



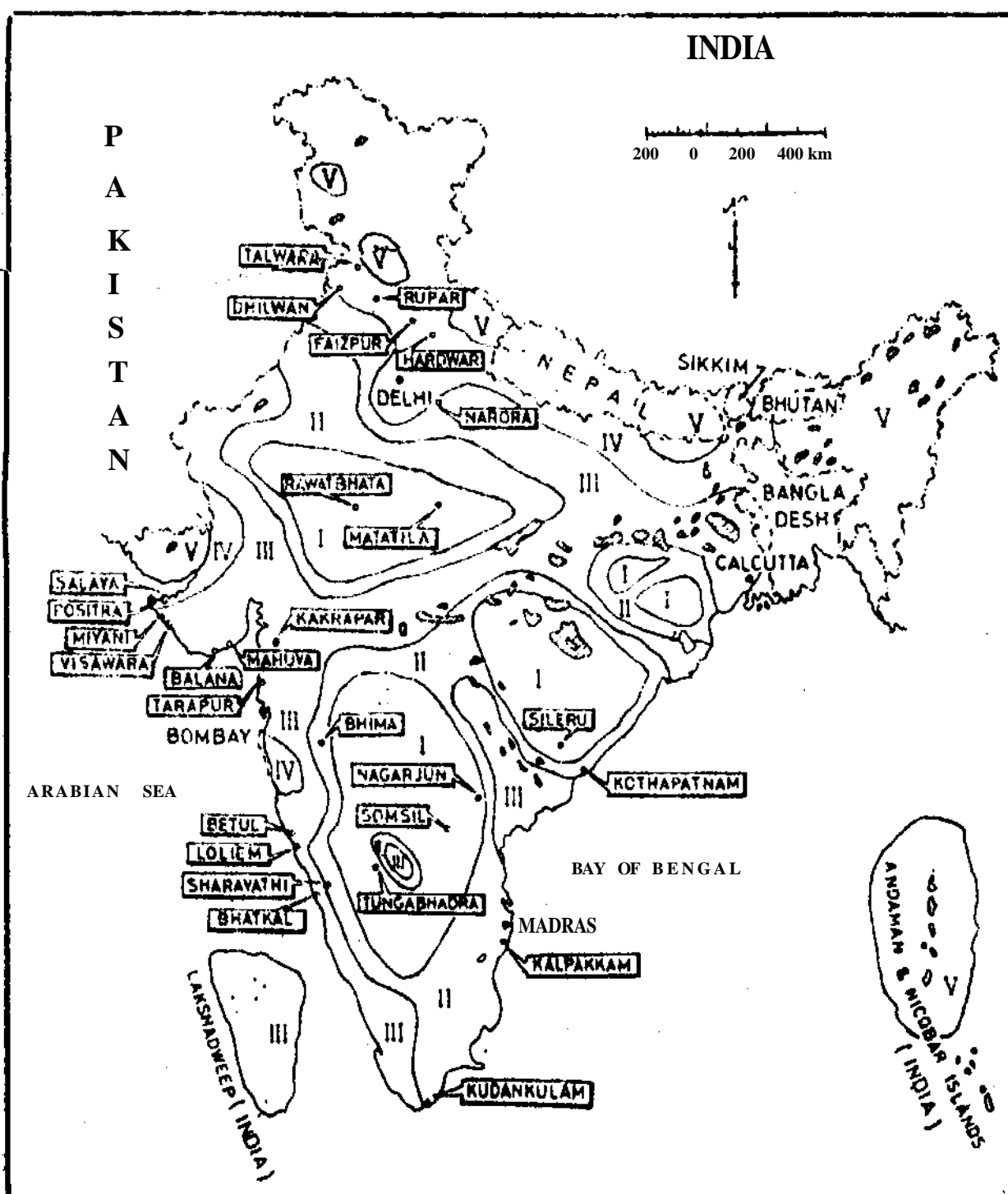
# ANUMUKTI

A JOURNAL DEVOTED TO NON-NUCLEAR INDIA

Vol. 1 No 3

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## THE HIT LIST



SITES INVESTIGATED FOR NUCLEAR POWER PLANTS

Seismic Zones I, II, III, IV & V correspond to V & less, VI, VII, VIII & IX on the modified Mercalli intensity scale  
Shaded areas depict coal deposits

In September 1970, Government of India constituted a national committee under the Chairmanship of Shri V.R. Vengurlekar to study in depth and recommend a panel of suitable sites for setting up nuclear power stations. The modus operandi adopted by the committee was to have site investigations carried out by agencies of the different states concerned. On the basis of all the accumulated data the committee made comparative evaluations of various sites.

The recommendations of the committee have never been made available to the public, despite repeated requests. However, the International Atomic Energy Agency (IAEA) and the OECD Nuclear Energy Agency jointly organised a symposium on 'Siting of Nuclear Facilities' in Vienna from 9-13 December 1974. In it a member of the National Site Selection Committee Shri L. Venkatesh and T.P. Sarma of the Health Physics Division of BARC presented a paper entitled 'Siting of Nuclear Power Stations in India.' This paper contains the map published on page 11 as well as a set of guidelines which were used by the committee to determine the relative merits of different sites. The symposium proceedings were published in a book form by the IAEA in April 1975. I strongly recommend this paper as also another by S. Krishnamurthy and S.D. Soman on siting considerations for fuel reprocessing plants (details in the next issue of *Anumukti*), to all antinuclear activists in the country. Unfortunately access to this paper is not easy. Therefore in the following I shall highlight some of the points discussed in the paper.

#### Site Selection Criteria

Site Selection depends to some extent on the proposed type of reactor. The Indian programme is based primarily on the natural uranium fueled, heavy water moderated CANDU type of reactors. All sites were evaluated on the basis of their suitability for setting up CANDU reactors of 1000 MW (c) capacity in stages. (Thus, existing reactor sites, e. g. Tarapur, Rawatbhata, Kalpakkam are likely to have additional units constructed on them.)

#### Distance from coal deposits

Even after recourse to creative bookkeeping it makes no economic sense to locate, nuclear

power plants in regions with large coal fields. The breakeven distance from coal fields beyond which nuclear power is expected to be cheaper depends on number of factors like pithead prices and the transport costs of coal, the difference in capital costs in the construction of nuclear and coal powered units the unit size adopted for nuclear units, etc. Estimates of this breakeven distance range from 500 Km. to 800 Km from pithead.

#### Water requirements

Nuclear power plants are thirsty monsters. They require enormous quantities of water for both process cooling and condenser cooling. The amounts required for a 1000 MW (e) station are 300 cusecs of freshwater for process cooling and 2500 cusecs for condenser cooling. Thus nuclear power stations can only exist near large (1200-1500 acres) reservoirs or canals or on the sea coast with some additional freshwater availability. Even with these huge amounts the temperature of the outgoing condenser water gets raised by 8 degrees centigrade. This outfall water when let into a reservoir forms warm water zones which deplete the dissolved oxygen in the water and consequently prove fatal to fishes.

