



ANUMUKTI

A Journal Devoted to Non-Nuclear India

Volume 7 Number 2

October/November 1003

Awards

The beginning of the year is usually considered to be a fit time for announcing of awards commemorating significant actions during the past year. For once, *Anumukti* joins the bandwagon.

National Gratitude Award for the most significant acton by members of the nuclear community:

- *Shift operators at Narora Nuclear Power Plant*

On the night of 31st March, 1993, it was their quick thinking and decisive action in utilising the fire engines which had come to put out the raging fire at the turbine room of the plant to instead drive the secondary pumps and cool the reactor, that avoided a major nuclear catastrophe in one of the most densely populated regions of the country.

Nucleocrat of the Year Award for the best action by an official of the nuclear establishment:

- *Or A Gopalakrishnan (Chairman, Atomic Energy Regulatory Board)*

for his initiative in trying to impose some form of control and regulation over the proliferating X-ray clinics all over the country This is a long overdue action and *Anumukti* can only applaud this initiative to reduce excess radiation dose received by the patients, radiographers, doctors, onlookers and the general public, (see story next page) If only Dr Gopalakrishnan can summon the same initiative and curb the excessive radiation emissions from nuclear facilities.

The Nukespeak Award for the most outrageous statement by a nucleocrat:

- *1. Dr R Chidambaram (Chairman, Atomic Energy Commission)*

There has been no accident of any kind in nuclear stations in India and no radiation injuries have occurred at any time." (P77Bhubaneshwar 7.9. 1993)

- *2. Dr R Chidambaram*

"We don't dump nuclear waste anywhere. We immobilise it." (PTI Bhubaneshwar September 7,1993)

- *3. Dr R Chidambaram*

"No harm will be done even if the radioactive sources remain in water and slush of the Cooum for a thousand years. (The Hindu October 22,1993)

All these statements are breathtakmgty outrageous. They confirm to the 'high' standards of nukespeak set by such illustrious predecessors as Dr Raja Ramanna and Dr P K Iyengar. One can only admire a person who has such a well developed

case of foot in the mouth disease. No other nucleocrat came anywhere near Dr Chidambaram's exalted level on the nukespeak scale.

Never Too Late For Realism Award:

• 1. *Dr R Chidambaram*

"The spent nuclear fuel lying at Tarapur can cause radiation hazards. Indefinite storage is certainly a problem". (*The Telegraph: 20.12/93*)

• 2. *Mr D. V. Gopinath*
Director of health, safety and environment group at Bhabha Atomic Research Centre

"Emergency situations beyond the design basis of nuclear power plants cannot be ruled out. There is need for implementing a comprehensive preparedness plan." (*Times of India 11.9.1993*)

India to initiate X-ray Controls

India's Atomic Energy Regulatory Board (AERB), which produces guidelines on radiation safety, is to review the operating conditions of medical radiography equipment and to update the guidance it issued in 1989. The board has announced a nationwide regulation programme under which all existing radiography units will be registered, reviewed for radiation safety, and subjected to stringent controls. The programme is designed to eliminate what officials from the board say are unsafe practices that could be jeopardising the health of patients as well as staff.

India has about 50,000 medical radiography units, and about 1,500 new machines are set up each year. Radiographic diagnosis is very popular and patients sometimes demand x-ray examination.

The board has evidence that some radiography machines have faulty dia-

From the Editor's Desk

Every year, come October November, I start getting a bit nervous. This is Diwali time and the time when my printer takes a long holiday. Besides, during Diwali there is a very heavy rush for printing jobs. Almost every year for the last five years the October/November issue gets delayed and that makes for a backlog which takes a long time and effort to clear.

But this year, I was sitting pretty. Most of the work had already been done and there were just one or two little things that I wanted to change. Diwali was still a while away and I felt sure that now with modern technology like fast computers and all available at Vedchhi, this was the year that Anumukti finally would start sticking to schedule.

And then there was literally a bolt from the blue. As I was giving the final touches, a surge of lightning struck near the house and the computer took off into orbit. Recovery was painfully slow and when finally the hardware was replaced there appeared a virus in the software which took even longer to repair. I learnt a lot about computers and computer viruses, but *Anumukti* remained in the limbo. Today is 5th of February, 1994 and I can only say Happy New Year and wonder whether these modern 'time-saving' gadgets really do save time. Someone rightly said, "Either you work with people or you work with machines. People give trouble and are unreliable but machines are a whole lot worse."

phragms and improperly oriented primary beams. Protective accessories like gonadal shields and lead aprons are not used in many units, according to the board.

"Although radiation safety authorities offer personnel monitoring services, x ray units are unfortunately reluctant to use them", said a senior official from the board. Studies conducted by the board have shown that some patients might be receiving 50—200% excessive exposure.

The board has also expressed concern over poorly trained radiography staff. It says that private institutions with neither adequate equipment nor qualified trainers have cropped up and offer very short courses in radiography. Those trained in such institutions find jobs in many of India's privately owned units and hospitals.

Many doctors share the board's concerns. "In this business there are probably more unqualified people than adequately trained radiographers," said Dr Rajjnder Nath Bagga, secretary of the Indian Radiology and Imaging Association, which represents some 2000 radiologists.

The new initiative will make periodic quality assurance tests of all radiography machines mandatory. The board and the radiologists' association also plan to conduct joint training programmes for staff in radiography units.

Gurunandan, science writer, New Delhi; British Medical Journal 30.10.1993

Hiroshima's shadow over Sellafield

Sellafield is the site where Britain began its quest for the A-Bomb. Today it is the heart of nuclear Britain with large reprocessing plants. The thermal oxide plant (THORP) located there was recently allowed to start operations by the government, although antinuclear groups have vowed to take the matter up in the European Court of Justice. Sellafield or Windscale as it was previously known has become a byword for nuclear contamination. The Irish Sea near Sellafield is the most contaminated sea in the world and there have been many reports of excess childhood leukaemia cases in the immediate neighbourhood of the plant. In 1990 Or Martin Gardner of the Southampton University, published a paper which showed that the chances of leukaemia in children were significantly enhanced if their fathers had worked in the plant and had received radiation (well within the 'acceptable' limits) during a period six months prior to conception. (See Anumukti Vol.3 No.3) Recently, a case was brought against British Nuclear Fuels (BNFL) the owners of the plant by two of the victims. This is the first of three articles which outline the major arguments on both sides, the variety of health problems encountered in the area and the difficulties in taking a major industry like nuclear power to court.

A 11 pm on 8 October, the final curtain came down on Hope and Reay vs British Nuclear Fuels, so ending one of the longest suits in the history of British civil law. The "Sellafield cancers case", as it was dubbed by the nation's headline writers, had all the makings of classic legal drama—allegations about radioactivity and genetic damage, families of children with cancer seeking compensation, a large and powerful industry in the dock. The case also threatened to break new legal ground. For the first time a British court was being asked to rule on personal injury claims based on alleged genetic damage from radiation. Victory would throw the doors wide open for other Sellafield families to sue.

At issue was whether the cancers suffered by Vivien Hope and Dorothy Reay—the daughters of lifelong employees of British Nuclear Fuels (BNFL)—could be blamed on radiation damage to their father's sperm at BNFL's nuclear reprocessing plant at Sellafield. But as the hearing unfolded it soon became clear that Sellafield's safety was not the only thing on trial. Also in the dock was the competence of science, specifically its ability to judge the risks of radiation to reproductive cells. Could exposure to rela-

tively low doses cause genetic defects to be passed on to children through damaged sperm?

