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What sets worlds in motion is the interplay of differences, their attractions and repulsions. Life is plurality, death is uniformity. By suppressing differences and peculiarities, by eliminating different civilizations and cultures, progress weakens life and favours death. The ideal of a single civilization for everyone, implicit in the cult of progress and technique, impoverishes and mutilates us. Every view of the world that becomes extinct, every culture that disappears, diminishes a possibility of life.

Octavio Paz

A Voyage that Diminished the Possibilities of Life

First came the visionaries—the seekers after truth, the people whose insatiable curiosity and genius led them to probe deeper and ever deeper into the mysteries of nature. People like Ernest Rutherford—the giant New Zealander whose ingenious experiments using a little bit of wire and some sealing wax were to alter the whole course of scientific development in the twentieth century; there was Niels Bohr, the Danish mountaineer and footballer, who gave us our picture of the atom—the most recognisable symbol of the modern age; there were the Germans Edwin Schrodinger and Werner Heisenberg who gave the theoretical tools—the framework to understanding the secrets of the micro world* there was Paul Dirac the Hungarian physi-

cist's physicist and his compatriot Leo Szilard—the man who dreamed the whole enterprise up and many others. And there was Enrico Fermi: "The Italian navigator who landed on the shores of the New World and found that' the natives were friendly."

That was the encoded message which announced to the American authorities that a nuclear chain reaction had been established and that it was controllable. On December 2nd, 1942, in a laboratory constructed underneath the squash court of the University of Chicago, Fermi and his group of co-workers, forged the key that opened the vast store of energy locked inside the atom.

Uranium is the heaviest naturally found element. Nucleus of atoms of uranium spontaneously divide into smaller bits, nuclei of lighter elements, and a few (sometimes 2 and sometimes 3) neutrons all moving at great speeds. The trick was to get these neutrons to act as triggers for further breaking up of other uranium nuclei. If this could be done on a sustained basis, then that was the key to the vast store of energy. The problem was that most of the neutrons were moving too fast. They would speed away before they could hit other atoms and cause fission. Fermi put a piece of paraffin wax in the way. The wax was to act like a crowded bazaar to the speeding neutrons. They slowed down, became more amenable to capture by other uranium nuclei and the chain reaction became sustainable. Like an-

other Italian navigator exactly 450 years before him Fermi landed the spaceship earth on the shores of the new world. But were the natives really friendly?

After the dreamers came the schemers. People like General Leslie Groves, who made useful products out of these discoveries. Like weapons of mass destruction. Groves wasn't the only one. There were many others: The political leaders: The top executives of large corporations: The military men. And they weren't all just Americans either. They were to be followed by the Russians, and the British, and the French, and the Chinese; and the Indians and the Pakistanis and the Israelis and the ...

After Hiroshima, the stream of nuclear scientists divided into three. One channel went on to make bigger and better (worse for you and me) bombs. These were people like Edward Teller—first rate scientist but a paranoid personality. Then there was the other stream—a small counter current. Scientist who said enough was enough and who tried to turn the clock back from the approach of midnight. And there was the mainstream. People who thought that nuclear energy was an inexhaustible, clean, cheap and safe source of energy and a solution to all the world's ills if only it could be harnessed and put to peaceful uses.

Many ingenious peaceful uses of nuclear by-products were found. There were the uses in medical diagnosis and therapy. There were agricultural uses, and in food preservation and in all kinds of gadgets from radioactive smoke detectors to starters in energy efficient tube lights, to watch dials that glowed in the dark. And on and on... No doubt there would be many more in the future.

But the main use apart of course from the weapons that nuclear en-

ergy has been put to was in boiling water and generating electricity.

But, on this, the fiftieth anniversary of Fermi's forays under the squash court, nuclear electricity faces an uncertain future. It has in a very deep sense proved itself to be "poisoned power". The very process of fission, leads to the creation of a bewilderingly large variety of poisons. Amongst these poisons are some of the most toxic substances known to humanity. Thus for example, a small spec of plutonium weighing no more than a trillionth of a gramme lodged in a person's lung can cause cancer. Nuclear power plants produce such poisons in quantities of hundreds and sometimes thousands of kilograms. Keeping these poisons isolated from the environment for essentially eternity has proved to be an insurmountable task. Far from being "too cheap to meter", nuclear energy has instead turned out to be too costly to continue. Despite huge government subsidies, (totaling according to the government's own estimate to more than \$ 40 billion by 1979 in U.S.A. alone, nuclear power has failed the

market test and no new power plants have been ordered for the last eighteen years. Neither has nuclear energy been as safe and clean as its backers had claimed. Catastrophic accidents have taken place far too frequently and routine emissions have proved to have been far more harmful than previous expectations.

But as advocates of 'development' never tire to point out, there is no free lunch; somebody has to pay the price. The price has been paid disproportionately by the voiceless—the yet unborn generations, the indigenous people of remote regions where all the uranium mining and the bomb testing have taken place, by young children and by women. Dr Rosalie Bertell winner of the Right Livelihood Award has estimated this price as the untimely deaths of 32 million people.

Christopher Columbus had also found the natives friendly. The natives paid for their friendliness with the destruction of their lives and culture. The track record of nuclear colonialism has been much worse.

Congratulations Dr Gofman for the Right Livelihood Award

Dr John Gofman is one of my heroes. He did his Ph.D. in nuclear chemistry and then went on to become a medical doctor. Today, at 74 years of age, he is Professor Emeritus in Molecular and Cell Biology at the University of California at Berkeley.

While a graduate student in 1942, Gofman proved the fissionability of uranium-233 and developed the process which isolated the first workable quantity of plutonium and discovered several radioactive isotopes of uranium and protactinium. His pioneering work on the chemistry of lipoproteins has received several medical awards.

But good scientists, though not dime a dozen are still not very rare entities. Far more than being merely a good scientist, Dr John Gofman is a man of scientific integrity and has courage of his convictions. Thus, when he found that the health effects of low, officially 'acceptable' doses were in actuality killing millions of people, he put his entire 'career' and funding on line and said so. For his outspokenness, he was hounded by the radiation establishment. His books, *Radiation and Human Health*, *X-Ray3: Health Effects of Common Exams* and *Radiation Induced Cancer from Low-Dose Exposure* are all classics in the field. *Anumukti* is eagerly awaiting the yet to be published book on heritable health effects.

Allaying Public Fears

In the last issue of Anumukti, we mentioned that the Kakrapar Atomic Power Plant (KAPP-1) started functioning from the 3rd of September, 1992- Shri Narayan Desai had gone on a five day fast in protest against the starting of this unit without the mandatory safety testing. The fast has galvanised many in the vicinity of the plant to become active in their opposition to the plant. As part of our campaign, we had informed the local press and local and state level politicians of the implications of starting KAPP1 without fully testing out the Emergency Core Cooling System. When Shri Narayanbhai announced his decision to fast, this was conveyed to the State Government and to some political leaders in the state. The Narmada Development Minister, Shri Babubhai Jasbhai Patel, forwarded Shri Narayanbhai's letter to the Prime Minister along with a note of his own. The Prime Minister's reply dated October 9, 1992 reads:

Dear Shri Patel,

Thank you for your letter of September 7, 1992.

You may have received by now the clarification sent to you by Dr. P.K.Iyengar, Secretary and Chairman, Atomic Energy Commission, at my request. A copy is enclosed for ready reference.

