# ANUMUKTI

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## *Early Morning Test Light over Nevada, 1955*

*your mother slept through it ill,*
*her face turned away*
*like the dark side of the earth.*

*wed heard*
*between rancheras on the ratio*
*that the ladles*
*ini ike two bears*
*ikat he among the stars*
*above Nevada*
*would fade at* 3:15 as *though seared*
*by a false sun.*

*The stove exhaled all nighy*
a *trinity of the rings.* YOU *entered*
*your fourth north*
*of floating* in *the tropical,*
*star-crossed water*
*your mother carried under her heart*
that *opens and closes*
*like a* butter*fly.*

*when the* sky *flared,*
*our room lit up. Cobwebs*
*Sparkled on the walls, and a spider*
*absorbed the* light
like a *chameleon and beqan*
*to inch forward the outer rings*
*as if a fly trembled.*

*Rooster crowed, The dog*
*seratched at the door.* I went *outside*
*hearing, the hens and thought*
*weasel*
*and found broken eggs, the chicks*
*spongy, their eyes*
*stunned and shrouded*
*by thin vells of skin.*

*"Don't open your eyes."*
I *whispered to you when darkness*
*returned. I thought of your bones*
*still a white gel, I remembered the story*
*of blood of blood smeared on the doorways,*
*and* I placed *my hand on the balloon*
*you rode in-that would slowly sink*
*to your birth.* I *Said*
*the old German name your mother already picked*
*for you, Robert. It means bright fame.*

***Robert Vasquez***
***A tomic Ghost: Poets Respond to the Nuclear Age.***

## ■ LETTERBOX

Dear Editor,

Last year, I worked for Friends of the Earth International on a safety analysis of the Rovno and Khmelnitsky nuclear power plants in the Ukraine. These plants are VVERI000 plants - exactly the same kind of plant that the Indian government is negotiating to construct at Koodankulam. The safety analysis I did for these plants therefore has direct relevance for the Koodankulam project.

We found that a lot of questions are being asked about the safety of this type of nuclear plant. Yet the kinds of questions that are asked about the safety of this type of nuclear plant, though well - known in Europe, are not asked at all in India, and indeed, very little seems to be known at all about Russian-design nuclear plants, even amongst India's atomic establishment, which seems very happy to keep it that way.

Most of the problems with VVER 1000 safety are actually set down in a book published by the IAEA, called the 'Issues Book'. According to the Issues Book, these problems are:

- The possibility that the reactor pressure vessell may become brittle, due to the effect of neutrons on the steel. This would make it possible for it to crack violently open during an emergency, causing a major catastrophe with very large release of radiation. The government needs to ask very detailed questions about steel composition, welds, intesity of neutron flux, etc.
- The possibility that control • rods may fail to insert properly during an emergency, preventing the reactor from shutting down. Failure to shut down could also

***Continued on page 16***

## ■ From The Editor's Desk

The fall of the Gujaral government is not an occasion for regret. Being a jellyfish is not a good recommendation for a Prime Ministerial candidate and Mr. Gujarat's conduct in high office proved a great disappointment to many who had expected far more from him.

There is no doubt that people in the country yearn for an honest and accountable government. The issue of stability is being played up as if a corrupt government which lasts its full course is a boon in itself. Have we forgotten Shri Narasimha Rao's government so soon! What does honesty and accountability mean? It certainly does not mean that one hides behind rules and does nothing. It also does not mean that no mistakes can be made. As long as there is full transparency in the process of the government, no secret deals are being made for private gain, I feel certain that the people of India will tolerate some amount of incompetence as long as it contributes to the learning process.

Shri Nabakrushna Choudhuri, who was chief minister of Orissa from 1949 to 1957, managed to run the government for seven years with a majority in vidhan sabha of only three! This was much before the days of the anti-defection law. Nowadays, this fact seems to belong to Ripley's Believe It Or Not. Perhaps in those early days of independence the representatives of the people had not developed a "conscience" and were hence saved from having to defect to serve the people.

In this *Anumukti* number, questions regarding these issues of accountability, transparency, democratic control keep cropping up. We learn (page 3) how the US government in the fifties and early sixties was so hellbent upon bomb production that they managed to seriously compromise the health of the very people the bombs were supposedly meant to protect! This massive assault, far more insidious and damaging in the long run than anything the Soviets could have launched was possible only because the US government despite its cacophony regarding freedom was not accountable to its citizens. The great delay in publishing the results of the study makes it apparent that the government even today is not willing to be held accountable for its actions in the nuclear field.

On page 8 we see that the Russians too are unwilling to have the truth come out regarding their nuclear skeletons and the lengths they go to suppress those who try to ferret it out. On page 15 we find the government of Bangladesh falling for the same old discredited arguments of the nuclear lobby.

Amidst all this, the decision of the Indian government and the nuclear establishment, to open up and allow international inspection of the Kakrapar site (page 5) might at first sight seem like a breath of fresh air. Has the leopard changed its spots? Or rather, as my daughter would put it has the twisted tail of the dog suddenly become straight? I recently met some workers from Kakrapar who told me how they were being coached on what to say in front of the team of international inspectors from WANO. Amongst the topics which were totally taboo was the damage caused by floods in 1994, and the fact that the Emergency Core Cooling System of unit-1 has never worked to design specifications. No wonder when this is what we mean by accountability and openness, the people want to try out t new set of rulers every opportunity they get.

*Surendra Gadekar*

# *Boom!Boom!Baby Boomers*

The years just after the second world war are known as the baby boom years since that was the time when a war weary generation decided to enjoy the fruits of peace. Recent evidence indicates that the name, for Americans at least, has a totally different and somewhat sinister connotation.

Ever since United States dropped the first atomic bombs on Hiroshima and Nagasaki in August 1945, there has been interest in the question of how the resulting gales of radiation and fallout affected those who survived. This question is of vital interest not only to the Hibakusha (the atomic bomb survivors) but to many other victims of the nuclear madness all over the world. Even after fifty years the question, does nuclear fallout cause an increase in ill-health among the exposed populations, still begs an unequivocal answer. In an age of the rapid advance of science, this uncertainty after decades of research on a question which affects the health of millions is incomprehensible, almost criminal.

The whole thing starts making sense only when we begin to examine the issue like any other criminal conspiracy; start looking for motives and opportunity. Who profits by this state of confusion? Who would be liable for damage to health and environment if an unequivocal connection could be proved? Who has the power to "halt the march of science"? The answer to all these questions is only one. It is the governments of the most powerful nations in the world who have had both the opportunity and the motive. It is they who made the bombs and tested them repeatedly in the atmosphere and underground, It is they who repeatedly assured their own populations that there **was** nothing to worry. And it is they who have stuck to a policy of stout denial in the face of mounting evidence.

One of the major reasons that governments can get away with their lies has been the fact that there have been very few proper studies of the exposed. Supposedly scientific studies have without any basis just assumed that a certain region like for instance North Utah had negligible fallout from nuclear testing and hence the people there could be used as controls. Since no measurements were made or if they were made, they were kept under wraps, studies made under such mistaken assumptions have never been convincing.

Contamination in some areas has been so large and its effects so stark, that despite all attempts by the government to deny any harm whatsoever, the people have just never believed the denials. American Ground Zero: The Secret Nuclear War by Carole Gallagher which was published in 1993 and has photographs and interviews of many of the victims is a detailed account of the life of ordinary people laid waste by the callousness of their own supposedly free and democratic government.

