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धर्मक्षेत्रे चान्दपुरक्षेत्रे समवेता युयुत्सवः . . .

Today Mahabharat is being fought once again. I don't mean the carnage in the Gulf. That is modern warfare— totally bereft of morality, purpose and meaning—a war to test the war machine.

The setting of Mahabharat is the border of Gujarat and Madhya Pradesh at a place called Ferkuva in Gujarat and Chandpur in M.P. On one side is a large band of about to be dispossessed people, whose battle cry is "*Koi Nahi Hatega — Bandh Nahi Banega.*" They are willing to die, but are not willing to be made into sacrificial goats. On the other side supposedly is an even larger army - people involved in a 'Mahayagna' to a Goddess called 'Development' whose battle cry is "*Jeevadon*" (Sardar Sarovar Dam is Gujarat's lifeline.)

For me the analogy with Mahabharat was brought into sharp focus because I saw Chunibhai Vaidya in the camp at Chandpur. Chunibhai to me, has been for nearly two decades now, a great hero. During the dark days of emergency, when many a stalwart in the press had decided that silence was indeed golden, Chunibhai's voice in the *Bhoomiputra* was a stinging call to freedom. Despite persistent persecution by the government he had remained unbowed and defiant. Today however he had come as one of the leaders of the pro-dam agitation having being sent by the Chief Minister of Gujarat to parley with the leaders of the anti-dam agitation.

The position of the pro-dam rallyists can be briefly summarized thus:

- The entire people of Gujarat support the construction of the dam.
- The decision to build the dam was taken after much deliberation lasting many years. Now, nobody, howsoever eminent and respected, has any right to reopen the issue. A delay of even a single day means a huge expense (Rs. 4 Crores) to the public exchequer in Gujarat.
- While they are willing to talk to the leaders of the anti-dam agitation on issues such as resettlement and deforestation, the question of the government reviewing the project as a whole or of stopping work on the project while such a review was in progress, just did not arise.

The saner elements amongst them (a small minority) also felt that:

- Confrontation between the people of Gujarat and the people of M.P. should be avoided and agreement should be reached through negotiations alone.

Each of the first three points is debatable to say the least. Public support to issues varies with time as the amount of information available to the public changes. Governments are prone to present only one (very rosy) side of the picture while commissioning a project. They are also liable to resort to ambiguity and misinformation so that by the time the project affected people come to realize what is to be their impending fate, it is already too late and the issue has been well and truly settled. In the not too distant past almost everybody including myself thought that nuclear energy was a boon. It is only as more and more information has become available that people have come to realize the unmitigated curse it actually is. To forego the

right to reopen and reexamine issues in the light of new information just because the matter has been previously settled and now a large amount of money has already been spent, is not a sign of sanity. It would be somewhat like letting a wrongly condemned innocent serve out his sentence rather than look at fresh evidence establishing his innocence just because originally the victim had been subjected to a 'fair trial'; or to knowingly eat spoiled food because food costs money.

Nobody can deny those who support the dam their democratic right to express their viewpoint through rallies, demonstrations, slogans, etc. In a proper system we would have one rally bringing pressure on the government to stop work on the dam and reconsider while the other rally would pressurize the government to do no such thing. Each would try to convince the public of the rightness of its cause. The ensuing debate would result in an informed public which could then make up its mind. Unfortunately what is happening on the Gujarat - M.P. border is the very negation of the democratic process.

What we have opposing the entry of anti-dam agitationists into Gujarat is not a mere rally of the people, but a rally which is state supported if not actually state sponsored. It is the state which provides commandeered buses to transport the rallyists, most of whom prefer to spend the cold nights in comfort at home. At times, the distinction between the rallyists and the police has been totally obliterated. Thus, what we are witnessing is an attempt by the State aided and abetted by vested industrial and commercial interests to silence its critics by unleashing on them a counter demonstration of larger numbers. It is besides the point that as days pass these large numbers have found it difficult to match the determination and staying power of those whose very survival is at stake. Even the police has found the place too cold for comfort.

Many credit the Gujarat Chief Minister, Shri Chimanbhai Patel as the mastermind behind this strategy of pitting one demonstration against another. The manipulative skills of Shri Patel are no less renowned than those of Shakuni Mama in Mahabharat. But it is not the amorality of Chimanbhai which is of importance. It is those who have willingly lent themselves to be his instruments who need to reconsider their actions. If this attempt to silence dissent succeeds, then the way would be open for all administrators to resort to rent-a-crowd techniques to crush dissent on any issue whatever, be it environment, communalism, or corruption in the state machinery. In fact, there already has been a great proliferation of fascist methods all over the land. 117 journalists have been killed in Punjab by people who have banned other journalists from calling them 'terrorists'. The attempt to gag '*India Today*' is wellknown. Not so wellknown is the attack on the office of a small bimonthly publication *The Voice of the People* Awakening in Bombay for daring to write an article critical of BJP. Recently a group of Sarvodaya leaders who were peacefully fasting and praying for the restoration of communal harmony in Ayodhya, were badly beaten up by hoodlums belonging to the Bajarang Dal who were proud of the fact that they belonged to the 'Godse' tradition. The police in this case intervened by arresting the peaceful demonstrators instead of taking any action against those in flagrant violation of the law, because to even touch these 'sacred bulls' in Ayodhya today is to invite disaster upon oneself. But whether out of cowardice or out of collusion, the fact remains that the State today is a participant in the attempt to subvert the freedom of expression.

Mahabharat is a recurring theme in our culture. It is a tale which can be and has been viewed at many levels and which furnishes many morals. A quarrel between brothers which ultimately led to universal destruction. A war which became inevitable because decent and respectable men decided that standing up against injustice was not necessary and discretion was politic. A fight of right against might in which both sides sometimes indulged in morally indefensible actions but in which Dharma ultimately triumphed against seemingly invincible state power.

Just as we go to the press, distressingly late as usual comes the very welcome news that Medha Patkar and her colleagues have given up their twenty two days fast and the agitation is to enter a different phase. We applaud the realisation that the environmental movement in India needs life not death. Some may consider this retreat, a defeat. I don't. Mahabharat was not won or lost at Kurukshetra. It was a battle in the field of Dharma, where only Dharma could be victorious.

*Surendra Gadekar*

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Last year, Argentine President Carlos Menem announced that a nuclear waste dump planned near the village of Gastre in the region of Patagonia, was to be abandoned, or "frozen", at least until the year 2040. Yet at least 70 people are presently working at Argentina's National Commission for Nuclear Energy on the project. Another 50 people are at work on the same project at the National University of Cuyo. The planned dump has been opposed for a number of years by activists and communities in both Argentina and Chile. Now, the plan is receiving support from France. When Juan Schroeder, an anti-nuclear campaigner denounced the French connection, he and later his family, began receiving death threats. What Schroeder was objecting to were plans by the French Government to export nuclear wastes to Argentina. Despite Menem's declaration, the decree which established the project has never been revoked. The manager of the project said in a public debate "the work for the dump site proceeds normally."

# The Sterilized Zone (Part II)

We continue our series on Nuclear Off site Emergency Response Plans. In our last issue, we had briefly focused on guiding principles, types of accidents, radiation hazards, and given a bare outline of the protective measures envisaged and defined the concept of emergency zones. We shall consider different protective measures in detail in future issues. In the following we focus further on general principles.

## Underlying Principles

The principles which govern the planning of protective measures in the event of radiation accidents are based on the following :

In the event of an accident, protective measures may need to be implemented to limit the radiation exposure of the members of the public. However, the implementation of these protective measures can involve social cost, risk inconvenience and hardship to those involved. Therefore, any protective measure should be introduced only if the from further exposure to radiation would be greater than the detriment to the health and social life that would result from the protective measure itself.

