NuclearFuel

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A U.S. INSPECTOR FAULTS IAEA ON SAFEGUARDS

prompting one critic to wonder whether U.S. workers at the agency know how the agency works

THE REACTION AND THE REPORT – page 8

OTHER HIGHLIGHTS

EEC UTILITY SEEN AS SOUTH AFRICA'S SUPPLIER

Amid speculation that South Africa obtained enriched uranium for Koeberg-1 from the USSR or China, U.S. and French government officials are certain it was obtained from a European utility, probably within the European Economic Community. "This was not something specially enriched for South Africa," a State Department source told NuclearFuel. "There was no new supply contract." The U.S. has refused permission for export of enriched uranium because of South Africa's refusal to place its enrichment plant under safeguards, although officials say progress is being made in that area. South Africa, meanwhile, has laid off a "small amount" of its enrichment obligation to DOE by selling to a Japanese utility.

HOUSE JOINS SENATE IN BUDGET CUT DOE SEES AS A THREAT TO KILL GCEP

Meeting Nov. 18 to iron out differences between House and Senate versions of the FY-82 energy and water development appropriations bill, House conferees agreed to a reduction of $86-million in DOE's enrichment program. That's just $4-million less than the Senate wanted to cut and enough of a cut, according to DOE, to kill the agency's gas centrifuge enrichment plant.

DOE officials had said that $70-million of the $90-million reduction passed by the Senate would have to come out of GCEP. It would push FY-82 funds for the project down to $530-million, DOE said, causing another year's delay which might drive key contractors away from the project. To make the cut more palatable to GCEP backers, the conferees instructed DOE to make sure the general reduction is prudently allocated so there is minimal impact on production schedules. Said a DOE source: "Isn't that a great directive – take a cut but don't let it have any impact."

DOE AGREES TO RETHINK ITS PROPOSED FEE FOR EXPORT OF GAS CENTRIFUGE TECHNOLOGY

DOE officials are telling about 15 U.S. companies involved in construction of the Portsmouth, Ohio gas centrifuge enrichment plant (GCEP) the ground rules for preparing proposals to Australian companies considering building a 1-million swu/year enrichment plant in Australia. Most important, the companies are told, is that they may not transfer any classified technology until the U.S. negotiates an amended agreement for cooperation with Australia.

DOE tentatively proposes to assess a licensing fee to reimburse the federal government for development of the centrifuge technology. The fee would add about 5% to the costs of building

the Australian plant, DOE sources say. The companies have asked DOE to reconsider. DOE, which does not want to render any U.S. proposal noncompetitive, agreed to consider alternative approaches to obtaining compensation for its advancement of the technology.

Competition to provide Australia with enrichment technology heated up in 1979, when Australia asked a number of foreign governments if they were willing to participate with a private Australian group in a multinational enrichment venture. Late that year, the Australian government encouraged the development of the Uranium Enrichment Group of Australia (Uega), a consortium of the Western Mining Corp., Peko Wallsend Ltd., the Broken Hill Pty. Ltd. and CSR Ltd. Uega undertook a prefeasibility study, to which the U.S. contributed unclassified information, and concluded early this year that indeed, enrichment is a desirable commercial development. It then announced its intention to do a two-year feasibility study.

At the end of 1981, Uega said that it would like to choose between centrifuge and chemical exchange technologies. Sources now say that selection is likely to come in mid-1982. According to other sources, however, the feasibility study will last through 1983.

Knowledgeable sources say that gas centrifuge is Uega's preferred technology so the U.S. companies' main competition is from Urenco, which has had a proposal before Uega for at least a year. If Urenco were chosen, then the 1971 Treaty of Almelo between the governments of the Netherlands, the U.K. and West Germany would have to be amended to include Australia, sources say.

The lead for developing proposals rests with the three centrifuge manufacturers – Goodyear Aerospace, Boeing, and Garrett AiResearch, sources say. For the moment at least, those three companies are expected to submit separate proposals. A source at one of the companies, though, says cooperation among the manufacturers might improve the chances of U.S. technology being selected. "The Australians are not interested in seeing a bunch of carpetbaggers," he says. He adds, though, that such collaboration, when the companies are competing for future work at GCEP, could pose serious antitrust problems. And he says it is likely the Justice Department will be asked for an opinion in the near future.

In addition to the three centrifuge manufacturers, it would be necessary to form a loose consortium with architect, engineering and construction companies to share the risk of the Australian venture. Sources familiar with Uega's plans say the group is looking to the technology supplier to have an equity in the plant. In addition, the sources say, Uega is looking for a third partner – probably a potential customer like Japan – who would also have an interest in the facility.

– Michael Knapik, Washington

REAGAN WANTS REPORT BY YEAR'S END ON PROSPECTS FOR PRIVATE ENRICHMENT

President Ronald Reagan has ordered an interagency review, to be completed by the end of this year, of prospects of turning over some or all of DOE's uranium enrichment enterprise to the private sector, and of impacts such a move might have on U.S. defense, nonproliferation, and other foreign policy interests.

"It would have been inconsistent of us if we didn't look at greater private sector involvement in the U.S. enrichment enterprise at the same time we're allowing private U.S. companies to bid on becoming a partner in an Australian enrichment enterprise," said a White House source.

A DOE source said the review will incorporate ongoing work that had been done over the summer in response to requests for a look at privatization by the Office of Management & Budget and the Office of Science & Technology Policy. He said DOE efforts to date have raised many of the same questions that occurred during two previous attempts – in the late 1960s and the mid 1970s – to turn over some or all of uranium enrichment capacity to the private sector. Some of those questions, this source said, are:

– Will the government sell its existing plants to a private group or just allow a private group to build any new capacity needed to service world enrichment markets?

– If private firms build only new capacity, how will they and DOE compete in the enrichment market?

– How will U.S. defense needs for enriched uranium be met?

– And what types of financial guarantees will private enrichers require from the federal government before they are willing to construct a new plant or take over existing ones?

"In other words," the source said, "there were a whole host of problems in the past which are only compounded by the decline in enrichment demand in recent years." It is unlikely that private U.S. companies pushed for this review, he said. "What's driving this is the consistent Republican Party philosophy that private enrichment is the ideal way to go."

INDUSTRY WATCHERS GROPE FOR UNDERSTANDING OF COGEMA'S PLAN TO PURCHASE PATHFINDER

Cogema's purchase of 80% of Pathfinder Mines took the U.S. uranium industry by surprise, and left many uranium men perplexed. Some said the purchase made sense, while others questioned what the French company would do with more uranium.

Cogema, a wholly owned subsidiary of the French Atomic Energy Commission, said it would not be making major managerial or operational changes after negotiations are completed. Existing contracts also are not expected to be affected. Neither Cogema nor Utah International, parent to Pathfinder, would disclose the purchase price, although a French newspaper said it was $200-million, a price sources described as reasonable. Negotiations are expected to be completed by the end of the year.

Pathfinder currently operates three uranium surface mines and two mills in Wyoming, although its work force has dwindled from a peak of about 1,600 employees in 1980 to about 775. Its reserves are estimated at 30,000 tonnes U3O8.

The company's 2,800-ton/day mill in the Gas Hills mining district near Riverton is fed from the Lucky Mc mine nearby and from the Big Eagle mine near Jeffrey City. The Shirley Basin mine/mill complex, south of Casper, is licensed to operate at 1,800 tons/day.

While the French are believed by some to be following a route similar to the one they have taken with coal, by buy-

ing up inventory and property when prices are low, one source said that route doesn't necessarily make sense, as far as uranium is concerned. "I am surprised to see Pathfinder withdrawing and Cogema taking over. If it does not make sense for Pathfinder or Utah, why does it for the French?"

U.S. coal reserves are "very huge and cheap to mine," he said, but uranium reserves are higher cost than anywhere in the world. "I guess the French are looking more at the future of the industry. It means Cogema is betting more on the future of uranium and the nuclear industry than GE (General Electric), which makes sense." GE is parent to Utah International, but all of Pathfinder's common stock is deposited in a separate voting trust as part of an agreement between GE and the U.S. Department of Justice at the time GE bought Utah in 1976.

Another source, knowledgeable of the industry, said, "I have no idea what the French are up to," but he speculated it might be for "insurance." They could buy into the spot market to fulfill existing contracts and save Pathfinder uranium for the French program "for another day," he said.

News of the purchase delighted some Pathfinder employees and the local industry in Wyoming. "The French nuclear program is in as good a shape or better than in most other countries and certainly better than in the U.S.," said one source. "Pathfinder will feel more secure about the future," he predicted, because the future "looks a little more certain."

GAC WINS $4.2-MILLION FOR TWO UTILITIES IN URANIUM SETTLEMENT WITH RESERVE OIL

Gulf States Utilities and Philadelphia Electric will split $4.2-million in lieu of 1.6-million pounds of uranium as a result of a settlement between General Atomic Co. (GAC) and the Reserve Oil & Minerals Corp. and Standard Oil Co. (Ohio). The settlement cancels a 1973 contract under which Reserve and Sohio were to deliver 5.5-million pounds of uranium to GAC from their jointly owned L-Bar operation in New Mexico.

Under contracts with GAC, Philadelphia was owed 1-million pounds of uranium and Gulf States 600,000 pounds. But "there were different time frames for delivery and different price mechanisms so that each utility was prepared to settle for the same amount of money," a lawyer for Gulf Oil Corp. said. Gulf is a partner in GAC with Scallop Nuclear Inc. The lawyer said the settlement removed any obligation by Reserve and Sohio to deliver uranium to GAC, and at the same time obligated them to pay cash to satisfy GAC's obligation to the utilities.

THE U.S. SUPREME COURT TURNED DOWN AN APPEAL by the Consolidated Rail Corp. and other railroads of a ruling that railroads may not charge higher rates to haul spent nuclear fuel. That appeals court decision earlier this year (NF, 16 March, 13) affirmed a ruling of the Interstate Commerce Commission that special train service was an unnecessary safety measure, and that, therefore, charging higher rates for such service was unreasonable.

NRC TAKES CONTROL OVER URANIUM MILLS FROM FOUR STATES, PENDING FACTS REVISION

NRC took legal control of mill tailings regulating in four agreement states this month, and although it looks as if Washington, Colorado and Texas are in position to regain their authority within the next few months, New Mexico apparently is not nearly so close and the situation in that biggest of all the uranium-producing states could become complicated as company licenses come up for renewal.

NRC issued uranium mill operators in the four states a general license Nov. 10 to save them from being without any license to possess mill tailings and thus in violation of the Atomic Energy Act. NRC says the failure of the agreement

states to execute amended licensing agreements by the Nov. 8 deadline set by the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) automatically ended the states' regulatory authority.

In the Federal Register notice announcing the general license, NRC says the license is conditioned on the operators complying with all conditions in the agreement state licenses they held before Nov. 8, which regulated the management and disposal of mill tailings. It "continues the status quo and imposes no added burden on agreement state licensees."

NRC also says the general license will terminate when NRC and a state enter into an amended agreement.