Expert witnesses flew in from across the globe and for 90 days scientists and lawyers grappled with a mass of seemingly conflicting findings. Half this time was devoted to discussing epidemiological research into the possible links between radiation exposure to adults and cancers in their children. And in this crucial part of the hearing the court examined some 15 different studies. Finally, the debate about these studies boiled down to a duel between two opposing pieces of research.

The plaintiffs' hopes were pinned largely on a controversial British study by the late Martin Gardner, professor of medical statistics at the University of Southampton. Three years ago, Gardner claimed to have found a statistical link between the incidence of leukaemia and non-Hodgkin's lymphoma in children born to men employed at Sellafield and the amount of radiation the men had been exposed to before their children had been conceived. Pitted against his research in court were results from the largest and most influential of all studies of the genetic effects of radiation—the huge

follow-up study of survivors of the atomic bomb blasts in Hiroshima and Nagasaki in 1945. This study, as BNFL's lawyers eagerly pointed out, found no excess of cancers or genetic defects in the children of survivors who had been exposed to radiation.

When the hearing ended, the ruling ran to more than 200 pages. Yet the essence of the judgment was simple enough: in the debate about epidemiology, the negative findings from the atomic bomb study were deemed more convincing than Gardner's positive findings. BNFL cleared, was the tone of most newspaper headlines. **But despite this result, the courtroom debate had succeeded in exposing potential complications with the atomic bomb research which have never before been aired in public.**

Atomic Bomb Survivor Studies

The genetic studies on the children of atomic bomb survivors began in the spring of 1948, and were led for many years by Jim Neel and Jack Schull Neel, now at the University of Michigan Medical School, Ann Arbor, became acting director of field studies for the Atomic Bomb Casualty Commission in Hiroshima in 1947. Two years

later he was joined by Schull, now at the University of Texas. The Radiation Effects Research Foundation (RERF) succeeded the ABCC at Hiroshima.

From the outset of the case, the results from the ABCC and RERF posed a major stumbling block to the Hope and Reay families. In more than forty years of research, Neel, Schull and their colleagues have failed to uncover any convincing evidence of an excess of harmful genetic mutations in children whose parents had been exposed to atomic bombs. This is despite the fact that they have looked at as many as 75,000 such children, and that the average exposure to radiation at Hiroshima and Nagasaki was higher than that for Sellafield workers.

Gardner's Results

The contrast with Gardner's results couldn't be greater. In 1990, he and his colleagues published a paper in the *British Medical Journal* claiming that children born to Sellafield workers who had previously been exposed to a cumulative dose of more than 100 millisieverts of radiation—twice the maximum annual dose at present allowed under British law—were eight times more likely than other children to develop leukaemia or non-Hodgkin's lymphoma.

Gardner believed that the discrepancy between his study and the Japanese data could best be explained either by differences in radiation dose rates—a sharp blast in the case of the atomic bombs versus chronic exposure to low levels at Sellafield—or else by differences in the average intervals between exposure and conception. Both these points were important to the plaintiffs' case. But, in addition, the plaintiffs' lawyers tried to expose weaknesses in the ABCC and RERF study.

Bizarre paradox

Part of their approach was to focus on what seems to be a bizarre paradox

in the Japanese data: namely, that children born to atomic bomb survivors appear from these data to be healthier than children of the same age born in Japan as a whole. And not by a trivial margin either. Stillbirths were down 85 per cent, deaths from cancer by 20 per cent, overall mortality by 30 per cent and infant mortality (from all causes) by 35 per cent. So counterintuitive are these findings, argued Eva Alberman, a reproductive epidemiologist at St Bartholomew's

The most likely explanation for the apparently crazy finding in the ABCC study:—The children born to atomic bomb survivors appear from the studies to be healthier, than those born in the rest of Japan—is that the study failed to diagnose all cases of congenital problems.

Hospital in London and a key witness for the plaintiffs, that they can mean only one thing: the researchers must have inadvertently failed to identify all the deaths and genetic deformities in children of survivors who had been exposed to radiation. It was either that, or the bombs had conferred some beneficial effect—which "seems crazy". This was robustly denied in court by Neel and Schull, who said the beneficial effect was either statistically insignificant or the product of terminology differences.

Testifying in court, Alberman highlighted two apparent inconsistencies in the Japanese data. First, she said, the reported incidence of Down's syndrome among children born to survivors was half what would be expected on the basis of statistics from other countries; and secondly, Down's syndrome was twice as prevalent in the

children of survivors classified as "not exposed" as it was in children of "exposed" survivors. Neel and Schull's explanation is that, on statistical grounds, the rates are too unreliable to compare in that way. But Alberman believes the most likely explanation is that the ABCC study failed to diagnose all cases of Down's syndrome. And if that is so, she says, perhaps other congenital conditions had been underdiagnosed. According to the ABCC's figures, about 1 in 100 babies conceived by atomic bomb survivors between 1948 and 1954 were diagnosed as having a major congenital deformity such as hydrocephalus, spina bifida and polydactyl. The comparable figure for Britain in 1958 was 1.7 in 100.

In the early years after the bombs, Alberman told the court, most Japanese women gave birth at home, attended by midwives who were not trained in diagnosing deformities. Another potential problem might have been deliberate underreporting. Neel's opinion about this seems to have shifted with time. In court he said: "It rapidly became known throughout Hiroshima and Nagasaki that malformation was a possible outcome of exposure to the bomb. This did much to remove the stigma because then you had a causal agent inflicted upon the women. It was a cause she could accept." But in 1958 Neel wrote: "The birth of a malformed child stigmatises the family involved to a greater extent in Japan than in most Western cultures, and it seemed quite possible that the physician-interviewer had not established sufficient rapport with the family to obtain an accurate history. So could the Japanese data have underestimated the medical problems suffered by the children of survivors exposed to radiation? Testifying on behalf of BNFL, Neel and Schull accepted in court that the studies had been difficult to carry out. But they were adamant that their estimates of the genetic risks of radiation exposure were accurate. The main reason for their confidence was that these estimates are based on a comparison of

similar groups of children—those born to people who had been exposed to radiation from the bombs, and those born to people living in or near Nagasaki and Hiroshima who had been exposed to little or no radiation.

The reported rates of stillbirths, congenital deformities, infant mortalities and deaths from cancer are almost identical in these groups of children. And it is this comparison that matters most, say Neel and Schull. Even if the children of atomic bomb survivors seem to have been abnormally healthy compared with children living elsewhere (and this claim was denied in court), the fact that parental exposure to radiation seems to have had little effect in the children's health means only one thing in the eyes of the ABCC researchers: that exposure to radiation failed to damage the reproductive cells of the atomic bomb survivors.

To shatter this assertion, the plaintiffs' lawyers had to try to show that the diagnosis of medical problems may have been uneven in the "exposed" and "unexposed" groups. Could American researchers, for example, have overlooked a disproportionate number of leukaemia cases in the children of the "exposed" groups? This was unlikely, said Neel, because any problems would automatically apply equally to all groups of children in the study.