*The concern for risk, inconvenience, and hardship caused to the public is indeed touching and very commendable. But would not this concern be far more appropriate if shown during the site selection process itself. The risk imposed on the public even during the routine operation of the plant, let alone during an accident, is quite considerable and totally Involuntary. The people near a nuclear plant accept the risks imposed by the plant only because they are ignorant of them.*

*Secondly, who decides which risk is greater: whether from further radiation or from implementation of the protective measures? In the*

*nucleocrats' scheme of things, the answer is obvious: officials decide. They have the knowledge, they have the information, they have the scientific detachment and 'objectivity': the public on the other hand is ignorant and is incapable of understanding such 'technical' issues. The fact that the officials also have vested interest in keeping the nuclear enterprise going and in minimizing its problems and risks, is besides the point. Also irrelevant is the fact that the officials who make the decisions between different levels of risk are not the ones who are incurring the risks themselves but the guys sitting In Bombay. But then that is what objectivity is all about! (See discussion on Intervention Levels)*

Risk from stochastic effects should be limited by introducing protective measures so as to achieve a net positive benefit to the individual. Examples of stochastic effects are cancers, genetic mutations, etc., for which there is no minimum radiation dose or threshold for initiation. These effects cannot be predicted for any specific individual but can only be estimated as an increase in their probability of occurrence in proportion to the dose among the exposed population.

Serious non-stochastic effects should be avoided by introduction of protective measures to limit individual exposures below the threshold value for these effects. Examples of non-stochastic effects

## PROBABLE EFFECTS OF ACUTE WHOLE BODY DOSES

Dose in rems	Probable Effects
0 — 25	No detectable clinical effects. Probably no delayed effects.
25 — 100	Slight blood changes with later recovery. Possible nausea. Delayed effects possible but serious effects improbable.
100 — 200	Nausea and fatigue, possible vomiting. Reduction in certain blood cell counts with delayed recovery.
200 — 300	Nausea and vomiting on the first day. Two week latent period followed by general malaise, loss of appetite, diarrhoea, moderate emaciation. Possible death in two to six weeks; for most healthy individuals recovery likely.
300 — 600	Nausea, vomiting, diarrhoea in the first few hours. Short latent period followed by epilation (loss of hair), loss of appetite, general malaise, then haemorrhage, emaciation, purpura (an eruption of small purple spots of the skin), diarrhoea, inflammation of the throat. Some deaths in the first weeks. Eventual deaths to about half the individuals at about 450 rems.
1 600 and more	Nausea, vomiting, diarrhoea in the first few hours. Short latent period followed by diarrhoea, haemorrhage, purpura, inflammation of the throat, fever by

are skin reddening, epilation, (falling of hair), changes in blood chemistry, vomiting, etc. for each of which to occur there is a definite threshold radiation dose value.

*This table of probable effects of acute whole body doses, illustrates the nuclear mindset as nothing else can. The whole attitude which permeates the nuclear effort is right there in black and white— Up to 100 rems: "delayed effects possible but serious effects improbable" — this from the same guys who just a few lines previously write, "stochastic effects are cancers, genetic mutations, etc. for which there is no minimum dose or threshold for initiation." Let us consider the delayed effects. If just a 1,000 people each get this dose. According to the latest report of the U.S. Committee on Biological Effects of Ionizing Radiation (BEIR-V) — the nucleocrats' own bible — this much dosage would result in anywhere between 8.6 and 42 persons getting fatal cancer. This itself is an enormous number, hundreds of times larger than 'normal' incidence. However, many independent scientists consider this estimate too low. (Over the years, the BEIR committee has a record of periodically revising their probable cancer numbers upwards). Dr Goffman's calculations show that it would be more like 266 which is more than one fourth of the population irradiated. But to Indian nucleocrats these fatal cancers are nothing "serious." What they demand as proof of hazard are dead bodies littering the streets, as in Bhopal. Alas, Bhopal has shown that even that horror is perfectly acceptable — since there is "net benefit to the individual."*

*High acute doses of radiation cause immediate problems. (See Table on previous page). These symptoms are a cause of worry not only to the poor afflicted patients but also to public—relations conscious nucleocrats. Therefore, the philosophy is, use protective measures to try and keep individual doses below the threshold where injury becomes quickly apparent. As far as other effects such as cancers and genetic abnormalities are concerned, they take a long time to manifest themselves and therefore the risk of introducing the protective*

*measures can safely be balanced against the risk of producing cancer later, so as to "achieve a net positive benefit to the individual."*

*However, unfortunately, these cancers are not imaginary — they do occur and to those who get them till talk of "net benefit" is a cruel joke.*

## Intervention Levels

Intervention levels serve as aids in planning and decision making during an emergency. Expressed in terms of projected radiation doses, they provide guidance on the need to take specific protective measures, such as evacuation, sheltering, thyroid blocking and banning consumption of affected foods. Intervention levels are laid down as a lower and an upper level. Below the lower level, the protective measure would not normally be justified. At or above this level the measure is recommended for implementation unless valid reasons exist for deferring action. At or above the higher level, the measure is mandatory unless implementation entails demonstrably greater risks for the people involved.

*Intervention levels also illustrate the Indian nuclear mindset admirably. For one thing, they are amongst the highest in the world. For example Britain recommends a lower level of 0.3 rem for sheltering while it is 1 rem in India. But the most dangerous level here is the lower level recommended for banning food consumption. One rem per year for the general population is just way too high. If food contaminated to this level were to be eaten by the whole population of the country, it could result in anywhere up to two million cases of new cancers every year. Since this is the lower level, nucleocrats consider action banning food consumption at less than this level as inappropriate. The mandatory upper level of five rems a year is just out of this world. (May be nucleocrats are actually secret population control agents). For comparisons sake, the recommended public radiation exposure level in the US (where too the same breed rule the roost but public consciousness is somewhat greater) is one tenth of a rem.*

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## Intervention Levels for Radiation Exposure

Protective Measure	Lower Level in rems		Upper Level in rems	
	Wholebody	Thyroid	Wholebody	Thyroid
<b>Sheltering</b>	1	—	5	—
<b>Sheltering and Thyroid Blocking</b>	1	2	5	<b>10</b>
<b>Evacuation</b>	2	20	10	<b>100</b>
<b>* Banning food consumption</b>	1	10	5	<b>50</b>

**\* : Consumption of contaminated food would deliver this dose in one year.**

# The Cancer Controversy

Since gamma or penetrating radiation is a normal constituent of the atmosphere, repeated exposure to a small dose of ionizing radiation is an inescapable condition of life on this planet. There are several reasons to believe that these inevitable exposures could cause cancers and birth defects.

But it has also been argued that background radiation is a benign influence which provides essential stimuli to the immune system. With universal exposure to this more or less constant dose of background radiation, and no alternative sources of radioactivity, it might have remained impossible to refute this optimistic view. However, man-made sources of radioactivity should make it possible for epidemiologists to arrive at the correct conclusion.

Studies of the health effects of very small doses of radiation face three design problems: how to accurately measure the radiation doses large numbers of persons have received (the dosimetry problem), how to prevent comparisons between exposed and unexposed groups from being bedeviled by other differences (the selection problem), and how to cope with the varying lengths of cancer latency (the follow-up problem). These technical problems lie at the center of the debate about the cancer effects of low-level radiation, and the cancer issue is central to the controversy about nuclear technology. Therefore, it is important to appreciate the strengths and the weaknesses of the more important surveys of radiation effects that have been conducted. These include a mortality study of the Japanese atom bomb survivors, carried out by the Radiation Effects Research Foundation (RERF data), a similar study of workers in the nuclear weapons industry (Hanford data), and the Oxford Survey of Childhood Cancers (OSCC data).

