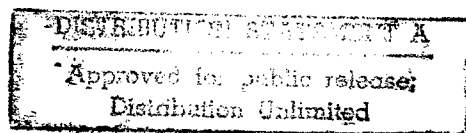




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JPRS Report

Nuclear Developments



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Nuclear Developments

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CONTENTS

15 MAY 1990

CHINA

Support for Nuclear-Free Zone in Middle East Voiced [XINHUA]	1
Testing Completed on Heat-Supplying Nuclear Reactor [XINHUA]	1
Guangdong Nuclear Power Project Construction Continues [Guangzhou Radio]	1
Nuclear Industry Helps in Gold Production [XINHUA]	1

EAST ASIA

INTER-ASIAN AFFAIRS

Japan Asks Soviets To Push DPRK's IAEA Compliance [Seoul SEOUL SINMUN 22 Apr]	3
---	---

JAPAN

LDP, JSP Meet at Atomic Industrial Forum [Tokyo TV]	3
---	---

NORTH KOREA

Pyongyang Said Exporting Missiles to Third World [Seoul CHOSON ILBO 21 Apr]	3
Conditions Said Attached to Nuclear Safeguard Inspections [Seoul TV]	3
Safeguards Agreement Expected by September [Seoul YONHAP]	3

EAST EUROPE

GERMAN DEMOCRATIC REPUBLIC

Nuclear Power Plant Flaws Examined [Frankfurt/Main FRANKFURTER ALLGEMEINE 17 Mar]	5
--	---

LATIN AMERICA

ARGENTINA

Suspension of Condor II Missile Program Reported	8
Iraqi Connection Denied [DYN]	8
Defense Minister Comments [CLARIN 22 Apr]	8
U.S. Pressure Cited [CLARIN 25 Apr]	8
Project for 'Peaceful Purposes' [TELAM]	9
British Reaction [CLARIN 25 Apr]	9
Motivation Discussed [Madrid EFE]	9
Air Force Chief's Statement [TELAM]	10
Technical Details [CLARIN 29 Apr]	10

CHILE

Defense Minister Denies Nuclear Capability	11
JANE'S Report [Santiago Radio]	11
Minister's Statement [Santiago Radio]	11

NEAR EAST & SOUTH ASIA

EGYPT

Paper Backs Iraq, Libya on Nuclear Inspection [AL-AKHBAR 11 Apr]	12
--	----

INDIA

Commentator Scores U.S. Stand on Pakistan Bomb [THE HINDU 2 Mar]	12
Stolen Uranium Destined for Pakistan Recovered [THE HINDU 28 Feb]	16
TV Deletes Sundarji Remarks on Pakistan Nuclear Stance [THE HINDU 28 Feb]	16
Officials Comment on India's Nuclear Option	16
Navy Chief of Staff [THE TELEGRAPH 11 Mar]	16
Minister of Defense [THE HINDU 9 Mar]	17
India Rare Earths Monazite Sands Allegedly Dangerous [THE HINDU 28 Feb]	18
Fast Breeder Reactors Urged for Nuclear Power Program	18
Speakers at Kalpakkam [THE HINDU 6 Mar]	18
More Details on Reactors [THE HINDU 25 Feb]	19
Experts, Opponents on Safety of Nuclear Power Plants	20
Nuclear Energy Officials [THE TIMES OF INDIA 10 Mar]	20
Opponents of Narora [PATRIOT 3 Mar]	21
Madras Seminar [THE HINDU 7 Mar]	21

IRAN

'Uproar' Over Trigger Devices for Iraq Viewed [RESALAT 5 Apr]	22
---	----

PAKISTAN

French Reactor: 'Row' Over Belgian Participation Reported [DAWN 23 Mar]	23
Munir Assures Safety in Nuclear Radiation Utilization [DAWN 25 Mar]	23
Prime Minister Assures Continuation of Peaceful Program [THE PAKISTAN TIMES 30 Mar]	24

WEST EUROPE

CANADA

Pickering, Bruce Plants Each To Close Reactor for Testing [THE TORONTO STAR 4 Apr]	25
--	----

FEDERAL REPUBLIC OF GERMANY

Opposition Parties Criticize Fusion Research [FRANKFURTER RUNDSCHAU 22 Mar]	25
---	----

TURKEY

First ASR-227 Missile Produced; Has 2,000-Kilometer Range [MILLIYET 12 Apr]	28
Completion of First Nuclear Reactor Reported [MILLIYET 17 Apr]	28

Support for Nuclear-Free Zone in Middle East Voiced

*OW2604101790 Beijing XINHUA in English
0928 GMT 26 Apr 90*

[Text] Beijing, April 26 (XINHUA)—A Chinese Foreign Ministry spokeswoman today expressed appreciation of and support for Egypt's recent proposal that the Middle East should be a region free from destructive weapons.

She was answering a question requesting China's position on Egypt's proposal at a news briefing here this afternoon.

China has all along stood for complete prohibition and thorough destruction of nuclear weapons, chemical weapons, biological weapons and other weapons of mass destruction and given its support to the proposal for establishing a nuclear-free zone in the Middle East, the spokeswoman said.

"It is our view that should the countries concerned in the Middle East reach an agreement in this regard through consultation and on a voluntary basis, it would contribute to the Middle East peace process and to the stability and peace in the region," she said.

Israel, the most powerful country in this region in terms of military strength, should take the lead in making a response, she added.

Testing Completed on Heat-Supplying Nuclear Reactor

*OW0105173190 Beijing XINHUA Domestic Service
in Chinese 0745 GMT 22 Mar 90*

[By reporter Huang Wei (7806 1218) and correspondent Ma Xuqian (7456 2700 3123)]

[Text] Beijing, 22 Mar (XINHUA)—The 5 billion-watt low-temperature heat-supplying nuclear reactor designed and made in China stopped supplying heat today. It has now supplied normal heat for exactly 100 days. This figure indicates that China stands at the forefront internationally in the practical application of technology in the realm of low-temperature nuclear heating.

The use of nuclear energy to supply concentrated heat in urban areas has been a topic of international study for more than a dozen years. Compared with heat obtained from burning coal, nuclear heat has the special features of coal conservation, lower production cost, and no environmental pollution.

The 5 billion-watt low-temperature heat-supplying nuclear reactor designed and built by the Nuclear Energy Technology and Research Institute of Qinghua University is the world's first shell-type low-temperature reactor that has gone into operation with an inherent safety factor. It has adopted an advanced integrated structure of natural cycle. It puts the heat exchanger and the

reactor core together in a pressurized shell as an integrated body, thus improving the safety factor and the reliability of the reactor. For the transmission system of the control rod, the engineers, for the first time, used the theory of hydraulics to raise and lower the rod. Such a device has the merits of a longer life, tighter seal, and lower production cost.

Not long ago, Dr. (Frehl), world-famous expert in the field of nuclear energy in the FRG, sent a message of greeting to China. He said the completion of this 5 billion-watt reactor "is not only an important milestone in the international development of heat-supplying nuclear reactors, but also a milestone in tackling the issue of pollution."

Guangdong Nuclear Power Project Construction Continues

*HK0904035090 Guangzhou Guangdong Provincial
Service in Mandarin 0400 GMT 8 Apr 90*

[Text] Since its first nuclear reactor was installed last September, the Guangdong Nuclear Power Station has been under rapid construction over the past few months.

The overall installation work of the first generating unit of the Guangdong Nuclear Power Station is currently under way. Now the construction of the factory building that will house the second nuclear reactor of the Guangdong Nuclear Power Station has almost been completed. Some 60 percent of the installation work of the Guangdong Nuclear Power Station is expected to be completed within this year.

(Zhan Yunlong), general manager of the Guangdong Nuclear Power Joint Management Company Limited said that the year 1990 is a year in which the quality-control and investment-control work of the Guangdong Nuclear Power Station will enter a crucial stage. In 1990, a lot of preparatory work has to be done regarding the Guangdong Nuclear Power Station Project in connection with organization, technology, material, service, quality control, and state examination of the project.

(Zhan Yunlong) added that at present, the Guangdong Nuclear Power Joint Management Company Ltd is actively carrying out the training of its staff and workers. According to the construction plan, the first generating unit of the Guangdong Nuclear Power Station is scheduled to generate electricity as of October 1992, while the second generating unit is scheduled to generate electricity as of July 1993.

Nuclear Industry Helps in Gold Production

*OW3004140790 Beijing XINHUA Domestic Service
in Chinese 0520 GMT 27 Apr 90*

[By reporter Hu Nianqiu]

[Text] Beijing, 27 Apr (XINHUA)—The nuclear industry department is taking an active part in developing gold production. It is reported that in the last three

years, the nuclear industry department discovered and reported to the state 45 percent more gold deposits than the state plan target.

With the State Council's approval in 1987, the nuclear industry department has treated the development of gold production as a major item to be transferred to civilian industrial departments, and its personnel have conducted a large number of geological prospectings. To our knowledge, the nuclear department has so far completed 300,000 meters of prospecting drilling, conducted relevant scientific research, and achieved valuable results in using new technologies for gold prospecting and metallurgy, such as the heap soaking technique [dui qin ji shu 1018 3190 2111 5890] and the resin pulp method [shu zhi kuang jiang fa 2885 5176 4349 3364 3127]. At

present, the nuclear department has set up seven gold production experiment stations and processing and production lines.

The development of gold production and increase in the state's gold and foreign exchange reserves are conducive to enhancing the country's creditworthiness. China's nuclear industry department, composed of scientific research, geological, capital construction, and production personnel, has a strong capability for comprehensive research and development. Gold prospecting is similar to uranium prospecting, and gold deposits and uranium deposits usually exist together. These factors create many favorable conditions for the nuclear industry department in developing gold production. It is reported that the China National Nuclear Industry Corporation has made a plan for finding several times more gold deposits for each year during the eighth five-year-plan period than its present annual finds.

INTER-ASIAN AFFAIRS

Japan Asks Soviets To Push DPRK's IAEA Compliance

SK2204080190 Seoul SEOUL SINMUN in Korean
22 Apr 90 p 1

[YONHAP report from Tokyo]

[Text] In connection with the fact that North Korea is constructing a nuclear processing plant, the Japanese Government on 20 April requested the Soviet Union to exercise its influence to have North Korea accept an inspection team of the International Atomic Energy Agency [IAEA].

In a meeting with Petrovskiy, deputy Soviet foreign affairs minister, who is on a visit to Japan to attend the a UN arms reduction conference held in Sendai, Japan, Akao [name as published], director of the UN department in the Japanese Foreign Affairs Ministry, said: "Japan hopes that North Korea will correct its violation of the Nuclear Non-Proliferation Treaty," and requested Petrovskiy to have North Korea accept an IAEA inspection team.

JAPAN

LDP, JSP Meet at Atomic Industrial Forum

OW2304055190 Tokyo NHK General Television
Network in Japanese 1000 GMT 11 Apr 90

[Text] Representatives from the Liberal Democratic Party [LDP] and the Japan Socialist Party [JSP] today exchanged opinions on policy regarding the use of nuclear power at the 23rd annual meeting of the Japan Atomic Industrial Forum in Kyoto.

The 23rd annual meeting of the Japan Atomic Industrial Forum opened at the state-run Kyoto Kokusai Hall on 9 April; there were about 2,200 participants. On the final day today, representatives of the LDP and the JSP took part in a session as panelists. The LDP's Hiroshi Mitsu-zuka, former party policy affairs research council chairman, said that government and utility companies, realizing that their public relations activities are inadequate, should make greater efforts to provide the public with information on nuclear power which is easier to understand and more accurate. In response, JSP Policy Review Committee Chairman Shigeru Ito said that all information should be fully disclosed. He said that, regarding life and energy as important, opportunities like symposium should be held for the public to discuss and reach a consensus on the nuclear power issue.

Many citizens also took part in the convention this year. They discussed a broad range of issues including alternative energy sources and the treatment of radioactive waste.

NORTH KOREA

Pyongyang Said Exporting Missiles to Third World

SK2104024290 Seoul CHOSON ILBO in Korean
21 Apr 90 p 1

[YONHAP report from Paris]

[Text] In its recent report, the French Defense Research Foundation [FEDN] has revealed that North Korea has a considerable level of technology in the field of ballistic missiles and has been one of the main countries, including the Soviet Union and China, exporting missiles to Third World countries.

In its recent edition of the quarterly "(Strategique)," FEDN, a renowned French military affairs research institute, has termed North Korea as an "intermediary source of exports," while calling the Soviet Union and China primary missile exporting countries. It also noted that North Korea has revised Soviet-made Scud-B missiles for itself and has supplied Third World countries with them, thus playing a major role in the international proliferation of ballistic missiles.

Conditions Said Attached to Nuclear Safeguard Inspections

SK1504131890 Seoul Television Service in Korean
1200 GMT 15 Apr 90

[Report by correspondent Yi Yun-song from Tokyo]

[Text] North Korea, which has been refusing to allow the International Atomic Energy Agency [IAEA] to conduct on-the-spot verification, is reported to be demanding, in return for its acceptance of verification, that nuclear-possessing countries sign a treaty with nonnuclear-possessing countries to the effect that the former shall not use nuclear weapons against the latter. A Japanese Foreign Ministry source disclosed this today, adding that the IAEA recently contacted North Korean delegates in Vienna, Austria in connection with the issue of nuclear nonproliferation.

International nuclear weapons experts analyzed that North Korea is demanding the signing of this practically impossible treaty as a precondition for allowing verification to postpone joining the IAEA verification treaty until completing the development of nuclear weapons on its own.

Safeguards Agreement Expected by September

SK1804094390 Seoul YONHAP in English
0924 GMT 18 Apr 90

[Text] Seoul, Apr 18 (YONHAP)—The International Atomic Energy Agency (IAEA) expects North Korea to

sign a full-scope nuclear safeguards agreement in compliance with the Nuclear Non-Proliferation Treaty by September, a high-ranking IAEA official said here Wednesday.

"We expect North Korea to conclude the agreement before the IAEA General Assembly meeting in September," Boris Semenov, deputy director general of the international organization, told reporters.

The Soviet nuclear expert, now visiting Seoul to attend the 5th annual joint conference of the Korea Atomic Industrial Forum and the Korean Nuclear Society, said the expectation is not a "prediction" but a "hope."