I hope you will be able to use your good offices with the Sarvodaya leader, Shri Narayanbhai Desai, to allay his apprehensions.

Energy is vital for our progress. Nuclear energy is one of the most important energy sources available to us. Safety systems are important in all industrial undertaking and our approach to them should be

positive and constructive. As you will notice, the safety systems in KAPP-1 are supervised by the Atomic Energy Regulatory Board and the expert committees it has set up to monitor the detailed operation and testing. I am glad Shri Desai is taking such a keen interest in the nuclear power plant. I am certain that his misgivings will be allayed by the Atomic Energy Regulatory Board. The Chairman of the Atomic Energy Regulatory Board, Shri S.D.Soman will be available for any further clarifications if required.

With regards,
Yours sincerely
P.V.Narasimha Rao

We also reproduce Dr P.K.Iyengar's letter in full

No.6/6(14)/92-PP/789
September 8, 1992

Dear Shri Patel,

We have seen your letter dated July 28, 1992 addressed to the Prime Minister regarding Kakrapar Atomic Power Project-I. The question of adequacy of safety systems in KAPP-1 is decided by the Atomic Energy Regulatory Board and the expert committees that it has set up to monitor the detailed operation and testing. It is only after their approval that KAPP-1 attained criticality. A monitoring mechanism by an independent group has been established for this purpose, and the Department of Atomic Energy relies on their verdict. The Nuclear Power Corporation is responsible for the construction and operation, and is subject to the approvals given by the Atomic Energy Regulatory Board

In this connection, we may point out that individual opinions could be coloured and that is the reason why a committee of experts is asked to decide on such issues. Leaders in

society should also value the opinion of such experts before coming to decisions on the social implications of such safety measures. I am sure that the Chairman, Atomic Energy Regulatory Board, Shri S.D.Soman, will be available for anybody who wishes to get clarified on any problem with regard to KAPP-1.

With regards,
Yours sincerely,
P.K.Iyengar

AERB Chief Visits Vedchhl

We received this letter much after Shri Soman's visit to Vedehhi.

Shri Soman spent one and a half hours with us. His major point too was to show that AEHB was independent of the Department of Atomic Energy (DAE). As proof he offered AERB annual report which is a separate document and not part of the annual report of DAE. However, on questioning he admitted that this was the first year in which the report had been published separately and previously AERB's report used to form part of the DAE report. Shri Soman and the other officials who had accompanied him, did not say a word about Emergency Core Cooling System (ECCS) in KAPP-1 till they were just about to take leave and had in fact stood up to do so. At that time Shri Soman brought out an unsigned note (on plain paper not AERB stationary) and handed that over with the comment that testing of the ECCS had been "done in an integrated fashion" at KAPP-1 and found to be satisfactory. On being asked "then how come Shri Natarajan and Shri Ghosh (who are both members of the AERB constituted safety committee) had written their note," he made no reply. He replied in the negative when asked if he (Soman) had called Shri Natarajan to ask him why he

(Natarajan) had written such a note when the ECCS had been found to be "satisfactory".

After the visit to Vedchhi, a press release was issued by KAPP authorities claiming that "Shri Soman had set all Shri Narayanbhai's fears at rest." Whereas, during the visit, he evaded giving a direct answer to the only question that Shri Narayanbhai put to him, that was "Does the AERB or the DAE consider the health and safety of the people living in the vicinity of the plant, to be their responsibility?"

Reply to the Prime Minister

The following is an edited text of the letter written by Shri Narayan Desai to the Prime Minister, which was forwarded by Shri Babubhai J Patel along with a note of his own. What I have edited out are portions which summarized Dr Iyengar's letter, since we have reproduced the original letter in full.

Dear Pradhan Mantriji,

I am thankful to you for your letter October 9, 1992 in response to Shri Babubhai Patel's letter in connection with my fast.

At the outset, let me confess that Dr. P.K Iyengar's letter that you have enclosed with your's is far from convincing.

Dr. Iyengar wants us to have faith in experts. It must be noted that both Shri K.Natarajan and Shri Ghosh are 'experts', being members of the AERB constituted safety committee specially charged to take care of the safety aspect of the Atomic Power Plant in question. They are the very people whose opinion the AERB and hence ultimately DAE are supposed to respect and implement. To my knowledge no representative of the DAE or the AERB has repudiated the substance of Shri K.Natarajan's note,-that integrated testing of the Emergency

Core Cooling System (ECCS) as per design intent was not done in toto before the KAPP-1 was actually started. All that Dr P.K.Iyengar has done is to imply that there are differences of opinion in the committee, and the committee as a whole including presumably Shri Ghosh and Shri Natarajan have acquiesced in allowing the reactor to start.

In this connection, let me recall the facts regarding the point at issue, about which there is no dispute.

- . 1. ECCS at KAPP-1 was tested in February 1992.
- 2.The test showed that the system did not function as per design intent.
- 3.Parts of the system which malfunctioned were, probably, repaired and retested in June and August '92. However, full integrated testing of the entire ECCS was not undertaken.
- . 4.Thus, whether the ECCS would function as required in an emergency situation is at present unknown and a matter of speculation and hope.
5. ECCS testing, in fact, could not be undertaken since the AERB had already given its permission for fuel loading and heavy water loading in the primary heat transport system. An ECCS test at that stage would have meant that heavy water worth hundreds of crores of rupees would have become contaminated and downgraded and hence useless for reactor purposes.

Let us be aware of what is at stake here. In case the ECCS does not function as required in an emergency situation, we would have a major disaster in South Gujarat, which would deal a crippling blow not only to the state of Gujarat but to the economy of the entire country. The example of Chernobyl (another instance which the experts claimed

could never happen) is already before us.

In such a situation, I would like to submit that, if at all we could afford to make an error, the error has to be on the side of safety. I do hope and pray that there will not be an accident or a leakage of radioactivity in KAPP-1, but as responsible representatives of the people it is your duty to see that no action is taken that would endanger the safety of the people living around the Power Plant in any eventuality.

I must also point out that 'independence' of AERB hardly has a meaning when we consider the fact that there have been numerous instances when DAE has gone ahead and done whatever it wished to do, being confident that AERB would retrospectively approve, and AERB has always done so. A case in point is the December 1991, massive leak of radioactivity from a pipe in the CIRUS reactor complex in BARC Bombay, reported in a series of three articles by Rupa Chinai in *The Sunday Observer*. Since the area where the leak was detected is criss-crossed by numerous other pipes, the Reactor Safety Committee recommended that all pipelines carrying radioactive effluents be tested, repaired if necessary, and confirmed to be no longer leaking before starting CIRUS reactor. The apex safety body, 'SARCOF which is directly related to AERB, gave its permission to start the reactor, subject to fulfillment of the stipulations of the Reactor Safety Committee, on 5th February '92. The reactor was started that very evening without the conditions being fulfilled. That very night, one of the fuel elements suffered damage releasing large amounts of radioactivity into the coolant system, which had to be pumped out through the pipeline which was known to be leaking and had not been repaired. This instance is a clear abdication on AERB's part of its regulatory responsibility and illustrates the contemptuous attitude in which this body is held by

officials of DAE. AERB has till now not publicly reprimanded anyone for this violation.

Before concluding, I would like to quote from the report of the Kemeny Commission, which was set up to investigate the causes of the Three Mile Island accident in USA. in March 1979.