## RERF data

This ongoing survey began five years after the bombing of Hiroshima and Nagasaki and is still keeping tabs on 80,000 survivors. It is estimated that several members of this study population received a very high (over 100 rad) dose of gamma radiation. But two thirds of the group are believed to have received under 10 rad, which is less than the usual lifetime dose from natural background radiation.

Over the years there have been many comparisons of the mortality rate of these survivors and of other Japanese citizens born at the same time (external or exposed / unexposed comparisons), and also between groups of survivors who experienced different dose levels (internal or graded-dose comparisons). The results of this work have always been the same: cancer deaths have always appeared to occur in direct proportion to the estimated dose received; and for other causes

of death there has always been an impression that no significant differences existed between groups of exposed and unexposed persons or between groups of survivors who received low and high doses.

On the strength of these observations, RERF investigators long ago decided that the only late effect of radiation was cancer. In other respects there were no material differences between A-bomb survivors and their Japanese contemporaries. For this reason, the safety recommendations of the International Commission on Radiological Protection (ICRP) and the World Health Organization (WHO), and all the cancer risk estimates contained in the latest report of the U.S. Committee on Biological Effects of Ionizing Radiation (BEIR V) are based on the following assumptions: If a population is exposed to ionizing radiation (excluding prenatal exposures), there will be no late effects apart from cancer, and the risk of any individual developing cancer, will be directly proportional to the dose received (straight line or linear dose relationship). There is also general agreement that RERF data are probably the most reliable source of cancer risk estimates for occupational exposures and other low-dose situations, although there is no reason why the findings of other high-dose studies, such as the British ankylosing spondylitis study of late effects of radiotherapy (referring to a rare disease involving spinal fusion), should not be used to supplement RERF data.

Despite the general consensus, one has only to consider the appalling state of Hiroshima and Nagasaki in the autumn of 1945 and the following winter to realize that a number of questions have been left unanswered. For example how could thousands of injuries from the blast as well as radiation have had no effect on the makeup of a population of five-year survivors? Would survivors of such injuries (to say nothing of general devastation) not have had stronger constitutions than non-survivors? Finally, why have there been no tests of a relatively simple theory, namely, that, at high dose levels, in addition to cancer, there may be other harmful effects of radiation, such as immune system damage, which were counter-balanced statistically by the "beneficial" effects of the early deaths, that is the selective survival of exceptionally fit persons?

With only one bomb in each city, any selection effects of the early deaths would be as strongly dose related as any late effects of radiation. Therefore a balancing act between contrasting effects of selection and damage to the immune system could easily leave a false impression that neither effect had occurred.

In 1978 RERF scientists looked for and failed to find, any signs of selection. But ten years later,

when RERF released a data tape relating to deaths from 1950 to 1982, George Kneale and I had the opportunity to do what should have been done much earlier—namely, to apply to non-cancer deaths a statistical test of *simultaneous* effects of beneficial and harmful influences.

Such a test was not difficult. When applied to 24,461 non-cancer deaths it produced evidence of two opposing effects which were dose related but not exactly balanced. Below 100 rad a beneficial effect was in ascendancy, but above this level it was clearly the weaker of the two effects. When deaths from heart attacks and strokes were excluded, it was possible to see that the remaining deaths, including all deaths from infections, were most affected by the two contrasting influences.

There is, as yet, no sign that this independent analysis of RERF data will influence official recommendations concerning radiation exposures. If, however, we are correct in assuming that the beneficial effect is selection, and that the harmful effect is immune system damage, there should certainly be changes. For example, the lasting selective effect of the early deaths would make it necessary to revise opinions about the general validity of RERF data, and a lasting effect of immune system damage would make it necessary to revise opinions about the best method of estimating cancer risk. The method currently approved by ICRP and other authorities, "linear extrapolation of high-dose effects," merely requires applying a straight line or linear dose equation to cancer deaths of A-bomb survivors or radiotherapy patients. But if cancer is not the only late effect of exposure to high levels of radiation, the current risk estimates for low doses should be replaced with estimates based on the cancer experience of nuclear workers.

## Hanford data

One of the oldest and largest of several U.S. centers for research and development of nuclear weapons is Hanford Nuclear Reservation in Washington State, where the main activity, since 1943 has been the large scale production of weapons-grade plutonium. The employment records of Hanford workers indicate their annual doses of external radiation, initial job title and subsequent changes, results for all tests for internal radiation (which are known collectively as bioassay data), and the results of tracing cause of death through social security death benefit claims. These data have been examined by two rival groups of epidemiologists. Thomas Mancuso, George Kneale and I (MSK) examined these records in 1977, but were later replaced by scientists from the Battelle Pacific Northwest laboratory (PNL).

We found a detectable cancer risk at supposedly safe dose levels, well below the maximum permissible dose for external radiation, five rad

per annum. According to PNL, this is not so, and one sign that "all is well" is that Hanford workers have a lower cancer death rate than the expected rate for all U.S. citizens of comparable age.

The MSK argument is as follows: The low cancer death rate is merely the result of the fact that sickly persons were excluded from employment at Hanford. This so-called healthy-worker effect is typical of all well-paid industries, and may be different for workers in the same industry doing different types of work.

Inspections of Hanford job titles revealed so many changes (presumably avoid exposures above the maximum permitted dose), and so many meaningless titles (presumably to meet secrecy requirements), that we decided to equate danger levels of work at Hanford with the frequency and the results of bioassay (internal radiation) tests. This decision was followed by a statistical analysis of the effects of *external* radiation, with and without controlling for danger levels. With this control, there was a definite evidence of a cancer risk, and without it the evidence "disappeared."

PNL, who recognized four groups of "main occupation" and ignored frequent job title changes, argued that the MSK use of the bioassay data produced "an artificial bias towards a positive correlation of radiation exposure and mortality." This criticism might be relevant if MSK had categorized workers according to the sum of all their bioassay tests, but in fact we assigned workers *annual* positions on the danger scale. PNL has now conceded that, even without the MSK type of control, there is evidence of a radiation effect for one type of cancer (multiple myelomatosis), a disease of the bone marrow, which "has persisted with additional follow up."

The dispute persists regarding interpretation of Hanford data, which for our part is based on records up to 1977. On July 17, 1990 however, the U.S. Department of Energy released all records of Hanford workers to 1981, which my colleagues and I will examine over the coming months. This is only the first batch of records, which will eventually include follow-up to the present date of workers at all important Department of Energy facilities.

Nothing of much value has thus far come from other studies of nuclear workers, which have had shorter follow-up periods and/or involved smaller numbers. As a contribution to the low-level radiation and cancer controversy, the Hanford studies to date clearly rate very low. But in conjunction with other studies of nuclear workers they hold out the promise of a final resolution of the question by the end of the century.

## OSCC data

The first evidence of any cancer effects of low-level radiation came from comparing the medical records of children who died from leukemia or other forms of cancer in Britain

(cancer cases) with those of healthy children from the same regions (live controls). These comparisons showed that members of the group who developed cancer had been X-rayed before birth twice as often as members of the control group.

This crucial finding of the Oxford survey dates back to 1956. Similar studies of cancer deaths have continued in later years. The later work not only confirmed the original X-ray findings but also showed that all childhood cancers have *in utero* origins. Eventually, with national coverage of all cancer deaths of children under 16 years of age from 1953 to 1980 (22,531 cases), and with independent measurements of the background radiation for each 10-kilometer square of the country (there is considerable variation in the terrestrial component of these doses), it became possible to assess the potential cancer effects of background radiation. Seizing this opportunity, the Oxford survey showed that prenatal exposure to background radiation is an important cause of childhood cancer and is possibly the *only important* cause; for more than half the OSCC cases, these early exposures were the apparent cause.

