominently. A group of authors from five Latin American countries also presented a paper on *"The Latin American case"* for regional disposal facilities.

The encouraging message from these activities is that discussion of multinational repositories is no longer a taboo in the international arena. In fact, the concept has become mainstream. There are still some large disposal programmes that react sensitively, particularly those directly involved in siting, but the potential benefits are now recognized by all but the most parochial waste management agencies. This is a healthy situation. Even closer integration with national programmes may become possible in the scope of the newly proposed SAPIERR-2 project (see earlier item), which also encourages interactions with countries that have strictly national disposal policy, but are prepared to help other smaller programmes work towards safe, secure and economically viable shared solutions.

US-Russian National Academies Workshop on International Spent Fuel Storage, Vienna

June 1st and 2nd saw the second meeting of the joint US-Russian National Academies Workshop on *Setting the Stage for International Spent Nuclear Fuel Storage Facilities* take place at the IAEA in Vienna. The workshop was sponsored by the Russell Family Foundation, USA and chaired by Professor Nikolay Laverov, Russian Academy of Sciences, and Milton Levenson, U.S. National Academy of Engineering. The first workshop was held in Moscow in May 2003; Arius was also invited and we reported on the meeting in Newsletter No. 5.

The discussions in June focussed on packaging and shipping of spent fuel, liability and insurance during shipping and receiving at a repository, the adequacy of national legislation and country perspectives on the Russian proposals for international spent fuel storage (see Topical Article).

Neil Chapman and Christina Boutellier of Arius were invited to the workshop and presented two talks, on *"International Repositories: European Perspectives"* and *"Overview of National Laws in Relation to a Regional Repository: Legal and other Non-technical Aspects of Multinational Repositories"*.

This was very much a further exploratory meeting which was not appropriately constituted to open out discussion onto the actual options that Russia could present and the real issues underlying them. Nevertheless, it illustrated the enthusiasm within Russia and the USA, at both government and scientific and technical levels, to develop the Russian project. The involvement of a private sponsor with a keen interest in promoting nuclear security is a key pointer to the recognised importance of international back-end solutions.

Rosatom-IAEA Multilateral Approaches Conference, Moscow

July 13th – 15th saw a major conference take place in Moscow, organized by Rosatom with the support of the International Atomic Energy Agency (IAEA), entitled *Multilateral Technical and Organizational Approaches to the Nuclear Fuel Cycle Aimed at Strengthening the Non-Proliferation Regime*. The

conference, attended by 220 participants, was widely reported internationally (e.g. see *London Times*, July 15th). **Neil Chapman** of Arius presented a paper on "*The Importance of Storage and Disposal in Multinational Approaches to the Fuel Cycle*", whose objective was to spur discussion on the issues brought up in our Topical Article later in this Newsletter. The Arius paper focussed on some of the findings of the SAPIERR project and on the perceived pre-requisites for successful international disposal, with the current Russian situation in mind.

In keeping with the conference title, the dominant theme was nuclear security and the role that multinational initiatives can take in achieving this. The meeting was opened by **Aleksandr Rumyantsev**, who presented greetings from Prime Minister Putin. Rumyantsev foresees a possible international network of nuclear fuel cycle centres acting as service providers, commenting that unilateral approaches could cause commercial difficulties. Guarantees of supply should be strengthened within a non-proliferation framework (see also the previous Newsletter item on this month's speech by Mohammed ElBaradei). The Rosatom position is that the IAEA should be involved if a commercial system encounters problems. Russia has the relevant legislative framework for involvement in multinational initiatives and the IAEA can be the provider of guarantees. A subsequent talk by Tariq Rauf of the IAEA noted that the guarantor aspect of fuel service supplies within the IAEA statutes had not been fully explored yet, but will be addressed soon.

Yuri Sokolov of the IAEA stated that, in promoting secure, sustainable development of nuclear power, the Agency is suggesting a global reduction in the production of fissile materials, limits on reprocessing that is not IAEA monitored and that all participants in multilateral schemes should sign relevant IAEA agreements. He pointed to the strong R&D and industrial structures within Russia as a prime reason for holding the meeting in Moscow.

I. M. Kamenskich (Rosatom) promoted the concept of international storage in Russia. His view is that storage would be a preferred option to disposal because so many spent fuel re-use, reprocessing or disposal options were being pursued or considered around the world that storage is the only common mode that actually could be internationalised.