NRC says it expects to enter into such an agreement with Washington by the end of November, with Colorado sometime in December, and with Texas in early 1982. "Since complete amendment documentation has not yet been received from New Mexico, it is not possible to forecast when an amendment can be executed," NRC says.

Robert L. Fonner, an NRC attorney, told NuclearFuel that "as long as New Mexico is proceeding in good faith to develop a program, the commission will not terminate (the general license)." No date was given for final compliance with the terms set down by NRC.

The commission notes that the general license "is a temp orary measure to fill a legal void and not a validation of state programs for mill tailings or rejection of existing state programs."

According to Al Topp, chief of the radiation protection bureau for New Mexico's Environmental Improvement Division, "There's lots of work back and forth with our staff before New Mexico is ready to submit a final proposal." Topp went on to say that he felt NRC exercised its authority in "the mildest possible way" by issuing the general license.

According to an NRC lawyer, the agency's action in making its general license effective immediately on issuance has drawn criticism from at least one industry lawyer who maintained that the commission could not assert authority over mill tailings in agreement states without first granting the state a hearing. The NRC attorney called this theory "flat-out wrong."

Paul Robinson, director of the Southwest Research & Information Center (SRIC), an Albuquerque-based environmental group, charged that by making the general license effective immediately – instead of providing a notice period and opportunity to seek a public hearing – NRC was "precluding public participation" in its decision. Robinson added, however, that SRIC does not plan to challenge the legality of that action. He said that "the real test" of New Mexico's amended regulations will occur when Sohio's L-Bar uranium mill and United Nuclear's Church Rock mill come up for license renewal early next year.

UNC RESOURCES AND FARRIS MINES INC. DROPPED DAMAGE SUITS against each other last month after UNC agreed to pay Farris "a small cash settlement," a UNC spokesman says. Farris had sued UNC in a federal court in New Mexico asking for $15.5-million in damages and alleging that UNC broke an oral contract under which Farris was employed to strip overburden from UNC's St. Anthony uranium mine. UNC in turn sued Farris for $2.5-million for failing to fulfill certain obligations.

EPA IN SITU MINING AMENDMENTS GET WARM RESPONSE IN DENVER

Changes proposed by the Environmental Protection Agency in underground injection control regulations, especially affecting in situ mining, were strongly endorsed by industry groups at an EPA hearing in Denver Nov. 5. Standing alone in opposition to the changes was the Colorado League of Women Voters which said the amendments would weaken controls over uranium solution mining as well as in situ recovery of oil shale, tar sands, lignite and coal.

The proposed amendments were described by EPA as an effort "to increase the flexibility of state programs, reduce paperwork and reporting burdens and solve some problems which would have made compliance difficult for specific industries." They also will help settle out of court a 1980 challenge by mining and oil companies.

"It has been called to the agency's attention," EPA geologist Francoise Brasier said, "that requiring no movement of containments after closure may not be technically or economically feasible to achieve in at least some abandoned mining well sites. It may be extremely difficult to remove all residues of the mining activity from the mine site. For example, ammonia in the case of a uranium mining operation using ammonia in the lixiviant. As the natural flow of the aquifer is re-established after abandonment, such residues may be carried into protected portions of the aquifer. The original regulations required the permittee to demonstrate that no movement of containments from the mined zone into an underground source of drinking water would occur. Under the change the permitting authority could prescribe whatever aquifer cleanup and monitoring are necessary for an adequate level of protection for the underground source of drinking water."

EPA estimates that its revisions of its regulations under the Safe Drinking Water Act will result in savings of $70-million over the next five years for owners and operators of injection wells. The agency said the changes would save the states about $1.4-million in the same period by reducing their work load.

EXXON PROSPECTING PLAN CALLED 'OBNOXIOUS'

Plans by Exxon Minerals to prospect for uranium in a Utah wilderness-study area are being opposed by the Wilderness Society, which calls the proposal "rather obnoxious."

The Bureau of Land Management district office in Cedar City says it expects to rule Dec. 14 on Exxon's application to drill eight holes on about 20 acres and to build 5.1 miles of road to reach the drilling sites. Meanwhile, Gulf Minerals Resources, which also had applied for exploration rights on 21 acres in the same section of the Fifty Mile Mountain Wilderness Study Area, has withdrawn its application. A spokesman says the withdrawal was not because of opposition by the Wilderness Society but stemmed from the company's decision last month to curtail uranium exploration because of depressed market conditions.

BLM's environmental assessment of the two proposed exploration projects near Escalante, Utah, says that less than 0.1% of the wilderness study area, about 100,000 acres, would

be affected by the exploration. BLM said the Exxon project's impact would be "substantially unnoticeable" once the company completes reclamation work, including filling mud pits, planting grasses and shrubs.

The Wilderness Society is unmoved, however, and a spokesman says there is "a high likelihood" that the society will appeal either through administrative channels or in federal court if Exxon's application is approved. The Federal Land Policy Management Act, that spokesman says, requires operators to prove that the impact of exploration or development will not impair the character of that area for wilderness consideration. "The environmental assessment points out rather directly there will be impairment in the area," he says.

NRC USURPING EPA TAILINGS RESPONSIBILITIES AND DOING A BAD JOB OF IT, INDUSTRY ARGUES

The Environmental Protection Agency, not NRC, was authorized by Congress to promulgate regulations under the Uranium Mill Tailings Radiation Control Act of 1978, industry lawyers argued last Tuesday (Nov. 17).

Counsel for the American Mining Congress (AMC) and five uranium producers told the U.S. 10th Circuit Court of Appeals in Denver that "NRC is unlawfully doing what EPA was authorized to do." The attorneys presented oral arguments before a three-judge panel hearing the industry challenge to NRC's mill tailings regulations. The action was consolidated into one case after three separate suits were filed against NRC by Kerr-McGee Nuclear, United Nuclear, Western Nuclear, Energy Fuels Nuclear, Phillips Uranium and the AMC. The National Wildlife Federation and other environmental groups have entered the litigation as friends of the court.

"NRC unlawfully rushed into a void when EPA failed to meet its obligations," said Peter Nickles, representing Kerr-McGee, United Nuclear and Western Nuclear. "This is an attempt by NRC to push everyone out of the way – the EPA and the states," Nickles said. "NRC is saying, 'Look, we have the authority to protect public health and safety.' We prefer EPA."

"We take the position," Nickles responded to Judge William Doyle's question of why the companies prefer NRC, "that EPA is more sensitive to cost-benefit analysis. The EPA has more expertise in assessing risks and costs. NRC should implement and enforce."

Nickles told the court NRC had based the regulations "on assumptions" and "has been hypothesizing risks." He asserted, "We cannot have a zero risk condition. Otherwise the industry is dead." Nickles said implementation of present NRC regulations would cost uranium producers "hundreds of millions, more than $1-billion."

Another industry lawyer, Anthony Thompson, argued that NRC "did not make a determination of significant risk. Instead it substituted assumptions and regulated down to zero risk. The absence of a determination of significant risk invalidates these regulations."

Thompson, representing the AMC, Phillips Uranium and Energy Fuels Nuclear, was particularly critical of what he called "the inflexible standards for radon emissions and tailings cover." NRC requires tailings piles to be stabilized to prevent radon emanation of no more than two picocuries per square meter per second and the tailings to be covered by at least three meters of earth. Thompson contended NRC had based its risk assessment on statistics of radiation exposure for the entire U.S. population. "The NRC cannot accurately estimate the risk of nearby population (to tailings) let alone continental population," Thompson said. "This de facto risk assessment is totally ineffective."

Sheldon Trubatch, a Department of Justice lawyer representing the NRC, said the Mill Tailings Control Act "provides the NRC with specific authority to promulgate regulations to protect health and safety." He said the purpose of the act is to eliminate the radon hazard from tailings piles and that NRC regulations will achieve that.

Trubatch said that "NRC believes the costs (of compliance) are reasonable. The commission believes the most reasonable way to prevent radon from being blown around is to keep the tailings in place." – *Frank Pitman, Denver*

SENATORS PLAN ANOTHER EFFORT TO GET SOMEONE TO CLEAN UP EDGEMONT

Language giving DOE clear authority to clean up mill tailings at Edgemont, S.D. will be added to NRC's FY-82 authorization bill when that bill reaches the Senate floor, according to congressional sources. Although the House version of the bill is silent on the issue, the House is expected to accept the Senate amendment, the sources say.

The tailings, contaminating more than 60 structures in the town, came from a uranium mill owned by the Tennessee Valley Authority. TVA purchased the mill in 1974 from the Susquehanna Corp. but decided in 1978 putting it back into service would not be economically feasible. Because it also picked up a mill license in the deal, TVA could not get its property added to the list of those to be decontaminated by DOE. That left no one responsible for decontaminating off-site structures.

NRC officials believe off-site cleanup should have a high priority, but who should do it has been in doubt for over a year (NF, 18 Aug., 4). To date, NRC has been directing sampling and engineering assessments of the properties under authority of its FY-80 supplemental appropriations act. Although NRC officials assumed they would also direct the cleanup, NRC lawyers said the agency lacked authority and precluded any action.

Next the House Appropriations Committee, in its report on an FY-81 supplemental appropriations bill, directed DOE to do the cleanup (NF, 11 May, 4). Following passage of the bill, however, DOE lawyers raised a red flag, saying that the report language by itself was not sufficient to confer authority.

Although sampling and detailed engineering assessments of homes and vacant lots will not be completed until the fall of 1982, NRC officials now estimate that about 63 properties will require remedial action at a cost of about $11,000 for each property. NRC and DOE officials say, though, that they expect those estimates to be lowered after the Environmental Protection Agency revises its cleanup criteria. NRC at Edgemont and DOE in its remedial action program have been evaluating properties based on interim criteria published in April 1980. EPA is reassessing those criteria and is expected to relax them so that less remedial action will be needed (NF, 12 Oct., 1).

NUCLEAR FUEL EXPORT LICENSE ACTIONS PENDING BEFORE U.S. NRC

This is NuclearFuel's tabulation of nuclear fuel export licensing actions pending before NRC. The intent is to provide quick reference for those interested in tracing the progress of particular licenses through the approval process. For this purpose, we have retained for today's listing those applications previously listed for which licenses have been issued. (The most recent tabulation was in the NuclearFuel issue of Oct. 26, pages 6-7.)

The table is arranged alphabetically by country of export destination; it includes NRC's license application number and the date on which NRC logged receipt of the application, as well as time elapsed (to the nearest month) since that receipt; it lists either the reactor for which the uranium will be used as fuel or the purpose (e.g., fabrication) for which an export license is sought; and it gives the status of the application (as of our press time), together with the date on which that status was attained. Unless otherwise noted, the quantities are given in kilograms of uranium as UF6, and enrichment percentage is noted.

Status of applications being considered by the State Department is reported to Congress periodically as required by the Nuclear Nonproliferation Act. State explains that the exports to South Africa are delayed "pending the outcome of certain ongoing discussions with the South African government."