Condenser water is also used for disposal of liquid radioactive wastes during normal operation at coastal stations. In other words, the sea is used as a dump not only for the heat but also for the radioactivity. At inland sites where water is needed for irrigation and other community uses, this philosophy of dilution and dispersal comes a cropper. Inland sites thus need large cooling towers and storage ponds for chemical treatment and subsequent controlled release to the environment.

#### Electrical system

Nuclear plants are extremely capital intensive with comparatively low fuel costs and hence it is best to utilize them to the maximum extent, possible. (In technical jargon—for base load with high load factor.) It is necessary that a good part of the power produced should be absorbed quickly after start-up to avoid problems of poisoning the reactor. This can be achieved satisfactorily only if there are large industrial loads in the grid in the vicinity of the plant which can come on line swiftly.

For the satisfactory operation of the plant an assured supply of adequate start-up power

of appropriate voltage from the grid is essential. The capacity of the nuclear plant should not be larger than 15% of the total capacity of all the generating units in the grid. Weaknesses in the grid can cause frequent tripping. The choice of the site of India's first CANDU reactor at Rawatbhata in Rajasthan was subsequently strongly criticised by a review committee appointed by the DAE itself (Prasad committee). The poor performance of the reactor was blamed on weaknesses in the grid.

### **Foundation conditions**

The geologic stability, the seismic susceptibility and the tectonic features of the area are extremely important from the viewpoint of nuclear plant safety. The nature and the magnitude of any possible future earthquake needs to be accurately estimated from geophysical field experiments. This information helps in determining appropriate design parameters for the station structures, equipment and safety systems. Unfortunately, the science of earthquake prediction is still in its infancy the world over. Even in an extensively studied region like California, last month's (1. 10. '87.) Los Angeles earthquake was on a previously unknown fault. In India, as it is, the available local seismic history is rather short. As recently as December 1967, the peninsular shield of India was considered one of the stablest regions of earth free from all seismic activity. The Koyna earthquake put paid to all such comforting theories. Today, some experts believe that human intervention in the environment, e. g. in the form of large dams, can by itself be the cause of alterations in the geologic stability. Therefore, the zones should be taken only as indicators of previous seismic history and not be considered too seriously as determinants of future earthquake activity. In the aftermath of the Koyna earthquake, changes were instituted in the design of CANDU reactors as it was found that the design adopted for Rawatbhata and Kalpakkam was inadequate to withstand moderate intensity tremours. God help us if as a result of the Narmada project there are changes in the stability of Madhyapradesh—Rajasthan region.

### **Environmental conditions**

In the normal course of operations, nuclear plants pollute the environment through controlled releases of radioactive nuclides in the form of gases. The acceptability of

such releases at a given site depends upon the disposal capacity of the environment, the concentration and transport processes of radioactive products in the neighbourhood of the site, utilization of the environment and radiation safety standards. Under accident conditions, plant behaviour is not under control and large releases of radioactivity to the atmosphere may take place. It is because of this fear of disastrous accidents that plants are situated in areas of low population density. Population distribution near the site, meteorological conditions, ground water flows, local environmental utilization are all needed for site evaluation. At present, no residential population is permitted within 1.6 km of the plant and up to 4.8 km is only thinly populated. Administrative measures are used to restrict the growth of communities around the plant. Care needs to be taken to see that the predominant wind directions are not towards any major population center. In fact because of the frequent storms, hurricanes, heavy littoral drift, etc. most of the east coast of India has not been found suitable for reactor siting.

### **Access**

Nuclear plant sites need to have good all weather roads connecting them to equipment manufacturing places as also ports of entry. The largest single piece involved for a 235 MW (e) unit is about 7.5 metres long and has a 7m diameter and weighs about 75 tons. For a 500 MW unit a single piece may weigh anything up to 280 tons. Movement of such heavy equipment to the site by tractor-trailer combination over long distances present many problems. Great length of roads concerned need to be surveyed and improvements made in bridges and culverts as well as changes made in road alignments and curves. All this takes a great deal of time.

### **Conclusions**

The moral of the story for the antinuclear activist :

Ideal nuclear sites are hard to find. There are many exacting preconditions, some of them mutually contradictory (low population density and close proximity to large industrial centers) which need to be fulfilled by an adequate site. In its eagerness to promote nuclear power, the nuclear establishment has made choices

like Rawatbhata which later experience has taught it to rue.

Any serious attempt to achieve the projected target of 10000 MW by the year 2000 AD would mean the prompt (next 2-3 years) acquisition of many of the sites shown in the map.

A strong antinuclear movement specially concentrated around the sites in the form of well organised local groups can still prevent large scale nuclearisation of India. It is not yet too late.

Besides the points discussed above, Indian reactor sites pose a special hazard. The whole programme is based on the reprocessing of spent fuel to extract plutonium. Transport

of highly radioactive spent fuel between reactors and reprocessing plants is hazardous. Considering the road and traffic conditions at present in the country DAE proposes to build small reprocessing plants right next to the reactors. Unfortunately this remedy is worse than the disease it seeks to cure. Reprocessing plants are a bigger menace to the surrounding environment than even reactors. The consensus of opinion the world over has been either to dispense with reprocessing altogether or to build large central reprocessing facilities and take the transport risks. In the next issue of *Anumukti I* shall discuss siting criteria for reprocessing plants.

*Suraidra Gadekar.*

## LETTER BOX

Each era has had to face some challenge to the continuation of civilisation. However, mankind has managed to turn back from the precipice in time to save itself. I hope we still retain enough sanity to be able to solve the issues concerned with use of nuclear energy. The other side of the coin is that every new invention has brought in its wake a group of people who have felt that the new invention may lead to doom. May be, their constant vigilance and warning is what has led to 'taming' of the new invention enough to control its capacity for doom. However, if we have as a race met all these past challenges, why should we doubt that we can and will do so once again? No doubt, there must exist and thrive a band of vigilantes who take up such issues and work as the voice of conscience and sanity. Secondly, I feel that in the context of the world situation as it exists today, your voice of reason and sanity is too weak to be heard or to have an impact.

*Sharad Shirodkar  
Bombay*

It was interesting to hear about the work against nuclear industry in India—I keep wondering how one can oppose both nuclear weapons and nuclear power in a non-adversarial way. I have found in the U.S. that we are a 'nation of protest movements'—not a nation of peace movements. I have recently written a book called "WAYS OUT, a book of

changes for peace'. I find Gandhi's constructive protest a wonderful resource. I do not believe we can ask people to give up jobs in nuclear industry without carrying them a gift of some alternative possibilities for work.

