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Worldwide Report

NUCLEAR DEVELOPMENT
AND
PROLIFERATION

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WORLDWIDE REPORT
 NUCLEAR DEVELOPMENT AND PROLIFERATION

CONTENTS

ASIA

PEOPLE'S REPUBLIC OF CHINA

China's Nuclear Industry Examined (Fuzhou FUJIAN RIBAO, 1, 5, Nov 85).....	1
Economic Responsibility of Nuclear Establishment Nuclear Power Generation, by Zhou Peirong	1 1
China's Stand on Nuclear Cooperation Reiterated (Fuzhou FUJIAN RIBAO, 11 Nov 85).....	4
China's Nuclear Exports, International Safeguards Discussed (Fuzhou FUJIAN RIBAO, 14 Nov 85).....	5
Daya Bay Fuel Could Be Domestically Produced by 1993 (Albert Chan, Timothy Jim; Hong Kong SOUTH CHINA MORNING POST, 13 Jan 86).....	6
Hu Yaobang, Li Peng Meet Nuclear Specialists (Beijing XINHUA, 21 Jan 86).....	8

CANADA

Status of Uranium-Producing Industry Discussed (Oliver Bertin; Toronto THE GLOBE AND MAIL, 26 Dec 85)....	10
Religious Groups Urge More Public Input on Nuclear Issues (Ottawa THE CITIZEN, 27 Dec 85).....	12
Pact Reportedly Near on Waste Disposal Research (Ritchie Gage; Toronto THE GLOBE AND MAIL, 27 Dec 85).....	13

AECL Seeks To Build New-Style Reactor at Chalk River (Toronto THE GLOBE AND MAIL, 4 Jan 86).....	14
Briefs	
Uranium Dust Risk Study	15
EAST EUROPE	
BULGARIA	
Minister Interviewed on Energy Situation, Resources (Nikola Todoriev Interview; Sofia OTECHESTVO, No 21, 12 Nov 85).....	16
Report on Construction of Nuclear Unit Number Six in Kozloduy (various sources, various dates).....	24
Pace of Construction Stepped Up, by Todor Tanev	24
Soviets Ship Shell for Bulgarian Reactor	27
Military To Help Build Belene Nuclear Plant, by Valentin Neshkov	29
Progress Report on Activities at Kozloduy 1000 MW Units (Tsvetan Furenski; Sofia STROITEL, 20 Nov 85).....	30
HUNGARY	
Nation's Role in Construction of CEMA Nuclear Power Plants (Sandor Bajza, Karoly Toth; Budapest ENERGIA ES ATOMTECHNIKA, Vol XXXVIII, No 7-9).....	33
LATIN AMERICA	
ARGENTINA	
CNEA President Discusses Nuclear Program (Buenos Aires TELAM, 2 Feb 86).....	43
Briefs	
CNEA Budget	44
Nuclear Projects Rescheduled	44
BRAZIL	
Sarney-Betancur Manaus Talks Include Nuclear Accord (Jose Sarney; Sao Paulo O ESTADO DE SAO PAULO, 31 Jan 86).	45
High Financial Costs of Plant Construction Scored (Editorial; Sao Paulo O ESTADO DE SAO PAULO, 21 Dec 85)...	46
SBF Lauds Agreement With Argentina on Nuclear Research (Rio de Janeiro O GLOBO, 1 Dec 85).....	48

Nuclebras Not To Build any Plants in Sao Paulo State (Sao Paulo O ESTADO DE SAO PAULO, 4 Dec 85).....	49
Nuclebras Employees Strike for Wage Demands (Sao Paulo O ESTADO DE SAO PAULO, 6 Dec 85).....	51
CNEN President Outlines Nuclear Research (Jose Roberto Arruda; Sao Paulo O ESTADO DE SAO PAULO, 12 Jan 86).....	52
Scientists Criticize Nuclear Research Program (Sao Paulo O ESTADO DE SAO PAULO, 14 Jan 86).....	54
Evacuation Plan Discussed for Nuclear Plant Area (Rio De Janeiro O GLOBO, 19 Jan 86).....	55
Briefs Chaves Defends Program's Continuance	56

NEAR EAST/SOUTH ASIA

INDIA

Bhagat Answers Questions on Rajiv Statement (New Delhi PATRIOT, 4 Dec 85).....	57
---	----

PAKISTAN

Commentary Alleges India Has Tactical Nuclear Capability (Nazir Naji; Lahore NAWA-E WAQT, 3 Feb 86).....	58
---	----

Briefs Talks on French Reprocessing Plant	60
--	----

SOUTH AFRICA

Koeberg Nuclear Refuelling Soon (Johannesburg THE CITIZEN, 16 Jan 86).....	61
---	----

Briefs Power Reduced for Reloading	62
---------------------------------------	----

USSR

Specialist Discusses Tokamak Progress, International Cooperation (B. Kadomtsev Interview; Moscow IZVESTIYA, 1 Dec 85).....	63
---	----

WEST EUROPE

SWEDEN

Nuclear Waste Begins To Be Stored in Sealed Rock Caverns (Bjorn Anderberg; Stockholm DAGENS NYHETER, 11 Jul 85)....	67
Weapons Grade Plutonium Seen Resulting From Waste Storage (Stockholm SVENSKA DAGBLADET, DAGENS NYHETER, various dates).....	69
Fuel Waste Storage Danger	69
New Sealed Storage Method, by Henrik Ekman	70
Energy Minister Comments, by Bo M. Melander	71
'Swedish Model' Outlined, by Bo M. Melander	74
Danish, Swedish Opposition Group	77
Briefs	
Uranium Mining Activity Ended	79
Ringhals Plant Undergoing Rebuilding	79

PEOPLE'S REPUBLIC OF CHINA

CHINA'S NUCLEAR INDUSTRY EXAMINED

Economic Responsibility of Nuclear Establishment

Fuzhou FUJIAN RIBAO in Chinese 1 Nov 85 p 4

[Text] Beijing, 31 Oct (XINHUA)--China's nuclear industry, which had made significant contributions to the national security of this country and to world peace, is now entering its second phase. Most of its research and production capabilities are being directed to serve the economic development of China.

It is estimated that 80 percent of the products of China's nuclear instrument factories are being used for agricultural production and consumer needs; 80 percent of the construction and installation work force in the nuclear industry are now being used for urban and rural construction; in addition, research organizations and design institutes within the Ministry of Nuclear Industry have completed nearly 400 research and design projects which have produced positive economic benefits for the consumer industries. There is also an adequate reserve of nuclear fuel and other products required for the development of China's nuclear power industry. Early this year, in response to requests by officials of the State Council to "expand the scope of industrial applications based on nuclear technology," efforts to serve China's economic development have been further accelerated.

Nuclear Power Generation

Fuzhou FUJIAN RIBAO in Chinese 5 Nov 85 p 4

[Article by Zhuo Peirong [0587 1014 2837]]

[Text] Beijing, 4 Nov (XINHUA)--Today, a convention was held in Beijing in celebration of the 30th anniversary of China's nuclear industry. Attendees of the convention include model workers of the nuclear industry, representatives from advanced groups and advanced units, and concerned citizens of the nuclear community.

Representing the Central Committee and the State Council, Comrade Li Peng extended his warm congratulations to the pioneers, the party officials,

the scientists and engineers, the technicians and other comrades working in the nuclear industry. He also expressed his sincere greetings to the model workers and representatives from the advanced groups and units.

Comrade Nie Rongzhen asked his deputies to convey his greetings.

The minister of nuclear industry, Jiang Xinxiong, gave a speech at the convention with the title: "Let us strive for innovation and make use of our past experiences; let us join forces in the struggle to develop China's nuclear industry." He said that by reviewing the hardships and achievements during the past 30 years, we can learn from our experience to guide our future development. He emphasized that the key issues of past achievements and future development are: party leadership, self-reliance and cooperation, establishing a team of ambitious and disciplined personnel, and developing objective scientific attitude and serious work atmosphere.

The chairman of the engineering committee of the National Defense Department Ding Henggao, the commander of the 2nd Artillery Corps of the People's Liberation Army Li Xuge, and Vice Admiral Zhang Xusan all expressed their thanks to comrades in the nuclear industry for their efforts in modernizing China's military forces; they also wished them continued success in their new mission of economic construction.

During the convention, awards were given to 207 model workers, 107 advanced groups, and 22 advanced units of the nuclear industry.

Beijing, 4 Nov (XINHUA)--In a speech delivered at the convention celebrating the 30th anniversary of China's nuclear industry, Vice Premier Li Peng emphasized that in serving China's economic construction, future development of the nuclear industry should concentrate on nuclear power generation.

Li spoke highly of the achievements of China's nuclear industry over the past 3 decades. He said: "In developing nuclear weapons, we have made significant contributions to the security of this country and to world peace. We have established an integrated system of nuclear technology and nuclear industry, and built a firm foundation for the peaceful use of nuclear energy. Now, the industry is entering a new phase where on the one hand it will continue to serve the needs of modernization of China's national defense, on the other it will shift its primary technical and industrial resources to economic development to further promote the peaceful use of nuclear energy. Comrades of the nuclear industry, let us explore this new era with confidence just as we did in the pioneering days!"

Li pointed out that nuclear power is an advanced energy source. We should strive to develop this energy source within this century and accelerate the development into the next century. The nuclear industry is expected to play a major role in developing nuclear power.

He also pointed out that the scope of applications of nuclear technology in economic construction and consumer needs should be expanded. While encouraging results have been obtained in the areas of medical treatment, food preservation, agriculture, and measurement technology, the range of applications should be further extended. The use of nuclear technology should go beyond the stage of research and prototypes and should produce practical benefits to economic construction and consumer needs.

In closing, Li said that the Ministry of Nuclear Industry should diversify its resources to different industries. Its labor force in construction and mechanical processing should be shared by the society, and its powerful team of technical experts should be made available for consulting and other activities.

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PEOPLE'S REPUBLIC OF CHINA

CHINA'S STAND ON NUCLEAR COOPERATION REITERATED

Fuzhou FUJIAN RIBAO in Chinese 11 Nov 85 p 4

[Text] United Nations, 8 Nov (XINHUA)--During today's special session on "A Report by the International Atomic Energy Organization," Qian Jiadong [6929 0857 2639], a special consultant to the Chinese delegation at the United Nations, reiterated China's position against supporting, encouraging, or helping other countries develop nuclear weapons.

Qian Jiadong said: "In cooperative efforts with other countries, the Chinese Government has taken measures to ensure that peaceful nuclear projects will not be redirected for military purposes. China's stand in this matter is firm and uncompromising. The accusations made by some people on this issue are completely unfounded."

He also rejected rumors about nuclear cooperation between China and South Africa. He said: "Everyone knows that the Chinese Government has always been strongly opposed to South Africa's apartheid and racist policies." China "has never had any association with the South African Administration, not to mention nuclear cooperation. This is a fundamental position of the Chinese Government which cannot be changed by people with ulterior motives."

Speaking at the General Assembly, representatives from the United States, Indonesia, Finland, Luxemburg, Democratic Germany and Czechoslovakia all praised China's recent announcement to submit several of its civilian nuclear facilities to the International Atomic Energy Organization for inspection and safeguard measures.

In today's closing session of the 40th General Assembly, a resolution was passed to urge all nations to participate in "effective and harmonious international cooperation" in order to promote the peaceful use of nuclear energy and the application of nuclear technology."

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PEOPLE'S REPUBLIC OF CHINA

CHINA'S NUCLEAR EXPORTS, INTERNATIONAL SAFEGUARDS DISCUSSED

Fuzhou FUJIAN RIBAO in Chinese 14 Nov 85 p 4

[Text] Beijing, 13 Nov (XINHUA)--A spokesman of the Ministry of Foreign Affairs said today that requests had been sent to nations which receive nuclear exports from China to accept safeguards of the International Atomic Energy Organization.

He said that the Chinese Government had made this point very clear.

During a news conference this afternoon, a newsman asked about China's reaction to a report in the 10 November edition of the SUNDAY THAMES, which quoted U.S. Senators Cranston et al as saying that China is exporting nuclear technology to Pakistan, South Africa, and Iran. The paper also suggested that the 46 U.S. Congressmen were justified in accusing Reagan for signing a nuclear pact with China.

The spokesman pointed out that the concerns raised by the U.S. Congressional members were completely groundless. He reminded the reporters that the Chinese Government had made repeated statements that China neither encourages nor participates in nuclear proliferation, nor does it provide assistance to other countries in developing nuclear weapons. He said: "In the area of nuclear cooperation with other countries, which include France, West Germany, the United States, Brasil, Pakistan, and Japan, whether these programs are already ongoing or under negotiation, they will be limited to peaceful use only; this policy is true today and will be true in the future." He emphasized that China and Iran do not have such a cooperative agreement; as for South Africa, China has no diplomatic relation whatsoever, not to mention nuclear cooperation.

Also during today's news conference, a spokesman of the Ministry of Foreign Affairs announced that at the invitation of President Mobutu of the Republic of Zaire, the Minister of Commerce Liu Yi will represent the Chinese Government to participate in the celebration of the 20th anniversary of the Republic of Zaire in Kinshasa on 24 November.

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DAYA BAY FUEL COULD BE DOMESTICALLY PRODUCED BY 1993

HK130842 Hong Kong SOUTH CHINA MORNING POST in English 13 Jan 86 p 6

[From the "South China Beat" column, based on research by Albert Chan and compiled by Timothy Jim: "Beijing Aims To Make Own Fuel by 1993"]

[Text] China hopes to produce its own fuel for the Daya Bay nuclear plant in 1993--one year after the plant is to go into operation.

According to the contract with the French reactor manufacturer, Framatome, China is obliged to buy the first load of uranium fuel from Framatome but it is then free to choose its own suppliers.

As about a third of the first load of the French fuel has to be replenished annually, it means theoretically the first load will be consumed in three years. It also means the Daya Bay plant may be using fuel produced on the mainland 12 months after commissioning when the first reloading is scheduled to take place.

A senior Chinese official with the Guangdong Nuclear Power Joint Venture Co says the main advantages of getting nuclear fuel in China are cost and safer transportation. He also said the contract with Framatome stipulates that the first load must come from France to ensure the reactors start up smoothly. This is also necessary because the uranium used for the first load has different properties from regular fuel and the French have years of experience in nuclear plant commissioning.

Another advantage of using French fuel for the first load will be in helping to spotlight trouble during the first couple of years of operation. It will be easier to establish whether any trouble stems from the reactors, the turbine generators or the fuel, if French fuel is used. However, because of cost and risk factors, China hopes to fuel the Daya Bay reactors with its own uranium as soon as feasible.

The Chinese official said that transportation of radioactive fuel from Europe to China involves a much higher risk than shipping it from closer by, Japan for example.

He cited the accident in August 1984 when a French cargo ship, the Mont Louis, which was carrying spent uranium, sank near Belgium. The higher risk would lead to higher insurance premiums and eventually to higher operational costs.

The Chinese official said that although the first reloading will only occur in 1993, a decision on where new fuel should be bought has to be made much earlier, probably three to four years ahead.

The fuel supplied by Framatome comes from another French company, Cogema, which is a nuclear fuel manufacturer that has access to uranium reserves in various places, including African countries and France itself.

China is currently working with Japanese interests to establish reserves of uranium in Tengchong County in the western part of Yunnan Province.

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PEOPLE'S REPUBLIC OF CHINA

HU YAOBANG, LI PENG MEET NUCLEAR SPECIALISTS

OW211606 Beijing XINHUA in English 1554 GMT 21 Jan 86

[Text] Beijing, 21 January (XINHUA)--General Secretary of the Chinese Communist Party Central Committee Hu Yaobang called on China's nuclear industry to produce more goods for civilian use and assist other industrial sectors.

Hu made the remark to 10 outstanding Chinese nuclear specialists at a meeting on peaceful use of nuclear energy here this afternoon. The meeting was also attended by Chinese leaders Fang Yi, Li Peng, Yang Shangkun and Hao Jianxiu.

The 10 experts are Jiang Shengjie, Wang Ganchang, Liu Xingzhong, Min Yaozhong, Huang Qitao, Yu Min, Lian Peisheng, Qian Gaoyun, Lu Dexian, and Sun Zuxun.

Hu said workers in the nuclear industry have made valuable contributions to the country. Due to their endeavors, China has beefed up its defense capacity with the development of its own nuclear weapons.

China has developed a basically integrated nuclear industry and trained a contingent of qualified nuclear technicians, a stage which, he noted, is significant.

Hu added that China's nuclear industry should produce more civilian-use goods and assist other industrial sectors.

Vice-premier Li Peng said the nuclear industry is confronted with the task of developing better, more extensive and peaceful use of nuclear energy.

Calling it one of China's fundamental policies, he said, "There are bright prospects for the peaceful use of nuclear energy."

To help other industries, China's nuclear industry should focus, among other things, on nuclear electricity generation, Li said.

The Vice-premier stressed that China should basically rely on itself while importing advanced nuclear technology.

State Councillor Fang Yi said China should foster a force of its own nuclear technicians and specialists, and strengthen the study of the peaceful use of nuclear energy.

Nuclear scientists and technicians should cooperate with universities and enterprises, so as to broaden the field of production.

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CANADA

STATUS OF URANIUM-PRODUCING INDUSTRY DISCUSSED

Toronto THE GLOBE AND MAIL in English 26 Dec 85 p B14

[Article by Oliver Bertin: "Luck, Vision Saved Uranium Firms"]

[Text] When Jane Fonda focused world attention on the nuclear industry with her 1979 movie, *The China Syndrome*, it helped precipitate a chain of events that Alan Lowell, vice-president of Rio Algom Ltd., describes as "the virtual decimation of the U.S. uranium industry."

That movie and the subsequent meltdown at Three Mile Island near Harrisburg, Pa., created such a regulatory nightmare that construction ground to a halt on half-completed nuclear power stations across the United States, leaving them as empty shells.

U.S. utilities were left with a five-year supply of uranium they could not use, and this led to an active spot market where fuel can still be bought for less than half the price it originally cost.

The U.S. mining industry fared no better. Production plummeted to about 11 million pounds from 44 million between 1980 and 1985, and many mines and mills were forced to close.