To put such a long ranging controversy at rest, the US Congress in 1980 passed a law (Public Law 97-414), which in part, directed the Secretary of Health and Human Services to "conduct scientific research and prepare analyses necessary to develop valid and credible methods to estimate the thyroid doses of Iodine-131 that were received by individuals from nuclear bomb fallout (and) to develop valid and credible assessments of the exposure to Iodine-131 that the American people received from the Nevada atmospheric nuclear bomb tests."

As part of fulfilling this mandate, National Cancer Institute (NCI) undertook a massive study beginning in 1980. In essence, the NCI study is the first time anyone has determined where the fallout landed and the degree to which people were exposed. As the chief investigator of the study. Bruce Wachholz said, "This is a crucial step in understanding the impact of the nuclear weapons tests on public health"

***Effects of fallout often subtle***

Researchers know that in the aftermath of a nuclear explosion, the gamma rays and neutrons that explode from an atomic fireball cause acute radiation sickness, burns, cancer, cataracts and some other diseases. These rays constitute just a small part of the fallout and cover a relatively limited distance Their impact is dramatic and often immediate. The major part of the fallout is a mixture of all kinds of radio-

## *Knowledge Is Not Wisdom*

The Atomic Energy Commission (AEC) learned of the risks of fallout and the prevalence of hot spots with the first atomic test. Fallout was discovered 200 miles from the test site where "Trinity," the first nuclear bomb, was detonated in New Mexico in July I94S. The nuclear establishment also knew that a Western test site would spread contamination across most of the country. In I948. .well after the end of the Second World War, the committee assigned to choose a location was told by U S Air Force Meteorologist Col B G. Holzman that an East Coast site would be advisable "because the United States is predominantly under the influence of westerly winds." The committee intentionally chose a Western site because the weapons labs were nearby, which it felt would be helpful in "accelerating the pace of the weapons development program."

active fission products, and its effects can be more subtle. These radioactive poisons ride prevailing winds and can cover much of a continent. One of the many radioactive components of fallout is Iodine 131, which naturally concentrates in the human thyroid gland. The thyroid uses Iodine to make thyroxin and other hormones that regulate metabolism. The body is unable to distinguish between normal life-supporting Iodine and the radioactive poisonous Iodine. Children who do not get enough Iodine may not grow normally orfully develop mentally. Adults develop goitres: enlarged, overworked glands struggling to meet the body's demand for thyroid hormones.

*Study became political issue*

The National Cancer Institute study was essentially complete in 1994 and the full report is expected to be more than 100,000 pages. However, the institute showed some reluctance in releasing the results of the study. The study first became a political hot potato more than a year ago, when an advisory panel from the Centre for Disease Control requested a copy and was rebuffed. Some members of the advisory panel subsequently complained publicly that the institute was trying to suppress the data. "We are profoundly troubled by NCI's handling of this important study," said a letter issued by Physicians for Social Responsibility and the Military Production Network, a coalition of nuclear watchdog groups. "NCI officials have failed to release the material in their possession that would allow the public, health experts, policy makers and the media to begin assessing the impacts of these exposures." Tim Connor of the Energy Research Foundation and a member of the panel says, "To be sitting on this information, which shows where people are at risk, and to not be sharing that information with public health officials and others in a position . . . to mitlgate those risks is unconscionable."

Wachholz said it simply took researchers a lot of time to interpret the voluminous material, draw conclusions and summarise findings.

Most scientists agree that the next step is to try to get a better handle on what connection, exists between Iodine 131 and thyroid cancer, and many activists already are calling for studies of the counties identified in the NCI report. "The whole population ... that was young or in utero for that period through 1962 needs to be studied," says Arjun Makhijani of the Institute for Energy and Environmental Research. "This issue is going to go on for a very, very long time."

## *Lying Habits Die Hard*

*Estimates of thyroid doses, first reported in testimony to Congress in 1959 and still cited in 1997, range from 0.2 to 0.4 rad. But children on average actually received an estimated cumulative dose to the thyroid of 6 to 14 rad, and in the 24 most heavily contaminated counties, between 27 and 112 rad.*

Powerful governments have a vested interest in not letting the truth come out. Hence, it is no wonder that studies done so far on potential of radioactive Iodine to cause health problems have been both tantalising and frustrating in equal measure. Some researchers like David Becker, professor of radiology at New York Hospital/Cornell University Medical Centre, calls the association between Iodine 131 and thyroid cancer "weak."

The 1986 meltdown of the nuclear reactor in Chernobyl, presents a dramatic and tragic picture. Here the link between Iodine 131 and thyroid cancer seems obvious: More than 500 children have come down with the disease. Researchers are still trying to pin down the cancer-causing isotope and dose. However, the latest studies have been showing strong evidence of link between thyroid cancer and even fairly low levels of Iodine 131 exposure. A recent study by Elaine Ron et al. (Radiation Research, vol. 141, pp. 259-277, 1995) concludes that there is "convincing evidence" of increased thyroid cancer risk to children under 15 years whose thyroids are exposed to 10 rad or more.

The data, compiled by the National Cancer Institute, is the first to show high exposure rates outside Nevada and Utah. The new information is likely to set off calls for US federal compensation to some residents where the highest exposures are predicted. Some Utah residents have already been paid by the government for living in high-exposure zones; this study shows that thousands of residents of other states may have received the same exposure. NCI officials declined to discuss the report or the potential health effects of the fallout. But the highest average exposure in the hot spot counties — 16 rads for adults and up to 160 rads for children — far exceeds the 10-rad level at which the government recommends people be monitored by a doctor. The exposure rates for children are up to 10 times higher than the adult rate because radioactive Iodine was spread largely through contaminated milk, and children tend to drink more milk than adults and their thyoroids are much smaller.

*Main findings*

More than a thousand nuclear tests were conducted by the US. Of these, just ninety released almost 99% of the total Iodine-131 entering the atmosphere at the Nevada Test Site (NTS). These ninety tests released about 130 million curies of Iodine-131, mainly in the years 1952,1953,1955, and 1957. This amount is enormous, approxi-

mately ten times the amount released from the 1986 Chernobyl accident, Some radiolodine was deposited everywhere in the United States, with the highest deposits immediately downwind of the NTS. The study shows that under today's federal limits, people in every county in the United States were exposed to too much Iodine 131. The lowest deposits were on the west coast, upwind of the NTS. In the eastern part of the country, most of the deposited Iodine-131 was associated with rain, while in the more arid west, dry deposition (where particles settle on the ground) prevailed. Because Iodine-131 decays with an 8-day half-life, exposure to the released Iodine-131 occurred primarily during the first two months following a test.

For most people, the major exposure route was the ingestion of cows' milk contaminated as the result of Iodine- 131 deposited on pasture grasses; other exposure routes such as the inhalation of contaminated air and the ingestion of contaminated leafy vegetables, goats' milk, cottage cheese, and eggs also contributed. For individuals within a particular age range, milk consumption can vary substantially. For example, surveys have shown that 10% to 20% of children between ages I and 5 do not consume cows' milk. Their doses were only about one tenth of those received by children who consumed fresh cows' milk at average rates for their age. Conversely, the milk consumption of 5% to 10% of individuals in the same age range was two to three times greater than the average and their thyroid doses were therefore proportionally larger. The type of milk consumed also is important. It is estimated that at that time about 20,000 individuals in the U.S. population consumed goats' milk. Thyroid doses to those individuals could have been 10 to 20 times greater than those to other residents of the same county who were the same age and sex and drank the same amount of cows' milk. Goats' milk concentrates Iodine-131 more than cows' milk.