*Gene Hoffman  
Santa Barbara, California*

This is in response to the letter written by Shri N.G.Goray (Vol. 1 No. 2, October, 87). He seems to live under an illusion that scientists will find some way (one day) to separate nuclear energy from its attendant destructive elements and further that they will know how to control the BRAMHASTRA they have invoked. Any dilemma of science is also the dilemma of our entire civilisation. But for him the problem of nuclear energy seems to be the persisting dilemma of science alone. If one knits his emphasis on mastering energy (underlining the national and international political implications to enforce hierarchy) and the question of signing of a nuclear free zone agreement amongst China, Russia, Pakistan and India (a most improbable event) one finds that his vision is that of a nuclearised India living under a conceptual deception known as the 'doctrine of deterrence'. We should instead strive for a non-nuclear India and a nuclear free world in the interest of preserving both ours and the global civilisation.

*R.Mani Vannan  
Delhi*

# Save The Western Ghats-March

About a year ago, environmentalists working in different voluntary organizations in South India-Kerala, Tamil Nadu, Karnataka, Goa and Maharashtra, met in Goa to discuss the environmental problems of this region and share their experiences.

These discussions brought out the important role played by western Ghats in India's environment, cultural life and economic development. The Western Ghats which rise in the hills of Southern Tamil Nadu stretch out into a range in Kerala, Karnataka, Goa and Maharashtra. All the eastwards flowing rivers of South India originate in the Western Ghats. The high rainfall region of these Ghats contain an invaluable wealth of flora and fauna. They provide the raw material for an innumerable number of artisans in the region. They contain the most varied kind of Horticultural gardens of Rubber, Coffee, Pepper, Cardamom, Areca and Coconuts, In short the Western-ghats are a backbone for the economic well being of the entire southern part of India.

However, in the last few decades, the Western Ghats have been exploited beyond reasonable limits under the pretext of 'development'. The hydroelectric projects built to support a chain of heavy industries have destroyed lakhs of hectares of pristine forests. Vast tracts have been felled to provide raw materials to industries. Mining activities too have had their toll. These areas continue to be barren even after all mining activity has ceased. Valuable trees have been felled to meet the needs of the rich urban dwellers and for export. In the long term these activities will convert this unique ecological niche into a desert. Further there is fear of major earthquakes on account of the gigantic dams built in this region. The faults observed under the Supa dam are indicative of this danger. Together with this, bad management of the forest resources by the people, such as attempts to cultivate hillslopes, deforestation to meet the fuelwood and green manure needs and unrestrained grazing by cattle, goats and sheep have further degraded the Western Ghats.

In Karnataka, the environmental problem has been compounded by the presence of several

factories that have been polluting the environment on a massive scale-along the Tungabhadra, at Ammasandra, Nanjangud, Karwar, Mangalore and Bhadravathi. The Kali, Varahi and Sharavathy Projects have caused large scale destruction of green forests. Thousands of hectares of village common lands have been transferred to Karnataka Pulp wood Ltd., a Joint Sector Company for raising of eucalyptus plantations for industrial needs. On the pretext of energy short fall, a nuclear power plant is being planned at Kaiga. The problems of people uprooted from the sites of these various schemes have multiplied over the years and spread from Ramanagar to Kadra, Kodsalli and Kaiga.

After seven months of preparation and involvement of over 150 voluntary organizations Save the Western Ghats March began on November 1st from the southern tip at Kanyakumari and the northern tip at Navapur towards Goa.

The organizers hope and are working towards identifying concerned young men and women who can be important part of this people's movement and can facilitate the organizing of the affected people who could take initiative in planting trees on large scale, try to bring pressure on the authorities and preventing further denudation of the Western Ghats and also bring the Wastelands to productivity to meet basic needs of rural and tribal people especially the poor e.g., fodder for cattle, fuel for cooking, raw material for artisans, small timber for housing, green leaves for manure and fruits. As one organiser said "the basic responsibility of preserving and sustaining the environment and ecology is best left to the people, bureaucracy and state playing the role of an enabler (Not producer, as the forest bureaucracy has tried and failed). Only awakened people can act as safeguard against further destruction of environment and also regenerate the barren areas to meet their basic needs".

The experiences of the Marchers from both ends will be shared in the two day meeting on January 29 and 30, 1987 in Ponda, Goa. This is followed by a three day Conference, where the Marchers together with other Envi-

environmentalists and concerned persons will evolve a long term strategy and possible organizational framework for the Central involvement of people for restoring and sustaining the ecological balance for the Western Ghats.

The effort which is taking the shape of the people's movement has the potential to contribute not only to the saving of the Western Ghats, a significant and basic part of the ecology of the Southern India but also save the whole country and world from the ecological disaster.

*Kumar. Kalanand Mani  
and Sri. S. R. Hiremath*

*C/O. Samaj Parivartana Samudaya (SPS)  
"Ashadeep". Jayanagar Cross. Saptapur,  
Dharwad-580001, Karnataka.*

## The Brazilian Horror

"Never have I seen such a tragedy", affirmed the physicist Jose Rosenthal of CNEN (the Brazilian Nuclear Energy Commission), referring to the spread of radioactive cesium-137 in the central Brazilian town of Goiama. The accident involves approximately 100 gms. of Cs 137, 'an amount similar to the total Cs fallout on the whole of West Germany following the Chernobyl disaster) and has already claimed 4 lives with 40 more hospitalized of whom many are not expected to survive.

In Brazil workers are legally required to provide their employers with X-ray photographs of their lungs. This has led to the proliferation of private radiological clinics set up by people with lot of money and no scruples. The cesium in powdered form was contained in a lead box found by some men in an abandoned radiology clinic. They sold the lead cask to a scrap metal dealer who opened it. Reports say that people present were fascinated by the luminosity of cesium and started, playing with it. Maria Gabriella, the 6 year old daughter of the scrap metal dealer rubbed the powder all over her body and paid for her innocent, exuberance with her life.

The powder has contaminated a whole neighbourhood. People took the glittering

powder home to show it to their family and friends. When the horrible symptoms started appearing they tried to wash it all off thus contaminating the water drains. Then panic gripped the city. Its one million citizens became national pariahs. 30,000 people visited control posts in a ten day period, Business in the city fell by over 60%. Not many people wanted to buy food or clothing for the fear of contamination. Many abandoned their homes. People had to produce certificates from the CNEN testifying their radioactive 'cleanliness'.