If there was any winner in the five-year debacle, it was the mining industry in Canada. Because of a combination of luck and foresight, companies such as Rio Algom and Denison Mines Ltd., both of Toronto, can look to modest growth through the 1990s.

They were lucky because Canada has been blessed with a wealth of low- and medium-cost uranium deposits, which have enabled the industry to fill the sales vacuum left by the closing of higher-cost U.S. mines.

They showed foresight because they decided many years ago to spread sales among customers in Japan, the European Community and Canada, and to insist on long-term sales contracts.

Largely because of the problems in the United States, Canada emerged last year as the largest uranium producer in the world, with production of 29.1 million pounds of uranium oxide and a 20-year order book exceeding \$10-billion.

Rio Algom's sales manager Richard Schwarz remains optimistic about uranium prospects for the future despite the woes in the United States. He expects the world market to grow by about 5 per cent a year until 1990 and by about 2.5 per cent through to 1995.

Canadian demand is forecast to grow to about 5.9 million pounds of uranium oxide by 1995 and remain at that level beyond the year 2000. This compares with demand of about 4.4 million pounds in 1985.

Uranium prices have been improving for several months, reversing a decline that started in 1980. Industry experts say prices will continue to improve for the foreseeable future because demand is outstripping supply for the first time in many years.

If industry forecasts hold true, the surplus of unsold fuel that has depressed the market will dwindle faster than earlier expected, and could be exhausted by about 1990.

Rio Algom is further protected by supply contracts that total about 115,000 pounds of uranium oxide and extend to the year 2020.

Denison has long-term contracts — with Tokyo Electric Power Co. Inc. and Ontario Hydro — that total more than 150 million pounds of uranium oxide and extend through to the year 2012.

The key to Canada's uranium future, however, lies in Saskatchewan's Lake Athabaska basin, where deposits are among the largest and richest in the world.

There has been so much development in Saskatchewan in recent years that it has raised total Canadian production by 24 per cent the first seven months of this year.

The Cluff Lake mine — owned 80 per cent by French-owned Amok Ltd. of Saskatoon and 20 per cent by the provincial Crown corporation, Saskatchewan Mining Development Corp. — has recently completed a major expansion that will enable it to produce about 1,000 tonnes of uranium a year.

This is dwarfed by the Key Lake

mine nearby, which has become the largest uranium mine in the world since it opened in June, 1984. President John Nightingale said the mine is producing about 4,200 tonnes of uranium a year from deposits that total 75,000 tonnes grading 2.5 per cent on average.

Ownership of Key Lake Mining Corp. of Saskatoon is shared by the provincial Government, the exploration arm of federal Crown corporation Eldorado Resources Ltd., and Uranerz Exploration and Mining Ltd. of West Germany.

The Key Lake deposits are dwarfed in turn by recent discoveries at nearby Cigar Lake. Not only are these proved reserves the largest in the world at 110,000 tonnes of uranium, but they are also 10 times richer than most.

This mine could come on stream about 1993 if the joint-venture partners decide to proceed.

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CANADA

RELIGIOUS GROUPS URGE MORE PUBLIC INPUT ON NUCLEAR ISSUES

Ottawa THE CITIZEN in English 27 Dec 85 p A5

[Unsigned article: "More Input by Public on Nuclear Issues Urged"]

[Text]

TORONTO (CP) — Decision-making on nuclear issues should be more accessible to the Canadian public, says a report commissioned by five religious groups.

In its 150 pages of findings released this week, the Interfaith Program for Public Awareness of Nuclear Issues concludes that, although nuclear energy is "an important and viable option among available energy resources," decision-making on its use should involve more checks and balances and be more open.

Set up after Canadian uranium exports to Argentina became an issue in the war with Britain over the Falkland Islands, the program was sponsored by the Anglican, Roman Catholic and United churches and Jewish and Baha'i communities. Hearings were held in October and November 1984 and a five-member panel examined several nuclear issues.

In calling for changes in existing decision-making processes, the report said there should be "more open and continuous debate" into

whether nuclear power should continue to be the major new source of energy for Ontario and whether safety measures in the industry are adequate.

Calling for "more genuine consideration of options for different energy futures," the panel said organizations whose main job is the delivery of energy "should not dominate the process of weighing alternatives for the future."

The report said that nuclear power "must not be examined in scientific and technical terms alone," adding that "the insights — both expert and lay — about social, economic, environmental and public-health dimensions of nuclear power are necessary in the decision-making process."

The report also said that a number of submissions cited the need to deal with low-level radioactive wastes, and "unless these wastes are 'cleaned up,' the climate of the whole decision-making process for nuclear energy in Canada will be clouded with public rancor."

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CANADA

PACT REPORTEDLY NEAR ON WASTE DISPOSAL RESEARCH

Toronto THE GLOBE AND MAIL in English 27 Dec 85 p B9

[Article by Ritchie Gage: "Pact Near on Research into Nuclear Waste Disposal"]

[Text] WINNIPEG

A four-year nuclear waste research agreement between Canada and the United States will likely be signed within weeks, according to an official with the U.S. Department of Energy.

Patrick Wilkey, a Chicago spokesman for the U.S. nuclear waste disposal program, expects the pact to be signed before the end of January. He said his country wants to participate in the rock research near Lac du Bonnet, Man., because Canadian expertise will speed its own efforts.

(The United States has more nuclear electricity generating plants than any country in the world and more radioactive waste. It wants a solution to its disposal problems by 2006.)

The pending agreement will be a shot in the arm for the Manitoba project, which employs about 45 people. It will also be recognition for Canada's research expertise in this sector.

The commercial manager of Atomic Energy of Canada Ltd., Ray Sochaski, who works at the province's Whiteshell Nuclear Research Station, said he expects the agreement to be reached soon. Additional funds from the United States would give the research a big boost. About \$17-million of the program's \$19.2-million budget has

been spent.

The Japanese Government has also shown interest in the program, Mr. Sochaski said.

AECL has amassed data on the potential of granite rock as a permanent storage vault for radioactive residue. Spent fuel, consisting of uranium capsules, must be stored for at least 500 years. It is currently stored under water at most Canadian and U.S. nuclear plants. The ultimate solution is to bury the waste permanently.

The research program is fundamentally a mining project. Researchers have bored and blasted a fifth of a mile into the granite. This allows scientists to test computer models of waste storage. Because water migration is the only way radioactivity can escape, hydrology data have formed a major part of the information base.

The U.S. contribution will provide the funds to push the shaft an additional fifth of a mile into the 300 million-year-old rock and facilitate further experiments.

Egon Frech, a public affairs spokesman for the program, said Government-owned AECL is convinced that rock burial is the answer to the disposal problem, but that the company's scientists "want an answer to every conceivable question which could be asked about disposal of radioactive waste."

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CANADA

AECL SEEKS TO BUILD NEW-STYLE REACTOR AT CHALK RIVER

Toronto THE GLOBE AND MAIL in English 4 Jan 86 p A13

[Text]

OTTAWA

The federal nuclear power regulator has been asked to approve construction and installation of a new kind of reactor at Chalk River Nuclear Laboratories near Petawawa, Ont.

The Atomic Energy Control Board said in a statement that Atomic Energy of Canada Ltd. wants to build and operate a prototype of the reactor, dubbed MAPLE for Multipurpose Applied Physics Lattice Experimental.

The new reactor is aimed at international markets, AECL told the board in its notice of intent, the first stage in the licencing process. The board approves construction of all reactors in Canada and monitors their operation. AECL, a federal Crown corporation, currently operates four research reactors at Chalk River, about 160 kilometres northwest of Ottawa.

If permission is received and the reactor is built, MAPLE will demonstrate the concept's workability

and will also be used to produce radioisotopes for medical, industrial and research applications.

The MAPLE reactor will use a somewhat different concept than the other type of Canadian reactor, the Candu. It will use an open-tank-type reactor assembly within a light-water pool. The core is light-water cooled and moderated but includes a heavy-water reflector.

The Candus, Canada's only commercial-size reactors, use heavy water for cooling and moderation of the reactor process.

The MAPLE will use low-enriched uranium fuel, operating at thermal power levels up to 20 megawatts. That level is about 1,000 times more than the most common Canadian research reactor, the Slowpoke.

Once the regulatory process is clear, AECL plans to locate MAPLE in a separate building adjacent to the NRX reactor building at Chalk River. It will share services with the 40-megawatt NRX, which began operation in 1947.

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CANADA

BRIEFS

URANIUM DUST RISK STUDY--Ottawa--The Atomic Energy Control Board has commissioned an \$850,000 study on the health effects of breathing air laden with uranium dust to find out more about the hazards of uranium mining. The five-year project, which will be reviewed by an independent panel of experts from other countries, is described as one of the first major attempts to document the effects of radioactive uranium dust. Text Toronto THE GLOBE AND MAIL in English 26 Dec 85 p B14/ /12851

CSO: 5120/28

BULGARIA

MINISTER INTERVIEWED ON ENERGY SITUATION, RESOURCES

Sofia OTECHESTVO in Bulgarian No 21, 12 Nov 85 pp 8-11

[Interview with Nikola Todoriev, minister of energy, on the occasion of the 13th Party Congress by the magazine OTECHESTVO; date and place not specified; "Energy Alarms, Energy Hopes"]

[Text] [Question] Comrade Todoriev, what energy raw materials of its own does our country have at its disposal and how are they being used?

[Answer] Nature has endowed us with very few energy resources of our own. The black coal that has been discovered, for example, is just enough in respect of quantity and qualities to say that we have any. Our brown coal--Pernik, Bobov Dol, Burgas--is also scarce. But its qualities are low, too. If we are not unique, we are at least one of the few countries that use in their thermoelectric power plants fuel with ash content of the order of 60-62 percent. This naturally gives rise to problems. The ash is highly abrasive, the equipment and heating surfaces deteriorate, and the breakdown rate of the steam generators is correspondingly great.

Another native raw material is lignite, the bulk of which is to be found in the Eastern Maritsa field. But here a refinement is necessary. The Americans designate as lignite coal which has a calorific value even over 4000 kilocalories per kilogram. In the GDR, the highest consumer thereof in Europe, its calorific value is 1800-2200 kcal/kg, with admixtures few and mainly sand. Our lignite yields 1150-1450 kcal/kg. If you squeeze a small lump of it in your hand and hit it against the wall, it clings there--oily, sticky clay, which makes it difficult to convey, pulverize, etc. Nevertheless, with the help of the Soviet Union we have begun to use this coal--now 20 percent of the country's electric power is obtained from it in the "Maritsa-Iztok" Complex. Hence the policy of developing native resources is absolutely right. Years ago a number of specialists--Bulgarian and foreign--asserted categorically that Eastern Maritsa lignite was clay and nothing could come of it. Someone had to manifest foresight and decide, "It will be developed!" The person who did this was Comrade Todor Zhivkov.

Some persist in thinking that Bulgaria is rich in water sources. But we are the water-poorest country in Europe, poorer than all our neighbors. That is why our country is setting about building an alpine series of hydroelectric power stations, with great water diversions running many kilometers to collect even the tiniest brooklets. Our hydroelectric plants are not built to operate

on flowing water with a relatively constant discharge, for our rivers are small and become deep mainly during the melting of the snow. That is why our hydroelectric power plants are mostly situated on dam lakes. Our dam lakes serve multiple purposes--irrigation, industrial and drinking water, production of electric power. The proportion of hydroelectric power is not large but, by way of compensation, it is very valuable, for it is used to meet peak loads around the clock (a hydraulic turbine is started up very rapidly and at once takes up the load).

[Question] What impact has the drought of several years had on our country's water resources?

[Answer] This drought is a veritable disaster for Bulgaria. Our dam lakes now have water volumes below the permissible minimum at which operation of the electric power plants is authorized. Moreover, some of the series of hydroelectric power plants have dam lakes that cannot be filled in a single winter, with the result that we shall feel the drought even two or three years later with normal precipitation.

[Question] Bulgaria has outstripped many countries in the building of atomic power plants. What necessitated the development of atomic power at such a high rate?

[Answer] Shortage of our own resources and continuously increasing consumption of electric power due to industrialization of the country and an ever higher living standard. This growth of consumption had to be met from somewhere. Moreover, the party position on an overtaking rate of development of our power supply has always been and remains urgent, with the result that we had to resort to atomic power plants. But they have not been welcomed cordially. On the contrary, there have been many opponents and there has been almost no atomic-power-plant operating experience in the world. Atomic power plants have been constructed in only 20 countries. Indeed, it took both boldness and foresight to give the green light to the policy for which today there is no alternative. At that time the atom was still associated in people's consciousness with one of the grimmest and most devastating events of World War II. And once more Comrade Todor Zhivkov with his characteristic flair for innovation succeeded in assessing the part atomic power plants would play in our future development and in taking a firm stand for them. Thus Bulgaria became the first in the Balkans to build an atomic power plant. Today we produce one-third of our entire electric power at "Kozloduy" Atomic Power Plant. In terms of this yardstick, only five countries in the world have outstripped us.

[Question] There are certain hazards involving violation of the ecological equilibrium by some activities in power engineering. I refer not only to the hazard of radioactive contamination, but also to the damage done to the landscape during the building of a series of hydroelectric power stations.

[Answer] Truth to tell, in the beginning no attention was paid to the ecology. Later on, however, things changed radically. Now tunnels, mainly, are built in order not to affect the landscape. Wherever there are canals, they are mandatorily covered, planted to grass, reforested, etc.

But the atomic power plants are less harmful to human beings than a single X-ray examination in the hospital. The radiation background at "Kozloduy" is three times as low as in Sofia. (Don't be alarmed, it's far below permissible norms in the capital, too.) The reason for the great difference lies in the exceptional measures against radiation contamination of the environment taken early on in the planning of the atomic power plant.

To be sure, radiation is no joking matter. That is why every atomic power plant is equipped with many means of defense. Otherwise, its operation simply would not be permitted. And, in connection with the use of nuclear fuel, let me remind you that a World Agency for the Peaceful Use of Atomic Energy exists. It has its inspectors everywhere and uses modern means of monitoring. In the reactor compartment of the "Kozloduy" Atomic Power Plant there is installed a sealed camera to keep track of the motion of the nuclear fuel. The camera is actuated only on the command of the inspector observing the power station, who has his headquarters in Vienna. Only he can remove the exposed reel from the camera during his periodic on-the-spot checkups. The international monitoring is very strict. And I would remind you that the last session of the National Assembly adopted a special law stricter than any similar laws in the other countries using atomic energy for peaceful purposes.

[Question] What is done with radioactive wastes and spent fuel? There have been hazards also involving thermal pollution and plans are now being made to increase capacities. . .

[Answer] Solid and liquid radioactive wastes are collected in special storage places serviceable for operation throughout the life of the power plant. As regards spent fuel, we are in an especially favorable position--we return it in a special container to the Soviet Union.

A special expedition, organized through CEMA to investigate the radioactive contamination of the Danube, has found that the "Kozloduy" Atomic Power Plant does not contaminate the river. So-called thermal pollution, however, is inevitable at such capacities. But since the amounts of water are huge, the temperature rise of the water is comparatively small. When the river level dropped, as it did this year, 1 or 2° variations may result. We do not exceed any permissible norms whereby we would harm the flora and fauna in the region.

[Question] Let us return from the ecology to the economy. The energy difficulties that our country has experienced and is experiencing are no secret to anybody. Let us once more seek the reasons for these; let us talk about the lessons that have been learned and the measures taken.

[Answer] The difficulties are overwhelmingly of a temporary character--the drought which deprived us of hydroelectric power plants, the long and severe winter, delays in putting some new capacities into operation, the shortage of our own gaseous and liquid fuels. We have some power plants which by now have each operated 25-30 years and which are both obsolete and outworn, given which objectively they operate at a higher breakdown rate.

Nor are the subjective weaknesses for the occurrence of troubles few. One of these is the lapses in the maintenance and operation of the power plants.

That is why this year we have channeled considerable resources into the repair of basic capacities. The volume thereof is 70 percent larger than last year. This has created complications in power supply during the summer season, but we have thus assured a better winter season. The repair campaign is continuing along basic lines.

To the subjective weaknesses let me add also excessively low discipline. There is some slacking and we are taking special measures against it. But we must look at the alarming facts from another angle as well. Labor in the energy sector is hard--continuous production process, different days off, underground work of miners, some unsolved material questions. That is why it is difficult to recruit and retain personnel--the result is considerable turnover. In one power-generating unit--and especially the atomic power-generating units, there is more electronic equipment than in some machine-building plants, but we cannot attract and retain electronic specialists. That is why recently a decree was adopted whereby the pay of miners and power workers was increased by 15-20 percent, additional remuneration was provided for, alleviations in pensioning, etc.

Let us go on with discipline. We have management personnel whom we have torn to pieces with criticism; yet the questions do somehow end up with them--downwards: the shift, the power-unit duty officer, etc., care only to have their working time come to an end and get away. Things which until recently were incomprehensible in power engineering. It is not just a matter of pay. Surely work with people has been neglected, too; surely the question of choice of vocation is of significance, too; and surely you, too, as journalists bear a certain blame--little is written about the hard and responsible occupation of power workers and miners.

[Question] What determines the establishment of the conditions of power consumption?

[Answer] Power engineering has characteristic features of its own. It has no stockpiles. The moment of production coincides with the moment of consumption. Therefore power engineering is controlled in centralized fashion. Even our limited resources would have been sufficient if consumption were but evenly distributed around the clock. But you know that is not so; power consumption peaks occur in the morning and evening. At that time for a period of 6-7 hours a capacity balance cannot be met. There are no hydroelectric power stations that have a 20-percent share and that are, besides, suitable as switching installations for regulating the power system. That is why the peaks must be "trimmed down."

[Question] Can we assume that as regards operating conditions we are at a holding point, i.e., we do not permit the overall situation to worsen so that we can count on improvement?

[Answer] In September, due to repairs and the reasons already enumerated, barely half the available capacities were in operation. The repaired capacities are already in service and we are progressing. But the lack of VETs [hydroelectric power plant] reserve will continue to be felt. A motor vehicle can move

on four tires, but has a full set of five. At one time or another you will puncture a tire--a pipeline in the boiler will burst and the turbine will stop, and then we must have something to take up the load.

[Question] Another exceptionally important question is the economical consumption of electric power. Let us begin with your sector. What is the consumption of electric power for your thermoelectric power stations' own needs? What is being done to reduce losses in the carrying of electric power?