## *The health of the photographic industry rated higher than the health of the people*

The first "Trinity" test also resulted in at feast one hot spot in Indiana, over 1,000 miles away. One month after the test, the customers of the Eastman Kodak Company complained of buying fogged X-ray film. After an investigation, a physicist it Eastman Kodak determined that packing material that had been made from corn husks at a plant in Indiana had become radioactively contaminated. He deiuced that the origin of the contamination was from an atomic explosion. The physicisi's knowledge of the secret project was not altogether surprising the Kodak Company ran the Tennessee Eastman uranium processing plant at the Oak Ridge National Laboratory.

Kodak also reported problems from fallout after the first test in Nevada in January 1951, but this time they occurred as far away as company headquarters in Rochester, New York. After a snowstorm, Geiger counters at the Kodak plant showed readings 25 times above normal. When Kodak complained and threat-;ned to sue, the Atomic Energy Commission agreed to give the company "advance information on future tests," including "expected distribution of radioactive material in order to anticipate local contamination."

In fact, the entire photographic film industry was warned about fallout. Throughout the atmospheric testing program, AEC officials gave the photographic industry maps and forecasts of potential contamination, as well as expected fallout distributions which enabled them to purchase uncontaminated materials and take other protective measures. The National Association of Photographic Manufacturers was also given some data on the nature of the test shots, "for their own information"

But the AEC did not see fit to provide milk producers or consumers with similar information, even when the significance of the milk pathway became clear

*Pat Orimeyer & Arjun Makhijani*
*Bulletin of Atomic Scientists Nov/Dec 1997*

*Beyond National Boundaries*

Additional cases would also occur in parts of Canada among children who were highly exposed at the time. Some people in northern Mexico also appear to have been exposed.

Further study will be needed to address the many uncertainties about the effects of thyroid irradiation. This study should focus especially on the hot spots to identify those most at risk. However, the need to address uncertainties should not be occasion for delay in alleviation. There is ample evidence of risk and medical screening should be made available to all who were exposed as children

Since atmospheric nuclear testing has also been conducted by four other nuclear powers — the former Soviet Union, France, Britain, and China, these countries also need to make public all their data on fallout, and in particular on lodine-131 releases.

*Surendra Gadekar*
*Bated on Pat Ortmeyer and Arjun Makhijani's article in Bulletin of Atomic Scientists and article in Washington Times*

# *RAMIFICATIONS OF OPENING NUCLEAR POWER REACTORS TO INTERNATIONAL INSPECTION*

*By Vijai K Nair*

The announcement by the Indian Government to throw open two nuclear reactors at Kakrapar for international inspections is not really an earth shattering policy shift that it is made out to be. On the contrary it is a feeble announcement of no consequence. It does not affect either the national nuclear technology agenda nor by making this 'concession' do we in any way decrease the antipathy of nuclear suppliers and thereby facilitate the transfer of dual use technology to India.

*Status*

As of date India has 10 operating power reactors; and 4 power reactors at different stages of construction. It is negotiating the construction of 2 power reactors with Russia; Besides it has a series of research reactors of which one is an operational Prototype Fast Breeder Reactor. Of these, only the units at Tarapur and Rajasthan are under bi-lateral safeguards administered by the International Atomic Energy Agency (IAEA). India has not ratified the IAEA Convention on Safety of Nuclear Plants, nor has it acceded to any of the international non-proliferation arrangements that would require it to throw open all its nuclear facilities to IAEA inspections.

*Objective of the policy shift*

The stated aim of the policy shift to throw open the two power reactors at Kakrapar to outside safety experts is to mollify international concerns that India is operating reactors of unsafe design and to acquire feedback so that appropriate corrective actions can be taken to enhance safety.

*Verification versus Inspection.*

The IAEA is authorised under its Statute to establish and administer safeguards designed to verify that nuclear material and other nuclear related items are not used to further any military purpose. It is important to note that the IAEA's safeguards system is distinct from its work in the area of nuclear safety. The IAEA carries out its 'verification activities under agreements made pursuant to a host of arms control agreements such as the NPT, CTBT, and established NWFZs which require each State Party to declare and submit to IAEA safeguards all the nuclear material under its jurisdiction or control for comprehensive safeguards. The IAEA also applies safeguards to nuclear materials in the five declared nuclear-weapon States under what are called "voluntary-offer agreements". In some States not party to the above instruments, the IAEA applies safeguards under agreements which specify, in addition to nuclear material, non-nuclear materials, facilities and equipment to be verified. As India has not acceded to any of these arrangements, verification of its facilities to audit end use is not applicable.

*Come one, Come All*
*Come and see Kakrapar;*
*We have nothing to hide*
*Except the floods, the fire and*
*the untested falled*
*Emergency core cooling*
*System*

*Selectivity, Safety and CBMs*

The Government statement clearly defines the intent • inspections designed to provide greater transparency and generate domestic and international confidence in India's ability to create and efficiently manage nuclear power facilities. The stress is on safety and not verification of material utilisation.

It would allow inspectors to examine safety systems and devices, plant design and management techniques, operating procedures, waste disposal methods etc. of the selected nuclear power plants. All other nuclear facilities including research reactors, fast breeder reactors and reprocessing facilities are excluded from this offer.

Even in the designated facility inspectors would not have access to materials or records of materials. The disclaimer that all this would be effected outside the fold of the IAEA Convention on safety of nuclear plants suggests that while agreeing to inspections of selected nuclear facilities the actual protocol would have to be negotiated with the IAEA without compromising the existing national nuclear strategy.

Therefore, while acquiring a reasonably sound knowledge of the working of selected nuclear power reactors, thereby being able to interpolate material quantities, foreign inspectors would not be able to establish exact figures of materials in the cycle or their end use. Furthermore, since the facil-

ity thrown open to inspection is exclusively for power generation without any linkages to military programmes, external inspections would not compromise the nuclear option.

*Global Non-proliferation Im peratives*

The purpose of the established IAEA safeguard's is to gauge the extent of nuclear technical competence and to provide the technological trip wire to assess - if and when a state may develop nuclear weapons. The Indian nuclear weapon philosophy is predicated on a relatively limited weapons capability and does not imitate the deterrence philosophy in vogue in the West. It is in India's interest to keep the military and the civil nuclear technology separate. Therefore, placing these civil facilities under limited international inspection does not compromise national strategic imperatives and fails to assuage the primary concerns of the US and other countries' non-proliferation goals.

Technology requirements of the research reactors, components of the nuclear fuel cycle and the Fast Breeder Reactors have many things in common. Under these circumstances, the new policy would not, as seems to be the wish of our policy makers, slacken the technological noose instituted in 1974 to circumscribe development of India's nuclear technology.

The Indian offer to place power reactors open to international inspection will not generate the desired technological spin off. But it would,: to the extent of actual and still existant systemic failings, compromise the nuclear establishment and with it the development of strategic capabilities. It would heighten international interference in the national nuclear sector making for avoidable political ripples. Also it would increase the fiscal overload on an already meagre sectional budget by having to pay for inspection costs.