"IAEA is very eager to conclude negotiations with North Korea as soon as possible and some measures are being taken to accelerate that process," he said.

Semenov said the IAEA and North Korean authorities had been holding bilateral discussions on the text of the agreement. He said that three to four paragraphs of the text have yet to be worded to mutual satisfaction. North Korea has been under mounting pressure to sign the agreement, which would enable the IAEA to inspect its nuclear facilities.

Touching on the IAEA's binding force, he said, "IAEA is not a police force and the safeguards agreement should be made on a voluntary basis." Semenov said he got the impression that nuclear power plants in South Korea are run in a "superb" manner during his visit to two plants in Kori and Wolsong.

Commenting on the Chernobyl nuclear mishap four years ago, he said newspaper reports on the aftermaths of the incident are not supported scientifically and they have been exaggerated.

GERMAN DEMOCRATIC REPUBLIC

Nuclear Power Plant Flaws Examined

90GE0037Z Frankfurt/Main FRANKFURTER
ALLGEMEINE in German 17 Mar 90 pp 7-8

[Article by Guenter Paul: "Brittleness Isn't the Only Danger—Risky Nuclear Technology in Greifswald"]

[Text] Lubmin, 16 Mar—When one speaks of Greifswald, then recently the nuclear power plant in the north of the GDR located in the neighboring locality of Lubmin has been part of the discussion. It is a facility composed of four reactor blocks that went into operation in the 1970's and that in the future is to be expanded to Blocks 5 through 8. It is said that the plant is run-down and the management is irresponsible. A commission of specialists from the Ministry for Environment and the Society for Reactor Safety ("Toepfer Commission") has recently recommended that Block 2 of the nuclear power plant that was shut down as a precaution not be started up again because of the worsening brittleness and that Block 3 should also be shut down. They adhered to this recommendation in the GDR, for the weaknesses of the plant are not unknown there.

East Berlin was once heavily involved in the development of nuclear power technology. As early as 1957, the GDR put into operation the first German research reactor (Rossendorf). In 1966, they started up the 70-megawatt facility at Rheinsberg, a pressurized water reactor (WWER 70) that was built to Soviet designs and was developed almost 70 percent by the Scientific-Technical Office for Reactor Construction in Berlin and by the Office for Nuclear Research and Nuclear Engineering. In pressurized water reactors, the cooling water is channeled through the reactor core. It transfers the heat taken up there to a closed water circuit. The water of this secondary circuit vaporizes and drives the turbines to generate power.

What began as a progressive development in the GDR was to end miserably. In April 1955, an "Agreement on the Assistance of the USSR to the GDR in Development and Research in the Area of the Physics of the Atomic Nucleus and the Utilization of Atomic Energy for the National Economy" was signed. A resolution of the Council of Ministers followed at the beginning of the 1960's saying that in the future nuclear technology should be imported complete.

The purpose of this qqgwas to divide up the work on major projects among the CEMA states so as to be able to achieve the desired objectives more quickly. At that time the GDR wanted, among other things, to develop its own large aircraft. The cumbersome exchange of "goods for goods" was implemented. The Office for Nuclear Research and Nuclear Engineering was dissolved in the GDR in 1962. New blood mostly deserted the projects. Thus, there was no longer anyone warning against false developments. At that time, according to Prof. Ernst Adam from the Energy Conversion Section

of the Technical University in Dresden, the GDR departed from world standards.

In those days, East Berlin had to buy from the Soviet Union what it offered and in nuclear engineering that was the pressurized water reactor WWER 440-230 with 440 megawatts of power. The suffix "230" stands for the long obsolete construction line that was later replaced by the much safer type WWER 440-213. There are a total of 14 reactors of the type 230 in the former Eastern Bloc and they are in the Soviet Union, Bulgaria, the CSSR, and the GDR. Two other reactors of this type in Finland have been "hardened" with Western safety technology.

One of the disadvantages of this reactor is that it was supposed to be transported by rail and therefore its size had to be kept down accordingly. In every reactor, neutrons are set free that make the reactor wall brittle. Small cracks form that are not harmful at first. Normally such cracks can spread only at low temperatures that do not occur in operation. The more brittle the material is, the higher is the critical "transition temperature," so that the cracks ultimately become dangerous in operation.

The neutron bombardment that leads to brittleness can be mitigated through water between the reactor core and reactor wall. In the case of the WWER 440-230, however, the column of water is so small (because of the requirements on the size of the reactor) that the walls necessarily become brittle sooner. In the case of reactor Block 2 in Lubmin, the critical transition temperature, according to their data, has now reached 147 degrees, the limiting value considered just barely admissible. This is why this block was recently shut down.

No one, to be sure, knows for certain what values are really critical for the reactor. In the West, they hang "advance samples" in the reactor core to assess the danger of brittleness: they are made of the same material as the reactor wall. Since they are subjected to a stronger neutron bombardment than the wall, they become brittle sooner and serve as a warning signal for the operation of the facility.

In the case of the WWER 440-230, it would be difficult to attach these samples because of the small dimensions of the block. Only Finland has insisted on their installation. Moscow rejects complaints in the GDR, which has no such samples. At a conference of the International Atomic Energy Organization (IAEO) held in 1977 under the motto "Nuclear Power and Its Fuel Cycle," a representative of the FRG asked the Soviet guests why they had delivered their old reactors without the usual pressure containment. The clear answer: when our customers order a suit with vest, we delivery it with a vest, otherwise we omit the vest.

Although there are no brittleness measurements for the WWER 440-230, there are at least calculations. But Friedrich-Wilhelm Heuser from the Society for Reactor Safety in Cologne thinks that these calculations are completely unreliable, because they are based on tests with less impure kinds of steel. And comparative values

from advance samples out of the Rovensk Nuclear Power Plant in the western Ukraine (WWER 440-213) are only conditionally applicable to Lubmin, because no nuclear power plant is like any other.

Wolfgang Brune, deputy general director at the nuclear power plant North, points to additional investigations in Novovoronezh. There they sacrificed a pressurized water reactor of the type WWER 200 in 1987 to measure the brittleness based on drilling cores from the pressure vessel. They previously also tested the technique of "thermal healing" on the reactor: to a certain extent, the brittleness in the reactor wall can be eliminated through intense continuous heating. The reactor Block 1 at Lubmin was again made suitable with this technique in 1988. The Soviet Union has guaranteed that 90 percent of the brittleness there has been eliminated. So far, however, there have been no material tests that can confirm this.

Supposedly Block 3 of the facility at Lubmin was not shut down based on the recommendation of the Society for Reactor Safety but on the basis of the advice of the Soviet Prof. A.D. Amayev, which was merely taken over in Cologne. Amayev, reports Brune, found out six months ago that under certain circumstances (in the case of a limited neutron flow) the brittleness can spread more rapidly than would normally be expected. But the quantitative proof is not yet in. Every nuclear physicist knows about this effect, says Heuser in Cologne. The shutting down of the block was therefore absolutely necessary. Official posts in the Soviet Union, on the other hand, have criticized the GDR for the "hasty" shutdown, probably because the reactors that they operate also get talked about.

Aside from the brittleness—which can be controlled if it is known—the reactors stationed in Lubmin have some special features that would not be permitted in the FRG. The absence of the pressure containment customary in the West is conspicuous. The reactor buildings in Lubmin have a leak rate of almost 1,000 percent by volume per day. That is, every day a volume of air slightly contaminated with radioactive particles escapes that is equal to 10 times the volume of the building. A leak rate of 0.5 percent by volume per day is expected for the planned Blocks 5 through 8 (with containment); a leak rate of 0.1 percent by volume per day is usual in reactors of the FRG.

In the GDR, they knew from the beginning that the reactor buildings could not be made completely air-tight because of the door cracks and pipe sockets. When the first part of the facility was supposed to go into operation in Lubmin, the operators therefore demanded an "integral leak test." But there was no equipment for this anywhere in the Eastern Bloc. Moscow did not know how the test was supposed to be performed and it was proposed that the leaks be measured only at two or three typical exit points. Because they could not agree on the procedure, the then Premier Stoph decided to begin trial operations.

Although the reactors in Lubmin do not have any containment, the nuclear power plant there does not appear to be any worse radiologically in normal operation than American nuclear power plants. To be sure, as admitted by Hans Scheel, vice president of the State Office for Atomic Safety and Radiation Protection [SAAS] in East Berlin, the metrology of the GDR is not adequate for certain tasks. Thus, there are no high-quality spectrometers for precise measurements.

The nuclear power plant North has been monitored since December by a complete incident radiation measuring system of the Siemens firm. Even in the exhaust chimney, they say, the radiation values are surprisingly low. Heretofore workers had more often received an excessive—but within the allowed limits—dose of radiation in adjusting X-ray equipment for material testing than in the nuclear power plant. And that, according to Scheel, is because of the improper use of the equipment.

The SAAS understands the population's displeasure over the previous policy of secrecy and it also understands a certain uneasiness. But the secrecy was ordered from above, they say. No one felt good about that. Almost all the orders came from above or from the Soviet Union, toward which many of those responsible are ill disposed. What Moscow said, was an order. Every letter from the Soviet Union was stamped "confidential" and under penalty of law could be shown only to those who needed to know its contents for their own work. Such letters are now shown willingly in the GDR. Times have changed.

The secrecy could very well also be the reason for the fact that until now little was known in the West about the course of safety discussions in the Eastern Bloc. As early as February 1987—a few months before Chernobyl—Ernst Adam from the Technical University in Dresden had drafted an expert opinion on a then current "reconstruction proposal" by the Soviet Union for Blocks 1 and 2 of the nuclear power plant in Lubmin. Naturally it was "confidential." Among other things, Moscow had recommended the establishment of a redundant multistage emergency cooling system for leakages in pipes up to 200 mm in diameter as well as measures to raise the fire safety. Under the previous Soviet understanding, the high-grade steel coolant lines more than 100 mm in diameter needed to be secure against breaks, so that measures against larger leaks were considered superfluous.

The discussion on the safety of the reactors of type WWER 440-230 spread rapidly in the Eastern Bloc. Above all the GDR took action. Last summer, at the suggestion of East Berlin, the "control agencies in nuclear energetics" of the Soviet Union, Bulgaria, the CSSR and the GDR agreed on a "standpoint" with 16 principles setting forth new minimum requirements to guarantee an acceptable safety level for the blocks.

They mention, among other things, measures to increase the tightness of the pressure room system and to reduce the loss of radioactive substances to the environment

and additional measures for fire protection. The Society for Reactor Safety has recently criticized the danger of fire in the power house of the nuclear power plant North. No one knows what it would cost to carry out the necessary measures. Last fall the Soviet Union estimated that an extensive reconstruction of the nuclear power plant in Lubmin would be just as expensive as a new building.

Toepfer Commission as Highest Court of Arbitration

The fact that so far only a few practical conclusions have been drawn from the recommendations—even though there are now plans for the establishment of reactor safety and radiation protection commissions—probably has to do with the economic system of the GDR. An example for this is the construction site in Stendal, where a new nuclear power plant has been under construction for years. There they are never certain what supplier (from the states of the Eastern Bloc) will send certain structural parts and when. And the material allocations from East Berlin also seem to be based on the principle of randomness. Thus, many structural parts that have already been delivered just rust away.

One is constantly hearing that this is not a safety problem but a purely economic problem. When a component rusts too much before it is installed in the facility, then it just has to be replaced. The cooling towers, among other things, are ready but they are not needed until 1994 at the earliest. After a long wait, a member of the board of the Karlsruhe Nuclear Research Center was allowed to view the construction site last spring as the first visitor from the FRG. No one had dared to issue the permit for the visit. That was ultimately left to Guenter Mittag.

There was especially serious political interference in Lubmin in 1982. At that time, serious corrosion leakages were discovered in 1,132 of 33,216 thin needle heating tubes of the steam generators of Block 1. The corrosion appeared primarily where the tubes were "supported." The reactors of type WWER 440-230 are considered "good-natured" because their steam generators lie horizontally and hold large quantities of water: in the case of an incident, the water can carry off the residual heat of the reactor for six to seven hours, so there is more time for actions than in Western nuclear power plants. This cost of this advantage was the disadvantage of the unfavorable tube supports.

The real reason for the corrosion was finally found in the high copper content of the high and low-pressure preheaters of the feed water in the secondary system. The copper mixed with the residual salts of the sea water that circulates in the secondary system and was then deposited in the mount areas of the needle tubes in the heat exchanger. In Lubmin, they pointed out at that time that the harmful copper content in the water could not be measured with the instruments available in the East. The

corrosion, it was said, was the result of Soviet construction defects. Moscow did not want to go along with this evaluation. For this reason, under Soviet pressure, Fischer, the then general director of the nuclear power plant, was dismissed for "unsatisfactory management."

As a result of the incident, they changed the still disputed "water chemistry" in the secondary circulation in Lubmin. Chemicals are now added to the sea water to compensate for the salts. The copper-rich materials were replaced by copper-free special steel. The Kraftwerk Union was entrusted with the periodic monitoring of the state of the steam generators. Leaky needle tubes have been pegged shut since then.

The most serious incident so far in Lubmin took place in 1975. In an inspection of the facility last month, the IAEA classified the incident Category 3 ("serious incident"), but at the same time pointed out the in general obviously quite reliable operation of the nuclear power plant. (Of the 1,191 events registered in 1988 and 1989, the IAEA assessed only six as being of moderate importance. The rest were so minor that they can no longer be registered in the safety scale). The incident in 1975 began with a cable fire in the power house that was caused by gross negligence. A foreman wanted to show an apprentice how one is not supposed to work and thereby bridged safety devices in such a way that there was a short circuit. (Since that time, certain parts of the facility can no longer be entered by one accountable person alone.) As a result of the short circuit, a relay serving as overvoltage protection failed and the reactor was automatically shut down.

At this moment, the emergency feed-water pumps for the steam generator should have started up but they did not. In the incident, the "good-nature" of the reactor with the large amount of water of its steam generators worked out positively. Altogether there were about 10 defects, of which the most unpleasant was probably the failure of the indicating instruments for several minutes. Gradually the safety devices melted through and again and again some of the instruments "were blinded." The workers were busy with the installation of new safety devices. No sooner were they ready at one place when they melted through somewhere else. No one knows the reason for this to this day, says Wolfgang Brune. But the block attendant never had the (subjective) impression that the process—the entire course of the incident—was out of control.