"After many year's of operation of nuclear power plants, the belief that nuclear power plants are sufficiently safe grew into a conviction. One must recognize this to understand why many key steps that could have prevented the accident were not taken. The Commission is convinced that this attitude must change to one that says that nuclear power is by its very nature potentially dangerous, and therefore, one must continually question whether the safeguards already in place are sufficient to prevent accidents."

I would, therefore, request you to note the seriousness of the matter and not to be guided solely by the advice of these experts, especially when experts seem to differ so drastically with each other on a matter that could have catastrophic consequences.

With kind regards
Narayan Desai

Comments

It is the duty of responsible public servants to allay public misgivings regarding various facets of government policies. The best and in fact the only way in the long run to do this, is to openly confront problems, honestly investigate, make the results available to one and all, so that the general public becomes a partner in the governance of the country, and ordinary people feel that they have a say in policies that affect their own lives. Instead, what we have is that "Allaying Public Fears" is a game which politicians and "experts" play with gusto. Our leaders

tell us, whom can we trust if not the experts. The head expert tells us, you cannot trust what a single or in this case two experts say when they feel that no outsider is listening, but you can only trust the public statements of a committee of experts. It is well known from all walks of life, that experts are capable of good advice only at times when their own personal interests are not at stake. Whenever there is money to be made or the prospect of career advancement are apparent, doctors advice unnecessary operations, teachers advice unnecessary tuitions, engineers approve unsafe structures, nuclear regulatory bodies approve of untested designs. In such a situation, public safety can only be insured not by relying on the opinions of expert bodies, but by the activities of an enlightened citizenry.

Recently, following the flurry caused by reports regarding the high prevalence of disease and deformities around the Rawatbhata Atomic Power Plant, the Department of Atomic Energy has decided to conduct a survey of cancers amongst their own permanent workers and their families at Tarapur. Such a survey is unlikely to come up with any thing of significance for the following reasons:

1.The 'healthy worker effect': The permanent staff of any industrial undertaking including nuclear stations is better fed and has generally a better standard of living and health than the population at large. Thus, even at Ilanford, studies have shown that nuclear workers as a group have less number of cancers than the general population. It is only when comparisons are made between groups that are comparable, that one can get sensible results.

2.Tampur is a bad choice for such survey since, there are many other confounding factors pre-

sent. There is a lot of other industry nearby. A good number of the nuclear workers don't live at Tarapur but commute from Bombay, etc. Thus, even if one finds something significant, one would not know what to attribute it to.

3.The permanent staff of nuclear power plants, by and large does not do the really 'dirty jobs. That honour is conferred upon the hapless 'casual' workers most of whom live in the vicinity. These poor fellows are not considered as nuclear workers except when the question of the applicability of radiation limits comes up. Thus, though they probably receive the largest doses of radiation, their health is not regularly monitored, nor are any records kept. In case a comparative study was to choose its control group from this sample, peculiar results are bound to come up since the presumable unaffected group would in reality be the more affected one.

However, even despite all these problems with a study at Tampur, DAK still wants to do such a study of its employees, the way to do an honest study would be to not look only at effects like cancer which take decades to show up, but at the general pattern of disease and deformity and then try to see if this pattern was in some way peculiar and not found in other truly comparable groups. That way something could emerge that would be of real benefit to the workers. Unfortunately, the purpose of DAK studies is not to be of use to anyone, but only as a tool in the game of 'allaying public fears',

Surendra Gadekar



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The Uranium Concentration Camps

In Europe, as in America, the postwar call to arms forced a rapid expansion of the uranium mines of the Erzgebirge, employing many tens and ultimately hundreds of thousands of miners. Recently discovered documents reveal that following a secret agreement in November of 1945 the Soviet Union was granted exclusive rights to all the uranium mined in Czechoslovakia. These mines in Bohemia were greatly expanded under Soviet supervision and began producing ore for shipment to the east. Bohemia was destined to become the primary source of uranium for the Soviet Union until the 1960's, when large deposits were discovered and developed in Kazakhstan and Central Asia. The Schneeberg mines of Saxony were also revived under Soviet occupation: uranium ore figured as part of the war reparations paid by the East Germans to the Soviet Union.

In the 1950's, about the same time that U.S. health authorities began to take the problem seriously (at least at the level of research), Czech health officials began to study the health effects of uranium mining. Health records and vital statistics were gathered on uranium miners, coordinated by a Health Institute of the Uranium Industry, established in the mining town of Příbram in 1954 for this purpose. As in the U.S., Czechoslovakian efforts to publicize the health problems of the miners ran up against cold war fears that releasing such information would compromise national security. In 1960, Dr Vladimir Rericha of the Health Institute of the Uranium Industry was asked to prepare a comprehensive overview of the incidence of lung cancer among Czech miners. Between 1960 and 1965, Rericha and his staff compiled elaborate epidemiological evidence

that miners at Joachimsthal and Homi Slavkov were dying from lung cancer about five times the rate of coal miners and the general male Czech population — results that were similar to U.S. findings at this time. Rericha prepared a paper detailing his findings for the Health Institute in 1966, and simultaneously sought to publish his results in a more conventional scientific journal.

Rericha's efforts to publicize the carnage in Czech uranium mines were blocked by orders of the State Security Police. The report and its contents were classified and publication was barred in foreign or Czech periodicals — a ban that was not lifted until the Velvet Revolution of 1989. The logic behind the ban was extraordinary: as Rericha

today recalls it, Czech security authorities said they were afraid that from uranium health statistics, one could calculate either uranium production levels, or the quality of uranium being mined, or both. For this reason, all information on rates of cancer in uranium miners was declared "top secret." The cynicism of such a ban, even on its own terms, was made apparent to Rericha in the 1970's, when he again tried to publish his findings. Rericha was again denied the right to publish, despite the fact that the administrative chief responsible for all Czech uranium mining defected to the West in 1970. With all the details of Czech uranium mining available to Western intelligence agencies, why were the health hazards of uranium mining still kept secret? One can only conclude that the Czechoslovak Authorities feared that revelation of the sacrifice of the country's miners for the sake of Soviet atomic power

would not have gone over well with the Czechoslovak people.

The Czech uranium mines (where uranium was first identified and exploited) are well known. Not widely known (even to Rericha and his colleagues) was the fact that the Czechoslovak government organized 17 to 20 concentration camps at the three major uranium mines, in which tens of thousands of political prisoners were forced to work in the 1950s and 1960s. All of the prisoners forced to mine uranium were political prisoners. The scale of the prisoner camps was approximately equal to that of "civilian" employment in uranium mining. According to Secret Police Archives, numbers of political prisoners at the uranium concentration camps were:

Year	1951	1952	1953	1954	1955
Prisoners	9,029	11,280	11,816	9,655	7,974

The Number of Political Prisoners

By 1960 the number had dropped to 2,600, and by 1963 the political prisoners had been replaced at the concentration camps by a population of criminals.

Compared to civilian miners, the political prisoners bore the brunt of the hazard and received practically none of the compensation. Civilian miners were paid extremely well — about ten times the average salary of physicians, for example. But the concentration camp inmates were forced labourers, and the vast majority did not survive to enjoy the compensation that was finally awarded in 1989.

Robert Proctor

Where Have All The Babies Gone?