Undoubtedly peer review is a positive approach and can bring about the much needed element of accountability. There is phenomenal expertise available within the country which could be harnessed to improve questions of safety, optimisation of assets, and environmental degradation. This can only come about if reports of the Atomic Energy Regulatory Board are placed on public audit and debated openly in the Parliament. The intention should be to give impetus to the stagnant nuclear technology and power sector through greater transparency and accountability generated through domestic assets rather than offering cosmetic gestures to an international technology restrictive regime whose objective is to cap the Indian growth in this field.

Regrettably, the Government appears to have resorted to well established norms of announcing, what is termed as, fundamental policy changes, where in substance none really exist, thereby maintaining the status quo of mediocrity. Accountability starts at home before it can credibly be projected to others. Avoiding domestic transparency and accountability and offering vague and meagre concessions to the international nuclear community, no useful purpose is likely to be served.

*WANO -You Neve r Know*

Despite claiming that WANO's recent peer review of the Chernobyl nuclear power station had 'seriously misjudged' the situation, government inspectors have launched a safety review of the plant's only currently operational reactor, unit 3. The WANO review concluded that there were severe management and safety culture difficulties at the plant. The restart date for Chernobyl-3 has accordingly been put back a further 6 weeks from the planned date of 1 October Ukraine insists the WANO report is an attempt to force the unit to close without compensation.

*(Nucleonics Week. 25 September;*

# *Cat's Eyes or Bull's Eyes?*

## *IRRADIATED GEM STONES: CARCINOGENIC J E W E L R Y FLOODS ASIAN MARKETS*

The so-called "cat's-eye" stones are bombarded with neutrons in a nuclear reactor to change their colour from yellow to a dark brown. This makes them more valuable. A "normal" stone, for example. costs a few hundred dollars per carat whilst the dark brown ones are worth thousands per carat Methods to change colour by irradiating the stones arc legal But afterwards they must be stored for about two years to let radioactivity decay to a normal level in September the Bangkok Center for Gemstone Testing spread a preliminary warning because of abnormally high levels of radioactivity being found in the stones. They suppose the stones involved to have been distributed illegally by unscrupulous dealers who used irradiation for colour enhancement without storing them afterwards The Bangkok center is saying that anybody who finds such a radioactive stone should store it in a lead lined container until the next century. But Row do you find out if the cat's-eye you want to give your loved one for Christmas (or for some other reason) is radioactive? Never mind the fact that most people aren't privy to communiques from the Bangkok center And where does one find lead lined containers, anyway? The source of the gem stones is still unknown. According to officials at Bangkok's Gemstone Testing Center several signs point to Indonesia It is believed that low quality cat's-eyes from India have been exported to Indonesia to be irradiated there. Indonesia denies the accusations, claiming there is no way to perform the enhancement operations illegally. Thailand. India and indonesia are now all accusing each other of being the country of origin for the stones. However, irradiating stones to change their colour is not limited to those countries; it is also done in other countries such as the Netherlands (for instance at the research reactor at the University of Delft)

*Source: WISE-News Communique 482*

# *The Police State Refuses To Wither Away*

## *The Kafkaesque World Of Aleksandr Nikitin*

Just in case anyone thought democracy and the rule of law were coming to Yeltsin's Russia, the country's security police inmid-June brought additional charges against nuclear safety campaigner Aleksandr Nikitin. International commentators have been solid in condemning the prosecution of the former naval captain for treason and espionage as absurd and unjust, and the case is being watched closely as an indicator of the state of human rights in Russia. Nevertheless, the General Prosecutor's Office has allowed investigations to continue, and the Federal Security Service (FSB) remains intent on bringing the case to trial. Over the past year, signs have emerged that officials at various levels of the Russian state are disgusted by the continued persecution of Nikitin. But the latest developments show that within the ruling apparatus, key decision-makers believe that arbitrary arrest and the denial of internationally accepted legal rights need to be preserved as a serious, ever-present threat to control government critics.

After quitting the navy in 1992, Nikitin worked in St. Petersburg as a researcher for the Norwegian environmental organisation Bellona. A specialist in nuclear submarine technology, he co-authored a Bellona report entitled The Russian Northern Fleet: Sources of Radioactive Contamination. Late in 1995 early drafts of this report began to seriously embarrass the Russian government, showing that in naval bases in the north of Russia, large quantities of nuclear waste were being kept in inadequate, decaying storage facilities. Bellona's employees and supporters in Russia began to suffer crude security force harassment.

By the time the final version of the report was released in April 1996, Nikitin was in jail - arrested the previous February 6 on preliminary charges of having revealed secret information. It was only in October that formal charges of treason, espionage and falsifying documents were filed by the FSB. By this time Nikitin had been adopted by Amnesty International as its first prisoner of conscience in post-Soviet Russia. The European Parliament and officials of the European Union issued strong statements in his support. One of the problems faced by the FSB in framing charges was that the supposedly secret information in the Bellona report was all freely available to any researcher with the patience to search it out. In the course of 1996, Bellona andits supporters showed this beyond doubt. "Nikitin and Bellona have demonstrated that all of the information they published was from open sources," the US State Department observed in a January 1997 country report on human rights.

Another problem was that under Russian law, the information arguably could not be secret. The Law on State Secrets adopted in 1993 states that no information on the conditions of the environment or on extraordinary incidents and catastrophes that endanger human life and health may be classified. The solution which the FSB found to this dilemma was Kafkaesque. Nikitin was deemed to have violated two secret Defence Department decrees, so secret that their contents could not be revealed even to his defence attorneys. These decrees had been adopted in 1993 and 1994. The fact that Nikitin—who had left the navy in 1992-could not have known of their existence was of no consideration. Neither was the fact that under the Russian constitution, no one can be charged for violating acts of which they have not been duly informed.

After more than 10 months in prison, Nikitin was conditionally released on December 14, 1996 reportedly on the personal orders of General Prosecutor Yury Skuratov. Deputy General Prosecutor Mikhail Katyshev, who had been entrusted with examining the FSB's case against Nikitin, told the English-language Moscow Times on December 15 that in his view the case contained "no hint of espionage". "It is time for the prosecutor's office to admit that mistakes could have been made," Katyshev said. But Skuratov who, as the government's top legal official, had responsibility for deciding whether the prosecution should go ahead, did not order it dropped. Early in March 1997 the case was sent back to the FSB, with orders to tighten the allegations. For more than three months a renewed inquiry was conducted by a group of defence ministry officials approved by the FSB.

In April Nikitin was awarded the Goldman Environmental Prize. Meanwhile, the case grew steadily more notorious. On June 17 1997, Nikitin's lawyers were presented with a new set of charges. The defence ministry experts had decided that Nikitin had breached another secret decree. This one was dated from 1996 -after the Bellona report had been released. Reporting the response of Nikitin's lawyen to these developments, the Moscow daily Nezavisimaya Gazeta remarked on July 1: "ln the view of the defenders, the situation more and more recalls the well-known fable about the

wolf and the lamb. Nikitin is guilty only of the fact that someone very much wants to eat him."