Yet there was one uncertainty which Neel freely acknowledged in court. Early in their study, the ABCC researchers had to abandon their attempts to gather data on miscarriages in the first five months of pregnancy. It became clear, said Neel, that it was impossible to monitor these losses. This meant that the researchers had to make two assumptions when calculating the genetic risks of radiation: first, that fetuses were lost for the same reason in "exposed mothers" as in "unexposed mothers"; and secondly, that the rate of loss was the same in all groups.

Because these assumptions are unverifiable, Alberman contends that the ABCC results cannot be used to assess accurately the inheritable risks of radiation exposure. A high proportion of spontaneous abortions in the first few months of pregnancy are thought to result from genetic mutations that affect fetal development, she told the court. And there are at least some grounds for thinking that such mutations might have been more prevalent in the reproductive cells of survivors exposed to high doses of radiation. If Alberman's concerns are justified, then the ABCC's estimates of genetic risk are based on data gathered after the period during which most of the lethal damage from radiation would have been eliminated.

Rocketing Abortions

Another potential source of bias between the "exposed" and "unexposed" groups emerged in court: abortions. All over Japan the abortion rate rocketed after the war. With thousands of people returning from Japan's former colonies, the government decided to make abortion freely available as a form of birth control. One consequence of this policy was that as many pregnancies were deliberately terminated in Hiroshima in 1950 as came to term.

What if a disproportionate number of these abortions were of fetuses with genetic defects, asked the plaintiffs' lawyers. Might not the high abortion rate then mask some of the harmful effects of radiation? This was unlikely, said Neel. The high abortion rate could only have biased the results if some women chose abortions because they knew they had been exposed and as a result suspected they might be carrying damaged fetuses. Certainly, Schull told the court, there was a great fear among exposed survivors that radiation might cause congenital deformities in children. But there was no evidence that any women survivors had decided to have an abortion for these reasons, he said. Rather, the

most commonly acknowledged reason for abortion was poor economic circumstances, according to a study of a small sample of survivors by Schull. But in court Alberman wanted to know why data from Hiroshima showed an increasing trend in abortion with increasing radiation dose.

It is clear from the ruling that the debate about miscarriages and abortions failed to convince the judge that diagnosis of medical problems in the "exposed" and "unexposed" groups of survivors could have been seriously biased. But this still leaves a paradox unexplained: why did the children born in both groups appear to be healthier than those born elsewhere in Japan or in other countries? Why were the rates of infant mortality, stillbirths and cancers seen in the children of survivors so low?

According to the ABCC study, death rates from cancers in children of "exposed" and "unexposed" survivors were 20 per cent lower than in people of the same age in the rest of Japan. The researchers' explanation of this is that cancer rates are rarely uniform within a country and it therefore makes no sense to compare results gathered in specific towns and cities with national averages. But cancer epidemiologist Scott Davis and biostatistician Ken Kopecky, who have both worked at RERF, told the court that it was reasonable to presume that the ABCC study had missed some cases of leukaemia, particularly in the early years of follow up when conditions were difficult, and that this may have contributed to the low cancer rate. Schull conceded that just ten misdiagnosed leukaemia cases among children of "exposed" survivors could have obscured a link between the cancers and inherited effects of radiation exposure. One potential source of error highlighted in court was the risk of misdiagnosing leukaemia as respiratory disease: children with leukaemia are 300 times more vulnerable to pneumonia.

*October/Nov
ember 1993*

The frequency of stillbirths among atomic bomb survivors was recorded to be six times lower than the number of stillbirths recorded by the Japanese government for the districts of Hiroshima and Nagasaki as a whole, and which included individuals who were too far away from the nuclear explosions to be irradiated. Neel argues that this gap reflects differences in the definitions of stillbirth used by the ABCC and the Japanese government. The government figures are relatively high, he maintains, because unlike those from the ABCC they include babies who lived for a few hours and then died — cases which the ABCC counted as infant deaths and some deliberate abortions. The ABCC figures, on the other hand, are relatively low because they exclude miscarriages before the fifth month of pregnancy (the Japanese government's miscarriage records start from the third month) and stillborn babies with major malformations.

But such differences cannot be the whole story, argue critics, who raise three problems. First, since the ABCC was counting as "infant deaths" cases which the government termed "stillbirths", one might expect the ABCC's infant mortality figures to be higher than those collected by the Japanese government for Japan as a whole. In fact, the opposite is true. Secondly, the government stillbirth rates for Hiroshima and Nagasaki were based on medical data for the surrounding rural areas as well as for the cities themselves. (Unlike the ABCC figures, which were largely confined to the cities.) This makes the real gap between the ABCC and government data even greater, for the official stillbirth rate for cities in Japan was almost twice the rate for rural areas, according to 1950 figures.

Finally, even without adjusting for urban-rural differences, it is hard to make the government and ABCC figures tally. Adjusting the ABCC figures so as to include babies stillborn between three and five months gestation

and those with major malformations would increase the ABCC figures by about 65 %, while adjusting the government figures so as to exclude deliberate abortions would produce a 10 % reduction in the official stillbirth rate. The government and ABCC figures would still differ by at least a factor of three. Alberman's conclusion about the ABCC stillbirth figures: they fail to include babies that should have been registered but possibly died before registration.

Infant mortality rates for children of "exposed" and "unexposed" survivors were 35% lower than in Japan as a whole. In the 1940s and 1950s most infant deaths in Japan were caused by infectious diseases like T.B., Cholera and Pneumonia, which exacted their biggest toll on poor, badly housed families with little access to health care. Neel told the court that the most likely explanation for the low infant mortality figures was "that living conditions were difficult in Hiroshima and Nagasaki prefectures, but they were more difficult elsewhere." If that is true, than things must have been very bad indeed elsewhere. Neel and Schull agreed in court that there was a shortage of trained medical staff and diagnostic equipment in Hiroshima and Nagasaki in the first few years after the bombs, and in a 1990 paper they state: "It is not unreasonable to assume that the aftermath of the bombing worsened the socio-economic status of many survivors." As late as 1968 the Japanese government felt the need to pass a special law "to extend welfare, by providing special allowances, to A-bomb survivors who suffered injuries and even now experience special hardships."

Until the recent High Court case, the unusually low rates of stillbirths, mortality, congenital malformations and cancer reported for the children of atom bomb survivors had barely been debated by scientists. Why? One reason is the authority the ABCC study has acquired as a yardstick for assessing the risks of direct exposure to ra-

diation on nonreproductive (somatic) cells. Many governments frame their rules on occupational exposure on the basis of the Japanese data. If there is nothing wrong with the data gathered from people who were directly exposed, ask most scientists, why should there be anything wrong with the data gathered for survivors' offspring?

But the acceptance of the somatic studies has not been universal. For three decades, Alice Stewart, an epidemiologist from the University of Birmingham, has argued that the data underestimate the risk of cancer developing in children exposed to radiation while still in the womb. Stewart discovered that children who had been exposed to X-rays in the womb were 60 per cent more likely than average to develop cancer. In contrast, the follow-up study of Japanese children who had been exposed to radiation while in the womb found no increased risk. Many scientists belittled Stewart's findings for several years, until other epidemiological studies began to confirm them.