Ihe British Medical Journal of 9th February, 1992 (vol.304 pp 343-6) carries a study by Prof. R.KAVhyte of McMaster University, Hamilton, Ontario, Canada which demonstrates a correlation between atmospheric atomic bomb test in the 50s and 60s and rise in infant mortality. Until now such correlations have been denied by all international radiation-protection bodies (like ICRP, UNSCEAR, BEIR) and health authorities world-wide.

High Statistical Correlations

The high statistical correlations indicate that there was an excess of 320,000 infant deaths in the period 1950-1980 in the USA and UK alone. All first day infant deaths, neonatal deaths (within the first 28 days) and still births were included in this study.

As an example, this graph shows the first day neonatal mortality (deaths/1,000 live births) for England and Wales and USA plotted against calendar years. Before 1950, (the beginning of the atom-bomb tests) the curves show a deviation: the mortality rate no longer continues to decrease but even increases slightly. After the cessation of the bomb tests in 1963, the mortality rate begins to decrease again, following a delay, until the curves at the end of the 60's resume the trend seen before the bomb tests. Similarly shaped curves were also **demonstrated for the excess mortality in the first 28 days after birth and the number of still births.**

Confirmation of Previous Studies

More than three decades ago, Prof E.J-Sternglass had already drawn

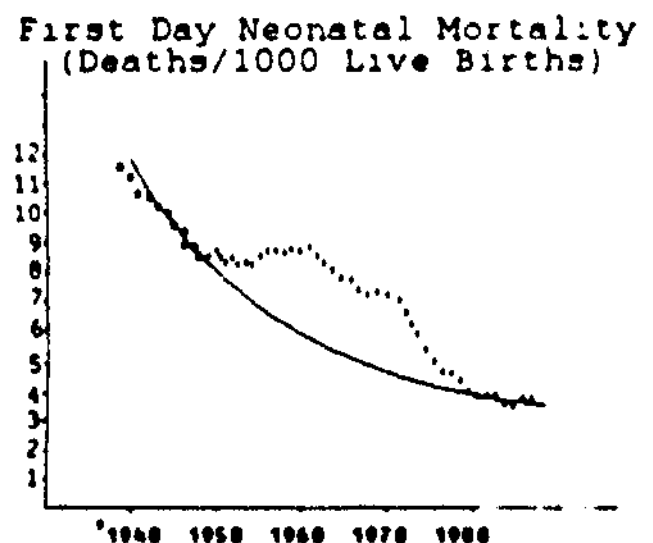
attention to such a correlation between physical and mental damage to humans and both the fallout from atom-bomb tests as well as emissions from nuclear power plants. The latter, even under normal operating conditions, also discharge atomic fission products similar to those found in fallout, such as strontium-90, iodine-131, carbon-14, tritium, krypton-85, etc. In his paper, Whyte also cites a study from Sternglass published in 1969 which demonstrates close geographical and temporal correlation between the increased strontium-90 pollution, as a result of the atom bomb tests between 1950 and 1963 and an excess in infant mortality. Whyte also cites another study by Prof Jens Scheer of Bremen University, who showed that there was a 35 percent increase in infant mortality in southern Germany after the Chernobyl incident. Today there is a wealth of laboratory and epidemiological studies dealing with the effects of fallout and low-level radiation on humans, animals and plants. All these findings should hopefully at last influence the radiation protection lawmakers.

Consequences for Society

In a memorandum on the implications of the Whyte study, Dr Sternglass says that in USA alone, 280,000 additional infants have died from 1950 to 1980 as a direct result of atom-bomb tests. Today, there could be millions of persons aged 10 to 45 years who have been harmed by the atomic bomb tests because some ten times more underweight babies survived which, nonetheless, frequently showed physical and mental problems. Therefore the greatest health and economic dam-

age through fallout would not be increased rates of leukaemia and cancer among children, but instead an increase in premature and underweight births. This would result in increased infant mortality, impaired pregnancy and immunological deficiencies in children that survive (though Whyte does not discuss immunological deficiency in his paper). For every thousand live births the number of underweight babies is some 100 times greater than that of children dying from cancer and leukaemia.

A recently published study by the Ukrainian parliamentary commission, shows that just six years after Chernobyl, there has been a distinct increase in cancer amongst children, a large increase in birth de-



fects and growth problems in both Ukraine and Byelorussia. In addition, it was pointed out that two to three and a half times more children are suffering from immunological deficiencies than before 1986.

Risks Underestimated

Therefore, according to Whyte, the health risks from fallout (any fallout whether from bomb-tests or from nuclear accidents like Chernobyl or

from the routine emissions from formally' operating nuclear power plants), have been underestimated by between 100 and 1,000 times because the radiation protection levels have only taken account of cancer and genetic defects! These 'acceptable' limits are based on the Hiroshima-Nagasaki data, which was the result of a single short-duration radiation burst. Such radiation damage is more easily repairable in contrast to the indirect damage caused by free radicals which takes place at low levels at low dose rates.

Supralinear Response Curve

The data from Prof Whyte support the growing evidence that in order to arrive at a maximal allowed concentration of fission products in milk, drinking water and foodstuffs, a linearextrapolation from high and

externally received radiation doses like that of the Hiroshima victims is unsuitable. It follows that the most sensitive sectors of our society are insufficiently protected, namely the developing foetus and the elderly who both have weak immune defenses. Today it is irresponsible to still deny the supra-linear effect of radiation in the low dose region. Furthermore, the variations in radiation sensitivity among the population due to different factors like age, sex, illness, genetic composition, etc. have not been taken into account in the radiation protection laws.

Shut Down All Atomic Power Stations

At the end of February, 1992 the first International Conference of the newly formed Association for Radiation Protection took place in Kiel,

Germany. Its theme was: New Assessment of Radiation Risks. Over 300 scientists and doctors took part in the gathering. The conference adopted a statement which was drafted by Prof Horst Kuni of the University of Marburg and the Otto-Hug Radiation Institute. The statement said, "...we consider it safe to say that the collective dose released, as a result of the operation of atomic power stations, is sufficient to result in significant health risks to the employees as well as the general public." It called for a total shut-down of all nuclear power plants.

Ralph Graeub

Ralph Graeub is a chemical engineer and a member of the Radiation Safety Group for the Swiss section of Physicians for Social Responsibility.

ATOMIC DECEPTION: OH, WHAT A TANGLED WEB! ATOMIC DECEPTION: OH, WHAT A TANGLED WEB!

"The national security state that the United States has evolved toward since 1945 is significantly a denial of the American democratic vision: suspicious of diversity, secret, mcuiial, exclusive, monolithic, paranoid"

*Richard Rhodes,
The Making of the Atomic Bomb*

The Indian State is walking down the same antidemocratic path that the United States has traversed. Thus, it is interesting to know and note the similarities in the policy of lies and official deception and denial of access to knowledge that both states have followed. The following is an account of the 'war' the U.S. government waged on its own citizens in the name of "national secu-

urity". Using the Freedom of

Information Act, Hanford Education and Action League (HEAL) has gained access to once classified information on the governmental policies which allowed the secret releases of radiation into the air and the Columbia River. A number of these 'techniques' of information management have been used and are still being used also by the Indian nuclear establishment.

Hanford managers did take many precautions to limit exposures to radioactive and toxic materials. They were not totally cavalier, as some suspect. Radiation protection was a major concern in the design of the reactor and chemical separation

plants. But there were mistakes, there were accidents, and people

took chances with the health of others. Instead of confronting these imperfections and working honestly to correct the situations, the government adopted an official policy of cover-up. It feared the public's reaction to the truth and the loss of the ability to build atomic weapons.