Overall the nuclear power plant North offers advantages as well as disadvantages relative to Western facilities. But there can be no getting around retrofitting if one wants to continue to operate the reactors. The responsible officials in the GDR are aware that much in the facility is obsolete. They say that the Toepfer Commission is acknowledged to be the highest court of arbitration. The people in the GDR are willing to accept as binding whatever this commission recommends in its final opinion.

ARGENTINA**Suspension of Condor II Missile Program Reported****Iraqi Connection Denied**

*PY2104232890 Buenos Aires DYN in Spanish
2134 GMT 21 Apr 90*

[Text] Buenos Aires, 21 Apr (DYN)—Defense Minister Humberto Romero said today that Argentina has "suspended and frozen" the "Condor" missile project. He also denied international press reports that the missile was being built in secret with Iraq for potential use against Israel.

During a meeting with reporters this afternoon, Romero said: "The project was suspended because of a political decision, and also because we do not have funds to finance this technical project."

This is how the minister implicitly alluded to the repeated press reports from Europe, the United States, and the Middle East about Argentine participation in the construction of one of the stages of the Iraqi missile system.

Although he did not specifically mention Iraq, Israel, or the report on the missile, Romero said: "We want to put this to rest in the face of publications that appear in the international press every so often." He added: "We always said the project never represented any risk or danger for anyone, but at any rate the project was suspended, it is frozen."

This week Iraqi President Saddam Husayn said his country can wage a total war against Israel through the use of medium-range strategic missiles that can reportedly carry chemical weapons. Husayn also said any Israeli effort to bomb the Iraqi missile manufacturing plants would be futile because "our missiles are made in parts in different areas of the world."

On several occasions our country has been mentioned as the manufacturer, in cooperation with Egypt and Iraq, of medium-range—about 800 km—ballistic missiles. Each time Argentina has categorically denied this. The Argentine Air Force successfully developed the "Condor I" and "Condor II" projects. It has been assured that these are for putting a domestic satellite in orbit.

The last missile test was made July 1989 at the Chamental Airspace Base, La Rioja Province, where a stage of the "Condor" missile travelled more than 160 km.

Defense Minister Comments

*PY2604233090 Buenos Aires CLARIN in Spanish
22 Apr 90 p 3*

[Text] Defense Minister Humberto Romero has stated that the Condor II project was halted [paralizado] due to

a political decision and a lack of funds, but he reiterated that the development of the missile "was not a danger to anyone."

This is the first official announcement of the halting of the project, which has caused international comment and a spate of political and diplomatic pressure against our country.

The Condor project was implemented by the Air Force to develop a rocket with a range of 700 km to place satellites in orbit.

From the start it was stressed abroad that the rocket was being developed jointly with Iraq and that the latter was going to use it to substantially alter the military balance in the Middle East.

The United States repeatedly expressed its concern to Argentina about the manufacture of this medium-range rocket, but the Argentine Government always insisted that the project was of a peaceful nature.

In his chat with journalists, Romero stressed that "the Condor II project has been halted. It is being discontinued because of a political decision and because we do not have the funds to finance an initiative of this nature. We wish to calm everyone concerned by assuring them that the project has definitively been halted, frozen. In view of reports that have appeared in the press, we have also stated that the development of the project did not mean any type of risk or danger for anyone."

During the past few days the topic of this rocket, which is manufactured in our country [as published], has been the object of commentaries in the international press because of the warlike attitude of Saddam Husayn's Iraqi government toward Israel.

On the other hand, the industrialized countries agreed in Vancouver in April 1987 not to give funds or technology to third nations for the development of medium-range missiles. The agreement was signed by the United States, Great Britain, France, Italy, Canada, and Japan.

U.S. Pressure Cited

*PY2604024090 Buenos Aires CLARIN in Spanish
25 Apr 90 p 8*

[Text] President Carlos Menem said yesterday the project for the construction of the Condor II missile was deactivated some time ago for lack of resources. He admitted, however, that the government made that decision to avoid a confrontation with the United States and other countries.

The U.S. concern for the project was recently reiterated to Argentine officials—including President Menem—by President George Bush, Secretary of State James Baker, and U.S. Ambassador Terence Todman.

The Argentine Government reportedly expects that freezing this project will help get the national aeronautics industry into the U.S. market, especially with the IA-63

Pampa training plane. It has been learned that about 500 of these planes may be sold in the United States in an operation worth several million dollars, and that efforts in this regard had been made under the Raul Alfonsin administration.

This may not be the only reason for the suspension of the Condor II project. London was also pleased with the Argentine decision, because that type of missile would be a permanent threat to its defense of the Malvinas Islands.

President Menem also discussed other current issues at a radio station yesterday. Menem rejected former President Raul Alfonsin's remarks that the government is leaning toward the right by saying the concept of the Radical Civic Union is "strictly demagoguery."

Regarding the social and economic crisis, Menem said the population "is bearing the situation" because the people know the government's economic adjustment program "is not another lie." Menem admitted the percentage of poverty is "extremely high," but said that this is true not only in Argentina but in all the developing countries, "which are in the same condition as we are, or worse."

Project for 'Peaceful Purposes'

*PY2704024490 Buenos Aires TELAM in Spanish
0137 GMT 27 Apr 90*

[Text] Buenos Aires, 26 Apr (TELAM)—Defense Minister Humberto Romero has stressed that "we can be sure that as countries begin to understand that the technological development of the Argentine rocket industry is for peaceful purposes, there will be no problems regarding Condor II."

Romero reiterated that "this project has been deactivated for economic reasons." He acknowledged the concern that it has generated and said that it will continue "until other countries fully understand the project and realize that they need not be concerned about it."

Romero made these remarks to a group of reporters [words indistinct] at his ministry, where he maintained that "we will try to progress in everything that involves technological development so we will not lose the pace that we have achieved in this race."

He added that "the concern that has emerged in various sectors due the bad reports that have circulated, and we cannot determine their origin, have generated a certain type of concern." [paragraph as received]

He stated that our country "seeks peace and good international relations," and he gave as an example "the development of nuclear energy technology." He stressed: "Argentina is well ahead in high technology. It [words indistinct] numerous nuclear reactors, and there have been absolutely no problems."

He revealed that Brazil is carrying out a "satellite program based on rockets of a similar technology," and he said that "in everything that pertains to technological development, we will try to implement it at the same pace so as not to fall behind."

British Reaction

*PY2604202290 Buenos Aires CLARIN in Spanish
25 Apr 90 p 8*

[Text] London (EFE)—British official sources told EFE that the Argentine decision to suspend the Condor II missile project, which was being developed with Egypt and Iraq since 1984, was "well received" in London.

The sources said that "any initiative to reduce the development of this type of technology" is positive, referring to the decision to freeze the project, as announced by Argentine Defense Minister Humberto Romero on 21 April in Buenos Aires.

Romero said that the project will not continue because of a lack of resources and because "of a political decision."

Iraq, which has chemical weapons and is believed to be able to make nuclear weapons, two weeks ago warned that it is capable of inflicting great destruction on Israel.

If the Condor II missile is made, it will have a range of 800 km, enabling Iraq to hit Tel Aviv, Tehran, or Istanbul.

Motivation Discussed

*PY2804040290 Madrid EFE in Spanish
0337 GMT 28 Apr 90*

[Text] Buenos Aires, 27 Apr (EFE)—Argentine President Carlos Menem today denied that the paralyzation of the medium-range "Condor II" missile project was motivated by foreign pressures. Menem said that the reason for the paralyzation is a lack of funds to carry on with the project.

Brigadier General Jose Antonio Julia, the Air Force chief of staff, has said in the city of Cordoba that the manufacturing of the "Condor II" missile has been paralyzed for more than a year for economic reasons.

In remarks gathered by the official news agency TELAM, Julia added that "everything that has been said, especially abroad, makes me smile because it is incredible for anyone to think that the project could endanger peace in the Middle East or that it could upset the balance of power."

A source of the Argentine Air Force, who wants to remain anonymous, told EFE on 26 April that the government suspended the construction of the "Condor II" missile so that they would be able to sell about 500 IA-63 Pampa airplanes to the U.S. Air Force.

The same source said that a U.S. company will sign an agreement with the Argentine Air Force next month to deliver the advanced training Argentine airplane in the United States.

The five prototypes of the Argentine missile were made in a factory located in a forest of Falda del Carmen, Cordoba Province, about 700 km northwest of Buenos Aires.

A spokesman of Colonel Luis Guerrero, head of the project from its inception shortly after the end of the Malvinas war, told a Buenos Aires daily last week that the missile project was suspended because of an agreement with the U.S. government.

Guerrero added that there was an international campaign against the Argentine rocket "because the United States never forgave us for transferring technology to Iraq that permitted that country to build its own missiles in a much shorter time."

Dante Caputo, Argentine foreign minister 1983-89, admitted in an interview that was published in Buenos Aires last January that the Raul Alfonsin government suffered "all types of pressures" by the United States for the manufacturing of the "Condor II."

The governments of Great Britain and Israel coincided in their criticism of the project for different reasons, Caputo, 1988 president of the UN General Assembly, admitted. The United Kingdom disseminated a report saying that the "Condor II" was manufactured by Argentina to attack the "Falkland fortress" on the Malvinas Islands.

Argentina is trying to sell two Meko-360 type rocket-carrying frigates, of German origin, to Iran, and is offering his "pampa" planes and the "TAM" (Argentine Medium-size Tank), a "family" of armored vehicles that includes troop transports.

Air Force Chief's Statement

*PY2704181890 Buenos Aires TELAM in Spanish
1747 GMT 27 Apr 90*

[Text] Cordoba, 27 Apr (TELAM)—Brigadier Jose Antonio Julia, chief of staff of the Air Force, has stated that the project for manufacturing the "Condor II" rocket has been paralyzed "for more than a year" for economic reasons. He ruled out the possibility that it could have upset the balance of power.

Julia said that the implementation of the project is "old history." He added: "I am amused by everything said abroad about the project because it is incredible for anyone to think that the 'Condor II' project could endanger peace in the Middle East or that it could upset the balance of power."

Technical Details

*PY3004154890 Buenos Aires CLARIN in Spanish
29 Apr 90 p 7*

[Report by Daniel E. Arias]

[Text] Everybody is praising and trying to justify the Argentine Condor II project—the only one we had—now that it has officially died, however, a more technical description of the now defunct project will reveal the gap left by our flimsy space project.

According to the type of fuel used, missiles are classified as solid, liquid, and cryogenic-fueled missiles. The solid-fueled missiles carry their fuel (that burns) and the comburent (that supplies the oxygen to trigger the combustion) on a sticky rod, the combustion of which cannot be regulated. The cake burns completely once the combustion starts. Therefore, solid-fueled missiles are difficult to control although they are much simpler and cheaper. Moreover, they can withstand rough handling and can be easily fired. The military prefers this type for manufacturing short-range missiles.

The liquid-fueled missiles carry the fuel and the comburent in completely separate tanks. The two elements meet in a combustion chamber where they ignite after travelling through pipes. Valves make it possible to regulate the power of the engine. Ground personnel are able to stop the engine and restart it in full flight, in short, to control the missile as they wish by radio control.

The cryogenic-fueled missiles were developed during the 1970's and 1980's. They carry hydrogen and liquid gas which are lighter than any other propellant element but are also very expensive to refrigerate and to isolate. This technology makes it possible to build very fast vehicles because of their power-to-weight ratio.

They are used to place huge communication satellites in space some 36,000 km above the equator, or to attack a city from the other side of the world.

Liquid-fueled missiles represent the technology developed during the 1950's and 1960's and, to a certain extent, explain Soviet leadership in space research. These old, heavy, cumbersome, and unbreakable missiles do not have fragile equipment and make it possible to place cargo into outer space at a reasonable cost. On the other hand, the large family of U.S. and European cryogenic-fueled missiles continue at an experimental stage and are unpredictable (as the case of the space shuttle and the Ariane IV and V). Moreover, they are incredibly costly.

Too poor to even think of developing liquid-fueled missiles, Brazil and Argentina have tried to place solid-fueled vehicles into orbit for decades. This is not all easy because these missiles are really little more than flying rods [canitas voladoras], but the Castor, which was developed by Argentina in 1978, the Sonda IV developed by Brazil, and the Japanese launching devices

developed by ISAS (a university space research agency) have proved to be reasonably manageable beasts.

The Castor represented the phase previous to designing a spaceship and this must be the reason why it mysteriously died in 1978 after a series of incredibly successful tests and after having allowed us to reach an agreement for a "joint-venture" with the FRG to study the atmosphere. The absence of mistakes by a debtor country may be fatal.

When Argentina once again started to discreetly think about outer space (1982-83), it already had enough knowledge to consider larger projects. In fact, with its one-meter-diameter tube, the Condor could place a 200-kg cargo in a low polar orbit of only 200 km.

This project would have allowed Argentina to have one or more pairs of eyes in space so that it could assess its natural resources, predict the water flow of rivers on which hydroelectric dams could be built, determine where it could find oil and uranium, and cheaply stop illegal fishing on the continental shelf. This possibility could not be accepted by some people.

Brazil, which is less restricted, is about to progress from the Sonda IV to the Sonda V and has openly invited us to jointly develop the spaceship. What will Argentina answer? "We will"? Or will it have a chauvinist attitude? What a pity it did not adopt that attitude now that it is letting the Condor project die in its first stage—it was never tested—when the pressure is not as great as it has been. Worst of it all is that it is not receiving anything in exchange.

Very well then, it is accepted, the Condor will go no further. What is left? Very little. Should we develop satellites exclusively for space research to discover the secrets of the sun, or study the cosmic explosions of X-rays. These issues, if unaffected by economic and political factors, do not disturb anybody. NASA is quite willing to give us room, free of charge, on their rockets for these types of satellites. There is no possibility that we will gain either money or space sovereignty. There is no need to point out that any similarity between this possibility and an independent space research program, such as Brazil's, is mere coincidence.