There were several reasons why the Oxford survey group could complete such a difficult task. By interviewing mothers, including those of control subjects, it was possible to assemble a wide range of case and control records from several places including prenatal clinics, hospitals, and X-ray departments. Also, the Oxford survey had records of climate and population density, as well as annual numbers of live births, stillbirths, and infant deaths for over a thousand local authority regions. With such voluminous data it was possible to recognize events which had a direct effect on cancers, such as post-natal X-rays (harmful effect) and inoculations against infections (beneficial effect), as well as events which made it difficult to recognize the true frequency of childhood cancers because they operated as "competing causes of death." Competing causes included stillbirths, infant deaths, and infection deaths of older children — which were found to have an exceptionally strong association with leukemia. By steering a straight course between a host of confounding variables, the Oxford survey detected the effects of natural background radiation and showed that it was harmful in the same way that

pre-natal X-rays are harmful; that is by causing cancer mutations.

## Conclusions

Both the bombing of Hiroshima and Nagasaki in 1945 and the use of radiotherapy made it inevitable that studies of A-bomb survivors and hospital patients would take precedence over studies of nuclear workers. Ideas about possible effects of natural background radiation were bound to be coloured by what is known today as RERF data and the ankylosing spondylitis survey.

According to these sources, it would be safe to assume there are no late effects of radiation apart from cancer, no lasting selective effects of early deaths of A-bomb victims, and no cancer risk at low dose levels (below 20 rad). At the same time, a rapidly expanding nuclear industry successfully avoided the troubles with afflicted radium luminizers in the 1930s simply by obeying a rule that workers receive no more than five rad per annum. The nuclear establishment had good reason to believe that a potentially dangerous situation had been completely diffused, and optimists were still free to regard daily exposure to background radiation as a benign influence.

For several years the only indication to the contrary was the Oxford survey's finding on prenatal X-rays. But today we face the possibility that there are other late effects of radiation besides cancer; and the possibility that the selection effects of the two nuclear explosions are still reflected in the death rates among survivors and are the reason why no cancer effects have been found at low dose levels. If these possibilities are confirmed, we may one day realize how fortunate it was that the Oxford survey findings put a brake on the enthusiasm of nuclear power advocates. Otherwise we might never have pressed for direct studies of the effects of low doses of radiation.

*Source: Alice M. Stewart  
Bulletin of Atomic Scientists September 1990*

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Editor's Note: There are a number of references to this article which are available in the *Bulletin*

## Voices of Warning

The Greek legend of Cassandra, the princess whose gift of prophesy was unfliningly accurate but never believed, was no doubt a story born in reaction to the earlier destruction of much of the Aegean ecology by the Mycenaean civilization in the centuries before 1000 BC. That destruction was so widespread and devastating — the forests that once covered the Mediterranean coast were

**cut down, hills opened to erosion, grasslands made into deserts by spreading herds — that it led to the collapse and obliteration of Mycenaean culture and subsequent Greek 'dark ages'. Some voices, surely, there must have been crying out against that destruction, warning of the consequences if foresters continued to cut the trees and the herders to unleash their flocks, promising that civilization**

itself would come to an end — and yet, just as surely, they were ignored, probably scorned and derided. The memory of all this most likely led the later Greeks to imagine such a seer as Cassandra and device the myth of her futile prophecies.

And so today, the signs are all around us, the evidence apparently incontrovertible, the voices raised in warning. And yet like the Mycenaeans — and the Romans, the Sumerians, the Mayans, the Harappans, the Tang Chinese, and others — the rulers of this civilization refuse to hear, refuse to change.

Those of us who are Cassandras by profession and inclination might be moved to despair: at times it seems so illogical to speak what to gods have determined will be ignored. Yet, what else can one do?

I am moved to these thoughts by the latest bit of cassandraic evidence to cross my desk. According to the largest and the most comprehensive recent reports of cancer deaths in industrialized nations — published in *The Lancet*, August 25, 1990, written by an American professor, the director of the UK census office, and the director of the World Health Organization's statistics office — the rates have been soaring alarmingly. Between 1968 and 1988, rates of brain cancer and bone-marrow cancer in people over 65 increased by 50 to 600 per cent, depending upon the industrialized country selected, and kidney cancer, breast cancer and lymphoma by 10 to 50 per cent. Overall cancer mortality, high enough to begin with in the sixties, has immensely magnified in just twenty years.

These are deaths in industrialized countries — the US, Japan, UK, and three other European nations — and it is industrialization that has caused them. Epidemiologists are agreed that environmental factors, particularly air pollution and toxic waste in ground and water, and dietary regimens, are the culprits.

And no, it is *not* a matter of better reporting or diagnosis of disease, nor of old people simply living longer. Those factors were considered and discarded in this study, with the conclusion that the

increased mortality — the sharply, startlingly increased mortality, I might say — is simply the result of the way Western civilization has chosen to evolve.

And does such news make the front pages, prompting cries of anguish and alarm from officials in charge of our health, from activists eager to protect citizen victims? Hardly. The report appeared in *The New York Times* on page 18, effectively buried, and it was accompanied by business-as-usual disclaimers from medical and governmental officials. "The statistics here are well known," said the yo-yo who is the deputy director of the division of cancer prevention at the National Cancer Institute outside Washington. "I don't think it is telling us anything really new."

Well, if it's so bloody well known, why don't more people know it? And if it's nothing new, why hasn't something been done about it?

Cancer is the very clearest early warning device that this civilization has. It is as indisputable as death, as sharp as pain. If death rates are going up, on average, more than 300 per cent over the last twenty years, this is a horrible indictment of the way industrial society lives — and does.

And yet the message, for all its clarity, is ignored. Cassandra will not be heard.

*Kirkpatrick Sale*

*Resurgence No 143 November/December 1990*

**When pollution levels in Copenhagen , mark. rise above the World Organisations' standard, Friends of the Earth's anti—smog network swings into action human chains block traffic on main roads for several minutes during the rush hour. have had to bear some heavy fines blocking traffic, but together with a coalition of trade unionists, cyclists and senior citizens, they're determined to win an alternative traffic plan for the city. The plan includes percent cut in traffic, a light rail line, a better bus service and improved bicycle access.**

## A Tale of Two Superpowers

*Many 'defense' analysts including Gen Sunderjee and Jasjit Singh have recently been arguing that India should "exercise its nuclear option." In plain words, openly declare its intention to make nuclear weapons and then proceed to make and test them along with their delivery systems. This is supposed to be a cost-cutting measure! Right now, we are not going into the merits of this thesis, but merely present a short account of the human cost to the bomb-makers themselves of the very first bomb making efforts at Hanford in U.S.A., and Chelyabinsk in the Soviet Union. The portion regarding U.S efforts appears as an editorial by Len Ackland in the September 1990 issue of Bulletin of Atomic Scientists We would strongly recommend activists to read this issue of the Bulletin in depth since it is specifically devoted to the health effects of low-level radiation. The material on the Soviet Union has been prepared by Thomas Cochran and Robert Norris and published as a paper in a series called Nuclear Weapons Databook.*



# Human Guinea Pigs

Tom Bailie, a farmer born in 1947 near the Hanford nuclear weapons production complex, has long believed that his thyroid disease and sterility as well as the cancer affecting relatives and neighbours were caused by the radiation emissions from the complex. "I'm not antinuclear," he said, "but what they did to us was industrial recklessness and stupidity."

