

ANUMUKTI

A Journal Devoted to Non—Nuclear India

Volume 7 Number 6

June / July 1994

Floodwaters Drown Kakrapar

First there was fire. Now Water. The turbine building at Kakrapar atomic power station which was gutted in a devastating fire on 15th September, 1991, has now again suffered extensive damage due to floods. Equipment worth crores of rupees has been devastated and the station is not expected to start functioning again for months. A Chernobyl-like catastrophe was averted only because as luck would have it the plant was in a shut-down state at the time.

The monsoon arrived in South Gujarat with a bang. There had been a few preliminary showers from June 10th onwards but nothing had prepared the population for the fury that was unleashed on June 15th and 16th. The rain continued steadily for hours together during which about 25 to 42 centimetres of rainfall was recorded in different talukas of Surat district. All the rivers and small streams of the area were in spate rising by metres within a few hours. Fortunately the rain stopped by the evening of June 16th and the waters started receding.

The scene they left behind was one of utter devastation. A thousand houses were demolished in Bardoli alone and many more elsewhere were damaged. Whole sections of roads, railway lines and bridges vanished into oblivion. Trees were laid low and farms turned into ponds. We (Sanghamitra and Surendra) were caught 100 kms from home and had to trudge back through rivers and streams and making long detours.

River Tapti runs east to west north of Kakrapar nuclear power station. There is a dam on the river at Ukai about 25 kms east of the plant and a weir at Kakrapar which is just one kilometre north of the plant. Just behind the turbine building there is the Moticher lake which has a gate to control flows at Ratania. The outlet ducts of the turbine building connect it to the Moticher lake.

As the rain poured on, the level of the water in the lake started to rise. By night fall on the 15th, it had risen sufficiently that the water started flowing from the lake towards the turbine building. The engineers on

duty at the time took no remedial action. By the next morning the water had filled the underground room containing pumps, motors, cables, etc. which feed the boilers and are necessary for the regular recirculation of steam from the turbine to the steam generating section in the reactor building. Floodwaters had also spread to other sections of the reactor complex including the offices of the project director and the chief project engineer, the master planning group, the field engineering section, the Civil Job Section amongst others. The reactor building was mercifully spared. Computers by the dozen and hundreds of papers and files were soaked in the slush. There was more than five feet of water near the main entrance and the workers of the morning shift had to swim inside. All the large storm drains in the area failed.

It was only by 11 O'clock, 16th morning that the authorities woke up and began remedial action. A site emergency was declared and all non-essential workers were evacuated from the reactor site. Other meas-

ures consisted of activating external pumps to drain the buildings and making efforts to get civil authorities to order the opening of the Ratania Gate so that the level of water in the Moticher lake could begin to fall. It was only on the 18th morning, after the waters had receded completely, traffic had resumed on the roads and a large pump was brought from Tarapur, that some success was achieved.

Unit-1 of Kakrapar had been on a planned 72 day shutdown from 5th February, 1994. The plan was to check and replace the faulty turbine blades which had been the cause of the fire in the turbine room in Narora last year. (See Anumukti Volume 6 Number 6 June / July 1993.) It is worth recalling that at the time the chairman of the Department of Atomic Energy, Dr R Chidambaram, had claimed that the Narora plant would be operational within four months at the most. It is now 14 months with no sign of that happening. The shutdown at Kakrapar too had stretched beyond schedule and the unit was supposed to recommence generation on the 15th of June. Fortunately it didn't. If the unit would have been operational and producing steam, then a flooding of the pumps would have resulted in steam being pushed back into the reactor building causing overpressurisation and a large explosion as at Chernobyl.

Work on Unit—2 of Kakrapar has been proceeding rapidly and the authorities have been rather anxious that it becomes operational this year. (Just three years behind schedule.) Hopefully, the flood waters have drowned these aspirations.

The floods have once again demonstrated rather vividly the total failure of planning and the inadequacy of the administration in dealing with a nuclear emergency. Since the roads had been badly damaged due to floods, it was difficult for anybody to

From the

How Many More Warnings Before the Final Curtain?

Just before a catastrophic volcanic explosion, there are many signs of increased volcanic activity. There are greater lava flows and more smoke and gasses from the cone, the frequency of small earthquakes increases perceptibly, etc. Examples abound of those who ignore these warnings and continue their business as usual lifestyle, ending up as victims of volcanic eruptions. Pompeii is a reminder of what happens to those who continue to sleep till it is too late.

Accidents in the nuclear jargon are called 'unusual incidents'. The Indian nuclear programme is so accident prone and mishaps so frequent, that to call an accident unusual is a distortion of truth. They are, however, most peculiar. Where else in the world would one find the massive steel and concrete containment building collapsing on its own like a house of cards.

One thing we can always be sure of. Even in times of crisis, when all others would be worried sick and unable to think coherently, nucleocrats would be calmly at work finding charming new words to enrich the English language. Their description this time for a 130 tonne chunk of concrete falling is 'delamination'.

In 1988, hundreds of women of Karnataka, under the leadership of Dr Kusuma had 'raided' Kaiga and brought construction work to a halt by jumping into the foundations. Unfortunately, the momentum of those inspiring days has been frittered away and the Kaiga movement today is in a state of coma. The same inertia grips the antinuclear movement everywhere. It is high time that we heed the warnings of the nuclear volcano. Unless we put an end to our indulgence towards this insanity we are bound to suffer the sorry fate of victims of nuclear violence.

even get to the reactor site. If there had been an off-site emergency, the authorities would have failed to evacuate even themselves leave alone the population. Even now, five days after the event, the civic authorities have not been able to provide relief to affected villages in the vicinity.

South Gujarat is fortunate that unlike other areas of Gijarat, the rain gods still smile on it. Hopefully they would continue to do so every year. But even moderate rain today can cause havoc. 'Development' has meant large scale deforestation and the blocking of the natural drainage by roads, canals, railway lines and

other constructions. Another large contributor to this has been the 'levelling*' of agricultural fields. The natural systems which provided protection earlier have perished.

Rains, floods, cyclones, earth' quakes are 'natural' events. Planning for the nuclear plant should have taken all such factors into account. The floods have demonstrated the incompetence of the nuclear planners in a very striking manner. They are the people who cannot even design storm-drains properly Can the people continue to trust these 'experts'?

Surendra Gadekar

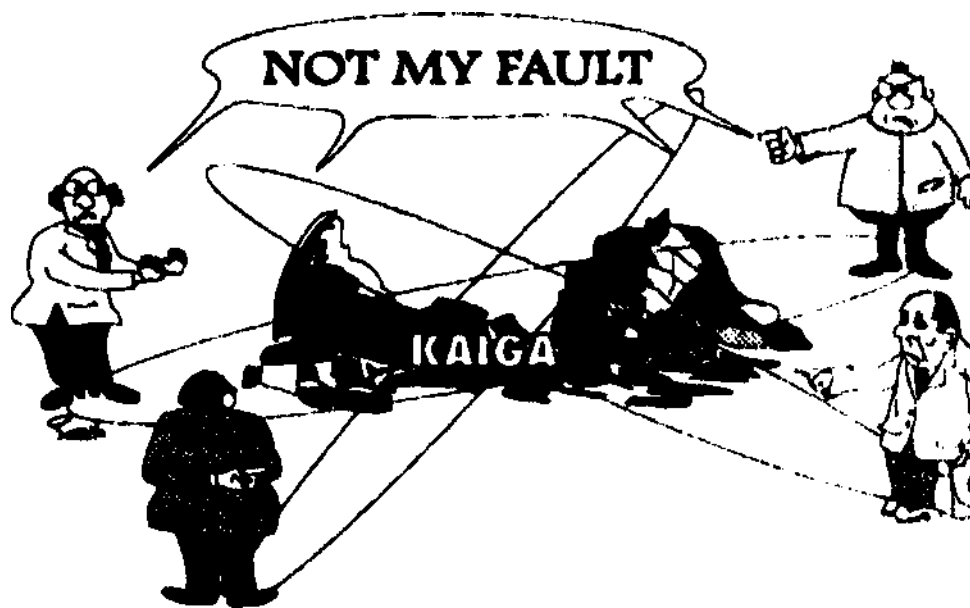
A Double Wall off Deceit and Disinformation