Exxon Nuclear has requested an export license for 2,275 kg of uranium enriched to 3.3%; the material will be used in the first Electricite de France reactor that becomes available as part of EDF's effort to diversify fuel fabricators (NF, 9 Nov., 2).

Transnuclear's request to export 23.285 kg of uranium enriched to 93.3% for use in the Saphir research reactor in Switzerland has been amended because of the Swiss program to reduce the enrichment of Saphir fuel. Transnuclear is now requesting 15.208 kg of 93.3% enriched uranium and 21.213 kg of uranium enriched to 45.4%.

Destination: reactor or purpose	Quantity (kg U as UF6 unless otherwise stated)	U-235 (percent)	Applicant	License number and date application received	Elapsed time to date (months)	Status (see key) and date
ARGENTINA						
RA-3	12.03	90.4	Edlow Intl	XSNM-1496(4/12/79)	31	C – 4/13/79
RA-6	50.13	19.9	Edlow Intl	XSNM-1587(9/7/79)	27	C – 9/24/79
BANGLADESH						
Triga Mark II	55.4	19.9	General Atomic	XSNM-1669(3/28/80)	20	C – 4/2/80
BRAZIL						
Angra-1	1,726	3.45	Westinghouse	XSNM-909(8/24/79)	27	C – 9/6/79
Angra-1	16,242	3.35	Transnuclear	XSNM-1629(12/3/79)	24	C – 12/10/79
FRANCE						
Orphee	15	93.3	Transnuclear	XSNM-1543(7/17/79)	28	F – 10/23/81
Rapsodie	60	93.3	Transnuclear	XSNM-1544(7/17/79)	28	C – 12/10/79
Siloe	26	93.3	Transnuclear	XSNM-1545(7/17/79)	28	F – 10/23/81
EDF	2,275	4.05	Exxon Nuclear	XSNM-1882(10/5/81)	New	C – 10/6/81
GREECE						
GRR-1	7.018	93.3	Euratom	XSNM-1848(7/6/81)	5	C – 7/7/81
INDIA						
Tarapur	19,858	2.71	Edlow Intl	XSNM-1740(9/25/80)	14	C – 10/14/80
Tarapur	19,858.8	2.71	Edlow Intl	XSNM-1872(9/8/81)	3	C – 9/10/81
INDONESIA						
Janus-3	54.135	19.95	Transnuclear	XSNM-1855 (7/21/81)	4	C – 7/22/81
JAPAN						
~~KUHFR~~	~~42.11~~	~~93.3~~	~~Nissho-Iwai America~~	~~XSNM-1271(5/13/80)~~		License issued
~~Shimane-1~~	~~3,723~~	~~2.92~~	~~Marubeni America~~	~~XSNM-1868(8/6/81)~~		License issued
MEXICO						
Laguna Verde-3, -4	620,000	4.0	General Electric	XSNM-1814(5/8/81)	7	C – 5/14/81
NETHERLANDS						
HFR (Petten)	38.095	93.3	Transnuclear	XSNM-1824(5/21/81)	6	C – 6/1/81
PERU						
RP-O	31.45	19.9	Edlow Intl	XSNM-1588(9/7/79)	27	C – 9/20/79
RUMANIA						
Triga	37.2	19.77	DOE	XSNM-1749(10/7/80)	14	C – 10/10/80

Key to Status of Application

A – application is incomplete, awaiting reply to NRC request for more information.
B – being prepared by NRC for transmittal to State Department.
C – sent to the executive branch agencies.
D – letter returned from State Department, being prepared for NRC commission review.
D* – letter returned from State Department, routine reload, in process of being issued.
E – letter returned from executive branch, in process of being issued.
E* – letter returned from DOE, routine reload, in process of being issued.
F – under review by commission.
G – special case requiring further review by NRC staff or executive branch.
H – generic approval.
I – case returned from State Department without action.
J – amendment only, executive branch review not required, in process of being issued.

Destination: reactor or purpose	Quantity (kg U as UF6 unless otherwise stated)	U-235 (percent)	Applicant	License number and date application received	Elapsed time to date (months)	Status (see key) and date
SOUTH AFRICA						
Safari-1	26	93.3	U.S. Nuclear	XSNM-690(4/4/75)	80	C – 5/14/75
Koeberg-2	75,431	3.15	Transnuclear	XSNM-1552(8/1/79)	28	C – 8/10/79
Koeberg-1	75,431	3.15	Transnuclear	XSNM-1553(8/1/79)	28	C – 8/10/79
SPAIN						
Sayago	88,636	3.25	Westinghouse	XSNM-1169(7/19/77)	52	G – 5/22/80
Vandellos-2	73,173	3.15	Westinghouse	XSNM-1185(8/12/77)	51	G – 5/22/80
Lemoniz-1, -2	2,774	3.2	Westinghouse	XSNM-861(11/8/77)	49	G – 5/22/80
Asco-2	2,774	3.2	Westinghouse	XSNM-865(9/10/79)	26	G – 5/22/80
Asco-1	2,774	3.2	Westinghouse	XSNM-866(9/10/79)	26	C – 9/24/79
Cofrentes	115,000	3.7	General Electric	XSNM-1630(12/3/79)	24	C – 12/10/79
Valdecaballeros-1, -2	239,500	3.9	General Electric	XSNM-1644(1/14/80)	22	C – 1/23/80
SWEDEN						
Oskarshamn-2	102,000	4.05	Edlow Intl	XSNM-1886(11/9/81)	New	C – 11/12/81
Barsebaeck-1	84,000	4.05	Edlow Intl	XSNM-1887(11/9/81)	New	C – 11/12/81
Barsebaeck-2	96,000	4.05	Edlow Intl	XSNM-1888(11/9/81)	New	C – 11/12/81
Forsmark-1	1,230	4.05	Edlow Intl	XSNM-1403(11/6/81)	New	C – 11/12/81
Forsmark-2	34,135	4.05	Edlow Intl	XSNM-1752(11/6/81)	New	C – 11/12/81
SWITZERLAND						
Saphir	21.213	45	Transnuclear	XSNM-1840(6/18/81)	5	C – 6/23/81
Saphir	15.208	93	Transnuclear	XSNM-1840(6/18/81)	5	C – 6/23/81
WEST GERMANY						
GETR	55	93.3	General Electric	XSNM-1204(9/27/77)	50	C – 10/3/77
THTR-300	103.26	93.3	Transnuclear	XSNM-1685(5/19/80)	18	C – 5/23/80
FRM	7.994	93.3	Transnuclear	XSNM-1821(5/21/81)	6	C – 6/3/81

BRAZIL MOVES FORWARD TOWARD UF6 PLANT

Uranium Pechiney Ugine Kuhlmann (UPK) officials said the Nuclebras UF-6 conversion plant, to be built with UPK technical assistance, is now scheduled to be on line in 1985.

In recent interviews with NuclearFuel, company sources said training of Brazilian engineers in France began this year as did work on a conceptual design for the plant. UPK's agreement with Nuclebras dates back to 1978, but execution was held up while a safeguards agreement between France and Brazil could be reached. UPK and Nuclebras also had protracted negotiations on the terms of the technology transfer.

Under the agreement reached, UPK will play a role of manager-consultant in the project. The French company is providing training, design engineering, the Comurhex conversion license and conversion services to meet Brazilian needs before the plant is put on line. Nuclebras will manage the civil engineering and procurement. Neither the cost nor capacity of the plant have been set yet, according to UPK, but the cost of a typical conversion plant is about 250-million French francs ($44.8-million at current exchange rates).

The plant will be situated in Resende, the chosen location for an ensemble of fuel cycle installations – the others being planned under the umbrella accord for nuclear power development with West Germany. UPK officials said that accord does not prevent the Brazilians from doing some business elsewhere. "It is not a question of Franco-German competi-

tion," said a UPK official, noting that 25-30% of the world's conversion capacity is based on the Comurhex process. Moreover, the West Germans were not offering a conversion technology.

Construction of the facility is scheduled to begin in early 1983.

LATEST CRITIQUE OF IAEA SAFEGUARDS IS SEEN CAUSING A STIR BUT FALLING SHY OF ITS MARK

A report some sources say will damage the IAEA and safeguards would have the opposite effect if Sen. John Glenn (D-Ohio) has his way. The report, prepared at the request of NRC Commissioner Victor Gilinsky by a former IAEA safeguards inspector, describes technical difficulties of safeguarding nuclear facilities under the agency's aegis.

"We've long known that the IAEA is the only thin line of protection we have against diversion," Glenn said. He said he has "consistently advocated more support for safeguards" both in terms of numbers of inspections and in terms of research toward better monitoring methods, and "the report clearly points out the need for both."

Glenn, a Senate leader on nonproliferation issues, said he is "disappointed" that following a Senate resolution in July calling on the Reagan Administration to engage in discussions with leaders of other countries about improving safeguards, he had received "no substantive response" from the President that such discussions had taken place.

A former U.S. official with a long background in nonproliferation issues called the report "pretty weak," and "nothing really different than the rumblings of people for years." He said the report failed to explain why certain problems were necessarily problems, in some cases, and in others, why those problems couldn't be solved. The paper's biggest shortcoming, however, was its limited scope since its focus was essentially on technical rather than political problems of safeguards, he said. "All this fellow does is point to fly droppings on the window. He doesn't say there are so many on there you can't see out. He doesn't come close to that."

That source, however, also criticized the U.S. for being "a bit blind" for viewing U.S. inspectors as "international servants who owe allegiance to an international entity rather than to the U.S." Other inspectors "know why they're there," he said. To the extent the U.S. "finds out disturbing things about nuclear programs, it comes through our own intelligence network" and "our people in Washington should be feeding information back" through appropriate channels to U.S. inspectors. While this may occur to some extent, "we go to greater lengths to observe this notion these people (inspectors) are autonomous."

Inspectors for their part should seek to determine "how far the system will let you push it. That information is invaluable." At the same time, he added, they should keep that type of information "from getting broadcast" if they feel it's important to end the type of harrassment described in the report.

A congressional source predicted the paper would raise "all over again" the debate on U.S. nonproliferation policy, particularly with respect to NRC's role. "There is nothing in here that is a surprise to me," said the source. "What's different is some of the details." He predicted it would have a "ripple effect because it's going to raise the whole issue of what NRC should do in terms of safeguards." In other words, "should NRC act as a rubberstamp to executive branch agencies on export licenses or independently assess each case?" Another source predicted that critics of nuclear power "are going to try to publicize it (the report) as much as they can," and he said it could raise the question of whether "the agency is worth anything at all."

IAEA safeguards is just part of the nonproliferation picture, said the U.S. State Department. However, "the U.S. has been engaged in extensive efforts to improve the technical, legal and conceptual aspects of the safeguards regime to keep it abreast of changing conditions and technology. Important progress has been made and those efforts are continuing."