P.P. Poluektov (VNIIMN and one of the members of the IAEA multinational approaches report drafting group) proposed using the IAEA as an inter-governmental co-ordinator. He noted that, since 2003, Russia has been able legally to import spent fuel for reprocessing and return. It would require new legislation to dispose of spent fuel. Russia has identified possible sites for storage but international support by the highest levels of government is needed. He said that Russia is ready to develop international nuclear fuel cycle contacts, is considering the disposal issue and will report back, and emphasised that any international repository must be to the highest standard. When asked his opinion of whether the USA would allow Russia to take in

spent fuel, 80% of which is US-flagged, he accepted that the scheme would require political goodwill from the USA, but he had the impression that it would be possible to obtain this.

A significant part of the meeting was devoted to discussing Generation 4 reactor systems and the use of fast reactors with full actinide re-cycling. According to **Philippe Pradel** (CEA, France), these will produce very small volumes of fission product wastes and will have high proliferation resistance. The 'classic' PUREX/MOX fuel cycle is not very proliferation resistant, but has not 'gone wrong yet' and commercial Pu is not very attractive for weapons. He believes that fast reactors with closed fuel cycles are the way forward. A subsequent presentation by **Alexander Bychkov** (RIAR, Russia) supported the view that new approaches are needed to the fuel cycle, supporting the concept of partitioning and recycling within a closed fuel cycle. He noted that the technology is modular and flexible and well-suited to internationalisation. Later in the meeting, **A. V. Lopatkin** (NIKIET, Russia) described the new generation BREST fast reactor, which has no blanket – all the breeding occurs in the core, which uses high-density fuel, with no requirement for high enrichment levels. The initial cores in this type of reactor can comprise Pu and spent fuel. Subsequently, any surplus Pu can be used as the cores of new reactors. BREST reactors could have attached fuel cycle facilities for recycling fuel, with all reprocessing and regeneration done locally and no requirement to transport fissile materials. Another subsequent series of papers looked at the benefits of molten salt reactors (UF₄ mixed with Li and Na fluorides), which could operate at low pressure, with low chemical reactivity but at a high burn-up and with lower waste productions, potentially accommodating multiple fuel cycle options. Other talks looked at gas cooled graphite-ceramic fuel reactors designed to burn weapons-grade Pu (**Yuri Sukharev**; **N. N. Ponomarev-Stepnoy**), the use of small (<700 MW) reactors by countries without fuel cycle facilities (**V. V. Kuznetsov**, IAEA) and low-power (300 MW) floating reactors to provide power, heat and desalination for remote regions – a project in which China, Canada, Indonesia and India are also interested (**V. P. Solovyev**).

It is interesting to note that moves in the advanced fuel cycle, new generation reactor direction could lead to significant re-evaluation of the fate of LWR spent fuel. Some countries might find that moving to new fuel cycles, storing their LWR fuel and re-using it, could be attractive. Provision of a long-term storage service, possibly linked to fuel regeneration services, could be of great interest to some, whilst others may continue to prefer simply to dispose of fuel. There is certainly potential for a shift in attitudes about the value of spent fuel that could eventually have repercussions on many national waste management programmes. It is not inconceivable that some facilities currently being defined as final disposal repositories may, in reality, only be used for interim storage of spent fuel that will eventually be recycled/reprocessed.

Gideon Frank (AEC, Israel) opened by saying that the old NPT regime had not worked and proposing four ways of dealing with this. First: containment, via a ban on technology export. This must be backed up by reliable assurance of supply, with the effective removal of spent fuel as an essential incentive. Second: conditional growth, with export of technology under strict conditions linked to economic justification and good standing with respect to nuclear obligations (although it is not clear who should be the judge of this). Third: consolidated growth via multinational approaches, where the risk of 'break-out' from the NPT is confined to the host state only, which means that the host must already be a 'technology holder'. Fourth: a package deal, where the vendor provides nuclear power plants and leases the fuel, removing spent fuel, either themselves or via a contracting third party country, or to a multinational repository. He believes that the way ahead is to consolidate, with a safety net for the free market that provides credible fuel supply arrangements and enhanced IAEA enforcement capabilities. The interim solution is to take back spent fuel and store it. **Z. E. Lauckhardt** (USDOE) commented that governments should come together to discuss arrangements to ensure security of fuel supply, but these would need a strong nuclear industry working in partnership with government – a strong industry is one of the best non-proliferation tools.

