

# NuclearFuel

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## Fuel bank fund reaches threshold of \$100 million with Kuwaiti pledge

A plan to establish an international nuclear fuel “bank” that would give countries an incentive to refrain from developing uranium enrichment and spent fuel reprocessing in their nuclear power programs reached a key goal March 5, as the fund to set up the bank passed the \$100 million threshold in pledged contributions.

A \$10 million pledge from Kuwait March 5 put the fund over the top, the nongovernmental Nuclear Threat Initiative, which has led the effort, said in a press statement.

In September 2006, the privately funded NTI said it would contribute \$50 million if \$100 million could be raised from other sources (NF, 25 Sept. '06, 1). Pledges to date have come from the US (\$50 million), the European Union (\$32 million), the United Arab Emirates (\$10 million) and Norway (\$5 million).

The announcement came during the IAEA’s quarterly Board of Governors meeting in Vienna. The next step is for IAEA member countries to agree on the specifics of a plan for the bank.

In a March 5 interview, NTI Vice President Laura Holgate said “the expectation” is that IAEA member states will develop a detailed proposal for the next scheduled board meeting in June. But she said it is very possible the proposal would need further discussion and could be approved at the September board meeting.

That is the last meeting that would allow the plan to be put in place before the NTI-set deadline, which requires both that donors contribute the neces-

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## Single waste site won't work, Chu tells panel

One site for permanently disposing of the country’s nuclear waste inventory isn’t going to work and could be replaced with a mixture of short- and longer-term storage sites before final disposition, Energy Secretary Steven Chu told a Senate panel March 5 as he highlighted possible alternatives to the DOE repository project in Nevada.

Chu said the sites would probably be “geographically distributed” but did not elaborate.

Short-term storage, he said, involves storage scenarios in which the spent fuel is easily retrieved. Some see that as including the spent fuel stored where it is now, at the 104 power reactors in the US. Fuel in longer-term storage would be “sealed away,” Chu said.

Chu addressed energy issues during a hearing of the Senate Energy and Natural Resources Committee March 5, a week after President Barack Obama

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## Spot price remains under downward pressure

The spot price of uranium remained under downward pressure — as it has for weeks — even after several suppliers cut prices to secure recent deals, analysts said.

The most recent published price — by Ux Consulting March 3 — is \$43.75 a pound U3O8, down \$1.25/lb from Ux Consulting’s price on February 23. TradeTech’s exchange value at the end of February was \$44/lb, down from \$47/lb at the end of January.

How far the spot price might drop in this current cycle is uncertain and depends on how motivated sellers are to conclude deals, several analysts said. Right now, buyers would want a price lower than the most recent published price in order to consider a deal, these analysts said. The prices that buyers appear willing to pay now for March or April delivery are at or below \$40/lb, according to several brokers. One analyst said the spot price probably “has

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### Platts Forward Uranium Indicator

Current		Previous	
Low-High	Midpoint	Low-High	Midpoint
40.00-45.00	42.50	41.00-47.00	44.00

### Other Uranium Pricing Indicators

Source	Price	Previous price
<b>TradeTech<sup>1</sup> (Feb 28)</b>		
Exchange value	44.00	47.00 (Jan 31)
Long-term U3O8	69.00	69.00
UF6 value (\$/kgU as UF6)	124.00	131.00
<b>Ux Consulting<sup>2</sup></b>		
Spot price (Mar 2)	43.75	45.00 (Feb 23)
Spot conversion (U.S.) (\$/kgU as UF6) (Feb 23)	8.50	8.50 (Jan 26)

1. TradeTech's Nuexco exchange value reflects the company's judgment of the price at which sales of significant quantities of yellowcake could be concluded as of the reporting date.

2. The Ux Consulting's price indicates, subject to the terms listed, the most competitive offer available of which Ux Consulting is aware. Those terms (Mar 2) are: quantity, above 100,000 lb; delivery, within three months.

### Secondary SWU Market Price Estimate (US\$/SWU)

Source	Price	Last Report
<b>TradeTech (Feb 28)</b>		
Unrestricted	159.00	158.00 (Jan 31)
Restricted	162.00	160.00
<b>Ux Consulting (Feb 23)</b>		
Spot	160.00	160.00 (Jan 26)

**Editor's Note:** Table updated from NF Uranium Pricing Supplement of February 27, 2009. The Uranium Pricing Supplement, issued biweekly on Fridays, is available exclusively to NF electronic subscribers. For more information on electronic subscription delivery, please contact customer support, at the e-mail or phone numbers listed in the index box on the final page of this issue.

\$1.75/lb to go" before a bottom is reached, given demand is "wishy-washy." But he said he would be surprised if the price dropped below \$40/lb.

Another analyst noted that in normal commodity markets, buyers purchase small lots as the price is falling — and still get a lower average price — rather than waiting until it hits bottom. But in the uranium market, he said, buyers wait for the "inflection point," meaning the point when the price changes direction and they're sure it won't go any lower. Then all the buyers come in at the same time, pushing the price up, he said.

Ux Consulting in its March 3 market commentary said that it agreed that the price remained under downward pressure. But it said that "buying interest is picking up, resulting in more deals and expected deals. It is this type of buying interest that will eventually stop the price slide and pave the way for another price recovery."

In Platts' opinion, based on discussions with market

sources, spot U3O8 transactions over the next week are expected to be concluded within the range of \$40-\$45/lb U3O8.

Entergy has given suppliers until March 16 to respond to the utility's request for offers to buy up to 1.2 million lb U3O8 equivalent. The original due date for offers to Entergy was March 6.

In other news, several sources said that they understand that Goldman Sachs has an option to buy Nufcor International and expect Goldman Sachs to do so. Nufcor International wasn't included with the rest of the Constellation commodities trading group Goldman Sachs bought. The reason was simply because Nufcor International "is uranium," one of the sources said.

Rio Tinto has signed a memorandum of understanding with Jordan's Atomic Energy Commission for uranium exploration in Jordan, Rio Tinto spokesman Nick Cobban said March 5.

### Utilities provide glimpses of their uranium coverage

In recent filings with the US Securities and Exchange Commission, Arizona Public Service said all of its uranium needs are covered through 2011, while FirstEnergy indicated it has contracts for all uranium requirements through 2010 and a portion of its uranium requirements covered through 2014.

AmerenUE said it has U3O8 and UF6 inventories and supply contracts sufficient to meet all its uranium and conversion requirements through 2014. Enrichment requirements for Callaway are covered only through 2012; fabrication services are under contract through 2010, AmerenUE said. It said it expects to enter into additional contracts for nuclear fuel.

MidAmerican Energy said that it has been advised by Exelon that all uranium requirements for Quad Cities-1 and -2 can be met through 2010 and partial requirements through 2016. Exelon owns 75% of each unit and MidAmerican owns 25%. Exelon has also indicated it has all enrichment requirements covered for the plant through 2010 and partial requirements through 2028.

Duke Energy said it has contracts to cover 100% of its uranium requirements through at least 2011.

Xcel Energy said it has current contracts to cover 100% of its U3O8 requirements through 2009, about 68% of requirements for 2010, 80% for 2011 through 2013, 47% for 2014 through 2017, and no arrangements for 2018 or beyond. The utility said that current enrichment contracts cover 100% of requirements of 2009 through 2012 and about 60% of 2013 requirements. The company said a contract to cover open enrichment requirements for 2013 is being negotiated, but no arrangements for enrichment services for 2014 and beyond are in place. Offers for enrichment services for 2014 and beyond are "being reviewed," the utility said.

South Carolina Electric and Gas said all its current uranium requirements are covered by a contract with USEC that

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## Cameco sees Canadian uranium going to India before US material

Canada might be able to sell uranium in India before the US does, even though Ottawa does not yet have a nuclear cooperation agreement in place with New Delhi, a top Cameco official said this month.

The US-India accord came into force last December. But India is insisting on concluding an agreement on reprocessing before it seals any deals with US companies, said an internal trip report from a delegation of US nuclear companies that traveled to India January 11-16 (NF, 23 Feb., 1). That precondition applies to sales of uranium as well as reactors, according to the report and to Scott Melbye, president of Cameco, Inc., the US-based marketing subsidiary of Cameco.

Melbye was a member of the US delegation and also part of a Canadian delegation that was in India the following week. Cameco has mining operations in both the US and Canada.

At one time, the Canadian government had reservations about exporting uranium and other nuclear goods to India, in part because of the countries' nuclear history (NF, 27 Feb. '06, 6). India used plutonium from the Canadian-supplied Cirus reactor for its 1974 nuclear test.

But Canada did not block the consensus decision last year by the Nuclear Suppliers Group to lift international restrictions on trade with India, and, later in the year, began discussing nuclear cooperation (NF, 6 Oct. '08, 14).

The India-Canada pact is still being negotiated, but Canadian suppliers "could see more fruit from [India] earlier than the US" because the Indian insistence on the reprocessing agreement appears to be a "sticking point," Melbye said in a March 2 interview.

More broadly, Melbye expressed optimism about the prospects for uranium sales in India. The Indians have an immediate need for material and also want to have supplies "locked down in the longer term," he said. As a result, the Indians may be less price sensitive than some other customers, Melbye said. But he emphasized that, like any other buyer, they will still be "holding any deals up to the light."

Assurance of long-term fuel supplies has been a long-standing Indian concern. According to the trip report — by the US-India Business Council, the lead organizer of the January 11-16 visit — Anil Kakodkar, the head of India's Atomic Energy Commission and Department of Atomic Energy, said India would "require all vendors to supply a lifetime stockpile of fuel to 'prevent disruption' in addition to alternative supplier relationships with 'friendly countries.'"

He was referring to a section of the US-Indian cooperation agreement that commits the US to supporting "an Indian effort to develop a strategic reserve of nuclear fuel to guard against any disruption of supply over the lifetime of India's reactors." The provision adds that, if there is a disruption, "the United States and India would jointly convene

a group of friendly supplier countries to include countries such as Russia, France and the United Kingdom to pursue such measures as would restore fuel supply to India."

That language — which first appeared in a document submitted to the Indian Parliament in 2006 — has been controversial with nonproliferation advocates in the US Congress and elsewhere. They say that accumulating a long-term supply of fuel would soften the impact of a supply cut-off if the US took that step in response to an Indian nuclear test.

The 2006 Hyde Act — US legislation that opened the door to US-Indian cooperation agreement by granting New Delhi a needed exception from US nuclear-export law but which also included certain nonproliferation conditions — takes up the issue in its "statements of policy" section. "Any nuclear power reactor fuel reserve provided to the Government of India for use in safeguarded civilian nuclear facilities should be commensurate with reasonable reactor operating requirements," the act says. That language was introduced by Barack Obama, then a Democratic senator from Illinois.—*Daniel Horner, Washington*

## Kepeco cancels plans to invest in US mine, looks elsewhere

State-run Korea Electric Power Co. has canceled a May 2008 memorandum of understanding with US-based Yellowcake Mining on the development of the Uravan-Beck uranium mine in Colorado, a Kepeco source said March 4.

Kepeco decided to end its involvement after receiving more attractive proposals for equity involvement in uranium projects whose development was further along, the source said.

He said Kepeco is exploring the possibility of an equity participation in uranium mines that are either in development or production in Australia, South Africa and Kazakhstan. He would not identify the projects.