An aspect to reflect upon is that the public's awareness about Hanford's radiation did not start with the release of the once classified documents in 1986. There were rumours about Hanford's radiation dangers as early as August 1945. Rumours continued throughout the fifties and sixties. The other noteworthy aspect is the fact that the government is still making it difficult for citizens to have access to historical documents about Hanford. Thus, while much has been learnt since 1986, still

more remains concealed, and the government is working actively to keep its own citizens in the dark.

Was Ignorance the Cause?

During the past eight years, many scientists and Hanford officials have said that the reason the large radiation releases from Hanford were allowed was due to incomplete knowledge among early Hanford scientists of the dangers of radiation. However, this comforting view is not true. The documents reveal that the officials knowingly exposed workers and the public to levels of radiation exposure which they themselves considered dangerous. They routinely ignored their own guidelines regarding atmospheric releases of radioactive iodine till early fifties and dumped radiation into the Columbia river right up to early 1960s.

The reason for operating Hanford's factories in this manner are not entirely clear. But it is fairly certain that during the Second World War, the desire to win the war as quickly as possible provided the main push. According to Hanford's first operations manager, Walter O Simon, "the pressure was tremendous." But after August 1945, the reasons are murky at best. The highest releases during 1945 occurred after the Japanese surrender, when apparently there was no hurry'.

It is not as if Hanford officials did not take any precautions—they did. Within the plutonium facilities, they constructed the ventilation systems to suck the contaminated air away from those areas occupied by workers. Another precaution was the high emissions stacks on the separation plants. Simon recalled, "We did worry about gas emissions when the uranium from the reactor was dissolved to separate the plutonium. We monitored them *very* carefully, and ... if there was a good wind velocity to distribute them, we might have taken some chances ..."

They monitored the wind and would generally not release radiation if the conditions did not dilute the plume enough. Wakefield Wright, a chemical operations supervisor, has stated: "before you could dissolve in those days you had to worry about wind conditions ... They didn't want the wind to be in the direction of Tricities although they were 30 to 35 miles away. If we started dissolving and the wind got bad, we had to quit."

If the officials had taken these precautions, then why did they allow radioactivity releases which violated their own guidelines? From the available documents, it appears that even with all their precautions, they discovered that they could not obtain enough plutonium while operating the facilities safely. Even though Japan had surrendered and the war was over and there was no other nation which possessed atomic weapons, the government felt that they had to have more bombs. Therefore, the officials continued to operate the plants in ways they knew were dangerous and decided that the public could not be told the truth. They adopted deception as government policy.

How Did Hanford Cover It Up

In one word, by lying. A 1955 address by Hartford's chief health official H.M.Parker to a United Nations meeting on the peaceful uses of atomic energy, held in Geneva, provides an excellent example of how Hanford deceived the world. In the course of his talk, Parker mentioned "a single emission of 100 curies of iodine-131 in a few hours". The declassified documents now show that the actual amount released was nearly 80 times more than his version. In a similar vein, Parker also talked about another release of 100 curies of radioactive particle, which was carried off-site. What Parker did not tell his distinguished audience, was the fact that it was ruthenium (a longer lived radionu-

clide) that was being released, it traveled further than Spokane (more than 125 miles downwind) and the actual release amount was 360 curies.

Security: The Culture of Secrecy

During World War II, Hanford "was such a hush-hush operation that even the amount of ice cream consumed by the workers was classified " At the start of the Manhattan Project, the military adopted a security system known as compartmentalization. Individuals would only be told what was necessary to perform their tasks. Parker wrote that security could be maintained "if hazard and information is phrased in such a manner that the maximum information on the nature of the hazard is combined with the minimum information on the nature of the materials used and the processes involved."

The culture of secrecy was nearly a total preoccupation with Hanford workers and their families. The Federal Bureau of Investigation (FBI) maintained an ominous presence in the workplace* and in the neighborhoods of Hanford workers. One worker commented, "There have been cases of men talking or telling their wives more than they should. There are a lot of FBI men working in the areas. We all know when a guy starts getting careless, and it isn't very long until he is not around any more." To share concerns about Hanford's operations meant dismissal and ostracism.

Public Relations: The "Suppress Officer"

Milt Cydell, Hanford's public relations officer during and after World War II, was commonly referred to as the "suppress officer".

When the first atomic bomb was dropped on Hiroshima and the

workers at Hartford learned about the nature of their work, the rumour mill went into high gear. Harry Petcher, a food service worker at Hanford during World War II recalled "When the bombs were dropped my recollection was, God, is that what we were doing here? Did we get poisoned?" Hanford officials worked quickly to reassure the workers that building the bombs was safe.

Depending upon their audience and message, Hanford officials changed their tune. Writing two weeks after the atomic bombings, Parker and another key health official, Dr Simeon Cantril, wrote a memo to the workers stating that "we don't want any misinformation by the misinformed to mar either our record or the morale we have built up through confidence in the safety of our operations." In answer to concerns about Hanford's effect on the public living near Hanford, Parker and Cantril calmed the workers by stating: "*The amounts of radioactive iodine in Richland are entirely innocuous.*" Less than three years later, the same Parker, writing an internal memo, would refer to the "entirely innocuous" levels of iodine as being high enough to have caused "concern in 1945." A year later in another internal memo, Parker made another reference to the "entirely innocuous" levels of iodine: "*In 1945 iodine 1945 contamination of vegetation was 45 to 70 times accepted permissible maximum at Richland and Kennewick.*"

Medical:

A Profusion of Sad Stories

On June 9, 1952, Ernest Johnson died in his Richland home after becoming ill at work. He was a maintenance foreman at one of the plutonium production reactors at Hanford. He had not been feeling well that day and seen his doctor in the afternoon. As the funeral home prepared Johnson's body, several

suspicious marks were discovered on his skin. Knowing that he had worked at Hanford, the funeral home called the General Electric medical department. (General Electric Company were the operators of Hanford under government contract.-Editor) Because the injury could have been connected to Johnson's work, G.E. decided that an autopsy should be done but not by its own pathologist. Dr Frederic Davis, the pathologist for Walla Walla, was called to perform the autopsy. Davis was assisted by three Hanford (G.E.) physicians. The cause of death was listed as ruptured aorta near the heart. Johnson had a history of high blood pressure. The autopsy report could not explain the marks on his skin.

Johnson's widow, Marie, was suspicious of how he had died. Some of his co-workers had told her that her husband had been heavily exposed to radiation in the months leading up to his death. (The official Hanford records do not indicate this high exposure.) When Marie took her husband's body back to Chicago for burial, she had a second autopsy done. This time the autopsy surgeon considered the burn marks to be the result of radiation exposure. Marie Johnson began the process of filing a claim, contending that on the work radiation burns had contributed to Johnson's death.

The Atomic Energy Commission (AEC) refused to consider the possibility and organized a team of its own medical and legal experts to travel to Chicago in an attempt to get Dr Thomas Carter, who performed the second autopsy, to alter his opinion and not find radiation as the cause of Johnson's death. He was even threatened with legal action if he did not change his opinion. However, despite all the threats, Dr Carter remained steadfast. Having failed to move Carter, AEC felt compelled to discredit his testimony. In order to do this, the AEC arranged to have an "unbiased" review done of both the autopsy reports. How-

ever, AEC manipulated to have Dr Simeon Cantril, as the third and decisive referee. However, Cantril was far from unbiased. He was an AEC consultant since 1943, and was also the person who had helped in the preparation of the first autopsy report. The state of Washington accepted the findings of this review and denied Marie Johnson's claim.

