Nuclear Estate : A Threat to Democratic System

In the beginning we shape our technology, but if we are not careful in the end it will shape us. It is for the democratic process to operate to see that it does not do so in a way that damages our central rights and liberties. There is no issue more urgent than the democratic control of nuclear power.

Tony Benn
(UK Energy Minister 1974-79)

Social Impact of Nuclear Enterprise

Studies released by the DAE speak of the great *potential* benefits of nuclear energy, and describe how cheap and safe the nuclear fission is. In India, the proponents of nuclear power have paid little attention to unresolved questions, namely, the nuclear waste management and decommissioning of old and dead reactors. For it is claimed that our nuclear programme has not yet arrived at the level of these problems. But the most serious question of impact of nuclear technology on social behaviour and political institution has even greater relevance for emerging democratic system in India. Lovins (1976) has pointed towards social impact of nuclear and fast breeder systems. He has suggested large scale bureaucratic centralisation which is likely to result in the US from a breeder system and plutonium economy. These have a special bearing upon India as the DAE has envisaged FBRs for this country's third stage of nuclear development. If we are to encourage greater reliance on the nuclear power programme for our industrial growth and development, necessary safeguards required to maintain safety and secrecy of vast nuclear facilities spread all over the country would lead to increase in numbers and power of our secret police and governmental agencies which, most likely, will adversely affect the country's already weakened democratic system.

The DAE has become an oligarchic power system. It is an elitist institution in its valuational approach to socio-economic policy. Such was the characteristic of most scientific organisations when science was conducted in small rooms and its involvement for public affairs was minimal. But where the atomic energy gets the highest share of developmental budget and its policy decisions and performance are very much involved with national planning and public welfare, the question must be asked who really speaks for nuclear energy, and whose interests are represented by the DAE? Who benefit with this scientific and secret enterprise of the country? Do the top bosses of the DAE speak for the scientific community of the country? Do the directors and the secretaries of nuclear establishments properly constitute representativeness of the working nuclear scientists and engineers of the country? These are important though largely neglected issues for the Indian science policy analysts. Since the nuclear policy decisions directly affect internal and external affairs of the country with far-reaching consequences for the people of India, they cannot be and must not be allowed to be governed by an undemocratic system. If responsibility entails accountability, then ways must be found for making India's nuclear institutions more truly representative and the decision-making process more open and democratic.

To our knowledge there are no dossiers on individuals who oppose solar and renewable sources of energy or anti-conservation policy. But dossiers do exist on critics of nuclear power in this country and abroad. A study of Nuclear and Alternative Energy Systems Report sponsored by the US National Research Council disclosed that the Texas State Police compiled dossiers on the leaders of a local group opposing nuclear power plants. It has also been reported that the Virginia Electric and Power Co. which runs several nuclear facilities had advocated a bill establishing its own police force with power to arrest anywhere in the State and to gain access to confidential records of citizens who oppose nuclear power. In July 1976, a joint Energy Research and Development Administration-Nuclear Regulatory Commission task force in the US recommended full security checks on selected employees of facilities handling nuclear material. In India, it is reported that the DAE's intelligence bureau maintains a list of undesirable citizens with whom employees of the DAE are not allowed to associate. Police clearance is necessary for employment in all DAE's facilities.

Kosambi and Jayaraman Episodes

The successive Chairmen of the Atomic Energy Commission have used improper methods to silence critical opinions of independent scholars. It has been reported that the late Professor D.D. Kosambi, a great mathematician, and a Sanskrit scholar, was a senior fellow at the Tata Institute of Fundamental Research from its very inception in 1945. In early 1962, he delivered a few lectures advocating greater R & D efforts in solar energy vis-a-vis the nuclear technology. Dr. H. Bhabha was displeased by the criticism and Professor Kosambi's fellowship was terminated without any explanation. Since Dr. Kosambi, a man of national and international fame, could be sacked with impunity, this worked as a great deterrent against simmering criticism within the DAE.

In the recent times, Dr. Jayaraman episode will go down in the history of DAE as the most ignominious of its intolerance to free national debate. Dr. K. S. Jayaraman, a Ph. D. in nuclear physics, is one of the most outstanding science journalists in India and the Third World. He is the science correspondent with the Press Trust of India news agency. He also used to write a regular page "View from New Delhi" in a national science monthly *Science Today* (Bombay). In the June 1979 issue, Jayaraman entitled his despatch "The Message of Harrisburg" and observed that following the Three Mile Island incident, several countries in Asia and Europe were reassessing safety systems in their nuclear plants. The US itself closed down eight nuclear plants on safety grounds and shut down six others as their locations were close to seismic faults. Whereas in almost all countries there were predictable reactions to the Harrisburg accident, in India proponents of atomic power were nonchalant. With a scientist's concern he wrote :

> Our Department of Atomic Energy (DAE) is a sacred cow and any adverse comment on its activities is tantamount to blasphemy. Its work, though avowedly non-military, has always been clothed in secrecy, so that no intelligent debate dragging in its performance has ever taken place. Its report on the explosion at the Baroda heavy water plant was never made public. A scientist of the Nuclear Fuel Complex (NFC) in Hyderabad who told a reporter that wells were polluted by NFC effluents has been removed and his whereabouts are not known. A correspondent accredited to the government was denied entry to the Baroda plant to report on the situation after the explosion. The public was not told the details of the second explosion in Baroda or the recent fire that wrecked a plant at NFC. There had been theft of contaminated rods from a waste disposal site, of contaminated gold from the plutonium plant (PP) and a case of contamination of ground due to PP effluents" all of which were DAE's secrets. The attitude of DAE seem) to be that its records and log books are not for inspection by others and that how it handles its wastes is not the concern of the public. In such a climate what does one expect DAE to do if it faces a Harrisburg-like accident ?

The scientist, Dr. Jayaraman, raised pertinent questions whether the DAE had an emergency plan and if it would keep the accident a secret to itself ? He echoed the late Dr. Meghnad Saha in his argument, "Is the secrecy at all necessary when DAE is supposed to be engaged in peaceful power generation?"

Dr. Jayaraman also pointed out that in every democratic nation separate agencies were invested with responsibilities of different functions. But in India all the jobs—site selection, construction, operation of nuclear plants and enforcement of environmental standards, etc., are sole charge of DAE. Even the anti-pollution laws enacted by the Centre or the States have no control over radiocative pollution, which is strictly the domain of DAE alone. The message of Harrisburg for India, therefore, was that it "should have a separate a, ĥey outside DAE to keep a watch on the safety of nuclear installations". He also voiced the long-felt demands in the country that our Universities which have for so many years been "shut out", should be allowed to engage in nuclear activities. He rightly concluded that "it is time for the government to set up an independent committee to review DAE and to organise its set-up in a way that lends itself to frankness and accountability.".

On March 14, 1980, there had occurred a leak at Tarapur plant. As usual, the DAE made no announcement. But Dr. Jayaraman flashed the news on the PTI teleprinters. The DAE chief immediately denied its veracity but under the persistent questioning in the Lok Sabha, on the third day, Mr. Sethna admitted that there was a 'pinhole" leak and accused the Press of exaggeration. Dr. Jayaraman wrote an excellent piece which has become the best indictment of the AEC chief ever made in India. He rightly pointed out that the Indian Press "has highlighted every single achievement of the DAE, major or trivial. There will be no exaggerated reports on hazards and dis..ders of Tarapur plant, as alleged by Mr. Sethna, once the DAE lifts the veil of secrecy su ounding peaceful uses of nuclear energy."

Dr. Jayaraman's independent and authentic questioning of India's all-powerful establishment was unique in its fearless reporting. He was asking embarrassing questions. But his columns in *Science Today* proved a bit too embarrassing for the establishment and even though there existed no *emergency* then, inter-departmental pressures were brouht upon the PTI chief who forbade Dr. Jayaraman from writing for the magazine. The readers of the national science monthly were thus deprived of the benefit of investigative commentary by one of India's courageous science correspondents. It was a clear denial of free flow of information and violation of democratic process in which the citizens should be freely involved. Scientists working in BARC, TIFR, and other nuclear utilities are not allowed to participate in a discussion or write or speak critically on the organisational aspects of the DAE and/or on nuclear policy in general, either publicly or in academic forum, No free discussion is permitted inside the portals of the DAE establishments. It is like a concentration camp with the best living conditions possible in a poor developing country—for those who can excel in the art of sycophancy and silence.