E.G. Kudriavtsev (Rosatom) informed the meeting that Russia currently has 16,000 tU stored as spent fuel, which will increase to 24,000 tonnes by 2015 (interestingly, this is close to the spent fuel inventory considered in the SAPIERR project). He said that it will cost about 10 billion USD to dispose of this, with storage costing about 3 billion RUB/a (about 100 million USD per year). The Krasnoyarsk Mining and Chemical Combine has good waste facilities at present and could process up to 100,000 tU, retaining the fuel for use in fast reactors, with cladding waste disposed of at a repository that could be constructed on site. There are already large caverns (two of 3200 m³) and surface disposal facilities at Krasnoyarsk.

Adrian Collings (WNA) reported that the WNA now has 90% of the global nuclear fuel cycle organisations in its membership. By 2030 a further 4 trillion USD will have been invested in new reactors worldwide, with a then installed capacity of over 7000 GW. He expected that the WNA would work together with the IAEA to help champion the multinational approaches cause.

Igor Rybalchenko (VNIPIET) evaluated what would be needed to establish an international regional centre in Russia. The investment needed may be about 3 billion USD, which would cause a 10-12% increase in electricity prices if not offset by extra-budgetary funding, for example, from international sources. The minimum cost of developing the Krasnoyarsk facility for Russian wastes alone would be about 2.5 billion USD, increasing to 4.7 billion USD if additional wastes were imported. **Yuri Revenko** (MCC, Krasnoyarsk) later stated that MCC has Russian, Bulgarian and Ukrainian spent fuel in storage. The facility was recently inspected by EU (TACIS programme) experts from BNFL and

elsewhere and is being upgraded as a result of their report. The wet storage facility was built in 1985, with the first stage of a dry store to be commissioned in 2007. Potential disposal sites have been identified at two locations, 4 and 30 km from the store. Current drilling exploration underlines the MCC intent to build a deep repository in the future.

David McNellis (Russell Foundation) commented that the USA was indeed opposed to reprocessing of US-flagged fuel by Russia. He believes that it would be logical to have a national spent fuel store at one site and an international store at another. He suggested that the IAEA could monitor for compliance with international radiological and environmental protection standards and, upon request from a host country or a consortium, could also establish appropriate siting and technical requirements.

Maureen Clapper (US State Department) read a paper prepared by Alex Burkart (and quoted in the Topical Article below) on the US official position on multinational approaches. It is difficult to imagine, she noted, that all countries will have their own stores or repository, especially in regions of closely grouped States. The USA has consent rights over about 20,000 tU and would want to know that this fuel was destined for disposal and not reprocessing – consequently, a repository must be part of the Russian scheme and the USA would want to be convinced that this was environmentally safe. The US acknowledges that this requirement could make the concept less financially attractive to Russia. Transport of spent fuel is seen as potential problem as narrow water channels (e.g. the Dardanelles) and rail links are targets for interveners. Russian ports could have problems too, with those in the east requiring upgrading of parts of the trans-Siberian railway. The USA would also want to see proper, long-term funding provisions. Critically, the USA identifies a number of other topics that need to be resolved before it would give support, including Russian nuclear assistance to Iran and other chemical and biological warfare and advanced weapons matters.

Mike Smith (NAC International, USA) reviewed the growing stocks of spent fuel and Pu worldwide. Around 11-12,000 tonnes of spent fuel are discharged every year – around 290,000 t to date, of which 100,000 t has been reprocessed or re-inserted. Most of the remaining 190,000 t is owned by the USA, Canada, Russia, Japan and France. In the remaining 28 countries owning spent fuel, he saw a great opportunity for getting together and developing shared solutions. To date, about 1300 t Pu has been discharged. About 370 t has been extracted by reprocessing, with 130 t of this recycled.