Eighteen months after Ernest Johnson's death, Hanford official Dr W.D. Norwood claimed to a Seattle newspaper, "*We have never to our knowledge, had any sickness due to radiation...*"

Legal:

Defense in Depth

The documents show that from the very beginning, Hanford was aware that people would file legal claims when they found out what Hanford produced. In February 1945, Colonel Franklin Matthais, Hanford's wartime commander, wrote in his diary that he "inspected the meteorological and radiation monitoring setup and the recordings that are being taken to permit us to be prepared in case of claimed serious exposure in certain areas." He made the following noting in his diary on July 6, 1945 "I asked him to set up some procedure that would assure us of getting first information on any question that might lead to a legal claim." Mattias' paranoia regarding people suing Hanford went so far as to require a shepherd to sign a waiver before being allowed to herd his sheep to pasture near Hanford. He also asked state and federal government officials to sign secrecy oaths.

Science:

The Complicity of Silence

The hazards at Hanford were not a complete secret for many in the scientific community. At various times, the government set up consultative groups, made up of acien-

tists and officials from private businesses, industry and the universities. To the Hanford management, their role was purely public relations.

This consultation with outside "independent" experts does present an apparent problem: if there was anything really dangerous about Hanford, wouldn't these outside scientists have alerted the public? Most of the people on these advisory committees were from companies that either had or wanted AEC contracts. The scientists knew that as long as they kept supporting the party line that the radiation being released posed no harm, they could keep their position and professional reputation. When certain conscientious scientists violated this cozy arrangement by asking too many questions or by coming to different conclusions, the establishment would launch a campaign to discredit them—the isolated individual verses the established order. The experiences of many former AEC experts like *Dr John Gofman* are well documented.

Environmental monitoring reports are models of scientific deception. From 1946 to 1957 they were issued quarterly, but access was strictly limited to those people who had the proper security clearances. In 1958, the quarterly reports were con-

verted into annual reports and issued as unclassified documents. However, all detailed information available in previous years, became only general information about environmental impact.

Another way in which scientific deception was practiced was by changing the places from where samples were collected. Even when the monitoring reports were classified as 'secret', officials were careful not to report the worst news. During the fifties, as more reactors were added along the Columbia river, the radioactive concentration the river water increased several-fold. Until 1954, the quarterly reports included three readings—one along the north bank, one in the middle of the river and another on the south bank. Due to a channeling effect in the river, the south bank usually gave a reading 2 or 3 times higher than the north bank reading. Starting in 1955, the quarterly reports only mention one Hanford reading, and it is obvious that the lower north bank reading is being used.

Another method used to obfuscate reality concerns the various assumptions used in calculation radiation exposure estimates. For example, in the fifties there was much concern over the radioactivity in whitefish in the Columbia. Compared with other species, whitefish

concentrates more radioactive phosphorus, which was one of the key components of the radioactive effluents from Hanford. From 1959-64, Hanford reported doses to the bone from phosphorus-32 for an "average" individual; and from 1964 to 1966 for a "maximum" individual. What is intriguing is that while the "average" person ate much less fish than the "maximum" (10-25 pounds was considered average, 90 pounds for the maximum), the "average" person caught his/her fish in water that was more heavily contaminated. Hanford placed the fishing hole for the "average" person at the point of nearest approach to the reactors whereas the fishing point for the "maximum" individual was placed further downstream where the radiation is diluted by another two rivets joining Columbia.

The Deception Continues

Most of this article has focused on the deception during Hanford's first twenty years for which there is more information available. But the policy of deception has continued right up till the present.

Jim Thomas
HEAL Perspective 10 -11
Summer/Fall 1992

World Uranium Hearing and Ind Global Radiation Victims Conference

In September '92, two important antinuclear meetings took place. The World Uranium Hearing held in Salzburg, Austria from September 13th to 19th. and the Ind Global Radiation Victims Conference, held in Berlin from September 21 to 20. Both the conferences aimed at bringing together people who have

been affected by all aspects of the nuclear fuel cycle and weapon's testing—often indigenous people—and activists and more academically oriented "experts". The World Uranium Hearing was actually set up as a series of "hearings" at which "witnesses" gave testimony to a board of "listeners", while the Global Radia-

tion Victims Conference was a more conventional sort of a conference.

I was lucky enough to be invited to attend both events and a subsequent speaking tour arranged by the World Uranium Hearing at different places in Germany, Others from Australia included activists

from Melbourne and a group of aboriginal people from Maralinga, where the British tested nuclear weapons in 1960s.

The World Uranium Hearing was a high-profile event designed primarily to focus attention on the affect uranium mining has had on the indigenous people worldwide, though its concerns were not limited either to indigenous people or to uranium mining. There were testimonies from non-indigenous activists such as myself and from 'experts' with specific knowledge of particular aspects of the nuclear fuel cycle and weapon's testing programmes.

Nevertheless, the emphasis was on indigenous people. Testimony was received from American Indians, Canadian Inuit (Eskimo), Kazakhs, People from Chupotka and Novaya Zemlya in the CIS, Peru and Brazil and from small Pacific Islanders, Australian aboriginals and from India. India was represented by people from Meghalaya and Jaduguda in Bihar and Dr Dharendra Sharma from Delhi.

The World Uranium Hearing was an occasion to be remembered. It was extraordinarily well-funded for an environmental gathering with solid support from the city government of Salzburg, as well as the provincial and national governments. The proceedings themselves were at the old university in the medieval centre of Salzburg, while meals were had in the new residency palace ('new' here means 16th century), under chandeliers with chubby baroque angels flying overhead.

But it was memorable for far more than the setting. It brought home to an Australian activist the very real nature of the problems and the suffering caused by the nuclear experiment.

An example: As the conference drew to a close, it transpired that we

were to be taken to the slopes of Grssblockner, the highest mountain in Austria, for the final act. When we were taken there, it was in the most expensive-looking, hi-tech tourist buses that I have ever seen, let alone traveled in. (Let us leave aside for a moment the fact that one of our hi-tech buses broke down due to a subtle software malfunction). Who, I wondered paid for these buses? It turned out that the bus company is giving us this ride for free. Why are they doing that? Well, they are in the business of taking people up to the snow... and in May 1986, after the Chernobyl accident, the snow was 100 times as radioactive as is considered 'safe' for people, and the company suffered badly. Now, the proprietor is thoroughly opposed to nuclear power. There were many other small examples like this.

But what created the most impact at the hearing, were the testimonies themselves. There were stories of heroic and successful resistance and there were stories of prolonged deep suffering.

Joan Scottie, an Inuit from Baker Lake in the frozen arctic north of Canada, gave an inspiring account of her community's successful (so far) resistance to the establishment of a massive new uranium mining project at Kiggavik by the German company Urangesselschail.

A variety of American Indian representatives told of the effects on their people of living on lands by the side of the tailings piles of many now defunct uranium mines, and of the so far very feeble efforts by the U.S. government at cleanup.