[Answer] The efficiency of our thermoelectric power plants tallies with their rated indicators. Those that operate with imported fuel operate with indicators such as are achieved in the countries supplying the equipment. This is not so, however, with the stations fired with native coal. Even there we are making progress. For example, at the "Dimo Dichev" thermoelectric power plant where our new technology is used, consumption for our own needs are nearly half those at "Purva Komsomolska" thermoelectric power plant. But it is technically impossible to achieve the 7 percent of the "Varna" thermoelectric power plant. A power plant at "Maritsa-Iztok" with capacities equal to the "Varna" thermoelectric power plant must process five times as much coal and release 10-15 times as much ash and scoria as the "Varna" thermoelectric power plant.

Ultimately production cost determines efficiency. And the electric power that we produce from "Maritsa-Iztok" has a comparatively low production cost.

[Question] What are the latest data on our electric power consumption and how do they look in comparison historically and with the data of other European countries?

[Answer] The Ninth of September found Bulgaria with an annual per-capita consumption of 45 kwhr. To be more graphic, as much as a 1000-watt hotplate would consume in operating for 45 hours. Last year we already had 5260 kwhr per capita. This year the situation will be almost the same. In electric power consumption we have caught up with the advanced countries in Europe.

During the energy crisis in the 1970's the Western world, which is rich in its own resources, introduced draconian measures, combined with economic controls, for the purpose of their economical consumption. And they worked successfully. We are a little late with the measures. But it is by now as plain as can be that efficient use of energy has to be recognized as one of the general thrusts of our energy policy. And our potentials on this score are actually large.

The February Plenum of the BCP Central Committee raised frankly and categorically the question of the necessity for structural changes in the economy and in technologies. We must develop industry whose requirements can be met with the resources that we have. But we must not harbor illusions that such changes take place all of a sudden and that we are going to call a halt now to enterprises with a large electric power consumption. The realistic course is different. First we are required to stabilize the existing industrial technologies and they must fit into the established consumption norms. At the same time we must modernize them or replace them with new ones that consume less

energy for the same production. The potential reserves are great in the household sector, too. Consumption here has likewise grown appreciably, coming to 20 percent of the total volume, and together with the municipal sector to almost one-third. These are the figures for some of the most advanced countries, which, in contrast to us, have many cheap sources of energy. Since we do not have gaseous and liquid fuels, which are handiest for heating and cooking, the use of electric current has grown sharply. Even in the countryside where people used to love a roaring fire in the stove, there has been a changeover to electric radiators.

Advanced countries have begun abolishing overhead illumination and have changed over to local. Perhaps it does indeed create more coziness, but surely economies have something to do with it. Just go to the TsUM [Central Department Store] and have a look at the lighting-fixture. Our designers have racked their brains, it seems, over how to shade the electric lamp to the utmost rather than how to make optimum use of its light. Just see what we have come to in our present standards. A workshop is 100 meters long and 40 high, but the total illumination is overhead, lamp to lamp. Only two machines operate on the second shift, but the entire premises are lighted and heated. Yet resource-rich countries have introduced local illumination and local heating here too in order to economize.

[Question] In your interview on Bulgarian television and in the newspaper RABOTNICHESKO DELO you said that if the mass information media gave as much attention to energy problems as they do to water, you would be happy. What were your reasons for this?

[Answer] There is hardly a day when something is not written or said about economical water consumption and about the waste thereof. Perfectly right. The power consumption situation is likewise alarming, yet the necessary attention is not paid to it. But something has to be said, for example, to propagandize and inculcate economies. These habits must be created early in childhood. Maybe we are tardy, but we have now worked out lectures which must be delivered during the classroom teacher's hours in all schools. Children are more conscientious than adults. The Czechoslovak comrades in the evening during the minutes for the Sandman are urged to extinguish unnecessary illumination or turn off the superfluous appliance and the children indeed jump up at once and begin to put them out. Let me tell you about a curious instance. My physician acquaintance had gone for specialized training to Sweden, a country so rich in cheap energy resources that even its superhighways are illuminated. And in the laboratory only the laboratory assistant's table lamp was lit up. The Bulgarian asked what all this meant and she (the laboratory assistant) showed him the morning newspaper where in a corner in quite small letters it said, "Due to unforeseen failures, please switch off everything that is not needed." And that's all there was to it.

[Question] Obviously, in addition to propagand work, at least at this stage, penalties for electric power wasters will also be necessary.

[Answer] This autumn and winter limitation of consumption in industry is anticipated. Moreover, take note that strict penalties, including penalties

affecting the wage fund, will be imposed for the consumption of more power. Monitoring has also been intensified.

[Question] Inasmuch as there is a question of consumption monitoring, we should like to ask whether there is sufficient equipment to report the electric power that is consumed in industry.

[Answer] Unfortunately, this question still has not been definitively solved. There are not enough meters. It is anticipated that the number thereof will be increased. They will report not the enterprises' total consumption (it is metered right now), but the consumption of large machines and individual production lines. How are you going to compel a brigade to make economies if it doesn't know how much its section is spending? If one workshop economizes but the other overconsumes, the one that saved gets as much as the wastrel. But let us be clear: the problem will not be solved in a year or two. A great deal has been let slip by.

[Question] And will individual flowmeters be installed for centrally heated households?

[Answer] To date buildings have been constructed with vertical installations for central heating, which will prevent metering the thermal energy used by individual apartments. This is what is done for public buildings. For the entire housing block such general metering creates no incentives for individual families. As for regulators, a few thousand of them have been installed in Sofia. At all subscription stations, heat-regulating systems are now mandatorily installed. In the future it is anticipated that individual radiator regulators will be installed. I want to note that, beginning this year, in checking complaints about abnormally low temperatures in centrally heated dwelling units we will first of all look to see whether the windows are sealed. Unless they are, no action will be taken on the complaints. Our metering shows that in big cold spells good sealing, especially in paneled apartments, raises the temperature 2-3°.

[Question] May we place our hopes on new energy sources?

[Answer] Let me disillusion you a little although it is the "in" thing to speak of them. The most optimistic forecasts indicate that by the year 2000 solar energy's share--and only in certain countries at that--will amount to 2-3 percent. We, too, have a program; the new energy-source combine is working in our ministry. It produces solar collectors, heat pumps, and installations for the utilization of hot mineral waters. The matter of so-called secondary energy resources is quite different. Our country has many at-present waste-heat sources--furnaces, heat exchangers, drying chambers, etc. There are ways of using this energy, at least for in-house purposes of the enterprise in question. The use of new energy source will continuously increase.

[Question] What are the commonest outlooks for the development of the Bulgarian power supply during the present and the next decade?

[Answer] By 1990 atomic power plants' share of electric power will most likely amount to 40-42 percent, and in 2000 to 60 percent. In no event, however, will this form of power supply be developed alone. It operates under a basic load, and other, more maneuverable capacities are required to regulate the system. Such, for example, are the capacities of "Chaira" PAVETs [Pumping-Storage Hydroelectric Plant], which is now under construction. Additional capacities will be built at the "Maritsa-Iztok" Complex. Large cities in Southern Bulgaria will be supplied with heat by lignite-using power plants alone. The development of hydroelectric plants will continue although there are few hydroelectric sources not already included. Under construction to the Soviet Union via Romania is a 750-kilovolt power line, which will enhance the security of the national power system.

Speaking of prospects, let me point out once more the importance of efficient power utilization. Our experience teaches us that even the best monitoring system has never saved the situation unless the objectives thereof become everybody's conviction. Therefore, let us conclude with a wish: may the progress of the Bulgarian power supply become the cause not only of our sector, but of our entire economy, of every Bulgarian.

The editors thank Minister Nikola Todoriev for the explanations he has made. We understand that in a single--albeit long--conversation it is impossible to cover all the most acute problems and to discuss in detail the objective, as well as subjective reasons for power difficulties.

The magazine OTECHESTVO has opened its correspondent's post at the Ministry of Power Supply. We shall keep track of the routes of innovations into practice and the implementation of the programs that have been mapped out; we shall study cases of an irresponsible attitude towards energy.

In the next issue: "At 'Maritsa-Iztok' on the Eve of the New Winter."

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BULGARIA

REPORT ON CONSTRUCTION OF NUCLEAR UNIT NUMBER SIX IN KOZLODUY

Pace of Construction Stepped Up

Sofia STROITEL in Bulgarian 20 Nov 85 pp 1,2

[Commentary by Todor Tanev, Minka Tosheva: "Outlined Against the Sky"]

[Excerpts] The slashing icy wind hastens their steps toward Power Engineering House in Kozloduy. People of varied professions have gathered in this original creation of Bulgarian builders and architects. They have come to extend warm greetings to the international youth brigade of hero of socialist labor Ivan Lichev of the Industrial Construction Enterprise. It is not a formal 15th anniversary celebration. It is a warm commemoration of completion of a creative process, unique assembly operations, and of the minutes and hours of testing and inspection of the sixth nuclear power unit.

Bulgaria needs to expand its power resources rapidly. Duty draws the young people back to the banks of the Kozloduy. They are carrying out one of the most important construction and assembly operations. In 2-1/2 years the brigade has assembled more than 5000 tons of metal structural elements and is completing an average monthly volume of construction and assembly work representing more than 1.4 million leva. It has completed erection of the dome of the 1000-megawatt reactor and has received a rating of excellent for this extremely complex assembly operation. On the eve of the October Revolution, Vasili Goremski's team installed the last 85-ton block of the dome cornice of the 5th power unit, making it possible to concrete the dome and cornice of the reactor section on schedule. There are currently more than 260 persons in the brigade, 70 of whom are Poles and 60 Vietnamese. Until recently there were also Cuban construction workers on the staff. Soviet specialists are rendering invaluable assistance to the brigade.

On 2 November, 5 days ahead of schedule, the brigade of hero of socialist labor Ivan Lichev completed assembly of the top of the reactor section cornice. The reactor shaft, the wet recharging shaft, and the cooling pond had already been checked off the list. After working intensely around the clock, the brigades of Marin Popov, Nartsis Monov, Todor Todorov, Stoyan Aleksandrov, and Milcho Gergov in the group headed by Stoyan Vladimirov had completed the construction work connected with the outer structure (the unsealed part of the reactor section) up to elevation 41.40 meters.

Lastly, the construction work and metal structure assembly was completed in the machine room. This work was done by the brigades of Zlatko Stoyanov and Yordan Mikhaylov.

The inaugural event during the days of the glorious 68th anniversary was pouring the bedplate of the 6th unit's turbine foundation. It began at 1100 hours on 2 November and ended on 8 November.

On more than one occasion the staff had to perform complex and important tasks in an extremely short period, and more than once it had to fight off enormous physical and mental tension at great heights in order to complete their tasks with honor. The unique experience gained in constructing the 5th unit, in continuous three-shift operation, and in reaching a fast pace not previously achieved not only has elevated the occupation of construction worker but will also serve to speed up the construction work on the 6th unit.

The labor and management personnel have become accustomed to the idea that the 6th unit must be built twice as fast as was the 5th.

The pouring of concrete for the foundation bedplate for the 1000-megawatt turbine was accordingly the first test, the first serious verification of the readiness of the entire staff of the Plant Construction industrial enterprise in Kozloduy to shoulder responsibility for the new and extremely important task.

I headed for the machine room of the 6th unit in the early morning hours of the first day of work after the holiday. It was quiet at the site. There were no construction workers or supervisors there. This was a day of rest for them. The gigantic one-piece concrete block, the turbine foundation, had been covered to keep it warm. The 90-day period needed for mitigation of the difficult temperature conditions had begun to run.

A literal battle to complete the important and responsible task had been in progress 2 days earlier.

For 6 days a track was worn between the concrete plant and the machine room. On each shift 16 concrete trucks shuttled back and forth, one after the other. The uninterrupted jerky thumping of the concrete pumps made it clear from far off that something noteworthy and on a large scale was taking place here at elevation 3.60.

The work was followed closely by the most responsible construction supervisors, engineer Oved Tadzher, engineer Marin Gankov, engineer Dimitur Din-kov, and engineer Todor Topalski.

On 7 November itself, while the workers were demonstrating in towns and villages, the concrete pouring was coming to an end. Victory was achieved at 1500 hours on 8 November.

"We are waiting for the last concrete delivery truck," were the excited words of technical director Vasil Nikolov speaking to me over the telephone. From the first cubic meter to the last we didn't stop working for a minute, even on the days when the spring rains fell. Comrade Tadzher is here with us now. He congratulated us on this great success."

A flash bulletin reporting completion of the task ahead of schedule was posted in conspicuous places the same day. All those who took part in the concreting and in the establishment of efficient organization had given an excellent account of themselves.

Two days after the concreting I spoke with the director of the enterprise, engineer Todor Topalski. When I asked him for his assessment of the organization of the work, he replied, "we knew just how large and important a task it was to pour the concrete for the turbine foundation bedplate. It was the most critical operation in this stage of machine room construction, firstly because of the large volume (5200 cubic meters of concrete), and secondly because of the continuity of execution required by the plans and specifications. We had already gained experience with the 5th unit, and so we concentrated our attention on the preliminary preparations. This enabled us to finish 4 days ahead of schedule without a single lapse during execution. I can say that the organization was flawless."

All that remains is for me to assess our accomplishments. The experience gained from them will serve us as a guide in our future work.

A substantial contribution to the efficient organization and the quality of workmanship was made by the construction laboratory headed by engineer Valentina Stoyanova, who said, "to meet the requirement of continuity of operation, we must assure precise timing all along the chain, from concrete mixing plant to concrete delivery trucks, concrete pumps, and production elements. Provision was made for bringing in standby equipment in the event of breakdowns. Snezhana Doneva, who monitored project execution, stayed with us until the last day of the concreting."

During the 6 days the construction laboratory took 600 samples to demonstrate the strength of the concrete and an additional 500 to monitor its consistency.

The concrete will continue to be inspected for a full 90 days after the date on which it was poured, to monitor and maintain the favorable temperature conditions stipulated in the specifications in order to avoid cracking of the concrete slab.

During the concreting, Dimitur Dinkov, construction foreman, had this to say about the schedule for completion of the machine room and tasks in the coming year: "The decision to concrete the bedplate for the turbine foundation by 7 November was made at a meeting with the activists at the beginning of October. This concreting had been scheduled for February 1986. The successful completion of this critical task creates conditions for completing construction of the machine room ahead of schedule."

Soviets Ship Shell for Bulgarian Reactor

Sofia POGLED in Bulgarian 4 Nov 85 p 6

[Commentary: "More on the Bulgarian-Soviet Atomic Dynasty"]

[Text] The nuclear reactor of the 5th power unit, the first 1000-megawatt generating set outside the Soviet Union, is standing firmly on Bulgarian soil.

The news was reported to the Moscow bureau of POGLED by Georgi Shumanov, a representative of the Bulgarian foreign trade company Tekhnoimport. The message read: The shell of the nuclear reactor earmarked for the 6th unit of the Kozloduy nuclear power plant has been completed ahead of schedule at the Izhorski plant in Leningrad. The operation of transporting the shell for its delivery to Bulgaria has begun. It has now reached Ilichovsk. The 4 steam generators for the 6th unit have also been finished ahead of schedule. One of them is also at Ilichovsk.

Scope of the Operation

A half-hour after the telephone conversation with Shumanov in the office of the Tekhnoimport company, another call was placed to Sofia, where there quite naturally interest in the movement of the nuclear equipment. The only concern for the time being is occasioned by the fact that the water level of the Danube has dropped in recent days, and the consignment shipped not only is out of the ordinary but is also among the heaviest.

The complexity of the transport operation can also be gaged by the meticulous care and precision required in the manufacture of equipment such as this. "The shop at the Izhorski plant where nuclear reactor shells are assembled is exactly 1 kilometer long," we were told by Shumanov, "but I mention this only to give an idea of the scope of the work. The manufacturing technology is much more important and difficult." In fact, the shell is assembled from a large number of forged metal rings. Inasmuch as they are to operate under extreme temperature and pressure conditions, not even the most minute flaw can be permitted in the weld seams. Every millimeter meter of a seam is checked by means of ultrasound and a magnetic field and is passed through x-rays and a flaw detector. This repeated and rigorous inspection obviously adds greatly to the cost of production, but this is the only way to guarantee the extremely high level of safety typical of Soviet nuclear reactors.

Their design calls for a standby emergency system such that neither man nor environment will suffer even if the improbable happens.

An Additional Touch

There are currently 303 nuclear reactors in operation in 25 countries. According to information from the International Atomic Energy Agency, their power totals 275 million kilowatts and they annually generate 15 percent of the electric energy produced throughout the world.

Along with seven other countries belonging to CEMA, Bulgaria is in the family of "nuclear powers" and is an equal and active member of the socialist international organization Interatomenergo. Fyodor Ovchinnikov, the general director of this organization, said recently at a meeting with journalists accredited in Moscow that scarcely a decade earlier the most complex equipment intended for use in nuclear power plants in the socialist countries had been made exclusively in the Soviet Union. Now, he added, the products of nuclear machinebuilding are manufactured in 50 large plants and associations in 8 socialist countries. The Soviet Union and Czechoslovakia specialize in reactor production. Hungary turns out reactor repair equipment. Heat exchange equipment is manufactured in Poland. The GDR, Romania, and Yugoslavia provide cranes and special fittings. Materials for biological shielding of power plants are produced in Bulgaria, especially at factories in Radomir and Debelets. These materials are represented by special varnishes and doors (some of them even a half meter thick) used to isolate the highly restricted access areas of a power plant. These materials are also supplied to Tekhnoimport, and Shumanov stated in this context that Bulgaria is on schedule in meeting its obligations in this area. Nor have any complaints been received about defects or poor workmanship.

A Look at the Future

Specialists have estimated that a medium-sized city with 300,000 inhabitants requires around a trillion calories per hour for heating. Generating this heat by conventional means in steam boilers requires the burning of 400 tons of fuel oil. This estimate applies only to household needs; no allowance is made for industrial consumption.

It has also been estimated that heating needs will have doubled by 1990; that is to say, the consumption of fuel oil, coal, and natural gas burned in municipal boiler rooms will also have increased by this amount. And this will naturally also lead to greater pollution of the environment. But can't nuclear power plants also be used for heating?