Also, said State, the U.S. "continues to regard the international safeguards system of the IAEA as playing an essential role in our effort to prevent the further spread of nuclear weapons." At the same time "it is important to note" that other elements of the policy include "addressing the security concerns that might motivate some nations to seek a nuclear explosives option; working with other nuclear suppliers to inhibit export of sensitive nuclear materials and technology, especially to volatile areas; and increasing U.S. participation, and thus influence, in nuclear affairs by re-establishing a leadership role for the U.S. in nuclear commerce."

Apart from that official statement, State Dept. sources expressed shock and concern over public disclosure of the report, but said they expected to "weather" the storm.

"That sort of thing doesn't help the agency, the government or the cause of safeguards because it causes people to spend a lot of time arguing about how the report got out and how good it is when they ought to be spending energy getting safeguards improved," said one official. "If one is really interested in improving safeguards I don't see that as the best approach."

Said another: "If we start compiling all of the stories that come out of the IAEA from former staff members and particularly safeguards staff members, this is going to have a very damaging effect in the long run on the IAEA." He predicted that while "we'll have some rough sledding" as a result of the report's release "we'll weather the storm because people will realize that while IAEA is not perfect it's the only thing going so we should work to strengthen it, not weaken it."

While one State Dept. official called the report "overstated and unfair," a former department official said its author, Emanuel Morgan, hadn't "even taken his shirt off." In that respect, the report's summary is perhaps "appropriate," because "it says there are problems, we need to work on them and there are no simple solutions," he said.

The paper is "typical of the attitude most American types come away (from IAEA) with. They're disgruntled. They feel they're not truly appreciated." But the report fails to "go to the heart of the system," he said, by stressing only technical difficulties that on the face of it appear resolvable.

For example, in the section on fuel fabrication, conversion and unirradiated scrap recovery facilities, the author describes difficulties encountered in obtaining material samples and cites an instance when an operator wanted $1000 per sample from the agency. "What he's saying is we had this rule or framework of modus operandi and this country was giving us a hard time. . . . I don't see where this big problem presents

you with an indication that the system doesn't work. He is saying there is trouble getting people to do what you would like but that's been true since the beginning."

That difficulty, he added, does not necessarily stem from an operator's intent to "cheat." Some inspectors "don't know what they're doing." Operators resent the interference and "fear that some of these people would be smart enough or dumb enough to talk about what (technology) they've seen." Also the "ground rules" on inspections are continually changing, he said.

In the section on the difficulties in getting design information "he implies if we aren't able to check out design, there's no other way of determining there are no back doors. But he doesn't say that, and that's one of the big debates over there." Morgan doesn't say that without such information the situation is "hopeless," the source said. "He gives you 'for instances' but doesn't bring out that the item he was complaining about went to the heart of the system such that you couldn't tolerate any deviations."

The "undue emphasis on numbers and the technological means of making the system work" is a problem with the agency as a whole, he said. When the system was established in the early 1960s the agency "wanted to mechanize things. . . . They wanted an agreed-upon roadmap. They wanted to draw up a list of what it was responsible for doing and that they could get high marks on. They wanted to depoliticize the operation."

The thinking of some U.S. officials at the time was that inspectors "were not just supposed to be bookkeepers. They were supposed to do more than say whether the books were balanced. . . . When we shifted over to the international system we sacrificed an awful lot because we no longer relied on the people element. You took your chance on whatever type of personnel other countries served up for inspectors."

Nevertheless, he said, at the time the French and Canadians, in particular, were "undercutting the market by offering safeguards deals that were better than what the U.S. offered," so "unless you got some international action going you didn't really have a floor on things. What the IAEA did for us is at least head off the Canadians from using deals on safeguards in order to sell their reactors."

At the same time, though, "there were some people enamored with the international world . . . who blinded themselves into thinking they'll work things out and, as a consequence, tended to suppress criticism. As a result, I never expect much from reports like these. They never get to the real issues.

"The fact that agency inspectors get a hard time when they get out is to be anticipated," he said. The question is "how you can get back to a regime that gives you pretty much the same confidence as if you had your own people running it on a bilateral basis. Very simply, one could do something like that by running a two-track system. That way you'd have both your floor and your ceiling."

Other than that, inspectors should be encouraged to look for "fishy signs" – like determining how dependent a power grid is on a particular facility, or whether that facility is linked to a grid at all. Also, he said, inspectors should look at how long material is being stored, where various facilities are located and, generally, "how does the traffic move." Emphasis should be on "what situations deserve more analysis."

That type of "sleuthing" is near an impossibility, according to a U.S. official who works on safeguards. The system provides only for containment and surveillance measures and nuclear materials accounting. "It does not provide for sleuthing. The difficulty is that the technical approach is the only way allowed," he said.

An NRC staff review of the paper also concluded that as long as safeguards approaches for particular type facilities continue to develop in the direction of more equipment and more detailed information, while many states continue to take a very narrow legalistic view of the rights accorded the IAEA in safeguards agreements and facility attachments, old agreements will constrain the application of safeguards and sometimes render safeguards ineffective.

Morgan, a domestic safeguards inspector before his tour as an IAEA inspector from May 1977 to August 1980, left NRC this summer to start a business. Reached at his home, he told NuclearFuel that he would "have to see how the thing develops" before deciding whether he would comment on the report. At present, he said "I don't think it would be in my interest to comment on it in spite of the fact that it has been received by various people and there may be controversy." Gilinsky would not comment on the report. – *Stephanie Cooke*

REPORT ON THE IMPLEMENTATION OF IAEA SAFEGUARDS

The following is a report to NRC Commissioner Victor Gilinsky by former IAEA inspector Emanuel Morgan.

INTRODUCTION

The purpose of this report is to provide an inspector's insight into IAEA safeguards, based upon seven years as a domestic safeguards inspector with the U.S. Atomic Energy Commission's Division of Nuclear Materials Safeguards and the successors of that organization in the AEC and NRC, three years as an international safeguards inspector with the IAEA, and, in addition, several years as an NRC headquarters staff member.

The concept has been advanced at high levels that a country's signature of the NPT [Nuclear Nonproliferation Treaty] is the principle [sic] aim of IAEA safeguards. This report is only concerned with the technical aspects of IAEA safeguards inspection activities, and does not address such broad issues.

The concept has also been advanced that IAEA safeguards are of more value than is apparent by virtue of their technical value per se. This may be true where a state does not understand the means by which safeguards are applied. In my experience, the representatives of the state systems and the operators of the installations know exactly how effective international safeguards are and how the international safeguards system can be defeated. I can only address the technical capability to safeguards nuclear materials.

ORGANIZATION OF IAEA

The Board of Governors of the IAEA, on which 34 states are represented, is the principal authority which influences the policy of the agency. Voting is on a one-member one-vote basis, so that less populous countries have as much influence as more populous ones. In terms of budget, however, a large proportion of funding is provided by the U.S., and the U.S. also provides

additional monies and technical assistance to the agency.

The agency's Inspectorate is very responsive to concerns of the countries which it inspects. A complaint via the Board of Governors can end or alter the career of an agency employee. Thus, the Inspectorate is controlled by the inspected. A "diplomacy above all else" or "don't push your luck" mentality prevails.

Another point of interest about the IAEA organization in the Department of Safeguards is that nationals of the country inspected have access to inspection reports, seals, seal records, etc., that concern their own countries. For example, I once had to explain a report that I had written to an individual responsible for clearing it from the country that the report concerned. Although the IAEA takes modest steps to avoid this, it is unavoidable under the present controls.

Finally, it should be noted that the IAEA does not teach languages to inspectors and does not assist inspectors to learn the language of the country which he inspects. The IAEA operates in four official languages of the United Nations and on a semiofficial basis in German. Often the inspector cannot communicate with the party being inspected, except via a representative of the national authority or Euratom, who is conducting a parallel inspection. This occurs more often than not, I would estimate. A result of language difficulties is poor communications. For example, failure of an operator to carry out a commitment made to an inspector may be blamed on not having understood.

MISSIONS TO THE AGENCY

Member countries of the agency provide liaison to the agency by way of their missions to the agency. Some countries have a special staff for this purpose, such as the U.S. One of the comments one hears in Vienna is that "You can't get anything done around here without going to your Mission." As an example of this, I witnessed a case where a non-U.S. inspector was promoted to P-5 (ca. $55,000 p.a. tax free) while I was on inspection travel with him. He received two telegrams of congratulation concurrently. One of these came from his section head at the agency; the other came from his Mission. In my experience, I discerned inadequacy in the safeguards area. Most U.S. inspectors did not feel supported by the U.S. Mission.

SUBSIDIARY ARRANGEMENTS

A country that has signed the NPT in time concludes an agreement with the IAEA modeled after INF/CIRC 153. This agreement specifies in greater detail than that found in the NPT how safeguards are to be applied in the state. In addition to this agreement, subsidiary arrangements are concluded which specify how safeguards are to be applied. These subsidiary arrangements consist of a general part and of detailed attachments which specify how safeguards are to be applied to "facilities" and to "other locations" where nuclear material is present in small quantity.

Design Information

The facility attachments are concluded on the basis of "design information" (DI) submitted by the state. In my experience, the headquarters review of the DI and its field verification has been inadequate.

The agency has the right to carry out DI verification, but often only three weeks notice may be required to be given before an installation receives nuclear material from the time the DI is submitted. Thus, a review of the DI may not be possible and may not be permitted. Such a review is important in many types of installations, to assure that there are no undeclared diversion routes, connections to sampling stations, bypass lines, etc. For example, once a reprocessing plant becomes radiologically contaminated, there is no further chance for a DI review. I am not aware of any DI review of any reprocessing plant.

Also, many tank calibrations in a reprocessing plant can be performed only before an area becomes contaminated. Although verification and witnessing of tank calibration is not a design information review activity per se, it can only be performed before nuclear material is introduced. Due to the short time interval between the submittal of the design information and the introduction of nuclear material, as well as because the plant operator simply does not permit the witnessing of calibrations, the verification activity is only rarely carried out by the IAEA. This lack of assurance of tank calibrations introduces an additional uncertainty in the quantities of nuclear material, transferred and in inventory.

In the case of facilities involving sensitive information, such as reprocessing plants and enrichment plants, DI review is typically not permitted, although newsmen may be given tours. This shows the seriousness with which the IAEA is regarded in the real world.

Another shortcoming in the design information is its completeness. For example, in comparing the information on piping and tanks available at one [pilot] reprocessing plant, WAK [at Karlsruhe], with that provided for another, the PNC [Japan's Power Reactor & Nuclear Fuel Development Corp.'s Tokai] reprocessing plant, one finds that the PNC information is orders of magnitude more detailed than in the WAK case. In comparison, the WAK data is scant and probably inadequate. This is because the diversion paths and falsification scenarios possible in a reprocessing plant can only be addressed with complete knowledge in hand regarding by-pass and recycle routes, and storage locations.

In spite of, or without regard to, the adequacy, completeness, or examination of the design information, negotiations are conducted to conclude a facility attachment, to specify how an installation will be safeguarded. The country may, however, fail to agree with the agency on the facility attachment. Years may pass.