In redrafting the charges, the FSB set out to maximise the potential sentence. The charge of espionage has now been laid under Russia's new criminal code, which sets a maximum penalty of 20 instead of 15 years' imprisonment. The charge of treason has been brought under the old code, where again the penalty was higher. "Even a non-lawyer knows that an increase in liability does not have retrospective force," Nezavisimaya Gazeta commented on July 1. "Students in the law faculty get failed for such errors, but for the FSB investigators this is normal procedure." Nikitin was told on June 30 that investigations would continue for another three months, suggesting that the case might go to trial in the late autumn. When the court finally convenes, the prosecution is likely to present charges that are incompetently framed, that are very probably inadmissible under the Law on State Secrets, and that plainly violate the constitution. But that is not to say that the prosecution will lose.

In June 1996, on a petition from the FSB, the case was transferred from a civilian to a military court. According to Bellona, the FSB wants a military trial because the court would be closed, and because the security authorities would have more control over the conduct of the defence. Meanwhile Russian judges, military or civilian, do not have a distinguished record of denying the security authorities the verdicts they want.

It is no mystery as to why the admirals of the Northern Fleet, or the generals of the FSB, want Nikitin behind bars. But after a year and a half during which the persecution of Nikitin has alienated liberals at home and outraged environmentalists and human rights supporters abroad, one has to wonder why the Russian authorities allow the case to continue. Why does Yeltsin not simply order the charges dropped, recoup the support of a forgiving intelligentsia. and reap foreign accolades and aid dollars for having struck a blow against authoritarian conservatives?

The reason is that Yeltsin, along with his new team of aggressive young reformers, feel that they can not get by without the FSB and everything it represents. During May the astronomical total of unpaid wages in Russia rose once again, with no one expecting a significant fall any time soon Meanwhile, accusations continue to fly of the "reformers" delivering juicy chunks of freshly privatised oil company stock to friendly banks at derisory prices via rigged auctions Called upon to declare their earnings, government ministers put down six-figure dollar sums to "book royalties" or "lecturing fees". A robber capitalist needs a machine of repression. And to be a credible menace, that machine must be allowed to show potential dissidents that they are not safe from it behind laws, human rights commitments, or even the constitution.

*Ranfrey Clarke*
*austgreeni@ glas. ape .org*

*Source WISE Communique 476*

## *Turbulent times for fusion power*

Although all early power reactors were expected to produce energy "too cheap to meter," fusion energy was the holy grail. Fusion power was supposed to imitate the sum with a tightly held plasma in which fusion reactions would be indefinitely sustained. The claims for fusion power were so great that to outsiders the reactors seemed like the perpetual motion machines of the physical world.

Well, fusion research has been perpetual money-eating machines. Assorted governments have built giant "tokamaks" —huge doughnut-shaped chambers in which powerful magnetic fields are supposed to force deuterium and tritium atoms into close quarters, with enough heat applied so that the atoms collide forcefully enough to fuse together.

Once the fusion reactions begin, the energy produced by those reactions is supposed to keep the plasma hot—a step described as ignition. After ignition is achieved, it's supposed to be just a matter of periodically adding tiny bits of fuel. The reactions should continue as a long as the plasma is confined.

For a time, it seemed as if it might work. The tokamak at Princeton produced a measurable amount of power for a few seconds, but Congress has since turned out the lights. Measurable power was also produced at the European Community's tokamak at Chulbam, England, but a magnetic reaction caused the entire structure to jump by a half an inch.

No matter how large a rector was built, however, researchers wanted a still larger one. as well as more powerful magnets 10 confine the plasma. If only, they said, they could build *a really big machine,* it would be sure to work.

When the price tag began to skyrocket for larger projects, the major powers began talking about pooling

their resources to build a single, no-expense-spared demonstration model. In 1988, the United States, the Soviet Union, Japan, and the European Community got together to develop preliminary plans for the "International Thermonuclear Experimental Reactor," or "ITER." By 1992—with Russia taking over the Soviet role—they settled down to work on design.

No expense would be spared in building the $10 billion show stopper (the powerful magnets alone would cost billions). Sure, planners said, ITER might need 100 million watts to shove it into action, but once it go going, it was "99.5 percent" certain to generate a whopping 1.5 billion watts. As they moved to the final planning stage, they touted the reactor as a marvel of international co-operation and predicted it would lead to smaller, less expensive machines that would eventually power the world.

Then last year disconcerting whispers began to circulate in the physics community. Two researchers at the Institute for Fusion Studies at the University of Texas—William Dorland and Michael Kotschenreuther—began quietly talking to colleagues about their analysis of ITER'S design, and in particular about the problem of turbulence. (Wasn't it Richard Feynman who described the problem of turbulence as something about which even God's explanation was likely to fall short?) Finally, in November 1996, Dorland and Kotschenreuther demonstrated that turbulence at the plasma's periphery would be such a source of heat loss that ITER could not achieve ignition. The design, they said, "wouldn't work, and by a sustainable margin."

Previous calculations of how ITER would work had been based on projections from experiences with smaller tokamaks. Ironically, Dorland and Kotschenreuther were able to show that ITER'S problems were not analogous—they would be a direct function of its mammoth size.

Droland and Kotschenreuther received kudos from many in their field. For instance, Princeton physicist Ed Synakowski dubbed their model "essential" to understanding what is going on in a tokamak, and Steven Cowley of ULCA said that "for the first time, there is a physics-based transport model for tokamaks" *(Science*, December 6, 1996) But a lot of the folks at the Energy Department's office of fusion research were less delighted.

Scientists began to speculate on how ITER'S design might be altered to overcome the problem. And Waston Stacey, writing on behalf of the entire U.S. ITER Steering Committee, took care not to criticise Dorland and Kotschenreuther's results, complaining in a letter to *Science* only that the magazine had been wrong to suggest that the analysis would hurt rather than help the international project.

Still, the issue was serious enough that it had to be dealt with. In January, faced with both budget problems and powerful criticism of the ITER design, the Energy Department asked a team of fusion researchers to make a "sweeping review" of the ITER design. There were particular worries about funding. Even Richard Hazeltine, head of the Institute for Fusion Studies at the University of Texas, a long-time ITER sceptic, suggested a united front. Otherwise, he said, "there is the possibility that plasma physics could die."

Meanwhile, others reacted to the bad news about turbulence by piling on. The letters column of the March *Physics Today* was full of I-told-you-sos that criticised the fusion project for its engineering problems. Letters from William Parkins, James Krumhansl, and Chauncey Starr all had the same theme: After 50 years of failure, it was time to take a breather on a technology that had very little chance to ever working. And Krumhansl predicted that if the science were ever to be translated into a usable technology, it would be "a recipe for disaster" because "neither experienced design engineers nor cost estimators" had been adequately involved. According to Starr, fusion was a principle reason why "the public has become increasingly cynical about the intellectual integrity and reliability of the physics community."

But no one can outmanoeuvre fusion advocates, it seems. In April, the Energy Department issued the results of its review. According to the Fusion Energy Science Advisory Committee, ITER'S present design is just dandy, and there are no "insurmountable obstacles" to the reactor meeting its objectives.

Its revised objectives, that is. For after 50 years in pursuit of endless energy, the goal of ignition has been dropped. According to Martha Kerbs, the Energy Department's director of energy research, ITER is no longer about power generation *(Nature,* April 24, 1997). It is now about performing "an important set of science experiments." The next question, says Krebs, is whether Congress will agree.

*— Linda Rothstein*

### *Originally Ice-Breakers Now Strike Breakers*

Regional authorities in Russia's Far East have proposed converting a nuclear ship belonging to the Pacific Fleet into a makeshift power station in an effort to ease the tremendous effects a major miners' strike is having on electricity production. Such a move supposedly would give rise to a whole fleet of small, floating power reactors designed to bring electricity to remote regions.