Fyodor Ovchinnikov, general director of Interatomenergo, also has a comment on this problem. "The Soviet Union and the other socialist countries are extremely interested in this direction in nuclear power engineering. The summit conference of the CEMA countries adopted a program for development of nuclear power engineering to the year 2000, and under the program special attention is paid to nuclear thermoelectric power plants."

Two such thermoelectric power plants are currently under construction in the Soviet Union, one in Odessa and the other in Gorky. Although the latest nuclear technology is being applied in their construction, they have no complicated equipment and are easy to operate, and it is not mandatory for them to be built away from populated areas (the plant at Gorky is 10 kilometers from the city). The most important factor is economy. These power plants conserve 4 million tons of conventional fuel every year. "You can imagine," adds Ovchinnikov, "how much cleaner our cities will become. When there are nuclear thermoelectric plants, there will be no need for fuel oil or coal dumps and no need for special transportation. Nuclear thermoelectric plants will mean cities without smoke and soot."

The first unit in the series of standard nuclear power plants in service in the socialist countries was built in 1973 near Voronezh'. The renowned Voronezh' dynasty was instituted. Only 13 years have passed, and these plants are already in their third generation."

Military to Help Build Belene Nuclear Plant

Sofia TRUDOVO DELO in Bulgarian 12 Nov 85 p 1

[Article by Major Valentin Neshkov: "New Projects for Construction Troops--Belene Waiting for Military Builders"]

[Text] Construction of the second nuclear power plant has begun at a brisk pace. The dates for completion and commissioning the first 1000-megawatt power unit are also known. They are to fall in 1991.

The missions of the military construction workers in the unit in which officer Khristo Khristov serves were recently determined in greater detail. These troops are to build several important subsidiary facilities and the entire water supply and sewage network.

Certain difficulties have also arisen at the very outset and threaten to delay employment of the military construction workers. They are the absence of nearly 2 million leva in the planning estimates for the subsidiary facilities and the refusal by the Avtotransport economic organization to carry out production-related transportation of importance to the military unit.

Progress is also slow in solving the problems associated with planning and construction of the troop billeting encampment.

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BULGARIA

PROGRESS REPORT ON ACTIVITIES AT KOZLODUY 1000 MW UNIT

Sofia STROITEL in Bulgarian 20 Nov 85 pp 1,3

[Article by Tsvetan Furenski: "At Kozloduy: 1000 Megawatts Multiplied by Hopes and Problems"]

[Excerpts] It is now autumn of the 15th year of construction of the nuclear power plant at Kozloduy. The first rains have fallen, and it has turned cool, but with every passing day activity is heating up at the gigantic construction site. Nearly 17,000 construction and assembly workers from a wide variety of organizations throughout Bulgaria have converged on the site and are working in 3 shifts round the clock.

The object is to complete construction of the 5th nuclear unit on schedule, so that the new amounts of electric power for which people have been waiting will begin to flow through the power lines of the country.

Here at the end of 1985 the outline of the main building of this project, consisting of the domed reactor section and the square machine room attached to it, will rise almost to its full extent against the background of the Kozloduy Lowland. We say "almost" because the Western portion of the reactor section has not yet been fully erected and now resembles the broken wing of a bird. The only reason is that some heavy equipment still has not been delivered, a main and a standby lock from the Heavy Machinebuilding Complex in Radomir and 3 condensate pumps from the Vaptsarov plant in Pleven. Of course, these are not the only items missing from the long list of machines and equipment due from Bulgarian enterprises, but they are the ones generating a crisis by preventing both timely preparation of the facility for operation under wintertime conditions (many delicate mechanisms must be installed with air conditioning systems in operation) and ultimate start-up on schedule. Will we learn a lesson from the dozens of machinebuilding plants in the Soviet Union, which this year alone have already delivered 50,000 tons of equipment, thereby completely fulfilling their obligation toward the first Bulgarian nuclear energy endeavor?

Regardless of the enormous volume of work which must be done to meet the start-up deadline, it is nevertheless an encouraging fact that a governmental start-up coordinating commission is already in operation at the nuclear power complex. It has begun the process of full or partial acceptance of a considerable part of the component facilities (the combined auxiliary building, the chemical water treatment plant, the petroleum man-

agement unit, and 3 stories of the engineering and laboratory building). However, attention continues to be centered on the main building. It is expected that the bulk of construction work on it will be completed by the end of December. The equipment is also being installed at a fast pace. An especially important process is that of installing complex machinery and equipment, including the computer system, so that the 5th reactor, unlike its predecessors, will operate in a fully automatic mode. This task has been assigned to a joint Bulgarian-Soviet work brigade, which has pledged itself to complete the task in 3 months rather than 6, a record not yet set even in the Soviet Union.

Considerable effort, skill, and extraordinary precision are also being applied in welding the pipelines of the so-called primary loop system. Unlike their predecessors (with a diameter of 500 millimeters), these pipes have a diameter of 850 meters. Water heated by the decay of atomic nuclei will flow through these pipes, transferring its heat to the pipelines of the second loop and from them to the turbine. The work brigade led by order bearer Ivan Zhabov and dispatched by the management of Energomontazh in Varna is actively assisted by skilled assembly workers under the direction of Hero of Socialist Labor Ivan Stefanov. This brigade is now at work installing the first 1000-megawatt turbine in Bulgaria. It is expected to be ready for testing no later than the end of March 1986. Enviably effort is also being exerted by the groups headed by Ivan Dimitrov, Evtim Stamov, Dimitur Stefanov, and Dobrin Todorov. Considerable assistance has been provided by the Kharkov Turbine Plant, and especially by engineer Igor Lobanov.

One comment is to be made to the designers, and it should not fail to be taken into account at least in construction of the 6th nuclear unit and the nuclear power plant at Belene. In the machine room alone, hundreds, perhaps even thousands, of cylinders of oxygen are used up every day. Each cylinder is carried by an assembly worker on his back, together with the pipes belonging to it. It is a struggle for the workers to carry the cylinders up the steep steps of the temporary iron ladders. Wouldn't it be possible to supply the site entirely from the nearby oxygen plant over temporary pipelines and to build a temporary elevator for the workers and part of the equipment? This would save both time and human labor, and has in fact been done at a number of nuclear power plants in the Soviet Union.

The construction of the nuclear energy complex at Kozloduy is a project involving a huge staff of workers and many construction and assembly organizations. Following are comments made by some of the management personnel.

Engineer Todor Topalski, head of the plant construction management division, states that "we have already provided a full complement of services to the assembly organizations and are currently maintaining a standby service which will give assistance in the event of any difficulty. We deftly shift resources from the 5th to the 6th unit and back. We follow a simple but precise and clearcut formula in our operations, which is that each work site must have the optimum number of construction workers. We have already fulfilled our five-year plan."

Engineer Stoimen Maksimov, head of the energy equipment installation division, says: "Our work is moving along very well now. Our only problem is that we still do not have enough experienced skilled laborers."

Engineer Dimitur Dinkov, construction chief, has this to say: "Although there is still much work to do on the 5th unit and the deadline is approaching, in accordance with the resolution passed by the Council of Ministers in March of this year, we are already getting set up and are regrouping our forces to build the 6th unit. The entire construction process should take no longer than 3 years, that is, it will be completed 1-1/2 times faster than the 5th unit. In view of the experience we have gained by now, the elimination of the errors made in the design in the past, the decisive assistance provided by the Soviet specialists, and the fact that a large number of the powerful subsidiary facilities will serve the 2 units simultaneously, we are convinced that we will also meet the new deadline."

The conviction of the management and specialist personnel is also being translated into an article of faith of the construction and assembly workers. The eyes of workers all over the country are now on them. In the public at large hopes are being transformed into expectations of an additional 1000 megawatts in the year to come.

6115

CSO: 5100/3010

HUNGARY

NATION'S ROLE IN CONSTRUCTION OF CEMA NUCLEAR POWER PLANTS

Budapest ENERGIA ES ATOMTECHNIKA in Hungarian, Vol XXXVIII, No 7-8-9, pp 279-286

[Article by Sandor Bajza, graduate mechanical engineer and a department chief in the National Plan Office, and Karoly Toth, graduate mechanical engineer and deputy director general of the Interatomenergo International Management Association: "Hungary's Participation in the Realization of the Nuclear Power Plant Construction Program of the CEMA Countries"]

[Text] The participation of the Hungarian People's Republic in realization of the nuclear energy program of the CEMA countries is determined primarily by the integration which has developed in nuclear energetics machine manufacture. The Complex Program for the socialist economic integration of the CEMA countries approved in 1971 already prescribed the multilateral manufacturing specialization of nuclear energetics equipment. On the basis of a resolution of the CEMA Executive Committee the Interatomenergo International Management Association formed in 1973 conducts the work begun within the framework of the Machine Industry Permanent Committee of CEMA.

The long-range target program for cooperation to be conducted in the area of fuel-energetics and raw material branches, which developed on the basis of high level CEMA resolutions, prescribed the supplying of the most important energy sources to the economies of the CEMA countries. In the course of carrying out this program great attention had to be turned to more rational use of domestic reserves, the introduction of less material demanding technological processes and the development of nuclear energy. Satisfying the constantly increasing electric power needs of the CEMA countries required an accelerated development of nuclear energy. The share of the nuclear power plants in producing electric power is constantly increasing and according to available forecasts it will reach about 25-30 percent of the world electric power production by the year 2000. In accordance with these requirements the construction of nuclear power plants has accelerated in the socialist countries too.

Hungarian-Soviet Bilateral Agreement

Realization of the significant volume nuclear energy program made it necessary to ensure manufacturing capacity within the framework of socialist economic integration. For the 1976-1980 period the cooperation developed on the basis of bilateral agreements between the interested CEMA countries and the Soviet Union on a cooperative basis. Thus Hungary also undertook to introduce

manufacture of and to ship nuclear energetics equipment within the framework of a bilateral cooperative agreement.

The Hungarian-Soviet bilateral agreement was signed on 4 November 1974. Prior to the signing of the Agreement a broad study was conducted in Hungary to discover the manufacturing possibilities of the Hungarian machine industry. On the basis of analyses and studies conducted on the basis of Soviet needs a Hungarian export product list for 1976-1980 was developed.

These products were:

- devices for special water treatment equipment,
- machines needed to repair and assemble primary equipment,
- high voltage electrical devices, and
- fittings.

Manufacture was started primarily in factories with chemical industry and general custom machine manufacturing capacity, for example in the April Fourth Machine Industry Works, the Custom Machine Factory of the Csepel Works, the Ganz Electrical Works and later in the Lang Machine Factory.

The following achievements and experiences can be summed up in connection with execution of the agreement signed for the 1976-1980 period:

--Equipment worth about 55 million rubles and weighing 3,500 tons was shipped to the Soviet Union on the basis of the agreement;

--An equipment design background with special professional expertise developed, primarily at the Chemimas Enterprise but to a lesser extent in the Design and Research Institute of the Csepel Works and at the manufacturing enterprises;

--The domestic manufacturing enterprises created the necessary personnel and material conditions which made possible the solution of the tasks. In the course of this the manufacturing plants mastered the high level technical manufacturing culture and a manufacturing base was formed which, with suitable development, became capable of carrying out the higher level tasks after 1980.

The Multilateral Manufacturing Specialization and Cooperation Agreement

Preparation of a multilateral manufacturing specialization and cooperation agreement for the period between 1981 and 1990 came up after creation of the bilateral agreements. Within the framework of this preparation the first task was to work out a program extending to 1990 aimed at maximal development of the nuclear energetics machine manufacture of the CEMA countries. The 31st session of CEMA approved the maximal development program agreed upon. The program outlined the distribution of manufacture among the several CEMA countries. Thus, in the case of Hungary for example, it prescribed the manufacture of the following equipment: reactor servicing machines, cassette transloading equipment, special water purification equipment, transport technology equipment and special repair and assembly machines.

The program aimed at development of nuclear energy and nuclear energetics machine manufacture also determined the more important tasks in the areas of

technical-scientific cooperation, standardization and manufacturing cooperation. Preparation of a multilateral agreement embracing the next 10 year period of cooperation took place on the basis of this program. As in the case of other countries the plan office and interested organs of Hungary were brought into the preparation of the agreement within the framework of the work group of the CEMA Planning Cooperation Committee dealing with target programs.

The Hungarian proposal pertaining to integration deliveries for this period represented a broad product assortment and a significant delivery volume. Agreeing on our participation in multilateral specialization and on the list of nuclear power plant equipment to be manufactured took place with a broad inclusion of the interested chief authorities and industrial enterprises.

The State Plan Committee dealt in detail with the tasks for preparation for manufacture of the products included in the specialization plan and passed resolutions for their execution. Starting from the given conditions of our machine industry our proposal prescribed the development at bilateral and multilateral discussions of a product composition best suiting our economic policy goals and the expectations posed by integration.

The multilateral agreement was signed on behalf of the governments of the countries at the prime minister level during the 33rd session of CEMA (on 28 June 1979).

The Hungarian People's Republic, together with the other participating countries, undertook an obligation to aid the realization of the nuclear power plant construction program of the CEMA countries with manufacture and development of the specialized equipment, with mutual deliveries of such equipment and by providing defined services. Preparation for manufacture of the equipment took place basically on the basis of Soviet technical plans or documentation. The Soviet side, having the greatest experience in this area, continues to carry out the general planning and general design tasks. Soviet experts in the Hungarian manufacturing plants perform the technical take-over of the specialized equipment fundamentally influencing nuclear safety. Deliveries of the specialized equipment agreed upon multilaterally are included in the bilateral plan coordination protocol between Hungary and the interested countries and in the annual barter foreign trade agreements. Hungarian deliveries take place on the basis of contracts signed between the Transelektro Foreign Trade Enterprise and the foreign trade organization of the ordering country. The Power Plant Investment Enterprise (ERBE)--which is authorized to carry out foreign trade activity--has been charged with taking care of Hungarian imports.

The parties to the agreement created an Intergovernment Committee for general coordination of cooperation aimed at realizing the agreement and for regular supervision of the obligations. Hungary's minister of industry participates in the work of the Intergovernment Committee on the basis of a commission from the Hungarian government.

In accordance with the Agreement Hungary performs specialized manufacture of the following six product groups:

- reactor and steam generator repair and maintenance machines,
- technological transport equipment,

- nut tightening machines,
- cassette transloading equipment,
- special water treatment equipment, and
- instrument panels and switch panels for the VVER-1000 cassette transloading machines manufactured in the Soviet Union.

As can be seen from the above listing the equipment primarily serves tasks connected with servicing nuclear power plants and does not belong directly to the primary sphere. By its character most of it consists of special machines and equipment which are manufactured individually (the quantity to be manufactured each year does not exceed 3-5 units per type). Only the special water treatment equipment constitutes an exception to this. The manufacture of this equipment (ion exchange and mechanical filters, heat exchange devices, containers, etc.) takes place in small series, primarily out of acid resistant steel of nuclear power plant quality.

The machines and equipment in which Hungary specializes in accordance with the above well suit the manufacturing structure of Hungarian industrial enterprises, developing it further with products representing a high technical level and quality.

Enterprises with an international reputation and significant manufacturing experience undertook domestic manufacture of nuclear power plant equipment, such enterprises as:

- Ganz-MAVAG (cassette transloading machines),
- the Lang Machine Factory (technological transport equipment),
- the April Fourth Machine Industry Works (special water treatment equipment),
- the Custom Machine Factory of the Csepel Works (reactor and steam generator repair machines),
- the Chipping Machine Factory (some machines for the technological transport equipment),
- the EVIG [United Electrical Machine Factory] (electrical equipment and controls).

The Chemimas Enterprise takes care of the planning, coordination and prime contracting tasks connected with preparation for manufacture. We modernized those plants of our enterprises manufacturing nuclear power plant equipment in the interest of ensuring the necessary high technical level and guaranteed quality, we provided them with new technological and testing equipment and in some cases we expanded their existing capacity. Developments worth more than 1,500 million forints were realized by using bank credits and the enterprises' own funds. The investments began in 1979 at all enterprises figuring in the program and they were basically completed in 1982. Thanks to the measures cited our enterprises are able to ensure manufacture and delivery of the quality specialized equipment prescribed in the agreement at the modern technical level necessary in nuclear energetics machine manufacture.

The Ministry of Industry and the National Nuclear Energy Committee defined in a joint ministry level target program the research and development tasks connected with manufacture and further development of the specialized equipment. The subprograms of the ministry level target program extend to R&D on complete nuclear power plant water treatment equipment and development of transloading machines and special repair machines.

Every interested Hungarian enterprise and institution is participating in realization of the program. In addition to the manufacturing plants already listed we must mention the following: VEIKI [Electric Power Industry Research Institute], Chemimas, Gamma, SZTATI, KFKI [Central Physics Research Institute], VASKUT [Iron Industry Research Institute], EROTERV [Power Plant Designing Enterprise], PAV, BME [Budapest Technical University], etc. We have provided primarily from central sources for the research and development expenditures serving execution of the target program.

In the 1981-1985 period, opening a new epoch in multilateral cooperation, the specialized equipment of the Hungarian manufacturers went to every nuclear power plant being built (to the Soviet Union, the Bulgarian People's Republic, the German Democratic Republic, the Czechoslovak Socialist Republic and naturally to the Paks Nuclear Power Plant). In this 5-year plan the volume of deliveries increased many times compared to 1976-1980 and will increase further up to 1990.

More than 60 percent of the Hungarian deliveries for the 1981-1985 period were made up of deliveries of equipment for nuclear power plants being built with the VVER-440 type reactor blocks. We shipped equipment for the VVER-1000 type reactor blocks for the number 5 block of the "Kozloduj" Nuclear Power Plant and for power plants being built in the Soviet Union.

In accordance with resolutions of CEMA organs work is going forward to prepare forecasts and cooperation ideas extending to the year 2000. The multilateral manufacturing specialization agreement will be extended within the framework of this, with a simultaneous expansion and deepening of manufacturing specialization and cooperation. The interested Hungarian organs and organizations will be active participants in this work.