South Korea is the world's sixth-largest consumer by volume of uranium and relies entirely on imports, the Russian uranium holding company Atomredmetzoloto said last year after signing an MOU with a Korean consortium on the joint development of uranium projects (NF, 6 Oct. '08, 1). Consortium members were Kepeco, the Corporation of Resources of Korea and LG International.

Uranium mine developers and producers have seen a significant drop in the spot uranium price, which was \$43.75/lb U3O8 March 2, according to price reporting company UX Consulting. The current price is down from a high of \$136/lb that UX Consulting reported in mid-2007.

Yellowcake President and CEO Bill Tafuris declined to comment on Kepeco's reasons for withdrawing from the Uravan-Beck project. "I don't know what was driving them," Tafuris said in an interview. "A lot of companies are mothballing or closing their operations because of money issues. With Kepeco, I have not the slightest idea, though."

Under the agreement with Yellowcake, Kepco had planned to hold a 50% stake in the Beck mine in the Uravan mineral belt and to jointly confirm the amount of uranium deposits at the site, said Tafuris. Exploratory drilling is used to accomplish that. "We wanted to prove those reserves," Tafuris said, but Kepco wanted to deal with much larger projects.

### Still in Slovakia

The Kepco source said that his company is still working with the Vancouver, Canada-based Tournigan Energy Ltd. on an equity interest in the Kuriskova uranium deposit in Slovakia. Tournigan Energy is a mineral development company that is traded on the Toronto Stock Exchange's venture capital exchange.

The Kuriskova uranium deposit in Slovakia is Tournigan's main property after it sold some US properties March 2 to Fischer-Watt Gold Co. Inc., according to Tournigan's web site.

The uranium deposit at Kuriskova is estimated to have indicated resources of 14.7 million lb U3O8 and inferred resources of 17.9 million lb U3O8, according to a Canadian National Instrument, or NI, compliant study (43-101) that Tournigan released February 24.

According to NI 43-101, based on an engineering judgment, a measured mineral resource has the highest prospects for the economic extraction of ore. An indicated mineral resource, according to the study, has the next highest level of confidence for economic extraction, followed by an inferred resource, which has a lower confidence level.

—Cecilia Quiambao, Manila and Amena Sayid, Washington

## Navajo president seeks study on uranium mining's health impact

Joe Shirley, the president of the Navajo Nation, told a Senate committee March 5 that the rise in cancer and respiratory problems within his tribe is due to uranium mining and requires a long-term health assessment study.

Speaking at the Tribal Leaders' Summit held by the Senate Committee on Indian Affairs March 5 in Washington, Shirley asserted that cancer rates have increased as a result of past mining ventures. Shirley told a standing-room-only crowd that members of the Navajo Nation were suffering from the effects of mining operations that occurred nearly 50 years ago.

According to the World Nuclear Association, most US production has been from New Mexico and Wyoming, where known resources are 167,000 metric tons U3O8 in Wyoming and 155,000 mt in New Mexico. The Navajo Nation includes part of New Mexico.

Uranium mining is now banned on Navajo land in New Mexico and Nevada. In 2005, the Navajo Nation Council agreed to — and Shirley signed into law — the Diné Natural Resources Protection Act, which bans uranium mining on

Navajo land.

A Navajo representative said in an interview that the tribe opened land to uranium mining in the past because it brought in jobs, but mining operations lost their appeal as the price dropped. The average spot price of uranium has varied during the past 50 years when mining has been allowed on Navajo land. Currently at \$43.75 per pound, the first published spot price of uranium in 1968 was \$6.50.

—Regina Johnson, Washington

## Australian uranium exports to hit US\$604 million this fiscal year

The value of Australian uranium export earnings is forecast to increase 6% to around Aus\$940 million (US\$604 million) in the fiscal year ending June 30 over the prior year. It also is anticipated to jump 31% to Aus\$1.2 billion in the fiscal year ending June 30, 2010, thanks to assumed increases in some contract prices, according to a study by a government economic research agency.

In its March Quarter Commodities Report, the Australian Bureau of Agricultural and Resource Economics, or Abare, said the average Australian long-term uranium contract price is significantly lower than the world indicator contract price, referring to the Ux Consulting term price.

In 2008, the uranium spot price averaged US\$61.80/lb, while the Ux term price and Australian export unit price averaged US\$82.50/lb and US\$28.55/lb, respectively, Abare said.

Prices obtained by Australian producers were lower than the reference term prices as existing Australian contracts were signed at a time when spot prices were significantly lower, Abare said.

Abare said Australian uranium production is forecast to increase 5% to 10,583 metric tons U3O8 in the current fiscal year ending June 30, 2009.

Most of this production increase is expected to come from the Ranger mine of Rio Tinto unit Energy Resources of Australia. Completion of a laterite processing plant and a radiometric sorter in first-half 2009 are expected to add around 680 mt of additional capacity at Ranger, Abare said.

The laterite processing plant is designed to enable the processing of high-clay content ores, while the radiometric sorter improves uranium recovery, Abare said.

BHP Billiton's Olympic Dam is also expected to contribute to higher production as the operation improves its uranium recovery, Abare said.

### Exploration spending up

Spending on uranium exploration in Australia has increased substantially since 2004, reflecting both higher uranium prices and the removal of bans on uranium mining in South Australia, Abare said.

Exploration expenditure in 2008 is estimated to have totaled Aus\$224 million, an increase of more than Aus\$210

million on 2004 expenditure.

The large increase in exploration activity has led to the discovery of numerous deposits, some of which are projected to enter production over the period to 2013-14, Abare said.

Australian mine production is projected to increase by around 6% a year, reaching 14,000 mt U<sub>3</sub>O<sub>8</sub> by the end of the outlook period. South Australia and Western Australia are projected to account for most of this growth, Abare said.

In South Australia, four new projects are expected to begin operations in the outlook period; namely Curnamona Energy Oban in situ recovery, or ISR, project, Pepinnini Minerals' Crocker Well mine, Uranium One's Honeymoon in situ recovery, or ISR, project and Quasar Resources' Four Mile ISR development, Abare said.

The largest of these projects is Quasar Resources' Four Mile ISR development, Abare said. The project is expected to begin operation in 2010 with the mine concentrate to be processed at Heathgate Resources' Beverley mine, which is near the proposed development, Abare said.

Also in South Australia, BHP Billiton has announced staged plans to expand the Olympic Dam mine. The first stage is scheduled to be completed in 2013 and will increase capacity at the operation by around 500 mt U<sub>3</sub>O<sub>8</sub> a year.

In Western Australia the state ban on uranium mining was removed in 2008, but uranium production is not expected until the end of the outlook period because the development of regulatory frameworks, mine approvals and mine developments are not expected to be completed before 2013.

Projects expected to begin operations by 2013-2014 include Mega Uranium's Lake Maitland project and Toro Energy's Centipede-Lake Way project, Abare said.

### Global outlook

Abare said world uranium requirements are forecast to increase faster than world supply in 2009, resulting in a supply deficit on the market for the sixth consecutive year.

Abare forecast spot prices recovering to around US\$62/lb at the end of 2009. However, it forecast the 2009 average uranium spot price at around US\$52/lb, a decline of 15% from the previous year.

In 2010, the spot uranium price is forecast to average around US\$70/lb, an increase of 35% from 2009 prices, Abare said. Strong consumption growth and a decline in secondary supplies of uranium will support this price increase, Abare said.

Global mine production is forecast to increase in 2009 by 8% to 56,000 mt U<sub>3</sub>O<sub>8</sub>, driven by production increases in Kazakhstan, Africa and Australia, Abare said.

In Kazakhstan, production is forecast to increase by around 14% to 11,500 mt U<sub>3</sub>O<sub>8</sub> as new mines commissioned over the previous two years increase production and Kazatomprom's Semisbai ISR project and Uranium One's Kharasan Two ISR commence operations.

Paladin Energy's Kayelekera project in Malawi, Areva's UraMin Trekkopje project in Namibia and First Uranium's

Buffelsfontein project in South Africa are forecast to increase African production by 10%, to more than 10,000 mt U<sub>3</sub>O<sub>8</sub>.

In addition, South African and Namibian mines that began operating in 2008 are expected to contribute to growth in mine production, Abare said.

### Medium term

Abare said large investments in new mine capacity are projected to result in mine production increasing 10% a year on average, to around 90,000 mt U<sub>3</sub>O<sub>8</sub> in 2014. Production increases in Africa, Australia, Canada and Kazakhstan are forecast to account for most of this growth.

However, the timing of new production may be adversely affected in the short term by current credit conditions brought about by the global financial crisis, Abare said.

Uranium production in Africa is projected to increase 14% a year, to around 20,000 mt U<sub>3</sub>O<sub>8</sub> in 2014, as significant new production is commissioned in South Africa, Niger, Namibia and Malawi.

In South Africa, the commissioning of First Uranium One's Randfontein and Uranium One's Buffelsfontein, both in 2010, and Valencia Uranium's Valencia project in 2011, should lead to an annual production increase of around 30%, to 3,100 mt U<sub>3</sub>O<sub>8</sub> in 2014, Abare said.

Niger's production is also projected to increase by around 3,000 mt U<sub>3</sub>O<sub>8</sub>, following the startup of SinoUranium's Azelik project and Areva's Imouraren project in 2012.

Production in Namibia and Malawi is projected to increase by around 5,400 mt U<sub>3</sub>O<sub>8</sub> by 2014 as two projects expected to be commissioned in 2010 approach capacity.

In Canada, uranium mine production is projected to increase moderately from 10,750 mt U<sub>3</sub>O<sub>8</sub> to 11,500 mt U<sub>3</sub>O<sub>8</sub> in 2013. Abare said production from Areva's Midwest project, expected to start up in 2012, will be largely offset by the closure of existing operations.

Canadian mine production is expected to increase significantly beginning in 2014 with the commissioning of Cameco's Cigar Lake operation, but potential delays in the startup of Cigar Lake represent a downside risk to the projections, Abare said.—David Stellfox, Barcelona

## Detailed design work for Eagle Rock being accelerated, Areva says

Areva is taking steps to speed up detailed design work for its Eagle Rock uranium enrichment plant in Idaho, the company announced March 2.

In a press statement, Areva said it is "accelerating its activities and gearing up to launch detailed design, procurement and construction planning while the NRC reviews the license application" the company submitted December 30.

The goal is to complete the detailed design before NRC completes the review so that the design will be ready before plant construction begins, about two years from now, Areva's Sam Shakir said in a March 4 interview. Shakir is

president of Areva Enrichment Services, or AES, the subsidiary responsible for the construction and operation of the Eagle Rock plant.

Areva's target date for bringing the first cascade online is February 2014, and the company is not changing that date, Shakir said. But the actions the company is taking will "substantially reduce the risk" of failing to meet it and will provide "some margin," he said.

The activities Areva is pursuing had previously been planned for later this year, Shakir said. But from reviewing other construction efforts, the company became convinced that it was important to have the detailed design as complete as possible before construction started, and decided late last year to accelerate the work, Shakir said. That point was driven home by speakers at the Platts nuclear energy conference last month, he said.

In the accelerated effort, AES will be working with Areva NP, Areva engineering subsidiary SGN, and The Shaw Group, Shakir said. AES has not yet chosen an architect-engineer for the plant, he said. AES will make that choice in the "coming months," but has decided it does not need to wait for that decision to move ahead with the detailed design, he said.