# *Too Costly to Continue Even in Belgium*

The most significant factors in the decision not to build new nuclear power plants in Belgium are the low price of natural gas and the high capital costs of nuclear, an official of architect/engineer Tractebel said.

Guy Frederick, general manager of Tractebel Energy Engineering, said that, while in the 1970s and 1980s the cost advantage of nuclear power was "evident," since the early 1990s "economics is now a new concern." In constant money, the cost of a nuclear reactor per kilowatt in the 1970s was "half of what it is today," Frederick said.

Under Belgian practice, the country's seven units are scheduled to be amortise 20 years after construction. However, it is expected that they will operate "long beyond the 30-years design lifetime we expected" when the reactors were ordered, he said. Examinations by utility Electrabel have shown that, "as long as maintenance is effectively organised, all components and systems can be serviced and the plant lifetime is theoretically unlimited."

Tractebel has calculated that, to prevent performance of an existing reactor from being profitable, a so-called "available cost" of 90 ECU/kilowatt/year must be exceeded by major backfires or interruptions. Calculations show that the last year safety inspection at the unit, cost Electrabel 55 ECU/K W/y. That action involved major fixes to internals and kept the plant off-line four months beyond the normal annual outage. A steam generator replacement at the plant, which kept the reactor off-line two months extra, cost 35 ECU/KW/y.

These measures represent the greatest interruptions to reactor operation in Belgium. "So it is hard to define the economic limit for operation of our reactor," Frederick said. While the economic argument is "far from clear," he said.

Frederick said that, for a new reactor project in Belgium—the country has postponed construction of an eighth power reactor after extensive study and parliamentary debate—ihe cost of nuclear fuel would be 20%, operation and maintenance (O&M) 20%, and capital cost 60S. For a competing combined-cycle plant fired by natural gas, the heaviest cost component is fuel (60%), followed by capital (25%) and O&M (15%). Figures for both projects assume the gas and nuclear plants operate for baseload generation at a capacity factor of 85% and price construction at a discount of 8.6%, the usual rate for Electrabel.

While nuclear utilities world-wide aim to slash O&M costs to keep their existing plants on line, the Belgian figures for new projects indicate that, even if nuclear O&M costs are in the future reduced by a third, "their effect on the economics of a nuclear plant project would be negligible," Frederick said. The same goes for attempts to reduce the costs of the nuclear fuel cycle.

For the competing gat-fired plant, the most significant factor is the price of gas. "If the price of gas remains stable for 20 years, gas will be out *of* reach and nuclear can't compete" in Belgium, Frederick said. However, Frederick noted that, historically, gas prices have been "hard to predict." Likewise, supply security is uncertain. "Some utility officials tell us that it is unreasonable to keep increasing our dependence on combined-cycle plants in a situation where the imported fuel represents 60% of the total costs of a kilowatt-hour," he recounted.

For nuclear power, the cost of capital is the most important factor "We have little cause of rejoice," Frederick said, since, unlike most of the world's technologies, "over the last 20 years the absolute costs of construction have continually increased." There is a "lot of talk" about streamlining by advance licensing, serial manufacturing, and simplification of regulation, "but while these steps are positive, will they have a really beneficial effect leading to a turnaround in the general trend of cost escalation for nuclear construction?" Frederick asked.

Despite his pessimism, the Tractebel manager said there are possibilities for cost-cutting, including elimination of "monopolistic" market niches enjoyed by vendor firms in the complex process of building and licensing reactors.

Frederick also said that he hoped that deterministic regulations, which currently impose a "too severe burden," might be alleviated should Belgium build an eighth reactor. But he cautioned that, "before that happens, the onward march of gas will continue in Belgium," noting that Belgium is close to finishing the fifth combined-cycle plant built since the last reactor there was started up.

*-Mark Hibbs,*
*NUCLEONICS WEEK — May 15. 1997*

**ft**

# *Short Notes From Near and Far*

*The secret of Ratnaballi*

Mark Hibbs the legendary German correspondent of *Nucleonics Week* and *Nuclear Fuel* has done it again. Exploiting the Indian weakness for sounding off in front of white skinned foreigners, he has found out the till now well guarded secret of Ratnahalli. Ratnahalli isjust six kilometres of Mysore city and ever since the construction of the Rare Materials Plant started a decade back, activists in Mysore have claimed that it was a uranium enrichment plant. Stout denials were all they ever got in reply. It should be noted that this is one of those nuclear facilities, whose existance has not been revealed officially to Pakistan as per the rules of the treaty for not attacking each others nuclear installations. The question, why was India interested in uranium enrichment when our "peaceful" nuclear programme did not use the stuff, always remained unanswered. However, in the December 2 issue of Nucleonics Week, Mark Hibbs reports that, "For the first time, to my recollection, the Indians said outright here that the plant near Mysore is meant to be used for making Highly Enriched Uranium for submarine fuel, enriched to between 30-45% U-235. BARC types categorically denied the technology is to be used for either development of a boosted device or for Low Enriched Uranium fuel for reactors." It seems that the chakkars of the Soviet leased submarine INS Chakra have not been enough for the ghanchakkars of New Delhi.

*Guided Democracy Guides On*

One thing to be said about nucleocrats—nothing deters them from their chosen course. Certainly nothing as ephemeral as public opinion. Like King Bruce they believe in try, try try again. People from the area of Mala, in northern Sweden, have rejected plans by the Swedish nuclear fuel and waste management company, SKB to further investigate the idea of building an underground repository for spent nuclear fuel in the region. Results from a referendum held Sunday showed 55% of residents opposed the plans. SKB expressed 'regret' on the outcome, but seemed optimistic that their efforts were gradually gaining favour with the public, citing that in 1995 a similar vote in the Storuman region resulted in a 71% vote against similar work.

*Love Thy Enemy*

The US and Russia have agreed to end the production of weapons grade plutonium. Under the agreement, the US will assist Russia to the tune of US$80 million, with the conversion of its three operating plutonium production plants to civilian power plants by the year 2000. Russia has also agreed not to restart 10 other such reactors, already off-line. The US has made similar promises, agreeing not to start its 14 plutonium production reactors, which have been off-line since 1989. (Reuters, 23 September)

Close on the heels of reports that only 2 US utilities have expressed interest in producing tritium for the Department of Energy's (DOE) maintenance of its nuclear weapons inventory, a senior Russian defence official has indicated that the Russian Federation would consider selling the US the tritium it needs. *(Nucleonics Week. 25 September,1997.)*

*The Mess They Left Behind*

As imperialist masters the British were bad enough but compared to the Russians they positively shine. The fraternal bear-hug of the Soviets has left an incredible trail of death and devastation.

Several Georgian soldiers are suffering from chronic radiation sickness and from fourth degree radiation burns. Some have developed large sores on their lower extremities due to exposure to extreme radiation. Only after several soldiers complained about pain and strange wounds was it discovered that radioactive capsules filled with Cesium-137 had been left behind by Russian troops at a former Soviet military base. So far 17 capsules have been found. They appear to be scattered on the base as well as outside of it. Georgian hospitals are ill-equipped to give proper care, and soldiers are suspicious of promises of adequate treatment in Moscow.