The tragedy has highlighted the total confusion and unpreparedness of the authorities. When news of the accident became known, 42 technicians from CNEN travelled to Goiania, where many of them worked without proper protective clothing. The machines brought for measuring radioactivity quickly broke down, the measurements were inaccurate and one technician as well as four policemen were contaminated. The patients were transferred in ordinary ambulances which were used without decontamination for days. The hospitals did not have enough disposable clothing nor isolated rooms for the victims. At least two nurses and one doctor were also contaminated.

The problem of what to do with the radioactive waste has not yet been solved. The football stadium where the victims were first brought for checks needs to be decontaminated. There were suggestions that it be washed and the grass burnt. Unfortunately radioactivity cannot be got rid of so easily : The water will run into the sewer system and fire will make the radioactive particles airborne spreading contamination far and wide. Cesium has a half life of thirty years and thus contaminated material can remain a threat for hundreds of years. It is for this reason that the residents of the city do not want burial of the accident victims in the city cemetery though they have been placed in coffins with layers of lead and concrete each weighing 600 kg.

Source : WISE news communique 281.2428; 282.2843  
The Telegraph : 4.11.'87

## Protest against Kaiga

Peace activists wearing distorted masks and spotting snappy anti-nuclear badges and T-shirts marched along with their children to Raj Bhavan on November 15th morning, simulating the horrors of a radioactive environment, to oppose the Kaiga Nuclear Plant as well as the ongoing atomic projects in the state of Karnataka.

The marchers belonging to the Citizens Against Nuclear Energy (CANE) dropped flat every 50 feet on the way-(they call it 'rod show') stopping curious pedestrians and motorists.

The silent processionists presented a memorandum to Governor A. N. Banerji urging him to convey to the Centre their "no" to the Kaiga Plant, Ratnahalli Uranium Plant, uranium mining at Arebail and to the reported nuclear waste disposal plant at Kolar Gold Mines.

A "Statement of Public Concern" signed by 60 prominent citizens and expressing serious concern at the "sudden spurt" of nuclear related activities in the State during the past two years was also released on the occasion.

The statement signed among others by Gorur Ramaswamy Iyengar, Dr. U. R. Ananthamurthy, Prot. Gopalakrishna Adiga, Dr. Siddaiah Puranik, Dr. Shivaram Karanth, Dr. H. M. Nayak and Dr. G. S. Shivarudrappa. It demanded at least a Moratorium on the Kaiga nuclear plant and the Rs. 350-crore Rare Earth Mineral Plant (REMP) at Ratnahalli' near

## Access

We strongly recommend our readers to read Arjun Makhijani's article "Low Level Radiation and Cancer" which appeared in the October 31st, 1987 issue of *Economic and Politick Weekly*. A recently published BARC study by K.S.V. Nambi and S. D. Soman on the relationship between radiation levels and health status in 5 cities in India tried to indicate that higher radiation levels correlate with lower

Mysore till an impartial analysis of environmental impact was made, public hearings conducted and a national debate on nuclear energy question held as promised by the Prime Minister.

They also demanded the immediate repeal of the Atomic Energy Act of 1962, release of information pertaining to all nuclear related activities in the State, setting up of an energy information cell, evolution of methods to expose every MLA and MP to the factual information on energy economics and nuclear truths and making of the Atomic Energy Regulatory Board fully autonomous.

Briefing reporters, CANE members Suresh Heblkar, Mr. Nagesh Hegde and Mr. H. S. Doreswamy said the Kaiga plant, besides exposing the forests and the Kali river to radiation, also involved a security risk with the concentration of large dams and a naval base.

The Rare Earths Plant at Ratnahalli was consuming 66,000 KW of power from the State grid and one lakh gallons of water from the KRS dam. They maintained that the enriched uranium produced from the plant would be of no use to any of the reactors in the country.

They accused the Government of casting away the basic tenets of participatory democracy in keeping the academic scientists and elected representatives off the information on nuclear plants and indulging in large scale 'disinformation'.

incidence of cancer. Makhijani finds that not only is the data used in the study deficient, but the analysis is faulty and important contributory factors entirely ignored. He calls this paper "a shameful piece" of work presented in the guise of science," which not only discredits the authors but also BARC (Bhabha Atomic Research Centre) and the referees and the publishers of the Journal *Health Physics*.



# Radiating Complacency

*The International Commission on Radiological Protection (ICRP) is a panel of experts born out of a gathering of radiologists in 1928 at Stockholm. Supposedly watchdog of public health, they have over the years zealously guarded the interest of the 'experts' (nuclear industry in particular). Below we reprint 3 articles from two magazines which have in the past taken a generally pronuclear stand.*

The limits set for exposure to radiation are far too lax

The experts on radiation have got it hazar-dously wrong. ICRP used to believe that there was a safe level of radiation exposure. Then, in the 1960s, it admitted that the risks of radiation simply increase with the dose received; there is no level of exposure below which radiation is completely safe and above which it becomes nasty. The commission said then that the change in risk should be treated as smooth, even for small doses. It probably shouldn't be. Some new evidence suggests that risk may even rise faster at low levels of radiation than at higher ones.

For practical purposes a safety line has to be drawn. The ICRP, which is meeting at Come in Italy, is supposed to chalk in that demarcation line. The present line is drawn at 50 milli Sieverts (mSv) a year for those subjected to radiation at work; for members of the public it is five mSv a year, with a recommendation that their average over a lifetime should not exceed one mSv a year. So a worker getting the full 50 mSv a year will in 1½ years suffer the full dose an ordinary person is supposed to be permitted in his lifetime. And the permitted limits themselves suddenly look too high for the public, and far too high for the workplace.

The commission is concerned mainly with two things. One is a measure of the link between radiation dose and cancer risk; the other is a criterion of acceptable risk. The "safe limit" is the dose that carries the highest acceptable risk of cancer. The latest ICRP risk estimate (set in 1977) states that if 100 people each receive a dose of 50 mSv over a year, 625 of them will

eventually die from radiation-induced cancer. So a person who has a year's worth of radiation at the workplace limit faces a risk of death of one in 1,600. Over a working life of just under 40 years, those annual risks add up to a chance of death by radiation-induced cancer of around two in 100.

Many people now think the risks are much greater. In 1980 a joint sub-committee of America's National Academy of Sciences and the National Institutes of Health gave a higher risk estimate: between 790 and 2,500 deaths per 100,000 per 50 mSv per year. Recent studies of the survivors of the Little Boy and Fat Man atomic-bomb attacks on Japan also suggest that the relation between dose and cancer has been underestimated. More than 800 scientists and doctors have sent the ICRP a petition calling for an immediate reduction of present permitted limits by four-fifths.