Commenting on the discrepancy between the Japanese studies of womb exposure and data from Western populations, Nick Day, director of the Medical Research Council's Biostatistics Unit, said in court: "Instead of two childhood cancer cases (linked to womb exposure) observed in the survivors, you would expect 11.45. So between 11.45 and 2 there is clearly quite a divergence. The results on womb exposure show most dramatically how the studies on atomic bomb survivors have been allowed to take precedence over other studies that have produced conflicting results. Now that Stewart's results have been confirmed, the RERF researchers are claiming that their study is consistent with hers. Is the same likely to happen with the paper by Gardner? Time will tell.

Sara Downs

Retinoblastoma and Low Level Radiation

Twenty times more common in children whose mothers have lived in Seascale

The village of Seascale, near the Sellafield nuclear reprocessing plant, is best known in epidemiological circles for its longstanding high incidence of malignant disease in young people, which has recently been confirmed as having persisted during 1984-90. Throughout, the excess has been largely accounted for by leukaemia and non-Hodgkin's lymphoma. No cases of retinoblastoma have been found in Seascale, but at least five cases have occurred in children whose mothers had lived there at some time during 1950 onwards. The maternal grandfathers of three of these children had worked at Sellafield. Three further cases have occurred among children born in Copeland, the county district that contains both Seascale and Sellafield, but whose mothers had never lived in Seascale; the father of one and the paternal grandfather of another had worked at Sellafield.

Controversy continues over the possible causes of the excess of leukaemia and lymphoma in Seascale. Gardner and colleagues concluded that the excess was restricted to children of mothers who were resident in Seascale at the time of the birth, but Kinlen has recently shown that a similar excess exists among young people in Seascale who were born elsewhere. In **their** case-control study of young people in West Cumbria diagnosed during 1950-85 Gardner et al found **that the** excess occurred among children **whose fathers** had been exposed to high levels of radiation before **the** child was conceived and suggested **that some cases may have resulted from paternal germ cell mutation. This does not, however, account for the excess among those born outside Seascale.**

Epidemiological evaluation of the **ap-parent association of retinoblastoma with Seascale is, if anything, even more difficult. Retinoblastoma occurs in two forms. Hereditary retinoblastoma is nearly always bilateral (both eyes) and occurs in families in which there has been a germ cell mutation. About two thirds of hereditary cases arise from new and one third from old germ cell mutations. Non hereditary retinoblastoma is caused by two mutations to a somatic cell and is invariably unilateral.**

One of the cases linked to Seascale is known to be hereditary. This was in a girl with no family history of retinoblastoma who developed bilateral tumours; she had a partial deletion of chromosome 13, which was not present constitutionally in either parent and thus represents a new germ cell mutation. It seems likely that most of the remaining, unilateral cases are non-hereditary as probably under one in 10 cases of unilateral retinoblastoma is hereditary. At first sight it is puzzling that no case has been

diagnosed among children who were themselves resident in Seascale. Although the observed incidence among children of mothers who had previously lived there has been calculated to be about 20 times expected. Even if the risk was indeed 20 times that in the rest of Britain, only one case of retinoblastoma would be expected in Seascale every 40 years

Virtually nothing is known about the causes of non-hereditary retinoblastoma or of mutations leading to the hereditary form. The cumulative incidence for combined hereditary and non-hereditary forms of the condition ranges from 45-60 cases per million among mainly white populations to about 100 per million in Nigeria and

Uganda; the highest recorded rate, though based on only 11 cases, is 153 per million among Navajo of the southwestern United States.

Little international variation exists in rates of bilateral retinoblastoma, with cumulative rates generally of 15-25 cases per million, whereas the incidence of the unilateral, predominantly non hereditary form ranges from 30-40 cases per million in many industrialised nations with temperate climates to about 75 per million in tropical Africa and 125 per million among the Navajo. These data indicate that non heredi-

tary retinoblastoma is more common among populations of low socioeconomic status and in tropical climates.

The only published case-control study of retinoblastoma included 67 sporadic hereditary and 115 non hereditary cases in North America. There was a significantly raised odds ratio for non hereditary tumours among children whose mothers had never attended high school, again pointing towards an association with poor socioeconomic conditions. Seascaple, however, has a population of an unusually high socioeconomic status.

Antenatal obstetric irradiation is the only environmental factor certain to cause more than a handful of cases of childhood cancer in Britain. By far the largest body of evidence for this is the Oxford survey of childhood cancers, but separate analyses of retinoblastoma in the survey have never been published and, as cases were ascertained from death certificates and survival with retinoblastoma has been very high for at least half a century, it contains very few cases of this tumour. In the American study, for sporadic hereditary cases there was a non-hereditary cases there was a non-signifi-

'cant raised risk with exposure to x-rays during pregnancy. Many Navajo have been engaged in uranium mining, but information on exposure to ionising radiation was apparently not available for the affected Navajo children or their parents. A large study linking the records of the National Registry of Childhood Tumours with those of the National Registry of Radiation Workers is in progress, and this

should show whether there is a raised risk of childhood cancer in general, or of particular types, in the offspring of radiation workers and, if so, whether the risk is related to the dose of radiation.

The best available method for moving closer to solving this puzzle may be to study DNA from the affected children, as this might distinguish so-

matic **from germ line mutations. If a mutation could be found in tumour** material this would lead to a search for constitutional **mutations in the child** and his **or her parents. If germ line** mutations are found the **type of** mutation might shed light **on** their cause.

C.A Stiller

British Medical Journal: 21.8.1993.

Taking an Industry to Court

The author of this article as well as that of the first article on Sellafield, Sara Downs worked as a researcher for the firm of solicitors for the plaintiffs in the Hope & Reay -Vs-British Nuclear Fuels case. She visited Vedchhi in September and wrote this article. This was before the judgment in the case had been delivered. In India too, we have many cases of personal injury caused to people living in the vicinity of nuclear establishments. This article gives a foretaste of the kinds of problems the victims are likely to encounter in their efforts to obtain justice from the legal system.

This article relates lessons learnt during the preparation of a case recently heard in the British High Court: [Hope & Reay -Vs- British Nuclear Fuels public limited company (BNFL)]. Vivien Hope and Dorothy Reay lived near the Sellafield nuclear reprocessing plant in Cumbria, owned by BNFL. The incidence of leukaemia and non Hodgkin's lymphoma among young people living near the plant between 1950-1991 has been shown to be more than 15 times higher than expected. Vivien had contracted non Hodgkin's lymphoma and Dorothy had contracted leukaemia. Their case was that radioactivity from the Sellafield plant caused or materially contributed to their cancers. Although this was a personal injury claim for damages due to radiation exposure the lessons learnt are relevant to other personal injury claims by members of the public against a large industry in the civil courts.

Considering a Case

One must be convinced that the claimant (the potential Plaintiff) has a

good case. Running this type of cases is expensive and extremely hard work for everyone involved. The industrial company against which the claim is to be made, will undoubtedly have greater resources than those available to the Plaintiff. In general also the scientific community are more likely to be on the side of the industrial company because there are large gaps in our knowledge of the precise effects of industrial pollutants, and scientists are by their nature conservative. Or they may be sympathetic to the Plaintiffs' case but their work might be funded by grants given directly or indirectly by the industrial company to be sued. They will be reluctant to prejudice these.

A strong case which results in a successful claim may open the door to further claims where the evidence is less compelling. A weak unsuccessful claim is likely to close the door to a later stronger claim even if the evidence is compelling. The Plaintiffs legal costs legal costs may well have been raised through fund raising activities. If the case is unsuccessful, people will

be reluctant to contribute to further cases.