*Utilities Advertisement in the Wake of Three Mile Island*

*(A found poem)*

*we are committed to cantor Anil openness.*
It may *not be possible to answer all the questions.*

*Incidient. Core material Meltdown.*

*This is time to avoid emolionalism.*
*Truth only gets obscured*
*and rational decisions are Impded*

*leak.* Emission. Ex*posure.*

*There are lessons to be learned.*
*first constitution goes to public*
*safety and health.*
*look At our record.*

*For* radiation c*onsider*
*X-RAYS, microwaves, the sun.*

*This is matter of risk assessmant.*
*No available energy source*
*is risk-free.*
*The question of human error must be*
*death*
with.

It may *not be possible.*
*we are committed.*

# *DRACULA ON THE PROWL A GAIN*

## *Rajasthan reactors on way to full-scale recovery*

*The following article which appeared in The Hindu of 2nd December is just a sample of the recent publicity blitz regarding the recovery of the Rajasthan reactors launched by the nuclear establishment. The achievement of replacing pressure tubes is being touted as a great triumph of Indian technology. It »$ nothing of the kind. The Canadians bad already done this more than a decade ago but that did not help their reactors last longer and they had to mothball seven of the same CANDU type reactors in one shot. Unfortunately this kind of hype is very common with the nuclear establishment and it gives a bad name to Indian scientists in general and devalues even genuine achievements.*

The second unit of the Rajasthan Atomic Power Station (RAPS-II), which is set to create history as a symbol of Indian resistance to a strict embargo regime dictated by the West, will resume power generation by March 1998.

Almost given up for dead three years back, the unit, along with its neighbour RAPS-l, is on its way to a full-scale recovery. More than 250 out of the 306 coolant channels of the reactor have been replaced by a fine-tuned RAPS team. The rest of the job would be completed before the end of the month.

Once the present exercise is over, the unit has to undergo all the procedures that are mandatory for the commissioning of a new reactor. Refuelling will be followed by a series of tests. Then, each system of the plant would be run separately, followed by the start-up of the reactor.

Speaking to The Hindu near the core of the reactor where he was supervising the replacement operations, the Project Director, Mr. V. K. Chaturvedi, said safety upgradation and installation of additional infrastructure were also being undertaken simultaneously. As per the direction of the Atomic Energy Regulation Board (AERB), the country's watchdog of nuclear safety, a high pressure heavy-water injection system had been installed. In the event of any emergency related to the cooling system, 50 tonnes of heavy water would be pumped in instantly.

*The above paragraph contains not one but two errors. If the interview was actually conducted near the core of the reactor both these guys would have got burnt to a crisp in a short time. The high pressure heavy water injection system is meant for pumping out hea\y water during emergencies not pumping it in.*

Other additions included a supplementary control room, an additional on-site diesel generator to power the essential services in the event of floods (the reactor is situated near the Ranaprathap Sagar dam on Chambal river), segregation of power supply lines and instrumentation panels. "The reactor can now run for 30 more years," said Mr. Chaturvedi, who was deputed by the Nuclear Power Corporation (NPC), which runs all the nuclear power reactors in the country, exclusively for the revival and rehabilitation of the plant. The reactor would now run to its capacity of 200 MW.

Besides reviving a defunct reactor along with the economy of the entire Rawatbhatta region, the extremely delicate job of coolant channel replacement, which is happening only for the second time in the world, has also armed the country with a proprietary technology that could be marketed in the Pressurised Heavy Water Reactor (PHWR) services sector abroad. Pakistan, Argentina and South Korea have reactors of this category and would need replacement of coolant channels at some point of time.

The resurrection of the reactor is a show of indigenous strength in the entire spectrum of nuclear technology when Canada which supplied the unit, refused to help and dubbed the reactor unsafe in international forums. But against.all odds, the "Coolant Channel Replacement Group (CCRG)". constituted by the NPC three years back, found a solution which cost only a fraction of what Canada spent for a similar reactor.

While the Canadian technology would have cost Rs. 4 crores per channel. Indians could wind up the entire replacement procedure for the same amount, Mr Chaturvedi said .It was an operation which was 306 times less expensive, that too at a much lesser level of exposure to radiation. The end-fittings and the new coolant channels cost more than Rs. 80 crorcs

The total cost of the revival is estimated at Rs. 252.54 crores with Rs 53.6 crores earmarked for safety upgradation and rehabilitation.

The project was ahead of schedule by about six months. This would help reduce the cost by about Rs.20-25 crores. This saving would be made in the Interest During Construction (IDC) component which totals to Rs 45.31 crores. About Rs. 10 crores was saved in indirect costs too.

The problem was first noticed in the 1980s when Canada reported that the Zircalloy pressure tubes of a simi-

*February/ March*
*1997*

*1$*

lar reactor at Pickering had developed cracks. This led to investigations at RAPS-II which revealed that the garter springs separating the coolant tubes and the calendria tubes had moved and the former was touching the latter. This resulted in the formation of hydrides at the point of contact because of the inherent characteristics of Zr-alloy and the temperature difference between the pressure tube and that of calendria. The Canadian experience also indicated that hydride formation could lead to cracks and leak.

The new channels are made of Zr-Neobium, an alloy stated to be more stable in a radioactive environment.

The reactor was shut down in September, 1994 and after extensive studies, in October, 1995 it was decided to take out the fuel. By January 1996, defuelling was completed which was followed by decontamination.

From January to April 1996 workers were trained on life-size mock-up. The removal of channels were completed in four and half months, much ahead of its schedule.

Besides enriched uranium, the core would use 18 bundles of thorium oxide which would help the reactor achieve maximum power. In fact, thorium as fuel represents the third phase of India's nuclear programme whereas enriched uranium belongs to the first phase.

In a country-wide perspective, the achievement at RAPS breathes fresh life into the country's nuclear power programme which has been hit by paucity of funds. Five more reactors, which used Zr- alloy tubes, would face the same situation at some time or the other. The CCRG will now be a near-permanent task force of the NPC.

*G. Pramod Kumar. The Hindu*
*December 2. 1997*

*Editor's Note: Rawatbhata Nuclear Power Station has been operating, or rather usually not operating at the site for the last 25 years. It is somewhat late in the day for the authorities to wake up to the fact that it is situated on the banks of a river and diesel generator is needed in case of floods. There was a fire in the turbine building in 1985 and the report on the fire had specifically mentioned that power lines need to be segregated for safe operation of the plant. The fact that the authorities took as much as twelve years to do this and continued to run the plant in an unsafe manner is an indication of their callousness with regard to safety.*

# *Stupidity is Contagious*

## *Bangladesh decides to have a nuclear power plant*

In a recent article dated October 17, 1997, the *Daily Star* reported that the Government of Bangladesh had decided to implement the Rooppur Nuclear Power Plant Project. The decision was reportedly taken at a meeting of the Rooppur Nuclear Power Project Implementation Committee with the Prime Minister in the chair and the Finance Minister, Energy Minister, Education Minister, Planning Minister and the Atomic Energy Commission Chairman in attendance. It was observed in the meeting that the "environment-friendly" nuclear power project would meet the country's electricity demands, particularly those of the northern region at tower costs. The Prime Minister directed the committee to speedily implement the project.