It is not surprising that experts differ. They always do. The flaw in the present system is that the particular group of experts that set the international guideline has persistently shown a bias towards complacency. The ICRP played no part in the campaign to stop the tests of nuclear weapons in the atmosphere—tests which, according to some estimates, could by the end of this century have caused up to 3m people to die prematurely. It withdrew its support from the rule which limited x-rays of women to ten days after the start of their periods in order to avoid irradiating a very young embryo. Although nobody is sure that x-irradiation at such an early stage is harmful, the damage done by x-rays later in pregnancy is proven. The commission is open to the charge that it puts the convenience of radiologists above all.

To deserve public confidence, the ICRP needs either to cut the present limits on exposure to radiation or provide a convincing answer to its critics. Widening its membership to include representatives of the public and workers who are exposed to radiation would help.

Source : The Economist (12. 9. '87)



## The legacy of the A-bombs

The survivors of the atomic-bomb explosions in Japan are one of the main sources of information about the effects of low-level radiation. Their response to doses of radiation—including quite small ones—has been carefully monitored since the 1950s and is used to work out the likelihood of harm for various levels of exposure. Any reassessment of the Hiroshima and Nagasaki data has an effect on risk estimates in the nuclear industry and in medicine.

Such a reassessment is now underway and many of the results have recently been presented by Professor Edward Radford, an epidemiologist at the University of Pittsburgh in Pennsylvania. One of the main problems with the data is knowing what doses were received by the survivors. Little Boy and Fat Man, the bombs dropped on Hiroshima and Nagasaki respectively, were, after all, the first of their kind. The radiation characteristics of Fat Man, a bomb that used plutonium, were well enough understood for dose figures for various distances from ground zero (the point on the ground directly below the explosion) to be calculated. Little Boy was a different sort of bomb, using uranium. For some time it had been thought that the two explosions were different, in that Little Boy gave out more of its radiation in the form of fast neutrons than did Fat Man. Now it appears that the harm done by neutrons was about the same in each of the explosions.

This has two main implications. One is that more of the cancers found in the population of Hiroshima than were previously thought were caused by electro-magnetic radiation (that is, gamma rays and x-rays which are more common in everyday-life than are fast neutrons). The other is that the statistics on cancer rates among both Hiroshima and Nagasaki survivors can be pooled, allowing more reliable measurements of the relation between radiation dose and cancer.

The dosage levels received by the victims of Hiroshima are also being recalculated. New evaluations of the shielding provided by moisture in the air—it was a hot, muggy day—have almost halved the estimates of radiation dosage received. The incidence of cancer may have been underestimated, too. Some forms of cancer can sometimes be overlooked. They turn up more often in careful autopsies than on routine death certificates. Among the cancers that

appear to have been underestimated on Japanese death certificates are those of the lung, liver, pancreas, prostate and urinary tract. This has made it hard to derive figures about the relative susceptibility of various body tissues to radiation-induced cancer. For example, if figures from death certificates are used, no significant relation between prostate cancer and radiation dose is found. If figures from the special tumour registries in the two cities are used (these are more accurate and also include non-fatal cancers) a relation between cancer and radiation is found.

Another reason that estimates have been low is that the survey, unfortunately, is not yet finished. The cancer rate in the two cities is still above average. Most distressingly, the cancer rate for people who were under ten in 1945 is very high, eight times higher than that for those who were over 35. This provides an illustration of the way that sensitivity to radiation depends on age, and shows that children are particularly at risk.

Another fact to be considered when looking for lessons from the bombings is the general health of the sample population of survivors which, five years after the bombing, was better than normal, insofar as their death rate was below average. As well as radiation, they had survived fire, blast, exposure, hunger and extreme grief and stress. A large number who survived the immediate effects of the bombing had soon died of a variety of common diseases; many died who might otherwise have developed cancer. Thus the five-year survivors were a rigorously selected group, not a typical population. Some scientists suggest that more accurate figures may eventually come from studies of the 135,000 people who were evacuated from the Chernobyl area.

That evidence will take many years to arrive, until then, the survivors of Little Boy and Fat Man will continue to dominate thinking about the effects of low-level ionising radiation. Professor Radford argues that this evidence, as it now stands, clearly shows that the risk estimates sanctioned by the International Commission on Radiological Protection are too low by a factor of as much as ten.

Source : The Economist (12. 9. '87)

### Rethink on radiation dose limits in Britain

The British government is likely to amend its present radiation dose limits following advice from National Radiological Protection

Hoard based on information from a preliminary reassessment of fatal cancers in the survivors of Atomic bombs.

In September ICRP concluded that the results of the Japanese study raised the risk estimate for the exposed population approximately twofold. The ICRP decided against immediately recommending a change in dose limits and will not issue new advice till it has completed a review, likely to take at least two years. NRPB is recommending an annual dose limit of 15 mSv for radiation workers and

0.5 mSv for members of the public. (The present limits are 50 mSv and 5 mSv respectively.)

Revaluation of the Japanese data means that the risk associated with continuous exposure at the occupational dose limit of 50 mSv per year has increased from 1 in 2000 per year to about 1 in 700 per year : a level of risk that "verges on the unacceptable" according to Roger Clarke NRPB's director.

Source : Nature 330, 304, (26.II.'87)

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## The only Source

A common refrain in the sales pitch of nuclear advocates is that nuclear energy, whatever its problems today, is the only energy source capable of meeting future needs. Dr. Raja Ramanna, the erstwhile Chairman of the Department of Atomic Energy (DAE), made this claim a number of times. In his words, "Nuclear power is the only option for meeting the future needs of power in the country. We in India must not miss this new industrial revolution; for if we do we are bound to lead ourselves to total economic disaster." Sales people are notorious for their zeal. They skip over the 'small print'. Consumers on the other hand, need to be cautious and pay special attention to the small print, or else they risk being taken for a ride.

Before we get into the argument regarding the innocuous-looking "only" one point needs to be clarified. People do not need energy per se : They need energy to accomplish certain tasks e.g. lighting, cooking transportation, manufacturing etc. Electricity is well suited

for certain applications and not so well suited for others. In any case, only about one sixth of the country's total energy needs are met by electricity at present. Nuclear power can deliver energy only in the form of electricity. Thus it is clear that nuclear power can never be the answer to *all* our energy needs. However, let us examine a much narrower claim : can nuclear power totally satisfy at least our electricity needs of the future?

What is the situation with regard to electricity consumption today? Barely 2% of the electricity consumed in the country today comes from nuclear reactors. The rest 98% comes from coal (75%) and hydroelectric (33%) plants. Thus, coal and hydel power are well established and proven technologies. New ways of producing electricity based on the sun, wind and biomass make a negligible contribution at present.