The Role of BARC Officers' Association

The BARC Officers' Association (BARCOA) in a Memorandum submitted to the Prime Minister on January, 29, 1980, wrote that the performance of the working scientists have had little effective say in decision-making in scientific or personnel matters :

> Too many important facts like those concerning health hazards, progress of important projects and service conditions of individual scientists have been unnecessarily kept secret not only from the public but also from the majority of the scientists. As a result the latter are alienated from the management whom they consider solely responsible for all the failures of the Department. The working scientists do not want to accept the reponsibility for these failures without the right to participate in decision-making.

Due to serious alienation of the working scientists and the deep hiatus between the management and the scientists, India's nuclear programme has failed to contribute seriously to the national development. Over the last few years the BARCOA had persistently tried to open a meaningful dialogue on these issues with the BARC and the DAE managements. "Unfortunately", the Memorandum reported, that they

> have grown so used to treating the working scientists with indifference, if not outright contempt, that they do not seem even to comprehend the idea of such a dialogue. Thus, in spite of our repeated requests they have refused to give the

Association information even on such matters as the 'precise framework of rules and regulations governing the terms of employment of scientists' 'seniority lists', and the 'promotion norms'. Our request to draw up guidelines for transfer of scientists from one field to another was termed interference in the management's prerogatives.

The Memorandum further emphasised that the failures of the DAE's projects which have come to light recently could have been foreseen long ago. For the individual scientists were often aware of "the underlying unsound technical decisions or unjust personnel decisions that have brought about the failures and the discontent. However, in the environment of *fear* and secrecy prevailing in BARC and DAE, they preferred to keep quiet. Occasionally, when they protested, their protests were ignored and steps were taken to silence them or destroy their credibility. This state of affairs continues even today and *we are afraid that some of our projects may not function properly or may run inro difficulties in future unless the working environment here is drastically changed*' (Emphasis original).

The BARCOA further informed the Prime Minister that "*concentration of too' much power in the hands of a few who were practically accountable to none*" is the major cause of inefficiency and lack of seriousness of purpose in the DAE.

"In the absence of any effective accountability", the Memorandum continued, "the temptation to misuse their powers for building personal empires was simply too strong for most scientist managers to resist. To forestall the possibility of any future challenge to their unquestioned authority they also arranged things so as to inhibit the emergence of a fearless scientific community." The Memoradum urged the Prime Minister to have an inquiry into the functioning of the DAE and suggested essential immediate steps which included :

(a) Full academic freedom and the right to air dissenting views in all scientific matters should be guaranteed to the working scientists

(b) Norms of promotion and confirmation should be made public. This is *absolutely* essential if the confidence of the working scientists in the sense of fairness of the authorities is to be restored.

The scientific leadership which was expected to provide direction and guidance to the DAE's management has simply become its instrument. It failed to encourage development of a self-confident and fearless community of scientists with healthy traditions and ethos. Instead, a majority of the scientific leadership, in the words of the BARCOA :

> has succumbed to the lure of administrative power and position, faltered in its vision, lost sight of the goals of the department and contributed to the increasing alienation and frustration of the working scientists by a behaviour bordering on the authoritarian, lawless, arbitrary, cynical and plainly unscientific. They have arrogated to themselves all the freedom and autonomy granted to the department for unhindered progress of science, centralised the real decision-making power in themselves and treated the working scientists, who needed these freedoms most, with contempt. In the name of secrecy they have refused to be *accountable* to the scientific community not only in their treatment of the individual scientists, but also in decisions concerning the structure of the oragnisation or choice of projects.

It is significant to note that BARCOA was permitted to be active only during the Janata Party rule (1977-79) when reforms were initiated in the DAE. However, soon after Mrs. Gandhi's return to power, the liberalising process was reversed and the DAE was desparately trying to curtail the functioning of the BARCOA. According to a BARCOA spokesman, apart from harassment at work, and denial of accommodation and leave "which is normal", six committee members of the BARC union have been transferred since the formation of the organisation, while the secretary and vice-president of the association at the Nuclear Fuel Complex (Hyderabed) have been dismissed and the general secretary has been removed from service.

There were reports of harassment of activist members of the Atomic Energy Workers and Staff Union and victimisation of the joint secretary of the Rajasthan Anushakti Kamgar

Union (Kota). The BARCOA has played a constructive role and been only necessarily critical. It pointed out to the fundamental issues involved in such a complex enterprise and rightfully drew the attention of the nuclear brass and the Prime Minister to the working relation between the nuclear workers and the administrators. If the scientific workers remained discontented and the bureaucracy alienated, the DAE could not hope to maintain high standard of safety and performance.

The BARCOA has rightly maintained that the top executives of the DAE, while refusing to permit investigation and evaluation of their performance, were publicly attempting to pass the blames for their mismanagement and corruption to "agitational" attitude of the Unions. The government must realise that in a nuclear power system a critical situation can easily be developed through carelessness of the workers within the establishment and a reactor due to its poor maintenance, inspite of its good design, and fail safe back-up systems, can easily suffer "a planned failure" or a "careless accident". However, it is most unfortunate that the government did not respond to their appeal. The DAE has evolved its own methods to stiffle free debate over the nuclear programme.

The DAE without Constraints of Planning Commission

The Planning Commission has over the years evolved a procedure of assessment, selection and approval of big funding projects. All official projects with a financial outlay of Rs. 20 crores or more go through the process of scrutiny involving a three-tier system.

A concerned department (or ministry) first submits its proposal to the Planning Commission where it is evaluated by the Projects Approval Division (PAD). If approved by the PAD, it is forwarded to the Public Investment Board. In turn, the Board, after having examined its various economics in terms of the public financial support, pushes the project up to the Central Cabinet for its approval and sanction. Thus, as a rule, all projects of Rs. 20 crores or over get theoretically a good *grading* before getting the final approval of the Cabinet which is *presided* over by the Prime Minister. However, since the Prime Minister is also the Minister of Atomic Energy (and also of Space) when the demands of the DAE are prepared, they are not subjected to normal scrutiny. No project of the DAE, even if it is of Rs. 100 or 500 or 1,000 crores, is ever submitted to the PAD of the Planning Commission. Instead the projects of the DAE go directly from the table of the Secretary of the DAE to the Prime Minister's personal perusal who may or may not diclose the substance of the project to the Cabinet. Most critical projects are never placed on papers and decided upon by direct meeting between the Prime Minister and the Chairman/Secretary of the AEC/DAE.

The honourable members of the Central Cabinet simply grant their consent to the budgetary demands of the Ministry of Atomic Energy as "recommended" by the Prime Minister. Details for an ambitious N-power programme of 10,000 MWe for the Sixth Five-Year Plan (1980-85), for example, were never discussed by the Cabinet. The Plan programme of the DAE falls into three Plan sectors, namely, R&D, Industry and Minerals, and Power. In May 1980, the Planning Commssion initiated action for the formulation of Plan proposals for the Sixth Plan period by constituting working groups for different sectors including the power sector. The power working group under the Chairmanship of Secretary, Ministry of Energy, included N-power programme of the DAE. The Planning Commission also wanted to review the past performance of the DAE and integrate the N-power with the national energy programme. However, the DAE refused the Planning Commission's bid to assess the N-power programme. Instead, it set up two "internal working groups", one for the R & D sector and the other for the I & M sector. The DAE formulated its own independent Five-Year Plan and presented its N-power plan to the "working group on power" constituted by the Planning Commission which considered and recommended the N-power generation for 1980-85. According to the Performance Budget of the DAE 1981-82, the Commission, after holding discussions with the departmental representatives, "approved" the Plan outlays under the sectors as "reconmmended" by the DAE totalling Rs. 1,049.01 crores which included Rs. 799.05 crores for N-power and industry and extension.