Eagle Rock will closely resemble Georges Besse II, the enrichment plant Areva is building in France, although the first GB II unit will be bigger than Eagle Rock, he said.

That unit, on which Areva began construction in September 2006, will have a capacity of 4.3 million SWU/year, while Eagle Rock's will be 3.2 million SWU/y, Areva spokesman Jarret Adams said. The second GB II unit also will be able to produce 3.2 million SWU/year; construction on that unit will start this month, Adams said.

The detailed design work at Eagle Rock is starting earlier in the process than it did at GB II, Shakir said. AES is "looking very hard and deep" at the GB II experience to draw lessons from it for Eagle Rock — although some aspects will have to be "Americanized," he said.

To help the learning process, AES is bringing to the US some of the technical managers from SGN, which is responsible for engineering, procurement and construction at GB II, Shakir said.

### Customers and competitors

The driving force behind Areva's decision is that the company has customers that are "absolutely counting" on Eagle Rock, Shakir said. The actions Areva is taking are "what any prudent company would do," he said. He said "a significant portion of [Eagle Rock's] output for many years" already is under contract.

The enrichment market is tight and, along with LES' National Enrichment Facility in New Mexico, Eagle Rock is "the least risky and most assured project to move forward," he said.

USEC is building its American Centrifuge Plant in Ohio. Like LES' and Areva's, it would use gas centrifuge enrichment technology, though a different kind. Global Laser Enrichment — a joint business venture between GE Hitachi Nuclear Energy and Cameco — submitted its environmental

report to NRC in January and said it plans to deliver the rest of the license application by June. GLE technology is based on Silex, an Australian technology that separates isotopes by laser excitation.

In the March 2 press statement, Areva also announced the appointment of three AES executives. Robert Poyser will be AES' vice president of Idaho Falls operations, George Harper will be vice president of engineering and Michael French will be senior policy adviser, the company said.

Poyser will be based in Idaho Falls and will oversee the buildup of staff there between now and the middle of next year, Shakir said.

Meanwhile, NRC spokesman David McIntyre said March 4 that the agency has completed its acceptance review of the Eagle Rock license application. NRC is preparing to send a letter to Areva but is waiting for Congress to approve a spending bill that includes funding for NRC and many other government agencies for the rest of fiscal 2009, he said. The schedule for the more detailed technical review of the application could be affected by the funding level in the bill, he said.

The interim spending bill under which NRC and the other agencies are operating expires March 6.

—Daniel Horner, Washington

## Brazil, verification agencies aim for naval fuel safeguards negotiations

Brazil, the IAEA, and the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials, or Abacc, have begun preparations to negotiate a verification regime for the production and utilization of low-enriched uranium fuel for Brazil's navy, diplomatic sources in Vienna and Brazil said last month.

One Latin American official said that a "preliminary concept" for safeguards of this fuel had been drafted by involved parties as the baseline for pending negotiations and suggested that trilateral talks might begin by the end of the year. Vienna sources said that the IAEA Department of Safeguards is willing to begin negotiations with Brazil and Abacc regarding Brazil's naval fuel program on the basis of that preliminary concept.

The lack of international endorsement of Brazil's nuclear navy project in some quarters has factored into Brazil's refusal so far to endorse important global non-proliferation and nuclear trade initiatives, one senior Vienna official said.

So far, Brazil will not accede to the Additional Protocol for safeguards, Incirc-540, for parties to the Nuclear Nonproliferation Treaty, NPT. Brazil is also standing in the way of a consensus approval of new export guidelines drafted by the Nuclear Suppliers Group, NSG, of which Brazil is a member.

The IAEA did not reply to an e-mail request submitted last month for confirmation or denial that preparation for naval fuel safeguards negotiations is under way.

## Dedicated plant

Brazil has harbored designs for a nuclear navy for three decades. The project was dormant during most of the 1990s but was given a boost when Brazil in 2000 set up a project for commercial uranium enrichment based on gas centrifuge technology previously developed by the navy. More recently, the nuclear navy project has found favor at high levels of Brazil's federal executive government, including President Luiz Inacio Lula da Silva, who has endorsed it.

Brazil's state-owned fuel cycle firm, Industrias do Brasil, or INB, has announced it will begin enriching uranium at its plant in Resende in May. According to Brazilian officials last week, INB is testing operating centrifuges under vacuum conditions in an initial module of centrifuges for which the IAEA and Abacc have approved safeguards provisions.

Plans by the navy to enrich uranium for submarine reactor fuel, Latin American officials said, call for enrichment to take place at a dedicated facility, however, not at INB's existing Resende plant. The Resende plant, they said, is subject to a trilateral safeguards agreement that limits the level of enrichment to 5% U-235. The reactor fuel required by the navy must be enriched to perhaps close to 10%.

The navy's centrifuges are said to have a design throughput slightly less than 10 SWU/yr (NF, 25 Sept. '06, 8).

## Franco-Brazilian deal

In late December, France and Brazil announced they would cooperate in the development of both conventional and nuclear submarines.

Shortly before that, diplomatic sources said, the US government attempted to persuade Brazil to agree to comply with key aspects of the Additional Protocol and to not go ahead with its plan to establish a nuclear navy based on production of fuel that would be outside IAEA safeguards while in the hands of the navy.

Jose Goldemberg, a former Brazilian Cabinet member and now an observer of Brazil's nuclear program, said that the announcement of Franco-Brazilian cooperation "appeared to render obsolete" US diplomatic efforts to halt Brazil's nuclear navy project.

Details of future Franco-Brazilian nuclear naval cooperation have not been announced. So far, Brazil officials said, French industry has agreed to assist the navy only in specifically non-nuclear aspects of submarine development. Brazilian sources assert that Brazil has enough know-how to develop a propulsion reactor and its fuel without foreign assistance.

US officials would not disclose whether the US had urged France not to transfer nuclear reactor or nuclear fuel technology to Brazil's navy. But one US official said last fall that "it would be in line with our policy should [France] not contribute to [Brazil] having nuclear activities outside of IAEA safeguards."

## Safeguards concept

Brazil's nuclear naval ambitions were boosted politically in 2007 when Lula appointed Admiral Julio Soares de Moura

Neto, a firm advocate of submarine development, as the head of the navy. Since then, the navy has championed the development of nuclear submarines to protect recently discovered offshore oil reserves. The navy now wants to deploy nuclear submarines by 2020 and to produce fuel for an initial submarine reactor core by 2015. For this reason, one official said, the negotiation of the safeguards agreement "should begin before the end of this year."

According to another official, a "preliminary concept" for safeguarding fuel produced for the navy was drafted as the basis of trilateral safeguards negotiations. It calls for the fuel to be enriched in a dedicated centrifuge facility under safeguards applied jointly by Abacc and the IAEA. Uranium enriched and processed into UO<sub>2</sub> fuel for a submarine reactor would be withdrawn from safeguards at some point before it is transferred to the navy and inserted into the reactor core. The fuel would be outside safeguards while it is in the core. Containment and surveillance methods would be used to deter any diversion of the fuel while it is in the reactor. When the reactor is defueled, according to the officials, Abacc and the IAEA would reverify the fissile material inventory represented by the irradiated fuel and return the material to routine safeguards.

Vienna diplomatic sources said the IAEA would be prepared to negotiate a safeguards agreement with Brazil and Abacc on the basis of such a concept.

## Additional Protocol, NSG

Since 2008, and most recently during a meeting in Vienna earlier this year, Brazil has singularly and firmly objected to proposals supported by other members of the NSG that require an Additional Protocol be in place in the recipient state before technology for uranium enrichment, spent fuel reprocessing, and heavy water production, so-called ENR, could be transferred. This proposal was made in the course of drafting of new NSG export guidelines over several years.

In a December 2008 interagency white paper outlining its national defense strategy, Brazil's Ministry of Defense said it would accelerate the development of nuclear submarines and develop an industrial-scale nuclear fuel cycle as part of its commitment to develop "strategic" technologies. The document also said Brazil's nuclear development program would be circumscribed by constitutional law in Brazil and by Brazil's international obligations. Brazil would not agree, however, to any increase in NPT-related verification requirements "without disarmament by the nuclear [weapon] powers," the paper said.

But during an NSG meeting in January, officials attending the conclave said, Brazil appeared to go beyond concerns about global disarmament in raising objections to the Additional Protocol. They reported that Brazil said it would not agree to the protocol unless the "status quo" of Brazil's nuclear program was not interfered with or challenged. The sources said that Brazil appeared to be asserting its right to have an indigenous nuclear naval fuel program to which IAEA access was restricted.

Some Brazilian nuclear officials expressed concern that the Additional Protocol might give the IAEA undesirable access to non-nuclear parts of the navy's submarine development program, because some technology the navy developed for gas centrifuges might be applied elsewhere in that program. Unique levitation technology designed by the navy for centrifuge bearings (NE, 6 Dec. '04, 1) may be incorporated into the design of a silent, so-called "turbosilva" ducted submarine propeller, Brazilian officials said.

The Additional Protocol does not specifically mention any IAEA access rights to facilities where technology used in gas centrifuges is applied for non-nuclear purposes. It does state that a participating country must provide the IAEA a "description of the scale of operations" at sites where centrifuge assemblies are manufactured, as well as "access to" those locations. If Brazil's navy has co-located non-nuclear submarine R&D activities, which rely on technology developed for centrifuges, on sites where it is assembling centrifuges, the IAEA could claim it had right of access to the R&D activities should the IAEA not be satisfied by other information provided by Brazil about that activity, one Western safeguards official said. "The protocol is not crystal clear on this point and we're getting into a gray area here," the official said.

According to diplomatic sources, last fall the US tried to persuade Brazil to abandon its indigenous nuclear submarine fuel cycle program and to agree — in the interest of NSG consensus on ENR transfers — to comply with key aspects of the Additional Protocol without making a political commitment to signing and ratifying Infcirc-540. Latin American diplomats termed the goal of this diplomacy agreement by Brazil to a "modified version" of the Additional Protocol. Thus far the US effort has not been successful, they said.

If US diplomacy fails to persuade Brazil to abandon or substantially modify its nuclear submarine plans, France could contribute technology used in its existing fleet of Amethyste submarines to help Brazil develop a nuclear submarine that resembles that class of French vessels, according to Brazilian sources.

Until it gave up its plan to have a nuclear navy in 1988, Canada had considered the possibility of leasing Amethyste-class submarines from France. The Canadian naval plan was opposed by critics, including US officials, who argued that Canada, a non-nuclear weapons NPT state, would thereby obtain unsafeguarded nuclear material.

Advocates of a Brazilian nuclear navy said that objection would not apply to Brazil because it would not import or lease any unsafeguarded fissile material during its development of nuclear vessels or its future cooperation with France, but instead produce the fuel itself.

According to open-source data, the propulsion system for Amethyste features a 48 MW PWR using LEU enriched to between 7% and 7.5% U-235. The Renar-11 reactor developed by Brazil's navy has the same rating, and anticipates fuel enriched to between 7% and 10% U-235.

Some sources suggested that the Renar-11 prototype, parts of which have been manufactured, would have a core

lifetime somewhat less than 10 years. Given these parameters, the Western safeguards official said, Brazil could enrich enough fuel for a two-submarine fleet in a dedicated plant having fewer than 1,000 Resende-type centrifuges.