People from Novaya Zemlya gave an impassioned account of the Soviet and now Russian government's persistence in using their ancestral hunting grounds as a place to conduct nuclear testing.

One thing that came across very clearly to me was that there seems

to be some mysterious link between peoples' social and political status and their geology that makes the land of indigenous people uniquely suitable for uranium mining, as a site for nuclear power plant, for nuclear waste disposal and for nuclear weapons' testing. The truth of course is, that governments think indigenous people as simply expendable. People who can be quite literally bulldozed or cheated into accepting almost anything. The same treatment meted out to say, residents of Paris, or Moscow or Delhi or Sydney instead of Tahiti or Novaya Zemlya or Maralinga or Meghalaya, would provoke a political crisis that would terminate the programme.

Research and lobbying in Australia just doesn't prepare one for the sheer emotional impact of all these real life stories, and often my wife Mishka and I were moved to tears. We weren't expecting to hear such tales of prolonged, intense, and wholly avoidable human suffering, not only from the indigenous victims of the nuclear industry but also from many who had once worked in it.

An example of this was the testimony given by a worker from the U.S. weapons' industry, who described the effects on his health. Here a large part of the pain came not only from the sickness caused by radiation exposure, but also from the years of being lied to, by his employers and government.

The crowing example of an industry insider-Victim' came in the inspiring testimony given by Vladimir Chernousenko. Chernousenko is the person who led and supervised the clean-up effort at Chernobyl. He is presently dying from the radiation exposure he received while doing his duty in constructing the sarcophagus at Chernobyl. He subsequently wrote a number of articles and a book giving a highly critical insider's view of the Soviet/C.I.S, nuclear industry. For him, fighting

the industry is a race against the effects of radiation on his own body.

Evidence from India came from activists from Meghalaya and Bihar.

Mr Hoppingstone Lyngdoh and Rev. Basaiawmoitof of the Khasi Jaintia Environment Protection Council spoke about the new plans for uranium mining in Meghalaya, Mr Xavier Dias and Mr Areeparampil spoke about the impact of uranium mining in Singhbhum district of Bihar. Besides, there was Dr Dharendra Sharma from Delhi.

At the conference in Berlin, there were reports from many scientists, including Dr Alice Stewart and Dr Rosalie Bertell and Professor E.T.Sternglass amongst others. The Berlin conference was dominated to some extent by the large contingent from C.I.S. who gave reports on the

effects of Chernobyl and of the nuclear bomb testing at Semipalatinsk in Kazakhstan. However, many of them were somewhat 'establishment' and often talked all around the subject instead of being straightforward.

A few questions do hover around the conference. World Uranium Hearing spent \$15 million on its delegates' travel, accommodation, and food, plus faxes, phones, translations, photocopying, etc. Was it money well spent? \$1*5 million, I believe, will certainly stop uranium mining in Australia. It would do much to stop the world-wide spread of nuclear industry, if farmed out to grassroots activist groups. However, it is a fact that this money was forthcoming for the World Uranium Hearing, but not otherwise. And, also that the Hearing did make an impact on the mainstream media.

Towards the end of the hearing, the Uranium Institute issued a 'briefing', in which it tried to detail all the 'benefits' of uranium mining to local communities. This briefing seemed very incongruous after the whole week had been spent listening to the 'beneficiaries' talk detailing suffering.

Finally, it must be said, that the indigenous people brought to both the conferences a deep spirituality and a holistic value system that contrasted very sharply with the institutional values of power and money. We will need these values as well as the hard data that we have had for years if we are to win the war against nuclear power and its fuel cycle.

*John Hallam
Friends of Earth
Sydney*

Petra Kelly: World Citizen

First a letter from a friend:

No, it cannot be suicide. Petra Kelly and General Bastian were people who stood and worked for a cause, against odds, on issues most others would not take a stand or get involved in* They were concerned at the growing arms trade, the nuclear industry, industrial pollution and the problems of refugees, especially the Tibetians.

At our first meeting, Petra Kelly had personally come down to identify and take me inside to her office next to the German Parliament in Bonn, as the guards would not let me in, without my passport for identification.

In November 1988, when we were participants at the Nehru Centenary Conference on Nuclear Weapons-Free and a Non-Violent World

in New Delhi, she had quickly obtained an appointment with Rajiv Gandhi at the lunch hosted by the late PM. One of the issues they had discussed during the more than 45 minutes discussion had been the nuclear industry, especially the fast breeder reactors. That evening both General Bastian and Petra Kelly had told me that Rajiv Gandhi seemed concerned and wanted more information.

Petra had expressed her concern at the consequences of German unification. When she had lost her seat in Parliament, she had sent a letter introducing us to her successor in Parliament, from the former Eastern Germany. She was simple, easily approachable and a dear friend to all concerned people around the world.

The Environment and Peace Movements have lost two great friends.

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Death of Petra Kelly is a great shock. She was like a shooting star - a brilliant burst of light in the night sky. Anumukti pays tribute to this world citizen by reproducing bits from her writings.

A Power Shared With Others

As we once thought of the physical world as separate bodies, acting on one another primarily by collision, so we thought of the social world, too, as changed only by coercive forces.

Many of our resources have to do with our own daily life, with the way in which we live, with the way in which we change ourselves. The tradition within the peace movement of seeking to live one's politics and attempting to move one's life into closer accord with the values of non-exploitation, liberation, freedom equality and mutual aid are the most important elements in disarming and in creating peace around us....

The depth of our own change cannot happen in one single day, this change must be renewed every day and continue all the rest of our life.

We are looking for a new power, powershared with others, not power exercised to gain control over them. Feminism, ecology and non-violence belong together and are interrelated. But at the same time, we must be watchful that, while we struggle together against the big war, the little war in our everyday life is not forgotten — the little war being waged against the weak, the handicapped, the elderly, against children

and women. All of us must be concerned with both levels: the big and the little war waged against us as individuals, against smaller countries, against the planetary environment, every single day. Resistance to war, to the use of nuclear weapons and nuclear energy is impossible without resistance to sexism, to racism, to imperialism, and to violence as an every day pervasive reality. There is a very profound relationship between the fact that many women and children are commonly attacked, beaten up, and raped, and that a nuclear war as well as a nuclear catastrophe threatens this entire planet Earth, which has no emergency exit.

UNPO (Unrepresented Nations and People's Organisation represents minority groups, indigenous peoples, and occupied territories not officially recognized by the United Nations. From their reports on human rights violations, it is evident that Western governments in particular and Western people in general have little or no awareness of the continued extinction of indige-

nous peoples. In over half the countries of the world, people are detained or imprisoned without trial; tortured or even executed for their race, gender, cultural, religious, social and environmental beliefs; and for their protest through non-violent means.

Human rights and environmental issues are and must be inextricably linked. "Without respect for people, people will have no respect for other species. Without an equitable and ecologically sustainable distribution of the world's wealth, there are no ecologically sustainable societies."

The ecological movements and the green parties must work towards advancing human rights in a far more radical way than has been the case, there is much to learn from indigenous societies, which have a harmonious relationship with land and nature, and simple lifestyles which offer models of what alternative and ecological societies could look like.

And What About Our Bomb? And What About Our Bomb?