However, on August 20, 1980 when the Minister of Planning presented the Sixth Five-Year Plan to the Parliament, it did not include the DAE's N-power programme. But Mr. Sethna, independently of the Planning Commission, on April 27, 1981, speaking before the Association of Indian Engineering Industry's annual meeting in New Delhi, disclosed that the Planning Commission has cleared six Narora-type 210 MWe nuclear reactors for the Sixth Plan period. It was also claimed that the DAE planned ten such reactors for the next two decades and thereafter "another 12 reactors of 500 MWe capacity" would follow. The official volume of the Plan 1980-85, however, contains no reference to the ambitious N-power plan. It is reported that no one from the Planning Commission was permitted to assess or critically examine the reports and recommendations of the DAE. But if the Prime Minister wanted to approve a N-energy plan there existed no regulatory/formal authority within the government that could have questioned the demands of the Department ofAtomic Energy.

The Ministry of Atomic Energy is one of the sacred ministries whose annual budgets have never been discussed by the Parliament of India.

Trans-scientific Considerations : The Tata Connection

We do not have direct evidence to prove the hypothesis that there exists any "conspiray" to capture politico-economic power in India by two powerful family groups of the country—the Nehrus and the Tatas. But if the political and nuclear-industrial operation is any indication, a potential threat of such an eventuality cannot be ruled out.

Official files are not open to us for critical scrutiny, but it can be surmised that financial gains and high rates of profits must have been drawn from the nuclear programme by those industrial houses which have secured logistic position in the decision-making process. As it is with the country's political culture, family connections of Tata, Bhabha and Sethna must have reaped rich dividents for the House of Tatas.

At the time of reconstitution of the AEC, in 1962, Nehru went out of his way to accommodate wishes of the Parsee child prodigy, Homi J. Bhabha. Mr. J.R.D. Tata, an uncle of Bhabha, was made the second most powerful member of the AEC, as the sole representative of industry.

Perhaps the Tatas were the only industrial house in the country at that time which could claim some knowhow in dealing with heavy steel technology. But some 'conflict of interest' cannot be denied in funding many Tata institutions and subsidising its projects by the DAE.

In 1948, Jawaharlal Nehru and the young nationalist government in New Delhi could not see the games of "friends" within, whose sole interest was the greed for the national resources. At what point in early years of independence, Tatas became active with Nehru's inner circle and how far *informal* activities proved useful in the forging advantageous *formal* connections is a matter for further investigations.

But the late Mr. M.O. Mathai, Special Assistant to Jawaharlal Nehru from 1946 to 1959, the early years of the Nuclear energy development, has reported in his "Reminiscences of the Nehru Age" about a Director of the Tatas making informal approaches to the first Prime Minister of India. Mr. Mathai described how in 1948, soon after India's "police action" in Hyderabad, the Director of Tatas introduced to Nehru former daughter-in-law of the Nizam of Hyderabad. A Turkish beauty, named Niloufer, separated from her husband and settled in Paris, was almost brought to Jawaharlal Nehru as "the PM's personal guest". On the Tata Director's bidding, the Prime Minister had pursuaded the Nizam to make reasonable settlement of long overdue financial claims of Niloufer. The Director of the Tatas told Nehru that

> Niloufer was anxious to come to Delhi to thank him personally for his kindness. The Tata Director went to the extent of suggesting that Niloufer might be put up on the Prime Minister's house.

However, Mrs. Gandhi's timely intervention stopped the ill-fated visit of the lady and Mr. Mathai told "the Tata Director that Niloufer's proposed visit could only do some harm to the P.M."

It may be sheer coincidence that around the same time Homi Bhabha was trying to establish his power equation with the first nationalist government in New Delhi. Bhabha's paternal aunt had married Sir Dorab Tata who along with Homi's father wanted him to obtain an engineering degree "with a view to join the Tata Iron and Steel Company at Jamshedpur". With the financial backing of the House of the Tatas, he had organised a Tata Institute of Fundamental Research in Bombay and was negotiating with the Western nations for the transfer of nuclear technology which could have rich dividends for his uncle's industrial establishment. It was a new technology and no industrial organisation in the country could have placed its claim to it. But for the Tatas, at the right moment had arrived a bright young scientist of the Tata family who matched the political aspirations of the Nehrus. He was aggressively ambitious and succeeded in establishing closer linkages between the Nehru government and his uncle's establishment. It is, therefore, not insignificant that when the Tata Director was offering Niloufer to the Prime Minister, Bhabha was busy organising the first Atomic Energy Commission (1948).

Next to Nehru, Bhabha was the only man in India who was given so much leverage in playing with the rules of the Government of India. He shared with Nehru "the same patrician backgrounds with proximity to wealth and political influence, both had been to Cambridge, lived like bachelors, considered themselves connoisseurs of art, music, food, etc. Their mutual attraction enabled them to speak the same language."

In subsequent years, 1952 and 1953, Bhabha was having tea or dinner with Nehru almost every two weeks. Bhabha saw to it that even though he secured the governmental support it entailed no governmental control over him. By making his programme and institutions an integral part of the government and placing the people committed to him as "the government officials" to control them, he secured his personal autonomy.

It is not to deny scientific organisational acumen to Homi Bhabha but to point out that trans-scientific considerations had given added advantage to Bhabha in turning him into a superman of India's nuclear development, when the title truly belonged to the great nationalist scientist, Meghnad Saha who was the father of nuclear science in India.

Certainly, the role of Nehru and Bhabha in the development of India's scientific institutions is far greater than a few Niloufers. But the Tata connection proves that the powerful industrial houses in the country have adopted unethical techniques to draw unrestrained advantages of the nuclear development. Mr. Tata was working to take over the country's N-power programme under his private sector industry. But due to untimely death of Bhabha and Nehru, the plan could not be materialised.

Most often than not trans-scientific considerations have forced many nuclear policy decisions on the DAE. For example, denial of rightful role to the Saha group of nuclear physics in the formation and development of India's nuclear programme and permitting the total autocratic and monopolistic authority to Bhabha in disregard to other senior nuclear scientists of India by Jawaharlal Nehru were indicative of substantial bias for which no apparent scientific justification was established. Jawaharlal was a great man and his services to the nation cannot be belittled by his human considerations. But it is suspected that the development of an open nuclear scientific policy was hampered by such personal pressures brought upon the national leadership at a critical juncture in our nuclear development.

In 1972, once again the Tata connections were proved decisive when another "Homi" Sethna was appointed to the Chairmanship of the AEC. In 1966, when Homi Bhabha unexpectedly died in an aircrash, Mrs. Gandhi, seeking political advantage to upset Morarji Desai's power base in Gujarat, had appointed Dr. Vikram Sarabhai—a prodigy of a Gujarat industrial house. However, in choosing Sarabhai's successor in 1972 she could not ignore the wishes of J.R.D. Tata. Out of the three aspirants, Raja Ramanna, Brahma Prakash and Homi Sethna, the Prime Minister favoured Homi. Ramanna who perhaps rightly claimed the scientific inheritance of Bhabha received a great setback.

In early 1981, after an interval of a couple of years of Janata rule, Mr. J.R.D. Tata has once again been nominated as a full-time member of the AEC. And the Tatas have over the years secured the highest financial advantages from the DAE. There is no nuclear power project in India in which the Tatas have not been assisting the country's nuclear advancement.

The Tatas were also involved with construction of "indoor switchyard" and a complete electrical system at MAPP and RAPP including fabrication of fuelling machine. On line refuelling system was also contracted to the Tatas. The Tatas were also responsible for 'carriage designing and fabrication, airlocks and matrification' of Research Reactor R-5 at Trombay and of Reactor Research.