The first contention of the pro nuclear argument is that after, twenty years of almost 'heroic effort' nuclear technology has attained the status of a mature technology. "Nuclear

energy has been established as an economically viable, competitive source of power." This bold statement often loses its strength in all the moaning about teething troubles which are invoked to explain away the poor performance of our nuclear units. However, for the sake of argument we shall assume here nuclear technology to be fully mature with all the teeth (including wisdom ?) fully revealed,

A change from a mere 2% contribution today to an overwhelmingly dominant role in the future would indeed be revolutionary. The nucleocrats justify this proposed change on the grounds that non-nuclear sources suffer from short comings that prevent their continued expansion. These short comings are of two types \*

1) Limited potential and an uneven geographical distribution : Thus, although only 17% of the total estimated hydel potential of 75000 MW has been tapped till now, expansion beyond 40000 MW is considered unpractical since most of the hydel power sources are concentrated in the Himalayas, far from the consuming centers, and transmission losses pose a great constraint. Similarly, although the country has large coal deposits (enough to last a thousand years at present rates of consumption) a greatly expanded programme of electricity generation based on coal could lead to depletion of the source in just a hundred years. Again, most of the coal deposits are concentrated in the eastern region

11) Environmental hazards Large dams cause extensive damage to ecosystems in their vicinity and change the health, productivity and ecological balance of downstream areas. Coal is difficult to mine, handle and transport and its burning produces a heavy burden of wastes and pollutants.'

Curiously, nuclear power does not stand up too well either under an examination applying the very same criteria that are used by pro-nuclear people to reject coal and hydro electricity. The environmental hazards of nuclear power shall be a constant refrain in *Anumukti* and we pass over them now without elaboration. Since only a relatively small amount of nuclear fuel (compared to coal) is needed in a nuclear reactor, at first glance it seems as if a reactor can be set up anywhere thus reducing the adverse effects of uneven geographical distribution of other power sources. In practice,

the requirement nearby of a large body of water (sea, lakes etc) for cooling and big enough electricity distribution grid severely restrict the choice of site. Nuclear power requires a very large infrastructure and as time goes on the availability of this infrastructure begins to act as a magnet for future nuclear growth. Thus, the trend worldwide has been towards clustering rather than dispersal of nuclear reactors. This clustering is sought to be justified on safety considerations since the transport of spent fuel is specially hazardous. For whatever reasons the fact remains that given time nuclear power plants start showing the same uneven geographical distribution as large hydroelectric plants.

The constraint on expansion arising from limited availability of raw materials, applies far more crucially to nuclear power than coal since uranium deposits in the country are far more scarce than coal. If DAE's current plan of generating 10000 MW does become a reality, the uranium deposits will be exhausted in a mere 30 years. Thus, on all counts, whether of limited expansion potential, geographical maldistribution or of environmental degradation, all the "mature" technologies suffer from equally serious short comings.

At this stage of the argument the nuclear advocates bring out the joker from the pack. Although, they say, the uranium supplies are just enough to sustain generation of 10,000 MW for 30 years, during this period such a programme would result in the production of 3200 kg. of plutonium every year. This plutonium after reprocessing would enable the setting up of one 1000 MW fast breeder reactor (FBR) every year. An FBR produces more fuel than it consumes and in a programme based on FBR's even the country's present uranium supplies can sustain a much larger (a 250,000 MW) electricity generation. Besides there are vast quantities of Thorium available in Kerala, which with the help of plutonium produced by fastbreeders will allow an even larger programme in the later half of 21st century. With visions of 350,000MW (i.e., around 350 times the present production), one is apt to overlook the fact that the vision depends not on the mature nuclear technology but on a wholly different beast not yet fully recovered from its birthpangs: the fast breeder reactor. The only statement one can make with no

fear of contradiction about the fast breeders is that their teething, growing, adolescence, marital, menopausal, senility problems all await us in the future. Only France has built one FBR, on anything like a commercial scale and that reactor has been beset by many problems. The capital costs of FBRs are much larger than the already sky-high costs of thermal (ordinary) nuclear reactors and that by itself makes the electricity produced in breeders at least twice as expensive as that generated in ordinary nuclear reactors. The financial disaster they portend is not the only reason to be wary of the fast breeders. They have many unresolved safety problems : for instance, unlike the thermal nuclear reactors, FBRs can explode like nuclear bombs. But even if all the safety problems are satisfactorily resolved, an unlikely eventuality as Chernobyl and other disasters teach us, FBRs still pose a very serious threat to society. Defending the weapons grade plutonium they produce in large quantities, from theft, sabotage and terrorist attacks would be a horrendous safety problem requiring imposition of police-state measures.

What do the pronuclear people have to say about the potential of the newly emerging electricity generation technologies based on renewable resources ? One of the most attractive characteristics of sources like the Sun, wind, small hydroplants and biological wastes is their wide-spread geographical distribution and the very short time it takes to put up a generating unit. These sources are nobody's monopoly and lend themselves rather easily with very little environmental disruption to small scale electricity generation to meet local (village-level) needs. Their costs too have rapidly come down in just the last decade because a little more money has been invested in their research. Thus, they are ideally suited to meet the future electricity as well as other primary energy needs of Bharat. Unfortunately, the very diffuseness of these sources is an anathema to the nucleocrats their whole thinking is geared to a few large units producing hundreds to thousands of Megawatts, with everybody in the country tethered to a grid and they themselves in control. Such a large format power distribution system, incidentally, has its own disadvantages universally. But particularly in India, which has experienced

three wars in three decades, and where the best of technologies are put paid to by inadequate maintenance, smaller generating units with some surplus capacity for needs of neighbouring areas, seem the ideal solution. The nucleocrats consider all such technologies only in terms of their Potential for bulk production and reject small scale units on the following counts :

- i) They are as yet unproven
- ii) They are as yet uneconomic
- iii) In the bulk production mode, they too cause environmental problems due to excessive land use, etc.

There are both sensible and silly ways of producing electricity. Ways which are in harmony with both the nature of the source (diffuse/intense) and also with the cultural living patterns of the people who are going to use the energy produced are sensible; those in disharmony are silly. For example an array of thousands of synchronised mirrors concentrating sunlight on a huge tank of water to produce steam, is as silly a way to boil water as a nuclear reactor. For one thing, it suffers from the same high capital intensity, long construction times, inflexibility and similar other problems that beset nuclear energy. The point to note is that even these admittedly silly ways are cheaper, certainly more 'proven' and ultimately less threatening than the fast breeder. That this is not a mere pipe-dream can also be easily proven. In California alone, for instance nearly 10000 MW of new electricity generation capacity based on renewables has come up in the last six years.

Indeed the answer to the question of just what electricity source would meet our future energy needs would depend on the kind of society we want to build. A society of conspicuous consumption and conspicuous waste in which all production is centralised, in which the demands of bulk consumers get preference over the small needs of the masses, in which a handful of people control the destinies of many, which has a large paramilitary and military apparatus safeguarding the security of the state, whose nuclear arsenals are a constant threat to its neighbours...such a society may feel the need to pursue the nuclear path.