The bizarre mishap at Kaiga during which a portion of the dome crashed down is a matter of utmost concern. The lives of thousands of innocent citizens around our nuclear reactors depend on the integrity of the containment structures. We have been solemnly assured by our nucleocrats that the containment structures provided by them are the safest, capable of withstanding earthquakes of the order of 6.5 on the Richter scale, or a bomb attack by an enemy warplane. Even if the reactor were to explode like a bomb, as has happened in Chernobyl, the integrity of the dome and the safety of the people will not be compromised. They are supposed to be designed and built to contain the radiation from the reactor under all adverse circumstances throughout the life of the plant.

And yet, within four months of its construction, the containment structure of Kaiga has come crashing down under its own weight, without any external influence whatever. If such a mishap were to occur with the reactor in operation, the consequences would be devastating. The steel and concrete debris of the collapsing dome would damage the core and leave it exposed like a smouldering radioactive volcano. The entire population of Uttar Kannada and Goa will be in danger and will require immediate evacuation. Neither the government of India nor the Atomic Energy establishment is in

any way equipped to handle a disaster of such magnitude.

The exact reason for the mishap at Kaiga is not yet known. Whether it is poor design, substandard materials or defective workmanship or a combination of all the three is to be established. What is the extent of corruption in the project? Are safety norms being thrown to winds so that the project is somehow completed in time? The people have a right to know the answers since it is a matter of life and death.



The Nuclear Community Speaks in One Voice

Unfortunately our nuclear establishment is not answerable to anyone — the people or the Parliament. For decades they have been conducting their covert operations behind a double wall of deceit and misinformation. Every effort will now be made by them to suppress the serious nature of the Kaiga accident and pass it off as 'minor' and 'inconsequential'. Till date they have not disclosed the true extent of the damage or the number of casualties. Injured workers have been kept in custody and are not allowed to meet anyone.

We demand a comprehensive inquiry into the causes of this most serious accident, by a team of independent experts who will not be influenced by the nuclear establishment. We reiterate our stand **against the folly of setting up nuclear power plants** anywhere, especially in ecological sensitive areas like **Kaiga**. Such shoddily built power plants pose a grave danger for the environment and the public. Despite all the money already wasted on it, there can be no justification for continuing the project at Kaiga. We urge the Government of Karnataka to take the initia-

tive and place before the people, all the details of the present and the past accidents at Kaiga and their possible consequences on public health. Let a well informed citizenry be the ultimate judge of the need for such projects.

Already several politicians at the local and state

level have voiced their opposition to the continuance of the Kaiga project. In an election year, it is natural for those in politics to define their attitude according to the voters' moods. Our opposition to Kaiga has always been purely on environmental and developmental principles. We sincerely urge everyone, including the political parties, to take a firm, principled stand and stick to it even after the elections.

*Sanjay Havanur
Co-ordinator CANE, Bangalore*

The Dome off Death

Trust the nucleocrats to come up with something truly bizarre. For years we have been bombarded with tall claims of the superiority of our double containment structures. They are supposed to withstand the worst of nature's furies. I remember a leading nucleocrat claiming that in the event of an earthquake the safest place to run for shelter would be your neighbour reactor building since it is built to withstand jolts of 6.5 magnitude on the Richter scale. They can survive bomb attacks - either by terrorists or by enemy warplanes. Above all they must withstand the internal stresses from the reactor core itself, including the tremendous pressures built under loss of coolant accident conditions.

No problem, say the nucleocrats. We have double containment structures you see. They form the fifth barrier against the radiation escaping from the core. "The containment provisions are proof tested to establish beyond any reasonable doubt that they are capable of withstanding the pressures that are expected in the case of an accident." A Chernobyl type of disaster, where the reactor core was totally exposed to the environment, just cannot happen in India. We have not just one but two containments so we should feel doubly safe.

But not quite. The term 'double containment structure'¹ implies a 100% redundancy in protection which simply is not there. The first containment is a 300 mm thick wall of pre-stressed concrete designed to contain a pressure of 1.25 kg/sq. cm. But the second containment is a much thinner wall of RCC designed to hold against only 0.07 kg/sq. cm of inner pressure. In other words, it is designed to contain the gases leaking out of the first dome. If in an accident, the inner containment

were to be breached altogether, the outer one would automatically cave in, exposing the core.

There has been a long and unresolved international debate as to whether reactor containments can really hold out against a LOCA. For one thing the actual stress on the dome in an accident has obviously never been measured. Given the complexity of the problem, one has to rely entirely on computer simulations for the answers. But these answers are only as reliable as the model used for the simulation which again is supplied by the nuclear scientists. Our own nucleocrats, true to their style, have never disclosed any meaningful information on reactor safety except for banal assurances of 'highest degree of safety' and 'defence in depth'. The antinukes have had their doubts about the integrity of the containment structures but kept their dark suspicions to themselves.

But what happened at Kaiga has been beyond their wildest suspicions. How could anyone have ever doubted the ability of a reactor containment, even the one being built by NPC of India, to withstand its own weight? On the afternoon of Friday the 13th (touch wood!) May, a massive slab of the inner containment of Reactor I detached from the dome and crashed. The earlier reports said that only one slab about 6.5 meters wide and weighing 20 tons had fallen. But the more recent reports suggest that nearly 40% of the inner portion weighing a massive 130 tons have got 'delaminated'. The dome was completed last January but plumbing, cabling and other works were going on. Both NPC and AERB have set-up separate committees to investigate the mishap. The AERB committee, under the chairmanship of a rather inappropriately

named Professor V N Gupchup, has been asked to submit its 'first interim report' within two months. The committee will also decide whether the fallen dome can be repaired or has to be rebuilt entirely

But the real and the most frightening issue is not accident itself but what it implies. The consequences of such a mishap inside a working reactor would be nothing short of nuclear catastrophe. In the worst case scenario, the falling debris of a shoddily built dome would damage the coolant pipes and other safety mechanisms. The core would suffer a loss of coolant with all safety mechanisms unavailable. With the containment roof having caved in, the core would be fully exposed to the environment like a smouldering radioactive volcano. It would be another Chernobyl and given the sheer incompetence with which our official machinery handles an emergency, the immediate death toll could well be in hundreds of thousands.

The AERB on its part has already issued directives to halt the construction work not only at Kaiga but also at RAPS III and IV. But the NPC seems more adept at splitting hairs rather than its atoms. The directive has been interpreted to cover only the civil construction of the inner containment. All other construction work at Kaiga will continue. However, there is another major threat to public safety that AERB has not recognised. The Kakrapar reactor has also been completed in a desperate hurry and with total disregard for safety. It has gone critical without adequate testing of basic safety systems. What guarantee do we have for the integrity of its containment? AERB must immediately order for the closure of Kakrapar and make a thorough investigation of all its safety mechanisms, including that



of the containment structures. With thousands of lives at stake, we simply cannot afford to take any chances with these domes of death.