Facility Attachment

When the facility attachment (F/A) is concluded, it is a consensus document which may permanently emasculate efforts to safeguard the installation. For example, the "actual required inspection effort" (arie) agreed to may be barely enough to cover scheduled visits and may leave no time to resolve discrepancies or complete tasks that took longer than anticipated. And arie is taken very seriously. Quite often, arie is about 10% of "maximum required inspection effort" (MRIE), which is specified in the "Blue Book."

Another area, particularly in the case of bulk handling and reprocessing plants where the F/A falls short is not requiring that a "tag list" or "list of inventory items" showing the gross, tare, net, element, and fissile isotope weights be made available after the "physical inventory taking" (PIT) of the operator of the installation. This tag list would be used by the inspector in his physical inventory verification (PIV). Since a tag list is often not required, very often the inspector is left to *take* the inventory, rather than to *verify* it. This is an often imposible task for the inspector, due to his limited time and manpower.

When a tag list *is* required by the F/A, the specific bits of information required, such as element and isotopic weights, are not called for. Again, the inspector is defeated. The reason the inspector is defeated in such circumstances is that where the operator provides the tag list only after the inspector completes his verification activities, the operator is in the position to correctly report those items that he observed the inspector to have verified, but to falsify the reporting of those items that the inspector did not verify. Thus, the operator is in a

position to falsify the material balance.

Typically, a stratified list of items on inventory is required prior to the PIT, for planning purposes. A record of actions taken during the physical inventory including a list of batch data is required. The list of batch data need not be available at the PIV, and further, is usually inadequate as a basis for verification, because individual items are usually not listed. Unfortunately, the distinction between PIT and PIV is often not comprehended.

Another shortcoming of the F/A is that it usually includes a clause such as, "inspection shall be by observation of the state authority's inspection only, unless observation is inadequate to permit the drawing of independent conclusions." This clause frequently leads to haggling and loss of precious time during the inspection as to what activities are actually permitted by the F/A, and often, to the failure of the inspector to carry out necessary activities.

The shortcomings mentioned above are not an exhaustive list, but should serve to illustrate that the inspector is often doomed from the start by an inadequately negotiated facility attachment.

Subsidiary Arrangements -- General Part

This part of the subsidiary arrangements specifies how a state formally reports the inventory and transfer activity to the IAEA. There are various categories of "inventory changes" permitted. One of these is the "measured discard."

Usually there is a specified limit on the amount of measured discards which may be discarded by the operator; such a limit may be, for example, 0.01 kg effective per month per bulk handling or reprocessing installation, of material that is "disposed of in such a way that is not suitable for further nuclear use." When the amount exceeds the limit, the state is required to consult with the agency before discarding takes place. Since the quantities and physical form of nuclear material reported to have been disposed of are typically not verified because the discards occur at times when no inspector is present, a credible diversion path is constituted by measured discards. This situation is compounded in severity, it would seem, in a country such as FRG, where all waste is transferred to a central waste handling facility, which is not subject to IAEA safeguards. Once the waste goes to the central facility, pending resolution of the ultimate disposal of waste issue, it is "out of sight, out of mind." Why IAEA is not permitted to inspect such a waste handling facility is unclear. At the time that the nuclear material is sent to such a facility, it often is suitable for further nuclear use.

Another category of waste removal is "retained waste." Retained waste is defined as "nuclear material which is generated from processing or an operational accident, which is deemed to be unrecoverable for the time being, but which is stored." Waste in this category, without regard to quantity, may be transferred out of inventory. Such waste no longer appears in the operator's book inventory records and is not reported to IAEA in the physical inventory list after the operator's physical inventory taking. Only by searching back to the time the transfer to retained waste occurred would a record be found. It is, therefore, "out of sight, out of mind." Considerable quantities of "retained waste" are stored at some bulk handling installations, but are not periodically verified by an IAEA inspector.

RECORDS AND REPORTS

Under this heading, I discuss the records of the installation and the reports that are submitted by the installation via the state (or regional authority such as Euratom) to the agency.

Records

The agency requires a system of records and reports in the facility attachment. The records are of two kinds, namely, (1) accounting records and (2) operating records.

I saw great differences between the quality of the accounting records from state to state and, within a state, from installation to installation.

I found, for example, that in FRG the records were not organized conveniently in the sense that in order for the inspector to perform a simple audit of the records, considerable time had to be wasted to summarize the activity that occurred since the previous visit. For example, in one major facility, the records were kept according to financial account. There were about 300 of these. There was no general ledger summarizing activity in the several hundred accounts, but there were numerous transactions within and between accounts. I found that to effectively carry out my audit, I had to create my own general ledger. During each inspection, I wasted several days in this activity. The facility simply saw no need to keep a general ledger, for its purposes. The point is that the operator or the state can cause the inspector to waste a lot of his limited time.

With regard to operating records, I also found deficiencies. For example, in one facility, there was no record kept of the final disposition of plutonium samples. Such samples were said to be returned to the process. But, one would expect a record kept showing date, time, and identity of the reintroduced samples. The agency simply does not concern itself with material control at that level of detail.

Reports

I noted that neither in FRG nor in Japan, nor elsewhere as far as I know, did a system of material transaction reports exist, such as does exist in the U.S. with the form NRC/DOE-741. This system is effective, in that serially numbered forms are issued by the shipper of nuclear material and are acknowledged by distribution of return copies by the receiver. These forms are matched by computer in the U.S. system to detect material missing in transit and to flag shipper-receiver differences. In the absence of such a system, an item missing in transit or shipped to an unauthorized recipient could go undetected.

The agency system, however, requires the reporting of transactions to the agency one month after the month in which they occurred. One way to detect material missing in transit or not shipped to the stated recipient, after the fact (but rather shipped to an unauthorized or undeclared recipient), is to compare each shipment declared as shipped in the monthly report with each shipment declared as received.

When I arrived at the agency in 1977, I found that this was being done in summary form, well after the fact, by a clerk, in the case of Japan under the Far East Section. However, with the advent of magnetic tape reporting with NPT in January 1978, this comparison, known as "running the transit accounts," became the responsibility of the section for data processing operations, Division of Safeguards Information Treatment, in the Department of Safeguards. This section has responsibility for all NPT reporting. It was claimed that it was impossible to run the transit accounts because sufficient design information for all installations to permit preliminary error screening of reports had not been provided by the inspectors. Thus, the emphasis changed from accounting to that of the use of the computer as a device of interest in its own right.

At a later date, it was claimed that transit accounts could not be run because batch numbers provided by shippers were not always the same as batch numbers provided by receivers. Another problem, in the case of Euratom reporting, was that France did not report to the agency except for the one facility under safeguards, so that transactions between France and another Euratom country could not be checked. Thus, for a variety of reasons, I was repeatedly told that the transit accounts

could not be run.

It was our belief, in Euratom section of IAEA, however, that transit accounts were run by Euratom, EEC, Luxembourg prior to the dispatch of the monthly reports to the agency. On one occasion, I was granted a special, nonroutine check of transit accounts, due to absence of supporting records. At that point, DIT was willing to entertain a special request. Several months elapsed in the course of running transit accounts for a single installation. I learned that there were shipments and receipts that did not match. We informed Euratom, Luxembourg, who replied that they had not detected this due to a computer malfunction. This episode lead [sic] me to believe that Luxembourg was not running transit accounts either.

Thus, the agency had, and presumably still does not have, any routine assurance that a stated shipment to an installation within a state or a group of states, such as Euratom, ever arrived. That is, with limited exception, when the agency checks the reports of installation X, it does not compare those reports with the reports of other installations which reported transactions with installation X. Thus, it only verifies the internal arithmetic consistency of installation X's reports, in effect, treated in isolation.

Another problem area for the agency has been its Advance Notification of Internation Transfer reports. These are not always reconciled either. And, when they are reconciled, they often don't agree, due to inability to match shipper's and receiver's reports.

Finally, the DOE sends copies of Form NRC-DOE-741 for international transfers to the IAEA. These also are gracefully allowed to pile up "in the corner." It seems that the IAEA does not need them.

INSPECTIONS

Although I have discussed inspections in other sections of this report, I will provide some background here as to what an inspection consists of and what it can and cannot do for various types of facilities.

During my employment with the IAEA, the types of installations that I inspected included reprocessing plants, conversion and fuel fabrication facilities (bulk handling facilities), reactors and critical facilities of various types, and laboratories.

The approach that I will employ here is to explain first how IAEA safeguards generally, comment briefly on the generic safeguards techniques, and then explain how safeguards are applied at various types of facilities.

How NRC Safeguards Generally

INF/CIRC 153, *The Structure and Content of Agreements Between The Agency and States Required in Connection With the Treaty on the Nonproliferation of Nuclear Weapons,* popularly known as the "Blue Book," articles 28, 29, and 30, provides the following statement:

28. The Agreement should provide that the objective of safeguards is the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection.

29. To this end the Agreement should provide for the use of material accountancy as a safeguards measure of fundamenta importance, with containment and surveillance as important complementary measures.

30. The Agreement should provide that the technical conclusion of the Agency's verification activities shall be a statement, in respect of each material balance area, of the amount of material unaccounted for over a specific period, giving the limits of accuracy of the amounts stated.

It is important to note that in the context of article 28, "diversion" should not be equated with "removal." This is an important distinction, because typically, an agency inspector *is* concerned with diversion in the narrow sense as removal.

With regard to article 29, one sees that the basis of IAEA safeguards is: material accountancy, containment, [and] surveillance.

Material Accountancy

In practice, "material accountancy" refers to the means by which the agency verifies the presence of nuclear material that should be present at an installation based upon records and reports. This system is, in itself, made difficult because the reports occur several months after the actual movement of nuclear material. Thus, the agency's material accountancy typically consists of verification of the *arithmetic correctness* of the operator's records, verification of the authenticity of the records by means of shipping documents and the like *furnished by the operator,* and several months after the fact, cross-comparison of this information with reports of the *same* operator, which he sent via his national system to the agency on magnetic tape. As mentioned previously, the agency has thus far found it virtually impossible to inter-compare an operator's reports with reports of any other operator, to verify the veracity of the reports, especially in the case of states under NPT.

Article 30 refers to the so-called MUF statistic, which is the operator's statement of the amount of nuclear material, based upon his physical inventory taking, that is apparently discrepant from the amount that is supposed to [be] present, based upon his records over a period of time. The LE (MUF) is typically *not* calculated, although the agency has good intentions of calculating an approximate LE (MUF) in the future.

Very rarely the agency calculates a D statistic, which is the inspector's MUF, based upon his verification of the operator's statement. This is typically incomplete, because the inspector rarely, if ever, measures all components of the operator's material balance closure and does not possess the information necessary to perform a realistic calculation. The agency just does not have the manpower to do much verification and often does not have time to take as many samples, even with a willing operator, as it believes necessary, of even the ending inventory component.

In the best of all possible worlds, the MUF statistic is the closest that the agency verifies the material balance. In reality, it falls very far short of what is intended, because of holes in the system which provide the MUF.