But for a just and equitable society as envisaged by the founding fathers of our nation, nuclear energy is a dead end route, and the quicker we abandon it the better

*S. N Gadekar.*

# Objectivity Meltdown and Obsessive Cynicism

A rather provoking article by Joe Kramer appeared in the March 1987 issue of the magazine of American Journalists, *The Quill*. "The Objectivity Meltdown" was apparently meant to ridicule efforts like *Anumukti's* to provide the public with unbiased information regarding nuclear energy. Once you realize, however, that Kramer is the press spokesman for the Wolf Creech Nuclear Power Plant in Kansas city Missouri, you will appreciate that the article was written in real earnest.

Kramer admits his bias openly. So the anti-nuclear reader would feel like saying "No wonder!" But the argument turns pretty soon against anti-nuclear attitudes. For Kramer 'discovers' vested interests on the side of the critics of nuclear power :

Leaders of the anti-nuclear power movement are inclined to portray themselves as mankind's saviours.. The antinukes describe themselves sanctimoniously and disarmingly as consumer advocates, environmentalists, public interest activists, industry critics. But they have no more claim to moral superiority than do the nuclear scientists and industry spokesmen who are made to look sinister by comparison because they are on somebody's payroll....

We would do well to remember, though, that not only is this argument old, it is also specious, because there is no essential connection between being paid for work and the nature of anti-nuclear protest. Kramer tries to assign the same questionable motives to the anti-nuclear protester as those that have been known to activate the supporter of nuclear power. And it is patent now that the supporter of nuclear power as a class refuses to take into account the lasting human considerations (as opposed to commercial or other short-term considerations) regarding consequences of nuclear proliferation. As for professionalism, we wish that antinuclear protesters were more professional than they are now !

As for financial backing and power, a comparison of the production quality of *Anumukti* with that of *Nuclear India* will reveal without doubt all that goes by way of advantage, which the words of Dr. Raja Ramanna, for instance, enjoy. Such advantages of establishment backing do not restrict themselves to the nuclear concern. And incidentally, could

a pro-nuclear establishment ever afford to keep spokespeople candid in criticism of shortcomings and dangers inherent in the nuclear idea and nuclear technology? Witness also the expensive powerhouse of administrative, legal and para-military and military support which governments committed to nuclear energy have had to call upon all the time. Whatever can be these attractive carrots that tempt the anti-nuclear workers, we wonder, for Kramer says,

Anyone who works professionally against nuclear power is getting a paycheck just as surely as is the person who works to gain acceptance for nuclear power.(-p.15)

We notice, by and by, that Kramer becomes more direct. Behind the activities of "the anti-nuke gurus" he discovers hidden agendas with the help of which they deceive and misuse "their fearful followers". Some of them even, he says, have "fairly radical goals". Well, the avowed agendas on both sides, pro and anti nuclear power, are quite obvious. Undeniably, too, some on both sides may possess questionable motives; such motives are hardly an anti-nuclear monopoly! To eradicate doubt in the minds of readers of *Anumukti*, all the same, we state in plain terms our motive and agenda (that is, if the title leaves them in any doubt) : liberation from a nuclear policy which implies a centralisation of nuclear power (in terms of its political and economic power), neglect of the interests of the majority of the population for the benefit of a few, disregard for human and environmental health within and outside the country. Admittedly, these thoughts are bound to appear radical to those staring at illusions of a nuclear paradise in the 21st century.

Having thus cleared *Anumukti*, we hope, of the bias of "the antinuclear power people and their misleading views," let us proceed to the way Kramer discredits the journalists reporting about nuclear accidents. Kramer, who himself had been a newsman for long years, is concerned about the missing professionalism, i.e., objectivity, of his former colleagues : they "glamorize" the anti-nuclear movement, because this serves to make their stories



sensational; they rely on anti-nuclear information in a disproportionate way and this reliance results in an "all-too-obvious anti-nuclear tilt" in the media. They do not just report what *has* happened, but they have gone *so far* as to stress the "what-ifs".

In a letter-to-the-editor appearing in the May number of *The Quill*, the journalist Timothy Lange from the *Los Angeles Herald Examiner* explains how what Kramer calls his "obsessive cynicism on the nuclear power issue" developed :

..after a few years of catching spokespeople for the industry and the Atomic Energy Commission in repeated distortions and outright lies, I began to question the bright-new-tomorrow press releases I had once swallowed so eagerly.

Is this "healthy scepticism, the hallmark of American journalism", which Kramer misses in the reporting of the media on the Three Mile Island and Chernobyl accidents, wrong if it slowly discovers the unholy alliance between governments and nuclear industry ?

Timothy Lange : "My scepticism turned cynical after I became better acquainted with the frightfully scandalous history of the nuclear industry and the relevant federal bureaucracies without which commercial atomic power would never have been developed."

Tom Gardner, writing for the Union of Concerned Scientists, which has been severely criticised by Kramer for its anti-nuclear position, underlines Lange's argument and shoots back :

Kramer is off base in suggesting, with no evidence, that media coverage of nuclear energy exhibits an intentional bias against nuclear power.. Kramer's article is a good example of why experienced journalists don't just wrap up their stories and send them to their editor after talking to the local utility spokesman (p 10/11). (In the US electricity is supplied by private utility companies.)

In the *St. Louis Post-Dispatch*. Patricia Tummons, defends a critical approach to the nuclear issue by noting that :

Responsible reporting on any undertaking that has potentially devastating consequences for the environment must address this issue.

i.e., even professional journalists have to go beyond just describing the disasters that had happened so far. They have to warn as well.

What does the other side say ? Here is Dyek Smyser, of *The Oak Ridger*, Tennessee, who characterises himself "as a newspaper editor for nearly 40 years in a community whose reason for being is nuclear technology, as a personal friend and neighbour to hundreds of persons involved with that technology".

Smyser, who has "felt the same frustration that Kramer has", also observes that the media

have resorted far too, often to discussions of the "what-ifs" and he explains this situation

by the *fact* that no "what-as" i.e, objective statements of nuclear catastrophes, was available. With Chernobyl the situation has changed

To the extent that Chernobyl furnished facts rather than speculation about the causes and effects of a nuclear power plant disaster, it could contribute significantly to a more accurate public conception of nuclear power,

While the surprised reader of this letter still wonders what the victims of the Chernobyl disaster and the consecutive dislocation would think about this statement, Smyser criticise? the anti-nuclear "mind-sets" of the media :

..has any other mind-set about a scientific and technological question been so at odds with the great majority of experts in the field as is the anti-nuclear power mind-set ? Alvin M. Weinberg, former director of Oak Ridge National Laboratory and perhaps most reasoned pre-nuclear scientist in the country, feels that this antinuclear power mind set is about to fore-close the nuclear power option for the US, at least for the next half century or more

It seems that Smyser overestimates the role and power of the media when in quoting Weinberg, he apparently evokes the spirit which endangers civilisation.—A point which resounds in Smyser's letter is the main topic of several other contributions to the discussion in *The Quill* in the first half of this year. These writers express their concern over a gap in the communication between scientists and journalists. Science, which has gained such an eminent role in our modern world, is given far too little importance in the media. However, media which depend on a consuming public, are able to give science or technology their due place only in the context of spectacular events like accidents in nuclear power plants.