"They" were a large, if undefined, number of US government officials, scientists and contract employees who ordered or knew about the regular releases of dangerous radiation byproducts, including radioactive iodine, from Hanford. These emissions were measured by the government, but kept secret for decades from Bailie and some 270,000 other residents of a 10-county area around Hanford. Finally, under pressure from local public interest groups (mainly Hanford Education and Action League (HEAL) — a group with whom *Anumukti* has an exchange arrangement) which filed Freedom of Information Act requests, the US Energy Department in 1986 declassified and released documents about Hanford's emissions. But the government refused to acknowledge that the radiation could have caused illness.

That policy of denial abruptly changed on July 11, 1990 when US Energy Secretary James Watkins admitted at a news conference that some residents in the Pacific Northwest US had received high radiation doses to the thyroid. Not Coincidentally, Watkins's rather generalized announcement preceded by a day the release of a two-year Energy Department financed study by an 18-member panel of scientists and other citizens. It disclosed that 13,700 persons — 5% of the 10-county population, — had on the average each absorbed a radiation dose of 33 rad (equivalent of about 1650 chest X-rays) from late 1944 to 1947 and that an undetermined number of children might have received doses as high as 2,900 rads to their thyroids.

"We learned several years ago that the Government decided —with cold deliberation— to use us as guinea pigs by releasing radioactivity into our air, water, milk and food without our consent," Bailie wrote in *The New York Times* after the recent revelations. "Now, we've learnt that we can expect continuing cancer cases from our exposure in their 'experiment.' Is this what it feels like to be raped?"

Bailie feels abused and betrayed by his government. "Moscow was condemned for its three days silence after the Chernobyl nuclear accident. What about Washington's 40 years of silence?"

The question should resonate across USA. Tom Bailie didn't volunteer for a hazardous Cold War waged in part by the large scale production and testing of nuclear weapons. Even if his family, and the hundreds of thousands of other families

living around the nations nuclear plants and the Nevada Test Site, had volunteered, they should have been fully informed of the risks. As new information became available, it should have been passed along. Such a civilized procedure should have also been followed with the estimated 600,000 to 1,000,000 men and women who worked in the U.S. nuclear weapons plants from World War II to the present. Instead, secrecy was the rule, "national security" the justification.

At the very least, society owes all of these people, these victims and potential victims of the Cold War, a thorough accounting of the health risks they incurred from radiation exposure and medical care for those who need it. Most of their exposure involves relatively low-level radiation, a phenomenon which is causing considerable controversy with regard to nuclear power plants, nuclear waste and other sources of radioactivity.

## The Most Contaminated Spot on Earth

In early 1942, the possibility of an atomic bomb became a serious issue for the Soviet leadership. In the university library at Vornezh, Flerov noticed that articles on nuclear fission were no longer being published in the West, a sign to him that secret work was under way. In May, Flerov wrote to Stalin that "we must build the uranium bomb without delay."

By the time of the Potsdam Conference, in July 1945, the Soviet Union had a serious atomic bomb project underway. After one conference session, Truman casually mentioned to Stalin that U.S.A. had a "new weapon of unusual destructive force." Stalin told Truman he hoped the U.S.A. would make "good use of it against the Japanese." He also ordered his scientists "to provide us with atomic weapons in the shortest possible time." One day after Hiroshima, Stalin put his secret police chief, Lavrenti P. Beria in charge of the Soviet version of the Manhattan Project. The first Soviet atomic bomb was assembled at Chelyabinsk and tested on August 29, 1949.

The Soviet Union followed a pattern of nuclear weapons materials production similar to that followed by U.S.A. Each began with construction of natural-uranium fueled, graphite moderated, reactors for plutonium production and development of gaseous diffusion technology for the enrichment of uranium. Today, the Soviet Union relies on both graphite and heavy water moderated reactors for plutonium and tritium production. The government announced in 1989 that it was ceasing the production of highly enriched uranium.

## Production Sites

Soviet plutonium and tritium production for weapons takes place at three locations:

Chelyabinsk-40, near Kyshtym in the Urals, at Siberian Atomic Power Station near Tomsk and on the Yenisey River, 10 km north of Dodonovo in Siberia. Prior to 1987, there were as many as 14 production reactors at these sites — six at Kyshtym, five at Tomsk and three at Dodonovo. Between 1987 and August 21, 1990 four of the production reactors at Kyshtym and one at Tomsk were closed down. The fifth reactor at Kyshtym was scheduled for closure in October 1990. In October 1989, the Soviet Union announced that it intends to cease plutonium production by the year 2000.

## The Kyshtym Complex

Called by its post office box address, Chelyabinsk40 is not marked on maps of the Soviet Union. It is about 15 km east of the city of Kyshtym on the east side of the southern Urals in Chelyabinsk province. It is located in the area around Lake Kyzyltash, in the upper Techa River drainage basin among numerous other lakes with interconnecting watercourses. Probably fashioned after U.S. Hanford reservation, it was constructed in 1945-46 reportedly using the labour of approximately 70,000 inmates of labour camps. Spread over 90 square kilometers, it employs some 10,000 people. Its population including dependents is variously estimated to be between 83,000 to 100,000.

## Radiation Exposure to Workers

The period 1948—1952 is characterized by exceedingly high exposures. At A—Reactor the *average* annual worker dose peaked at 93.6 rem in 1949, the first full year of operation: and at the chemical separation plant the annual average dose peaked at 113.3 rem in 1951. From 1949 to 1951, 0.5 per cent to 1.8 per cent of the workers were receiving more than 400 rems annually, which is 80 times the current occupational exposure standard (and considered by many to be way too high!)

## Waste Management Activities

Radioactive waste from chemical separation plant at Chelyabinsk is now converted into, special glass, placed in stainless steel containers, and stored in cans in a special storage facility at the site. This, however, was not always the case. In fact, during the early years radioactive waste management was nonexistent.

According to the official report, "During the first five years of the operation of the enterprise in this branch of industry there was no experience of scientific development of questions of protecting the health of the people or the environment. Therefore, during the fifties there was pollution of individual parts of the territory and around the enterprise." These bland words actually mean that from its beginning in 1948 through September

1951 all radioactive waste was discharged directly into the Techa river.

In 1951, after radioactivity was detected as far away as the Arctic Ocean (more than 1,000 km from Chelyabinsk) a new solution was adopted. The wastes were dumped into Karachay Lake which has no outlet. The Techa river and all its floodlands (8,000 hectares) were excluded from use by people. The Karachay Lake is a 45 hectare natural lake or (bog). It eventually accumulated 120 million curies(MCi) of long lived radionuclides cesium-137 and strontium-90. For comparison this is about 100 times the amount of these radionuclides released by the Chernobyl disaster. In the 1960s it was discovered that radioactivity from the lake was entering the ground water. Efforts to eliminate the reservoir began in 1967.

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**"It's hard to imagine what we could do with nuclear weapons to their [the Soviet] economy that they haven't already done to it themselves."  
U.S. Congressman Les Aspin**

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The area of the lake has shrunk to 25 hectares. Today, radioactivity in the ground water has migrated two to three kilometers from the lake. On the lake shore the radiation exposure is about 600 rems per hour enough to kill a person within one hour. In 1967, a hot summer followed by a dry winter. The water evaporated and dust from the lake bed was blown over a vast area, up to 75 km long, affecting 41,000 people. The lake is now slowly being filled with hollow concrete blocks, rock and soil to reduce the dispersion of radioactivity.

## Waste Explosion in 1957

During the initial period of operation of the chemical separation plant the irradiated fuel rods were treated by an all acetate precipitation scheme. After the fuel had been dissolved in nitric acid, and the uranium and plutonium had been extracted, radioactive solutions were formed which contained as much as 100 grammes per litre of sodium nitrate and 80gms/l of sodium acetate. The solution was stored for a year in tanks in order to reduce the radioactivity and cool prior to further treatment for plutonium extraction. After treatment, some portion of the solution was returned to the storage tanks and the less radioactive part dumped into Lake Karachay.