A number of theories have been proposed to explain the Kaiga mishap. The most far fetched one is that a geological fault passes right through reactor foundation. It might have thrown up a mild tremor, not strong enough to be recorded anywhere but sufficient to cause the collapse of the dome. If this is true, it only vindicates the environmentalists' arguments against the site selection. But the more plausible causes are faulty construction methods and sub standard materials, notwithstanding the righteous claims of NPC about using only tested, materials of the highest quality. The nuclear establishment's culture of secrecy and absence of accountability leads invariably to corruption. It has been alleged that the markets of Uttara Kannada are now flush with high quality cement, steel and other construction materials. Sometime ago the roof of the fire station building at the site too had collapsed when a conventional structure of cement in a Government project collapses immediately after it is built, the reasons are quite obvious; A local was put it neatly when he said that the contractors will collect their bills but leave behind a Chernobyl!

Having been severely criticised for the 300% overruns in cost and time incurred in all of its projects, the nuclear establishment has been hell bent on completing the Kaiga project on schedule at any cost. The question is whether safety concerns have been thrown to the winds in the process. It is already established that the actual construction done at the site was different from the plans submitted to and approved by AKRB. Also, several processes such as stressing sequence for the concrete were carried out without AERB's approval. Were the engineers at site authorised to make design changes? Were they competent to do so? If not, do we understand that the designs of our atomic power plants are subject to incompetent and/or unauthorised changes at site?

Immediately after the accident, the NPC officials closed the reactor building and barred entry. However, a team of women activists, led by the intrepid Dr Kusuma Sorab, visited Kaiga late in the night and spent some time with the labourers who live in sub human conditions around the site. They are a frustrated lot and accuse the contractors at site of all kinds of malpractices in construction. They also claim that there have been other accidents at Kaiga involving casual workers.

Compensations have been promised but never paid.

There is one aspect of the mishap that still remains shrouded in mystery. How is it that no fatalities have been admitted by NPC? Officially only 14 workers working above the dome suffered minor injuries. Only one of them is still in hospital, under strict police custody. The explanation given by Mr B. A. S. Prasad, chief Administrative officer is that the mishap occurred during lunch time and hence no one was inside the dome. The coincidence apparently has reaffirmed Mr Prasad's faith in God. But lunch hour at 11-45 AM at a construction site is too hard to swallow. Besides, what were those fourteen people doing on top of the dome during lunch hour? One of the workers, who was on the dome has little faith in Mr Prasad or God. According to him, at any given time there are at least 200 people working inside the reactor building. When the inner wall of the containment began to fall, a lot of dust was kicked up and no one could see anything. The local police were informed of the accident only late in the night. All this leads inevitably to a disturbing question. Has Kaiga already claimed its first human victims?

*Sanjay Havanur
Bangalore*

Only Public Action Can Ensure Safety

he latest disclosures by the Atomic Energy Regulatory Board about the May 13 accident at the Kaiga atomic power project should make us all sit up. On that day, a huge slab of concrete from the under-surface of the containment dome of Unit-1 of the plant, weighting 130 tonnes and with a diameter of 42.6 metres came crashing down.

According to spot reports, about 200 workers were inside the building. Miraculously — going by the Nuclear Power Corporation's account, that is — only 14 of them were injured. The public's suspicion that the damage might have been greater have not been assuaged by the fact that the injured workers are in police custody and incommunicado.

Only a full inquiry will, hopefully, fix responsibility for the accident. But meanwhile, the mishap has blown a big hole into the department of atomic energy's (DAE) claim that the containment dome, part of the essential safety systems at nuclear power stations, is itself a safe structure, reliably designed to withstand earthquakes of magnitude 6.5 on the Richter scale (about the same as Latur), or aerial bomb attacks.

Principal Barrier

Theoretically, the containment dome is, as the name suggests, meant to contain releases of radioactivity from the reactor it encloses. It is the principal barrier between vast quantities of radioactivity liable to be released in a mishap, and the public. In practice, it does not work that way: at Chernobyl, for instance, the force of nuclear explosion was 90 times greater than the level the dome was designed for.

Kaiga highlights the sinister possibility of the containment dome causing rather than containing a nuclear accident: had the plant been working "normally" when the mishap occurred, nothing could have prevented a catastrophic accident even a core 'meltdown'.

The possibility does not look less menacing when the AERB reveals that reputed firms such as Larsen & Tubro and STUP Construction of France were involved as builders and consultants of Kaiga. Indeed, according to the AERB, they made a major, unsanctioned alteration of the construction design, perhaps to speed up work, changing from construction joints at the circumference to "meridional construction joints".

It is not known if STUP made these changes with NPC's knowledge. But it is clear that the accident could not have occurred without a departure from sound working practices and safety codes and a lackadaisical, if not reckless, attitude to safety. This is not unique to Kaiga, but widespread at Tarapur and Rajasthan - where hundreds of workers have been exposed to excessive doses of radiation, as this paper disclosed - Narora, where a devastating fire occurred in March 1993, or at the Indian Rare Earths plant at Alwaye where there is a horrifyingly high incidence of Down's Syndrome among the children at DAE installations is scarcely reassuring and certainly no better than in industry, in general. But the consequences of a breach of nuclear safety norms are disproportionately greater, indeed enormous.

Special Category

It won't do to dismiss the Kaiga accident as inconsequential or something that the system can somehow

deal with. It belongs to a special category of worrisome accidents in a high-hazard industry, discussed by the Yale sociologist Charles Perrow in his remarkable book, *The Normal Accident*. It confirms the worst fears of activists who have been agitating against the Kaiga plant for almost a decade.

Here lies a lesson, the AERB is just not good enough to do the job of regulating the DAE for safety. It needs more teeth, more expertise, more demanding inspectors and more punitive powers and, above all, full autonomy.

Only an AERB which is detached from the DAE and reconstituted to include independent experts and concerned citizens can satisfy two elementary ethical requirements, viz., those who regulate, supervise or judge should, operate and hence may be in the dock; and, secondly, that people who are liable to be affected if a development project fails must be associated in deciding on its desirability, its operating practices and safety.

Now this is precisely what we have failed to do in India. We have invested heavily in activities with potentially harmful consequences for the public without bothering to create mechanisms to regulate them, or to deter and punish violations of safety standards. And we have blindly relied on "experts" - the scientific bureaucracy, to make decisions about true worth of large dams, flyovers, chemical plants or pesticides-intensive agriculture. Often, our political leaders are more open to issues of technology and its hazards than our scientocrats and "experts". The "experts" are usually too smug, dogmatic and closed in their attitudes to want to engage in serious, open debate.

However, a larger lesson is that even political leaders cannot be trusted to be objective, informed and fair-minded. The only remedy lies in public action. There is simply no substitute for involving the public - the ultimate criterion of benefit, and

also the potential bearer of the cost - in the evaluation, clearance and supervision of projects, stipulation of safety standards, and hazard reduction and disaster management. The US has a system of public hearings on dams. The idea must be en-

riched and extended to all large projects in this country.

*Prafut Bidwai
Times of India June 2. 1994*

National Profile of X-ray doses

Two years from now, India will be among the few countries in the world to have a national profile of X-ray doses, according to the Atomic Energy Regulatory Board which has embarked on an ambitious research project to gather exhaustive data on radiation doses to patients undergoing X-ray examination in thousands of hospitals and polyclinics spread across the country.