Because of the inherent difficulties of the MUF statistic, the agency has attempted to implement a system of "timely detection" at sensitive facilities. Such implementation is, at the present time, far beyond the capabilities of the agency to implement and beyond the willingness of the countries to undertake. It goes beyond the Blue Book, some believe, and would require massive amounts of sampling and verification, and real-time knowledge of the amounts of nuclear material moving between installations, rather than after the fact notification. At the present time, such efforts are only in their early stages.

Containment and Surveillance Measures

Article 29 also refers to containment and surveillance measures. At the present time, this refers primarily to seals in the containment category, and cameras in the surveillance category.

In the case of seals, the agency mainly uses the so-called "IRS Type-E" seal. This seal has been around for a long time, and as early as about 10 years ago, efforts were underway by at least one foreign government to "break it." The seal has been "beefed up" by the agency, but is basically an old device that requires labor intensive "post-mortem" examina-

tion, which verifies that the seal removed is the same one that was originally emplaced, rather than a counterfeit. The post-mortem examination is not necessarily capable of determining whether the seal was surreptitiously opened and then reassembled.

The agency also uses paper seals. According to expert authority, these seals are useful for only a few hours at best, because they can be removed and replaced, and also because they can be duplicated by a good printer.

There are several other seals around, but none of these have been used, except in limited tests.

In any case, a second basic shortcoming of the use of seals is that the item sealed can often be accessed by bypassing the seal.

Camera surveillance is of two types. One is the film camera, such as an 8mm Minolta. These are typically used in pairs in a sealed enclosure. They are set, in a power reactor, to each snap a picture at 15- or 20-minute intervals, so that, at best, there is only 7 to 10 minutes between snaps. These are intended to detect movements of large items, such as a cask bearing fuel assemblies.

The other type of camera is the TV camera, which turns on at predetermined intervals and snaps 8 or so frames.

Generally, the quality of pictures obtained is extremely poor. Further, there have been numerous failures. There have been significant improvements recently in reliability, but failures still occur at an alarming rate.

One scenario, which has appeared in several literary sources, is the placement of a photograph of the viewed scene in front of the camera. This is plausible, because the illumination level normally changes as lights are turned off and on, and the frames typically jump around. But there are also more sophisticated ways to defeat the camera.

A basic difficulty associated with containment and surveillance devices is that the device is not under the continuous observation of the inspector, as would be an alarm system in an industrial setting.

In my experience, another basic difficulty with both film type and TV type surveillance is that the image is often typically not clear enough to be meaningful. Typically, many activities occur on the film that are rather baffling. Also, people stand in front of the camera and barriers are erected that block the view. The camera may be moved. The lights may go out. And, often, the camera simply fails. Further, the interval between pictures is intended to protect against a known scenario, such as a cask movement to remove fuel, where it is assumed that the agency really knows how long the activity will take, so that the movement would be caught on film, whereas it might not really be known.

Safeguards at Specific Types of Installations

Reprocessing Plants

During my employment with the IAEA, I inspected at the reprocessing plants of PNC at Tokai Mura in Japan, GWK (WAK) at Karlsruhe in FRG, and once, Cogema at Cap de la Hague in France. The first two facilities were under "continuous" inspection regimes. The latter facility only stored fuel under safeguards, but had not reprocessed any of it. Basically, uncertainties associated with reprocessing plants involve, at best, a several per cent uncertainty of MUF. At worst, a lot of other possibilities open up, including the possibility that an installation might reprocess undeclared irradiated fuel, or understate the plutonium content of the declared fuel. One installation was rumored to have poessed [sic] an undeclared, never used, natural uranium storage pond, for example. In a reprocessing plant, therefore, one should look for hidden fuel as well as account for declared fuel. But the agency does not attempt to find undeclared fuel. For example, if a plant operator says that no fuel will be processed for one month, the agency will stop sending inspectors for a month.

In the case of understating the plutonium content of the input dissolver solution, the scenario would entail diverting some of the input dissolver solution to avoid measuring it in the input accountability tank. At a later time, the diverted solution would be transferred from its location in, say, a tank of the rework system, where it had been stored, to the extraction and purification systems, in order to extract the plutonium, at a time when the plant was declared "down" and not under inspection. The uranium solution needed to make up for the diverted uranium contained in the divertered [sic] dissolver solution would be replaced from uranium in storage, since uranium quantities are known from fuel element manufacturer's data.

This type of scenario is simply not covered by IAEA safeguards. IAEA rather bases its safeguards primarily on operator's data supplemented by camera surveillance. I know of no case where recycle acid was verified, for example, or where valves were sealed to prevent undeclared transfers. Samples are taken of the input and output solution, but are drawn from sample ports that have not been verified by design information review, so that one can't be certain where the sample came from. Further, the samples are handled in the plant by the operator and may be prepared by the operator, before shipment to Vienna. In one case, the operator and country refused to allow shipment of samples for a year on the grounds that it was illegal due to the absence of an approved shipping container. Finally, after the samples had been in the operator's control for a year, the agency was asked if they could be discarded, because they had been standing so long. The agency agreed.

In addition, because the samples must be diluted before shipment, analytical accuracies are reduced at Seibersdorf.

In the case of the Cogema facility, there is no input accountability tank, so that input accountability will probably have to be based on reactor data.

An independent means of assessing the plutonium content of spent fuel is by burnup calculations and isotopic correlation techniques. Unfortunately, burnup calculations, which require verification of reactor operator's data, is not even done on an occasional basis by the agency. Neither are isotopic correlation techniques applied. The agency simply takes the word of the operator as to the plutonium content of the spent fuel and checks that against what it finds at the reprocessing plant, subject, of course, to the limitations of that finding.

Research Reactors

In the case of research reactors, as in power reactors, the potential exists for undeclared breeding of plutonium and/or U233. In the research reactors that I inspected, of which there were several, there were no containment or surveillance measures provided to address these possibilities, nor am I aware of any measures which would have been effective. Typically, research reactors are inspected infrequently, perhaps once annually. The agency's camera surveillance would be unable to distinguish between irradiation of fertile material samples to produce plutonium or U-233 and irradiation of medical samples, for example, even if a camera could run unserviced for one year.

One medical use of research reactors, incidentally, is irradiation of highly enriched uranium to produce molybdenum-99, which is extracted and decays to technecium-99. The Tc-99 is used for medical scanning for tumors. After irradiation, most of the U-235 still remains in the target, which is typically mixed in concrete, prior to ultimate disposal. The highly enriched uranium could be extracted, however, as a po-

tentially attractive source of kilogram quantities of weapons grade material prior to the mixing with concrete. This extraction would probably not be detected by IAEA safeguards, since an IAEA inspector may only visit such an installation annually for one day.

Critical Facilities

One critical facility which I visited contained hundreds of kilograms of low exposure, weapons grade plutonium. A facility of this type is sensitive from the abrogation scenario standpoint where, under some sort of immediate threat, the country simply takes possession of all the nuclear material for immediate manufacture into nuclear weapons components. About 100 kg of this material was under IAEA seal. During biweekly "time detection" inspections, the inspectors would visually check the type E seals on this material, in spite of the fact that these seals can be counterfeited, so that only postmortem examination at headquarters is meaningful.

I once demonstrated to the operator and the inspection team leader that, due to the absence of some needed holes in the lid and body of the container, the sealing system was inadequate; the containers could be opened, the material removed, and the lid replaced simply by removing two bolts, without disturbing the seal. I also brought up this problem in Headquarters upon return from mission. However, this situation was not corrected, possibly because agency personnel had collaborated with the operator on the method by which the seal would be applied in the first place and felt partially obligated to go along with the outcome, when the operator said that the holes could not be drilled.

The method of safeguarding a major critical facility entails monthly sampling and remeasurement of unsealed fuel plates. The fuel plates can be remeasured to within about 3% by NDA [Nondestructive Analysis]. Perhaps 1% of the material could be removed by, say, drilling or remanufacture of the plates, without detection likely but this type of scenario is considered unlikely. Chemical analysis by the agency for highly accurate measurement of a suspect fuel plate is not foreseen in the usual facility attachment.

Power Reactors

Power reactors are of various types, and can be classified according to whether on- or off-line refueled, types of moderator and coolant, whether natural or enriched uranium, etc. On-line refueled reactors are considered more sensitive and safeguarding was primarily by counting all fuel elements and check of serial numbers against the invoice of unirradiated fuel elements. Identification of serial numbers on spent fuel is usually impossible. Although there is work underway, especially in Canada, to automatically count fuel elements, this was not done in my experience. Counting of power pulses on a chart was the means of verifying the number of fuel elements changed in the core in one instance, but "noise" pulses on the chart made this of dubious value. Camera surveillance was intended for loadout pond, to detect undeclared loadout of irradiated fuel by that route.

In the case of off-line refueled reactors, camera surveillance was used in the spent fuel pond area to detect undeclared loadout and seals were employed on the reactor head and/or at the entrance gate to the spent fuel pond between refuelings. Fuel elements were counted and serial numbers on unirradiated fuel elements were verified at inspections. In both cases, physical inventories occurred at annual to 18-month intervals. Nondestructive assay verification was permitted at that time. Inspection frequency ran from 3-month to 6-month intervals.

Verification of reactor operating history was by reviewing strip charts of power, steam flow, temperature, or neutron flux. Typically, a maximum of two charts were permitted to be reviewed. Access to the control room was not permitted. Rather, the charts would be removed and brought to the inspector for review in a meeting room.

The possibility of irradiation of additional fuel contained in normally nonfuel-bearing structural components of the fuel assemblies was not covered by the inspection approach of power reactors, although this has been discussed in a report on technical assistance to the agency by the U.S. The possibility of an adaptation to facilitate the irradiation of fertile fuel by other means was also not covered. For example, there is no close inspection of the reactor vessel prior to operation or at the time of maintenance to detect a shuttle system. Burnup calculations to determine the amount of plutonium in spent fuel were not verified, nor were power monitoring devices verified.

Fuel Fabrication, Conversion, and Unirradiated Scrap Recovery

This part of the fuel cycle centers around the fabrication of fuel for the various types of reactors and critical assemblies.

In larger facilities, the IAEA makes approximately monthly inspections of one day duration, performs an annual physical inventory verification of several days' duration and, where large quantities of direct use material are present, more frequent inspections may be made. A basic difficulty that I observed here are unwillingness to take samples and ship them to the agency's Seibersdorf Laboratory, on the grounds of cost or shipping regulations. In one European installation that I was aware of, the operator wanted $1000 per sample from the agency. A problem that I encountered was unwillingness to allow the agency to use nondestructive assay equipment that required small radioactive sources in their operation. The operator claimed that national regulations did not permit the presence of those particular sealed sources in his plant, in spite of the presence of large quantities of plutonium.