Activity of the Interatomenergo International Management Association (NGE)

The activity of the Interatomenergo NGE is organically linked to the multilateral economic and technical-scientific cooperation being realized in the area of nuclear energy machine manufacture and energetics. A representative of Hungary has participated actively in the work since the founding of the Association (December 1973). In accordance with a decision of the competent organs of the Hungarian People's Republic the "Chemimas" Chemical Machine Designing and Prime Contracting Enterprise received the commission to coordinate both domestic and international cooperation. Consequently "Chemimas" has participated in the preparation of every basic document for multilateral cooperation in nuclear energetics machine manufacture, within the framework of the Interatomenergo NGE, and is active in implementing the decisions made.

Going beyond manufacturing specialization and cooperation work the activity of the Interatomenergo NGE extends to working out uniform standards and requirements in the area of manufacturing and shipping specialized equipment and fittings and in regard to planning, equipping and operating nuclear power plants. Under the conditions of multilateral cooperation it is necessary that the cooperating enterprises of our countries work on the basis of uniform standards and requirements, thus ensuring the high technical level and reliability of nuclear energetics equipment.

On the basis of a commission from the Intergovernment Committee the Interatomenergo NGE also participates in resolving a number of questions. The member enterprises of the association assume an important role in this work when they participate in collecting the information needed to evaluate fulfillment of delivery obligations, in working out recommendations, in deepening and expanding manufacturing specialization for equipment and fittings in short supply and in carrying out measures to improve quality and the safety of the equipment.

Cooperation in Research and Development

Within the framework of the CEMA Nuclear Energy Permanent Committee a bilateral agreement for the period 1979-1986 was made between the Hungarian Academy of Sciences (MTA) and the State Nuclear Energy Committee of the Soviet Union concerning special reactor thermohydraulic tasks for the VVER-1000 type nuclear power plant (zone thermohydraulics, with special regard to critical heat flux, and a few thermohydraulic aspects of nuclear safety).

The MTA Central Physics Research Institute (KFKI), for the Hungarian side, and the Kurchatov Nuclear Energy Institute (Moscow) and the OKB Hidropress (Podolsk), for the Soviet side, are participating in implementing the agreement.

The experimental basis for the research and development work is the large device of the KFKI designated NVH. The zone models necessary for the experiments were prepared by the three institutions in a distribution of labor according to the work plan. Hungarian and Soviet researchers perform jointly the experiments done and to be done in Budapest. Utilization of the research results has taken place and will take place in a similar way. The first part of the work has been completed. The most important results have been summarized in the form of design recommendations. Completion of the second part of the work is expected in 1985.

The third part is connected with nuclear safety and represents primarily theoretical work, representing experimental work to a small extent.

The chief results of the research dealt with in the Agreement are embodied in experimentally tested computer programs accompanying the recommendations. The cooperation will probably continue in the next plan period, expanded with additional themes.

Concerning the Activity of the Temporary International Research Collective

In 1972 the European socialist countries signed an intergovernment agreement concerning creation of the Temporary International Research Collective (INK). The task of the INK was research on the physics of VVER type fuel element grids. Cuba and Vietnam and a Finnish research institute joined the agreement later. The agreement, originally for 5 years, was extended first to 1980 and then to 1985.

The chief goal of the research was to work out a reliable, experimentally verified computational model of VVER type reactors (440 and 1,000 MW). In accordance with this one of the chief directions of research was development of computer programs and data libraries. We achieved significant results in

utilization of nuclear physics data libraries, in describing resonance-absorption phenomena and in the area of fine net and crude net computation of the reactor. Significant difficulties are caused by the hexagonal geometric structure of the VVER type reactors and by the low hydrogen-uranium ratio, which made necessary the development of unique computational devices. A uniform computational system suitable for the fundamental goals is even now under development.

The other chief direction of research is creation of the experimental database serving to verify the computations.

One source of the data is the ZR-6 critical system established at the KFKI. Measurements are being made on this reactor with the participation of very many foreign researchers. Some of the measurements are made on the reactor heated to 130 degrees Celsius, under pressure, under unique conditions. In the course of the measurements we studied the chief parameters of the fuel element grids as a function of grid distribution, uranium enrichment, boric acid concentration and temperature, and we made a detailed study of the effects of the grid differences (absorbent rods, water holes, etc.) characterizing the VVER-1000 reactor. The processing of the measurements made at room temperature has been completed and a book about this will be published this year by the Academy Publishers. An evaluation of the temperature effects is still under way. A very essential element of our work was evaluation of the measurement data with a uniform apparatus containing the new achievements of mathematical statistics. On the basis of the measurement results a clear picture was obtained of the physics of VVER type fuel element grids and the results significantly enriched the literature on uranium-water grids. The other chief source for experimental data is the nuclear power plant itself. Within the framework of the INK we organized a collection of operational data on operating VVER nuclear power plant reactors. In the future this database will provide a basis for testing the uniform computational apparatus.

The INK offered a framework for starting research which has great practical significance. For example, within this framework began the noise diagnostic studies (on the ZR-6 reactor and then at the Rheisberg nuclear power plant) which are continuing today on a contract basis.

A general opinion developed concerning the INK that it was a very well organized cooperation, one considered exemplary for CEMA. The chief reason for this is that the Scientific Council of the INK, which meets yearly, has full decision making authority in regard to research. The several countries finance participation in research; the INK does not have its own common funds. The participating researchers get to know one another well at symposiums, in the course of common work done in so-called thematic groups and through bilateral contacts and the swift utilization of the results of others does not cause a problem. In this way a research community representing very significant intellectual capital has come into being.

Further exploitation of the existence of this community and the research not yet completed but especially the emphasis on a new research trend all justify an extension of the work of the INK for another 5 years, which will surely happen next year. The new research trend is improving the fuel element cycle of VVER type reactors, which is intended to exploit the economic advantages accompanying an increase in uranium enrichment.

Finally we should mention that the expert staff which grew up within the frameworks of the INK did a great deal in the course of installing the VVER type nuclear power plants in the several countries (safety analyses, starting operations, operating standards, etc) because the culture created is flowing into the operation of the nuclear power plants too.

Creation of the Paks Nuclear Power Plant, Planned for an Output of 1,760 MW, and Starting Operation of the Second VVER-440 Type Block

Realization of the Paks Nuclear Power Plant investment consisting of four VVER-440 type blocks (the reactor V-213 plan) was started in 1975 within a framework of broad CEMA integration. Soviet and Czechoslovak enterprises delivered the chief equipment for the primary sphere. In the course of building the blocks the deliveries of specialized equipment from the socialist countries increased and all eight countries are participating in deliveries for the third and fourth. Hungarian industry also provided or is providing a crucial part of the non-specialized equipment.

The first block of the power plant has been providing power as an operational machine since August 1983. In the course of its operational life the first transloading and first revision of the active zone occurred in the summer of 1984. The daily output of the block is about 10 million kWh, with extraordinarily certain availability and adhering to operational schedule limitations. The first block produced 3.27 billion kWh from the physical start-up to the first transloading, that is in the course of the first drive. The output for 1984 up to the end of December was more than 2.7 billion kWh, taking into consideration the transloading and maintenance work during the year.

Creating the block, putting it into operation and operating it have provided and are providing much experience for the units and personnel involved in construction, assembly, start-up and operation. All the experience, changes and modifications were and will be handed on when creating additional blocks. Utilization of the experience acquired is well illustrated by the fact that while putting the first block into operation took more than 368 days from the pressure test of the primary area to parallel connection, the similar time for the second block was about 100 days less, even if it is admitted that the common equipment for the two blocks had to be put into operation with the first block.

The following table shows the chief times for creation and start-up of the two blocks.

	First Block	Second Block
	-----	-----
Construction begins	1975	1975
Assembly begins	1980	1982
Clean assembly begins	Nov 1980	Dec 1982
Primary area pressure test	Dec 1981	Dec 1983
Physical start-up	Dec 1982	Aug 1984
Energetics start-up	Dec 1982	Sep 1984
Start of test operation	Aug 1983	Nov 1984
A permanent operational machine	Aug 1983	Nov 1984

The combined existence of a number of favoring factors resulted in the possibility of putting the second block into operation in a shorter time. These might be summarized as follows:

--Fewer individual tests of the technological system had to be performed (the common systems of the two blocks had been put into operation with the first block);

--Some of the chief phases of putting it into operation could be carried out with a higher level of preparation (electric and guidance technology preparedness are more complete than they were in the case of the first block);

--There were substantially fewer failures during initiation of operations, substantially less need to remodel due to bad operation. (The experiences with the first block appeared in the quality and quantity availability of assembly);

--Experienced personnel were available for construction and operation.

Summing up it can be established that in the execution of the work programs for putting the second block into operation, the expediency of this operation was aided by the understanding of the personnel and by shortening the time limits. The technical characteristics of the block make it possible to continue the energetics start-up according to schedule. By 24 September 1984 the block had reached 75 percent output and after successful completion of test operation at nominal output between 10 and 13 November 1984 it was proclaimed to be an operational machine.... Thus even while it was being put into operation it had become a significant producer of electric power. On 9 January 1985 the chairman of the State Start-Up Committee issued the permit to start permanent operation of the second block of the Paks Nuclear Power Plant on the basis of the agreement of the authorizing and professional consulting authorities.

Parallel with the successful start-up of the first and second blocks of the Paks Nuclear Power Plant work continued on construction of the third and fourth blocks, planned to go into operation in 1985 and 1986 respectively.

Making use of the construction experiences with the four VVER-440 blocks, we are planning a further expansion of the Paks Nuclear Power Plant between 1992 and 1995.

PHOTO CAPTIONS [photos not reproduced]

1. P 280. Machine working the sealing surface of an RP-PGV type steam generator collector, Custom Machine Factory of the Csepel Works.
2. p 280. MK type hydraulic nut tightening equipment, Custom Machine Factory of the Csepel Works.
3. p 280. VVER-440 type reactor IK container, Custom Machine Factory of the Csepel Works.
4. p 281. MK 3155 type steam generator pipe system repair machine, Custom Machine Factory of the Csepel Works.

5. p 281. Machine to repair sealing surface of reactor main dividing plane, Custom Machine Factory of the Csepel Works.
6. p 282. Welding together the pieces of a VVER-440 type reactor protecting cylinder (layered version), Lang Machine Factory.
7. p 282. Assembling two bands of a VVER-440 type reactor protecting cylinder, final adjustments, Lang Machine Factory.
8. p 282. The MP-1000-2 type cassette transloading machine, Ganz-MAVAG.
9. p 282. Control equipment for the MP-1000-2 type cassette transloading machine, EVIG.
10. p 282. Resin holding filter, April Fourth Machine Industry Works.
11. p 283. Ion exchange filter, April Fourth Machine Industry Works.
12. p 283. Evaporating device, April Fourth Machine Industry Works.
13. p 284. The Paks Nuclear Power Plant, the finished first and second blocks.
14. p 284. The Paks Nuclear Power Plant, construction of the third and fourth blocks (September 1984).
15. p 284. The Paks Nuclear Power Plant, reactor hall with cupolas of first and second reactors.
16. p 285. The NVH large experimental equipment of the Central Physics Research Institute of the MTA.

8984

CSO: 5100/3044

ARGENTINA

CNEA PRESIDENT DISCUSSES NUCLEAR PROGRAM

PY031509 Buenos Aires TELAM in Spanish 1528 GMT 2 Feb 86

[Text] Cordoba, 2 Feb (TELAM)--Alberto Constantini, president of the National Atomic Energy Commission [CNEA], has said the Argentine nuclear plan can no longer be delayed. He added that there will be no important budget cuts to change the work plan already established.

He explained that the budget to be debated in the Chamber of Deputies shortly includes all the activities programmed by the CNEA at a cost of over 400 million Australes. He said: The only amount that was not added to the budget, which some people interpret as a reduction, is 100 million Australes in foreign loans. With the foreign loans, I have 550 million Australes, which is what I need to fulfill the nuclear program.

Constantini made this statement to the local daily LA VOZ DEL INTERIOR and it was published in today's edition. He said he shares the idea of reducing government expenditures and strengthening the nation. He added: We can no longer waste time. We cannot again change the work schedule for Atucha II and the heavy water project, which are the most costly projects. If we do so, the cost of the projects will increase, which would go against the interests of the people in general.

He said: We have a 6-year delay but we plan to conclude part of the heavy water project in 1988 and Atucha II in 1996 because there will be energy needs at that time.

In conclusion, Constantini expressed concern because not enough resources are being appropriated to education and technological development. He said: If we do not move ahead in those two fields we will not be able to aid the growth of the country or improve our technology. We will not be able to industrialize the country in accordance with the new ideas of cybernetics. In other words, we will stagnate in the field of economic development.

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CSO: 5100/2042

ARGENTINA

BRIEFS

CNEA BUDGET--Renato Teriggi, manager of the National Commission for Atomic Energy [CNEA], has denied that his talks with the Finance Secretariat on the 1986 budget included a call for a 12 percent reduction in CNEA personnel expenses. Teriggi thus denied press rumors which, based on an allegedly official memorandum, mentioned the decision of the secretariat, under the responsibility of Mario Brodersohn, to impose this and other reductions which would also affect the development of Atucha II and the heavy water projects. Later he termed the difference between the budget forecast of the Finance Secretariat and those of the CNEA are "infinitely smaller" than those mentioned in the press news. [Text] [Buenos Aires TIEMPO ARGENTINO in Spanish 16 Jan 86 p 12 PY] /9274

NUCLEAR PROJECTS RESCHEDULED--During a meeting yesterday, President Raul Alfonsin and National Commission for Atomic Energy (CNEA) President Alberto Constantini reviewed the budgetary problems of the Atucha II and the heavy water projects and the beginning of work of the cobalt capsule plant. After a meeting, which was held at Government House, Constantini said: "The progress of the two projects has returned to normal, qualified personnel are being re-hired, and the projects' timetables are being rescheduled in order to proceed normally." In a statement distributed to the press shortly after his meeting with Alfonsin, Constantini stated that he asked the president to make an "exception" concerning the public administration hiring freeze, "in view of the need to hire people to start training them for the operation of the heavy water plant, which will be concluded in late 1987." Constantini explained that "I have also asked for exception from regulations forcing some people to retire from the grades not enjoying special treatment." In this regard, Constantini told Alfonsin: "We are part of a very unfair system. We neither belong to the presidential system nor to the national public administration system. We belong to a private system for autonomous agencies operating under the old law No 43749, which means that the people retiring today only collect 45 percent of the current retirement pay." [Text] [Buenos Aires CLARIN in Spanish 31 Jan 86 p 14 PY] /9274

CSO: 5100/2041

BRAZIL

SARNEY-BETANCUR MANAUS TALKS INCLUDE NUCLEAR ACCORD

PY011827 Sao Paulo O ESTADO DE SAO PAULO in Portuguese 31 Jan 86 p 4

[Joint Brazilian-Colombian communique issued to the media after the meeting between Brazilian President Jose Sarney and Colombian President Belisario Betancur in Manaus, Brazil, on 30 January]

[Excerpts] 1. Brazilian President Jose Sarney and Colombian President Belisario Betancur met in Manaus on 30 January 1986. In addition to the Brazilian foreign minister and the Colombian acting foreign minister, the presidential retinues were comprised of the main government officials in charge of bilateral and multilateral issues of greatest mutual interest.

2. The presidents' meeting was characterized by an atmosphere of great cordiality, a sign of the traditional links of friendship and cooperation that have always united the two countries. It should be noted that bilateral relations have been strengthened over the past few years and that the Manaus meeting establishes a new landmark in the Brazilian-Colombian relationship. The presidential meeting was chosen as the occasion to officially open the first session of the Brazilian-Colombian Cooperation Commission, which was created through the Friendship and Cooperation Treaty that became effective on 10 July 1985.

8. The chiefs of state voiced satisfaction with the upcoming implementation of the Amazon Bilateral Cooperation Accord, the Cooperation Agreement for the Peaceful Use of Nuclear Energy, and the Scientific and Technological Cooperation Agreement. Exchange of the ratification documents for these three agreements will take place shortly.

/9365

CSO: 5100/2040

BRAZIL

HIGH FINANCIAL COSTS OF PLANT CONSTRUCTION SCORED

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 21 Dec 85 p 3

[Editorial: "Atomic Interest Costs"]

[Text] The members of the special commission appointed to evaluate the Brazilian nuclear program, more specifically the agreement with the Federal Republic of Germany (FRG), should read carefully the interview of the president of the Brazilian Nuclear Corporation (NUCLEBRAS) published Friday. While complaining about the meagerness of funds, declaring that NUCLEBRAS had requested 7.7 trillion cruzeiros for next year and is going to receive only 3.5 trillion, Licinio Seabra confirmed that the company's foreign debt is really alarming. Another \$1.8 billion is needed to complete the Angra-II and Angra-III plants. By their completion date of 1995, those plants should cost the country \$7.5 billion, of which \$4 billion--mark this figure well--will be for financial charges.

According to Licinio Seabra, the financial cost of the two plants is \$1 million "a day"--we repeat, \$1 million a day is paid in interest on loans contracted with FRG banks to finance idle equipment. This does not take into account further delays, which will certainly come about in view of the lack of domestic funds. In summary: the Brazilian nuclear program based on the agreement signed with Germany is exceeding all anticipated cost estimates.

It is impossible at this time to know with any approximation the actual cost of an installed kilowatt. Originally, in 1975, there was talk of \$1,500 per kilowatt, a false figure presented by Paulo Nogueira Batista--then president of NUCLEBRAS--and Minister Shigeaki Ueki merely to delude public opinion, anesthetized by the dictatorial regime. Everyone knew that the cost would be much higher, and it was the ESTADO DE SAO PAULO exclusively that unmasked the farce, publishing the testimony of engineer John Cotrim, in which he declared that a nuclear kilowatt would cost a minimum of \$3,500 compared to \$1,200 or a maximum of \$2,000 for a kilowatt generated by the future thermal plants fueled by coal--a product we have in abundance, with no market. Today the \$3,500 cost already appears to be superseded because the financial charges--the interest on the \$4-million plus debt--make the whole program for eight plants originally envisioned by former President Geisel unfeasible.

The government is currently making an effort to revise the projects and financing program without any enthusiasm on the part of the German banks and supply firms, which continue to ship to Brazil the equipment already produced, which is being stored (until when?) in the atomic reactor construction factory installed in the state of Rio and sold by (guess who?) the German firms connected with the nuclear program. . . . Needless to say, that factory has an enormous idle capacity because it is competing with numerous other similar industries operating in Brazil for years, which had already found, and today find, it difficult to sell their production. But we continue to pay interest.