In the 1980's Argentina allowed its nuclear program, which at that time was the most advanced in the Third World, to be hindered. Now it is allowing its wings to be

clipped and, with a stupid smile, is foregoing every opportunity to achieve sovereignty in space. Each attempt to develop technology is labelled arms escalation by those so-called champions of peace, our creditors.

It is quite true, the Condor II may be a missile, as a cargo aircraft may drop bombs and a truck may be equipped with artillery for war. Does this mean that Argentina must stop manufacturing all types of vehicles? This question is not pointless in a country that refuses to make any progress.

CHILE

Defense Minister Denies Nuclear Capability

JANE'S Report

PY0404200790 Santiago Radio Chilena Network
in Spanish 1700 GMT 4 Apr 90

[Text] The specialized weekly magazine JANE'S has reported that Chile, Iran, the ROK, and Libya are capable of producing nuclear weapons, based on their technology and their political will.

The weekly believes that Argentina, Brazil, Colombia, DPRK, and Taiwan may also try to produce nuclear weapons.

Before the discovery of the affair involving nuclear detonators for Iraq in London, the list of countries with nuclear programs included India, Pakistan, Israel, and South Africa.

In addition to the nuclear club of five—the United States, the USSR, Great Britain, France, and the PRC—at least nine other countries are about to produce nuclear weapons.

Minister's Statement

PY0504191990 Santiago Radio Chilena Network
in Spanish 1700 GMT 5 Apr 90

[Excerpt] [passage omitted] Defense Minister Patricio Rojas has denied a foreign magazine report that Chile is capable of building nuclear weapons. Rojas maintained that Chile has signed the Tlaltelulco treaty and that, consequently, it cannot engage in any project of that type.

EGYPT

Paper Backs Iraq, Libya on Nuclear Inspection

*JN1304123590 Cairo AL-AKHBAR in Arabic
11 Apr 90 p 6*

[Editorial: "A Challenge To Expose Nature of Unjust Campaign"]

[Text] Iraqi President Saddam Husayn has said that Iraq is prepared to accept any international inspection to confirm that his country does not produce or try to produce nuclear weapons. Likewise, Libyan President Mu'ammar al-Qadhafi has said that he is also prepared to accept international inspection for chemical or nuclear weapons in Libya. The only condition set by the two Arab leaders was that inspection apply to all states in the region, particularly Israel.

Naturally, U.S. and British officials will ignore this clear offer made by the Iraqi and Libyan presidents because they know full well that Israel will never agree to put its nuclear or chemical installations under any form of international inspection. Moreover, acceptance of this offer would halt the biased, unjust coordinated campaigns against the two Arab states and expose their real objectives.

However, officials in charge of Arab media in all Arab states must highlight Iraq's and Libya's challenge for a response to the wild campaign involving Western media organs as well as U.S. and British intelligence services. The Arab League must also take up the Arab challenge so that world opinion will realize the extent of the allegations made by certain states against the Arabs at a time when their favoritism toward Israel and silence over its crimes and constant violation of all international laws have reached limits unknown before by the international community.

INDIA

Commentator Scores U.S. Stand on Pakistan Bomb

*51500098 Madras THE HINDU in English
2 Mar 90 p 8*

[Commentary by K. Subrahmanyam]

[Text] The proposed sale of 900 mw reactor by France to Pakistan has caused concern in this country and the official spokesman too has voiced the worry of the Indian Government about the possible augmentation of capability of Pakistan to pursue its covert military nuclear activity. Ironically enough the U.S. authorities, including the director of the Arms Control and Disarmament Agency have expressed their strong disapproval of the proposed French sale though the United States has waived its own law, the Symington Amendment, which forbids any assistance to a country engaged in military nuclear activity, for eight and half years thereby giving

the green signal to Pakistan to proceed with its nuclear weapon programme. The U.S. stand is not just one of the pot calling the kettle black. It is a case of unmitigated sanctimonious humbug because what France proposes to do for Pakistan is not half as mischievous as what the United States has done in the past eight years.

The French reactor proposed to be sold to Pakistan is a light water enriched uranium one. The reactor is similar to the one at Tarapur and the one India proposes to acquire from the Soviet Union. The fuel rods of enriched uranium in this reactor are removed at periodic intervals for replacement. These fuel rods will be irradiated ones and will have a mix of plutonium isotopes 239 and 240. It will have the maximum Pu 240 content of around 40 per cent. While Pu 239 is the preferred material to make a weapon, Pu 240 is not quite suitable since it fissions too readily and therefore its presence to a significant extent creates problems of two kinds.

Two Kinds of Problems

First a high Pu240 content in the Plutonium core heats it up as Pu240 atoms fissile rapidly and this in turn will distort the symmetrical shape of the conventional explosive lens around the core which has to implode to make the core supercritical and lead to a neutron chain reaction which results in nuclear explosion. Secondly a high Pu240 content because of its very readily fissile characteristic may lead to predetonation thereby reducing the yield of the weapon or even resulting in a fizzle. However literature is available that the United States and United States alone had conducted one nuclear explosion using reactor grade plutonium. Recently however when the United States wanted to make new warheads it sanctioned new production reactors designed to make weapon grade Plutonium and did not use the vast quantities of reactor grade plutonium it has in stockpile.

In international conferences, some American weapon designers have argued that both the problems of heating of the plutonium core and predetonation in respect of plutonium with significant content of Pu240 are solvable. No satisfactory explanation is available why the United States had to construct new weapon grade plutonium production reactors in that case.

The French reactor for Pakistan will produce plutonium with 40 per cent Pu240 content. This will happen after six or seven years when the reactor completes some 18 months of operation. Thereafter the uranium fuel rods have to be reprocessed in a separation plant if Pakistan is to get plutonium. Pakistan has a small hot cell facility to separate small quantities of plutonium. It was the operation of this facility which gave rise to the suspicion that Pakistan had been diverting the irradiated fuel rods from the fuel rods storage attached to the Karachi nuclear power plant (KANUPP) which is under safeguards of the International Atomic Energy Agency.

The Karachi reactor is like the Madras and Narora reactors. Fuel rods can be removed from those reactors and fresh ones put in even while the reactor is in

operation unlike as in the case of the proposed French reactor or the American reactor at Tarapur. Hence the KANUPP reactor can be used to irradiate natural uranium rods at a low burn up to produce Plutonium 239 with minimum Plutonium 240 content which can be taken out at the appropriate time.

Bhutto's Testimony

Zulfikar Ali Bhutto finalised the contract with France in 1976 for a plutonium reprocessing plant of the type we have at Trombay as well as Tarapur. It was at that stage Dr. Henry Kissinger warned Bhutto if he did not desist from the plan for plutonium separation plant he would be made a horrible example of. He in his death cell testimony expressed his belief that was what happened to him. Bhutto went ahead in spite of the U.S. warning and concluded the deal for the French reactor.

From his writings one could infer that Bhutto's plans were to set up the plutonium separation plant, then process the irradiated fuel rods from KANUPP in it and make the bomb. No doubt this would have involved violating the IAEA safeguards but Bhutto presumably had no scruples in that regard. He wrote in his death cell testimony: "A country does not have to be merely wealthy to possess nuclear capability. The essential prerequisite is the infrastructure. For this reason, I gave the highest priority to train thousands of nuclear scientists in foreign countries. Now we have the brain power, we have the nuclear power plant at Karachi. All we needed was the nuclear reprocessing plant. Arrangements for the heavy water, the uranium and the fuel fabricating plant had been made. We were on the threshold of full nuclear capability when I left the Government to come to this death cell. We know that Israel and South Africa have full nuclear capability. The Christian, Jewish and Hindu civilisations have this capability. The Communist powers also possess it. Only the Islamic civilisation was without it, but that position was about to change." It is obvious what Bhutto meant by full nuclear capability—the weapon capability.

Bhutto concluded the deal with France in March 1976. The United States exerted considerable pressure on France to cancel the deal. Pakistan had paid an advance of \$200 millions. France under U.S. pressure finally repudiated the agreement in 1978. By that time the French had already supplied the bulk of the equipment directly from their plants and through their subsidiaries in Italy. Some 90 per cent of the documentation had also been supplied.

Meanwhile Pakistan had the good luck to obtain the services of Dr. A.Q. Khan with his knowledge of working in the Almelo uranium centrifuge plant and who brought with him all documentation and drawings of the uranium centrifuge process. Bhutto also set up Dr. A.Q. Khan in project 706 independent of the Pakistan Atomic Energy Commission and directly under the military. Ultimately it was the uranium centrifuge process which led to the production of the Pakistan bomb. Pakistan

appears to have had Chinese help in the uranium bomb design (WASHINGTON POST 28 Feb 1983, NEW YORK TIMES 22 and 23 June 1984).

Bhutto's role in placing project 706 (the uranium enrichment programme) under Dr. A.Q. Khan has been described in chapter 9 of the book, "Aur line kat Gayee" in Urdu written by Maulana Kausar Niazi, a Minister in Z.A. Bhutto's Cabinet. He also cites that Mr. Ghulam Ishaq Khan, currently president of Pakistan was one of the envoys sent to the Arab countries to collect funds for the nuclear programme. Subsequently during General Zia's period Mr. Ghulam Ishaq Khan was one of the members of a small committee supervising and monitoring the programme. Dr. A.Q. Khan had acknowledged his indebtedness to Mr. Ghulam Ishaq Khan among others.

This article is not about Pakistan's accomplishment of the uranium bomb which fact Dr. A.Q. Khan revealed in his interview to Mr. Kuldeep Nayyar in January 1987. Here we are concerned about the implications of the French connection and the U.S. connivance in Pakistan's bomb making and the sanctimonious humbug of its present stand.

Unconvincing

A number of analysts in India have asked why Pakistan should attempt to gain mastery over the plutonium route while it already has presumably produced the uranium bomb. Pakistan's explanation about its energy shortage and the need for nuclear energy is not wholly convincing though it has a certain plausibility. It is no doubt true that Pakistan has very little of energy source material. But the Pakistanis boast of their being part of the Muslim Ummah and therefore one should expect them to get uninterrupted supply of oil from West Asia, especially when the Muslim countries have close military relationships with Pakistan, have extended both military and economic aid and according to Maulana Kausar Niazi have also financed its nuclear programme. One can only speculate on Pakistan's motivations. It is natural for it to have its own independent source of energy in spite of the Islamic connection.

Secondly the enriched uranium light water reactor gives legitimacy to its uranium enrichment programme. Thirdly its scientists get trained in reactor operating technology. So the deal with France for the 900 MW enriched uranium reactor has plausible justification. For reasons explained earlier the plutonium from this reactor is not likely to be available for the next seven years, is not likely to be preferred for weapon making and will be under IAEA safeguards which while not being leakproof still have some tripwire value.

The plutonium reprocessing plant which is yet to be commissioned though 90 per cent of the equipment and documentation has been received is the one to be watched, especially if the French reach a new understanding with Pakistan to sort out the residual issues and were to help in commissioning it. There are various

reports about Pakistan's attempt to develop a plutonium weapon option apart from the uranium one. This may be because plutonium weapons are lighter and more versatile.

U.S. Documentation

The following is a selective compilation of excerpts from the documentation of the U.S. Congressional Research Service.

25.6.84: Senator Cranston stated that Pakistan was operating its clandestine reprocessing facility to extract Plutonium at PINSTECH (Pakistan Institute of Technology), Pakistan expanded its weapons design team and stepped up imports of nuclear warhead parts and Pakistan's KANUPP reactor was subject to continuing failures in its safeguard system, making plutonium diversion highly feasible.

16.7.84: A Federal Grand Jury in Houston indicted three Pakistanis for trying to ship parts for nuclear weapons to Pakistan.

25.2.85: American Intelligence officials reported that Pakistan had enough plutonium to make nuclear weapons (NEW YORK TIMES, 25 February 1985).

11.7.85: ABC News reported that Pakistan had successfully tested the non-nuclear parts of the trigger for a nuclear weapon, using Krytrons from the United States (FINANCIAL TIMES, 17 Aug 1985).

17.8.1985: News report that Pakistan had tried to buy a small U.S. made flash X-ray machine useful for weapons development (FINANCIAL TIMES, 17 Aug 1985).

31.7.1986: Upon returning from his trip to the United States and Europe, the Pakistan Prime Minister Junejo, announced that the French Prime Minister, Mr. Chirac and he had decided to end the dispute over France's 1976 contract to supply Pakistan with a reprocessing Plant (NUCLEONICS WEEK, 31 July 1986).

5.11.1986: THE WASHINGTON POST reported that a Special National Intelligence Estimate earlier in the year had cited numerous activities that conflict with Pakistan's denials about developing nuclear weapons.

1.3.1987: Interview of Abdul Qadar Khan with Kuldip Nayyar that Pakistan possessed nuclear weapon (OBSERVER LONDON, 1 March 1987).

5.3.1987: The Senate Committee of Government Affairs held a hearing on effects of the spread of nuclear weapons. Richard N. Perle, Assistant Secretary of Defence cautioned it might be counterproductive to cut off U.S. aid to Pakistan since this might induce Pakistan to pursue its weapons interests with even more vigour (NEW YORK TIMES, 6 March 1987).

12.3.1987: Syed Mushahid Husain, Editor of MUSLIM backed Kuldip Nayyar's version of the interview with Dr. A.Q. Khan (NUCLEONICS WEEK, 12 March 1987).

14.7.1987: Arshad Pervez, a Canadian citizen of Pakistani origin was arrested in Philadelphia on charges that he tried to export material to Pakistan that could be used in making nuclear weapons. Senator Glenn placed on record the documents from the Pervez Case (NEW YORK TIMES, 15 July 1987, Congressional Record, 14 July 1987).

17.7.1987: The U.S. Attorney in Sacramento announced the indictment of two Americans and a Hong Kong businessman for illegally exporting to Pakistan sophisticated instruments and advanced computer equipment that can be used to make nuclear weapons (NEW YORK TIMES, 18 July 1987).

28.7.1987: A U.S. grand jury indicted a retired Pakistani General for conspiracy to obtain nuclear related material illegally in the U.S. (WASHINGTON POST, 29 July 1987).

1.11.1987: According to a British periodical Pakistan intends to adapt U.S. F-16 aircraft to deliver atomic weapons and Pakistan is nearing completion of a transportable bomb (FOREIGN REPORT, 1 Nov 1987).