Medical X-rays were first used in India within three years of their discovery. The rays were brought by the Indian Army to the North-West Frontier Province and used effectively by Surgeon Major Bewoor. Following his success, base hospitals in England were later equipped with the diagnostic and therapeutic tool. As per latest estimate, about 81 million medical X-ray exposures are taken annually in India, using 50,000 X-ray units operated nationwide. Nearly 1,500 new units are added annually.

Eleven scientific institutions including the Institute of Nuclear Medicine Delhi; Christian Medical College, Vellore; Kidwai Memorial Institute of Oncology, Bangalore; RST Cancer Hospital Nagpur and Irwin Group of Hospitals, Jamnagar have been involved in the project titled "Evaluation of Patient Organ Doses during Diagnostic Radiology."

"Radiology officers will visit all the X-ray centres in the country to collect the data on a proforma prepared by us which will later be fed into our

computer," said secretary AERB Dr. K. S. Parthasarathy

The project, first of this kind in Asia, is being undertaken following suggestions made by the International Commission on Radiation Protection that "some dose constraints must be arrived at by the regulatory body or professional organisations". According to the international body, the ranges of radiation doses in X-ray investigations were found to vary by as much as a factor of hundred. AERB's inputs will give valuable inputs in this decision making*

The AERB has sanctioned an amount of Rs. one lakh per institution for a year for the job. The collection of data which includes type of radiological exams, frequency, sex and age group will be conducted by radiological safety officers.

*Hiren K Bose
The Independent May 6.1994*

Comment

Hiren K. Bose's report "National profile of X-ray doses" ascribing to the International Commission on Radiological Protection the statement that "ranges of radiation doses in X-ray investigations were found to vary as much as a factor of hundred", if true, may have criminal negligence implications to those causing exposure to ionising radiation. A patient who should have received no

more than 8.4 millirems for a chest X-ray might have been exposed to 850 millirems ! This is not a hypothetical situation but has actually happened abroad. Between 1985 and 1989, in a community called Sittensen between Bremen and Hamburg in Germany, children were overexposed to diagnostic X-rays by as much as a factor of ten which resulted in more than seven hundred percent (700%) leukaemia occurrence amongst them as compared to children of the control area (the Mainz). In the February Annual Meeting of the American Association for the Advancement of Science, a session on breast cancer included many presentations linking breast cancer with medical X-rays. At the same meeting, Dr. Samuel Epstein, a professor of medicine at the University of Illinois at Chicago, speaking at a panel session on breast cancer research policy in the USA, said that the expanding use of X-ray mammography to screen women for breast cancer in the USA, was "reckless, if not criminal". In view of this, it is not only essential to gather exhaustive data on radiation doses to patients undergoing X-ray examinations, but to follow up of the patients themselves till their death* What have been the consequences of this reckless practice on unsuspecting uninformed people? There has to be an independent watchdog body having no conflict of interest like that of the nuclear industry; supervising the data base.

R Ashok Kumar

Twenty Minutes That Shook BARC

India's controversial atomic energy establishment has had yet another close brush with infamy. The CIRUS research reactor at the Bhabha Atomic Research Centre was just 20 minutes away from a "major disaster" last month following a "grave procedural error".

The "incident" occurred around 11 am on April 12 when operators at CIRUS failed to connect a water pipe to a spent natural uranium fuel rod that had just been taken out from the reactor for refuelling. There were no injuries or deaths. Department of Atomic Energy sources first said the incident could have measured '2' on the International Nuclear Events Scale, just below the Narora fire incident last year which measured '3' on the same scale, but later pegged it down at level '1'.

The operating licences of the entire crew, comprising five operators including the shift in-charge, have been withdrawn for a period of six months with immediate effect following the incident.

Dr A Gopalakrishnan, chairman, Atomic Energy Regulatory Board, which monitors safety aspects in nuclear reactors, confirmed the incident, and said a committee had already been formed to do a root cause analysis of how it occurred. A report is due in three weeks time.

DAE sources said the incident was another pointer to a "safety culture problem" prevailing within the BARC where CIRUS is located. "Last month they forgot to connect a water hose. What will they do tomorrow?" However, BARC Director A. N. Prasad downplayed the incident: "There is nothing so serious about what happened on April 12 so as to deserve being reported. We know how to manage such things. The

AERB is there, and we are answerable to it. Just leave us alone."

When an exhausted fuel rod— that is natural uranium that has been used up by the reactor to generate power -is taken out of the reactor, it is moved to the spent fuel bay, This is done by. first moving it into a 10-foot-long cask and then transferring it into a spent fuel pond.

Usually, when the rod is removed and is being moved to the top of the cask on the way to the pond, cooling is provided, as there is still some heat in the spent fuel element. The

"We know how to manage such things. Just leave us alone."

A. N. Prasad Director BARC

"I am only hurt that people think we need policing."

S. K. Chatterjee Director

NPC

heat is enough for radioactivity to be released into the atmosphere if it is not cooled.

When the rod is within the reactor, there is no such problem, as it is automatically and constantly cooled. An official in the know likened the procedure to a child in a mother's womb. "As long as the baby is inside, it does not have to worry about nourishment. But the moment it is out, it has fend for itself". But the moment the rod is taken out, the cooling is done by connecting a light water

hose to the cask. But on April 12, it was not, And the discrepancy was not noticed for at least 20 minutes by which time slight radioactivity had been noticed in the precincts of the reactor. Otherwise the rod would have overheated with disastrous effects. "If another 20 minutes had lapsed, we would have had a major problem on our hands. The temperature of the spent fuel would have shot up and the rod could have ruptured spewing radioactivity within the reactor establishment," one BARC source said.

Fortunately, the reactor- which has been operating at 20 MW capacity, half its installed capacity- had been shut down, when the incident occurred. "If such an incident had taken place in a power reactor, it would have been a totally different case," the source added.

S. V. Kumar, chairman of the AERB's safety review committee of operating plants, said the point to ponder was why the operators failed to connect the water hose to the spent fuel element. He, however, agreed that it was a matter of concern that such incidents were regularly being reported from CIRUS and its sister reactor Dhruva.

However, S Shankar, who heads the BARC reactor division, said the incident was not serious. Such incidents, he added, occurred the world over in all other industries and the CIRUS one was just one such. No more.

DAE sources revealed that the cask operator had, on the other hand, reported at least four times on April 12 that the flow of water was okay, even though no water was flowing to the spent fuel element, as the water hose had not been connected at all.

CIRUS was installed in 1961 and is said to be of vintage quality.

'The point to probe is whether the flow meters which have been provided to the operators of CIRUS are in working condition or not. If they are not, then it is very likely a case of dereliction of duty.' the sources felt.

CIRUS reactor superintendent R C Pant declined comment, saying it was up to the public relations wing of BARC and AERB to confirm or

deny the incident, and ascertain the veracity of its magnitude.

R. K. Sehgal, an activist for greater safety at nuclear establishments, however, felt too much was being sought to be made of the April 12 incident in an effort by the DAE to whitewash its previous lethargy in dealing with more serious incidents.

"The environs of the CIRUS Dhruva complex have been contaminated for years due to rupture in a pipe carrying radioactive fluids. Yet

all the people responsible for that have gone scot-free. Why?" he asked.

The five delicensed operators will not have to seek requalification when AERB conducts its review examinations six months down in the line. However, they will continue to draw their salaries.

*Krishna Prasad
The Sunday Observer,
May 7, 1994*

Containment: The Ultimate Barrier

Kaiga Dome Falls ... Collapses... Concern Over Kaiga Mishap.. Union Government Urged Thorough Inquiry... Matter Serious... NEWS 18th May, 1994

Of course the matter of the dome collapsing is serious. It has been the boast of Indian nucleocrats that our PHWRs - the pressurised heavy water reactors have a dome within a dome! And hence, the public can rest assured regarding safety.