Repatriation of high-grade research reactor fuel was another major theme of the meeting. **A. E. Lebedev** (TENEX, Russia) acknowledged that past decisions by the USSR to build research reactors were often more political than technical and siting sometimes took place in unstable countries. Early reactors used 80-95% enriched fuel, but later ones were lower enriched. The only historic return that had taken place

was in 1993-4, from the bombed reactor in Iraq, with help from NAC in the USA. From May 2005, the joint Russian-USA-IAEA repatriation programme has been underway, focussing on returns from 17 countries. The returned HEU fuel will be stored, reprocessed and down-blended to LEU fuel. The USA will provide financial support, provided the LEU is destined for use as power reactor fuel and the research reactor is shut down. Thirteen out of the 17 countries involved have so far agreed to the process. So far, 900 kg of fuel from six countries has been returned to Russia by air or road (see news item in this Newsletter). Work is currently in hand in Uzbekistan and an agreement is being developed with Latvia. Work to decommission a research reactor in Belgrade will require 35 million USD, with additional transport costs on top. Only two Russian companies (TENEX and TVEL) are licensed to do this work by the Russian government, and the transparency of the whole process is seen as highly important. A complementary talk by **Catherine Anne** (NAC International, USA) looked at the return of US research reactor fuel. It will involve 104 reactors in 41 countries. So far, 28 shipments have been carried out, involving 2100 kg HEU and 2700 kg LEU from 27 countries.

US-Russian co-operation mechanisms have recently been evaluated in an in-depth study by the US National Research Council and the Russian Academy of Sciences. Prepublication copies of their study report (*Strengthening US-Russian Cooperation on Nuclear Non-proliferation*) were circulated at the conference. The report was presented by **A. A. Sarkisov** (RAS) and **Rose Gottemoeller** (NRC). Interestingly, one of the potential obstacles identified was the way that the Russian tax code treats assistance funding.

Charles Yulish (USEC Inc, USA) described progress on the 'Megatons to Megawatts' programme – a joint USEC-TENEX arrangement to blend down ex-weapons HEU under Rosatom and US State Department oversight. The work began in 1995, when 6 tonnes of HEU was processed. By August this year the total had increased to 250 tonnes. The HEU is blended down to 4 – 4.4% enrichment LEU. This is a 20 year programme costing 12 billion USD. Cameco (Canada), Cogema (France) and NUKEM (Germany) are also involved. It is connected with the so-called "*Isaiah Project*", in which the USA has pledged ex-weapons HEU to fuel the first US new-build programme. The first new reactor core will effectively contain the HEU from 100 warheads and a reactor would burn 2000 warheads in its lifetime.

Topical Article

Nine requirements to develop an international repository in Russia

Neil Chapman and Charles McCombie

Arius is simultaneously promoting both of the multinational disposal models that were defined in last year's seminal IAEA report (IAEA, 2004) – regional repositories, shared by cooperating partners (e.g. the

SAPIERR initiative), and international disposal facilities, provided as a service by a large nuclear country. As is well known, the only option of the second type that is currently being discussed is the possibility of spent fuel storage in the Russian Federation. The storage proposal is currently rather general and was re-stated most recently in July by Aleksandr Rumyantsev, head of Rosatom, at the Moscow Rosatom-IAEA Conference, described earlier in this Newsletter. It would involve using surplus capacity at the state-owned Mining and Chemical Processing Plant, an underground facility for spent nuclear fuel storage, disposal, reprocessing and transportation, near Krasnoyarsk in eastern Siberia.

The concept of a Russian storage and/or disposal facility is regarded with suspicion by the majority of people – owing to the unenviable record of environmental pollution in the former Soviet Union, its poor nuclear industry safety performance, and the continuing lack of transparency and variable integrity of Russia's industrial and financial systems. What would it take to alleviate these suspicions and make a sceptical international community 100% confident? This Topical Article presents our views as nine key requirements that we believe would have to be met to make the 'Russian Option' an attractive and achievable solution. It is based upon a longer, invited article to be published in the *Safety Barriers* magazine (Radon Press) in Russia, later this year.

Background

Multinational initiatives to facilitate safeguards, provide increased nuclear security and guarantee the supply of fuel cycle services to countries with nuclear power programmes are very much at the forefront of international discussion (IAEA, 2005; McCombie and Chapman, 2004). Non-proliferation is a key issue in current deliberations on global security within the United Nations. Although the most urgent security and non-proliferation issues are concerned with the front end of the fuel cycle, it is equally important to ensure that spent fuel is properly managed. A major international workshop held in Moscow this July (see Newsletter item in this issue) explored many of the issues involved and focussed in particular on the role that the Russian Federation could play in providing facilities that would improve global control of spent fuel and high-level radioactive wastes.