17.12.1987: Arshad Pervez convicted in Federal court on charges of attempting to illegally export beryllium to Pakistan (NEW YORK TIMES, 18 Dec 1987).

14.1.1988: The Hessen Premier Walter Wellman said his Minister for Environment, Karl-Heinz Weimar, had been informed by "external sources" of leads that a German firm, Trans Nuklear, had been involved in shipping weapons grade plutonium from Belgium to Libya and Pakistan (NUCLEAR FUEL, 15 Jan 1988).

15.1.1988: Bonn Police searched the offices of two West German nuclear companies but found no conclusive evidence to support the allegation that weapon grade materials may have been illegally shipped to Pakistan (WASHINGTON POST, 16 Jan 1988).

19.1.1988: The IAEA denied a report that Libya and Pakistan obtained weapons grade plutonium from two nuclear plants in West Germany and Belgium (THE WASHINGTON POST, 19 Jan 1988). Nukem denied allegations that its subsidiary Trans Nuklear was involved in shipping weapons grade nuclear material overseas, allegedly to Libya and Pakistan.

21.1.1988: West German periodical STERN reported charges that materials suitable for nuclear bombs were smuggled out of the Hanau plants into Libya and Pakistan (CHRISTIAN SCIENCE MONITOR, 21 Jan 1988).

24.5.1988: A U.S. official confirmed the report that Pakistan test fired a missile capable of carrying nuclear weapons (NEW YORK TIMES, 24 May 1988).

12.1.1989: Pakistani scientists were assessing the results of an ambitious test firing of a multi stage rocket carried out on 10 Jan, into deep space and the subsequent recovery of the payload (Associated Press of Pakistan, 12 Jan 1989).

19.1.1989: The Pakistani press reported last week that talks will soon resume between France and Pakistan on the construction of a pressurised water reactor plant at Chashma. A senior press official said, however, there was nothing new in the bilateral nuclear talks (NUCLEONICS WEEK, 19 Jan 1989).

6.3.1989: The U.S. Government had issued about 100 specific communiques to the West German government about planned exports to the Pakistan Atomic Energy Commission and its affiliated organisations (NUCLEAR FUEL, 6 March 1989).

21.3.1989: A West German news magazine STERN reported that more than 70 West German firms had helped Pakistan to develop an atomic bomb and that Bonn officials ignored intelligence reports about strategic exports related to the project (WASHINGTON POST, 22 March 1989).

21.4.1989: Two small West German companies admitted supplying nuclear weapons related materials to Pakistan (WALL STREET JOURNAL, 21 April 1989).

1.5.1989: West German criminal justice officials said they had independent evidence that a tritium extraction and purification facility exported to Pakistan in 1987 was intended to purify and store tritium from irradiated lithium targets (NUCLEAR FUEL, 1 May 1989).

19.5.1989: CIA director William Webster testified before the Senate Government Affairs Committee that Pakistan was "engaged in developing a nuclear capability." "What creates problems for the United States is whether that capability has reached a point that it implicates the various amendments that apply to other assistance and relief for Pakistan" (NEW YORK TIMES, 19 May 1989).

15.6.1989: The Bush Administration dropped a previous demand that Pakistan pledge not to enrich uranium above 5 per cent according to U.S. and Pakistani officials. However, Pakistani Prime Minister, Ms. Bhutto during her state visit last week promised that Pakistan will not produce weapons grade uranium (WASHINGTON POST, 15 June 1989). Author's Comment: If the latter promise was credible then why should Bush Administration drop the demand?

18.7.1989: Prime Minister Benazir Bhutto, in Paris for celebration of the French Revolutionary centennial told reporters that she and PAEC chairman, Mr. Munir Ahmed Khan, had discussed the question of France's breach of its reprocessing plant deal in a meeting with French President Mitterrand (NUCLEONICS WEEK, 20 July 1989).

The above account would show that the French-Pakistan reactor deal would be no surprise to the U.S. decision-makers.

Play With Words

On 1 October 1989 the U.S. President, Mr Bush certified to the U.S. Congress that Pakistan did not, on that date, possess a nuclear explosive device. In a letter to Senator Pell, Chairman, Committee on Foreign Relations, Mr. Bush highlighted that the statutory stand was whether Pakistan possessed a nuclear explosive device and not whether Pakistan was attempting to develop or has developed various relevant capacities. In other words even if Pakistan had assembled a number of bombs and left the last two screws untightened in them and shown them to the U.S. authorities and pointed out that the devices would not in their condition cause a nuclear explosion, the President's certification would be valid.

In other words the President's certification is a play on words and has no meaning at all. His letter to Senator Pell is clearly a cover-up alibi to maintain, even if Pakistan later on unveiled its nuclear weapon stockpile, that on the day of certification they would not have caused a nuclear explosion in their then existing condition.

The U.S. bomb dropped on Hiroshima on 6 August 1945 would not have caused a nuclear explosion till the early hours of that morning when the physicist Dr Luiz Alvarez connected the last wires and armed the bomb before it was hoisted into the bomb bay of the aircraft Enola Gay.

The President's certificate, for all knowledgeable persons constitutes a positive confirmation of Pakistan's fully mature nuclear weapon capability reached under the patronage of U.S. waiver of the Symington Amendment. In such circumstances the U.S. concern about the French reactor sale is ridiculous and laughable.

Lastly a word about Pakistan pursuing the plutonium reprocessing. India reprocesses plutonium to fuel its fast breeder reactor of which it has a 15 MW test reactor and is designing a 500 MW prototype. Pakistan has no such programme. The testing of implosion devices without the nuclear core, the theft of Krytron switches, the purchase of a flash X-ray machine, attempts to get plutonium from abroad, etc., all tend to show that besides the uranium weapons Pakistan is pursuing the route to plutonium weapons also. With the impending reduction of nuclear arms among the major powers there is likely to be considerable amount of plutonium available from dismantled weapons. Pakistan has a worldwide clandestine network for acquiring nuclear materials and equipment. It has been phenomenally successful in its efforts. One cannot rule out the possibility of Pakistan preparing to produce plutonium weapons deriving its fissile material from the international black market. The U.S. Congressional Research Service chronology demonstrates how leaky the Western safeguards system is.

These are the harsh facts that face the Indian security planner.

Stolen Uranium Destined for Pakistan Recovered

51500097 Madras *THE HINDU* in English

28 Feb 90 p 9

[Text] Gorakhpur, 27 Feb—The Uttar Pradesh police recovered 250 gm of uranium and arrested one person following a raid on a house in Hajaripur locality of Alinagar area under the Kotwali police station today.

The Senior Superintendent of Police, Mr. Manoj Kumar, said here tonight that an alleged smuggler had purchased the radioactive element from somewhere in Bihar where a big gang was operating.

The Kotwali police arrested Ashok (30) in connection with the seizure.

Mr. Manoj Kumar said the uranium was supposed to be smuggled to Pakistan. Further investigation is on.

TV Deletes Sundarji Remarks on Pakistan Nuclear Stance

51500102 Madras *THE HINDU* in English

28 Feb 90 p 4

[Text] New Delhi, 27 Feb—Defence officials are concerned over the deletion of some remarks of the retired Chief of Army Staff, Gen. K. Sundarji in a TV programme telecast on Sunday (25 February). Gen. Sundarji is said to have made some observations with regard to the factoring in of the nuclear status of Pakistan and India and these remarks have been deleted.

When this correspondent contacted Gen. Sundarji, who happened to be in Delhi, he said that, in response to questions put by the producers of the programme, he had said that security planners could not avoid factoring into their calculations the perception of each side that the other may be a nuclear weapons power. In this as yet hypothetical situation, it would be dangerous if Pakistan miscalculated and undertook a military adventure that degenerated into a nuclear war which would be terribly destructive to both sides and especially so for smaller Pakistan. These remarks were not shown in the programme.

Gen. Sundarji refused to be drawn into the issue of the deletion of his remarks. However, he said there was nothing unusual about them since he had made similar remarks when assuming office and in his book which he wrote while he was Commandant of the College of Combat, Mhow. He said he was only talking of factors that security planners in both countries had to contend with. His points were by nature of cautioning elements in Pakistan who believed that, with a nuclear bomb, Pakistan could somehow mesmerise Indian decision making and snatch Kashmir from India. He said that, given the public record of Pakistan's efforts to acquire a nuclear

capability and the repeated Government of India statements regarding the Pakistani nuclear programme, it was but inevitable that Indian security planners had to work with the assumption that there was a probability that Pakistan had nuclear weapons capability.

However when this correspondent referred the matter to Zoom Communications, the company which produced the programme, it said it would not like to be drawn into commenting on the issue. It said it would not be in a position to contradict Gen. Sundarji either.

Meanwhile, officials in the Ministry of Defence expressed their exasperation at the kind of attitude shown by the deletion of the General's remarks. Their point was made by one official quoting from a 1980 book of Prof. Stephen P. Cohen (a specialist on Indian and Pakistani military) who cited discussions with Pakistani officials to say that they believed that a Pakistani nuclear capability would "neutralise an assumed Indian nuclear force." Other Pakistani officials cited by Prof. Cohen said "it would provide the umbrella under which Pakistan could reopen the Kashmir issue. A Pakistani nuclear capability paralyses not only the Indian nuclear decision, but also conventional forces and a brash, bold, Pakistani strike to liberate Kashmir might go unchallenged if the Indian leadership was weak or indecisive."

This official said that it was necessary at this juncture to put clearly before Pakistan that India's conventional forces would not be mesmerised by any Pakistani nuclear capability and allow any kind of a blackmail situation to emerge.

Officials Comment on India's Nuclear Option

Navy Chief of Staff

51500096 Calcutta *THE TELEGRAPH* in English

11 Mar 90 p 7

[Text] New Delhi, 10 Mar—The Indian defence establishment for the first time has publicly argued in favour of exercising nuclear option.

The chief of naval staff and the chairman of the committee of the chief of staffs, Admiral J.G. Nadkarni, articulated the viewpoint at a two-day seminar organised by United Services Institution of India.

The argument is buttressed by three factors: Pakistan might have already achieved nuclear weapons capability, nuclear weapon option is cheaper than the conventional arsenal on a longterm basis and there should be longterm plans to bolster India's image as a major regional power.

Several serving and retired officials of the three services, career diplomats and academics drawing a rough sketch of the "foreign and defence policies for India in the 1990s" argued in favour of and against exercising such an option. The analysis were in the background of rapid changes occurring both in strategic and regional environment.

According to Admiral Nadkarni, there was little doubt that Pakistan had either achieved nuclear weapon capability already or was very close to achieving this. He said since there could be no guarantee that Pakistan would not use the capability against India this would result in the deterioration of the security environment substantially.

The argument has an economic angle. The modernisation of conventional weapons system is an expensive proposition. While 75 per cent of the defence budget is made up of fixed maintenance sector only 25 per cent went for modernisation and whenever there is a cut in the budget it is the modernisation which gets affected. Another angle was that it would be extremely difficult to increase the capabilities with conventional weapons as that would require large funds and high force levels.

Another problem was increasing manpower. The armed forces were devoting 50 per cent of the defence budget on salaries and another 12 per cent on pensions. One of the generals warned that by the turn of the century the pension bill of the defence forces would be equal to their salary bill. Therefore, he said, "We have to have adequate force level to have superiority with economic viability." He said it was a myth to say that India was entering the big league as its Navy could not protect even its exclusive economic zone.

The approach paper of the conference, however, made it clear that there was little chance of using nuclear weapons in a realistic war-fighting scenario. It said, "India may have to exercise an option in the 1990s not only with respect to nuclear deterrence but also at the lower end of the scale that is ability to fight a non conventional war for a prolonged period."

It also emphasised the need to "assess the interventionist threat to India from the south" in view of the super-power buildup in the Indian Ocean leading to the formation of the rapid deployment forces.

Mr K. Subrahmanyam of the Institute for Defence Studies and Analysis in his paper argued strongly in favour of going nuclear. According to him, while the United States and the Soviet Union were likely to reduce their nuclear arsenals, this was not going to result in the elimination of the nuclear weapons and their use as a lever for power. "A perception of nuclear asymmetry about us would be a great temptation to the Pakistanis."

Minister of Defense

51500096 Madras THE HINDU in English
9 Mar 90 p 11

[Text] Visakhapatnam, 8 Mar—India will have to reconsider its self-inflicted ban on going nuclear should Pakistan develop such capabilities, the Union Minister of State for Defence, Dr. Raja Ramanna, has said.

He was talking to reporters after inaugurating the "Matsya" and "Surya" dry docks in the naval dockyard complex here on Thursday.

Asked if more nuclear submarines would be acquired, the Minister said "acquisition of subs is not the main issue. But we have to acquire the skills and technology that go with them."

On the proposed supply of a nuclear reactor to Pakistan by France, Dr. Ramanna said that several countries were supplying such reactors to several others. "But we will face such a situation."

The Government was determined to achieve self-reliance on the defence front, he said. "We will pursue such a policy vigorously."

Dr. Ramanna said defence would have to get a higher allocation in view of the threats from across the border. Asked if the Navy would get a higher outlay this time, he said, "All the requirements of the three military wings will be taken into consideration."

Dr. Ramanna did not think a war with Pakistan was imminent but said "we have to be in full preparedness." He did not see any military threat from other quarters. A war need not necessarily be between two armies. Acts of subversion and terrorism could also be treated as war, the Minister said.

On the Kashmir issue, Dr. Ramanna referred to the Government's efforts to arrive at a national consensus involving all political parties and hoped that things would improve. "By and large the Kashmiris are good people with deep attachment to us. But something went wrong somewhere," he said.

Earlier, inaugurating the dry docks the Minister described the facility as a valuable addition to the Navy. He said it should be used to the optimum level. "Having acquired such a high technology at a very high cost, the Navy should help other civilian industries upgrade their technologies."

The Minister told the dockyard authorities not to maintain the docks as a mere repair facility but to develop capabilities for building warships.

Dr. Ramanna spoke of the "rivalries and flashpoints" in the Indian Ocean and emphasised the need to keep the ocean tension-free. He also referred to the "heightened tension in our relations with Pakistan over the Kashmir issue" and said "periods of strife upheavals and trials such as these and other external threats that may develop in future warn us of the necessity to be on guard."