In that installation, the operator and state had refused to permit the agency to apply timely detection continuous inspection at the facility by virtue of its contention that inspection was limited by the Blue Book to flow and inventory key measurement points. As a result, the agency "punished" the state by reduced inspection to 2- or 3-month intervals. In this case, the state did agree after several years to the timely detection inspections on a trial, informal basis to parts of the facility. But, without full cooperation and a serious investment in computer hardware and extensive accurate measurements, which I have yet to see, timely detection is of limited value.

The agency's approach to verification is based upon a report, BNWL-1852, "Example of Verification and Acceptance of Operator Data – Low Enriched Uranium Fabrication Plant," Battelle Pacific Northwest Laboratory, Richland, Washington, August 1974. This report provides the framework for the concept of verification of strata of flows into and out of the plant, as well as in beginning and ending physical inventories. A material balance for a period of time is formed by the plant operator from the following components on the right side of the equation: MUF = BI + A - R - SR - EI, where MUF is material unaccounted for, BI is beginning physical inventory, A is additions to inventory, R is removals from inventory, SR is shipper-receiver difference [and] EI is ending physical inventory.

If everything could be measured perfectly and there were no mistakes or unaccounted for losses or diversion, MUF would come out equal to zero for a material balance period. But due to normally occurring errors of measurement, MUF is typically not zero, but indicates apparent "loss" or "gain." The idea is to determine whether the MUF is only due to measurement error or also due to unaccounted for loss, diversion, or a mistake.

Normally, the components of the material balance will

be composed of several strata each. For example, BI may be composed of good substrate material, the product material which is manufactured from the substrate, scrap and waste. The agency, ideally, verifies each stratum of each component of the material balance. In reality, it seldom is able to verify each component. In any case, it attempts to detect a diversion of a significant quantity of nuclear material by verifying a sufficient number of items in each stratum to provide a desired power of detection, (1-B), of the loss of a significant quantity with a tolerable false alarm rate, α. A theorem is derived which addresses the problem of whether the diversion of a significant quantity, if "partitioned across" (took place in) more than one stratum, would be detected with adequate power. The theorem shows that, if diversion were partitioned across more than one stratum, the power of detection would be as great as or greater, by virtue of a defect being found in at least one stratum, than if the diversion of the significant quantity had occurred all in one stratum.

The fallacy inherent in this approach is that there will often be at least one defect due to a mistake. Thus, if any mistake is found, the agency must alarm to the hypothesis of diversion by partitioning. And there are often false alarms (mistakes). This is even more serious when one considers that the country is the adversary, so that partitioning across all installations in a country must be assumed if any alarm occurs. Since it is patently not feasible to alarm to the possibility of diversion by partitioning across the state whenever a mistake is found, the conclusion that one reaches is that the agency is incapable of detecting the diversion of a significant quantity or of several significant quantities, by partitioning, in any state with a moderate to large nuclear energy establishment.

What Materials This Report Has Concerned

IAEA safeguards are aimed at the control of certain direct-use materials, namely: high enriched uranium, U-233, and plutonium; and certain indirect-use materials, namely: low enriched, natural, and depleted uranium and thorium which can be converted to direct-use materials. IAEA safeguards do not control uranium ore, neptunium, and a number of other materials which are controlled in the United States by DOE and/or the NRC. Uranium ore, for example, can be converted rather simply to uranium in a form that is an indirect-use material. Absence of its control is probably one of the glaring weaknesses of international safeguards today.

A large LWR produces roughly 15 kg of neptunium-237 per year, according to the Nasap [DOE's Nonproliferation Alternative Systems Assessment Program] study. The unmoderated spherical, critical mass of neptunium-237 is roughly 60 kg. Its control will probably be required in the future.

In this report, I have attempted to describe how IAEA safeguards work and some of their weaknesses. I have not addressed all issues; there are many which are presently the subject of r&d efforts by several countries, for example. But I hope that I have identified some of them. I think that it is clear at this point that there are not many simple solutions and that a great deal of effort and commitment of all parties will be required to address these issues.

PNC TO REPROCESS 200 TONNES IN TWO YEARS AT $586,900/TONNE IN PACT WITH UTILITIES

Japan's Power Reactor & Nuclear Fuel Development Corp. (PNC) is scheduled to reprocess 200 tonnes of spent fuel for seven utilities through October 1983. The eight parties agreed to set that total volume and the fee at $586,900 per tonne of spent fuel, up from $347,800.

The PNC plan is kept intact despite the agreement between Washington and Tokyo allowing full utilization of the 700 kg/day reprocessing plant at Tokai Village through the end of 1984. PNC admits that it has become impossible to fully utilize the design capacity (210 tonnes a year) because of longer shutdown periods for maintenance than had been anticipated years ago.

Recent years of operation have formed a rough annual pattern of the plant running from January to June, being shut down in July and August, and operating in September-October. As if to confirm the difficulties with 210 tonne/year reprocessing, PNC reprocessed a cumulative total of only 106 tonnes through June this year (NF, 6 July, 14), compared to 149 tonnes allowed until June (99 tonnes, as agreed upon in 1977, and another 50 tonnes agreed upon in February). The scheduling assumes no plant problems, which marked the Japanese reprocessing operation. Thus, PNC describes even the 200-tonne schedule as "a target."

The 200-tonne total is broken down into: Tokyo Electric Power Co., 41.3 tonnes (with 43.4 tonnes allowed to be carried to PNC's cooling pools); Japan Atomic Power Co., 40.2 tonnes (44.4 tonnes); Kansai Electric Power Co., 38.7 tonnes (40.8 tonnes); Chugoku EPC, 24.0 tonnes (26.6 tonnes); Chubu EPC, 20.6 tonnes (25.6 tonnes); Kyushu EPC, 18.8 tonnes (22.4 tonnes); and Shikoku EPC, 16.4 tonnes (16.8 tonnes).

The latest reprocessing agreement led Ichiro Nakagawa, science & technology minister and concurrently chairman of the Japanese Atomic Energy Commission, to issue a special statement, admitting that Japan unsuccessfully tried to eliminate the time limit but welcoming the new agreement with the Reagan regime as one with "many points that have been improved from the 1977 agreement" with then-President Carter's government.

He described the new pact as "the most practical solution at the present time," partly because of his agreement with Mike Mansfield, the U.S. ambassador to Tokyo, to use the three-year period for further negotiations. Japan will continue its efforts to realize elimination of time limits, which in Nakagawa's words is "a permanent solution" to the Tokai reprocessing question.

Utilities accepted PNC's proposal to raise the reprocessing fee apparently with no fuss. The revised fee, a PNC source said, is "for us to recover only the reprocessing costs." Besides the cost recovery (with no profits for the government corporation), there is a reason for utilities not to hate the fee hike. Industry sources agree that, despite a virtual lack of any significant fee differences between PNC and Europe, the deals with PNC should spell favorable total costs, including spent fuel transportation. It costs between $782,600/tonne and $869,500/tonne (at a rate of 230 yen to the dollar) to have Europe reprocess Japanese spent fuel, including transportation.

Not surprisingly, coastal transportation inside Japan is believed to cost far less than the transocean transportation to West Europe. "The only major factor in cost differences is transportation," one of the sources in Tokyo says. Nuclear Transportation Service Co. (NTS), a consortium of nine regional utilities and Japan Atomic Power Co., handles spent fuel transportation to PNC's Tokai works with a 1,290 gross ton vessel, Hinoura Maru, chartered from Nippon Express Co. Although designed to carry four casks at one time, the ship

actually transports only two at a time because NTS has only two casks each for BWR and PWR spent fuel.

PNC and utilities decline to divulge details on the cost for plutonium nitrate paid for by PNC for production of MOX (plutonium-natural uranium mixed oxides fuel) for the Fugen advanced thermal (heavy water) reactor. For the initial production (NW, 15 Oct., 9), PNC purchased and consumed about 200 kg of plutonium nitrate. One source speculates that utilities chose to get rid of their plutonium nitrate at fairly low prices "rather than maintain it by paying storage cost." The nitrate moved inside PNC's Tokai works from the reprocessing plant to a plutonium fuel development laboratory. – *Shota Ushio, Tokyo*

TICKET ON URANIUM'S ROLLER COASTER IS GOOD THROUGH 2000, ANALYSTS SAY

Instability will continue to be the dominant characteristic of the uranium market into the next century, say the Colorado Nuclear Corp. and Pickard, Lowe & Garrick Inc. in the 1981 version of their annual report on uranium supply, demand and prices.

"Through the entire period of the projections (to 2000), there is an upward trend in average price," the companies say. "However, continuing price oscillations are expected about this average trend." And those oscillations could be severe; in January 1981 dollars, the companies project prices of $30-50/pound in 1985, $30-70/pound in 1990, and $45-100/pound at the turn of the century.

That trend will continue in spite of "appreciable quantities of imports" to the U.S. – 40% to 50% of U.S. demand – and "reflects the general effects of producing from more expensive (lower grade, deeper, and smaller) deposits as time goes on. Under all conditions examined, the market remains unstable. Essentially all projections indicate that price rises will be followed by some overall expansion and subsequent price drops. The price drops prevail until the projected supply/demand imbalance again becomes relatively significant and another price rise follows," the report says.

A price rise is projected to begin by the end of 1982 " if many of the utilities that have intermediate-term uranium requirements begin purchasing activities in the near future" and don't rely solely on the spot market.

That rise will be "relatively short-lived," peaking before 1985, because of near-term inventory levels, and will be followed by a mild price drop, the report predicts. But, "by the late 1980s the indications are that the price may average substantially higher than today's value; including the possibility of a rather strong price peak before 1990." Thereafter, the trend is upward.

The "envelope" of price variations applies to both U.S. and non-U.S. sources of uranium, although it is based on U.S. demand projections as well as a number of other factors which could influence the market, such as demand variations, uncertain production capacities, producer and buyer attitudes and policies, inventory policies and imports.

"The proper interpretation of the overall envelope is that it represents the approximate bounds within which the price may oscillate. The closer the price approaches the lower boundary at a point in time, the higher the probability it will approach the upper boundary at a later point in time (and vice versa)."

After the late 1980s, "there is a large uncertainty in the projected year by year prices," the report says. "In particular, price peaks and valleys tend to get out of phase for projections based on different sets of assumptions. Thus, the most that should be concluded from the price projections after the late 1980s is the general magnitude of the upward price trend and that the market will be unstable."

In the U.S., demand estimates are based on projected nuclear plant capacities climbing to 130 Gw in the low case, 160 Gw in the mid case and 200 Gw in the high case by the year 2000. In 1990, 109 Gw, 121 Gw and 136 Gw are projected for the low, mid and high cases, respectively. The high case is similar to DOE's high-case projection, but the mid case "runs close" to the DOE low case, and the low case "is substantially lower than the DOE low case," the report notes.

Uranium demand is figured in the low case to rise from about 22,000 tons in 1990 to 24,700 tons in 2000. In the mid case, it climbs from 24,300 tons to 33,000 tons. In the high case, demand is 27,700 tons in 1990 and 43,100 in 2000. Excess inventory of 34,300 tons is projected to start declining by 1982. Unfilled demand "is projected to build up steadily through the 1980s, from about zero today to 4,000 tons per year by 1985 and to 12,000 tons per year by 1990."