This misinformation results in a phenomenon which Kramer calls the "Hiroshima Syndrome", the disability to distinguish between nuclear power and nuclear arms. Finally, the naive uninformed public gets frightened about anything connected with radiation, says Kramer. Considering the natural radiation which we are exposed to, we should remain calm about such low doses of additional radiation as are due to nuclear power plants. As the crown witness he quotes Dr. Robert Gale, the American bone-marrow expert who had rushed to USSR after the Chernobyl disaster in order to help Russian doctors *there* :

The long term consequences.. would be less than those expected from the burning of coal to generate electricity.

What this comparison means in actual terms, Dr. Gale explained at another place, (here

quoted from *Atom*, the journal of the British nuclear establishment) :

in the USSR about 20,000 deaths might occur in the next 50 years because of Chernobyl. The replacement of nuclear by fossil fuel would result in approximately, one million deaths in this period, if one Chernobyl-type accident is assumed.

Yet, Dr. Gale's statements and activities have been too contradictory not to be regarded with a lot of caution. But Kramer goes even further than Gale, stating the near-to-absolute safety of nuclear energy :

The consensus of most radiologists and radiation biologists is that the increase in long-term cancer deaths as a result of radiation from the Chernobyl accident will be of such a low order of magnitude that it will be difficult if not impossible to detect statistically

And such words from the pen of a man who just has reproached the press of being cynical ! A similar thoughtlessness—or is this intended ?—appears in the letter of Bertram Wolfe, President of the American Nuclear Society, who argues, that Chernobyl cannot happen in the U.S.(on specific technical reasons). He says:

In a sense the Chernobyl accident is an affirmation of the more careful and expensive approach to factor safety in the US \_\_\_\_

This sentence, in a way, echoes Du. Ramanna's words :

After the Chernobyl accident, I must say that most of our newspapers have taken the accident in the proper perspective i.e. to consider as a part of the learning process of the world. Future reactors will surely operate more safely under any circumstances as time goes on..

It seems that a long time before Kramer discovered the "objectivity meltdown", as

he calls his article, the virus of cynicism has caught hold on a nuclear establishment which, after failures in the technical and economic fields, has suddenly become vulnerable to public criticism.

We should like to suggest, most humbly of course, that the foundations of the pro-nuclear establishment have been shaken by the major disaster of Chernobyl. (It could, but naturally, be immensely more disastrous if such an accident were to occur in an otherwise technologically backward country such as India or Pakistan.) We may hear, in the voices of the Kramers of the nuclear establishment the high notes of an anxiety no longer deniable after Chernobyl. The anti-nuclear protesters did not *need* the Chernobyl disaster for their warnings ("what ifs"). The pro-nuclear establishment can only lose ground heavily with such an incontrovertible disaster. Try what they might, they can only resort to sarcastic rhetoric against anti-nuclear protests. And if the issues were less fundamental, we might feel satisfaction in the strident tones of Kramer. Our concern is so great, however, that we cannot rest contented at this sign of panic,

Sources : Joe Kramer "The objectivity meltdown", in : *The QUILL*, MARCH 1987, vol. 75/3, p.12-17. Tom Gardner. "Take the pro-nuke argument with many grains of salt", in : *The Quill*, April 1987, vo. 75/4y p. 10-11, Letters to the editor in : *The Quill* vol. 75/4-5. Raja Ramanna. "The nuclear power is the safest and most economic form of producing electricity", excerpts from a speech held in Bangalore on 10 Sept. 1986. Note on Chernobyl in *Atom*, August 1987, No. 370, p. 31.

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# NUCLEAR SELLING CAMPAIGN

The newly-constituted Nuclear Power Corporation has drawn up a 15-year plan to generate 10,500 MW that is, a tenfold increase of current capacity, and is envisaging an investment of Rs. 10,000 crore. The NPC has an authorised capital of Rs. 2,000 crore and will be in charge of the design, construction and running of nuclear power plants.

According to the chairman, the setting up of the corporation will facilitate, it to achieve two objectives : ensuring high operational efficiency of the power units and the completion of new projects expeditiously. In other words, the setting up of a corporation is a big step towards achieving the 21st century nuclear Utopia.

It may well be that the corporation will indeed have a greater degree of flexibility than had the Nuclear Power Board, its predecessor which was merely a component of the department of atomic energy. But it is highly unlikely that in a sensitive area like nuclear power the corporation will have any real degree of autonomy in decision-making. Moreover, the inefficiency apparent in the planning and construction or the functioning of nuclear plants is hardly because the NPB has been hamstrung in making vital decisions. Similarly, unless the corporation is structurally reorganised thoroughly, project management or construction efficiency is not going to be streamlined. And this, given its mammoth size and the need to centralise most of the authority, is not a probability. Quite clearly the constitution of a corporation is mainly for the purpose of being

able to tap public funds. Of the investment planned, 37 per cent is to be generated from its internal resources, 30 per cent from government loans or equity and the rest is to be met through market borrowing. The corporation will issue, public bonds—by the end of December 1987—to raise a capital of Rs. 100 crore.

It is with the bond issue in mind that the chairman has urged the NPC to 'educate' the public about the plants, their operation and their impact on the environment. He has suggested that people living around these projects should be told about what is going on within the plants. Does this mean that the nuclear establishment is, at long last, prepared to divulge information regarding the status of the nuclear power industry in India ?

If the PR effort which preceded the inauguration of the NPC is any indication, all that this new outlook means is that we will now be subject to an intense and determined disinformation campaign. For it is quite ironical that the chairman should even mention the need to be more open. No corporation which is hoping to raise funds from the public can afford to draw attention to its weaknesses, its inefficiencies and the possible hazards it poses. What is required in the circumstances is a neatly tailored PR campaign to 'sell' the idea of nuclear power, which is precisely what we can expect in the months to come. This in turn puts a greater responsibility on those who have reason to be cautious and critical about nuclear power to separate fact from fiction.

Upto now the anti-nuclear groups in the country have been hampered by a dearth of information; now they will have to cope with a barrage of disinformation.

**SOURCE : Economic & Political Weekly (7. 11.'87)**

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