Admiral J.G. Nadkarni, the Chief of the Naval Staff, traced the growth of the Naval dockyard from a simple repair shop 25 years ago to the present modern complex. He said constant planning for its development and modernisation was responsible for this.

Vice-Admiral L. Ramdas, Flag Officer Commanding-in-Chief of the Eastern Naval Command asked the Minister to increase the manpower in the dockyard complex.

The two dry docks have been built at a cost of Rs 56 crores. "Surya" is an open dry dock for repairing warships. "Matsya" is a covered one for repairing submarines.

India Rare Earths Monazite Sands Allegedly Dangerous

51500101 Madras *THE HINDU* in English
28 Feb 90 p 11

[Text] Thiruvananthapuram, 27 Feb—An anti-nuclear group claims to have found evidence that the radioactive monazite sands of Chavara, near Kollam, in Kerala were increasing genetic abnormalities and infertility among the people in the area.

The results of a 30-month-long survey, carried out by an organisation called "Centre for Industrial Safety and Environmental Concerns (CISEC)" based at Kollam, were released at a press conference here. The study is said to have been funded by the World Council of Churches based in Geneva.

The CISEC has Mr. V.R. Krishna Iyer, former Supreme Court judge, as President. Its secretary and director, Mr. V.T. Padmanabhan, has in the past accused Indian Rare Earths Ltd. of concealing the radiation hazards posed by its two plants in Kerala, one at Chavara and the other at Aluwai.

The incidence of genetic defects in a population along a 26 km long coastal stretch north of Neendakara bridge was compared with an identical population along the coastal belt for 17 km northwards from Ambalapuzha. This would place the control group just north of the study group.

Both groups were comparable in terms of caste and profession, being made up almost wholly of fishermen, said Mr. Padmanabhan.

The difference came in the background radiation levels. The radiation level in the study area varied between 300 and 3,000 millirem a year, with an average of 700 millirems. The radiation levels in the control area were only around 120 millirem a year.

Down's Syndrome

The incidence of Down's Syndrome, a genetic defect leading to acute mental retardation, was four times higher in the radiation belt compared to the control area. Similar statistically significant differences were found for incidences of sterility, epilepsy, congenital blindness and deafness, cleft lip and palate, and skeletal abnormalities, says Dr. Rosalie Bertell, a radio-epidemiologist who is president of the International Institute of Public Health and a member of CISEC's advisory board.

Dr. Patricia Sheehan from Ireland, who has specialised in mental retardation in children and who is on the advisory board as well, was also present at the press conference.

The markedly increased sterility and congenital defects spoke of the strong genetic effect of the radiation, observed Dr. Bertell.

The centre wants steps to protect the vulnerable population. If they cannot be evacuated from the area, some shielding in the form of thick layers of earth from other places should be provided in places like schools.

Both Mr. Padmanabhan and Dr. Bertell felt that the RE separation plant at Chavara might be raising radioactivity levels even higher.

The full details of the study would be made available only after publication in peer review journals, stated Dr. Bertell.

Fast Breeder Reactors Urged for Nuclear Power Program

Speakers at Kalpakkam

51500100 Madras *THE HINDU* in English
6 Mar 90 p 4

[Text] Kalpakkam, 5 Mar—Nuclear electricity experts said the country should go in for fast breeder reactors (FBRs) in its second phase of nuclear energy programme. The FBRs appeared to be the most potent, technically viable and economically acceptable solution to the country's energy problems, they told a seminar on "Economics and safety of nuclear power reactors," organised by the Indian Nuclear Society, Kalpakkam branch.

Mr. S.P. Paranjpe, Director, Indira Gandhi Centre for Atomic Research, Kalpakkam, said there were misconceptions partly due to inadequate interaction between the nuclear community in the country and the public, and also from the propaganda against the development of nuclear energy. Hence, the seminar on the safety and economics of two types of reactors—the Pressurised Heavy Water Reactors (PHWRs) and the FBRs—which were inter-dependent components of the country's nuclear power programme. The natural uranium-fuelled, heavy water-moderated PHWRs, now working at Kalpakkam, Kota and Narora (and more of which would be built), formed the first phase of the nuclear electricity programme.

These PHWRs generated plutonium as a by-product. This plutonium would be used in the FBRs (they are called breeder reactors because they breed more fuel than they consume) to generate electricity again. "It is the objective of the Department of Atomic Energy to reach an installed capacity of around 300 million kilowatts by the middle of the next century through the fast breeders," Mr. Paranjpe said. The population increase plus the objective of boosting India's per capita income would mean a seven to eight-fold increase in the requirements of energy and only nuclear electricity could foot the bill, he said.

Safety Systems

Mr. T.S.V. Ramanan, Deputy Chief Superintendent, Madras Atomic Power Station, Kalpakkam, who spoke on "safety features of PHWRs," said safety in Indian nuclear installations applied right from site selection to design, construction, commissioning, operation and decommissioning of reactors. In the PHWRs, the principle of defence in depth, multiple barriers to radioactivity and inherent safety features considerably reduced the probability of any accident.

The engineered safety systems and safety in operation reduced the possibility of any abnormal situation developing into an accident. Reactor containment building consisting of two thick walls would bottle up radioactivity if there was an accident. Radiological protection and environmental surveillance programmes ensured the safety of plant personnel and the public.

Cost Efficiency

Mr. N. Rajasabai, Operation Superintendent, MAPS, who spoke on "Design of PHWRs and their economics," said the capital cost of a coal-fired thermal power station was marginally less than that of a nuclear electricity station but the operating costs of the latter were far below that of the former. In addition, exploration, mining, handling and transportation of coal accounted for 40 per cent of the total cost of the thermal power cycle but the corresponding figure for the nuclear fuel cycle was less than five per cent.

The fuel requirement for thermal power stations was high and they generated a lot of waste. The cost of coal-fired station would go up if equipment were to be installed to handle the problems of emission of fly ash, carbon dioxide, sulphur dioxide, etc.

Dr. Om Pal Singh, Head, Safety and Noise Analysis Section, Reactor Physics Division, IGCAR, said the fast breeder reactors were as safe as any reactor system and they incorporated additional safety features. They entailed less mining of fuel and energy extraction was 40 to 60 times more in the FBRs (than in the PHWRs). In the FBRs, the efficiency in conversion from thermal to electrical energy was also higher. In the FBRs, there was less production of radioactive fission product for one kw of electricity produced.

Mr. G. Vaidyanathan, Head, Thermohydraulic section, Nuclear Safety Division, IGCAR, said 70,000 tonnes of natural uranium resources in the country would help in the 15 gigawatt installed capacity of PHWR for 30 years. And the use of plutonium and depleted uranium from these PHWRs in the FBRs would help in additional generation of 350 GW for 65 years.

More Details on Reactors

51500100 Madras *THE HINDU* in English
25 Feb 90 p 3

[Text] Madras, 24 Feb—Compared to fossil fuels such as coal, oil and gas, nuclear energy is more easily available,

more dependable, economically viable and safe, according to Mr. S.R. Paranjpe, Director, Indira Gandhi Centre for Atomic Research Kalpakkam.

Delivering the convocation address at the eighth annual convocation of the Indian Institute of Materials Management, Madras chapter, here on Saturday, Mr. Paranjpe said the known oil reserves in India were 0.5 billion tonnes. They would be exhausted before 2040 A.D. Firewood was scarce and the total forest area of the country had dwindled from 74 million hectares in 1976-77 to 65 million hectares now. Even after the full exploitation of hydel potential, the country would face a deficit of 900 billion units of electricity. If this deficit were to be met by burning coal and generating electricity, the country would need an additional 600 million tonnes of coal a year.

In this scenario, the best alternative was nuclear energy Mr. Paranjpe said. The development of nuclear energy in the country involved a two-way process. The first step, currently adopted, was the use of thermal neutron reactors, capable of exploiting the U235 content of uranium. The second step would entail setting up of fast breeder reactors, which would use the plutonium by-product from the thermal reactors.

The heavy water moderated thermal neutron reactors, which would produce 10,000 MW by 2000 A.D., would generate enough plutonium to support a 1,000 MW fast breeder reactor (FBR) every year.

A fast breeder test reactor was already operational in the IGCAR and it had all the technological features which could be expected to be found in larger FBRs. Many of its critical components were also made in India.

"We have taken steps for building all the critical components for FBRs and orders for many of the components for the prototype FBR (500 MW capacity) will be placed before the end of this financial year," Mr. Paranjpe said.

"Fast breeder reactors have also reached near technological maturity. FBR technology is a proven one and it is available," he said. The Phoenix FBR in France had been operating for 15 years. Two Soviet FBRs had also been operating for 16 years and nine years respectively. Their plant load factors were commendable.

On nuclear safety, Mr. Paranjpe said nuclear establishments were partly responsible for not publicising scientifically established facts, which proved that nuclear energy was one of the safest and cleanest source of energy. Without nuclear energy India's economy would be in dire straits. There was no alternative source of energy capable of sharing the burden on the coal reserves, Mr. Paranjpe said.

He also gave away graduate diplomas in materials management to 13 students.

Mr. N. Subrahmanyam, course director, said materials management was a developing science and the IIMM

promoted skills in the discipline. The IIMM had 10 chapters and 5,000 members.

Mr. S. Sridhar, Chairman, IIMM, Madras Chapter, said the IIMM conducted graduate diploma course, students' course and post-graduate diploma course in materials management.

Mr. R. Sridhar, course coordinator, proposed a vote of thanks.

Experts, Opponents on Safety of Nuclear Power Plants

Nuclear Energy Officials

51500099 Bombay *THE TIMES OF INDIA* in English
10 Mar 90 p 3

[Text] Bombay, 9 Mar—The total radiation dose in some of the country's atomic power plants had increased last year.

This was stated by the chairman of the atomic energy regulatory board, Professor A.K. De, and the chairman of the safety review committee of operating plants, Mr. M.S.R. Sarma, at a news conference here today.

They said that the total radiation dose received in these units was between 1,600 and 1,700 "manrems" last year. They have been asked by the atomic energy regulatory board (AERB) to reduce it to 1,000 manrems per annum. "Manrem is the unit dose of radiation by a worker at a nuclear power station.

Mr. Sarma, however, emphasised that "while collectively such an increase could create some amount of health problems, individually no one was affected." Right now, he said, there was absolutely no cause for alarm.

He explained that annually it was safe for an individual to receive five rems (roentgen equivalent man) of radiation. "There was no evidence to show this causes health problems," he said.

According to Prof. De, a bare five per cent of the workers had received 2.5 "manrems" of radiation and some of them 1.5 per cent last year. At these units, efforts were currently underway to bring it down to one per cent. Prof. De stressed that no one had crossed the 2.5 per cent limit.

In an informal chat, Mr. Sarma said people in Bombay received 50 to 60 millirems of radiation annually while the figure for Kerala was as high as 1,000 millirems.

Prof. De said that the AERB has directed that a time-bound programme has to be initiated to reduce a collective radiation dose both at the Madras atomic power station and the Rajasthan atomic power station to 1,000 manrems this year. The board reviewed the collective

dose to the public due to the discharge of radio-nuclides and found out that the existing situation was satisfactory.

The figure was as high as 3,000 manrems at the Tarapur atomic power station some years ago but was subsequently reduced.

Prof. De said that the AERB had investigated the possibilities of bringing down the total dose of radiation to workers in nuclear power stations by appointing a review committee.

The report of the committee focused on collective dose in mining and milling of uranium and the operation of nuclear power plants as they accounted for eight per cent of the total dose.

The steps recommended by the AERB included a commitment from the managements to curb the radiation level, initiate designer-operator co-ordination and training in dose reduction methodology to improve the working conditions.

Among the technical solutions, he suggested material selection and control, chemical and fission product build-up control, maintenance of fuel integrity and development of remote tooling.

The nuclear power corporation had also recommended what is known as "collective dose budgeting," and appoint an officer at each site to co-ordinate all efforts to ensure that doses to workers were as low as possible.

Touching on some of the other issues, Prof. De said the AERB had monitored the operational safety of the Rajasthan and Madras atomic power stations and found that they had faced many problems during their operation in the past decade. He said that solutions were found "involving non-routine practices."

Considering the Narora atomic power station was located in a seismic zone, five micro-seismic stations were installed to issue an alert about an earthquake. Prof. De said the plant has been designed to take in certain intensity of earthquakes. If it exceeded the limit the plant would be shut down, he said.

Last year, the "inlets manifold" of the atomic power reactors at Kalpakkam in Madras was damaged. The units were cleared for operations by the AERB only after critically reviewing the incidents and after being satisfied with the design changes.

The power level was restricted to 50 per cent in the initial phase. At a later stage, it will go up to 75 per cent.

On one occasion during the start-up in the heavy water plant at Kota in Rajasthan, hydrogen sulphide got released into the environment resulting in a smell in the area.

The AERB allowed the plant to resume operations only after proper corrective actions were taken.

In another step, the operation of the uranium metal plant at the Bhabha Atomic Research Centre was suspended by the AERB safety review committee because of a chemical explosion and a fire. The unit was cleared to re-start only after resolving all the issues.

The AERB has decided not to allow the import of refurbished teletherapy—equipment for treating cancer—unless the suppliers produce documents from a competent authority of its acceptability in its country of origin.

In view of the potential for radiation hazards, the AERB has initiated an action plan to decommission old teletherapy units because the supplier was unable spare parts or servicing facility.

Based on the technical inputs the AERB has decided that the manufacture of IRC-2A (industrial radiography camera) type of devices should be discontinued, after 1991 when its type approval expired, Prof. De said.

The current design of the device allowed the removal of the radioactive sources from the device. This has resulted in higher radiation doses to workers.

"After 1991 all such devices would be allowed to be used till the end of their useful life only if the sources are fixed securely and cannot be taken out of the device," he said.

Prof. De said the radiological protection division of the AERB approved of over 100 types of medical x-ray to ensure built-in radiation safety.

Opponents of Narora

51500099 *New Delhi PATRIOT in English*
3 Mar 90 p 3

[Text] Four months after the Narora atomic power plant in Uttar Pradesh became operational, "Network to Oust Nuclear Energy," a voluntary organisation based in Delhi and consisting of a group of social activists, teachers, students and professionals has come down heavily on the Department of Atomic Energy for clearing the project.