Some sources suggested enrichment for the naval program might take place at Aramar, a naval nuclear installation near Sao Paulo. A small centrifuge enrichment facility there is under safeguards by Abacc and the IAEA.

—Mark Hibbs, Bonn

## Thorp expected to soon restart normal reprocessing operations

The UK's Thorp plant at Sellafield is expected to restart normal reprocessing operations within the next few days after a fitful 15 months of stops and starts, its operator, Sellafield Ltd. said March 5.

The 15 months were required to install a new medium-active salt-free evaporator, or Masfe, under a roughly 20 million pounds (roughly US\$28million) evaporator replacement project.

Two years ago, Thorp's operators estimated they could have the new Masfe online sometime before midyear 2008 (NE, 9 April '07, 8). This was later revised to December 2008 and then revised again to March 2009.

A crane first started lowering the Masfe in sections through a specially opened roof section of Thorp in December 2007. Various installation activities occurred throughout 2008 — even at times when Thorp was fully operating — because Thorp was built with a spare evaporator cell alongside the original.

Sellafield spokeswoman Ali McKibbin said March 4 that the Masfe became fully operational before the end of January. But Thorp's restart had to be delayed because of a problem with one of the chillers in another part of Thorp's chemical plants, she said. Thorp's back-end chemical plants separate out the plutonium, uranium and waste contained in the dissolved spent fuel.

McKibbin said a drive shaft failed in the chiller "so we have had to de-gas and repair it."

Thorp's chemical plants could start up again as early as March 6 and be fully active after "about five days," McKibbin said March 5. Spent fuel could be cut up at Thorp's front end shortly thereafter, McKibbin said.

The newly installed Masfe is designed to concentrate liquid waste after both the uranium and plutonium have been extracted from the dissolved spent fuel. The liquid is then taken downstream from Thorp for further evaporation and concentration before being vitrified into glass for long-term storage.

Thorp's chemical plants have been down since July 18 so Sellafield Ltd. could connect the new Masfe to other internal systems. "Some parts [were] washed out as appropriate," McKibbin said. However, the chemical plants' shutdown didn't deter some shearing work being carried out at Thorp's

front end, she said.

Around the latter part of October, Sellafield Ltd. was able to cut up some spent fuel from the Dutch Dodewaard BWR, she said. The 55-MW gross BWR was shut permanently in 1997. The Dodewaard operator, GKN, has a contract with Thorp's owners, formerly British Nuclear Fuels plc and now the Nuclear Decommissioning Authority.

"That sheared spent fuel was stored, waiting for the chemical plants to start," she said.

McKibbin said 91.7 metric tons of spent fuel have been sheared so far this financial year, ending March 31. The original target was 220 mt (Nucleonics Week, 3 July '08, 7). The revised final throughput for the financial year will be less than 150 mt, she said. Some 23 mt of this is accounted for by the Dodewaard fuel, with the remainder being advanced gas-cooled reactor, or AGR, spent fuel.

The requirement for the replacement Masfe was part of a lengthy program of asset improvements across the Thorp facility following its shutdown in April 2005 when 83 cubic meters of highly radioactive liquids were discovered to have leaked from a fractured pipe from primary to secondary containment during at least the previous eight months.

The incident was rated Level 3 on IAEA's International Nuclear Event Scale, denoting a serious incident without off-site radiological consequences (NE, 23 May '05, 1).

That incident was one of a series of well-documented setbacks since the plant opened in 1994. It still has around 16% of its first 10-year "baseload" of 7,000 mt of spent fuel to reprocess. Roughly two-thirds of that was originally contracted by foreign customers — around one-third by Japanese utilities and another third by European firms.

McKibbin said March 4 that Thorp's cumulative throughput last March 31 was 5,779.7 mt, making its current cumulative total 5,871.4 mt.

In addition to the four-year delay so far in completing the 7,000 mt baseload quantity, Thorp continues to have some post-baseload business from the UK and Europe, but McKibbin declined to provide details on specific customers and quantities of that business.

In 2005, Thorp sources said that Thorp's post-baseload program consisted predominantly of AGR spent fuel.

### Thorp's end date?

McKibbin said that she was "unable to say when the 7,000 mt baseload will be completed as Thorp's throughput is limited by the operation of the highly active liquid waste plants downstream of the Thorp facility."

In that waste plant area, where highly active radioactive liquids are further concentrated through evaporation, McKibbin said that Evaporator C is the only one of three evaporators designed to take the waste liquids from Thorp. But Evaporator C is limited by its condition and is currently authorized to deal only with 300 mt of Thorp's spent fuel throughput. After that, Evaporator C "will be shut down for further inspections to determine corrosion rates," McKibbin said.

She said permission will be needed from regulator

Nuclear Installations Inspectorate, or NII, to enable Evaporator C to handle additional amounts of Thorp liquids.

"Thorp is currently programmed to operate until 2016," she said. "However, clearly the availability of downstream evaporative capacity will determine the plant's throughput."

A UK government consultation document published in June 2007 noted the "complexities" associated with downstream Evaporator C, and warned that if the evaporator couldn't properly carry out its functions at any point, further delay in Thorp's operations was possible. The worst case would be waiting for the new evaporator, Evaporator D, to come on line around 2010-2011, the government said.

The NII said March 5 in an HSE newsletter published on its web site ([www.hse.gov.uk/nuclear](http://www.hse.gov.uk/nuclear)) that the 300 mt was governed by a permit it issued in May 2008. It noted delays in 2008 in the construction schedule of backup Evaporator D.

Thorp's peak reprocessing year was in FY-1999/2000 when it reprocessed 879 mt of spent fuel, just short of the 900 mt/yr its designers expected it to be achieving by that point in its operations.

### Gearing up again

Thorp was offline after its INES Level 3 spill for more than two years. The plant resumed reprocessing operations in July 2007. Some 33 mt of British Energy's (now EDF Energy's) AGR spent fuel were cut up, dissolved and then processed through the facility's chemical plants. The process was completed in late 2007.

From March to mid-May 2008, Sellafield Ltd. cut up and dissolved 57 mt of AGR spent fuel and then stored it until NII gave it permission in mid-May to reprocess the liquid.

McKibbin said reprocessing resumed June 11 and that the AGR campaign was completed by early July. NII said in an August 2008 newsletter that the Dodewaard BWR campaign started for a brief time in mid-July but had to be stopped after about 6 mt of spent fuel had been cut up because of a malfunctioning centrifuge. Another centrifuge, which was offline at the time, was brought back into service.

McKibbin said last week that the problem centrifuge had a shaft that "was showing signs of wear and was shut down. A new shaft is still being installed and (the work) will be completed this month," she said. The centrifuges are used to remove any solids from the dissolved fuel after shearing, she said.

McKibbin said Thorp was also able to shear around 6 mt of AGR spent fuel in mid-January "in order to top up the buffer storage tanks." However, Thorp will not start shearing again until the chemical plants are operational and processing the dissolved liquid from the sheared AGR and BWR spent fuel now in the storage tanks.

She said that usage of the buffer storage tanks meant that the reprocessing operation through Thorp did not have to be continuous. "You can shear fuel while the chemical plants are shut down and can operate the chemical plants (using the dissolved fuel contained in the buffer storage tanks) without necessarily shearing new fuel," she said.

—Pearl Marshall, London

## MOX shipment en route to Japan; opponents claim security risk

A convoy bearing three reloads of mixed-oxide fuel left France March 5 bound for Japan, where the MOX assemblies are expected to be loaded into LWRs of Kyushu, Chubu and Shikoku Electric Power Companies to kick off Japan's long-delayed plutonium recycle program.

The departure of the Pacific Heron from the Normandy port of Cherbourg was announced by Greenpeace, which said the ship had left the port about 5:15 pm.

Areva, producer of the MOX assemblies, said March 4 that its confidentiality agreements with the Japanese utilities prevented prior release of any information except that the shipment was under preparation and the country of departure.

On March 6, Areva NC, the UK's International Nuclear Services Ltd., and the Japanese utilities issued statements saying the Pacific Heron and the Pacific Pintail, its escort vessel, would take the MOX around the Cape of Good Hope and the southwestern Pacific Ocean, with expected arrival in Japan in the second half of May. Greenpeace had earlier predicted the shipment would take that route, which was used in previous MOX shipments to Japan.

Greenpeace International, Greenpeace France and Greenpeace Germany have been monitoring preparations for the shipment for the past month and releasing the information they have gleaned from anonymous sources. They refer to the shipment as "history's largest plutonium transport," saying the plutonium in the MOX to be shipped to Japan totals 1.8 metric tons.

Greenpeace nuclear campaigner Shaun Burnie said in an e-mail that the 1.8 mt figure had been calculated by Citizens Nuclear Information Center in Tokyo and associated organizations and individuals in Japan, the US and Europe. He said it was based on plutonium enrichment of 5% for BWR fuel and 9% average for PWR fuel. Burnie said the calculations "came to a figure of 1,754 kilograms, which we rounded up to 1800 kg."

Henry-Jacques Neau, spokesman for Areva's Logistics business unit, said March 4 that Areva would not confirm the quantity of plutonium nor the number of MOX packages. But he acknowledged it was difficult to keep secret the port of departure and the names of the vessels, because they were in full view of environmentalists and journalists monitoring the event.

Neau said the confidentiality requirements are part of Areva's contract with its Japanese customers.

### First from Melox

The MOX assemblies were the first produced by Areva for Japanese customers at its Melox plant at Marcoule near Avignon in southern France. After transport to Areva's La Hague reprocessing complex in Normandy, they were loaded into transport casks and trucked to the port of Cherbourg in two convoys, early March 4 and early March 5, according to

Greenpeace.

Greenpeace called the shipment a "dangerous and vulnerable operation." In a March 4 statement, Greenpeace said a "massive security operation" had been mounted to protect the MOX fuel convoy along the 20-kilometer stretch from La Hague to Cherbourg. Nevertheless, Greenpeace activists were able to project the image of a target onto the casks in the second truck convoy, Greenpeace said in a follow-up statement March 5. The organization also charged that physical protection measures for ocean shipment of the fresh MOX are insufficient, calling it "direct-use nuclear weapons material."

The Pacific Heron and the Pacific Pintail are part of the fleet of Pacific Nuclear Transport Limited, or PNTL, a joint venture of the International Nuclear Services (which holds a majority and is also the operator), Areva's TN International unit, and a consortium of Japanese nuclear utilities. INS is wholly owned by the Nuclear Decommissioning Authority. The cargo vessels are armed — although not as heavily as Greenpeace thinks they should be — and guarded by officers from the UK's Civil Nuclear Constabulary (police). PNTL has extensive experience in transporting nuclear material between Europe and Japan, including separated plutonium, spent fuel, fresh MOX assemblies, and vitrified high-level waste.

Greenpeace did not attempt to interfere with the vessels' movements, as the organization had done during past MOX transports to Japan. Those actions in some cases brought legal sanctions against Greenpeace and its members and injunctions against approaching the PNTL vessels.

Instead, the organization said it had written to 80 countries that are potentially on the MOX vessels' transport route to "ask them to refuse access" to their Exclusive Economic Zones. Under the law of the sea, an EEZ, usually about 200 nautical miles from the coast, is a sea zone over which a state has special rights over the exploration and use of marine resources. However, shippers contest the state's right to refuse EEZ access to vessels in transit.