There is sometimes an argument for delaying a claim until scientific research crucial to the case has **been** completed. In the Sellafield case it would have been risky to have made a claim for damages on the basis of anecdotal evidence that childhood

cancers were in excess near the plant. The claim became much stronger once further epidemiological studies of the area had been completed **and** the scientific community accepted that the excess was not a chance phenomenon.

Law

The law and legislation relating to the plant's operation must be thoroughly reviewed.

The plant may have been under the control of more than one company or government body and claims should be made against all of them in the initial writ.; unless the more recent operators have taken on all liabilities re-

suiting from the previous operations. In the early stages of the case it may seem clear that only one particular operation or operators are responsible, but one can be certain that one is only aware of a tiny proportion of what will be known by the time the case is heard in court. At that stage it may be apparent that operations by other operators of the plant had their part to play in causing the damages. If their contribution is crucial and they were omitted from the initial writ, the claim will fail.

There may be a number of causes for action and it is essential to be aware of them all so that the one most easy to prove is followed.. In the Sellafield case, conceivably a claim could have been made on the basis of negligence under the common law. However, on reviewing the legislation it became apparent that the Nuclear Installations Act 1971, placed nuclear installations in the UK under a strict liability to compensate for damages. This meant that only causation had to be established by the Plaintiffs and not negligence as well. Negligence is often difficult to prove because it requires showing that the operators reasonably should have been aware of the risks resulting in the damage to the claimant.. In the Sellafield case this could well have doubled the time spent preparing the case and the time spent during the hearing.

The Plaintiffs

From service of the initial writ the Sellafield case has taken four years to prepare and be heard in court. This is short for a case of this complexity and has only been possible by having the equivalent of two solicitors and one and a half researchers work on the case full-time.. There were also four barristers working intermittently on the case during its preparation and full-time once the court hearing began.

The Plaintiffs must be made aware of the fact that legal proceedings are lengthy and they themselves must be

convinced that the claim is important enough to them to see through to the end of the court hearing. They must be able to ignore criticism of their action. This may be difficult, particularly where the local community is economically dependent on the continued operation of the plant, as in the case of Sellafield. A very high proportion of the West Cumbrian population work at the Sellafield plant. 90% of the male population in the village closest to the plant (Seascale), where Vivien lives with her family, work there. Many local people see the families and lawyers making claims as greedy, publicity seeking and guided only by self interest. Local press is unsympathetic to their cases. One family has had to face pictures of their daughter who has died of leukaemia in the local paper alongside comments that her case is responsible for the hesitation of the British Government to give the go ahead for the operation of a new reprocessing plant (THORPE) on the site. In these circumstances it is invaluable to have a local support /pressure group sympathetic to the families cases. They can disseminate information to counter the pro nuclear lobby in the area and also help contact between families taking similar actions.

Evidence and Experts

The evidence provided to the court will be in the form of testimonies from experts as well as factual evidence from the families and other local people. Proof of causation in the Sellafield cases relied principally on scientific evidence and 90% of the time during the Court hearing was spent listening to examination and cross examination of this evidence. There was evidence from over 20 scientific experts from all over the world and it took over 7 months to hear. Many experts were needed because scientists generally have only a narrow field of expertise.

Choice of scientific experts takes time. Initially both the solicitors and researchers working on the case need to become thoroughly versed in the

scientific issues under scrutiny. Only then will they be able to make an informed choice of experts. It takes time to find out who are the experts in a particular field. One also must ensure that one's experts are known as impartial. The opposition will investigate each experts' background in detail. Any evidence of bias will be drawn to the courts attention during cross-examination. This is especially important for the Plaintiffs. Judges seem inclined to view scientists working for industry as impartial and those with substantial contacts with pressure groups as potentially biased. In the Sellafield case a large proportion of the Plaintiffs experts came from abroad, not only because they had expertise unavailable

in the UK but in some instances because they were not dependent on research grants given by the nuclear industry in the UK.

The other type evidence presented by Plaintiffs is that obtained through "Discovery". In the UK the rules concerning discovery are extremely powerful and the Defendants are under a strict duty to provide all documents in their possession relevant to the case apart from correspondence with their solicitors and those produced as a result of the legal proceedings. A common trick of Defendant solicitors is to delay production of discovery documents so that the Plaintiff's solicitors and experts have as little time as possible to review the documents and ask

for further documents. It may be necessary to apply to the court for an Order that the discovery documents are produced within a specific time scale. It is not unknown for the discovery documents most useful to the Plaintiff's case to appear in the last lists produced by the Defendants

Standard of Proof Required for Causation

In UK civil courts the Plaintiff is required to show that "on balance of probabilities" the Defendants activities have caused the damage. In other words, it is at least 51% more likely

than not that the Defendants activities are the cause. By comparison scientists demand a higher standard of proof. Most scientific journals will not publish papers showing an association where this is not statistically significant.. Conventionally statistical significance is said to be reached where it is calculated there is a less than 5% likelihood that chance is the explanation for the association..

When to Take Legal Action

Despite the publicity that a legal case can bring to an issue it should not be contemplated unless there is a good chance for success. Firstly because one is raising false hopes in the Plaintiffs, who have already been victims. And secondly because the money that would be spent on legal costs could be more productively spent elsewhere.

Running a case of the complexity of Hope & Reay -Vs- BNFL is expensive.

To have even a chance of winning Plaintiffs must be in a position to have expert evidence of similar quality to that of the Defendants and also the facilities necessary to respond quickly and efficiently as the case proceeds. The total amount spent by the Defendants and the Plaintiffs in the Hope & Reay -Vs- BNFL is estimated to several million pounds sterling. Similar cases are likely to be expensive in whatever country the action is taken.

Hope and Reay were funded by the Legal Aid Board in the UK. This government body provides financial aid for legal costs to persons on a low income where there is a reasonable chance of their case succeeding. If Vivien and Dorothy win, the Legal Aid Board will recoup it's costs from the Defense. If they loose, the board will have to bear the costs for the Plaintiffs case although neither they or Vivien or Dorothy will have to pay the legal costs of the Defense.

Despite the above, legal proceedings should be considered where is no prospect of the polluter compensating a victim or even making it's activities less harmful. A successful case is very convincing evidence that an industrial plant is causing damage to its local community, and a step towards halting damaging activities. If the claims by Vivien and Dorothy succeed, this will profoundly influence public opinion towards considering the Sellafield plant responsible for the cancer excess in it's vicinity. By contrast it may take years for a definitive statement regarding this effect to emerge from the scientific community. But most importantly a successful claim will enable victims suffering today to gain some compensation for the damage they have suffered and recognition that they have been wronged.

Sara Downs 7 September, 1993

Much A Doom on the Cooum

The first fortnight of October witnessed hectic activity on the banks of the Cooum in Madras. The notorious stench of the river was forgotten as hundreds of workers were pressed into action building a temporary embankment. 880 trucks were put to use dumping over 16,000 tons of gravel and 10,000 bags of sand. The reason behind all this activity was fear of radioactivity. Some disgruntled employees belonging to an American company, Haliburton Offshore Serv-

ices Inc., had thrown three radioactive sources into the river. This company was engaged in off-shore oil exploration work and following the incident, the Atomic Energy Regulatory Board (AERB) directed Haliburton to suspend well logging operations in five western region rigs and two southern rigs.