At the Third International Symposium on Small and Medium Size Nuclear Reactors New Delhi August 24-25, 1991, hosted by IAEA and others at least three papers devoted considerable space and time to dome design. A. K. Babar, V. Venkatraj and A. Kakodkar of BARC, in "Pressurised Heavy Water Reactor in Public Domain", state: "A comparison of core damage frequency of PHWR with that of PWRs (pressurised light water reactors) has been made and the advantages of a PHWR are explained from the viewpoint of public safety. The studies show that because of the design safety characteristics of a PHWR (e.g. presence of cool moderator as a heat sink under

accident conditions, calandria vault cooling system, double containment etc.) the impact of worst case accidents in the public domain is not likely to be any greater than that of the design basis 'accident'. However, just two years later D. V Gopinath, Director of health, safety and environment group at RARC won the "Never too late for Realism Award" of *Anumukti* for his statement: "Emergency situations beyond the design basis of nuclear power plants cannot be ruled out." (September 1993).

Nucleocrats frequently reassure us that containments are built carefully keeping in mind their extraordinary importance. Eabaret al state: "Because containment is the ultimate barrier in the case of an accident, particular care is exercised in containment design. The principle of double containment is used and care is exercised that this provision extends over all penetrations and leak paths. The layout considerations require a rather large containment for the PHWR. This augments safety by enabling reduction of hydrogen concentration, in the event of an accident." What is left unsaid in this is the fact that in case of fire, the explosion ratio is reached easily and

quickly because of the consumption of the large volume of air confined in the dome? Remember last year's Narora explosions!

Let us look at the extraordinary faith Indian nucleocrats repose in containment as a cure all safety feature. "A large number of accident sequences have been analysed, and it has been found that as long as containment is available, there is virtually no additional impact in the public domain regardless of the accident scenario considered. It has also been established that there is no possibility of a threat to containment integrity. Similar conclusions have been reached for similar reactors abroad. It must be mentioned here that some of the sequences considered in the above study include failure to effect a prompt shutdown following a LOCA (loss of coolant accident). Such a sequence is highly improbable. Further, based on a study of the consequences of this accident sequence and considering the resulting metal water reaction, hydrogen generation and energy liberated, it is observed that the impact in the public domain is not greater than that already considered for the design basis accident. This is so because, even though the release from

*June/July
1994*

the core would be more *assuming the availability of the containment, the impact would be confined within the exclusion radius (1.6 km). This brings out the important role played by the containment and validates the importance attached by designers to the evolution of a sound indigenous containment design for PHWRs, so that it effectively limits the consequences even when the entire inventory of I-131 and noble gases is assumed to be released from the core.*"

Another paper "Distinctive Safety Aspects of Small and Medium Sized Nuclear Power Plants in India", by M. Das and L. G. K. Murty, Nuclear Power Corporation, India talks of "a double containment that exhibits a forgiving behaviour under hypothetical overpressure conditions" and says it contributes to a design which would ensure that severe accident probability is Very low' and 'even if it were to happen, it can be fully contained*. Again: "the containments are built sufficiently strong to take care of LOCA and seismic events occurring simultaneously".

And yet, the dome just collapsed! The big chunk of concrete dropped down from a height of about 40 meters, says the news report. Despite the fact according to locally stationed engineers that "building activity has been subject to stringent quality control".

Another paper devoted especially to the reactor building structure in the New Delhi symposium referred to above, "Design Strategy of New 235 MWe Indian PHWR Reactor Building Structure", by PC Basu, Head Civil Engineering Section, AERB, A Dasgupta, Chief Engineer (civil and structural), Development Consultants Ltd., Calcutta, and HN Batavyal, Executive Director Development Consultants Ltd., Calcutta, attempts to delineate how the safety objectives in the 'new' design of reactor building structural systems for

PHWRs in India are fulfilled: 'Systematic method for handling both internal and external hazards generated due to man-induced and natural events in the design is presented.' The paper especially mentions that the design takes care of internal hazards which are listed as fire, internal missiles, failure of pressure parts, 'pipe whip' and jet impingement, blast effects and compartment pressurisation, internal flood, heating and condensation, dropped load, explosive gases and impact during construction. Further it mentions that *impact during construction and dropped load hazards are avoided by proper administrative control and control in the system design.*

"The configuration of internal structure is so developed that the structural elements which invite more stringent design criteria is protected, to the extent possible, from the internal hazards by the structural elements whose design criteria are relatively less stringent."

According to the paper the design approach is as follows: "Two classes of uncertainties—primary and secondary are dealt with. The primary uncertainties are associated with system uncertainties while secondary uncertainties are introduced in the design due to the limitation of data and knowledge (what are they?) of different aspects of design procedure and the state of the art. (In other words in nuclear reactor systems where no acts of the devil are permitted, they admit precisely this is possible, because of the fact that nuclear design is immature). They state: "The discrepancy between the predicted behaviour of the analytical model and the actual behaviour of the structure introduce secondary uncertainties and this reduces the confidence in design." Perhaps herein lies the real explanation of the Kaiga dome collapse.

They continue: "The primary uncertainties may be taken care of using characteristic values considering the randomness of the design variables like load, material properties, etc." This calls for probabilistic design approach of structures. However, experience shows that structural design in deterministic format following 'certain guidelines' also guarantees reliability in design. The deterministic methodology are adopted to design for structural integrity and serviceability. The secondary uncertainties are minimised to the extent possible. For this purpose the configuration of structural systems requires that the available proven analytical tools are applicable with high degree of confidence. However, all the design uncertainties cannot be addressed through analytical design. The remaining ones are to be taken care of by a systematic quality assurance programme.

"The approach to hazard in design and the concern for minimising secondary uncertainties are kept in mind during all stages of engineering i.e. siting, conceptual development, structural-layout, analytical design, and construction, the above activities are not independent but are inter-dependent, therefore, design strategy adopted must be such that the total safety is ensured through all these stages."

The above description makes it amply clear to the layman that there indeed may be an infinite number of slips between the cup and the lip, concretely, for a change! Well, that is just the unforgiving nuclear technology.

R. Ashok Kumar
Bombay Sarvodaya Mandal
299 Tardea Road, Nana Chowk,
Bombay 400007

Some Lessons in Nucleonomics

Recently I have been reading Nucleonics Week, a nuclear industry journal. Below are some excerpts from it and other journals. Read together they give a picture of the financial state of the nuclear industry today. They also shed some light on the alliance between Third World bureaucrats and First World corporate tycoons.

Lesson Number 1: Nuclear power plants are three times more expensive to build as compared to nucleocrats' claims.

The Parliamentary Committee on Energy in its report to parliament has criticised the long delays in completing new nuclear power plants that have led to cost overruns exceeding 300%.

The Kakrapar Atomic Power Projects two 220-MW pressurised heavy water reactors (PHWRs) using natural uranium fuel- was originally estimated to cost Rs 3.8252 billion but the cost has been revised to Rs-13,35-billion. The first unit began operating in May 1993 and the second is expected to go critical later this year. The fiscal 1994 federal budget (through March 1995) provides some Rs 400-million (about \$12.9-million) for the project.

The Rajasthan Atomic Power Projects third and fourth 220-MW PHWRs were estimated to cost Rs 7.1157-billion, but the estimate has now shot up to Rs 21.07-billion. The Kaiga Atomic Power Projects' two units, also 220-MW PHWRs, was approved at a cost of Rs 7.3072 billion, in 1987 but is now expected to run over Rs 22.76 billion.