It is not the first time plutonium or fresh MOX fuel has been shipped to Japan. In 1992, a PNTL vessel reflagged for the occasion as the Akatsuki Maru bore 1.7 mt of plutonium oxide to Japan, escorted by an armed naval vessel, with heavy military protection as it approached the small Japanese port of Tokai Mura. Physical protection measures for that shipment had to be approved by the US, under terms of the US-Japan nuclear cooperation agreement. That plutonium was destined for use in the Monju fast reactor, but only about half was fabricated into Monju fuel and it has never been used because Monju has been offline since a secondary sodium leak in 1995.

Following that maiden shipment, it was decided that Japanese utilities' plutonium at La Hague and the UK's Sellafield reprocessing plant would be made into MOX fuel in Europe before returning to Japan.

The first shipment of MOX for Japanese LWRs did not occur until 1999, after long negotiations on the security measures to be applied; the US accepted the two-vessel

system, rather than the military escort that had been used for the separated Pu shipment. But that batch of MOX was rejected, after British Nuclear Fuels plc acknowledged quality control falsification at its MOX Demonstration Plant during fabrication of those assemblies. The shipment contained about 446 kg of Pu. Two batches of MOX fuel made in Belgium (in the now-decommissioned Dessel plant) were also shipped in 1999 and 2001 (about 220 kg of Pu) but remain in storage pending political permission for loading.

Besides Greenpeace, the Japanese antinuclear groups Citizens Nuclear Information Center and Green Action have long campaigned against the Japanese utilities' plans to recycle plutonium in thermal reactors, known in Japan as "pluthermal." The recycle program is part of Japan's official nuclear energy policy that includes domestic reprocessing and MOX fuel fabrication and, eventually, recycle of plutonium and uranium in a fleet of fast reactors.

Under Japan's original schedule for plutonium fuel use in LWRs announced in early 1997 (Nucleonics Week, 24 April '97, 2) the first MOX assemblies were to be loaded into reactors in 1999.

But neither of Japan's two biggest utilities has been able to kick off the MOX recycle program, due to political and public acceptance issues (NF, 5 March '01, 1). With Tepco and Kansai stalemated, two years ago the leadership of the MOX program passed to smaller utilities that had obtained political approval for MOX use, or were expecting to get approval shortly (NF, 4 Dec.'06, 3).

The MOX assemblies now under way are bound for Chubu Electric Power Co.'s Hamaoka BWR station, for Shikoku EPC's Ikata PWR station, and for Kyushu EPC's Genkai PWR station.

Greenpeace last week charged that the physical protection arrangements for the MOX shipment are inadequate in light of the risks of diversion by terrorist groups. The organization also accused Areva of "lying" because Areva officials deny the MOX presents a risk of easy diversion to nuclear weapons use.

Greenpeace and its Japanese allies wrote on March 2 to IAEA Director General Mohamed ElBaradei, asking him to stop the imminent MOX shipment on grounds that it posed an unacceptable security risk.

In the "open letter," they said Areva statements distinguishing between civil- and military-grade plutonium risks are "misleading" and do not reflect the IAEA's "formal position" that reactor-grade plutonium can also be used in a nuclear weapon.

Greenpeace and the Japanese groups appealed to the IAEA to stop Areva from denying the weapons-usability of the MOX fuel being sent to Japan. They cited a 1990 IAEA safeguards glossary as saying that MOX fuel or powder could be converted to finished plutonium metal within one to three weeks. The four-page letter and an annex listed further quotations about the weapons-usability of reactor-grade plutonium, including one from ElBaradei's predecessor at the IAEA, Hans Blix.

### 'Americans trust'

PNTL and Areva stated that the physical protection arrangements for the MOX shipment met the requirements of the 1988 US-Japan nuclear cooperation agreement.

Neau said that "the fact that the Americans trusted our [transport and security] systems for the Eurofab shipment [of MOX from France to the US in 2004] indicates that our systems are serious." The precise measures, beyond the deck-mounted guns that are visible and the dedicated police force, are confidential.

Neau said he could not confirm that this week's shipment contains a record quantity of plutonium, saying that the 1992 shipment at least came close. "Given our [security] measures and our transport system, the debate is not about a few kilograms more or less," he said in an interview.

As for the proliferation risk from the MOX assemblies, he said that the plutonium contained in the Japanese MOX contains over 30% Pu-240, 10 times the concentration in "weapons-grade" plutonium. Even if potential diverters had a plant capable of separating the plutonium from the Japanese MOX — which he thought unlikely — they could not make a nuclear weapon with it, but only a so-called dirty bomb, he said.

Neau maintained that the Japanese MOX "has no interest" for would-be proliferators. "Nobody has taken material from the civilian nuclear fuel cycle to make a bomb. Countries that have weapons have used dedicated reactors" to produce weapons-grade plutonium, he said.

In a reply to the opponents' letter March 6, IAEA Director of Public Information Marc Vidricaire said: "In carrying out its safeguards verification activities the Agency does not differentiate between different isotopic grades of plutonium ... The Agency does however take into account the technological capabilities that would be required for processing materials into a form that could be suitable for nuclear explosive use."—*Ann MacLachlan, Paris*

## Duke, MOX Services fail to agree on new contract for fuel assemblies

Duke Energy Carolinas and Shaw Areva MOX Services were "unable to reach agreement" for renewal of the contract under which MOX Services is supposed to provide mixed-oxide fuel for the Catawba and McGuire nuclear stations, Duke said in a February 27 filing with the US Securities and Exchange Commission.

The contract "automatically terminated" December 1, Duke said in the 10-K filing. But the company also said it "continues to support the objectives of the surplus weapons disposition program and is interested in receiving a future proposal from MOX Services for the use of MOX fuel."

A MOX fuel fabrication plant that MOX Services is building at DOE's Savannah River Site in South Carolina is the centerpiece of the department's plutonium disposition program. Under that program, more than 30 metric tons of US

surplus plutonium is to be fabricated into MOX fuel for US reactors.

If the contract is not renewed, there will be no reactors committed to using the MOX fuel.

Last October, MOX Services issued a request for expressions of interest in buying MOX fuel (NF, 20 Oct. '08, 9). Also, some utilities have indicated broadly and informally that they are interested in exploring a closed fuel cycle.

In a March 5 e-mail to Platts, DOE spokesman Al Stotts said the department is "confident that one or more utilities will be willing to irradiate mixed oxide fuel when it becomes available." Utilities "have responded positively" to MOX Services' October request, but "procurement is still at an early stage," he said.

But a senior utility official said, "I think it should be a strong signal to DOE that their project is in trouble and they need to work harder to find customers for their product."

Duke spokeswoman Rita Sipe cited changes in the uranium market and in the schedule for the delivery of the MOX fuel as key factors in the two sides' failure to reach agreement before the contract terminated. As Duke noted in the 10-K, when the contract was signed in 1999, deliveries were expected to start in 2007. In the October request, MOX Services indicated that deliveries are now expected to start in 2018.

But Sipe said Duke had sent a letter saying the utility is still interested. Duke and MOX Services are "in discussions," she said March 5.

MOX Services spokeswoman Donna Martin said March 6 that her company is "continuing to work with Duke and other utilities that responded positively" to the request for expressions of interest. She confirmed that MOX Services had received a letter from Duke expressing its continued interest in "remaining a part of the [MOX] program."

According to the MOX Services request, the Savannah River MOX plant will produce 1,700 MOX fuel assemblies over 15 years, beginning in 2018. Of that total, 950 were to go to Duke.

### Industry interest

The Duke-MOX Services rift comes as an industry task force comprised of utilities and potential reprocessors is urging NRC to move ahead with a draft proposed rule on the agency's approach for licensing a reprocessing facility (Inside NRC, 2 March, 4). The task force, under the auspices of the Nuclear Energy Institute, is headed by Jack Bailey, the Tennessee Valley Authority's vice president for nuclear generation development and construction.

At a February 26 meeting of task force members and NRC staff, Bailey said utilities have a real interest in reprocessing. In an interview during a break in the meeting, Bailey said his company was "looking at what we can do" with regard to MOX use.

It is possible TVA will submit a license application to NRC within the next two years for a "lead use" MOX demonstration, he said.

Duke has conducted a similar program for four MOX

assemblies, which it has irradiated for two cycles at Catawba-1. After the second cycle, which ended last spring, the assemblies were found to have experienced "excessive assembly growth," according to a Duke report to NRC. The assemblies were not reinserted for the current unit 1 operating cycle; it is not clear if they will later be reinserted (INRC, 10 Nov. '08, 1).

In addition to TVA, the utility members of the task force include Constellation Energy, Duke, Entergy and Exelon (INRC, 5 Jan., 1).

Exelon does not "have any plans to use any MOX test assemblies," spokesman Marshall Murphy said. Exelon sees the task force as an opportunity to participate in "licensing framework guidance," he said.

In a March 5 e-mail to Platts, Entergy spokesman Michael Bowling said, "We believe a closed fuel cycle is likely to be valuable to nuclear energy customers in the future, but more work is needed to determine how we make reprocessing a reality. That is why we have taken a leadership role in fostering the closed fuel cycle discussion even though we have no active plans for near-term reprocessing." Entergy is "not testing or otherwise using MOX," he said.

—Daniel Horner, Washington

## DOE's mixed-oxide facility project lacks realistic schedule, GAO says

The National Nuclear Security Administration still has not developed a "reliable" schedule for the nearly \$5 billion mixed-oxide fuel fabrication facility, or MFFF, project at the Savannah River Site in South Carolina, despite project spending rate of about \$25 million a month, a Government Accountability Office official told lawmakers last week.

In testimony before the House Energy and Water Development Appropriations Subcommittee, Eugene Aloise said GAO was concerned about the MFFF and other large projects overseen by DOE's semiautonomous NNSA and Office of Environmental Management, or EM. Aloise, director of Natural Resources and Environment at GAO, said in written testimony that the latest schedule for completing the MFFF — October 2016 — is in doubt because the staff has not conducted a risk analysis to determine the sequencing of activities, which ultimately can be used to measure the project's progress.

The facility will be used to convert 34 metric tons of surplus weapons plutonium into fuel for use at commercial nuclear power plants in the US. GAO says the costs have increased about \$3.3 billion over the initial estimate, and the project is now 11.5 years behind schedule.

DOE officials have been hauled before federal lawmakers for years to explain their management of major projects such as the MFFF. House appropriators said at the March 4 hearing they wanted the department to be more accountable for the problems plaguing both construction and cleanup projects.

Subcommittee Chairman Peter Visclosky, a Democrat from Indiana, said he was “aghast and appalled” at the constant problems with the DOE projects. He said he has grown impatient hearing the excuses from DOE officials and expects the new administration to quickly begin tackling the mismanagement. Representative Michael Simpson, an Idaho Republican, suggested it might be time for EM to be moved to the Army Corps of Engineers. His comment was met with silence from Aloise and the other two witnesses, Ingrid Kolb, director of DOE’s Office of Management, and Jonathan Breul, director of the National Academy of Public Administration, or NAPA.

GAO released a report (GAO-09-271) in January designating DOE’s contract management as a “high-risk area” — the 19th consecutive year it has made the list because of large cost overruns and schedule delays for major construction projects. The report found that nine of 12 major DOE construction projects totaling more than \$27 billion were exceeding budget estimates and experiencing schedule delays because of “ineffective” project oversight and “poor contract management.” Ten of the 12 projects were under NNSA or EM, and delays ranged from nine months to more than 11 years, the report said. GAO says budgets of the two offices total \$14 billion, roughly 60% of DOE’s annual budget.