Haliburton is the largest US. company supplying equipment to the oil industry. It is a subsidiary of the McDermott Corporation, whose pri-

mary nuclear subsidiary is Babcox & Wilcox, the compan that designed and engineered the il-fated Three Mile Island reactor. In recent years Babcox & Wilcox has specialised in fuel fabrication and reactor engineering for the US. Navy's nuclear submarines.

Newspaper estimates put the cost of building the embankment, which had an internal diameter of five metres, at around Rs 40 lakhs. A giant excavator was pressed into service and a hollow cylinder was lowered into the river

High Explosives Seized at RAPS

Explosive material was siezed by the Rawatbhata police form outside the premises of RAPS 3 & 4. This includes 51 bags each of 2.78 kg of gelatine powder and 46 bundles of

fuse wire. A case has been registered under section 5/9 of the Explosives' Act against ShriSafiMohammad and Santosh Kumar, lincensed blasters who had been hired by some of the

contractors of RAPS 3 & 4 for unauthorised blasting. The matter is still under investigation by the police at Rawatbhata.

and water was pumped out. Remote controlled equipment was used to extricate a two and a half inch long capsule containing about 150 gms of caesium-137. This was done on October 17th. A further four days of effort was required to retrieve the two americium-beryllium neutron sources. Divers went diving in the stinking slush of the Cooum and they used the most sensitive equipment—their feet—to locate and retrieve the lost sources. Now there is the question of what to do with the embankment. Some have suggested that a park be built there but any permanent structure at the mouth of the river would interfere with tidal back flows into the river. Of course the cost of dismantling the structure would be at least, another 40 lakhs. (Just for information sake, could a reader from Madras please inform us as to what was finally done?)

While the dedication and the effort displayed by Dr Gopalakrishnan (Chairman, AERB) and other members of his team in trying to recover the lost sources is worthy of commendation, the same cannot be said regarding their efforts to inform the public. Here the age old mindset of "allaying public fears" by hook or by crook held sway. Dr R Chidambaram, the head of the Atomic Energy Commission went so far as to claim that "No harm will be done even if the sources remain in water and slush for a thousand years." Dr Gopalakrishnan was a bit more circumspect claiming that "it was unlikely that any leakage of radioactivity can take place from these sources as the radioactive material in them is in a physical and chemical form where its teachability in water is extremely low." He also observed that "Cooum water is not potable and it is not used for industrial purposes either."

After the recovery of the caesium source Dr Gopalakrishnan made a more relevant pronouncement. He said, The gamma source (caesium) which we have taken out will emit 5,000 rem per hour on contact and the high dose of radiation will cause se-

vere burns if the capsule was held by hand directly. But once it was put inside the container with lead shield, the radiation outside the container is only 10 millirem per hour, which is acceptable."

While information regarding the activity of the two americium-beryllium sources was published in the newspapers (18.5 and 0.5 curies respectively) no information was forthcoming regarding the activity of the more penetrating caesium source. However, from the fact that it was emitting 5,000 rem at contact one can estimate that the capsule contained about 150 gms of caesium with an activity of 15,000 curies. This represents an enormous amount. For comparison one can only mention that the entire amount of caesium that was deposited on the whole of West Germany following the Chernobyl accident was estimated to be just 100 gms. This amount was sufficient to cause a measurable increase in neonatal mortality and in the number of birth defects in children conceived during the period. The same amount of caesium was responsible for the horrible accident involving a similar radioactive source at Goima in Brazil in 1987, in which four people died of acute radiation sickness and more than 240 were contaminated and which resulted in social ostracism of residents of the whole city of over 1 million people.

The statements by nucleocrats instead of allaying fears are more likely to add to public anxiety because they do not gel with their own hectic activity. If the material was so harmless then why expend this huge effort and money to retrieve the sources? Obviously, nucleocrats did not consider (and very rightly so) the sources to be incapable of causing grievous harm. Although the source might have been in a chemical form which was insoluble in water, at the time they were thrown in the river, there is no guarantee that the material would not react with salt water and produce chlorides of caesium which are certainly teachable.

After the sources were recovered, they were handed over to the police for getting the clearance of the court and for restoring to safe custody' of Haliburton Inc. Although the caesium source by then was securely placed within its lead shielded casing and emitting 'only' 10 millirem per hour, still these 10 millirems are likely to add up to something well over a few hundred millirem for the poor policemen whose duty it would be to keep a watch over the room where the sources were kept. Were these people informed of the risks they were running guarding the property of Haliburton Incorporated? The acceptable' (according to nucleocrats themselves) limit for radiation dose for the general public (including members of the police) is just 100 millirem per year

The incident on the Cooum brings into focus some points regarding the use of nuclear energy. One of the slogans used by antinukes in Europe after the Chernobyl accident was "Chernobyl is everywhere." This incident illustrates the truth behind this expression. Nuclear poisons can cause devastation and these poisons are not confined to nuclear reactor sites. They are in use in hospitals, industrial units, universities and laboratories and even in the field offices of multinational corporation like Haliburton Inc., where their disgruntled employees can easily lay their hands on them. Thousands of people have access to them. To expect that all these people would behave in an exemplary and responsible manner while dealing with these dangerous materials, is to expect too much. This makes the nuclear issue a matter of concern not only for those unfortunate enough to have a nuclear establishment in their vicinity, but for everyone. There is a lesson for nucleocrats, as well. Their knee-jerk "allaying of public fears" have made even their well meaning words and actions suspect in the eyes of the public. What they needed to do in this case was to take the opportunity to educate the public. Given out all the technical information so that other independent

'experts' could have formed their own conclusions and quantified the risk as precisely as possible so that the public would understand what was involved and what measures to take. The other lesson concerns us as a nation in this era of globalisation. Multinational overseas adventurers like Haliburton would become more and more involved in the 'discovery' of India. Unless they are severely and strictly regulated such incidents involving dangerous and toxic poisons will become more and more common in the days to come.

Sanghamitra

Rally at Rawatbhata

are than 500 people from Rawatbhata township and surrounding villages took out a rally on 26th of October 1993, to protest against the harmful effects of radioactive emissions from the nuclear power plant and against the dishonesty of the plant authorities. The rally gave a memorandum to the local assistant collector. The memorandum listed many demands which included demand for the construction of a referral hospital at Rawatbhata especially in the context of the increased morbidity due to nuclear pollution; facilities for treatment at the plant hospital in Rawatbhata in the mean-time; the closing down of the damaged unit-1 which has cracks in the end-shield; training for facing of emergency situations; construction of side roads and the establishment of a college and a technical school at Rawatbhata. The Assistant Collector promised to connect the nearby villages with the Rawatbhata grid by November 2nd, 1993.

After the rally, there was a public meeting at the market square of Rawatbhata, where villagers spoke of their difficulties. One of the major concerns expressed by a number of villagers was the absence of reliable electric

Are Multinationals Above The Law?

The Rules

If a radiation source is proposed to be handled in an open field, prior approval of the location where the source is proposed to be handled should be obtained by the user. Such open field application could be undertaken **only** when a) it poses no radiation hazard to those present around the proposed location of use and b) adequate space is available, to cordon off suitable area in order to ensure that no worker or member of the public would receive amounts of radiation dose in excess of specified limits.