The nuclear power plant at Narora embodies for us the worst aspects of development—the waste of resources on a technology which has revealed its severe limitations and dangers as well as the tragic uprooting of thousands of villagers and their transformation into the anonymous mass of the urban unemployed, the network says in a recently published booklet.

Despite the fact that Narora was a fertile agricultural land, it was selected as a site for an atomic power station. Moreover, it was on the banks of the river Ganga on the middle of a thickly populated region and in an active seismic zone with newly formed alluvial soil.

The booklet further points out that in the event of an atomic fallout, the areas, which are likely to be affected include Delhi, Meerut, Gurgaon, Faridabad, Mathura, Bharatpur, Agra, Aligarh, Etah, Bareilly and Moradabad.

The Ganga would carry the radioactive discharge thousands of miles along its course through UP, Bihar and West Bengal into the Bay of Bengal.

The plant load factor of other atomic stations is around 40 per cent. The designed output of Narora atomic power station is 435 MWe and hence an optimistic estimate of power from NAPS would be 40 per cent of 435 MWe or 175 MWe. Thus the cost per unit of power generated will shoot up, ranking the plant quite uneconomical.

Moreover, for every 100 MWe of generated power, the booklet points out, 130 MWth is "lost" as heat. But it is not lost at all; it is what constitutes thermal pollution. And while the customer may pay for this lost component, every citizen suffers the pollution.

It further argues that the Department of Atomic Energy (DAE) would anyhow have cleared the site chosen for the NAPS as the site selection committee of the works under the DAE. The consequence of a fault or failure in a NPP are so grave and have such long term effects spanning generations of people that no assurance of safety is really valid, the report says.

What constitutes a material failure, design failure, operating failure, or system failure to a scientist who looks at problem objectively can be a minor or major accident. A nuclear accident in UP would be a major international disaster far exceeding anything known in recent times since Hiroshima.

The report is entitled "The Untold Story" and it continues that the fact of the matter is that nuclear energy is based upon one gigantic hoax: that there is a safe level of radiation. Even the IACA uses the phrase maximum permissible dose and not "safe dose."

A nuclear reactor of the fast breeder type can explode like a nuclear bomb because increased fuel compaction can cause increased reactivity and the fissile mass becomes critical.

We must seriously question a "development" which violates every tenet of social justice, ecological morality and political sanity, the report concludes.

Madras Seminar

51500099 *Madras THE HINDU in English*
7 Mar 90 p 3

[Text] Madras, 6 Mar—Nuclear electricity has relevance in a country which has exhausted its hydro-potential, and even though India has a lot of potential for hydro-electricity, it lies in inaccessible regions or where its generation will cause environmental damage, according to Mr. T.N. Seshan, Member, Union Planning Commission.

Inaugurating a seminar on "The Social relevance and safety of nuclear power," organised by the Meenakshi College for Women, he said energy was the fundamental

yardstick of prosperity. India had a lot of hydro-electricity potential in the Brahmaputra basin, the Indo-Gangetic basin and the North-Eastern region. But access to these places was difficult and tapping the potential there would cause environmental damage. In this difficult situation where the hydel resource was situated in some pockets and coal in some other pockets of the country, the moot question was whether the country should go in for nuclear power or not. He pointed out that other sources of energy such as solar, wind and ocean waves still remained rainbows on the horizon.

He regretted that the plant load factor in power generation plants in the country was never more than 55 per cent when the totality of energy scenario was taken into account. However, if the PLF of power plant in a State was 45 per cent and it was improved by 10 per cent, it would mean a generation of 2,500 MW.

Mr. S.R. Paranjpe, Director, Indira Gandhi Centre for Atomic Research, Kalpakkam, who presided, suggested that men of integrity and competence, representing various disciplines, could form a panel to collect all available data on nuclear electricity, evaluate it and recommend a perspective plan of action, taking into account the need for nuclear power, its cost, benefits, risks, etc. The panel should invite various submissions, verify statistics quoted and allow the opposing sides to cross-examine each other. The Kalpakkam branch of the Indian Nuclear Society would fully cooperate if such a study were undertaken on nuclear energy and actively participate in its analysis, Mr. Paranjpe said.

Mr. N. Ram, who spoke on "nuclear power in India," said the motivation for India's nuclear energy programme was two-fold: general inclination towards a high-yield field and its attraction as a viable, prestigious proposition in a country which was chronically short of electricity.

But India tended to be ambiguous and vacillating in its pursuit of nuclear option viz. nuclear weapons. It was time to shed this shyness and inhibition and come out openly on the implications of this question.

"India had refused to accept safeguards on its nuclear activities unless it is applied uniformly to nuclear facilities in all countries. Therefore, we correctly refused to sign the non-nuclear proliferation treaty (NPT), which is discriminatory," Mr. Ram said. But the issue could not be seen in old light today. There was a lot of change. The public mood was positive towards disarmament and India should respond to it positively.

Dr. D.V. Gopinath, Head, Health and Safety Laboratory, IGCAR, Kalpakkam, said radiation was nothing new to the world. Natural background radiation had always existed and would continue to exist. Exposure to natural background radiation in the world was 1,000 times more than the radiation in the vicinity of a nuclear power plant and it was 100 times more due to medical exposure such as X-rays and 300 times more from phosphate industries.

Dr. Gopinath said when nuclear power reactors had logged more than 5,000 years of reactor operations, there had been only two accidents, at Three Mile Island in the United States in 1979 and at Chernobyl in the USSR in 1986. The containment at the TMI held and there was only insignificant exposure of the public to radiation. The TMI accident was caused by malreading and maloperations. Within a month of the TMI, the dam at Morvi in Gujarat burst and hundreds of people died. But it was forgotten in a month. But the TMI was still being discussed. The Chernobyl disaster did release large amounts of radiation.

Miss K.S. Lakshmi, Principal, Meenakshi College, said the seminar was organised to lay the foundation of the bridge of understanding between nuclear power scientists and those who are worried about its safety.

Mr. K.R. Sundararajan, Correspondent, welcomed the gathering. Mrs Ponmani Vairamuthu proposed a vote of thanks.

IRAN

'Uproar' Over Trigger Devices for Iraq Viewed

NC1604094790 Tehran RESALAT in Persian
5 Apr 90 p 12

[Commentary: "The Complicated Propagandistic Uproar From Iraq and the United States"]

[Excerpts] The current propagandistic uproar from Iraq and the United States indicates a policy aimed at focusing on the opposition between Iraq and the West. [passage omitted]

A glance at the Iraqi stances in the recent past, and at its difficult internal situation as well as its increasing economic crisis, and innumerable problems confronting Iraq in the aftermath of the cease-fire illustrates that the United States is engaged in a complicated propaganda game in order to project its new role for the Ba'thist Iraqi regime in the region.

Now the question arises: Does Iraq have the necessary strength to open up a new political front (in conditions when it is obligated to the West to implement Resolution 598 in the United Nations)?

Is Iraq trying to resolve its massive domestic problems or is it seeking to create tension in its relations with the greater countries? Will the Soviet Union remain indifferent to the complicated currents forming in the Middle East? [passage omitted]

Is the aim of propaganda to accentuate the Iraqi role as the leader of the Arab world and as an emerging regional superpower, that is, to give a regime an image of strength when the dictatorial policies of its rulers naturally cannot endure indefinitely!

The domineering powers' hostility and animosity toward the Islamic system in Iran should never be ignored. With the collapse of communism worldwide, apprehension in the West is mounting, inspired by Muslim nations' emulation of the Islamic system of Iran. Therefore, publicizing Iraq's possession of modern chemical, biological, and nuclear armaments could be interpreted as flexing its muscles in front of the Islamic Republic of Iran. In the same context, the Iran-Iraq war, which has now become a mere diversionary propaganda tactic, cannot overshadow the uprising in the occupied areas.

The Saddam regime has not yet responded to the UN secretary general's latest proposals for peace talks between Iran and Iraq. As a result, the dangers from this regime and its occupation of Iranian territory continue and only our vigilance against these precalculated plans can guarantee the perpetuation of our system.

PAKISTAN

French Reactor: 'Row' Over Belgian Participation Reported

51004705A Karachi DAWN in English
23 Mar 90 pp 1, 9

[Text] Brussels, Mar 22—Belgium's efforts to sell nuclear expertise to Pakistan have once again triggered a domestic political row here.

Anne Marie Lizin, Belgium's Minister for European Affairs, was in Islamabad earlier this month in a bid to involve Belgian firms in the French nuclear reactor to be built in Pakistan.

The Minister reportedly received strong Pakistani assurances that Belgian participation in the plant would be welcome.

But Ms. Lizin's attempts to sell Belgian nuclear know-how abroad has run into opposition from other members of the government.

Reports in the Belgian Press today said Robert Urbain, the External Trade Minister, had "voiced reservations" about Belgian participation in the Pakistani nuclear plant during his visit to Islamabad last December.

Urbain had argued that Pakistan must first sign the nuclear non-proliferation treaty.

Ms. Lizin is believed to have felt that the French commitment to supply Pakistan with a nuclear reactor had triggered "a change in the situation". Belgium's nuclear sector also wanted a piece of the multi-million dollar project.

Press reports here say Ms. Lizin's personal initiative has not been too well received by Robert Urbain. "Sparks could fly," is how the leading newspaper LE SOIR described tensions between the two socialist politicians.

Munir Assures Safety in Nuclear Radiation Utilization

51004705B Karachi DAWN in English 25 Mar 90 p 12

[Text] Lahore, Mar 24—The Pakistan Atomic Energy Commission has finalized rules and regulations for radiation protection and nuclear safety in the country and would enforce the same after a commission's meeting, scheduled to be held before the end of the month. Those rules and regulations, developed in consultation with international organizations, concerned ministries and organizations, cover the use of X-rays and radioisotopes in industry and research.

This was disclosed by the PAEC Chairman, Mr. Munir Ahmed Khan, while inaugurating the two-day national radiological conference, organized by the Radiological Society of Pakistan.

He said in radiology, the X-ray facilities would be licensed by the PAEC and regularly inspected to ensure that the patients and technical people were protected from an undue exposure.

Nuclear radiation, Mr. Munir Ahmed Khan said, had both benign as well as destructive aspects. If used excessively in an uncontrolled fashion, it was destructive but its judicious application in a controlled manner was a healer. The PAEC, he emphasized, was harnessing nuclear radiation for a variety of beneficial purposes.

Underlining the need for educating the public more about the potential dangers as well as benefits of radiation so that a common man had a better idea of the limits within which exposure to radiation would cause no problem in nature, a nuclear facility or a hospital, the PAEC Chairman said. "If we allow misconceptions about radioactivity and radiation to prevail unchecked, we will not be able to benefit from peaceful use of nuclear energy, such as generation of nuclear power or use of radiation in X-rays, in the field of health, agriculture and even in basic research."

As for PAEC's role in this regard, he said it was planning to organize workshops on nuclear energy and public understanding at Karachi and Lahore. This would help establish better communication with the media, public and the policy makers to educate public opinion. "We believe that if modern technology has to be used on a larger scale, it must be done with the full support and backing of the public at large."

About Pakistan's agreements with France and China for acquisition of nuclear power plants, he said they made a "major breakthrough" in the large scale introduction of nuclear power. These agreements, he observed, had virtually ended a 15-year embargo and boycott and unilateral restrictions imposed by Western countries on supply of nuclear materials, equipment and knowhow to Pakistan even under international safeguards. "Now, we do hope that flow of peaceful nuclear technology to

Pakistan will be restored and we shall be able to use this technology for our socio-economic development," Mr Khan said.

Earlier, Prof. Rasheed A. Mian, President of the organizing committee of the conference, in his address of welcome, proposed establishment of an institute of radiology which should function as a center of excellence where post-graduate training of a high standard could be imparted to doctors and scientists in all fields of radiology, diagnostic therapeutics and nuclear medicines.

Prime Minister Assures Continuation of Peaceful Program

51004705C Lahore THE PAKISTAN TIMES in English
30 Mar 90 p 1

[Text] Islamabad—The annual meeting of the Pakistan Atomic Energy Council (PAEC), to consider the projects and programmes of the Council, was held on Thursday

under the chairmanship of Prime Minister Benazir Bhutto at the Parliament House.

The meeting reviewed the activities over the past year and noted with particular satisfaction the recent breakthrough, achieved in the field of nuclear power through the Chinese and French agreements. The Prime Minister stressed that this signal progress had been achieved without compromising Pakistan's nuclear policy.

The Prime Minister also appreciated the enviable record of nuclear safety and radiation protection in PAEC establishments. She commended the work of PAEC scientists and engineers which has kept KANUPP running by locally produced nuclear fuel.

She emphasized the need for sustained research work and urged the commission to redouble its efforts in implementing its nuclear power programme. She also assured continued and full support of the government to the peaceful nuclear programme of the country.—APP.

CANADA

Pickering, Bruce Plants Each To Close Reactor for Testing

51200015 Toronto *THE TORONTO STAR* in English
4 Apr 90 p A12

[Article by Daniel Girard]

[Text] Ontario Hydro will close one reactor at each of its Pickering and Bruce nuclear plants for about four months starting next month for testing to prevent a repeat of a \$1.7 billion accident in 1983.

Hydro engineer Bryan Murdoch said "the rather extensive inspection" in Pickering Unit 4 will determine if the utility can continue operating that reactor until a 19-month shutdown to replace reactor pressure tubes scheduled for June, 1991.

The Atomic Energy Control Board had asked Hydro for all information on pressure tubes in four reactors at the Bruce A plant on Lake Huron as well as Unit 4 at Pickering, east of Metro.

Hydro presented the information 15 March and the board will formally respond in the next two weeks, Zygmund Domaratzki, director-general of the board, said yesterday from Ottawa.

"It looks like a pretty reasonable proposal that will generate a lot of information in a short period of time," he said.

Hydro will send metal shavings from tubes in Pickering Unit 4 and Bruce Unit 1 for analysis at the Atomic Energy of Canada Ltd. laboratories in Chalk River, said Tom Carter, a reactor engineer with Hydro's nuclear engineering department.