The intermediate storage facility consisted of a rectangular buried concrete canyon with wall 1.5 metres thick designed for holding 20 stainless steel tanks each with a capacity of 300 cubic metres. The tanks were entirely immersed in water and

utilized an external cooling system. Some of the instruments for monitoring the tanks failed and could not be repaired due to the very high radiation field in the canyon. As the solution in the tanks evaporated, the tanks rose breaking the seals in the waste transfer lines and contaminating the cooling water. Because of insufficient production capacity the tanks were switched to "periodic cooling mode." The cooling system in one of the unmonitored tanks failed however and the wastes began to heat up and dry out. Nitrates and acetates in the waste precipitated, heated up to 350° C and on September 29, 1957 at 4.20 PM local time exploded with a force of nearly 100 tons of TNT. Some 20 million curies of radioactivity were released to the atmosphere. The largest nuclear disaster previous to Chernobyl.

About 90% of the radioactivity fell in the immediate vicinity of the vessel. Radiation levels within 100 metres of the crater were 400 rems per hour: at 3 km the levels were 3 rems per hour. In a twenty square km area of extreme contamination all the pine trees perished within a year.

There were 217 towns and villages with a combined population of 270,000 who were significantly contaminated. Virtually all water sources were contaminated.

## The Situation Today

At some unspecified date, waste storage was shifted to double walled, stainless steel tanks, which have leaked on occasion but have undergone repairs. Concentration and immobilization of high level waste into glass blocks is being carried out. After 30 to 40 years of air cooling, the Soviets plan to bury the waste in granite or salt formation. The government has been looking in the region of the Urals for a possible burial site, but has been facing public opposition.

# LETTER box

*Sanctuary is a bimonthly publication which focuses of wildlife and ecology related issues and publishes some dazzlingly beautiful photographs, along with very informative articles. Sometime back I was pleasantly mystified to receive a spate of letters all carrying the same message pledging opposition to nuclear power and a readiness to disseminate information on the subject within one's community. The mystery was resolved when I received a copy of Sanctuary along with a letter from its editor Bittu Sahgal. The crux of the matter was the response to the deadly disinformation campaign launched by the Nuclear Power Corporation (NPC), through a series of advertisements which have appeared very widely in various publications including Sanctuary.*

The Techa River is cordoned off with a wire fence and people are forbidden to catch fish, pick mushrooms or berries or cut the hay. There are 450 billion cubic metres of radioactive water in open reservoirs. Fish in Reservoir No. 10 are reported to be "100 times more radioactive than normal.

As the Soviet weapon's production winds down a new environmental threat has arisen in Chelyabinsk. The massive production complex with its six reactors used to utilize contaminated water from the lakes, thus regulating the water level. With five of the six reactors now closed, the reservoirs might overflow with natural water and possibly even cause failure of dams, sending contaminated water into the rivers of the Ob basin. To counter this threat (among other more 'cogent' reasons), the authorities have proposed a new South Urals Nuclear Power Complex. Work on two large fast breeder reactors began in 1984 But since 1987 construction is at a standstill, firstly because there is no money and secondly due to public protest.

Editor's Note:

*We have previously published in Anumukti. various articles and a poem (see last issue) which describe the agony and the betrayal felt by the Hanford downwinders, as well as the horror of Kyshtym. The reason for this repetitiousness is that Hanford and Chelyabinsk are not something that happened 40 years ago in another country. They are happening today in ours. The nuclear mindset makes them inevitable. The question that needs to be posed to defense strategists is: Who are you trying to defend with the bomb? Is it the people? Is it the land? Both get contaminated in the very process of making the bomb. One kills one's own.*

*Some readers had strongly objected to this. Below we reproduce a sample of their protest.*

Having known *Sanctuary* to be a truly concerned magazine, I was rather dismayed to find an advertisement of the Nuclear Power Corporation glorifying nuclear energy as a safe technology. The presence of this advertisement is particularly ironic in the view that the report "Goa could go" was also printed in the same issue. Are you so hard up for advertisements that this kind of misleading propaganda should be accepted? I would prefer to believe that this was a slip up on your part.

S.Lakshmanan  
New Delhi

It seems incompatible with the purpose and interests of *Sanctuary* to use advertisements from corporations such as Nuclear Power Corporation. For too long we have stripped our environment in the name of development of the masses. Such a state of affairs is being perpetrated by the hegemony of a certain power class who control the information banks, and by the ballot gain their power to maintain a bureaucracy as corrupt and selfish as itself. They dupe the masses into believing the the destruction of our nation's natural non-renewable resources, its irreplaceable heritage, is development. I think I will be representing a large section of environment-conscious readership in requesting you in future to refrain from using such advertisements.

Bulu Imam  
Hazaribagh

*Sanctuary's Reply:*

*We had initially rejected the idea of carrying the advertisements, but after discussions with other conservationists we felt that the NPC should be allowed to have its say, with the idea of subsequently challenging their claims as we have done elsewhere in this issue. This is the closest we have been able to come to a public debate on the wholly untenable claims of the all powerful nuclear lobby in Bombay. In the case of Sanctuary Magazine this stance was practical, but the essence of such a media blitz must be condemned because very few other newspapers, or magazines would consider devoting equal space to countering the claims of each of advertisements. We would, however, be very grateful for still more responses from readers on the pros and cons of our carrying Nuclear Power Corporation advertisements.*

*It further announced its intention to utilize the surplus generated from NPC advertisements in the following manner*

- Present one year subscription to *Anumukti* to the first 150 persons who shall sign and send a specified statement directly to *Anumukti*. (Please see *Sanctuary* Vol. X No. 5 - Sept/Oct 1990 for the detailed statement.
- Provide secretarial and other infrastructural assistance to help organize citizens of Bombay to demand greater accountability on the issue of public health from the Tarapur Atomic Power Station authorities. (In this connection they have also invited me to go to Bombay in the month of March to give a series of talks to be arranged on the university campus, in various public halls and with organizers of NGOs -Editor)

- *Sanctuary* will petition the *Indian Society of Advertisers*, the *Advertising Standards Council* and the *Consumer Protection Society* to prevail upon the Nuclear Power Corporation to withdraw their campaign immediately and to issue public statements to inform society that it was misled. It will also send appeals to all members of IENS to counter the propaganda unleashed by NPC by publishing articles and statements which highlight the hazards of nuclear power.

*Anumukti's Stand:*

While the offer of 150 subscriptions is like the proverbial life preserver to the drowning man in our precarious financial state, we do not approve of this idea of "using their money to fight with them," for the following reasons:

- Firstly, it is not their money, its ours. We should not allow anyone to squander public money to misinform the public. Granted, we are today too weak to stop this criminal waste, but under no circumstances should we be collaborators.
- Should the onus of providing the forum for public debate be on us? Nothing stops or can stop NPC from having its say, but should this say be at the cost of the hard earned credibility of magazines like *Sanctuary*. NPC have huge resources at their command. The government controlled media are at their beck and call. It is not for the lack of an adequate forum that they have fought shy of a public debate. For forty years they did not feel the need to "educate the public." It is only in the post Bhopal-Chernobyl era, with its rising tide of environmental awareness that they have suddenly woken up. But even now their preference is not for a debate, but for stage—managed shows and this massive disinformation media blitz.
- May be a better form of public debate would be to print their advertisement series "Nuclear Power and You" in *Anumukti* without payment in conjunction with another series of ads, "You and Nuclear Power" (to be produced by us); the only condition, being that the same be simultaneously printed in their in-house magazines like *Nuclear India*, *Nu-Power*, and other such.