All of this reveals the complete lack of planning with which the nuclear program was drawn up, with an enormous dollop of irresponsibility. The Geisel administration acted in that manner because it wanted to control the complete uranium cycle; in short, it wanted the bomb. That explains, for example, why on installing the evaluation commission, President Jose Sarney strongly reiterated the peaceful aspects of the Brazilian nuclear program. We do not want the bomb but nuclear energy. Bomb or energy, the fact is that we are paying a preposterous, disastrous price for this double adventure when minimal resources are lacking to build the hydroelectric plants absolutely essential to meet daily consumption requirements and the electricity sector owes \$20 billion abroad.

8711/13104
CSO: 5100/2032

BRAZIL

SBF LAUDS AGREEMENT WITH ARGENTINA ON NUCLEAR RESEARCH

Rio de Janeiro O GLOBO in Portuguese 1 Dec 85 p 3

[Text] The Brazilian Physics Society (SBF) released the following announcement yesterday with regard to the peaceful cooperation accord for nuclear research development signed yesterday by Presidents Raul Alfonsin of Argentina and Jose Sarney of Brazil. The announcement is signed by Luis Carlos de Menezes, secretary of the organization's Administration, and by Luis Pinguelli Rosa, Member of the SBF's Commission for Following Brazil's Nuclear Program.

"Brazilian and Argentinian physicists have discussed the danger of nuclear armament in their respective countries and have noted the need for peaceful cooperation in nuclear research. Two years ago the Brazilian and Argentinian Physics Societies signed a document to that effect.

"That being the case, yesterday's (day before yesterday's) agreement between Presidents Alfonsin and Sarney can only be regarded as a positive step by the scientific communities of the two countries. It is important that it be followed by other steps, since there is still much to be done to guarantee the continent's military denuclearization.

"For example, until recently, the military authorities were asserting that Brazil would be acquiring the capability for nuclear bomb production, a fact that merited the SBF's explicit disavowal. In addition, the programs which Brazil and Argentina declaredly have for nuclear submarine construction are not peaceful applications.

"We are certain that our countries can establish the basis for the entire hemisphere's denuclearization if they could undertake concrete measures, including the possibility of mutual inspection.

"It is essential for the people of both countries to value and stimulate these initiatives, and for Argentinian and Brazilian scientists to follow the implementation of these declarations of intention. They can mark the beginning of a renewed solidarity phase among the Latin American people."

12987/12899
CSO: 5100/2029

BRAZIL

NUCLEBRAS NOT TO BUILD ANY PLANTS IN SAO PAULO STATE

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 4 Dec 85 p 27

[Text] According to a statement made yesterday by Nuclebras' president, Licio Seabra, Nuclebras does not intend to build a nuclear plant in Sao Paulo State and is putting on sale the areas bought for construction of Iguape I and Iguape II. In addition, they are ceasing the legal action for expropriation of the lands adjacent to the main lot, which would be reserved for the quarry.

He said that there is no basis for the news that Nuclebras was planning to defy Governor Franco Montoro and intended to build six nuclear plants on the Sao Paulo coastline. Emphasizing that it's a "tempest in a teapot," Nuclebras' president explained that there could be malice behind the spread of that type of news or it could be a misunderstanding.

According to him, Nuclebras is without means and is making a tremendous effort to finish Angra II, so that it can begin to think about work on Angra III. That is Nuclebras' only goal. The future of the nuclear program is being defined by a special commission of technicians and scientists appointed by the President of the Republic.

According to Licio Seabra, as a result of the stoppage of the other nuclear plants, SEST ordered, through a decree from Minister Joao Sayad to Minister Aureliano Chavez, that Nuclebras should cease its work and research in the Sao Paulo coastline and give up all the land.

In Seabra's opinion, an explanation for the possible misunderstanding is the siting study made many years ago for building up to four nuclear reactors in an area of about 2,500 acres, where the quarry would be located. However, that did not go beyond the study stage and Nuclebras is also selling that land, he stated, and not keeping any land in the Sao Paulo coastline.

He further pointed out that of the 91,119 square miles affected by the expropriation decree passed in 1981, Nuclebras had only been able to progress as far as publishing the notice of possession when it intended to build the two nuclear power plants at the Sao Paulo site. Since it had not been possible to reach an agreement, hundreds of judicial actions had been filed. Now the State Court is requesting the interested parties to desist from those actions.

Seabra explained that Nuclebras is definitely leaving the Sao Paulo coastline and cannot be made responsible for the ecological problems resulting from depopulation or real estate speculation: "during the time that those lands were in its possession, [Nuclebras] took care of them." Seabra asserts that Nuclebras is without financial means and cannot struggle with the burden of preserving that coastline or for protecting the ecology against real estate speculation. That burden must now be assumed by the government of Sao Paulo State, or more specifically by Governor Franco Montoro, according to Nuclebras' president.

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BRAZIL

NUCLEBRAS EMPLOYEES STRIKE FOR WAGE DEMANDS

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 6 Dec 85 p 26

[Text] Approximately 3,000 Nuclebras employees went on strike today in Rio and Minas Gerais, demanding a 9.6% wage reinstatement which has been denied by the Interministerial Wage Council for State Offices (CISE). The action unites chemical, electrical and urban engineers, as well as administrative personnel and journalists who work for the company.

In Rio yesterday afternoon at a general assembly, 700 workers out of a total of a thousand decided to go on strike. Afterwards, they held a demonstration and picketed as far as Cinelandia. The strike leadership, headquartered in the engineers' union, informed that the work stoppage will begin this morning with a congregation at the company's door.

Nuclebras' facilities in Rezende will also be affected by the action. Approximately 800 people work in Rezende, in the fuel element factory and in the uranium enrichment plant. The decision to strike has also been made in Belo Horizonte, where there are almost 600 people working in technological research and in Nuclebras' regional office. In Pocos de Caldas, the assembly to be held this morning is expected to approve the work stoppage for its 800 workers.

The action will not affect other subsidiaries--such as Nuclen, Nuclep, and Nuclemon in Sao Paulo--which have already reinstated wages and met other workers' demands. The Angra 1 Nuclear Plant in Angra dos Reis will also continue to operate. Also not affected will be the fuel supplied by the Rezende factory to the Angra 1 plant, which has scheduled fuel reloading for this month and has already had the fuel delivered.

At the same time that they decreed the strike, Nuclebras workers in Rio began collective bargaining before the Regional Labor Court to obtain a judgement of the case before the Judiciary's recess, which begins the 19th. A decision may be reached during the coming week.

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BRAZIL

CNEN PRESIDENT OUTLINES NUCLEAR RESEARCH

PY151625 Sao Paulo O ESTADO DE SAO PAULO in Portuguese 12 Jan 86 p 7

[By Jose Roberto Ayruda]

[Text] While the official nuclear program continues to experience difficulties and to suffer from a serious financial crisis, the parallel, or autonomous program, as President of the National Commission for Nuclear Energy [CNEN] Rex Nazare Alves prefers to describe it, is doing very well in its attempt to try to master the complete fuel cycle, including uranium enrichment and reprocessing.

Classified as a supersecret subject until now, Nazare has spoken about this subject for the first time. The key to the strategy of this program is its diversification. This CNEN program employs 3,000 nuclear experts, physicists, chemists, engineers, and other specialists. Nazare explained that he is obtaining good results because he has managed to convince businessmen that nuclear energy will be a great business for them.

The program does not envisage any great commissions or exaggerated plans. The CNEN selected the chemistry, metallurgy, and informatics industries that may become interested in obtaining some of the technology developed in the CNEN analysis super-laboratories installed in the Aeronautics Technological Center in Sao Jose dos Campos, the Institute for Nuclear Energy Research [IPEN] in Sao Paulo, and the Nuclear Technology Development Center in Belo Horizonte.

The radioisotope production and research programs for the medicine, industry, and agriculture fields, as well as the fact that the CNEN studies and controls 2,325 private and state companies that in some manner deal with nuclear products, have formed a structure that has allowed this independent organization to undertake a parallel nuclear program.

When in 1981 the Brazilian Government started doubting the effectiveness of the nuclear program envisioned and negotiated by Shigeaki Ueki and Paulo Nogueira Batista during President Geisel's administration, and considering the great uncertainty that the uranium enrichment technology sold by Germany represented and still represents, the alternative was to trust in the CNEN capability to develop other national techniques in the fuel cycle field.

The parallel program, which started in 1982, has already mastered the uranium hexafluoride (UF-6) production technology at the IPEN in Sao Paulo. Moreover, it is

conducting research programs in all other areas of the fuel cycle. According to Nazare, the secret lies in decentralizing, debureaucratizing, and relying on private enterprise. Nazare said: "You have to call businessmen, convince them that nuclear energy can be a big business, and get them hooked on the program. The CNEN selects specific national companies, most of which are small and medium-sized, with an affinity or capacity to participate in a specific sector. Then the CNEN appoints its nuclear technicians to work on the development of specific products or research programs inside these selected companies. They use the laboratories of these companies for various experiments. Thus, these companies make a substantial contribution to cutting costs."

Once the product has been developed and the technology is mastered, the CNEN receives a small income as royalty (between 2 and 5 percent), and the company develops the product at the industrial level.

Nazare noted that the fuel cycle needs to be fully mastered in order to be able to run research reactors and to guarantee the production of radioisotopes, which in turn will be used in other areas. He added that energy is merely one of the many sectors in which nuclear energy can be used and that since the other areas in which it can be used are essential to the national economy, it is an effort that must be shared by the whole of society.

The CNEN president said that in addition to developing the technology to produce uranium hexafluoride, the IPEN, in cooperation with private enterprise, has already developed all the equipment and material necessary to produce this gas at the industrial level. Electronic equipment -- which is important for the production of robots and equipment needed for the handling of radiated material -- is being developed by the CNEN and passed to the private sector in those areas of larger consumption, such as in the case of multi-analyzers, preamplifiers, digital counters, feeding modules, and fluorimeters.

Nazare noted that in the area of mastering research reactors, important and technologically advanced equipment such as detectors, ionization chambers, which measure radiation, and proportional counters have been produced locally. In addition, Brazil will now be able to develop other technologies to export manufactured products rather than only nuclear raw materials.

As an example, Nazare mentioned beryl, a mineral existing in large deposits in Brazil which used to be exported at \$90 or \$100 per ton. Now it is refined and sold as beryllium carbonate [carbonato de oxido], which is sold at \$300 per kilo. Some of the other technologies passed to the private sector include the production of organic solvent (tributyl phosphate), trioctyl phosphinic, crystallized magnesium, and zirconium oxide of nuclear or ceramic grade, among others. Considering the multiplying effect, Nazare did not want to predict when Brazil will master the fuel cycle with national technology. However, by his smile one can be assured that Brazil has found the way.

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CSO: 5100/2037

BRAZIL

SCIENTISTS CRITICIZE NUCLEAR RESEARCH PROGRAM

PY212048 Sao Paulo O ESTADO DE SAO PAULO in Portuguese 14 Jan 86 p 5

[Excerpts] The parallel nuclear program being developed by the National Commission for Nuclear Energy (CNEN), described in the Sunday edition of O ESTADO, is to be criticized because of its involvement with projects of military interest, such as the atomic-powered submarine and the Brazilian atom-bomb.

This criticism was made last night in Rio de Janeiro by the physicist Luiz Pinguelli Rosa, former president of the Brazilian Society for the Advancement of Science (SBPC) and present director of the Coordination Board of Postgraduate Programs Engineering (COPPE) of the Federal University of Rio de Janeiro. When he criticized the parallel nuclear program, Pinguelli Rosa defended the idea that the country's scientific community should be heard with regard to nuclear research.

Brigadier Tercio Pacitti, former rector of the Technical Institute of Aeronautics (ITA), and present engineering director of the Brazilian Air Force, also defended the idea that the scientific community should be consulted about the parallel nuclear program being developed by the CNEN.

Scientist Fernando Claudio Zawislak, researcher of the Federal University of Rio Grande do Sul and member of the Nuclebras Nuclear Program [Brazilian Nuclear Corporations Inc] Evaluation Commission, was very cautious when he spoke yesterday in Porto Alegre about the parallel nuclear program being developed by the CNEN. He said he was not informed about that program but termed the existence of two parallel programs "absurd."

Professor Zawislak said he did not know about the work being carried out by the CNEN. According to Zawislak, the matter has been mentioned in congresses and meetings of scientists and technicians in the nuclear field, but he is not acquainted with the CNEN's laboratories or the technology that it is being developed. Zawislak concluded from information that the CNEN president gave to O ESTADO that the "only thing that could possibly be discussed is the uranium enrichment program that is also being developed by Nuclebras."

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CSO: 5100/2037

BRAZIL

EVACUATION PLAN DISCUSSED FOR NUCLEAR PLANT AREA

PY202115 Rio de Janeiro O GLOBO in Portuguese 19 Jan 86 p 18

[Text] The two meetings already held among government scientists, ecologists, and experts in the nuclear field to discuss an evacuation plan for the Angra dos Reis population in case of a radioactive accident in the Angra I nuclear power plant are yielding good results. According to information supplied by Deputy Lutz Vieira, the president of the Rio de Janeiro legislative body ecological studies commission, the plan will be changed in order to allow for a greater participation of the civilian population. The scheme for disseminating this plan among the Angra dos Reis population will be redrawn.

Vieira stated that "the new cooperative thinking among the governmental agencies related to the nuclear energy field is very important. Another outstanding development is the fact that they have changed their minds and withdrawn the character of ultra confidentiality surrounding this issue. An example of this change is that a complete copy of the formerly secret evacuation plan will be submitted to a commission recently created made up of the Civil Defense organization, Furnas [a state electric power company] ALERJ [expansion unknown] and local Angra I staff.

In addition, Vieira reported that in March -- during the resumption of ALERJ operations -- the ecological studies commission will hold a seminar to discuss the population's evacuation plan at a technical level.

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CSO: 5100/2037

BRIEFS

CHAVES DEFENDS PROGRAM'S CONTINUANCE--Although he confessed his intention to present his divestiture from the Ministry of Mines and Energy on 25 February 1986 in order to seek elective office for the Constituent Assembly, Minister Aureliano Cheves continues to draw up its plans for the sector. Participating in a seminar on energy sponsored by the Association of Economists of Sao Paulo yesterday, he again supported continuance of the Brazilian nuclear program and, referring to its critics, said that "it is utopian on the part of the well-intentioned or dishonest on that of the demagogues" to believe that Brazil is never going to need nuclear energy. Recognizing the country's great hydroenergetic potential and the advances connected with research directed at the potentiality of coal as a source of energy, Aureliano supported continuing the Angra-II project and postponing, "not forgetting," the Angra-III project. According to the minister, the delay of work on the Itaipu and Vaipora transmission lines together with the drought that persists in the states of the South and Southeast, especially in the Iguacu River Basin, are overloading some hydroelectric plants in the Southeast region that are already working at only 15 percent their normal capacity. Aureliano said that these difficulties, which have forced the plants installed on the Paraiba River to supply energy to the states of the South, have led government experts to consider the reactivation of smaller plants that have considerable energy generating potential, such as the Igarape plant in Minas Gerais. The president of the Sao Paulo Electric Power Company (CESP), Jose Godemberg, said that if there is not enough rain by the end of January, the state of Sao Paulo may suffer energy rationing. He pointed out that the "programmed suspension of supply" will first affect industries that operate furnaces and only later will there begin to be a curtailment in public lighting. [Text] [Sao Paulo O ESTADO DE SAO PAULO in Portuguese 18 Dec 85 p 26] 8711/13104

CSO: 5100/2032

INDIA

BHAGAT ANSWERS QUESTIONS ON RAJIV STATEMENT

New Delhi PATRIOT in English 4 Dec 85 p 1

[Text] External Affairs Minister B.R. Bhagat clarified in Rajya Sabha on Tuesday that India's options on making a nuclear bomb were still open despite Mr Rajiv Gandhi's reported statement in Japan that India will not make one even if Pakistan acquired it.

While clarifying queries on his statement in Parliament on the Prime Minister's visit to Vietnam and Japan, Mr Bhagat repeatedly said that he saw no "contradiction" between what Mr Gandhi said in Japan and what he has been saying in the country. "Did he ever say that we will make the bomb?" he counter questioned.

The External Affairs Minister said, "Our present position is that we are not making a nuclear bomb. But it does not bind us for future."

"No country, much less we, are going to compromise in any way our security interests which is paramount," he said.

"We have always maintained that our nuclear programme is for peaceful purposes even though India had nuclear implosion technology," he said and reiterated that "we have definite information that Pakistan has a nuclear weapon programme which introduces a new dimension in our security perspective."

"We have to keep our options open for our security," the Minister remarked.

Earlier, members from the Opposition stressed that if Mr Gandhi had overruled the possibility of India making a nuclear bomb even if Pakistan made one, he was closing India's option. On the other hand, in Parliament and elsewhere he has said that India's options were open.

CSO: 4600/1266

PAKISTAN

COMMENTARY ALLEGES INDIA HAS TACTICAL NUCLEAR CAPABILITY

GF061844 Lahore NAWA-E WAQT in Urdu 3 Feb 86 p 1

[By Nazir Naji]

[Excerpts] Lahore — India has acquired the capability to manufacture tactical nuclear weapons. The nuclear shells, which can destroy everything within a perimeter of 2 km, are already deployed by NATO and the Warsaw Pact. The PRC also has equipped its army with these weapons. These tactical nuclear arms can be fired from ordinary mortars.

A Western technical research paper has written that Indian scientists began efforts to manufacture these shells from plutonium soon after their 1974 nuclear explosion. The idea was to manufacture such shells which could cause destruction in a limited area. They started tests at the Kasipur gun and armaments factory. The substance used in these shells is called a toxic agent. The toxic effects of these nuclear shells remains effective only for a short period and only within a limited area. This substance is being kept secret. India at present is capable of equipping one batallion of its artillery with these shells. India also has manufactured a hydrogen bomb and it can test it at any time.