Suggestions have been made from time to time by Russia concerning the possibility of long-term or permanent spent fuel storage services. The current focus is on using the Krasnoyarsk facility as an international store and, possibly, as a final repository for spent fuel. Under existing national legislation, Russia could import spent fuel for:

- long-term storage, with eventual return to the sender;
- storage, with regeneration of light water reactor fuel for re-use in new generation reactors, perhaps in Russia (thus possibly entailing no return requirement to the sender);

- storage, with reprocessing and return of some of the ensuing wastes to the sender.

Each option is economically attractive for Russia since they all provide either income from provision of services or fuel for the future, or both. However, at present, the law does not allow import for eventual disposal.

Arius is supportive of developing a Russian option that would be attractive to potential users and which would satisfy international requirements for safety and security. Success for such an initiative will require a range of important international stakeholders to be highly comfortable with what is offered and with the conditions attached. In addition to the technical aspects, complex political, societal and security issues are at stake. As stated in a paper by Alex Burkart (US State Department) at the July symposium in Moscow:

“The overriding principle for State-to-State transfers of nuclear waste are established both in an IAEA Code of Practice and the Provisions of the Joint Convention. A sending State should ship waste or spent fuel only with the consent of the receiving State and only after satisfying itself that the receiving State has the administrative and technical capacity, as well as the regulatory structure, needed to manage the waste or spent fuel safely. Similarly, the receiving State should only consent to receiving the waste or spent fuel if it can satisfy itself that it can meet those requirements. This means that shipments of spent fuel and nuclear waste fall clearly under State jurisdiction and reflect a State’s policy. While technical factors are important in evaluating a proposal, political factors always count in State decisions as well.”

Nine requirements

We believe that nine key requirements will need to be met for the Russian proposals to have any realistic chance of success and international acceptance:

1. **Import of spent fuel for disposal, as well as storage, should be permissible.** A new law will be required in the Russian Federation to allow disposal of fuel that is not to be, or cannot be, recycled (reprocessed or regenerated). Potential users of a Russian service are unlikely to wish to receive fuel back after interim storage. A major attraction of an international facility is that provisions for long-term storage and disposal do not have to be made in one’s own country, thus avoiding the high costs of a national repository and also reducing many of the political and societal problems entailed in siting such facilities. In addition, this would allow accommodation with the United States over the fate of US-flagged fuel. In the words of Burkart’s paper:

“Before approving new arrangements for the retransfer of any spent fuel containing U.S.-origin nuclear material, the United States would almost

certainly need to be assured that the spent fuel was destined for eventual disposal and not for reprocessing. A permanent repository need not be available at the time of the export, and long-term interim storage could be part of any scheme. But the scheme should also involve specific plans for, and the commitment of sufficient resources to, development of a geologic repository.”

2. **A geological disposal option (not only for spent fuel, but also for vitrified high-level wastes and other long-lived wastes) should be part of the package.** As noted above, any country that does not want to build a repository for spent fuel will not want to have to build one for returned reprocessing wastes or for its other long-lived wastes. Russia needs to be prepared to retain HLW from reprocessing of foreign spent fuel, to accept high level wastes that customer countries may already have received from other reprocessing countries and to accept other long-lived wastes from customer countries. The service should thus be complete, so that countries can use it for all their wastes that will require deep disposal.
3. **International acceptability is essential**, in particular to the European Union and the United States. Disposal outside the EU is not current EU policy and the USA has strict requirements (mentioned above) with US-flagged materials. Any country (or group of countries) would have to present the scheme’s credentials to their own public and institutions with great commitment. Acceptability will depend upon the scheme being openly executed to the highest technical standards being developed internationally, using appropriate best available technology and being subject to international monitoring. At present, politicians and the public tend to prefer national options, arguing that this enables closer control of possible environmental and safety impacts. It will only be possible to gain support for export if Russia can demonstrate clearly that there will be no relaxation of standards.
4. **Economic advantages for user and supplier.** Any scheme must benefit both implementer and user economically. If the previous requirements are met, Russia stands to benefit substantially by charging appropriate rates for a service not currently available anywhere else. The approach to compensating host communities willing to accept an international responsibility needs to be set out clearly, so that users are convinced of the equity of the scheme. Offering a service that enhances global security and helps small countries to meet their waste management responsibilities can also bring significant political advantages. Users should be prepared to pay for avoiding the problems and unpredictable costs of running their own national disposal programmes, which can take decades and might never even reach a successful conclusion. Disposal prices will thus be significant but, owing to the huge economies of scale in repository implementation (e.g. see figure on page 2 of this Newsletter), they

may still be less than small nuclear countries would have to pay for a national repository.