We do not have any literature on the political philosophy of Mr. J.R.D. Tata to know his approach to the country's politico-economic ills. But we know about his love for flying, He has been one of the finest and earliest flyers of the world and was an inspiration to the late son of Mrs. Gandhi who died in an aircrash in June 1980. But rumours are rife that Mr. Tata is getting closer to Mrs. Gandhi, perhaps closer than he was to Jahaharlal Nehru during Bhabha's days. Specially, since his nomination to the AEC, Mr. Tata has voiced his open support for the Prime Minister. At this ripe age of 79, he admits that although he has been aloof from politics, he is willing to be closer to "any government which will allow us to come closer".

Mr. J.R.D. Tata, along with Mr. J.J. Bhabha, the younger brother of the late Homi J. Bhabha, were involved in public controversy about giving irregular financial support to Mr. A.R. Antulay, a political prodigy of Mrs. Gandhi.

In 1981, on Mrs. Gandhi's bidding, Antulay was made the Chief Minister of Maharashtra, the richest State in India. He was found guilty of misusing his position and collecting huge funds for spurious charitable foundations, some of which were named after Mrs. Gandhi and her late son Sanjay. The Tata Trusts contributed millions of rupees to Antulay's trusts, in exchange of undue favours granted to them by the government.

Mr. Tata admitted that the Tatas have gone closer to Mrs. Gandhi, perhaps at the cost of other big industrial houses in the country. But his political ambition now is more challenging. For, he has voiced his disagreement with the political system where "only politicians become ministers". He has also reiterated his doubts about the effectiveness of a Westminster-type of parliamentary system where "the opposition always sought to bring down" the government, which "led to instability" and "further impeded economic activities". In contrast, he is fond of the Swiss system but believes it impracticable in India and has advanced alternative of "presidential form of govenment, which could ensure induction of required expertise into the government and greater stability" to the country.

Performance of Larsen & Toubro

In the name of self-reliance and achieving import substitute in the country, the Government of India adopted a policy of subsidising industrial houses for nuclear industrial development. Several big and small companies have come to existence with direct patronage and alliances with the bureaucrats within the DAE administration. Some private companies, in practical terms, are no more than mere subsidiary organisations of the DAE. In a totally secret goings-on, what share of the subsidies is returned to the personal coffer of the bureaucrats is anyone's guess. But after the Tatas, the second most important vendor of the DAE is Larsen & Toubro Company Limited which has succeeded in obtaining major orders from the DAE's nuclear energy projects, L & T received orders for manufacturing vital equipment for the core sector in the nuclear projects including 11 heavy water towers and electronics for the DAE's plant at Kota. Its gross sales turnover for the year ended in March 1978 was Rs. 140 crores. The growth of L & T over the preceding decade (1967-68 to 1976-78) was "quite extra-ordinary", 400 to 600 per cent. "The Company enjoys an enviable reputation in the critical world of Bombay stock exchange because of its remarkable record of growth". The L & T equity share is one of the top five blue chips that are recommended by the knowledgeable stock-brokers of Bombay. The fortunes of the Company evidently rose in the seventies after they had secured orders from the DAE.

According to the official claims of L&T, it has contributed to the nuclear energy development by manufacturing critical equipments like calandria, steam generators, end shields, end shielf rings as well as heat transfer equipment like moderator heat exchangers, standby coolers, bleed condensers, bleed coolers, etc., for RAPP Unit II and MAPP Unit I and II. Similar equipments are also under fabrication for MAPP Unit I and II. L&T has supplied heat exchangers, distillation trays and cartridges for the heavy water plants at Baroda, Talcher and Kota. The Company has also secured orders for critical components in research reactors including manfacturing of items made in exotic materials involving dissimilar material welding.

However, it has been reported that major R&D efforts were carried out by the public sector companies, mainly at BHEL workshops. BHEL has been the main supplier of nuclear-related technology to L&T. Knowledgeable persons at BHEL claimed that R&D in the critical sectors of the nuclear energy programme was to the great extent developed at its floors according to Canadian designs and specifications and was supplied to L&T by BHEL. It is admitted, however, that the BHEL is capable to replace the Canadians only in "the secondary systems". Otherwise the Indian industry was not yet ready to replace the foreign technology.

In spite of the dedicated hard work put in by the BHEL undertaking, orders for fabrication of the critical components were secretly granted to L&T. It may be a sheer coincidence that one Mr. H.C. Sethna, probably a relation of the then Chairman of the AEC, has been placed in a high position in L&T as the "Executive Manager" of the Engineering Group II of the Company which looks after the business with the DAE.

In early 1970s, without public knowledge, L&T was awarded contracts to manufacture nuclear reactor calandria for RAPP II. Since it was a challenging job involving new technology, the Company was given "the most favoured" subsidies to the time that it was treated as a government agency for all purposes relating to transfer of technology. All necessary knowhow was freely supplied by the DAE from its R&D units at BARC and the Company was allowed open imports of all necessary technology, machinery, spares and raw material.

Soon the great potential for high profit became evident and in less than five years, the Company's activities spanned over the manufacture of steam generators, end shield rings, auxiliary heat exchangers for both RAPP and MAPP I and II. L&T's public relations operation proved more effective than BHEL and other public sector undertakings. Criticism from private and public companies notwithstanding, L&T was awarded contracts in many criticial sectors of nuclear_programme, including construction of the modular laboratory at Trombay, and supply of equipment for plutonium processing plants, fabrication of all the exchange unit towers including the distillation trays and heat exchangers for both the Kota and Talcher heavy water projects.

Nuclear fabrication works with complete engineering and construction services were carried out by a subsidiary of L&T, Engineering Construction Corporation Limited (ECC), which was responsible for erection of all the exchange unit towers at Kota. It also lifted the 550-tonne tower for the heavy water project at Baroda. Also for the heavy water plant at Tuticorin, ECC was credited for successful erection of the second heaviest isotopic exchange tower in a single lift, which weighed 353 tonnes and had a height of 41.2 metres. This was, of course, a technological fiat for the first time performed in the country.

EEC was also awarded jobs relating to construction of the DAE's N-power projects at MAPP, Talcher, Kota, Baroda and Trombay. It is reported that L&T since entering into business with the DAE has floated a number of companies solely to handle the nuclear jobs. Even if they are formally subsidiaries of L&T, in their technical operation and financial balance sheets, they are private workshops run by the DAE but kept under the umbrella of L&T.

Thus, to conclude, both industrial houses—the Tatas and Larsen and Toubro—have received official concessions from the DAE in various ways including free supply of industrial knowhow and engineering advice and free import permits for many critical items which placed these industrial giants at an advantageous position vis-a-vis other competing industrial organisations, particularly the public sector ones, like Bharat Heavy Electricals Limited.

Many engineers and executives of the Tatas and Larsen and Toubro have made short and long engineering study trips abroad for which the DAE footed the bills. Both the companies have received handsome orders of critical jobs relating to N-power projects for which the know-how was supplied to them freely by the DAE.

The Story of Nehru Centre

It is now widely acknowledged that the scientists cannot be isolated from their social and political culture. They too like any salesman, in order to secure big funds and to further their personal ambitions, adopt to the public relations techniques. It is for such vagaries that the scientists at the DAE have willingly or unwillingly served the interest of unscrupulous politicians. Most often the big decisions taken at the DAE were (are) not basically scientific, nor were they in the best interst of the national technological advancement.

India's political leadership is eager to match its peers in the advanced nations in fame and prestige by demonstratively forging the country's scientific and technological achievements to a matching height. This eagerness has given impetus to some nuclear scientists to aspire for advanced technologies with obvious political backing even at the cost of general welfare of the people.

Mrs. Gandhi is an astute politician who kept Mr. Sethna (ex-chairman of the AEC) and Dr. Ramanna, the present Chairman of the AEC, divided. Personal feuds between the two nuclear chiefs played havoc with India's nuclear programme. But in their in-fighting both vie desparately to seek political patronage of Mrs. Gandhi. They did not hesitate to exploit her weakness for the dynastic aspirations.