Needless to add that we strongly welcome the other suggestions mentioned by *Sanctuary* and do our utmost to cooperate. We would honour the commitment made by *Sanctuary* with regard to the pledges — in fact, we have already placed all those who responded on our mailing list.

# REVIEW

## DIMONA THE THIRD TEMPLE ?

The Story Behind the Vanunu  
Revelation

Mark Gaffney

AMANA BOOKS (1989)  
P.O. Box 678, Brattleboro, VT 05301  
U.S.A.

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The nation of Israel is an enigma. On the one hand it is a state as described in this book:- Unjust, brutal and repressive towards its non-jewish population; belligerent towards its neighbours; uncaring, at times even contemptuous of world opinion; willing to engage in one outrageously criminal act after the other; prepared to carry its obsession with security to an extent that it seems willing to bring nuclear holocaust upon the world; indeed a pariah nation.

But, there is another side to Israel. No other people in history have been as persecuted as the Jews. For more than a millennium, they were the only victims available to the Western Uncivilization. Gandhi correctly described Jews as "the untouchables of the world." After being denied land-ownership for more than two thousand years, the transformation in agriculture that the Jews in Israel have brought about in the last hundred years seems nothing short of miraculous. It is the land where the most innovative and radical ideas have been put into practice; where socialism of the kibbutz is still a living idea: it did not degenerate into the 'New Class' as it did in nations where it was the officially sponsored ideology; a country which is alive and vibrant in its arts and sciences; a place way ahead of almost everybody in solar energy research ...In short, it is indeed, the Promised Land.

Recently, I was talking to an Israeli friend. He was totally opposed to the politicians now in charge of the country. "Politics in Israel is worse than in India The same leaders have mislead for more than 20 years. Yet, he defended their policies with great and what I felt as unnecessary vigour. But he admitted one thing. The moment Israel was ready to use nuclear weapons on anyone, it would lose all moral justification to exist.

Mordechai Vanunu, for eight years a nuclear technician at the Dimona research facility in the

Negev desert is presently serving an eighteen year prison sentence. This is his reward for having dared to expose the true state of affairs with regard to nuclear weapons development in Israel. He was kidnapped by Israeli secret service agents from Rome, drugged, trussed like an "african slave", chained to a crate on a cargo ship and brought to Israel. He was reviled in the Israeli press as "the greatest traitor of the 20th Century," a homosexual, an exhibitionist, unbalanced and a general 'loser'. On several occasions even his family members were attacked and humiliated.

This book is not so much a story of Vanunu and how he got access to Israeli nuclear secrets, not even about the secrets themselves. One wishes it were! Alas, despite Vanunu's heroic efforts there are many puzzles still left But rather, it is an extremely well researched book about the policies of nuclear ambiguity that Israel has pursued with total amorality for long. It is therefore, of some special interest to readers in India. For India too — the land of non-violence and satyagraha, is an old adept at playing this game of "keeping the nuclear option open". (So, for that matter, is Pakistan).

The book also contains an extremely interesting appendix — which details the evidence for a low yield atomic blast on September 22, 1979 somewhere in the Indian ocean. It was believed at the time that the event was indeed an atomic explosion carried out jointly by Israel and South Africa, but a later report discounted this explanation.

The book lacks an index and this detracts from its otherwise fine quality. An important contribution to the understanding of the dangerous cauldron that is the Middle East

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### An Open Letter

My principal message is in several spheres. The individual; citizen, wherever he lives, has to find a way on the personal level to add his contribution to improve the quality of life on earth, to make everyday life pleasant and more tolerable. Much can be accomplished, starting with what the society offers. If, for example, a person can contribute in the sphere of social equality, by working against discrimination due to race, religion or sex, such a person can earn respect and is worthy of emulation. In my. own case, I wanted to expand awareness the nuclear danger in my own country, Israel, and in the Middle East. And I believe that my action contributed to the security and brotherhood of nations.

I showed by my action that the individual still has power, regardless of the almost unlimited resources of the establishment. Indeed, individual action can be a mighty weapon. Through action

the individual can hold the establishment accountable. By means of civil disobedience he can expose the dark machinations of any regime, for the sake of the general welfare. Because governments cannot operate without the cooperation of their citizens, civil disobedience will be discovered by many more people to be the mighty weapon it truly is. An action like mine teaches people to trust their own God-given intelligence. An action like mine demonstrates that people must not blindly follow their leaders on crucial issues involving nuclear weapons. Indeed, if there ever was a case for civil disobedience, it is this.

The nuclear threat is relatively new and has not yet been sufficiently comprehended in the world. Most people are simply unaware of the tremendous volcano under them. Should that volcano erupt, there will be no way back for mankind. It will be the end. And this threat, this holocaust, which hangs over us is all too possible, because of human frailty and error — as was shown by Chernobyl.

In the West, people have grown accustomed to living with the nuclear menace, without realizing the magnitude of the danger, and without conscious awareness of the real possibility that nightmare could actually happen. Not only have the superpowers sanctioned the intolerable presence of large quantities of nuclear weapons, the fact is that many nations in the Third World are following in their footsteps, without regard to the dangers.

To do what I did I had first to overcome many personal obstacles. Most important among these was the exposure of my private life to slander and the sacrifice of all my future plans. I had to overcome the force of general public opinion around me, especially of those held up as wise. I also had to overcome the views of intellectuals and experts who worked with me at Dimona. I had to say to them "It is you who are mistaken. It is you who are on the wrong path. On this matter, it is I who know better." And I remain certain that my action was worth the sacrifices I had to make, since I was able to point out - consistent with my own philosophy - what must be done in the name of mankind.

To act as I did undermines the blind confidence in the leaders. We saw an example of this problem of blind trust during Israel's invasion of Lebanon. At that time a majority of Supported the war without doubting it — yet today the situation is exactly reversed. Today most people know that it was not a defensive war — but folly. Today most people know that it was simply a bloodletting to bring about by force the so-called "new order" in Lebanon. Yet because Israelis followed their leaders blindly during that war, many civilians and

even children were executed in cold blood. I knew the truth from the war's first day. I knew it was going to be one more example of slaughter. I don't know how I knew, but I did. I simply would not believe the stories and announcements of the Israeli government. Because of those events, I began to take a more critical look at Israel's nuclear programme.

Today I am convinced of the great danger posed by Israel's nuclear policies. Today the government still does not even admit the existence of nuclear arms in the country. They hint at their existence, yet they refuse to allow international inspection of the Dimona reactor. Because the citizenry here is not informed, people are unable to work in a coordinated way to prevent the disaster which may lie ahead. The danger is that in a future crisis, Israel's leaders will be influenced by unreliable information, or will mistake a false threat for a real one, and so will trigger off a nuclear holocaust.

Today nuclear weapons are principally designed for use against civilian populations. A single bomb exploded over a modern city can kill hundreds of thousands of its citizens. Nor does the tragedy end there. Long afterwards, contaminating fallout radiation can make whole regions uninhabitable for many years. In addition, as was demonstrated at Hiroshima and Nagasaki, thousands of people will continue to die from cancer for years after the explosion. Moreover, it must be understood that since Hiroshima the dangers have increased because the destructive power of today's bombs is many times greater. The number of these weapons have reached terrifying levels. It is no wonder the Soviets and the Americans are seeking to eliminate some missiles from the European theater. Yet, from the standpoint of the individual, the best way to effect protection is to study the problem. Only by learning more about the danger can one hope to organize effective prevention.