The source of radiation should be safely stored in a location which is **duly** approved. The storage should be chosen that it would be free from potential fire-hazard, flooding, water-logging, etc. Further, to avoid loss by pilferage or otherwise, adequate security should be provided for the source of radiation.

Personnel who would be actually working with the source of radiation should be regularly monitored for the amount of radiation dose received by them in the course of their work.

Depending upon the type of use and the nature and amount of radiation sources handled, the applicant should be equipped with safe handling accessories as specified.

Has The AERB Taken Any Action?

It is obvious from the above that the dumping of radioactive sources in the Cooum River is a gross violation of the rules regulating the use of these sources. The responsibility lies not only with the disgruntled employees but also with Haliburton which failed to provide "adequate" security? Now that negligence on part of this multinational has been prima facie established, will the AERB take legal action against the company for endangering public health and safety. Or is the Atomic Energy Act only meant for desi activists ?

supply. They said that the one 'benefit' for which they had paid an enormous price, was being denied to them! They had not only faced eviction from their ancestral lands when the dams were constructed but were now undergoing severe hardships due to diseases caused by radiation pollution. Shri Mangilal Gujjar of Loharia village said that he had within the last two years taken 128 patients from his and surrounding villages to Udaipur for treatment of T.B. The sarpanch of Ekling-

pura described how because of absence of roads, severely ill patients had to be carried on a cot. He said that we provide them basic necessities like milk, vegetables and cereals, why can't some of the budget be spent on our wellbeing? Dr Rampratap Gupta, said that despite the billions spent on the construction of two hydroelectric dams and two units of the nuclear power plant and heavy water plant, there is growing poverty and unemployment in the region, and a great

paucity of educational and health services. This was proof that our planning process was defective and had not contributed towards the benefit of the majority of our population and we needed to rethink our developmental policies. Surendra and Sanghamitra Gadekar of Anumukti also spoke at the meeting. They talked about the implications of the results of the survey on

Physicians call for a boycott

The International Physicians for the Prevention of Nuclear War (IPPNW) is calling for a worldwide boycott of medical instruments supplied by the German company Siemens. IPPNW, a federation of national physicians' groups in 80 countries is demanding that Siemens leave the nuclear business. The announcement came at a press conference in Munich on 9th of August when Michael Roelen, Secretary of the German section of the organisation, said that beginning from September 1993, physicians belonging to the organisation including the 10,000 members of the German section, are being urged not to buy Siemens' products any more.

the health of the people living in the vicinity of the plant and also about the need for continuous monitoring.

The chairman of the Parmanu Pradushan Sangharsh Samiti, Shri Ratan Lal Gupta said that various small accidents that had taken place in both the nuclear power plant and in the heavy water plant were just warn-

Siemens

A spokesperson for Siemens AG, Norbert Bocker, has said he wanted to begin a dialogue with the IPPNW. but the call to boycott might not be favourable for such a dialogue. He said that it is still too early to take legal steps, implying that the company might take the physicians' organisation to court over the boycott.

The boycott is part of an international campaign by the IPPNW which aims to ban plutonium production by the year 2000. From what Till Bastian, former secretary of IPPNW said, the action should be seen as "an 'ncentive' to the company to get out of the nuclear business. Its share of the nu-

ings that Rawatbhata was sitting on a time-bomb. He warned the authorities that if the demands of the local population were not granted then the public would be forced to take recourse to agitation and legal redress. The meeting ended with a firm resolve to continue the struggle.

clear-related work has already fallen from 20 percent to two percent, according to IPPNW estimates The organisation also wants an end to the production of MOX fuel rods in Siemens' Hanau plant.

An IPPNW study *Plutonium: Deadly Gold of the Nuclear Age* published last year warned of the dangers of approximately 520 tonnes of plutonium currently existing world-wide. Plutonium should no longer be treated as a 'raw material' but as what it really is a deadly poison.

WISE News Commurvque:397 3.9. '93,

Australian Environmentalists Block a New Reactor

Like India, Australia has a nuclear Establishment—sort of. It does not have the kind of facilities that BARC has—indeed it hasn't got BARC's bite—but there is a nuclear research establishment, conveniently situated between a national park, a vast rubbish dump and the fastest growing suburban area in all Sydney. A perfect site for a reactor.

The reactor concerned isn't much to write home about either. In 1954 British announced they would give one in exchange for the privilege of using the Australian desert to test nuclear weapons. The reactor was completed in 1958 and entered full-power operation in 1959.

The reactor is known as HIFAR' (High Flow Australian Reactor). It belongs to a small group of similar reactors whose design dates from 1954, when it was 'the state of the art' for research reactors. Two similar reactors, DIDO' and PLUTO' were built in England at the Harwell research establishment, and have now been in shutdown after doubts were raised about their safety by a senior Harwell engineer. Another similar reactor is operating in Denmark, but with advanced equipment that HIFAR hasn't got. Another in Germany has been rebuilt at vast expense, as has one in Japan.

In the early stages of HIFAR's operation, research was done in areas of material testing, (for power reactors)

and neutron scattering. A lot of money was wasted in trying to design and test materials for a beryllium moderated reactor for use in desert areas a project which, when it was abandoned, left behind lots of waste that is still lying around. Weapons-related research was also carried out, and an Australian nuclear weapons lobby emerged.

By the 90s it was clear that Australia wasn't going to have either nuclear weapons or nuclear power, and HIFAR was left without a role. At the same time, major problems were starting to emerge with HIFAR safety: The cooling system in the reactor's thermal shielding had cracked and thousands of gallons of water were leaking into the room below where pumps for the

*October/Nov
ember 1993*

heavy water were situated. Problems had also emerged in the heavy-water heat exchange system.

'ANSTO'—Australian Nuclear Science and Technology Organisation (the successor body to Australian Atomic Energy Commission), has a problem in justifying its existence, and the large amounts of taxpayer dollars needed to keep it afloat and to keep the now well and truly aging HIFAR operating.

ANSTO saw salvation for HIFAR and itself in two areas: neutron scattering research and radioisotope production.

Neutron scattering, according to ANSTO, is one of those wonderful 'cutting edge' technologies that will lift Australia from its antipodean slumber and propel it into the 21st or 22nd century, while radioisotopes production will save the lives of all those whose trip into the 22nd century has been too much for them, and who have developed cancers or heart conditions.

So, what is 'neutron scattering'? Neutron scattering involves the penetration of matter—bits of plastic, metal or pharmaceuticals or whatever—by beams of 'cold', 'hot' or 'thermal' neutrons to examine its structure. Neutron scattering has been done at HIFAR for many years but it has singularly failed to galvanise the Australian R&D scene. A few dozen researchers perform esoteric experiments on 'Kondo' systems, spin glasses and supermagnets. They are mostly costly experiments. The queue of eager corporations waiting to do market driven R&D on HIFAR just hasn't materialised. It is the same situation all over the world.