5. **Long-term availability of facilities should be guaranteed for user countries.** The facilities offered by Russia may be unique. If so, they need to be available over the period that wastes will be generated by user countries, so that all wastes for geological disposal can be exported – otherwise their national problems are not solved. This point is very important for some Central and Eastern European countries that began a nuclear power programme under the assumption that spent fuel would be returned to the USSR – an option that was later withdrawn.
6. **International support and recognition.** If the scheme proves internationally acceptable (point 3, above) then the major nuclear nations and international agencies and associations (IAEA, OECD-NEA, WNA) should throw their weight behind it, acknowledging that Russia would be providing a service that will enhance global security and safety. These organisations can promote groups to help establish and guard the rights of the various parties to any waste transfer agreements.
7. **Transparent project management.** Information on the way that the scheme is managed, along with all its significant technical, societal and economic aspects, should be available to interested parties. Public and political communication should have high priority in Russia and internationally. The acceptability of the project to national and local stakeholders in Russia needs to be clear. An analogue for major international services being provided by one or a few countries is reprocessing, where customers countries have formally joined together to require extensive access to information from the reprocessors. A similar arrangement may be appropriate for disposal and Arius could be a pre-cursor for such a group.
8. **Use of best knowledge and expertise.** Transparency and international standards will be achieved by ensuring direct participation of the best international technical expertise. The Russian scheme should be a truly international project, generating wide enthusiasm in the global scientific and technical community. Russia could take the initiative by establishing credible advisory groups at the outset, including internationally recognized experts in the disposal area.
9. **Active involvement of the IAEA** in establishing the project and, later, in an oversight monitoring role, will underwrite its overall credibility. The IAEA has already expressed its interest in the monitoring function.

Satisfying each of these nine requirements presents its own challenges, especially since some of the main players have very different views on them. But each of the key players needs to be confident and convinced, which requires their involvement in setting up such a

scheme. Purely unilateral initiatives (in Russia or elsewhere) will probably not succeed – a proper multinational approach is absolutely essential.

We believe that, given the encouraging developments within Russia, the key players should now join in a free and open discussion to develop plans for how a specific project can be established – a project that addresses each requirement head-on.

The immediate objective should be to produce:

- an agreed set of requirements that an international repository must fulfil;
- a project plan, which, over several years, would lead to implementation of such a repository;
- recommendations for specific actions by national and international organisations so that the first steps can be taken towards this implementation.

We hope that 2006 will see such an initiative take shape, with Arius taking a role in promoting it, alongside our activities in shared regional solutions.

References

- IAEA (2004). Developing and Implementing Multinational Repositories: infrastructural framework and scenarios of co-operation. TECDOC 1413
- IAEA (2005) Multilateral Approaches to the Nuclear Fuel Cycle: Expert Group Report to the Director General of the International Atomic Energy Agency.
- McCombie, C. and Chapman, N. (2004). Nuclear Fuel Cycle Centres - an Old and New Idea. Annual Symposium of the World Nuclear Association, London, 8-10 September 2004.

Publications

Arius has interacted over the past few years with two postgraduate students producing doctoral theses on international waste management solutions – one in Australia and one in Germany. Below we outline the scope of the two theses.

The Search for an Effective International Regime for the Long-Term Safety and Security of High Level Radioactive Waste: Pangea and Beyond



Dr Vincent Cusack, Centre for Social Research, Edith Cowan University, Perth, Western Australia.

De Cusack's thesis explores the option of multinational repositories and draws out some arguments and incentives as to what could motivate states to collaborate and share in a repository. It looks at the issue as a 'global public goods' problem to be resolved. The author believes that this provides a tighter philosophical argument, and clarity of the benefits that ARIUS has already advanced, namely economies of scale, and environmental and security benefits. Summarising the public goods argument (if it is possible, in such a short statement), the author notes:

"HLW disposal is a 'global public goods' problem requiring collective action. A multinational repository will have non-excludable benefits beyond the nuclear states using it, in that it reduces the general risk of nuclear terrorism, and non-rival benefits for the states using it, in that it solves a costly problem that can't be solved by states acting alone. The efficiency, security, and environmental benefits to one country must not subtract in any way from the benefits available to the other countries using the repository".