In order to reaffirm his loyalty to Mrs. Gandhi, after a brief spell with Mr. Morarji Desai as Prime Minister (1977-79), Mr. Sethna associated himself with various organisations set up to foster dynastic glory of the lady Prime Minister. On November 20, 1980, he delivered a "Sanjay Gandhi Memorial Lecture" on "Energy Strategy for the Eighties" in New Delhi which was organised and attended by certain corporate vested interests under the name of "Development Research Group". Our enquiries revealed that there was no such Research Group in the capital.

Mr. H.N. Sethna and Dr. Raja Ramanna were also associated with a multimillion-rupee project floated to immortalise the name of Jawaharlal Nehru. In 1972, a Nehru Centre was established in Bombay with strong financial backing from the big industrial houses and supported by the State of Maharashtra and the Central Government headed by Mrs. Gandhi. Many Directors of the companies having direct commercial activities with the DAE, were closely associated with the foundation of the Centre. Mr. H.N. Sethna, the Principal Secretary of the DAE, headed the Editorial Committee of the Centre. Infamous Mr. A.R. Antulay who was found guilty of malpractices by the High Court of Maharashtra and was subsequently removed from the Chief Ministership on January 12, 1982, was the Chairman of the Centre in 1981, and Dr. Raja Ramanna was the General Secretary of the Nehru Centre.

The late Mr. Rajani Patel, a political bigwig of the Congress Party and the founding General Secretary of the Nehru Centre (1972-1982), once wrote that "the task force (of the Centre) had the benefit of suggestions and advice from several eminent scientists and academicians, including Dr. Homi Sethna, Dr. Raja Ramanna and others."

The Executive Committee of the Nehru Centre included many prominent industrialists, and Mr. H.N. Sethna. It is also reported that many big and not so big firms that received contracts from the DAE have to make handsome "voluntary" contributions to the Centre and also to the ruling party. Such charges are not new nor do they refer to only Mrs. Gandhi's party. But the fact remains that Mrs. Gandhi, by virtue of being the Prime Minister for the longest period, has drawn the maximum premium from the invisible alliances between the contractors-vendors and the DAE.

Since Mr. Sethna and Dr. Raja Ramanna were on the key positions of the Nehru Centre, it was convenient, particularly in the feudal politico-economic system, to get "philanthropic" contributions from the DAE's syndrome of contractors. The scope for such kickback dividends is very high in a secretive governmental programme where the Prime Minister being the Minister of Atomic Energy also holds the regulatory powers over the nuclear energy programme. Even if the activities of the Centre, named after the great nation-builder Nehru, were not objectionable, direct involvement of the two chiefs of the AEC/DAE and BARC in the management of the Nehru Centre is questionable.

Dominance of Science by the Nuclear Estate

Almost all research grants and R&D funding in India come from the Central Government and nearly 60 per-cent or more of science budget is controlled by the Department of Atomic Energy and the Department of Space. In 1981-82, out of a total S&T Budget of Rs. 6,640 million, Atomic Energy received Rs. 3,800 million (60%) and Space received Rs. 1,071 million. Other details were not available.

In the revised Sixth Five-Year Plan (1980-85), for the DAE (R & D only) budget was Rs. 533.57 crores and for Space (S&T only) Rs. 392.73 crores. In contrast, social welfare received Rs. 2.00 crores. Rural reconstruction: Rs. 10.05 crores. More than one hundred Universities were granted for advancement of science Rs. 142.00 crores, which included fellowship, cost of equipments and purchase of computers. Renewable energy resources (R&D) were given Rs. 7.6 crores by the DST.

The nuclear estate, thus, commands enormous power of patronage for the scientific community in a country where there exists no other agency or organisation which can offer financial support for big research activities. Thus all science in the country has become captive of the nuclear estate and the government. Little scope exists for independent and critical scientific work. Practically almost all S&T organisations including the Pugwash Committee of India are managed by technocrats and secretaries of the government.

In 1980, when Mrs. Gandhi was returned to power in New Delhi, the Science Advisoy Committee to the Cabinet (SACC), the highest scientific policy-making body, was reconstituted. The single largest group represented on the Committee belonged to the pro-nuclear lobby. Twelve out of the original 18 members were from the nuclear or pro-nuclear establishments, including Chairman, AEC; Secretary, Space; Director, BARC; two Fellows of TIFR/DAE Secretary, Electronics; Scientific Adviser to the Ministry of Defence.

India's top Scientific Policy Committee, SACC, also included a man who represented a private consultancy firm having strong political alliances with the DAE : Dr. M.N. Dastur, Chairman-cum-Managing Director, M/s. M.N. Dastur and Co. (Pvt.) Ltd., Calcutta. He has close connections with the families of Mrs. Gandhi and Mr. Sethna. According to published reports, Dr. Dastur was the man who bought the highest number of shares worth Rs. 1,400,000 in Mrs. Gandhi's late son's defunct motor enterprise, Maruti. Dr. Dastur is also reported to be a relation of Mr. Sethna and has directly benefitted from contracts with the DAE.

At Hyderabad, the DAE established the Nuclear Fuel Complex to manufacture nuclear fuel elements for use in power reactors. Besides production facilities for zirconium oxide, sponge and fabrication plants, the complex includes facilities for the production of natural uranium dioxide, of enriched uranium dioxide from imported UF_6, and the assembly of fuel elements for the atomic power programme. M/s. Dastur & Co. were appointed as consultants for this project, and were also contracted for the design of civil works, electrical and ventilation works and other services like steam, water, cooling water, compressed air, etc. However, the responsibility for process selection, and for the design, specifications, and procurement of the various equipment and machinery, and for the commissioning and initial operation of the plants which involved basic R&D expenditure and scientific inputs rested with the BARC.

In reply to a question answered in the Lok Sabha on April 2, 1969, it was stated that "no tenders were invited for the appointment of M/s. Dastur and Co". They were selected on the basis of their experience in the field of metallurgical and metal industries. The Fourth Lok Sabha Estimates Committee (1969-70), in Hundred and Twenty-Ninth Report on "Department of Atomic Energy" noted that in appointing M/s. M.N. Dastur and Co., the DAE made an *ad hoc* selection "on the basis of the adequacy of experience in handling similar projects". But the Committee observed:

> From the sketchy information furnished to the Committee in January 1970, they (DAE) are not in a position to comment on the justification of the terms and conditions of the agreement entered into with the consultants and whether the progress so far made is according to the schedule.

The Scientific Leadership with No 'Rule of Law'

The scientific leadership at the DAE is basically non-academic if not anti-academic and is to be differentiated from the working scientists. Most of them have risen to the top positions through inner adjustments with the political and industrial vested interests. No one among the top tens at the DAE is in this sense an outsider. But they have lost their innocence due to their unholy alliance with the politicians and with the administrative elite. Consequently our traditional faith in the objectivity of the scientists has been falsified and their defence of the nuclear technology cannot be accepted at face value for they have been integral components of the establishment for too long to be scientifically objective in their assessment of N-energy. Their first and foremost loyalty rests with the DAE. But since the consequences of their scientific enterprises are far-reaching for the nation at large and they vigorously seek socio-political support for their big funded activities, they cannot rightfully claim immunity from public and academic criticism. It is regrettable that the scientists occupying the top positions in the DAE have been alienated from the working scientists within and without the BARC and the DAE facilities.

A BARCOA memorandum to the Kuppuswamy Committee (1979) has asserted that the top scientists cannot be totally free from the blemishes which have led to miserable state of affairs at the DAE. For those top-ranking scientists who were expected to provide necessary leadership have succumbed to "the lure of administrative power and position." In the name of secrecy they asked for freedom of nepotism, corruption and arbitrariness. Instead of providing inspiration to the working scientific community, the top scientific administrators have acted without necessary public policy perspective.

A scientist is expected to have the basic attitude of open debate before deciding the policy issues. But the top scientists at the DAE and BARC have urged a total ban on any critical examination of the nuclear policy. Dr. M.R. Srinivasan, formlery the director of the Power Project Engineering Division, and now the first chairman of the Atomic Power Board, has voiced his deep resentment to free debate. In December 1980, he attempted to boost up credibility of the nuclear power by issuing a few PR statements. He claimed that the ene[illegible] issue is one where it is necessary for us to evolve a consensus to speed up nuclear power development. This is possible, however, only if we cut across the differences between political parties, amongst administrators, scientists, technologists, trade union leaders and the general public. While we cannot insulate our energy policy from the interplay of international forces, it should at least be possible to insulate it from the interplay of internal politics or needless argumentation."