The utility will also send 540 pieces and 8 full tubes from Unit 3 at Pickering, which is currently being re-tubed, he said.

Similar tests have been done on Units 2 and 3 at Bruce, said Carter.

The analysis costs about \$80,000 to \$100,000 per reactor, he said.

Metal pressure tubes containing nuclear fuel fit inside a calandria tube filled with a heavy water moderator. The two tubes are separated by carbon dioxide gas and rings around the pressure tube called garter springs.

Hydrogen absorption and movement in the springs can cause "blisters" that can lead to a rupture.

A ruptured pressure tube at Pickering's Unit 2 reactor in 1983 led to a 1.8-metre (6-foot) rip and cost \$1.7 billion in replacement power and repair costs. As a precaution Hydro closed Units 1 and 2 for four years to install tubes made of stronger metal.

FEDERAL REPUBLIC OF GERMANY

Opposition Parties Criticize Fusion Research

90WP0068A Frankfurt/Main *FRANKFURTER RUNDSCHAU* in German 22 Mar 90 p 6

[Article by Karl-Heinz Karisch: "The Dirt Comes When You Implement It"]

[Text] "On paper," Munich physicist, Professor Jochen Benecke says, "on paper everything looks quite clean—the dirt comes when you implement it." The scientific expert of the EC Parliament in Brussels talks about nuclear fusion in drastic terms. Physically he regards it as an exciting subject, to be sure, but completely unsuitable for solving the problems of an energy-hungry mankind in the distant future. At a time when the British nuclear reprocessing facility Sellafield is back in the headlines—this time because a relationship has been demonstrated between cancer in children and their fathers' work at the nuclear facility—they are concentrating on a not yet existing technology, which would produce at least twice as much nuclear waste as conventional nuclear reactors.

So it is almost reassuring that the politicians' dream of nuclear fusion is at this time being relegated to the realm of scientific fables and so far promises to become one thing above all: the largest billion-DM flop in research history. The process which allows the suns in the universe to glow will probably never be realizable on earth, Benecke believes.

The Munich elementary particle physicist has a pile of good reasons for this. But the "storytellers" in fusion research have been able to coax increasingly larger research funds from the politicians with promising theories and tiny steps on the road toward ignition of the necessary plasma from the hydrogen isotopes deuterium and tritium.

They believe the future is even rosier. "Nuclear fusion is a long-term option with very great potential," raved Research Minister Heinz Riesenhuber at the end of February when presenting the Third Energy Research Program just passed by the federal cabinet. But strangely enough: Although fusion researchers in the 1970's predicted a breakthrough within a few years, a good 20 years later Riesenhuber will still have to have extreme patience. "Despite major progress in recent times, economic application is certainly another few decades off." That is no exaggeration. Estimates by the scientists themselves are now another 30 to 60 years until the startup of a reactor.

Until then, predictably, many billions of marks will have to be spent on this "fusion mission." They would be better spent on technologies for saving energy and for using renewable energies such as sun and wind, in the opinion of SPD [Social Democratic Party of Germany] and Green Bundestag members who are involved in this.

The two opposition parties thus recently submitted motions to the Bundestag. The SPD demanded a report from the federal government, "by means of which the German Bundestag can make a decision about continuing or abandoning fusion research." The Greens went a step further. They demanded a freeze on the money until an independent expert group has submitted a report evaluating the technological results. In addition, Bonn should not enter into any more international agreements on nuclear fusion research. Wolfgang Daniels, diplomat physicist and Green delegate, says with self-criticism: "This frontal attack on fusion research has been dormant for a long time."

The initiatives by the two opposition parties were a little too fast for the governing parties. But they didn't want to dismiss the motions entirely, and so a proven method was agreed on: Both requests were referred to the responsible committees. But the two parties were not satisfied with that. They are demanding a hearing on the subject. Ultimately, says SPD Bundestag member Wolf-Michael Catenhusen, chairman of the committee for research and technology, with such a billion-DM program, Parliament cannot just deal with it in budget discussions.

He is not the only one beset by the fear that the Europeans and the FRG in particular might be throwing billions out the window. "Both in Japan and the United States the funding for fusion has clearly been reduced over the last few years," he states. There, nuclear fusion is now only being studied as a physical principle. Those scientists have obviously abandoned the dream of an energy-dispersing reactor. And although Catenhusen, together with the scientific member of the SPD parliamentary group, Matthias Machnig, has presented a background paper which gives a devastating verdict for the chances of fusion, he still refrains from making a final judgement. "Objectifiable scientific criteria must be developed," he demands, "which make it easier for politicians and the public to evaluate fusion projects earlier, to determine whether they are actually making any progress on the way to a fusion reactor concept."

A difficult undertaking; for even the beginning of fusion research did not exactly follow rational odds. The U.S. program was based on having something to counter those opposed to development of the hydrogen bomb, in which the fusion process is uncontrolled. For this reason there were parallel studies as to whether thermonuclear energy could not also be used in a controllable manner and for peaceful purposes.

U.S. fusion research was totally tied to the projects to develop the H-bomb, however. Not until its development did the "Matterhorn" project after 1954 devote itself exclusively to nuclear fusion as a potential source of energy. The end of the secrecy came in 1956, when the United States and the USSR almost simultaneously acquainted the world's public with the sensational new direction of research. The first "successful" fusion experiments were reported. At the second Geneva Atomic Conference in 1958 the United States presented a special

show on fusion research, which was praised as the salvation of an energy-hungry world. By using it, the experts promised, the human being will "have found the ultimate solution to one of its most urgent problems."

From the aspect of the West German researchers, another research area in which they had fallen behind the nuclear powers now presented itself. As early as 1956 the first experiments were therefore started, culminating in the founding of the Max Planck Institute for Plasma Physics (IPP) in Garching near Munich. The decision to do major research had been taken. In 1985 the scientific director of IPP, Professor Klaus Pinkau, was able to state that all of the competition in the field had been beaten. "Fusion research in the FRG is number one in the world." A national elitist feeling that costs a lot and brings us little.

According to what Green Bundestag member Wolfgang Daniels had determined, those people are "frustrated." "As scientists they are working on a project which may be reality in 30 years—or it will then be decided that it will all come to nothing." Finally, it is not a matter of just igniting the solar oven, but whether it is also possible to "harvest" anything. And that, in his opinion, is something even many of the physicists working on it doubt.

"These people have interesting hobbies," Daniels reports. "I visited a company making solar collectors, and there were two very clever people giving tips—they were fusion researchers from Garching." On the other hand Pinkau, their boss, presents himself as continuing to be optimistic. Power production from nuclear fusion, which will be possible in about 60 years, will be considerably cheaper than using solar energy and be fraught with fewer hazards than nuclear reactors, he said. After all, fusion fire can never "get out of hand," since there is always just enough fuel present in the furnace chamber for a few seconds. And as a new argument: No greenhouse gases such as carbon dioxide are created, as in burning coal or oil, he said.

Nuclear fusion involves a physical process, in which the nuclei of heavy hydrogen atoms (deuterium and tritium) are fused into an atomic nucleus of the inert gas helium, while releasing very large amounts of energy. In this reaction one neutron, carrying 80 percent of the energy, is released for each fusion. The tritium, which hardly exists in nature but is necessary for the process, is bred from lithium by means of the releasing neutrons. For this process the gases must be brought to a temperature of 100 million degrees C. In so doing, a so-called plasma is developed, in which the atomic nuclei and the electrons surrounding them separate from each other. Since no material on earth can withstand such temperatures, the plasma is enclosed in a toroidal vessel with strong magnets. At sufficiently high temperature, pressure and density of the plasma, the nuclear fusion process is to begin.

At present, two lines of construction have turned out to be particularly promising. In the so-called stellarator, the isolating magnetic field is created solely from the outside through magnetic coils. In the Tokamak type a part of the magnetic field is produced by a strong electric circulating current, which flows in the center of the plasma torus. Both methods are being studied at the Max-Planck Institute.

About DM2 billion are available for Euratom's "Nuclear Fusion" program from 1987 to 1992, which is being financed by community funds from the European Community. The FRG contributes DM200 million annually to these EC expenditures totalling DM900 million. This is so that the 12 partner nations including Sweden and Switzerland may gain their entire knowledge, Federal Research Minister Heinz Riesenhuber (CDU [Christian Democratic Union]) announced in October last year after a major query from the Greens. But despite the optimism he has otherwise demonstrated, he had to admit: "A general failure of the efforts to realize commercial fusion power plants cannot in principle be excluded at the present development level of fusion research." However, he considered this "neither plausible nor probable."

Hence, the preliminary plans for an "International Thermonuclear Experimental Reactor" (ITER—from the Latin for "journey" or "road"), in which, besides the EC, the United States, the Soviet Union, and Japan will also participate, are already being coordinated from Garching. Riesenhuber wants the preliminary plan on his desk as early as the end of this year. This would enable a decision about construction as early as 1994, and he even has firm ideas about where to locate the ITER facility: the FRG. Because the world's leading fusion experiment at the moment, JET (Joint European Torus), is located in Culham in Britain.

Plans for the NET (Next European Torus), the results of which are to be included in the ITER plans, have been under way since 1986 within a European framework. This is connected with a cost explosion of enormous proportions. NET will already cost eight times more than JET and represent a DM8 billion item in the ledgers; the total costs for construction and operation are even estimated at DM17 billion.

In view of these sums, the European Parliament in 1988 charged its project group for Evaluating the Scientific and Technical Options with undertaking a study. In the paper submitted in 1988, the costs until a potentially usable fusion reactor has been achieved in 2050 are estimated at DM100 billion. At the same time the warning is issued that, by tying up the funds for such a long term and with the international participation, not only would the other focal points of energy research be shortchanged. Such a program would also "have a tendency" to withdraw from "parliamentary control." The European Parliament agreed with this evaluation and in March 1988 demanded that when the program is next

examined an independent judgement be sought in order to evaluate the possibilities of nuclear fusion.

One of the experts for the STOA group of the European Parliament was Professor Benecke. "So far, no one knows whether controlled fusion can even be realized based on the physics," he said in a conversation with FRANKFURTER RUNDSCHAU. But if it is possible, numerous problems are already known today.

A fusion reactor is vastly more complicated in construction than a normal nuclear reactor. The most extreme technologies would be gathered for it. The plasma must be heated to at least 100 million degrees, and behind a thin wall there would be temperatures at nearly absolute zero in order to operate the superconducting magnets. "All of that in a very tight space and under a violent neutron bombardment." For this reason the shell of the reactor vessel very quickly becomes brittle and radioactive, he said. At this time it is anticipated that the shells must be exchanged every two to five years, which would cause enormous amounts of "bulky" radioactive waste.

Another problem is the tritium, he said. It simply wanders through the steel like hydrogen. But: "Tritium is very dangerous biologically, because in contact with water it exchanges hydrogen atoms; tritiated water is created." This radioactive tritiated water is easily incorporated into body cells and causes genetic damage.

According to calculations by the elementary particle physicist in Munich, fusion power, if it comes about, will be at least ten times more expensive than today's nuclear power. He bases his statement on competent professionals. Two members of the Scientific Leadership at the Max-Planck Institute for Plasma Physics, Dieter Pfirsch and Karl-Heinz Schmitter, indicated as early as 1984 that the power density of a fusion reactor will be very low. The result: For comparable power from a conventional nuclear pressurized water reactor, a fusion reactor would have to be designed eight times larger. Benecke draws the conclusion: Due to their size they will only be useful for base load operation, and because of the low availability they are unsuitable precisely for base load operation.

The SPD and the Greens have adopted these evaluations. Physicist Wolfgang Daniels from the Greens calls for a turnaround: "For nuclear fission, major complaints are now being heard about the errors of yesterday. Oh, if only we had done more for the renewable energies back then." Otherwise he already regards nuclear fusion as a financial fiasco similar to the fast breeder at Kalkar, which could not be realized politically.

And SPD delegate Catenhusen also wants to guarantee from the outset "that measures to promote renewable energy sources, in particular photovoltaics (using sunlight) and promotion of energy conservation," must take precedence in energy research in the FRG.

But even if temporary nuclear waste storage sites in the FRG are overflowing and final storage continues to be

unclear, the federal research minister remains equally supportive of the atom. To be sure, he likes to talk about the federal government wanting to do more for the natural energy sources; but Bonn's "Third Energy Research Program" mentions the bare figures. They speak the language of the nuclear lobby: DM800 to 850 million will be spent on studying nuclear energy and fusion research until 1993.

However, the renewable energies will get as much as DM300 million—although it is precisely in this environmentally gentle field that the greatest technical progress has been achieved in the past years.

TURKEY

First ASR-227 Missile Produced; Has 2,000-Kilometer Range

*NC1804081290 Istanbul MILLIYET in Turkish
12 Apr 90 p 8*

[Report by Tuncer Bahcivan: "The First Turkish Missile Is Ready"]

[Excerpts] The first Turkish missile, the ASR-227, manufactured by the Defense Research and Development Institute, has been tested successfully. The institute, which is affiliated with the Turkish Scientific and Technical Research Institute, is now waiting for instructions from the general staff's office to start producing the missile. [passage omitted]

The range and destructive capability of the prototype ASR-227 missile, which uses solid fuel, is adjustable. Modern technology has been used in the production of the first Turkish missile, and it is capable of hitting targets at a distance of 2,000 km if necessary. [passage omitted]

Completion of First Nuclear Reactor Reported

*NC2004123690 Istanbul MILLIYET in Turkish
17 Apr 90 p 13*

[Report by Ercument Isleyen]

[Excerpts] Turkish scientists have successfully built Turkey's first nuclear reactor after working on the project for three years. The reactor, which will be used in nuclear research and which only 20 countries in the world are capable of building, is entirely the product of the work of Turkish engineers and technicians. [passage omitted]

The reactor, which has been named Turkish Reactor-1, was built in a water tank which holds 450 cubic meters of water. It lies at a depth of 8.70 meters. The United States refused a request for uranium-235, which is required to operate the five-megawatt reactor. The question of uranium-235 was also taken up in the past when Turgut Ozal visited the United States as prime minister. However, the uranium could not be obtained from the United States. Consequently, a request was conveyed to France. The French response was positive and preliminary agreements for the acquisition of uranium-235 were concluded with that country. [passage omitted]