Aloise acknowledged at the hearing that many of the projects were “unique” and “one-of-a-kind” and involved a “high degree of difficulty” in deploying. But he said some of the problems were basic and recurring issues, such as starting with poor baseline estimates.

Aloise said in his written statement that the cost estimate for the waste treatment and immobilization plant at DOE’s Hanford site in Washington state has shot up nearly \$8 billion from the original projection and has been delayed by more than eight years. Other projects plagued by delays include the highly enriched uranium materials facility at the Y-12 National Security Complex in Tennessee (nearly two years behind schedule) and the pit disassembly and conversion facility in South Carolina (with schedule delays of more than 11 years).

Kolb assured the subcommittee that Energy Secretary Steven Chu was committed to addressing the contract and management problems and that the department was developing an “action plan” to get to the root causes of issues that have kept DOE in GAO’s crosshairs since the inception of its high-risk list in 1990. She told a skeptical panel that the department was making progress — an assessment the appropriators said they have heard before.

GAO and several appropriators noted that EM was allocated an additional \$6 billion in a recently enacted stimulus package. They questioned how the money, inserted by Senate appropriators, would be used and whether it was more than the department could handle. Kolb said the department was in the process of finishing a spending plan for the funds.

NAPA plans to release a report in May analyzing DOE’s human resources, acquisition and financial management practices, Breul said. One issue that was previously examined

was the threshold level requiring clearance for contract awards — a process that could slow awards by several months. He said the \$5 million level that was in place had been a “relatively low” level, considering contracts can range from tens of millions to hundreds of millions of dollars. APA recommended raising the level to \$50 million, a suggestion DOE’s Office of Procurement and Assistance Management implemented in September.

Breul reported in his written testimony that “some improvements have been made,” although “no major reduction in procurement lead times” has yet been achieved.

—*Jenny Weil, Washington*

## Yucca Mountain ... *from page 1*

issued a preliminary budget proposal for fiscal 2010 that would only provide the program with funds needed for DOE to answer questions during NRC’s licensing review of its repository application. At the same time, the administration said, a new strategy would be developed on ways the high-level nuclear waste now slated for disposal at a Yucca Mountain repository could be better managed.

A special commission will be assembled this year to look at the issue, Chu said, adding that the administration also expects to receive recommendations from the panel this year. “I think other countries would participate in this fresh look” at waste management, he told the committee. Some observers of the DOE program said after the hearing that they believe the inclusion of foreign partners in this effort could signal an emphasis on spent fuel reprocessing and recycling, both of which are being pursued in Europe and Japan.

Republican Senator John McCain of Arizona fired questions at Chu during the question-and-answer portion of the hearing, demanding to know what is wrong with the Yucca Mountain project. “We have learned a lot in the last 25 years,” Chu responded in an apparent reference to reprocessing.

McCain again asked: “What’s wrong with Yucca Mountain, Doctor Chu?” Chu replied, “We think we can do a better job.”

McCain — like his Republican colleagues Lisa Murkowski, the committee’s top Republican, of Alaska and James Risch of Idaho — criticized the administration’s plan to scrap the Yucca Mountain project after spending more than 20 years and \$9 billion studying the site.

McCain said the nuclear power industry would be very reluctant to invest in new power reactors if there is no path forward for its waste. “Nuclear power has got to be an integral part of America’s energy future if we’re going to reduce carbon emissions,” he said.

Murkowski expressed a similar concern, saying she did not know what “pulling the plug on Yucca Mountain” would do the country’s pending nuclear renaissance. “Look, if I were looking to advance a new nuclear facility, this comment from the administration that we are starting the

process [over]... would be very disconcerting," she said of the administration's search for a better way to manage utility spent fuel. She asked Chu to make the speedy resolution of the nuclear waste issue a top priority.

Murkowski has been advised by members of the NRC that the president's budget request would not be sufficient to allow the Yucca Mountain repository licensing process to be completed in the next three to four years, as required by law, according to her spokesman Robert Dillon.

Dillon said it was likely Murkowski and other members of the committee will introduce amendments to the energy bill that will deal with waste disposal or require the administration to revisit the Yucca Mountain issue. The energy committee is expected to consider the bill and amendments during the last week in March.

Risch reminded the secretary that federally owned defense HLW is at DOE sites across the country, including Idaho National Laboratory, and has to be moved. Unlike utility spent nuclear fuel, defense HLW cannot be reprocessed and would have to be disposed of in a deep-geologic repository like the one DOE planned to build at Yucca Mountain. DOE has a binding agreement with the Risch's home state of Idaho to move all of the spent fuel and HLW out of the state by 2035. But there are also program milestones the department would have to meet along the way, Risch said. If the department fails to remove all of the spent fuel and HLW by 2035, it could be hit with a \$60,000 a day fine until all of the radioactive waste is gone.

### **Hanging in limbo**

The administration's budget proposal was seen by some sources last week as putting the DOE repository program in limbo — placing it somewhere between inching forward, at best, and being terminated — next fiscal year, which begins October 1.

The budget document didn't cite a dollar amount that would be sought for the repository project in FY-10, but several industry officials said the expectation is that the administration request will come in at or below \$200 million. It could be as much as \$100 million below the program's \$288.39 million allocation in the FY-09 omnibus spending package, one industry source said. The omnibus bill was on the Senate floor late last week after clearing the House February 25. The FY-09 allocation is roughly \$200 million below former President George W. Bush's budget request.

Former waste program director Edward Sproat said in a recent interview that the \$288 million sought in the FY-09 bill could cover the program's licensing costs. But the bigger question, Sproat said, is whether it would allow the program to keep the technical staff it needs to respond to NRC questions on the license application and to revamp the program, if necessary. Sproat, a presidential appointee, resigned his post in January before the change in administration.

The prospect of an even deeper cut in FY-10 added to industry concerns last week, with one official saying the program could lose a tremendous amount of "intellectual capital." The repository program has lost 1,000 jobs during the

last five years to budget cuts and attrition and its current 1,400 workforce could shrink to 900 employees when its prime contractor is replaced next month, according to DOE spokesman Allen Benson.

In comments on the National Journal's web site February 23, Nuclear Energy Institute President and CEO Marvin Fertel said that, given the uncertain future of the Yucca Mountain project, DOE should reduce the 1 mill waste fee so that it would only cover licensing costs incurred by DOE, NRC and local governments in Nevada that provide program oversight. A mill is one-tenth of a cent.

Some observers of the DOE program last week questioned whether continued deep cuts in funding could in itself constitute a total breach of the spent fuel disposal contracts the department signed with nuclear utilities in 1983. Under these contracts, the federal government was to begin removing utility spent fuel from reactor sites in 1998. In return, nuclear utility customers are to pay a 1 mill fee for every kilowatt-hour of nuclear-generated electricity sold. Waste fee collections total roughly \$700 million a year and are paid into the Nuclear Waste Fund, a federal trust fund, to bankroll the DOE program.

When DOE failed to meet the 1998 deadline, more than 60 utilities sued the federal government for damages in an effort to recover the cost of their extended onsite storage of the irradiated fuel. The damages sought totaled billions of dollars, which if awarded are to be paid out of the taxpayer-funded Federal Judgment Fund.

A total breach of contract would mean there is no path forward for the utility waste, leaving it stranded at reactor sites, something that sources have said would prompt utilities to file additional damage claims. It is widely believed the Obama administration decided to let the NRC licensing review continue, rather than withdraw the DOE application, in order to avoid a total breach of contract and increased taxpayer liability.

Had the administration withdrawn the DOE application, DOE likely would have been hit with requests that the \$22 billion now in the waste fund be refunded, Fertel said in his comments on the National Journal web site. He added that state regulators also likely would have taken legal or legislative action to protect the money in the waste fund and to place future waste fee payments by electric utility customers into an escrow account.

### **Search for new solution**

The administration's call for a plan on how the US should deal with the waste is not unexpected. During his confirmation hearing in January, Chu told the energy committee that the US needs a plan for managing utility spent fuel and indicated that spent fuel reprocessing and recycling might be the answer.

Late last year NEI officials at a media forum expressed a willingness to participate in discussions aimed at reaching a new consensus on what to do with the waste (NF, 15 Dec. '08, 1). But the Yucca Mountain repository program should not be abandoned, they said, noting that a repository would

still be needed to dispose of the waste even if the country were to move to a closed fuel cycle in which spent fuel was reprocessed and recycled.

The country cannot move away from its long-held plan for a once-through fuel cycle, in which spent fuel removed from the reactor core is destined to be disposed of in a deep-geologic repository, without having a backup plan in place, Paul Genoa, NEI director of policy development, told state officials last month. Speaking at a National Association of Regulatory Utility Commissioners meeting in Washington, Genoa said a new consensus would create a new path forward for the waste.

The nuclear power industry believes the administration should establish an independent panel of scientific, environmental, engineering and public policy leaders to look at developing an integrated spent fuel management strategy, Fertel said last month in an interview. He said the panel could study the issues for 12 to 18 months and then make recommendations to the president and Congress.

An integrated strategy advocated by the nuclear power industry involves interim storage of utility spent fuel, research and development work aimed at closing the fuel cycle through the use of new reprocessing/recycling technologies, and a repository for the disposal of reprocessed waste.

The NRC's existing waste confidence rule states, in part, that the commission is confident that spent fuel can be safely stored at reactor sites for at least 100 years. The agency's revised rule, whose public comment period closed last month, extends the commission's confidence, saying that spent fuel can be safely stored at reactor sites for at least 60 years after the unit's operating license expires. Most US reactors currently can operate up to 60 years after receiving a 20-year renewal of their operating licenses.

—*Elaine Hiruo and Jean Chemnick, Washington*

## NEI proposes six ways to simplify dry cask amendment requests

The Nuclear Energy Institute sent NRC's division of spent fuel storage and transportation, or SFST, a proposal March 4 outlining ways to focus the agency's reviews of the shielding and radiation protection analyses in spent fuel cask licensing submittals.

The proposal stems from a November 21 meeting with NRC in which industry officials aired their concerns with NRC's reviews (NF, 15 Dec. '08, 12). NEI requested the meeting because industry believes the radiation protection and shielding analyses are relatively straightforward and compliance is easy to monitor, yet they continue to generate many questions from NRC staff during safety reviews of amendment requests.

The proposal addresses six areas: the level of detail required in a safety analysis report, or SAR; bounding calculations and results; the definition of a small change versus a small effect; burnup and cooling times versus heat load limits in a certificate of compliance; technical specification dose

rates; and computer codes. Steven Kraft, NEI senior director for used fuel management, offered to meet with NRC again to discuss the proposals in depth.

In addition, Kraft's letter transmitting the proposal asked SFST Director William Brach to provide detailed examples of recent deficiencies in cask submittals so vendors could better understand where improvements are needed. Kraft said NRC presented a good overview of its expectations at the November meeting, but did not provide any concrete examples.

NEI said SFST reviewers are asking for "a significant increase in the level of detail" in the shielding and radiation protection evaluations in cask licensing submittals. In some cases, vendors are asked for more detail on amendments than was needed for the initial NRC certification and "in many cases, beyond what is reasonable or necessary for the shielding reviewer to make a safety judgment." Requests for calculation packages are not supported by the regulations and "seem to be excessive," NEI said.