At the DAE/BARC scientists-turn-technocrats seem to have lost their scientific temper and the public policy perspective. They seem now to fear "argumentation" and critical evaluation.

They resemble Heisenberg and Weizsacker of Germany who, during the rise of totalitarian government in 1933-45, adopted to what Joseph Haberer has termed "the politics of prudential acquiescence" towards the political power. When confronted with a choice between conscience and power, nationalism and internationalism, justice and repression, democracy and authoritarianism, they invariably gravitated towards power and parochial[illegible]m, repression and dictatorship. With "martyrdom" categorically rejected as an absurdity, the only reasonable choice open to them was that of acquiescence and open support for unjust industrial-economic system and inept political leadership, *not* resistance or opposition.

Based on INDIA'S NUCLEAR ESTATE (1983).

JNU 'attacks academic freedom'

by Kuldeep Kumar

New Delhi, May 19 : Authorities of the Jawaharlal Nehru University (JNU), established in 1969 to promote the study of the principles for which Nehru worked during his lifetime, are attacking his most cherished ideal—academic freedom— in a most arbitrary manner. They have transferred Dr. Dhirendra Sharma, an Associate Professor at the Centre for Studies in Science Policy (CSSP) for about 10 years, to the School of Languages without assigning any reason.

Had it been a simple transfer of an academician from one department to another, there would have been no cause for concern. But the fact that a battery of international luminaries—Prof Noam Chomsky of the Massachusetts Institute of Technology, Tony Benn, famous British Labour member of parliament, Dr Philip Gummett of the deptt. of science and technology, University of Manchester, Prof. Harry Rothman, director, technology policy unit, University of Aston in Birmingham, and Les Levidow and Robert M. Young of the Science in Society Unit, London—have taken up cudgels in support of Dr Sharma, is an indication of the gravity of the issue.

What emerged after a conversation this correspondent had with Dr Sharma and a scrutiny of documents is simple —Dr Dhirendra Sharma is being hounded out of the CSSP for his critical views on India's nuclear programme, his criticism of the role played by the house of Tatas, represented by J.R.D Tata and Homi J. Bhabha, in shaping up the whole exercise and the huge profits amassed by certain private firms in the contracts given by the Department of Atomic Energy.

From the JNU authorities' point of view, what came as the proverbial last straw was Dr Sharma's espousal of the cause of democratic freedom at a time when the vice-chancellor, Prof P.N. Srivastava, was systematically decimating the students' union and the staff association by expelling students and suspending employees.

"For ten years", says Dr Sharma, "the university went on giving me facilities for conducting research in my field and sponsoring my participation in various seminars and symposia in India and abroad. My credentials were never questioned. My articles were widely appreciated. Now, when my book 'India's Nuclear Estate' came out a few months ago criticising the nuclear establishment, they have suddenly decided to strip me of all facilities necessary to carry on my work in the field of science policy. Violation of so many rules and regulations indicates that the JNU authorities are working under some kind of pressure. If there is none, then either the vice-chancellor is naive or a knave.".

How have the rules and regulations been violated ? He produces his appointment letter dated January 18, 1975 employing him as Associate Professor at the Centre for Studies in Science Policy, School of Social Sciences, with effect from December 31, 1974. An order issued by the university on March 9, 1976 says he was confirmed in the same post on the expiry of the probation period.

Further, the executive council of the university on September 17, 1979 adopted a resolution which said that prior written consent of a faculty member was essential for his transfer.

"The University was in such a hurry that the order for my transfer was delivered by a special messenger at my house. I have since written a number of times to the vice-chancellor requesting an appointment with him. He does not even reply. Now, the registrar ards at various nuclear plants, Ramanna called a press conference to denounce the exercise as 'unpatriotic'.

Interestingly, Sharma finds himself isolated within the university. No senior faculty members came to his support, not did the teachers' association lodge any protest at the violation of principle that 'the transfer of a faculty member from one Centre to another may only be made with the written concurrence of both the Centre as well as the faculty member concerned.

Jawaharlal Nehru University's teachers like to think of themselves as 'leftist' and 'progressive' (though few criticise Mrs. Gandhi's infringements of civil liberties). Initially the 'left' teachers found it easy to turn a blind eye to Sharma's discomfiture, because the rumour-mills had branded him a 'CIA agent'.

It was not until Noam Chomsky and others openly supported Sharma that many of the professors felt a twinge of remorse. Still none of them supported Sharma publicly. If each university is so dependent upon the State's patronage, therefore, can academics ever pursue critical inquiry?

Courtesy : New Statesman 7 September 1984, pp. 21-22

Selected Bibliography

Anderson, Robert, S. BUILDING SCIENTIFIC INSTITUTIONS IN INDIA : SAHA and BHABHA (Montreal : McGill University. Center for Developing Area Studies, 1975).

Duayer de Souza, Merco. THE ESTABLISHMENT OF NUCLEAR INDUSTRY IN LDCs : the Cases of Argentina, Brazil and India. (Thesis submitted to the University of Manchester for Ph.D., 1979. Unpublished).

Lilienthal, David, E. ATOMIC ENERGY : A New Start. (New York : Harper & Row, 1980).

Lovins. Amory, B. and Price, John, H. NON-NUCLEAR FUTURE : The ease for an ethical energy strategy. (Cambridge, Mass. Ballinger and Friends of Earth International, 1975).

Sharma, Dhirendra. INDIA'S NUCLEAR ESTATE (New Delhi : Lancers International, 1983).

Walker, William & Lonnroth, NUCLEAR POWER STRUGGLES : Industrial Competition and Proliferation Control. (London : George Allen & Unwin, 1983).

THE NUCLEAR FIX : A Guide to Nuclear Activities in the Third World. eds. Thijs de la Court, Pick and Nordquist. (A WISE Publication, 1983).

NO CLEAR REASON : Nuclear Power Politics. Edited by the Radical Science Collective. (London : Free Association Books, 26 Freegrove Road, London N. 7 1984.)

11-21

REFERENCE MATERIALS ON NUCLEAR ISSUES

1. The Only Way out of the Nuclear Nightmare
   By George Kennan
   Nuclear Bulletin No. 3, Health And Society Group

2. The Insanity of Nuclear Power
   Nuclear Bulletin No. 4, Health and Society Group

3. Karen Silkwood: Victim of the Nuclear Police State
   Nuclear Bulletin No. 5, Health And Society Group

4. A Short History of the Anti-Nuclear Movement
   Nuclear Bulletin No. 6, Health And Society Group

5. The Worldwide Threat of Nuclear Technology
   Nuclear Bulletin No. 1, Health And Society Group

6. Radiation, The Greatest Public Health Threat of All Time
   Nuclear Bulletin No. 2, Health And Society Group

7. The Underdog's Densepack,
   Article in The Illustrated Weekly of India by O V VIJAYAN

8. "In a Nuclear War, It Is Better to be Victims Than Criminals"
   Article in The Illustrated Weekly of India by GERT BASTIAN

9. The Politics of Nuclear Energy
   By Alan Roberts

10. The Peace Movement and the Third World
    By Eboe Hutchful

11. The Arms Race,
    Reprinted From UNESCO Courier, November 1970

12. The Final Epidemic
    The Medical Consequences of Nuclear War
    By P S Kamath

13. A Nuclear War And India.

11 32

****

T H E HEALTH D A N G E R S O F N U C L E A R P O W E R

Dr. Kusuma, R.N., R.M., M.B.B.S., M.S.(Bomb)

The Nature has its wonderful echo system through which it maintains its equilibrium. The changes and pollution of air water and land is being continuously nullified or minimised by this mechanism. Thus the nature undisturbed maintains the health of every living creature. But when the changes and the polution crosses the capasity of echosystem it becomes dangerous to the health. Thus the environmental dangers have direct impact on every living creature including man; who is an inseperable element of Nature.