"The committee feels that the loss of benefits to the economy owing to time and cost overruns of projects cannot be overestimated," the report said, hoping the Nuclear Power Corporation, of India (NPC) will at least

now stick to the revised schedule of completing the work.

The Department of Atomic Energy (DAE) has cited the rising prices and changes in the scope of major activities as the main reasons for the steep cost hikes. The original estimates provided for only a 15% rise in costs, while the scope of work in each of the projects has increased due to what the DAE termed "the evolving safety requirements and continued technology evolution to conform to prevalent safety standards." Kakrapar-1 was originally scheduled to operate in December 1990. Rajasthan-3 and -4 were to be commissioned in May and November 1995, respectively, and Kaiga-1 and-2, in June and December, 1995. The revised schedule hopes to have all four ready by March 1997.

The FY-94/95 budget provides some Rs 2.9518 billion for the nuclear power projects still under the government's direct control like the Rajasthan station, fuel inventory, waste management facilities at Tarapur and Kalpakkam, and Heavy Water Pool management. About Rs. 11.83 billion is provided for new power projects being implemented and planned by the NPC, which now functions as an autonomous company

The budget allocates Rs.4.13-billion for Kaiga and Rs 3.53-billion for the new Rajasthan units. Tarapur-3 and 4, whose approved cost is Rs 24.27-billion, will get Rs 2.46-billion during FY-94/95 compared with Rs 600-million in FY-93/94. The Tarapur units are to be 500-MW PHWRs. Reporting on the progress of Tarapur,

the DAE said the final award for acquisition of land has been issued. Most of the components for one unit have been received- During 1994-95, civil works contracts are expected to be awarded and preliminary work will commence. The two units are scheduled to be completed by the turn of the century.

*Neel Potri, Nucleonics Week,
April 28, 1994*

The Same Story Across The World

A report prepared by the Federal Audit Court of Brazil contends that the cost actually incurred in building Angra-2 nuclear power plant are way above those released to the public. According to the utility Furnas Centrais Eletricas SA, the total cost so far for Angra-2 has been roughly \$ 4.6 billion and an additional \$1.5 billion is needed over the next five years to finish the project in 1999. Half the new money is expected to be financed by German banks (the project is German assisted and the construction is by Siemens). However, the Federal Audit Court says that Angra-2 has actually cost \$6 billion during 15 years of construction so far, excluding financing, and the auditors estimated that \$2.3 billion will have to be spent to complete the plant. Since financing of Angra-1 amounted to approximately 40 % of the nominal construction costs, the auditors put the total costs including financing of Angra-2 at well over \$10 billion.

"If Furnas it does not make any difference to construct a hydroelec-

trie plant or a nuclear plant, seeing that the government subsidises the cost of nuclear energy," wrote an auditor in reference to the Brazilian law which subsidises Angra-1. A proposed law granting a similar subsidy for Angra-2 is currently in Brazil's lower house. If the bill passes, Furnas' financial participation in constructing Angra-2 will be limited to the cost of a hydroelectric plant of comparable size.

"This means an investment of only \$1*2 billion for the utility, whereas the difference of \$6.1 billion will have to be absorbed by the taxpayers, in addition to the financial cost of the enterprise," said Rui De Goes, head of the local Greenpeace organization. "This is the first time that the account of Angra-2 are out in the open," enthused Goes, who said Greenpeace will request suspension of all work at Angra-2.

The conclusion of the audit with respect to Angra-1 are no less devastating. The auditors calculated a total construction cost of \$3.9 billion and affirmed that this amount "represents a new level for the analysis of the cost profit relationship of Angra-1." In a September 1993 report, Furnas admitted a total cost of \$2,375 billion, including \$752 million in financing.

*Armin Schmid
Nucleonics Week April 21, 1994*

Lesson Number 2: Even The Best Plants Are Just Too Expensive To Operate.

The California Division of Ratepayer Advocates (DRA) has recommended that Southern California Edison's San Onofre-2 and 3 reactors be permanently closed by 1998. The DRA, a division of the Public Utilities Commission, is the same agency that recommended shut-down of San Onofre-1 a few years

ago, which resulted in its closure in 1992.

According to the DRA, a shutdown by 1998 of San Onofre-2 and -3 would result in a savings to California ratepayers of more than \$1 Billion over the life of the reactors compared to available alternative energy sources.

The DRA analysis even admits that the two San Onofre reactors have been among the industry's top performers in terms of capacity and costs. But, says DRA, existing bids from independent generators (QFs, or qualifying facilities) can ensure electricity production at a lower cost than simply operating San Onofre.

scenario in which the nuclear plants are cheaper than the alternatives, even in the unlikely event that the reactors run at above 80% capacity for the rest of their license period.

In short, using hard numbers and southern California's particular situation, the DRA cannot imagine the possibility that nuclear reactors could be economical.

If the DRA proves successful in its effort to protect California ratepayers, as it was in promoting the shut-down of San Onofre-1, the shock waves will be felt throughout the nuclear industry. After years of defending cost overruns, unanticipated capital costs and so forth, in

California finds that Its best run plants with plant load factors of more than 80% are "uneconomical" compared to alternatives.

The DRA analysis does not take into account serious safety issues, such as the likelihood that during its

How come Indian nuclear plants which cost three times their estimate to build and have plant load factors ranging between 20% and 60% are economical?

the hopes that simply operating reactors would prove cheaper than alternatives, utility executives could

lifetime San Onofre, a Westinghouse-designed plant, will have to replace or repair its steam generators, or remove and replace its fire barrier.

Instead, the DRA analysed only SCE's own anticipated operating and maintenance costs to come up with its conclusion that it is simply not economical to operate these reactors any more.

The DRA argued that not only are the QFs cheaper than the nuclear plants, but so are the utility's own demand-side management measures. Indeed, DRA could not find a

be called on the mat to demonstrate why they shouldn't close their nuclear reactors, simply because the operating and maintenance costs are too expensive. As reactors continue to age and face higher and higher maintenance costs, this appears a likely scenario. In the end, if San Onofre-2 and -3 are found uneconomical, it is difficult to imagine any reactor, which undergoes the same sort of rigorous cost-benefit analysis, that could be found economical. Once again, California may be leading the nation.

*The Nuclear Monitor
May 9, 1994*

Lesson Number 3: The Costs of Decommissioning Reactors are Deliberately Underestimated

The Canadian Auditor-General is sharply critical of Atomic Energy of Canada Ltd (AECL) for failing to provide for expected costs of decommissioning facilities and restoring research station sites to green field condition over the next half century. In his report to Parliament on the 1993 accounts of all government departments, the auditor-general said the provision of \$200 to \$300 million failed to include the likely cost of "the most significant portion of decommissioning activities." The plan includes expected near-term costs for shutdown reactors, but not for research reactors and many facili-

Quote of the Month

"I will not say, you keep generating nuclear power even if it is uneconomical. But if you keep practising it, it will become more and more economical."

*S.K. Chattarjee Director NPC
In Frontline June 17, 1994*

ties currently in use at the Chalk River and Whiteshell laboratories.

Moreover, the auditor-general said, "In future the corporation intends to provide an allowance for the costs of decommissioning and site remediation only to the extent that funding from external sources is realised." That was inadequate to properly determine AECL's financial position and could result in demands on Parliament for further funding in the future.