Instead, shielding evaluations should include "the information used to determine a representative sample dose rate" for cask components containing design basis fuel, NEI said. If different cask models provide significantly different shielding, the application should discuss the expected difference in dose rate and be "realistically conservative, but not necessarily absolutely bounding for every possible combination of allowable contents and component model," NEI said.

Radiation protection evaluations should summarize the system design features and operating recommendations directed toward minimizing dose during loading and unloading operations, consistent with keeping doses as low as reasonably achievable, or ALARA, NEI said. Vendors should provide in the application a single estimate of occupational exposure using the dose rates from the shielding analysis, based on the vendor's best judgment using standard procedures and reasonable estimates. Detailed dose estimates based on operations and number of personnel should be provided in supporting calculation packages that would be made available for NRC inspection, NEI said.

To justify its proposal, NEI said that plants' ALARA programs are based on the actual radioactive materials at a plant, not the conservative values in cask applications "that, necessarily, over-estimate the dose rates by maximizing the potential source term." Temporary shielding and other protective measures may be taken under ALARA programs that would not be required by a cask certificate. Plants should have the flexibility to balance estimated doses for installing temporary shielding versus doses without the shielding "to determine the appropriate, ALARA-based plan of action," the proposal said. Plants use the information in a cask SAR "as a starting point that provides a conservatively high value for dose rates, not the expected value." It is important to know the order of magnitude of expected doses (300 mrem/hour or 3,000 mrem/hour), NEI said, but the level of detail NRC requires should "reflect the manner in which the information" is used at the plants.

NEI argued that NRC should need only one calculated dose rate from a reasonably conservative model to conclude

there is reasonable assurance that the system will meet the dose limits in 10 CFR Part 72. Proposed amendments that would authorize new contents or storage components could be bounded by a previous submittal, and those that are should not require new analyses, NEI said.

NEI further said that NRC reviewers “are currently requesting a level of precision in the shielding analysis input values that are inappropriately high and not commensurate with the safety significance of the results or regulatory requirements.” The document proposed specific approaches for different inputs, such as axial burnup and enrichment distributions, that would recognize “the inordinate amount of scrutiny by the NRC staff given the inconsequential effects of small changes to these inputs.” The proposal points to numerous NRC questions that vendors have answered over the years that have shown variations in these inputs have “virtually no effect on dose rates” at the dry storage facility’s controlled area boundary, where the limits of Part 72 apply.

While NRC staff has required vendors to provide both decay heat limits and burnup versus cooling time limits for approved cask contents, NEI argued that only one set of limits should be necessary. Because thermal analyses drive the designs for storage systems, all limits are based on the thermal analysis and ensure the cladding is protected against gross ruptures, NEI said. Deriving allowable burnup and cooling time combinations based on the allowable heat load is “unnecessary and redundant,” the document said.

NEI also argued that staff’s practice of requiring storage system designers to include dose rates in the technical specifications is “unnecessary to assure safety.” In some cases, the tech specs also specify the location for measure dose rates and specific times during loading when they are to be measured. But licensees already measuring dose rates at the appropriate times and “will take suitable corrective actions if unexpectedly high dose rates are measured, simply because the site radiation protection programs demand such prudence,” NEI said.

NEI questioned NRC’s long-time practice of requiring dose rate measurements to guard against misloading an overburned or undercooled assembly, saying dose rate measurements would be “extremely unlikely” to detect a misloading event, unless multiple assemblies were misloaded in the exterior cells of the cask. “No actual misloading events that have occurred, to our knowledge, have been discovered via dose rate measurement,” NEI said. Utilities track fuel movements very closely, as required by 10 CFR Parts 50, 72, and 74 requirements, and misloadings are taken very seriously.

Computer codes used to develop cask system analyses may be updated, or the code developers may stop supporting them after NRC has certified that system. When vendors submit amendment requests, NEI said, reviewers “often expect vendors to adopt later computer code versions without demonstrating that there is a significant safety benefit to be gained.” NEI urged NRC to allow vendors to use the same

codes and versions approved in the original certificate, as long as any safety-significant issues with the code have been identified and addressed. Updates or new codes should only be used “at the vendor’s discretion,” the proposal said. Mandatory use of new codes should be driven by 10 CFR Part 21 requirements on reporting defects and noncompliance, NEI argued.—*Maureen Conley, Washington*

## NRC staff to issue communication on criticality issues in pools

NRC staff will meet internally before reconvening with an industry group this spring to continue discussing agency concerns about recent licensee submittals involving spent fuel pool criticality — an effort that could culminate in a generic communication later this year that would provide guidance to licensees on how they can improve future submittals.

NRC officials said the initial meeting with the group, held February 26, was a good start and met the agency’s objectives of beginning a dialogue. The goal, agency officials said, is to improve both the industry’s submittals and the efficiency of NRC reviews.

William Ruland, director of the division of safety systems in NRC’s Office of Nuclear Reactor Regulation, or NRR, said last week that his staff would soon caucus to prepare for the next meeting. Ruland and his staff met with a group of industry officials last month that represented about 30 organizations, including licensees, vendors, the Nuclear Energy Institute and the Electric Power Research Institute.

One of the more controversial issues NRC staff raised involves what industry sees as a new emphasis on place value in calculations of the K-effective values. K-effective is a measure of fuel’s potential reactivity, with 1.0 representing criticality. Under NRC regulations, the K-effective in a borated pool must remain below 1.0 with no credit for the soluble boron and must not exceed 0.95 with boron credited. In an unborated pool, it must not exceed 0.95.

NRR technical reviewers Kent Wood and Diane Jackson said at the meeting that they sometimes look at two significant digits in their reviews of these calculations and round licensee values as necessary to get to two significant digits. Under that interpretation, an analysis that results in a 0.997 K-effective would not be considered acceptable because that value rounds to 1.0 and would violate the regulations, but a 0.994 K-effective would be acceptable, the NRC officials said. NEI’s Everett Redmond said that interpretation “is new to us” and would need to be discussed further.

One industry official last week explained that the K-effective value has always been viewed in terms of the “physical phenomenon” — fuel criticality — that would occur when the value equals one. “NRC staff in the past has always discussed this in terms of 1, not 1.0,” and has approved several applications with K-effective values less than one without

regard to the number of significant digits, the official said. The staff has now shifted the emphasis to a licensee's engineering approach, he said.

Jackson said last week the change in how the staff implements the regulations was not driven by the commission. She said every analysis is plant-specific and not every review will rest on that level of mathematical precision to determine whether a licensee will meet NRC regulations. Ruland said this issue and others will be discussed internally before the next meeting with industry. He said industry's interest in the issue shows "this level of precision is important to them" and demonstrates why the dialogue is important.

NRC's views on depletion and criticality analyses also prompted lengthy discussions that will likely be continued at the next meeting. Key among the concerns on both sides is how the uncertainty in the analyses is bounded. An August 1998 internal NRC memorandum sets guidance on the depletion uncertainty and has been used as the industry standard, the official said. That document is known as the "Kopp letter," after author Laurence Kopp, formerly a senior NRC engineer in NRR's division of safety systems. The industry official said the group would like to go over "what was covered by that uncertainty and what was not" at the next meeting with NRC.

Ruland said last week that the Kopp letter endorsed some engineering judgments that have been accepted industry-wide. But he said NRC is trying to shift toward "being more precise and to look toward the data and calculations to support" those judgments. "We have virtually no indication that judgment was incorrect, but we believe at this stage it is prudent to re-examine" those assumptions, Ruland said.

The industry official said utilities use different codes to calculate the changes in the contents of fuel as it is burned, known as depletion, which then feeds into criticality calculations that assess the reactivity of fuel of a given composition. But he said the Casmco criticality code is "extremely popular" and is widely used to meet reactor operating criteria for predicting when the core will go critical, as well as for utility's pool management calculations. He said the code has gotten better over time and has been "extensively benchmarked." But he said NRC staff indicated "a strong desire to see more justification" for using the code in spent fuel pool management, including the establishment of a "paper trail" to show it can be used and what its limitations might be.

Last month's meeting focused on issues NRC first raised in a November 2008 letter to NEI (NF, 29 Dec. '08, 9). In that letter, Ruland sought NEI's assistance in addressing concerns about "poor quality, consistency, and methodologies used in spent fuel pool (SFP) criticality license amendment requests (LAR) and continuing problems with the degradation of neutron absorption material used in the SFPs." The NEI group met February 27 with NRC staff to discuss the history of industry's work on the materials issues.

Ruland told the group that the spent fuel pool analyses

that licensees perform and NRC reviews are meant to ensure NRC meets one of its strategic goals: to prevent inadvertent criticality. While in the past pool analyses could include some engineering judgment, as utilities continue to re-rack their pools those analyses need to be more rigorous, he said. But recent applications for pool amendments have required "multiple rounds" of requests for additional information, or in some cases could not be accepted for review, Ruland said.

Saying that process is "not efficient," Ruland said he asked NEI to assist in improving the quality of submittals and planning ahead for novel licensing approaches. He added that "spent fuel pools are safe" and that plants "do have capacity" for additional fuel storage. His November letter said that deficiencies associated with precedents, references, justification of assumptions, fuel assembly and rack characterizations, determination of biases and uncertainties, and validation of computer codes in LARs could, if left unresolved, "increase the opportunities to create a situation where sub-criticality is not assured."

Wood said the agency has seen a spike recently in LARs affecting spent fuel pools, from an average rate of one to two per year to 19 in the past three years. In just about every case, the submittals fell short of what NRC reviewers expect to see, he said. Of that total, NRC has approved eight. Another eight remain under review; two were withdrawn by the applicants, and one was not accepted for review. Wood said last week he knows of three additional applications due to be submitted before summer, and expects several more before the end of the year.

Since the first spent fuel pool was licensed, pool capacities and initial fuel enrichments have increased, new fuel designs and materials have been introduced, and configurations have become more complex, Wood said. At the same time, safety margins have been decreasing, and NRC has seen an adverse trend in fuel handling events. Since NRC has no approved generic methodology, utilities must develop site-specific analyses to demonstrate the safety of their pools. Some guidance dates back 30 years, applicable regulatory guides are not comprehensive, and NRC's own standard review plan was referenced in only two of the 18 most recent submittals, he said. The agency is therefore looking to improve its guidance.

Ruland noted last week that while NRC has concerns, "Nothing is so pressing that we can't do this in a deliberate fashion." He said the ball is now in industry's court to offer a proposal, which NRC will consider as it decides how to move forward.—*Maureen Conley, Washington*

**CORRECTION:** DOE's prime Yucca Mountain contractor Bechtel SAIC Co., not the department, issued retraining/lay-off notices to BSC's 600 employees in late January as part of the repository program's transition to a new prime contractor. USA Repository Services, which replaces BSC as the program's prime contractor April 1, will decide whom it will hire and whom it will lay off. NuclearFuel reported February 23 that as many as 500 BSC employees could face layoffs.

## Fuel bank ... *from page 1*

sary funds and that the IAEA take the actions needed to establish the fuel reserve.

Also, IAEA Director General Mohamed ElBaradei is scheduled to leave his post at the end of November, according to the agency. Holgate said ElBaradei has put "personal emphasis" on getting the fuel bank started, suggesting that he would push to have the arrangements in place before he leaves.