In the name of development we are stepping towards self distruction the distruction of this globe. All the so called developmental projects are always planed and executed by the government. People are least concerned. It id high time for the people of our country and all over the world to unite and think about the policies of the government.

Nucliar energy has created crase in all the governments in the world. So is our government. The department Atomic energy was established in August 1954. Homi Bhabha became the first chairman of this department and the research started on nucleat energy at Bhabha Atomic nuclear center, (BARC) in Bombay. Blind folded towards the health dangers of nuclear power research continued for peaceful uses of this energy. But in 1974 Indias first atom bomb explosion at Pokharan, created restlessness not only in the subcontinant but also in the minds of the people of our country.

India's nuclear energy comission never tried to educate the people about the health hazards due to nuclear radiation. On the great scientists like Dr. Rajaramanna says ''It is the safest, cleanesst and cheapsst way of getting electrisity.'' On the contrary school text books describe the advantage of nuclear power but not a single word about the health dangers due to radiation. Our scientists claim that our technolgy is too good to cause any accident or health dangers. But so far more than 300 accidents that have occured in the atomic plants in our country is a national secret. No proper safty measures have been given to the workers, or in the campus and around to safe gaurd the people. Atomic Energy Commission has not produced a single health report so far, since its establishment in 1954. Today all the Atomic plants in India are out of function, but the low level radiation from the plant is continuing.

The health dangers from the radiactive material is inseparable from the environmental dangers, and the health hazards due to radiation has built the history since professor Wilhemm Roentgen discovered X-Ray in 1895 in his laboratory in Bovaria and since Thomas Edison showed his X-Ray floroscopy at Newyork city electrical expOsition in May 1896. After realising the dangers due to radiationin 1950s the non medical use of X-Ray floroscopi stopped, in United states. In 1896 Elinu Thomson made the following observations on Radiation effect which hold true even today.

* X-Rays can damage human tissues.
* The amount of damage was related to the amount of exposure.
* There in evidently a point beyond which exposure could not go without causing serious trouble.
* Several short exposures would have the same effect if made with a few days as the same affect dose given at one time. In other words spreading the dose over a longer period of time would not necessarily reduce the damage caused.
* The intensity of the rays decrease as the square of the distance from the X-Ray source.
* There was an incubation period, effects would not appear immedi tely

X-Ray which are relatively weak rays great such havoc what about the Atomic plants which emit low level radiation every moment in the form of alpha, beta particles, gama rays,and the fission products like strontium 90, IXdine 129 and131 which are much more dangerous to the life?

Elihus observations were not given much importance. As a result by 1922, 100 early radiologists died from over exposure to radiation.

Marie and Pierre curie were exposed to radiation during their experiments with radium.Marie died of cancer where as Pierre an accident death saved him from cancer sufferings.

In 1934 Marie Curie's daughter Irene and her husband Frederic Joliot discovered Radioactive isotopes. She died of radiation indused leukaemia.

Ionising Radiation: Four types of radiations are given out by radio active atoms when they decay. They are alpha and beta particles,X-Ray and gamma rays and nutrones which are uncharged particles.Radiation causes ionisation in the tissue, disturbing and injuring the cellular atoms and disrupts the cellular life process.

Alpha and beta radiation are much more dangerous than because these radioactive particles deposit on ground, plants and in water, enter the body and throw radiation inside the body.The body treats the radiactive radiation material as ordinary chemicals which therefore gets incorporated into the tissue.Most frequently affected organs are lungs,stoch,thyroid bones, liver and sex organs.These particles when deposit on the skin cause skin canser.

Nuclear plants throw their waste into the the environment continuously Few of them I would like to metion are stontium 90,Iodine 127,131.137 cecium 137 etc.These nuclear plant wastes are known as Radiactive nucliues They are nuclear fission products.

Iodine 131 enter the thyroid and cause Hyperthyroidism. Srtontium 90 competes with the calcium enters the bonemarrow causing leukaemia.These particles deposit on the land, plants and in water and enter the body of cows, through grass and water and through milk enter the human body.As infants and childern are the heavy consumers of milk they suffer most.

Back ground Radiation: Radiation that occurs naturally in soil and water and cosmatic radiation from outer spave are known as background radiation. Foruns consrened with nuclear energy therefore argue that the nuclear plants are not the only source of ionising radiation and that the natural radiation is much more than the radiation emitted by the plants.But they forget really ot intentionally that the nature has its own mechanism to nutrilise these effects of pollution in the form of heat, dust dirt and radiation. That is why the universe exists in healthy form when it is left undisturbed. But when the pollutionincreases beyound the nutrilising capasity of the nature it gets stored and affect the health of the plants,animals and man.

One more fact well known to our scientists, but on which they are mum, I would like to mention hrer is the quantity of background radiationis increasing because of man made pollution, through various developmental proceedures and through increasing number of nuclear plants and bomb testing.Health dangers can not be avoided when pollutionlevel goes beyound 5% of background radiation.Best example of this sort is found in our own country, i.e. in Kerala.Here the background radiation is unusually high due to man made pollution and ruthless distruction of forsts for money making,for growing rubber planttion and in the name of green revolution.A 1975 study indicates the marked increase in the genetic damage leading to increased number in mental retardation and mongolism. (Downs Syndrome).

Observations of Health Effects of Ionising Radiation by Various Scientists:

* ~~DR.SADO ICHIKAWA~~

*DR.SADO ICHIKAWA :

Observations of Health effects of Ionising Radiation by Various Scientists::

* DR.SADO ICHIKAWA:,Japanose Radiologist,

There have been constant reduction over the years in the amount on ionising radiation considered'Safe'', a ''tolerence level'', below which there was thought to be no damage.The theory on which it was decided was that if you could not see any damage rightaway, there was no danger. In 1950 s to 1960 s this dose was 25 rems. The observations were made only on experimental animals and in few human bodies exposed to more than 25 rem of radiation. The truth was that enough and cleanevidence was not available at that time coserning the effects of smaller doses of radiation. (Sadao Ichikawa,''The spider wart strategy'' fromx a 12 page report 1977.p.2)

* ALBERT SCHWEITZER: when heard that experts had determined permissible doses said '' Who permitted them to permit ?''.

* DRS, GOFMAN AND TAMPLIN: All the evidences both from experimental animals and from humans, lead us to expect that even the smallest quantities of x ionising radiation produce harm both to this generation of humans and future generations. Further more, it appears that progressively greater harm acrues in direct proportion to the amount of radiation received by the various body tissues andorgans,(Gofman and Taplin op.cit,pp 92-93).

* CONFERENCE OF CANCER RESEARCHERS IN USA, 1976:

We are now facing a cancer epidemic. Today one american in four will get some form of cancer in their life time. 90 % of present cancers are indused by chemicals added to our environment through food additiers, insecticides,and artificial fertilizers,industrials chemicals like pCB.s and epone,dyes and of course by radiation created by the nuclear power programmes and by fall outs still in circulation from above ground weapon s testing. Cigarette smoking is linked to the increaseng as well. (Nature 249,17 May 1974,pp 215-217). 215-217)

* JOSHUA LEDERBERG,:Nobel prize winner and professor of genetics at Standford University:

The present radiation standards in force now allow a 10 % increase in the mutation rate. A 1 % increase should be maximum allowed for radiation and chemicals combined.(Gofman and Tamplin,op. cit,pp.76-77).

* The atomic energy Commission report, 1968,(USA): on Genetic effects of Radiation:

A 10 % in crease in mutation rate, whatever it might ba be mean in personal suffering and public expense is not likely to threaten the human race with extinction or even serious degradation..... is bearable if we can convince ourselves that the alternative of abondoning radiation technologyaltogether altogether will cause still greater suffering. If the number of those affected is increased there would come a crucial point, ot theshhold, where the slack could no longer be taken up (by those not affected).The genetic load might increase to the point where the species as a whole would degenerate and fade towards extinction- a sort of 'ratial radiationsickness'.