*Ray Silver
Nucleonics Week April 28, 1994*

Lesson Number 4: Whoever Does the Damage and whoever might be at fault, You Pick Up the BUI

The Clinton Administration is pushing for a new international treaty on liability for accidents in nuclear power plants. The treaty would globalise responsibility for paying damages in case of nuclear accidents with costs being shared by all countries that use electricity from nuclear power plants.

Western nuclear supplier companies, still eager to do business in the ex-Soviet Bloc, are balking at the current lack of protection against legal action if they install equipment at plants that later have accidents causing third party damage. The treaty's immediate aim is to protect these companies.

Under the proposed new framework, damages for accidents would be paid out of an international pool of funds, to which each member country which has nuclear power plants would contribute. Every country that agrees to sign the treaty would contribute at least about \$ 280-million for accidents that occur within its borders.

The proposed treaty puts a limit of \$ 1.4-billion in damages for any nuclear accident. The estimate is that at the most, a country would have to pay \$ 105-million for accidents that might occur outside its borders—but the exact amount would depend on the amount of nuclear power it uses.

Existing U.S. law, which will continue to be operative even after the proposed treaty is signed, provides up to nine billion dollars in liability coverage of a nuclear accident as opposed to \$1.4-billion in the proposed treaty.

Indian Express June 7, 1994

Lesson Number 5: Despite the Hidden Subsidies, Private Executives Answerable to Shareholders, Have No Confidence In Nuclear

Senior U.S. utility executives are less confident today about U.S. nuclear power's future than they were two years ago according to a survey. Released by Washington International Energy Group, a consulting firm, the survey is based on responses to a four page questionnaire covering a wide variety of issues.

Asked if there will be "a resurgence of nuclear power in the U.S." only 37% of respondents answered yes. Two years ago, 68% said there would "definitely** or "probably" be a re-birth. Asked, "Do you think your company would ever consider ordering a new nuclear power plant?" 721 of the respondents said "no" this year, up from 57% in 1992. What's more, just 9.5% said their companies might consider ordering a new plant, down from 13.8% in 1992 and 16.5% in 1993.

The report, "1994 Electric Utility Outlook," notes that by nearly every measure, the quality and safety of nuclear performance in the U.S. is at an all-time high. The public attitude toward nuclear is also less stridently negative than in the past. Paradoxically, this success finally has been achieved at the same time that many Chief Executive Officers (CEO) have come closer to deciding that nuclear may not be able to survive in the competitive marketplace. Privately, many CEOs talk about someday turning over title of plants—even the best-run ones—to the government. Many more are preparing to write down their massive overhang of nuclear debt."

*Nucleonics Week January 13,
1994*

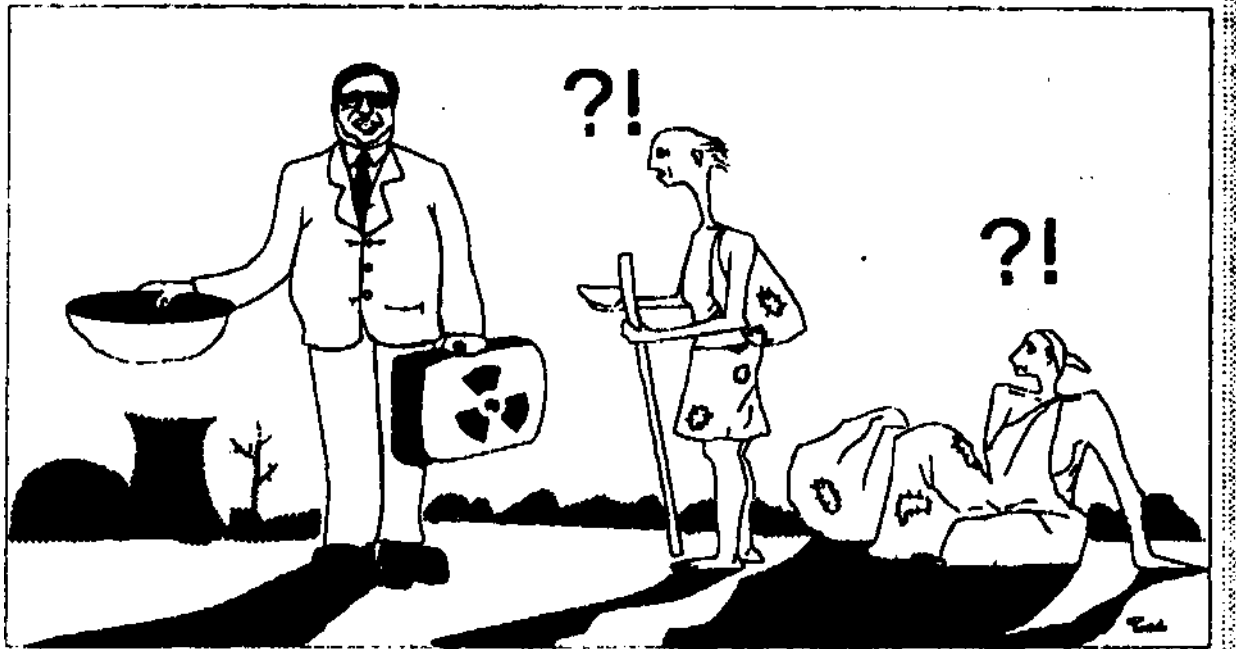
Third World Bureaucrats with Public Money to Squander Are Enamoured of the Charms of Nuclear Power!

India's nuclear establishment, which has had to prune its plans for 10,000 megawatts of installed nuclear capacity by 2000 to just 3,800 MW in recent years because of money difficulties, is getting surprisingly positive signals from bankers and investors.

There were no takers for the Nuclear Power Corp.'s (NPC) bonds in the last two years. "Today I am able to borrow at low rates of interest from banks and financial institutions and even non-resident Indians" settled abroad, said S. K. Chatterjee, NPC managing director.

Current installed nuclear generating capacity is only 1,720 MW from nine reactors, just 2.5% of the country's installed power capacity. The government has given the green light to the NPC to explore financing for joint ventures for plants and the NPC was able to tie up with the southern Indian states to set up a plant in the region with the corporation taking 51% ownership. However, the idea did not click with the western states like Maharashtra and Gujarat. One inhibiting factor seems to be the condition imposed by New Delhi lawmakers that the state-controlled NPC must be the majority owner with 51% equity. The NPC finds it tough to come up with even this much capital.

However, the corporation is thinking of building two 500 MW pressurised heavy water reactors at TWapur at an estimated cost of 60-billion rupees in addition to its ongoing projects. The government has indicated the NPC can go to financial markets to raise funds for this project, but the NPC has no source for its Rs 20-billion share other than the govern-



The New Boy On The Street!

ment, according to Chatterjee. He was confident the new-found enthusiasm among the bankers to come up with loans for nuclear power plants will help the NPC to go ahead with added capacity. The banks are now convinced nuclear power is economically viable in areas where there are no cheaper fuels like coal.

Nucleonics Week April 14, 1994

Bangladesh Considering Nuclear Power

DHAKA, April 22 (UPI) Atomic energy experts are urging Bangladesh to consider building a nuclear power plant in the Northwest section of the country. "Nuclear power is technically and economically viable for Bangladesh," they told Prime Minister Khaleda Zia during a secret cabinet meeting April 14, the Financial Express reported.