ANSTO rather believes that HIFAR is out of date and needs upgrading. They

Evolution of an Activist

How I was awakened to the reality of nuclear affairs? In 1985 I had a chance to visit BARC in connection with some heating device they wanted. I had

now want a new reactor with three times the flux, one and a half times the power and the latest in equipment. A careful look at ANSTO's own figures however, showed that even a new state of the art reactor, —a mere snap of course at \$200—400 million, will in fact put Australia about 12th or 13th in the world neutron scattering stakes. Hardly an impressive achievement! This reactor would be the single most costly item in Australia's R&D budget for many years. Meanwhile, programmes like solar energy, in which Australia at one time used to lead the world, have long since migrated to California and Japan where there is much less sun. Is this really the sort of priority Australia needs to propel it into the next millenium's technological wonderland.

Friends of the Earth, Sutherlandshire Council and Greenpeace have all spent the last six months arguing before a commission of enquiry that this is not an appropriate way of spending taxpayers' money and arranging among other things, for the commissioners to talk to that Harwell engineer who voiced doubts regarding the safety of HIFAR's brethren, DIDO and PLUTO. We have burned the midnight oil going through ANSTO's own figures with a fine toothcomb (well, actually a pocket calculator) and spent hours on the computer, the fax machine and the phone. We told the commission that a new reactor was a waste of money and HIFAR itself is an accident waiting to happen and should be decommissioned immediately. We pointed out the potential problems with HIFAR's emergency shutdown system, its lack of a backup shutdown system, and problems with the the un-interruptible power supply which in their own words, "has never operated satisfactorily."

known by then that nuclear plants meant many fishy things but had not reached a decision that I would have nothing to do with it. Once inside the

In addition, we pointed out that most of the research that goes on at ANSTO's Lucas Heights site is in fact not reactor dependent at all, and neutron scattering is, in fact, the second smallest programme at the site, with far more effort going into other fields of research. If HIFAR were to disappear tomorrow, most of these programmes would be largely unaffected. The only research programme that would actually disappear would be the neutron scattering programme itself.

ANSTO, as well as arguing the merits of neutron scattering as an entree to the next millenium, argued that HIFAR was needed to produce medical isotopes. It turns out that the 'cutting edge' of medical radioisotope technology are accelerators. Many of the isotopes that, according to ANSTO, could only be produced in a reactor, turned out to have active accelerator production programmes elsewhere.

The inquiry's most important conclusion was that ANSTO had failed to make a case for a new research reactor, and therefore, the commission "could not recommend its construction". The commission however, went on to suggest that HIFAR be refurbished—something ANSTO had said "wasn't practicle". It failed to acknowledge the safety problems at HIFAR. Thus the challenge to convince the people and the government that HIFAR should be shut down and Australia should withdraw from its ill-considered involvement in the nuclear fuel cycle, remains.

John R Hallam
6.10.1993

BARC, I found it very impressive, almost like a place from a science fiction story. At the nuclear fuel complex, I met a 'scientist' named Mr Khurana.

Clad in orange with a picture of Rajaneesh on his chest, he seemed quite at ease in the middle of many strange activities. These are some fuel rods for machining—weH, they have extremely low levels of radioactivity. It cannot penetrate even the skin." I was a little uneasy but walked on bravely with him till we came to a big iron gate because here even the scientist said that the radioactivity could be higher. On his pushing a button, the gate opened sideways and we saw in front a crucible containing uranium oxide for which an ignition device was required and which could be operated without going any closer. I asked what could be the radiation level where we were standing and the answer was that the man who monitored it was on leave.

A few months later we had Chernobyl. That same year it was my privilege to experience the awesome beauty of the Periyar lake in Kerala and later on learn about the poisoning of the Periyar river by the Indian Rare Earths Ltd. (IRE) plant at Alwaye. I could not sleep well because I had done business with IRE...

..While going through the account of your cycle yatra I had a strange feeling which I would call healthy jealousy. Every day there are several reminders of the prison that I have created around myself but the cycle yatra also reminded me of the possibilities of fulfilling childhood dreams of adventure with a much greater meaning! I don't know exactly when, but some day I am

bound to join you people in your yatra...

I have been trying to gather more information on the Narmada project. It is very distressing to realise that the Gujarati press refuses to see the problem of rehabilitation as it reality is. Even if we accept that the 19 villages of Gujarat can be rehabilitated, it is no more than a small fraction of the task. One hopes that as time passes the real nature of the project will become clearer to those who believe it is inevitable and that there will be a united front of all activists who will support the villagers who will be refusing to move.

Kersi Sabavala

read the news of Kersi Sabavala's untimely death in the newspaper. There it was in black and white Kersi Sabavala is dead. He died suddenly following an attack of malaria just after returning from a business trip to Bombay He was just forty. Even though now more than two months have passed, it is still difficult to adjust to the fact. Wasn't It only yesterday that Kersi had come for the first and alas only time to Vedchhi and we had spent half the night talking? He had said that he would visit again soon and stay at some length and enjoy the peace and maybe write something for *Anumukti*.

I first met Kersi four years ago at a meeting of the Narmada support group in Ahmedabad. After that we met somewhat infrequently at different places usually at some protest action or meeting connected with the Narmada agitation. Superficially, I knew him very little, but deep down I felt we were kins.

Kersi's support to Anumukti during the last four years was extensive and steadfast. From collecting money to putting an advertisement for Anumukti in various 'mainstream' fora, Kersi did it all. Anumukti deeply regrets his death. Below we republish excerpts from some of his letters to Anumukti as a mark of respect.

Blacklisting Nuclear Power

The following is the full text of the letter Kersi wrote to Nuclear Power Corporation on 11th of April, 1990.

We have received your tender enquiry (No:CMM/KAPP/4920). We manufacture a wide range of ovens and furnaces. But as a matter of principle we do not deal with organisations concerned with atomic energy generation. Our stand is based on the following facts:

- Nuclear energy is the source of one of the most dangerous kinds of pollution. Radiation at any level is harmful to life and environment.
- As radiation cannot be measured by ordinary means nor can be sensed by the people, atomic energy experts have succeeded in keeping the population in the dark.
- The harm that the radiation can cause may not be felt in the near future but can be passed on to the coming generations in the form of damaged genes.
- This subtle violence against life and nature is irreversible.
- There is no method yet devised to safely decommission a reactor after its short life of 25 years or so is

over. This is a totality unjustifiable liability we thrust upon generations to come.

For perpetuation of the evil of nuclear energy its various agencies are controlled by the power of the state. In countries where people have a say, the dream of nuclear energy has evaporated.

There is always the possibility of a major accident like that of Chernobyl as even for the most perfect

machinery the human factor cannot be wholly eliminated.

Nuclear power generation is a big drag on the progress of a poor country like India. With the same amount as sunk in this large scale ego trip, a lot more power can be generated in a decentralised and safer way.

The cover-up provided by the government to nuclear energy establishment in the form of the Atomic

Energy Act is contrary to the spirit of democracy.

- The nuclear establishment has kept alive the option of a nuclear bomb which is madness of the highest level.

In view of the above considerations we have no option but to blacklist your organisation.

Subscription Information

Rs. 30/~ per year (6 issues) within India

U. S. \$ 15/- per year or equivalent in other currencies for airmail overseas.

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

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

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

Editor Anumukti

Sampoorna Kranti Vidyalaya

Vedchhi, 394 641 India

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

Anumukti Team:

Shreyasi Dutt, Banaprava Naik, Sanghamitra and Surendra Gadekar

Published by S Gadekar for Sampoorna Kranti Vidyalaya and

printed at

The Parijat Printry, Ahmedabad

PRINTED MATTER

BOOK POST