Former President Moraji Desai had stopped action on the Indian nuclear program but Mrs Gandhi ordered the program to be resumed when she came to power in 1980. Prime Minister Rajiv Gandhi is also devoting his full attention to this program.

In this nuclear program India not only wants to establish its hegemony in Southwest Asia, but also to convey a warning to the PRC. India believes that the PRC is helping Pakistan in the latter's nuclear program. Pakistan and the PRC have both denied this but India adheres to its suspicion.

Between 30 or 40 Indian scientists are busy in the Bhabha Atomic Research Center working on the hydrogen bomb. This project is working on a scientific technique which is called the ICF, or international confinement fusion.

The United States has remained silent on India's fast progress in the nuclear field, while keeping a very strict watchful eye on Pakistan's peaceful nuclear program. President Reagan in a letter to President Zia warned him: "If Pakistan continues to work on its nuclear program, then the United States will stop its military and economic aid to Pakistan."

President Reagan said that Pakistan should use its Kahuta nuclear plant for processing uranium. This uranium will serve as fuel for the reactor but it cannot be used in manufacturing arms.

In reply, Sahabzada Yaqub Khan, in a meeting with President Reagan, assured him that Pakistan was ready to work on U.S. suggestions with regard to the Kahuta plant.

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CSO: 5100/4734

PAKISTAN

BRIEFS

TALKS ON FRENCH REPROCESSING PLANT--Islamabad (special correspondent)--A high-ranking French delegation will arrive in Pakistan on 11 February under the leadership of the secretary general of the Ministry of Energy. The delegation will hold talks on the sale of a nuclear reprocessing plant. During their 2-day stay in Pakistan they will call on President Ziaul Haq and Prime Minister Junejo. Pakistan signed an agreement with the previous French regime for the sale of a nuclear reprocessing plant, but that agreement could not be implemented because of international pressure on France. France attached some very difficult conditions to the sale and Pakistan could not accept them. The agreement, therefore, was shelved for years, but talks with the French authorities on the subject continued on various levels. After the Fes conference Foreign Minister Sahabzada Yaqub Khan held talks with the French foreign minister in connection with the sale, and the visit of the French delegation to Pakistan will follow up those talks. The delegation will include some high-ranking officials in the French Ministry of External Relations. Neutral observers in Islamabad have expressed the hope that France and Pakistan will work out a mutually acceptable formula under which France will be able to sell the reprocessing plant to Pakistan. These observers believe that the peaceful nuclear policy of Pakistan has been accepted at the international level. Moreover, international pressure on France has also weakened in face of the growing energy needs of Pakistan. [Text] [Lahore NAWA-E WAQT in Urdu 17 Jan 86 p 1] /8309

CSO: 5100/4733

SOUTH AFRICA

KOEBERG NUCLEAR REFUELLING SOON

Johannesburg THE CITIZEN in English 16 Jan 86 p 12

[Text] CAPE TOWN. — Unit One at the Koeberg power station is to reduce its output in order to refuel at the end of this month.

Escom's liaison officer, Mr A van Heerden, told The Citizen yesterday this would involve replacing a third of the nuclear fuel in the reactor, and inspections and maintenance would at the same time be carried out on the reactor vessel, the steam generators, primary pumps and turbines.

Unit number two would in the meantime continue supplying 922 MW to the national grid, he said.

Mr Van Heerden said fuel removed from the reactor would be stored under water for a number of years in the spent-fuel pool in the fuel building.

The handling of fuel would be carried out under water by remote control, and would be supervised by a team of qualified and trained Escom personnel.

The refuelling operation would be monitored by the Atomic Energy Corporation (AEC).

Mr Van Heerden said Koeberg's fuel elements, new and spent, were also

subject to international safeguards of the International Atomic Energy Agency, whose inspectors visited the plant regularly to audit the fuel.

He said the uranium dioxide fuel used at Koeberg was in the form of small ceramic pellets, which were sealed in zirconium alloy fuel rods 3,8 m long, mounted in fuel elements. The uranium

fuel was enriched to contain three percent U235, which is the energy source in the reactor.

Since first generating electricity in April last year, he said, Unit One had produced about 8 750 KWH. A KWH is the standard unit in which electricity is metered in the home.

Mr Van Heerden said this was equivalent to electricity generated by burning about 4,5 million tons of coal in a power station in the Transvaal.

Had Koeberg been a coal-fired power station, 2 660 trains would have been required to transport the coal needed by unit one since April last year. Unit one, however, used about 25 tons of uranium fuel in the same period.

Mr Van Heerden said

there was a substantial saving of fresh water by generating this electricity at the coast at a nuclear power station.

Koeberg had saved the country 22 000 million litres of water by using sea water for cooling. This was about 73 percent of the capacity of the Steenbras Dam, which supplies water to the metropolitan area of Cape Town.

Mr Van Heerden said the total increase in the radiation dose at the Koeberg site boundary this year has been 0,5 MREM, which was about two percent of the permissible radiation dose of 25 MREM a year set by the AEC. The natural background level of radiation is 100 to 150 MREM a year.

CSO: 5100/14

SOUTH AFRICA

BRIEFS

POWER REDUCED FOR RELOADING--Our Cape Town news staff reports that the power supply from one of the units at the Koeberg power station has been reduced in view of the first annual reloading of nuclear fuel at the end of the month. One-third of the units' fuel will be replaced, and routine check and maintenance work will be conducted during the same period. The used nuclear fuel, which will be removed from the reactor, is to be stored under water in the fuel building. The reloading of the reactor takes place under water; under strict control of a team of ESCOM [Electricity Supply Commission] experts. [Text] [Johannesburg Domestic Service in English 1600 GMT 15 Jan 86 MB] /12913

CSO: 5100/15

USSR

SPECIALIST DISCUSSES TOKAMAK PROGRESS, INTERNATIONAL COOPERATION

Moscow IZVESTIYA in Russian 1 Dec 85 p 3

[Interview with Academician B. Kadomtsev, by B. Konovalov; date and place not given]

[Text] Academician B. Kadomtsev tells of the prospects of building an international thermonuclear reactor.

The reaction of fusing light nuclei into heavier ones with the discharge of an enormous amount of energy has been revealed to the world in all its vast power by the explosion of thermonuclear bombs. And for more than 30 years now physicists have been trying to "tame" the thermonuclear reaction and make it burn peacefully in reactor "furnaces." Unfortunately, the outwardly simple idea of fusing nuclei has proved to be one of civilization's most difficult scientific-technical problems as efforts have been made to put it to peaceful use. Therefore it is wise and advantageous to combine the efforts of all the world's scientists to solve this problem, which would forever relieve the threat of energy starvation on our planet.

It is the general opinion of respected world experts that the most promising and fastest road to building thermonuclear power plants is the so-called "Tokamak's" (an acronym for the words for "toroidal chamber with magnetic windings"), which appeared first in the Soviet Union. They are doughnut-shaped devices in which the "fuel" is heated by a powerful electrical current, but prevented from scattering by a strong magnetic field. And it appears that this line of development will be the main focus of international cooperation on thermonuclear synthesis. IZVESTIYA's science observer asked a prominent Soviet scientist to tell about the state of the work and evaluate its prospects.

[Question] Boris Borisovich, there is a humorous picture in the works of the 10th European Conference on Thermonuclear Synthesis and Plasma Physics, which was held in Moscow in 1981. The picture shows a Tokamak in the form of a

rubber chamber which one physicist is inflating, while another tries to squeeze through "barbed wire" made of the designations of its physical parameters. All over the chamber you can see expenditures caused by "punctures" from earlier attempts to overcome the barrier. How do you assess the situation today? Has the Tokamak been able to break through this "barbed wire" that bars the way to thermonuclear power plants?

[Answer] At the present time, not entirely. For a commercial thermonuclear power plant the thermonuclear combustion must last for a long time at a consistent and very high temperature. The largest installations can now heat plasma to the astronomical temperature of about 100 million degrees, but this temperature is only held for fractions of a second. However, we have a fairly clear idea of what must be done to accomplish our goal.

I can give a simple analogy to make the situation understood. Everyone knows that a pile of coal contains a great deal of thermal energy. But if you try to ignite the coal with just a match, you get nothing. In order for it to ignite you have to have a certain volume of heated coal so that the heat loss through the outside surface is compensated for by its arrival inside. Therefore, you first make a stack of wood, which is easier to get burning, and then set the pile of coal on top it and set the fire. If the mass of the coal is great enough, self-sustaining combustion will take place. But if the red-hot pile is scattered, the individual pieces of coal will quickly go out.

In just the same way, if you take a small volume of plasma, this is like a "chunk of coal" and will quickly cool. The greater the volume of hot plasma, the smaller the role of cooling. The main line of development of the Tokamak on the way to becoming an industrial reactor is enlarging its dimensions. And physicists are moving along the road step by step.

In recent years a number of countries have built installations in which the so-called transition through constancy is supposed to be carried on; this is where the thermonuclear reaction releases about as much energy as is used to heat up the plasma. Essentially this demonstrates the possibility in principle of carrying on a permanent thermonuclear reaction. Physicists are now in this very stage of work.

[Question] How confident are physicists that it is possible to ultimately get a thermonuclear reactor by enlarging the dimensions of the Tokamak?

[Answer] From the point of view of physics, this question means how correct is the modeling of plasma behavior on a large scale done using modern equipment. To resort to an analogy, this is essentially the same thing as model testing in aerodynamic tunnels during aircraft design. Everyone knows how important and significant model testing is, but the pilot still has the last word. He is the one who gets in the cockpit and takes the plane up into the sky. And then things become perfectly clear. The situation with the thermonuclear reactor is similar. How exactly the modeling approaches reality is still not completely clear.

The route that we have already come shows that as the dimensions of the devices are enlarged the situation becomes increasingly favorable -- cooling per unit of

plasma decreases. Progress was especially fast in the initial stage, during the transition from the smallest devices to larger ones. The characteristics of plasma are also improving at large new installations today, but more slowly. And we still have not determined the volume at which plasma begins to sustain its own combustion. If you consider that a large thermonuclear installation is an expensive structure, then the lack of precise knowledge means either a certain risk in accomplishing the goal or the expenditure of additional capital to build a safety margin for obtaining the necessary parameters. Obviously, we would like to spend less money and also not blunder.

[Question] The recent meeting in Geneva cannot help taking us back to the history of the declassification of thermonuclear research. It is common knowledge that our country was the first to do this, and in his famous lecture at Harwell, the English atomic center, Academician I. V. Kurchatov told about the thermonuclear research being done in our country. Then at the second Geneva Conference on Peaceful Use of Atomic Energy all the countries withdrew the curtain of secrecy. It is interesting that it turned out that the studies being done in various countries duplicated one another. This was the most convincing demonstration of the usefulness of cooperation in this field. How do you assess the course of cooperation in thermonuclear research today and what are the prospects in this field?

[Answer] In 1978 the Soviet Union proposed to the International Atomic Energy Agency (IAEA) that the efforts of the highly developed countries be combined in order to jointly design, build, and then run experiments with a test thermonuclear reactor for the purpose of obtaining the data necessary to design and build a thermonuclear power plant. This proposal was adopted, and a working group on the international Tokamak, with the acronym "INTOR," was formed. An international working group of specialists from the USSR, the USA, Japan, and Euroatom (the organization of the Western European countries) has been working actively since 1979, meeting 3-4 times a year at IAEA in Geneva.

The first step was preparation of physical substantiation, and then a preliminary, as we say, or conceptual, as the say in the West, design was done. This draft design makes it possible to begin designing a real device. Because the data being obtained by all the participating countries during their research and development steadily reduce the degree of uncertainty in choosing technical concepts, the design is continuously being improved. This work continues today.

INTOR is supposed to show the possibility in principle of building a thermonuclear power plant using Tokamak reactors. All the basic engineering and technological decisions must be worked through on this device. The plasma must warm up in seconds and burn in the thermonuclear mode for about 5-10 minutes. The cycle can be repeated after one minute. This is plenty of time to obtain the scientific-technical data necessary for designing the industrial thermonuclear reactor.

The price of the INTOR class experimental installation is comparable to the cost of a large automotive plant. Calculations by specialists have shown that with an international solution process the contribution of each country will be just one-half to one-third of what independent construction of such a device would cost.

Because there is a certain element of risk in the technical concept, it makes sense, of course, to take this crucial step through combined efforts. The work already done on the INTOR project creates the basis for development and construction of an international thermonuclear reactor. In principle, it is already possible to move to the stage of the contract design, which should take about four years. And then it will be possible to begin construction, which will take somewhat longer.

[Question] To what extent can participation in the international project influence our national program of thermonuclear research?

[Answer] There is no question that combining efforts would enable us to cover the distance to our cherished goal -- building a thermonuclear power plant -- faster. The international community would receive free access to thermonuclear technology. But it must be understood that each country has to decide the question of its rate of advance toward thermonuclear power plants in conformity with its own particular program and financial capabilities. Each country must also develop thermonuclear technology independently on the basis of its own industry.

In our country the design of the Experimental Thermonuclear Reactor - Tokamak is under development. It can be the prototype of the experimental thermonuclear power plant, in a class with the world's first atomic power plant in Obninsk. This reactor will be able to return more energy to the grid than it consumes. International cooperation can make the solution of certain problems quicker and easier. But in principle we are ready to go the whole distance alone.

We must understand clearly, however, that the electricity received from the experimental thermonuclear reactors will still be comparatively expensive. And beyond this there are still many difficulties to be surmounted on the road to the industrial thermonuclear reactor which produces energy on a competitive basis with other types of power plants.

11176

CSO: 5100/8

SWEDEN

NUCLEAR WASTE BEGINS TO BE STORED IN SEALED ROCK CAVERNS

Stockholm DAGENS NYHETER in Swedish 11 Jul 85 p 9

[Article by Bjorn Anderberg: "First Nuclear Waste Down to Cavern Today"]

[Text] Sweden's 7,500 tons of spent, highly radioactive nuclear fuel is now to be stored in large basins 25 meters below the surface while awaiting a final solution to the waste problem.

Today, Thursday, Swedish Nuclear Fuel Processing Inc. (SKB) will open a new storage facility connected with the nuclear power plant in Oskarshamn.

From the beginning the idea was that all Swedish waste would be transported to the reprocessing facility at La Hague in France. At the same time there was uncertainty as to what would happen to the reprocessed waste, which Sweden would have received back from the French.

"Meanwhile, the government and we in the nuclear power industry have agreed that the best solution is to have interim storage of the waste in Sweden," says Sten Bjurstrom, managing director of SKB, to DAGENS NYHETER.

The agreement with the French reprocessing facility still stands, however. Continuous renegotiations are now under way to release Sweden from the contracts with La Hague.

"So far we have sold some of the reprocessed material to a Japanese company, and another part of it we have exchanged with the Germans, so that we store some of their non-reprocessed waste in exchange for their taking care of the waste we have sent to France," Sten Bjurstrom recounts.

Gradually all contacts with the French are to be terminated.

Instead, the 67,500-ton total amount of waste which will result from the Swedish nuclear power program will end up in the mountain under the Simpevarp peninsula.

"The new facility is today able to receive 3,000 tons of spent fuel, but an expansion is already planned for 1995," Sten Bjurstrom says.

Solution Later

Some time in the mid-2000's, long after all Swedish nuclear power plants are to have been scrapped, the final storage will take place.

"But what that will look like we don't know yet. Now, however, we have plenty of time to look for a good solution," Sten Bjurstrom says.

While waiting for the facility in Oskarshamn to be completed, the waste was stored locally at each power plant. Now, the famous transport ship "Sigyn" will gradually transport all the waste to the new facility.

The waste storage facility cost 1.7 billion kronor to build, money which the consumers of electricity must pay.

It is not only nuclear fuel which must be stored for the future.

The nuclear power industry also has so-called medium-radioactive waste, that is to say all the other radioactive equipment. That is to be finally stored in rock caverns at the Forsmark power plant.

11949

CSO: 5100/2509

SWEDEN

WEAPONS GRADE PLUTONIUM SEEN RESULTING FROM WASTE STORAGE

Fuel Waste Storage Danger

Stockholm SVENSKA DAGBLADET in Swedish 24 Nov 85 p 6

[Text] In as little as 100 years, our grandchildren's grandchildren will have access to plutonium for manufacturing weapons. The reason is that by then the plutonium in stored nuclear fuel will have become refined to the point that it can be used for military purposes.

According to the TT, Lars Nordstrom, former director general of the Nuclear Power Inspection Board, affirms that this will happen as a result of purely physical processes.

Nordstrom was expressing his views at a seminar organized by the People's Campaign Against Nuclear Energy in Stockholm on Saturday.

Reactors Start up

"Only Sweden has come up with a complete plan for the final storage of spent nuclear fuel. That plan has been circulated for comment and approved by the government. And on that basis, the startup of two reactors has been permitted," said Lars Nordstrom, and he emphasized that the final storage of spent nuclear fuel is not possible.

"What the plan means, therefore, is that we are establishing an ore deposit in which the material will mature, and sometime in the future, it may pass directly from the state of mined ore by way of leaching to that of plutonium in nuclear charges.

Refined by the Passing of Years

"We have been forced to proceed by way of complicated reactors and reprocessing to weapons."

Minister of Energy Birgitta Dahl declined on Saturday to comment on those statements.

According to Lars Nordstrom, no one had given any thought previously to the way in which plutonium becomes refined with the passage of years.

"It may be, of course, that others realized this but did not want to see it."

Rock Caverns Useless

He feels that it is senseless to talk about storage in rock caverns.

"When one produces a plan and shows that storage will last for 1 million years thanks to copper capsules, buffering material, and so on and gets that plan approved but forgets that the final storage site will become a mine for nuclear charges and eventually warheads, wouldn't you say that a mistake has been committed?"

But he has no solution to the problem.

He says: "I am afraid that we have made a big cultural mistake and created a plutonium problem that we cannot handle."

New Sealed Storage Method

Stockholm SVENSKA DAGBLADET in Swedish 26 Nov 85 p 9

[Article by Henrik Ekman]

[Text] The Nuclear Power Corporation's method for the final storage of fuel is getting some competition. Boliden WP-Contech is launching an alternative that is said to place fewer demands on the rock.

The method is known as WP-Cave. It emerged as an idea as far back as 10 years ago. Then, a year and a half ago, the National Nuclear Fuel Board joined in a project to evaluate the advisability of investing in it.