Officials of the Bangladesh Atomic Energy Commission told cabinet members a 300-megawatt nuclear power plant in Rooppur, 170 km (105 miles) from Dhaka, could be running by the end of 1995 at a cost of \$600 million. (*Nobody, but nobody has ever managed to get a plant ixinning in less than twoyears!—Editor*)

Rooppur, on the banks of the Ganges River, was selected in the early 1960s as a possible site for a nuclear power plant. Nearly 300 acres of land already has been acquired for the purpose, the paper said. (Editor's Note: As is usual with nuclear sites, Rooppur is not traceable on any decent sized map of Bangladesh. However, from the description it should not be very far from the Indian border. Could friends in West Bengal take the trouble to send in its exact location?)

But a lack of funds prevented construction of the plant, said BAEC briefing papers presented to the cabinet and obtained by the newspaper. Bangladesh suffers from a chronic shortfall of electricity, particularly in the summer when total production of 1,800 megawatts fails to meet the demand of 2,200 megawatts. The country uses locally-extracted natural gas and coal and imported oil to generate most of its electricity.

Government officials reportedly already are looking into suppliers for reactors, including China and Germany if they decide on a 300-megawatt product and the United States and France if they want a 600-megawatt plant, the newspaper said.

Indonesia Ready to Go Nuclear

Indonesia's plan to build two 600-MW reactors will be put before the country's Energy Co-ordination Board within 60 days said Djali Ahimsa, *{most appedately named—Editor}* the director general of Indonesia's Atomic Energy Agency.

Mitsubishi, Hitashi and Toshiba, one Asian diplomat said, are ready to build a reactor in Indonesia as a loss-leader. "The Japanese want to get a foothold in the Asian nuclear power market which is expected to grow," he said.

In advance of the nuclear power project, Ahimsa said, Indonesia has already expressed interest in Japa-

nese vendors' fuel cycle services. But Indonesia "still needs to assure the world that our programme is peaceful and transparent," he said. *{Heard that one before?—Editor}* He said, "We are counting on foreign credit financing for 80% of the project and for 20% of the funds to be raised in the Indonesian market."

France Hopes For Power Surge In Asia

France's state owned power company Electricity de France (EDF) is shifting its emphasis in Asia from passive consultant to active partner according to Jean-Christophe Delvallet, the company's Far East Managing Director.

EDF played a pivotal role in helping China design and build the Daya

Bay power station, a massive and controversial project near the Hong Kong border.

France's domestic energy market has been stagnant for several years, for EDF to look beyond its national borders for lucrative ways to expand the production and export of its energy. According to company figures, EDF earned a net income of \$526 million last year, up 18 percent compared with 1992. The increase was possible in large part because of the company's export business throughout Europe. "Now we are developing a good understanding of how things work in Asia," Delvallet said. "It is going to be a very important part of the world for expansion."

Ian Stuart UPI April 13, 1994

I Letter Box

You must be wondering who is more irregular and unpredictable—*Anumukti* or CANE members! Let me assure you that *Anumukti* has been far more active and regular than us. Though for a few months when the little journal did not appear, I sort of took it as Good News. After all magazines like *Anumukti* are not needed in a sane society. If you don't feel compelled to bring out the journal, the reason may be that the nucleocrats are also not being very active.

CANE as such has become quite inactive. We met recently after a gap of several months, to discuss your letter regarding Dr. Gopalakrishnan's offer of talks. The general consensus was that we should go along with the proposal, though everyone had his own reservations. There were doubts regarding the motives behind the offer. I am also not convinced that AERB chief could be ignorant of health effects of radionuclides / radiation. In your letter you

have suggested that his ignorance may be due to his engineering background, but being an engineer myself, I know that engineers are quite capable of understanding other subjects quite well. He may be testing the extent of your knowledge so as to use it in their campaign. But despite our apprehensions we all feel that the dialogue as suggested by Dr. Gopalakrishnan is a good idea. As a first gesture of openness why don't you ask AERB to send you *Nuclear India* regularly? (I did precisely that, and I have started receiving the rag along with *AERB newsletter* regularly. - Editor)

The news on Kaiga is somewhat encouraging. The Karnataka Chief Minister has declared that "all difficulties faced in the project have been cleared." Which means that the project has been having hurdles and will continue to do so. .

CANE has gone into such a deep slumber that most of us had forgot-

ten about April 26 altogether. There is no follow-up on the Supreme Court directive to Ministry of Environment, either. The next step required was hectic lobbying from North Kannada, but they too have gone into a coma. (This letter was written just before the dome collapse in Kaiga. Hopefully the reverberations from the collapse will shake the antinukes not only in Karnataka but all over, from their lethargy. - Editor)

I also wanted to join issue with you regarding the tone of your editorials, specially about the chaos 'created' by your computer. Being antinuke is no license for being anti-technology. There are no alternatives to good technology and computers are very good technology. Our problem is to identify what is good technology and what is not.

*Sanjay Havanur
Bangalore*

Anumukti for postcards !

Postcards have disappeared from rural Gujarat. For months on end we have been trying desperately to get a few and during our cycle yatra to Saurashtra we seqhed at each and every post office on the way without any success.

Anybody sending in his or her subscription in the form of 200 postcards will not only get six issues of Anumukti, but two extra back issues plus ofcourse our heartfelt gratitude expressed on a postcard.

Anumukti Vol.7 Number 4 February / March issue, seems to me one of the best issues ever. I particularly appreciate all the information published about Ms O' Leary's revelations regarding the secret US nuclear experiments on their own population.

It was most interesting to read that AERB chief visited Vedchhi!

Every Indian citizen has the right to full scientific information in clear language. That is why I feel that each Anumukti issue should carry a short list of facts regarding what nuclear energy is and what it does. **Knowledge is Power and one who knows can act and protest!**

*Sibylle Sharma-Hablik
Pondicheny*

I enjoy reading Anumukti very much, for its informative yet chatty style. Alas, constraints of time and a total absence of activism in Nasik prevent me from much more than being informed about nuclear issues. **But my good wishes and support are with you,**

*Sushma Sagar
Nasik*

There are vague hints about revival of Koodankulam. I have requested Sister Agnes of Thiruchirappalli to continue the local opposition at Nagercoil to the planned and aborted Russian plant.

The recommendation of European experts to close down the function-

ing two Chernobyl plants is another proof of the utter futility of the existing plant. The upward revision of mortality at Chernobyl from initial 31 to now seven to eight thousand is utterly shocking but not wholly unexpected.

Any data on the health consequences of the exposed population at Rawatbhata should be published in lay press from time to time.

*DrCN Deivanayagam
Madras*

I just got the latest Anumukti and I find that Dr. Zia Mian has sent you his articles which I had also received. If anyone contacts you, wanting copies of his articles **please** send their addresses on to me and I will send them Xerox copies.

*H. Basappa
21 Railway Parallel Road,
Bangalore 660020*

Subscription Information

*Rs. 30/- per year (6 issues) within India
U.S. \$ 15/- per year or equivalents other currencies for airmail overseas.*

Rs. 500/- for life (only within India)

Demand drafts should be drawn on the State Bank of India, Valod (Code: 0531) For cheques and drafts drawn on other banks, please add Rs 6/-

Subscriptions, donations and enquiries regarding circulation should be addressed to:

Editor Anumukti

Sampooma Kranti Vidyalaya

Vedchhi, 394 641 India

Tel: 02625-2074

Please do not send personal cheques or drafts addressed to Surendra Gadekar

Anumukti Team:

*Banaprava Naik, Sumesh Chandran, R. Ashok Kumar, Sanjay Havanur, Sanghamhra and Surendra Gadekar
Published by S Gadekar for Sampooma Kranti VidyaJaya and*

printed at

The Parijat Printry, Ahnwebed

PRINTED BOOKS