The projections are based on the assumption that there will be no reprocessing in the U.S. They also are based on enriching tails assays of 0.2%, 2½-year lead times, conversion yields of 99.5%, and a few other factors.

For demand in the Western world outside the U.S., estimates by DOE's Energy Information Administration are used. They are based on EIA's low- and mid-case nuclear generating capacity projections of, respectively, 165-181 Gw in 1990 and 300-350 Gw in 2000. In the low case demand projections are 27,500 tons in 1990, and 42,700 tons in 2000. In the mid case, with reprocessing, demand would be 31,600 tons in 1990 and 54,100 tons in 2000; without reprocessing, demand is figured to rise from 39,300 tons to 69,400 tons.

Production estimates are less precise, the companies say. Roughly, though, in the U.S., if prices remained at the current level, production would drop from slightly under 20,000 tons in 1981 to about 6,000 tons in 1990. If prices rose in 1983 to a level of $40-50 per pound, production would rise to about 24,000 tons in the late 1980s, dipping slightly by 1990.

Non-U.S. production could rise from under 10,000 tons in 1980 to anywhere between 20,000 and 60,000 tons in 1990, depending on prices, which could be $20-50 per pound. By the year 2000, the range is between about 25,000 and 75,000 tons.

Imports to the U.S. are expected to reach 40-50% of demand in the 1990s, but "uranium prices may not be much lower than if use were restricted to 20% to 30% of total U.S. demand," the report says. "The logic for this conclusion is that the price of imports will be governed by the marginal producer, and in order for foreign demand to be met primarily from foreign production, much higher cost foreign production must be developed."

Of existing non-U.S. production capacity, about 20% is from "economically favorable deposits in Saskatchewan and Australia. Of the potential new production, about 40% is from such low cost deposits. Some current high cost foreign production capacity will likely be shut down if the current low market price continues." – *Stephanie Cooke*

DOE TAKES A BACK SEAT ON ROD STORAGE WHILE INDUSTRY AND EPRI MOVE FORWARD

Utilities looking for support of rod-consolidation licensing programs – not finding much at DOE – are turning to the Electric Power Research Institute (Epri) instead. Epri expects to have about $200,000 to devote to such efforts in 1982 and "could easily double that in following years," according to an Epri source.

Epri's involvement at this point is very preliminary, that source said. So far three utilities have approached the organization for support and more are expected. There is "a lot of interest in a joint program," in which utilities might pool their efforts, but just how such a program would evolve is not clear, he said.

What is clear is that, with a limited budget for its spent-fuel storage program, DOE will be concentrating its efforts on cask storage rather than rod consolidation. In past years, the program had about $20-million per year; the level now is about $6-million per year, a DOE source said.

Earlier this year, Northeast Utilities approached the agency for help. "We could possibly help them later, but it would be a major strain on the budget now and we just can't do it now. As we begin to get some of these other programs behind us we can look forward to some of these other things. Hopefully casks will be wrapped up in a year or two. As soon as a couple of utilities have licenses on casks there will be no other need for us to be involved."

The extent of DOE involvement in rod consolidation – at least for the immediate future – was explained in a Nov. 6 letter from the agency's Office of Nuclear Energy to prospective participants in a rod-consolidation program. "We would expect a major portion of the cost burden to be borne by the utilities and by the manufacturer of the equipment which will be demonstrated," the letter stated.

"For our own part, we have reached a conclusion that the disassembly process itself, while an important prerequisite for storage of consolidated rods, is not of sufficient concern to the Nuclear Regulatory Commission so that the Department of Energy involvement would be appropriate. In addition, we have seen sufficient initiative and capabilities in the private sector to convince us that our involvement in equipment development should be limited to ensuring a viable competitive environment and to ensure that we have safe capabilities.

"The department's role should, therefore, be limited to addressing the seismic response and pool loading considerations which do seem to be of more concern. We hope to accomplish this as a minor participant with utilities, their a-e's (architect-engineers), and with private industry suppliers of disassembly and storage equipment and services."

A DOE source told NuclearFuel that its rod-consolidation program with the Tennessee Valley Authority – a $1.1-million effort to consolidate about a dozen assemblies – is important because "it kicks off the work," but "we don't have the flexibility to go halfers with anyone any more." DOE involvement therefore will be limited to software. What the agency might like to be involved in along with the TVA program, he said, is a rod-consolidation program for a PWR that would involve placing consolidated rods on existing stainless steel racks instead of the high-density poison racks because it would "allow us to test licensing but not to the hilt." Such a program would likely not "tax the status of technology in regard to being able to predict pool strength," and "present analytical techniques may be adequate."

The next step, if there is funding, would be "to go all the way" with "all the rods in the pool and high-density poison racks," such as Northeast suggested, "but I'm looking for something that fits in between and happens a little sooner." The intermediate step "might be before TVA if someone sees it clear to go that way." Rod consolidation "has to have a lower priority than our cask program because everyone can use a cask," he added, but "only people with strong pools can use consolidation."

An industry source questioned the need for an intermediate step. He predicted Northeast would go ahead and license a complete program because there "is no incentive to do a demonstration unless they can do it to completion." If that proceeds soon there would be no need for the middle step, he said. That source also questioned the need for DOE's role if it is limited to seismic response and pool loading studies. DOE studies tend to be generic, he said, and those type of studies must be "extremely plant specific."

A DOE source conceded "there may be a problem there," but he said such studies are "certainly not high on the priority list," and that the type of DOE involvement may be "negotiable." Meanwhile, an industry source agreed with DOE that there is enough interest in rod consolidation in the industry to limit the need for DOE involvement. Once away-from-reactor storage was abandoned, he commented, rod consolidation "got commercial real fast." Major competitors for the business include U.S. Tool & Die, Nuclear Assurance Corp., Combustion Engineering and Westinghouse.

KERR-McGEE NUCLEAR'S EARNINGS IN THE FIRST NINE MONTHS of 1981 were down over $2.5-million compared to the same period a year before. Most of the decline was due to a poor third quarter in which the company showed a loss of $549,000, compared to a net profit of $2.9-million from July to September 1980. For the first nine months of 1981, net earnings were $287,000 on $83.3-million in sales, compared to net earnings of $2.8-million on sales of $105.5-million in 1980. Through September, Kerr-McGee delivered 2.1-million pounds of U3O8 compared to 2.8-million pounds in 1980, and produced at its Sequoyah, Okla. conversion facility 4.1-million kg of UF6 compared to 4.5-million kg in the first nine months of 1980. Production of U3O8 through September totaled 3.6-million pounds, down 14% from the same period a year ago because of "the weak market for uranium caused by delays in nuclear power plant construction and licensing," Kerr-McGee said.

SOUTH AFRICANS' URANIUM REVENUES DIP

Two South African gold-uranium mines, Blyvooruitzicht and Harmony Mines, report sharply reduced revenues from uranium in the quarter that ended with September.

Blyvooruitzicht's uranium operation lost $1,253,000 after making $1,315,000 in the June quarter. The loss was attributed to a deferred sale. Uranium production fell to 78,336 kg from 85,294 kg in the June quarter.

At Harmony, revenue from uranium, pyrite and sulphuric acid – which fall under one account with uranium the major

portion – fell to $4,371,100 from $9,655,800. Production increased slightly from 146,593 kg in the June quarter to 152,419 kg in the September quarter.

AMERICAN NUCLEAR REVENUE CLIMBS BUT IT'S NOT COMING FROM URANIUM

American Nuclear Corp. continued its retreat from uranium in its fiscal 1982 first quarter as activity by its contract drilling division provided 96% of the company's $2,085,000 gross revenues in the period, up from a 46% contribution in the comparable quarter a year ago. That revenue figure rose 13% from the previous year's $1,843,000, but net income in the quarter, which ended Aug. 31, dropped from $220,000 to $149,000.

President John C. Ferguson told shareholders at the annual meeting that he expects the American Drilling Co. division to remain the corporation's primary source of revenues and operating earnings for the near term. He said income from uranium activities had decreased from the same period a year ago, noting the Tennessee Valley Authority order earlier this year to terminate operations at the Gas Hills uranium mining/milling project of TVA and Federal American Partners (NF, 31 Aug., 2; 16 March, 15). American Nuclear owns a 40% stake in FAP.

In line with this, uranium production at the 950 ton per day Gas Hills mill, near Riverton, Wyo., was ended this month by FAP, the contract operator under the partnership deal with TVA. FAP laid off 22 mill workers but kept 70 others on the payroll to clean up the facilities and "mothball" equipment. About 30 of them will be discharged over the next few months. The others will be assigned to monitoring interim reclamation, stabilization of mine and mill properties, and security.

The FAP mine in the Gas Hills was closed last February and the mill has been operating on stockpiled ore.

GULF SLOWS DEVELOPMENT AT MOUNT TAYLOR

Development of Gulf Mineral Resources' Mount Taylor uranium mine, 60 miles northwest of Albuquerque, N.M., is being slowed with the layoff of 100 of 700 employees. Gulf officials say, however, that they remain optimistic on long-term prospects for uranium and have no plans to stop development.

Ken Barnhill, general manager of Gulf's New Mexico uranium operations, says the mine will operate on a five-day work week rather than the seven-day work week that has been in effect. He adds that workers will continue to develop the mine which now produces 300-500 tons/day of ore grading more than five pounds of uranium oxide per ton.

Gulf, which started construction of the Mount Taylor mine in 1974, had originally planned to reach maximum production of 4,500 tons/day by the mid-1980s, but this schedule is being adjusted because of the depressed uranium market. Barnhill said he was not sure, because of economic conditions, when the mine would reach planned capacity. Two shafts, one 24 feet in diameter and the other 14 feet, were completed to the 3,300 foot level in 1979 after five years of construction.

The 4,500-ton/day capacity will be reached, Barnhill says, "when the demand for uranium and the market price justifies resuming significant capital expenditures." The Mount Taylor mine and mill were estimated in 1980 to require an investment of more than $500-million.

The Mount Taylor deposit is rated by Gulf geologists as one of the major uranium deposits in North America, with more than 128-million pounds of uranium oxide representing 22% of known, low-cost U.S. reserves.

STUDIES OF URANIUM RESERVES IN THE HOGGAR MOUNTAINS of southern Algeria should be completed by the end of 1981. The government will then have to decide whether to press ahead with development, a decision linked with plans to develop a nuclear power industry. Reserves in the Hoggar are estimated at up to 50,000 tonnes.

ELF-AQUITAINE AND THE FRENCH COMPANY GEOCONSULT are setting up a joint subsidiary in the U.S. specializing in geophysical and geothermal mining techniques, Elf said in Paris. The new company, Geoconsult Inc., to be based in Denver, Colo., will be owned 60% by Elf Technologies Inc., the Elf group's research and development subsidiary, and 40% by Geoconsult France. Beginning late this year, Geoconsult Inc. will offer North American clients geophysical and geothermal mining services.

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