The board supported the project with 4.8 million kronor in subsidies.

The final report was submitted on Monday. Project leader Christer Svemar of Boliden WP-Contech claimed that no flaws serious enough to make the method impossible had come to light.

Work Remains

Chief engineer Nils Rydell of the Nuclear Fuel Board, who was chairman of the project group, emphasizes that a great deal of work remains to be done before the value of the method is known. The big and difficult question is how to go from "paper calculations" to a practical test.

The power company's own alternative for final storage--KBS-3--involves collecting all fuel from the Swedish nuclear program at a single storage site. Storage tunnels are to be drilled at a level from 350 to 500 meters down in primary rock.

Casks in Rock

WP-Cave storage can be compared more to a large, 250-meter-high drum placed down within the rock. Galleries fan out in an egg-shaped area. As with the KBS-3 method, bentonite clay is used to encapsulate the fuel. But in this case, a single 5-meter-thick casing of bentonite is built around the entire storage area, which will have a diameter of 110 meters.

Another special feature of WP-Cave is its so-called hydraulic cage. This consists of three ring-shaped tunnels running horizontally around the storage area--one above, one below, and one at the "waist." They are connected by boreholes, thus equalizing the pressure in the rock beyond. The result is that water remains there and is guided around through the tunnels primarily, says Nils Rydell.

The project was concerned with a storage area capable of handling 1,500 tons of waste. With storage areas of that size, four or five WP caves would be required to store all the waste from the Swedish nuclear program.

Nils Rydell says: "Naturally, we will eventually choose one of those methods of final storage rather than several. But perhaps we will pick the best of the various alternatives."

Energy Minister Comments

Stockholm DAGENS NYHETER in Swedish 2 Dec 85 p 16

[Article by Bo M. Melander]

[Text] Minister of Energy Birgitta Dahl has told DAGENS NYHETER: "We are not locked into the current plan's details as far as final storage of the waste from nuclear power plants is concerned. The question is open and can be debated until about the year 2000."

She is currently working to achieve agreement as broad as possible. On Tuesday she will present a strategy for phasing out all nuclear energy between the end of the 1990's and the year 2010.

Since the heated quarrels over nuclear energy in the 1970's, which led to a referendum in which the majority voted to phase out nuclear energy by the year 2010, the rough seas surrounding the debate have grown calm.

Minister of Energy Birgitta Dahl has said time and again that the result of the referendum will be respected, but the opponents of nuclear energy have doubted that and demanded a plan.

Tomorrow Birgitta Dahl will present a phasing-out strategy that calls for Parliament to make a decision on the "switchover" in 1995. The first reactors are to be closed down at the end of the 1990's, and the rest will shut down over the following 10 years.

Here the nuclear waste is encapsulated in copper cylinders.

Workshops, dressing rooms, etc.

Storage of bentonite clay, capsules, etc.

Personnel elevator
Elevator for excavated material
Elevator for encapsulated nuclear waste

FINAL STORAGE
Lift trucks take cylinders containing waste to final storage

Tunnels and holes are refilled with bentonite clay.

Bentonite clay
Copper cylinders with nuclear waste (5 meters long)

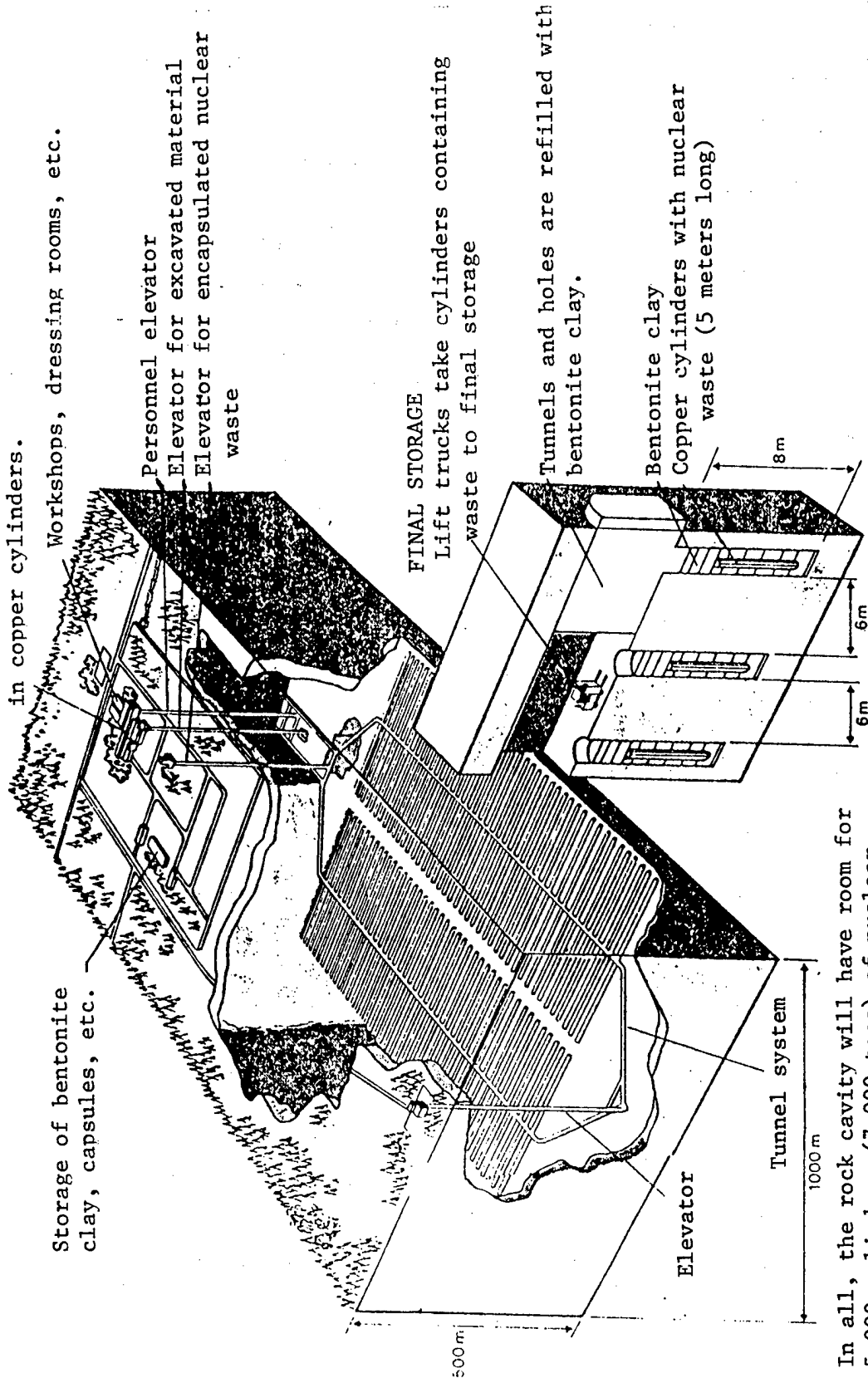


Illustration: AGNETA FEDERSEN/Swedish Film; MAXS MOLIN
Foto: TOMAS LAMPELL/KTH, SKB

In all, the rock cavity will have room for 5,000 cylinders (7,000 tons) of nuclear waste (1.4 tons per cylinder).

Sweden will have to choose some form of storage in rock, says Minister of Energy Birgitta Dahl, but she does not feel locked into the model shown above (known as KBS-3). She is keeping the question open for 15 years.

The final decision on nuclear waste will be made sometime around the year 2000.

Birgitta Dahl says: "The entire decisionmaking process that is to take place will be based on broad democratic cooperation."

The minister says: "Much distrust and deep wounds still remain from the years of heated debate. That is why it is important now for us to approach the problems with a little ordinary common sense."

We asked: "Will the phasing out of the reactors, which produce half the electricity supply, be successful?"

Birgitta Dahl said: "Absolutely. We must remember that half of today's production is used for heating, and we are becoming constantly better at conservation and at using energy more effectively."

Conservation and back-pressure power are the happy paths which, along with a number of other measures, will lead to a Sweden free of nuclear energy.

The plans for switching over are to be worked out by 1995.

Along with the phasing out of nuclear power plants, the question of nuclear waste is to be discussed until the year 2000, and geologists are to continue looking for suitable rock formations in which the waste can be placed.

"Stop drilling! Waste storage sites may become future plutonium mines where future generations can obtain plutonium for nuclear weapons." That was the recent warning by Lars Nordstrom, former head of the Nuclear Power Inspection Board.

Birgitta Dahl says: "Nordstrom's viewpoint is not new; it has been part of every assessment during the years in which the safest solution has been discussed. And we are not locked into the plans that exist today. But it is probable that there will have to be some kind of storage in rock.

"I was extremely surprised when Nordstrom said that the moral issue was new. In our party, the question of waste has always been linked with the risk of nuclear weapon proliferation and with disarmament issues, which we are involved in internationally."

Dahl emphasizes that the waste problem is a global one and that it involves not just waste from nuclear power plants but also that from the military nuclear fuel cycle.

"We must solve the problem because there is already so much waste around the world, and I am convinced that it can be done."

And Birgitta Dahl says that the moral issues are not a matter just for science but also, and in the highest degree, for the politicians, who are responsible for them in their context.

She is now hoping that all good forces in Sweden will cooperate in favor of a solution that will be the best possible.

We have 15 years of discussion about waste ahead of us.

JPRS-TND-86-005
21 February 1986

'Swedish Model' Outlined

Stockholm DAGENS NYHETER in Swedish 2 Dec 85 p 16

[Article by Bo M. Melander]

[Text] "The eternal questions" about nuclear waste are the same today as they were 20 years ago: how can we guarantee the safety of future generations and what might future generations do with the waste from nuclear power plants? The Swedish Government has not yet taken a definite stand on the waste question. It is keeping the question open for 15 years.

Internationally as well, countries are feeling their way through various technical principles and ethical discussions.

The "Swedish model" (see the illustration above) was forced into being by the so-called Nuclear Safeguards Law, which stipulated that the power industry must show a "solution" before being allowed to start up new reactors.

The solution is theoretical and has been accepted by Parliament as grounds for deciding to allow the startup of the latest reactors, but the government has not committed itself.

According to the rolling plan, bedrock in various places in Sweden will be studied between now and 1990, when detailed studies of a few sites will begin and continue until the year 2000. After that, supplementary studies and government processing of the formal applications will get underway.

According to plans, the go-ahead for excavating a rock cavity, if that is the solution adopted, will be given in 2010, and that cavity is to be ready to go into operation in 2020.

Rock or Sea

Internationally, studies are currently concerned chiefly with the storage of high-level wastes in salt beds, clay deposits, and primary rock at great depths. The ethical discussion surrounding that method of disposal is also concerned with the question of whether the deposits will have to be sealed or monitored by humans for many generations to come.

The storage of waste in thick beds of sediment on the sea bottom is under study by the OECD.

Earlier proposals to launch waste into space or bury it under polar ice are now considered completely unrealistic.

Treatment

There are currently two ways to treat spent fuel from a nuclear power plant:

Sweden has chosen to store the waste in the same form in which it leaves the reactor. Plutonium and other transuranic elements that are formed during operations at the nuclear power plant will remain in the waste. Transuranic elements make the waste "long-lived"--that is, dangerous for thousands of years because of its radiation.

The second method, used by a number of countries, is "reprocessing," meaning that the transuranic elements are chemically separated from the waste so that the uranium and plutonium can be reused. What is left over becomes high-level waste in the form of a solution of metallic salts, and the intention is to convert it into solid form for final storage.

One advantage of reprocessing is considered to be the smaller volume of waste. At present, very little spent nuclear fuel has been reprocessed anywhere in the world.

Regardless of the method chosen, final storage is still required, and the principle is that each country takes care of its own waste.

Selling Space

The International Atomic Energy Agency in Vienna has drawn attention to the possibility that countries with favorable geological conditions might sell space in their final storage facilities to countries whose conditions are less favorable.

China is currently the only country that has offered to take charge of spent fuel and high-level waste from other countries.

When Lars Nordstrom, former head of Sweden's Nuclear Power Inspection Board, recently dismissed the current plans, which do not call for neutralizing the plutonium--which can be used in the future to produce nuclear weapons--his objections were ethical and in line with similar debates in recent decades that have taken place primarily in the United States and Great Britain.

The plutonium problem has long been recognized, not only among opponents of nuclear power but also among the originators of the technology.

"Unacceptable"

In 1976, an ASEA nuclear engineer named Pelle Isberg wrote a book entitled "Swedish Nuclear Energy" in which he considered direct storage of nuclear waste "unacceptable." He wrote:

"Can one really treat all plutonium as waste? Whether from the standpoint of waste or that of energy, doing so seems completely unacceptable considering the course of the debate over nuclear energy.

"It is true that plutonium is better protected as long as it is in fuel pellets rather than in some other form of storage, but viewed from the perspective of 1 million years, that is not especially convincing."

Isberg felt that the right way to handle plutonium "would naturally be to burn the substance, and preferably, that should be done in breeder reactors."

But the reprocessing method involves risk because "plutonium leaks," and that can lead to the spread of nuclear weapons.

Various Solutions Around the World

So Sweden plans to store its waste in rock beginning in the year 2020. The power industry will be responsible for that activity under government supervision. There are no plans to reprocess waste.

Finland has the same plans, but is keeping the door open to reprocessing. The power industry is responsible under government supervision.

The United States is studying final storage in rock, salt, and clay beds and expects to start in 1998. It is open to both direct storage and reprocessing. The government is responsible.

France is studying final storage in rock, salt, and clay beds but has not decided how final storage is going to start. Nuclear waste is reprocessed. The government is responsible.

Great Britain is studying storage in rock and on the sea bottom, and its plans call for final storage after the year 2040. Waste is reprocessed. The government is responsible.

The FRG has concentrated on storage in salt beds. Plans call for storage to begin in 1998. The question of reprocessing will be decided before 1990. The government is responsible.

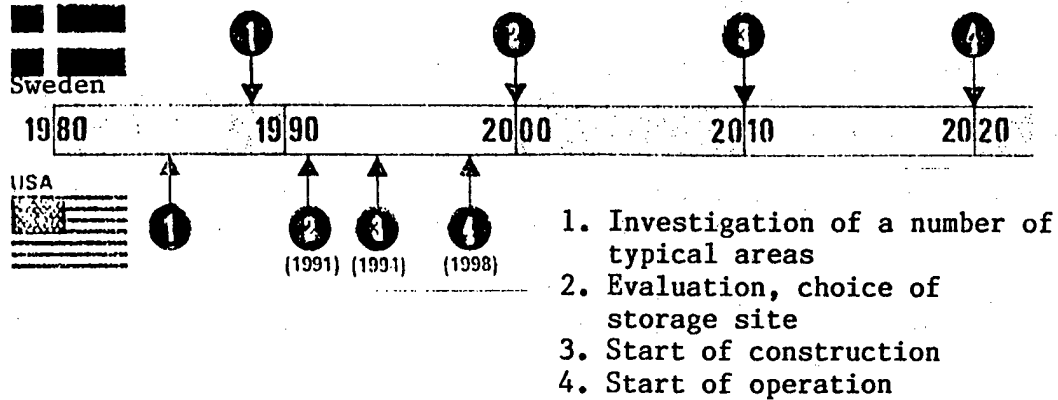
Switzerland intends to deposit its waste in rock by the year 2020 at the earliest. Waste is reprocessed, and the power industry is responsible under government supervision.

Japan intends to deposit its waste in rock after the year 2015. It is considering both reprocessing and direct storage. The government is responsible.

Canada also plans to store its waste in rock sometime after the year 2000. It is considering both reprocessing and direct storage. The government is responsible.

The Soviet Union has not published any plans concerning final storage or the method it considers appropriate. Waste is reprocessed. In the Eastern bloc, it is the Soviet Union that takes charge of waste.

Timetable for Nuclear Waste in Sweden and the United States



The United States expects to begin final storage as early as 1998 (stage 4). Sweden has chosen a longer time frame in which to investigate and evaluate various storage sites and does not plan to begin final storage before 2020.

Danish, Swedish Opposition Group

Stockholm DAGENS NYHETER in Swedish 16 Dec 85 p 16

[Text] (TT)--The People's Campaign Against Nuclear Energy and the Danish energy movement known as the OOA have issued a joint statement demanding that the nuclear power plant in Barseback be given special treatment and that a separate plan be established to phase it out more quickly than the other nuclear power plants.

Lena Warrer, a member of the OOA's special Barseback group, says: "We cannot postpone a discussion of the Barseback plant's continued operation for 10 years.

"We do not want to live under the threat from Barseback. The majority of Denmark's population wants Barseback to be closed down. The Swedish Government ought to take that into consideration."

According to the OOA (Organization for Information on Nuclear Energy), the fact that the Barseback plant is located so close to Copenhagen's 1 million inhabitants means that it concerns the Danes as much as it does the Swedes.

The People's Campaign Against Nuclear Energy says in the statement: "Denmark decided last spring not to introduce nuclear energy, partly for safety reasons. From the Danish point of view, continued operation of the Barseback plant is completely irresponsible and a serious provocation."

11798

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SWEDEN

BRIEFS

URANIUM MINING ACTIVITY ENDED--On Tuesday the board of Swedish Nuclear Fuel Processing (SKB) made the formal decision that the search for uranium in Sweden is to cease, the TT news agency reports. Although limited uranium mining in Sweden could become economically justifiable, the board is of the opinion that the supply of imported uranium is both good and secure. According to the SKB it will now be at least between 5 and 10 years before a reevaluation of the decision to halt the search for uranium might take place. [Text] [Stockholm SVENSKA DAGBLADET in Swedish 4 Dec 85 p 6] 11949

RINGHALS PLANT UNDERGOING REBUILDING--The National Power Administration has formally asked the government for permission to rebuild the steam generators in the second unit of the Ringhals nuclear power plant. The rebuilding will cost about 1 billion kronor but will pay for itself within 6 years, writes the Power Administration, which is of the opinion that a rebuilding will be very profitable. Energy Minister Birgitta Dahl has said that the government will study the issue very carefully once the Nuclear Power Inspection and the Energy Authority have had their say. [Text] [Stockholm SVENSKA DAGBLADET in Swedish 5 Dec 85 p 6] 11949

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