A society unable to recognize the nuclear danger, a society that fails to take the step[s necessary for survival, is a sick society. Indeed, the best evidence of this fact is the dark cloud, the menace, the warning signs which continue to hang over us. But there are other risks as well. A people that chooses to go on living in daily ignorance of such a threat develops other social and psychological problems which are greatly damaging in and of themselves - without a bomb ever going off. Hence, it is not just the deployment of nuclear weapons, but their very existence, which threatens mankind.

*Mordechai Vanunu  
Ashkelon Prison, Jerusalem  
July 1987*

# Rhapsodie in Blue

## STERILITY PROBLEMS BEDEVIL THE FAST BREEDER

*The whole nuclear programme in India is based on a fantastic hope. The fast breeder must work. (Fast breeder reactors are a new kind of reactors which are supposed to produce (breed) more plutonium than the uranium fuel they consume. Fast, refers not to the speed of breeding - which is fairly slow, - but to the speed of neutrons which cause fission). And it must work, not on a tidily little laboratory scale but on large 'commercial' scale. The reason it must, is because our uranium resources are strictly limited. (In fact, but for us and a few other aspiring 'regional powers,' nobody in the rest of the world even looks at such poor quality ores. And even these are getting rapidly exhausted. So, unless the breeder can assure us of 'unlimited' plutonium in the future, all the brave words like self-reliance and energy independence would remain mere words. Now, one might wonder why this bother about self-reliance when we manage very well with foreign collaboration in such esoteric fields as soaps and toothpastes! However, these industries do not produce material that can be used for making nuclear bombs. Fast breeder reactors do. However, the only guys who have built a commercial scale breeder, are the French. Their programme is a colossal financial disaster — but that is another story. The following report, which appeared under the headline: Ailing Nuclear Reactor Beyond Salvage in The Sunday Observer of December 9, 1990, gives details of the technical snags affecting the Fast Breeder Test Reactor (FBTR) situated at Kalpakkam.*

India's ambitious fast breeder nuclear programme has come to a grinding halt with the 40 MW fast FBTR becoming permanently unoperational. With this, the plan of setting up a 500 MW fast breeder prototype of the Kalpakkam type reactor has fallen through.

According to the Department of Atomic Energy (DAE) sources, the Kalpakkam FBTR has never been operational except for a few minutes on October 18, 1985 when it produced enough power to light a 200 watt bulb.

Immediately after the much publicized commissioning of the plant, it was shut down. It was then reported that the operating level of the plant would be slightly increased. But now, after five years, that remains a pipe dream.

According to DAE sources, the Kalpakkam FBTR had to be closed down because it was ill-equipped to run at a higher power or for more than those few publicized minutes.

DAE circles further claimed that there were several instances of "one minute criticality" before it completely collapsed. They attribute this to some basic flaws in the design of the reactor. Senior scientists working on the project allege that the design of the entire steam generation unit was done "independently" of the reactor design, and there were crucial variations between the two. The steam generation unit, they alleged, was not built according to given specifications.

To top it all, in the hurry to stay on course with the given goal of generating 10,000 MW through nuclear power by the turn of the century, the reactor was made critical even before the design anomalies were rectified. The result was that the sub-assembly unit of the core of the reactor, called the calandria was damaged. It is yet to be rectified.

In a reactor of this design, the control rods, (called the guide tubes) and fuel rods of enriched uranium are placed alternately. In the FBTR they

became intertwined, each obstructing the other's passage, thus rendering the reactor static. This is a unique problem which has no precedent, say DAE sources.

Serious radiation threat to the technicians stands in the way of rectifying the damage. The high radioactivity permits only intermittent access to the reactor and make it extremely difficult to adopt any hands-on approach in solving the problems. Due to premature criticality, even the simplest maintenance tasks are rendered complicated and long drawn out.

A recent proof of this was a circular put up on the notice board at Kalpakkam which congratulated the technicians on successfully disentangling the reactor guide tubes. But contrary to what the circular states, sources in Kalpakkam allege that the guide tubes have not been disentangled and are still within the core of the reactor.

The flaws in the guide tube assembly have stalled the insertion of fuel rods into the reactor core or its removal. This could lead to a serious accident if the reactor was "on power". Compounding the difficulties in undertaking the repairs is the lack of know-how in any part of the world.

In a desperate move to salvage the fast breeder programme, the DAE imported and used parts of the junked French reactor *Rhapsodie*, on which the Indian breeder is modeled. French nuclear experts are of the opinion that the components of *Rhapsodie* - which was primarily a private design decommissioned several years ago - were so dysfunctional that they would not fit the bill as far as the Kalpakkam project was concerned.

In fact, while providing the components France made it clear, according to DAE circles, that it would give no performance guarantee in the event of the DAE attempting to retrofit and use them in the FBTR.

But now, with new nuclear tie-ups being envisaged with France, attempts to import components and somehow salvage the project are going on at desperate speed. This is supported by the projected expenditure allocation of Rs.36.62 crores for the Indira Gandhi Centre for Atomic Research (IGCAR).

Senior engineers and scientist are, however, firmly of the view that the project cannot be salvaged at any cost. They are also very critical of the DAE's decision to go ahead with the design of the 500 MW prototype fast breeder reactor.

Dr.Paranjeepe, director of the IGCAR flatly refused to give any Information on the working of the fast breeder project. He just kept asserting that the information gathered by the journalist were "unauthentic" and "unsubstantiated."

Dr.Paranjeepe however, reluctantly admitted that there were "some minor problems" in the FBTR, which would be rectified in the "near future." He refused to divulge the specific nature of the problem.

The scientists at the IGCAR do not rule out the possibility of an accident, as they feel that the radioactivity of the fuel rods may trigger off a fusion process before they are removed from the core, which may be uncontrollable. They are, however not prepared to reveal the real threat, constrained as they are under the Atomic Energy Act 1962, which forbids them from revealing any classified information. Yet they maintain that the chances of Kalpakkam becoming another Hiroshima are higher than it becoming another Chernobyl.

## Zebra Mussels Take on Nukes

Zebra mussels are smelly, calm-like parasites which grow to approximately three centimetres in length. As unimpressive as they may appear, these creatures have a lot of people in the Great Lakes basin of North America scrambling for a way to kill them off. Experts believe that these organisms came to Great Lakes in the ballast water of foreign ships, in a new development, a US scientist has discovered that potassium is lethal to the mussels. Potassium is a cheaper and less environmentally harmful alternative to chlorine, ozonation or hot water.

Originally from the Black Sea, Zebra Mussels were first noticed in Lake St. Clair in 1988. By 1989 they had infested Lake St. Clair and Lake Erie, and by March 1990, they had spread to parts of the other lakes and rivers in the system. Adult Zebra Mussels have also been found at the Bruce Nuclear Generating Station on Lake Huron.

The larvae attach themselves to hard surfaces at densities of upto 700,000 organisms per square metre. Once they mature, a thick, hard coating

of adult mussels cover the surface. Consequently they have significantly reduced the flow into several municipal, power plant and industrial water intake pipes in both Ontario, Canada and U.S.

Nuclear power station operators in the US have repeatedly experienced "biofouling" problems over the last decade. The Nuclear Regulatory Commission (NRC) Information Notice # 89-76, to all operators of nuclear power reactors, identifies Asiatic Clams, American Oysters, Blue Mussels and Zebra Mussels as species of particular concern. This notice outlines regulations for prevention of biofouling and states that "the potential for biofouling has been of concern to the NRC since 1980 because biofouling can compromise the vital transfer of heat to the ultimate heat sink." In other words, Zebra Mussels have great potential for plugging cooling systems. Zebra Mussels have given us yet another reason to move away from dependence on large, centralized generating stations.

*Rod MacLeod*

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