Recent reports in the press have highlighted Pakistani efforts at acquiring a nuclear weapons capability, following the showing of a documentary film in the U.S. In this report we examine the some of the work being done in India in the same Held. The report is excerpted from a long article by David Albright and Mark Hibbs which appeared in the September 1992 issue of *The Bulletin of Atomic Scientists*. The May issue of the same journal carries a long article on the Pakistani bomb efforts. We shall in future be printing news regarding the Pakistani nuclear programme more regularly in Anumukti.

The "Peaceful" Explosion

No one has questioned India's ability to build atomic bombs since 1974, when it detonated a 12 kiloton "peaceful" nuclear explosive in the Rajasthan desert. Although Indian officials claimed the explosion was geared toward exploring such things as enhanced mining techniques and underground engineering tasks, it was clearly intended to develop a weapons' capability. Raja Ramanna said in his recently published autobiography that participating "in the development of a prototype weapon lent me a special status."

The plutonium for the 1974 test was produced at BARC in the Cirus research reactor, a 40 MW reactor supplied by Canada that began operating in 1960. This reactor can produce about 9 to 10 kilogrammes of weapon-grade plutonium a year.

Canada supplied the Cirus on condition that it be used for peaceful purposes only, but Canada did not require International Atomic Energy Agency (IAEA) safeguards on the reactor or an accounting of the amount of plutonium the reactor produced. India claims that its agreement with Canada did not preclude the use of Cirus produced plutonium for "peaceful" nuclear explosions.

The Cirus plutonium was chemically separated from the irradiated uranium fuel in the nearby Trombay plutonium separation plant, which began operation in 1964. Currently most of India's supply of weapons plutonium is believed to have been produced in the Dhruva reactor and separated at Trombay, with only a small amount of high quality plutonium produced in unsafeguarded power reactors and separated at Tarapur.

India is estimated to have an inventory of about 290 kg of plutonium available for manufacture of nuclear weapons by the end of 1991. Based on the Department of Atomic Energy's annual reports we believe, that almost all of this plutonium is in separated for

In the absence of information about the amount of plutonium needed for an Indian bomb, we assume it to be about 6 kilogrammes, a higher than normal value. Thus India has enough plutonium for at least 50 bombs.

Uranium Enrichment

Till as late as 1988, DAE had been denying that it had built a new uranium enrichment facility at Ratnahalli near Mysore? Now, in an interview, Dr P.K.Iyengar, director of Department of Atomic Energy (DAE) told Nucleonics Week that while India had successfully operated a 100-machine centrifuge cascade at Bhabha Atomic Research Centre by 1985 itself, we built the new facility to further develop the technology,"

Well placed Indian sources said that the Ratnahalli facility was not included in the list of nuclear facilities recently given by the Indian government to Pakistan, and that Pakistan, convinced that India had built a second centrifuge plant, had registered its objections in New Delhi after the two countries exchanged lists.

According to sources, construction of the Ratnahalli facility already underway in 1987, was subject to delays and took about four years to complete. One western official said production of enriched uranium product at Karnataka was "very recent" and likely began no earlier than mid-1990.

The enrichment programme could be part of a long term programme to build thermo-nuclear weapons. Though these weapons rely on the fusion of hydrogen (deuterium and tritium) for most of their explosive yield, the process is started by atomic blasts. Although plutonium or weapons grade uranium is used in the "primary", which provides the initial blast, only weapons grade enriched uranium can be so located with the thermonuclear fuel to provide an extra "kick" to get the fusion reaction going.

Advanced Fission Designs

Although India has reiterated that it has not built or deployed nuclear weapons since 1974, it has maintained and expanded the complex of laboratory and industrial support activities essential to a nuclear weapons programme. Because India has made progress in fissile materials production and processing, and in the production of other important materials, it is believed to have designed nuclear devices that are smaller, lighter and more dependable. One U.S. official said that India is continuing to do more research on design than Pakistan.

One indication of Indian aspirations in advanced designs is BARC's interest in beryllium metal. The use of beryllium makes possible the design of smaller, lighter and more advanced nuclear weapons. The minimum amount of plutonium or highly enriched uranium required to sustain a chain reaction or "critical mass" can be reduced by surrounding the core with a neutron reflector, and beryllium metal is

hard to forge and cast, and hot-pressing creates higher quality parts.

Boosted and thermonuclear weapons

India also makes tritium, which means that it could be exploring tritium based neutron emitters or tritium boosted fission weapons. Weapons experts however, believe that the development of boosted weapons would require full scale tests.

Although Indian officials have denied trying to manufacture an H-bomb, indirect indications of such a programme include lithium 6 purification and production, and an extensive inertial confinement fusion (ICF) programme at BARC. An ICF facility would be useful in the study of the high-energy, high density physics associated with thermonuclear explosions, the improvement of elaborate weapons design computer codes, and the development of sophisticated diagnostic techniques and instrumentation.

Delivery

In addition to combat aircraft able to deliver nuclear weapons, India is developing nuclear capable missiles. Agni can carry a pay load of 500 to 1000 kilogrammes over a range of 1,000 to 1,500 kilometers. This missile is large enough to hold a nuclear warhead and reach targets in China or Pakistan.

The economic and political costs of a decision to move forward on these weapons could be high. Besides draining valuable resources needed for economic development, deploying a nuclear arsenal would lead to Chinese and Pakistani countermeasures. In the long run, India's security would be reduced.

David Albright and Mark Hibbs

Nuclear India: A Dream Gone Sour

This film is a powerful inducement of India's nuclear programme. Some of its images, especially of deformed children-touched me greatly. For the last two years, I have personally known the plight and misery of some of these children. I have not been able to make any difference in their wretched existence. Therefore, a film which would make this awful condition known to the whole world and hopefully force our ruling class out of its uncaring cocoon should have been a source of some satisfaction. Unfortunately, this is not the right film to bring justice to the victims of our nuclear madness.

The reason why, inspite of its strong visuals the film fails is because it is based on a fundamentally flawed concept. It seems to say two things, both of them wrong. One, that if the "rules" are properly followed, then nuclear power can be run 'safely', and two that nuclear enterprise in India has failed because it is being carried out in India—this poor benighted land where people know no better than to drink water from leaks in radioactive effluent carrying pipelines and farmers are still ploughing their fields using hand held ploughs. The film glosses over the fact that nuclear enterprise has been a total disaster everywhere. Thus, we see the stereotype images of a bullock cart moving in the foreground, with the nuclear power plants forming the background. The commentary rubs this in with that if the same level of radioactivity as observed on the beach sands of Kerala were to be observed in Britain, it would mean immediate evacuation. While this may be true, the impression that the British nuclear programme is somehow safer or less dirty is not. Nobody is in a better position to appreciate this fact, then the maker of the film, James Cutler, who was the person who exposed the dirty linen of Sellafield.

The film is wrong on another count. It makes a great point of saying that the film was made clandestinely. This point is emphasised more than once, and is mentioned in connection with the all pervading secrecy surrounding the nuclear programme in India. I do believe that the Indian nuclear establishment would not have allowed the film to be made. But I also think that neither did the producers make any attempt to do so. It would have been better if they would have shown the same discretion in their presentation that they showed in filming.

The Indian nuclear programme is, in reality, a dream gone sour. The people living near nuclear establishments are not its only victims. We all are. We are saddled with a power source that does not, will not and cannot deliver the goods. Only the bads. The film with fine depiction of the contrasts between government claims and the reality on the ground does make one think. Unfortunately, its tone, is apt to raise one's patriotic hackles. This is a pity, since the major issue should have been one of social justice to the victims.

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