Dr Cusack then goes on to argue for shared responsibility for HLW and, thus, liability for potential accidents or environmental harm. He also argues for those provisions to be fully endorsed by the participating states in an International Treaty, should a multinational repository come to fruition. In effect, he uses International Law to facilitate a policy shift to a collaborative multinational solution. Dr Cusack is also of the view that addressing the long-term liability issue will help alleviate the public perception of risk with geological repositories.

Die internationale Endlagerung radioaktiver Abfälle - Eine völkerrechtliche und europarechtliche Untersuchung

The International Final Disposal of Radioactive Waste - A Public International Law and European Law Study



Wolfgang Dietze, Dipl.Jur., Institut für Völkerrecht, Abt. Atomenergiericht, Universität Göttingen, Germany

This doctoral work is shortly to be completed and submitted to the University of Göttingen (German language version only). The thesis will take a very broad approach to the legal aspects, looking first at safety and environmental aspects, security issues, and public and political attitudes. The author also

looks at the history of multinational initiatives, including those of Arius and SAPIERR. Wolfgang Dietze has already presented papers on this subject (e.g. at the international Waste Management meeting in Tucson), and is involved in the EC HERALD project, where he is looking at the possible harmonization of European waste management regulations.

Recent Arius Papers

The following papers have been published or are in press on behalf of Arius. Preprints can be obtained direct from Arius:

- McCombie C. and Necheva C. *The importance for Bulgaria of Multilateral Approaches to the Back-end of the Nuclear Fuel Cycle*, Bulgaria 2005
- McCombie C. *Multinational repositories for radioactive wastes: one component of a dual track waste management strategy*, ESTRATOS, House Journal of ENRESA, 2005
- McCombie C., Chapman N, and McKinley I., *Shared facilities for storage and disposal of radioactive wastes: the Asian context*, AOGS Conference, Singapore
- McCombie, C. and Chapman, N. *The Importance of Storage and Disposal in Multinational Approaches to the Fuel Cycle*. IAEA Moscow, July 2005.
- McCombie C., *Geological disposal: past, present and future*. Safety Barrier magazine of RADON press, Moscow, No 1, 2005
- Chapman, N and McCombie, C. *What will it take to develop an international repository in Russia?* Safety Barrier magazine of RADON press, Moscow (in press).
- Boutellier, C. *Overview of National Laws in Relation to a Regional Repository: Legal and other Non-technical Aspects of Multinational Repositories*. US-Russia NAS (in press) and RADON Safety Barrier Magazine (in press)
- Chapman, N. *International Repositories: European Perspectives*. US-Russia NAS (in press)
- Boutellier C., McCombie C, and Mele I., *Multinational repositories: ethical, legal and political/public aspects*, INLA Conference, Portoroz, Slovenia 2005
- Stefula, V. & McCombie, C. *SAPIERR Project: Interim Results*. Proceedings of ICEM'05, Glasgow, Scotland
- McCombie, C. and Chapman, N. *Developments in Multinational Disposal Initiatives*. Proceedings of ICEM'05, Glasgow, Scotland

- McCombie, C., Chapman, N. & Butler, G. CoRWM Work Package 4.3 : International Disposal. UK Committee on Radioactive Waste Management (available at: www.corwm.org.uk)

Upcoming Conferences

This section of the newsletter highlights upcoming conferences that are specifically relevant to Arius activities and objectives. Those at which Arius is attending or presenting papers are indicated.

November	
7 th – 8 th	EUROSAFE 2005, Brussels, Belgium
9 th	SAPIERR final project workshop, Brussels, Belgium Arius Presentations
February 2006	
26 th Feb to 2 nd Mar	Waste Management '06. Tucson, USA
March	
13 th – 17 th	World Nuclear Fuel Cycle 2006, Hong Kong
April	
28 th - 29 th	Geological Challenges in Radioactive Waste Isolation, 4 th Worldwide Review, San Francisco, USA Arius Presentation
30 th Apr to May 4 th	ILHRWM meeting, Las Vegas, USA Arius Presentations
June	
19 th – 23 rd	International Conference on Management of Spent Fuel from NPPs, Vienna
September	
6 th – 8 th	World Nuclear Association Symposium, London
October	
15 th – 20 th	15 th Pacific Basin Nuclear Conference, Sydney, Australia