He laid out an "ideal scenario" in which a fuel bank under IAEA auspices would have a funding mechanism that is "non-political, non-discriminatory and available to all States in compliance with their safeguards obligations." Release of the bank's fuel should be determined by "non-political criteria established in advance and applied objectively and consistently," he said. Also, no state "should be required to give up its rights under the [Nuclear] Nonproliferation Treaty regarding any parts of the nuclear fuel cycle," he said.

A continuing source of friction over the proposal has been the use by advocates, including US officials, of terms such as "forgo" in characterizing the decision on indigenous fuel cycle programs by potential recipients of the fuel. NTI and others have stressed that the decision has to be framed as a voluntary one that does not involve a renunciation of rights.

In his March 2 remarks to the board, ElBaradei also said he was circulating Russia's proposal for a low-enriched uranium reserve. Russia intends to provide further details "in the near future," he said.

One US official said that Russia had submitted a three-page "concept paper" to the board meeting, providing for "two reactor cores of LEU" to be stored at a Russian enrichment plant at Angarsk. Russia, he said, would brief the board, and the proposal would then likely advance to the June board meeting for a decision by the governors on whether to endorse the proposal.

According to Holgate, the Russian proposal is the same one that Moscow had previously offered, but the new development is that there is now an agreement with the secretariat to present it to the board.

ElBaradei said the Russian plan provides "assured" export licenses. That means that there are specific assurances that the material can be exported if the IAEA calls on it, Holgate said.

ElBaradei also said the Russian proposal "covers all long term costs." He did not provide details. Holgate said the Russians would be paid for the material, as would the suppliers under other plans.

The US official said his government supports both the Russian and the NTI proposals. The US now wants ElBaradei to present to the June board meeting a paper "on how to spend the money" for both proposals, he said.

Some other proposals in response to ElBaradei's 2004 fuel assurance initiative, US officials said last week, are less imminent. Proposals from Germany and Japan, they said, were elaborated by these governments at seminars held in 2008. A

briefing on a UK-sponsored proposal for enrichment bonds will be conducted by the UK government in mid-March, they said.—*Mark Hibbs, Bonn; Daniel Horner, Washington*

## U market ... *from page 2*

expires in 2016.

Constellation said it has commitments that will provide sufficient uranium for all its reactors "for the next several years."

### RBC analysts reduce forecasted spot price

Equity research analysts at RBC Capital Markets, in a report on the wider commodities market, lowered its spot uranium price forecast for 2009 to an average of \$50/lb, from \$60/lb previously. They said they took that action "to account for the weakness experienced in the market on a year-to-date basis."

"We had expected 2009 to be a stronger year for the [uranium] spot price, however, the continued influx of supplies and the apparent lack of both discretionary and non-discretionary demand has resulted in a fairly strong weakening of the spot price," RBC Capital Markets said in a March 5 research note.

"We remain bullish for the longer-term prospects for the uranium spot price, and we expect some improvement" in second-half 2009 as new demand comes to market, RBC analysts said.

The firm cited uranium as its "preferred commodity," because 2009 looks to be a difficult year for metals and bulk commodities in general. It said it expects other metals to fare poorly. "Significant sustained increases in commodity prices will likely not occur until excess inventory has been eliminated and idled capacity is restarted," the analysts said.

### Cameco preparing for move on distressed market?

Cameco could be gearing up to acquire assets in the current distressed market, after announcing March 5 that it had raised C\$459.9 million (US\$357 million) through a private shares offering to a group of underwriters led by BMO Capital Markets and RBC Capital Markets. Cameco said it intends to use the net proceeds of the offering to strengthen its capital position and "enhance its financial flexibility to allow it to take advantage of opportunities that may emerge from the current industry environment, and for general corporate purposes."

### Some see DOE as likely seller to SCE&G

Several analysts said South Carolina Electric & Gas may look to DOE to supply some — if not all — of the 1.2 million lb U3O8 equivalent the utility is seeking for an initial core of the first new reactor at its Summer nuclear power plant. The company is looking at building two Westinghouse AP1000s at the site.

DOE said in December that it was planning to offer ura-

nium for sale to US nuclear reactor operators for the initial cores of new nuclear units. DOE said its offer would begin in 2010, with an offering of up to 7,700 metric tons uranium of natural uranium (equivalent to 20 million lb U3O8).

A fuel buyer at another utility said that SCE&G might not get offers from sellers for the full initial core because they might believe that prices are too low right now.

Robert Yanity, spokesman at the Summer plant, said DOE uranium "certainly could be one of the options" for the new reactor's initial core. "We are turning over all the rocks as far as purchasing uranium goes," he said. "We are not precluding [DOE], but we are not going down any specific path at this time. We will keep our options open regarding the best entity to purchase the fuel from."—*Michael Knapik and Amena Saiyid, Washington; David Stellfox, Barcelona*

### Spent fuel cask developments

## SFST considering weld guidance

NRC's division of spent fuel storage and transportation, or SFST, plans to issue new guidance on welds and how they can be made in a manner acceptable to the agency. NRC staff told Holtec International in a February 19 teleconference that it "intends to draft a short guidance document" and will issue it either as interim staff guidance or a regulatory issue summary.

An NRC official said last week that the guidance will apply to all licensees. The issue was raised with Holtec first in the context of the Hi-Star 60 spent fuel transportation cask review because that cask is likely to receive the first new transportation certificate of compliance, or COC, that SFST will issue this year.

Some issues addressed in the guidance are expected to appear in a request for additional information, or RAI, that NRC plans to send to Holtec this week.

NRC staff initiated the teleconference "to advise Holtec that there are many unintentional welding conflicts throughout most package applications along with some general level of confusion on welding issues," the agency stated in a written summary of the meeting. The staff expects the guidance to provide "a path forward to avoid unnecessary RAIs" on such issues as non-code welds listed on licensing drawings and a "multiplicity of welding notes [that] makes it difficult to review" an application, according to the summary. The language NRC is proposing "would supercede any descriptions of welding in the application or the licensing drawings," it said.

Draft language that NRC discussed with Holtec is included in the summary, though staff said it would remain open to alternatives. The draft language would require that welding, examination, and repair of containment boundary and weld overlays of cask sealing surfaces be done in accordance with section III, division I, subsection NB of the American Society of Mechanical Engineers, or ASME, Code. Welding, examination and repair of fuel basket and basket shims

would be done in accordance with subsection NG, and work on welds on other cask components could be done in accordance with subsection NF, unless the COC or licensing drawings require otherwise. Any non-ASME Code welds should be identified on licensing drawings and should be done in accordance with American Welding Society codes, NRC said in the summary.

A summary of the meeting is on NRC's Adams database at accession number ML090550037.

## NRC issuing second RAI on Hi-Star 60

NRC is compiling a second request for additional information on Holtec's request to certify the Hi-Star 60 spent fuel transportation cask and expects to issue the RAI this week. An agency official said Holtec will be asked to respond to the 20 pages of questions within 30 days. If the cask vendor can meet that schedule and address all of NRC's concerns, NRC hopes to be able to issue a certificate of compliance, or COC, in April, the official said.

Holtec has a contract to supply four of the casks to the China Nuclear Energy Industry Corp., with delivery scheduled for June.

## Review scheduled for Hi-Star 180

NRC told Holtec last month that its January 17 application to certify the Hi-Star 180 spent fuel transportation cask system appears to contain the information NRC needs to begin its technical review. The agency set a target of June 2009 to issue a request for additional information, or RAI, if necessary, or to issue a draft certificate of compliance, or COC, and draft safety evaluation report, if no RAI is required. If there is an RAI, the draft licensing documents could be issued by mid-August, NRC said in a February 13 letter.

The parties met February 11 to discuss questions the staff raised in January on the application. NRC concerns were not resolved after two rounds of RAIs on an earlier submittal. Last month's meeting focused on burnup verification issues and the tests that Holtec performed on Metamic-HT to qualify that material to provide the system's structural support and neutron absorption.

Holtec is seeking actinide-only burnup credit for the Hi-Star 180's 37-assembly PWR basket without employing the burnup measurements NRC would require under its interim staff guidance. Those measurements are intended to guard against the misloading of a fresh or underburned assembly in the cask, which could represent an unanalyzed configuration. NRC staff asked Holtec in January to provide a full justification for depending on studies of misloading the system with a single fresh fuel assembly, rather than two or three, and for the number and combination of underburned assemblies chosen for the misloading analyses.

Rather than provide those justifications, which Holtec said would be difficult and time-consuming, Holtec proposed including additional administrative controls to prevent misloading, according to NRC's written summary of the meeting. The proposed controls include visual inspections of

the assemblies before loading, as they become discolored after insertion into the core; and accounting for all assemblies in the pool below a specified burnup before and after cask loading. Holtec argued those controls would ensure misloading of either fresh or underburned assemblies would be a "non-credible" event. With NRC approval of those two independent administrative barriers, Holtec would retain the misloading analyses as defense-in-depth.

NRC staff expressed some concerns regarding the reliability of reactor records and suggested additional considerations, but felt Holtec heard its message about the importance of documenting assumptions and providing additional details to eliminate staff questions, the summary said.

Separately, Holtec clarified in a February 17 teleconference that it knows of no US plant that would put spent mixed-oxide, or MOX, fuel into a Hi-Star 180 cask. Holtec agreed to NRC placing a condition in the Hi-Star 180 COC, saying it is not authorized for shipments of MOX fuel in the US. In addition to the 37-assembly PWR basket, Holtec is asking NRC to certify a 32-assembly MOX basket for transport of Swiss fuel.

Holtec has a contract to supply 14 Hi-Star 180 casks to Switzerland's Norostschweizerische Kraftwerke AG, or NOK, for the Benzau plant, which like other Swiss reactors would transport its spent fuel to the Zwiilag central interim storage facility. Holtec has asked NRC only to certify the system for transport. NOK is also licensing the system for storage with the Swiss regulatory authority. Holtec asked NRC staff for expedited review to prevent a disruption of NOK's fuel management plans

## NRC renews Hi-Star 100 COC

NRC's division of spent fuel storage and transportation, or SFST, renewed the certificate of compliance for Holtec's Hi-Star 100 spent fuel transportation cask February 13 for a new five-year license term. It was the second renewal for the cask, which NRC first certified in 1999. Only minor editorial changes were made. The new COC expires March 31, 2014.

## NRC issues Diablo Canyon RAIs

NRC's division of spent fuel storage and transportation, or SFST, sent a request for additional information to Pacific Gas & Electric February 13 on PG&E's request to amend the site-specific license for a spent fuel dry storage facility at Diablo Canyon. PG&E has asked for NRC to approve the amendment by May to support an initial cask loading campaign scheduled to begin June 1. NRC asked PG&E to respond to the RAI by March 9 to support that schedule.

The RAI asks 14 questions, including five each on the thermal and confinement analyses. NRC discussed the questions with PG&E in a February 19 teleconference.

PG&E filed its amendment request last April, seeking a number of changes to the license's technical specifications. Among those, PG&E would clarify helium leak testing requirements, eliminate limits on the time a cask could spend in the cask transfer facility, modify dissolved boron concentration requirements, allow use of Metamic as the neutron absorber, and clarify other requirements.

—Maureen Conley, Washington

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