*The Same Lies*

In a report in the same daily last year, the Bangladesh Atomic Energy Commission (BAEC) engineers and scientist had pointed out that nuclear technology is considered one of the "safest" power generation systems. BAEC engineers had also indicated that the annual fuel cost of a nuclear power plant was much lower than that of a conventional gas-burned plant. Therefore, according to them, the proposed nuclear plant would be part of an optimum mix of electricity generating plants for Bangladesh.

The concept of the Rooppur project was developed in 1961 and was approved for 70 Megawatt (M W) of electricity generation. The plant site is in the Pabna district, about 180 kilometers from Dhaka. The current plan is to have a much larger plant of 400 to 600 MW capacity, which is estimated to cost about $1 billion.

To the unsuspecting general public, only this kind patently false statements regarding attractive cost-efficiency, safety and environment-friendly aspects of the nuclear power plant are presented.

*Cost-Effectiveness*

A BAEC scientist was quoted in last year's *Daily Star* report as saying that "although the initial cost of a nuclear plant is double that of a conventional gas-burned plant, the fuel cost is much lower than that of a coal or oil-burned plant". He further asserted that a typical 300 MW plant would cost about

$600 million. However, this assertion is not correct since the presently quoted prices for a nuclear power plant are well over S 3000 for a kilowatt. Data from constructed nuclear plants show that tremendous cost overruns regularly occur due to unforeseen problems involving safety concerns, faulty construction, etc. The Diablo Canyon Nuclear Power Plant in (he USA comes to mind as an example of such cost overruns. This two-reactor plant, designed to generate 1100 MW per reactor, was planned in the early seventies and was estimated to cost around $500 million. About 90% of the construction was completed in 1976 within budget when a new earthquake fault was discovered near the plant. Seismologists estimated that this fault was capable of producing a much larger earthquake than the one the plant was designed to withstand. The plant completion was delayed for five years and the cost tripled to $1.5 billion. In 1981, the plant was ready to start operations, when the final inspection uncovered numerous errors in design and construction process, improper quality control, inadequate documentation, etc. Another five years were required to identify and correct all these errors. The final cost ballooned to about $8 billion before the plant started producing electricity ten years behind schedule. The level of anxiety, this induced in the people, unfortunate enough to be living close to the plant, could well be imagined. The experience of Indian nuclear power plants is illustrative which have usually cost three times their original estimate.

### *Safety Issues*

The problems of safety of nuclear power plants are all too familiar to *Anumukti* readers and will not be elaborated out here. Suffice it is to say that Bangladeshi nuclear technicians have no experience at all of a plant of this size. All they have been familiar with is running a small 3M W research reactor at Savar. It should be emphasized that a 400 to 600 MW commerciel power plant has technical and safety aspects which are not generally encountered in a small research reactor. It may be accurate to surmise that the experience of the BA EC personnel, would not be adequate enough to supervise the construction and installation of the Rooppur plant. In fact the *Daily Star* article quoted the BAEC chairman as saying that the International Atomic Energy Commission was willing to provide consultants to ensure safety in the installation and operation of the plant. It seems that BAEC will largely depend on foreign consultants to ensure safety of the plant as well as design and supply of plant parts and equipment. Such dependence on foreign experts has not always proven beneficial to third world countries.

### *Need for Transparency and Accountability*

In addition to this, transparency and accountability is always a problem in projects involving nuclear materials. It is always easy to hide behind "national security" and "sensitive information" to withhold information from the public. There are numerous examples of evasive actions and cover-ups by commercial nuclear plant authorities regarding the extent of malfunctions, accidents and consequent release of radioactive material. A news item published in the *Daily Star* on October 27,1997 illustrates the point. The news item states: "Immediately after the explosion in Magurchara, BAEC scientist were deployed at the site to detect any leakage of radioactivity but found none. The matter was never officially made public and all concerned remained tight lipped". We are told that all the 16 missing radioactive isotopes "miraculously" escaped leakage. We cannot, however, depend on such "miracles" to happen too often.

### *Only informed citizens can protect their rights*

In conclusion, it may be pointed out that most citizens of Bangladesh -not to mention a large population living in India—live within a 200-mile radius of the proposed Rooppur nuclear power plant. The disastrous effects of such proximal living to a nuclear plant are amply demonstrated in the case of those people living near Chernobyl Any accident in the Rooppur power plant has the potential to adversely impact the lives of every citizen of Bangladesh and of future generations All this for producing 400-600 MW of electricity when there exists a high potential of discovering large gas fields in the near future. Thus the setting up of this power plant should not be at all considered without putting these issues in perspective and without serious public debate. It is imperative that, as a minimum, the following steps should be taken by BAEC and the government of Bangladesh before any further pursuit of this project:

I. Organize public seminars where BAEC scientist and engineers will present their estimates of possible safety hazards and what steps will be taken to minimize them 2. Have public hearings in communities near the plant regarding the probability of accidents occurring during the lifetime of the plant to determine the level of risk acceptable to the population and whether it is at all willing to take such risks.

It is, therefore, incumbent upon the scientific community of Bangladesh to come forward and initiate discussions to inform the public about the issues involved. Otherwise, we may step into a possible nuclear nightmare, reminiscent of Chernobyl, with far worse consequences for the population.

*Dr. Ahmad Fazlul Kabir*
*engineering consultant involved in evaluating structural safety of nuclear plants*

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## ■ LETTERBOX

*Continued from page 2*

lead to a major accident. Control rods have failed to insert properly a number of times at VVER1000 plants. Problems with control - rod insertion have also cropped up recently at French plants, leading to the costly replacement of the whole control • rod drive mechanism at many plants.

- Problems with tubing at steam - generators. This can lead to leakage of rdioactive primary coolant from the pressurised primary circuit of the reactor into the secondary circuit. If the leakage is large, it can lead to a loss of coolant accident as well as damaging other parts of the plant.

Because of the design and layout of the plant, there is a part of the plant where main steam lines cross each other, directly adjacent to emergency feed water injection lines. In earlier models of VVER, there was also safety - related electrical equipment on the floor underneath. If a main steamline were to break for some reason (for example, it would be quite likely to do so if it had water in it from the primary system because of a steam - generator problem. It could also do so because of an earthquake), it would then whip about like a monster headless snake, destroying eveything in its path including emergency feedwater piping etc.

There are also a whole series of problems with the instrumentation of control systems of VVER plants, and Seimens and Framatome are engaged in replacing most of the l&C systems of every VVER in Europe and European Russia.

I do not wish to say by this that some other brand of nuclear plant would be any better. I don't want to persuade you that for example, if you bought a plant from, say, Westinghouse or Framatome or Seimens or Mitsubishi that you would then be safe. The problems that show up in VVER 1000 plants show up in various ways in other plants too.

But safety problems with VVERI000 plants are now certainly well documented, and searching questions need to be asked about this Koodankulam project now. The answers to these detailed safety questions are often costly, but not near as costly as not asking them is going to be.

*John Hallam,*
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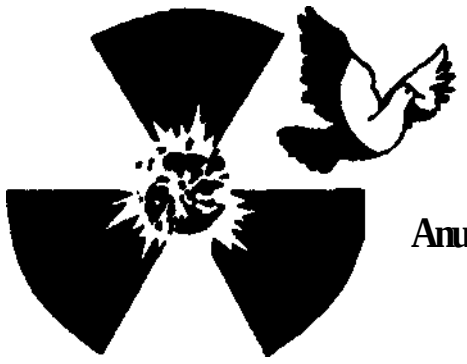

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