We are not near this thoshhold now, however and can therefore as a species, absorb a moderate increase in mutation rate without danger of extinction.(The genetic effects of radiation,U.S.AEC.Div. of technology informationSept.1968pp.44-45.Reprinted in ECO Stockholm conference Atomic Reactor safty hearing, Washington D.C.21 August 1972 Friends of the Earth)

In twenty years i.e. from 1968 to 1988 the chemical pollution and the nuclear plants in different countries have increased to a great extent. So the amount ofradiation also has increased to a threating level. India can not isolate itself fron the world.The radiation in one corner of the world will surely affect the other corner. Churnobil is the best example.

From the above statement of the AEC. USA,and the behavior of AEC, India, (now AEB), one can immagin how inhuman approch the atomic forums have towrds the radiation effects on human race.

* Observation of survivers of the Hiroshima and Nagasaki bombings, ~~Rasifisxislandsxsx~~ people treated with radiation therapy, Pasific islanders who were contaminated during 1950 sweapons testing,animal experiments, and uranium miners.:

i. There is no safe dose of radiation,There is no proven threshold below which biological damage does not occur.

ii. Radiation causes cancer,leukaemia,and geneticdamage which is some times seen as birth defects or chonic disease but can go undetected for one or more generations.

iii. Radiation can also cause heart disease,sterility,premature aging, premture births and miscarraiges.(Rosalie,Bertel 1 X-Ray exposure and premature aging in jounal of surgical oncology,9,379-391,1977)

iv. Higher rates of suicides and violence among persons exposed to low level radiation.

There are some 200 diseases caused by genetic mutation, diseases like systic fibrosis and dwarfism.

* Dr. Helen Caldicott- Paodiatritian and spcialist in systic fibroses and genetic diseases describesthe biological propeties of rdioactive waste and says if a gene which contols the rate of cell division is altered by radiation, the cell may divide in an uncontrolled fasion to produce cancer and leukaemia, It may take 15 to 20 years ~~to~~ before cancer appears after the cell is exposed to radiation. if the gene in sperm or in egg is altered by radioactive particlethe young may be born either with an inherated disease or the baby may appear normal but will transmit the damaged gene to th future generations to become menifest in later years" (Caldicoto cit)

* Dr. John Gofman: We are suffering now fromweapon testing fall out. These tests have put so much plcutonium in the lungs of residents of the noth hemishere that 116, 000 people in the United state and about one million people in the entire nothernhemispher have been committ d to plutonium induced lung cancer.(John Gofman "Estimate productionof human lung cancers bt plutonium from worlds wide fall out"Committee for nuclear responsibility report 1975- ,summery of conclusion, 10 July 1975.)

* Environmental protection ~~committee~~ Agency 1974:The most important route of contamination of edible herbage-because of long half life of Iodine 129,plant uptake of this radio ~~nuclide~~ nuclide from the soil should also be considered..

LOW LEVEL RADIATION: This has been neglected by the nuclear forms fixing a safe dose" dose.We have now realised that the minimum dose also can cause the same effects as big dose after a littor longer period..

Several scientists have cocentrated ~~on~~ themselves ~~on~~ with the effects on any living creature human, animal or plant, at very low levels of exposure, similar to amounts that the people living near nuclear plants are exposed to.

* Dr. Alice Stewat of oxford University-:Stydy done in 1958:

Those mothers who had been exposed to(radiation X-ray)in the first trimester ran twice the risk of having their children develop leukemia before the age of ten as those who were not. (A Stewart J.Webb and D.Hewitt"A survey of childhood Malignancies inBritish medical journal,1:1495, 1958. Refered Ernest J.Sternglass "Radioactivity " in Environmental ~~as~~ chemistri.J.O.M Bokris,ed I Newyork plenum press 1977) P.494.

* Dr Earnest Sernglass :This pioneering study represents the first quantitative evidence that total doses comparable to those receivev from background radiationin one year can produce serious health effects.... (I bid,p494).

~~* Two follow up studies by A.Stewart and G.W.Kneale : were done on large number of children who were X-Rayed in Utero.~~

* Two follow up studies by A Stewart and G.W.Kneale: Were done with large with large number of children who were exposed to radiation(X-RAy e) in utero,BMacMah n,"Prenatal Xray exposure and child hood cancer".in Journel of National Cancer Institute,28,117 ,1962,) This study was bases on hospital records of about 80 ,000 children born in Newyork and New England.A followup study of Dr. Stewart was based on 10 million childern born in England and Wales between 194 and 1965. The conclusion was(Radiationdose effects in relation to obstetric X-Rays and childhood cancers(Lancetl 11 118 ,1970) that the children exposed to radiation in prenatal condition have twice the risk of having cancer development and leukaemia below the age of ten.

*The first official survay report requested by the Canadian Minister for health for province of Alberta in 1960 on the effects of low level radiation:A comparison of birth defects in Alberta in 1959 and 1962 sh showed a rise of almost 78 % in two years! The increase was largely attributed to Soviet bomb testing near the Aric cirle in 1958 followed by heavy rain fall in 1960 and 1961 which brought the fall out to ground. (L.T.Jevann"congenital abnotmalities in children born in Alberta during 1961" in Canadian Medical Journal Association journel 89: 120,1963.)

* Dr Earnest Stern lass, Professor of radiation physics of Unive rsity of Pittsburg- His study proved - The infant mortality which had decreased in US. during 1930 s and 1940 s due to better medical care, began to rise in 1950s due to bomb testing fallouts. In 196 the rate declined after the tests stoped only to rise once more. The rise of infant mortality was observ d in the vicinity of nuclear plan ts, The plants were releasing low level radiation enought to cause a statistical increase in the infant deaths("Low level radiarion" book published in 1971)

*Earnest sternglass: Found excessive infant mo tality fate after 1970 li.e.after the establishment of MIllstone I nuclear plant (Haddam Neck, Connecticut),in both Rhode island (close to plant to east) and in Con - ecticut as compared to New Hamsire.

* Earnest Sternglass! 1975;"The increase in cancer deaths"

Over all cancer deaths rates in connectcut were highest in three towns within 30 miles of Millstone I pl nt. He presented his p paper on "Strontium 90 l vels in the milk and diet near Conne tcut near nuclear plants"- draft of report to congressman D.J.DODD on Connecticut, 27, october 1977, Table of cancer mortality rates in Connecticut and New England before and after start up of the Millstone nuclear plant in waterford,ct. Connecticut health department Registration reports U.S/ Monthly vital statistics report)

*Spiderwart Stretagy: Sadao Ichikawa: A radiation genetist , deprt. of a agriculture , kapian Kyoto, university in Japan and Motoyuki Nagata biology teacher;

Researcher on the real dangers of nuclear radiation to the unsuspecting public- His spider wart stratgy proved mutation due to nuclear plant radiation. Experimentsx were carried in 1974-1975 at the Homaoka nuclear power plant of the Chubu Elect ic power company i in Hamaoka, Shizuoka Prefacture, a plant whith two G.E boiling water reacters. One reactor was of 540 magga watts capacity , the other was still under construction at the end of 197 .

* Other researchers carried out si milalr experiments around six more Japnanes nuclent pl nt. They demonstrated the extent of genetic damage from biological constration of low levels of radoation in living plat tissue. The increases in pink mutation(from blue to pink) detected in the spider wart stemen hairs corr sponded to that indused with at least 300 milli rams(Ibid)

* United State Obse vation : X-Rays kill between 1800 and 14,000 American every year and cause 600 to 1 ,000 serious illnesses and disabilities.

* ATaft Sanitory Engenering centre of Public Health Service inCincinatte Estimate

* A Taft Sanitory Engenering centre of Public Health Service in Cincinna - tti estimate:

Americans receive 89.00 % of their daily intake of ~~their~~ Strontium 90 from the food they eat. 50.5 % from dairy products and 39.1 % from other foods such as wheat and vegitables(Prevention magazine Oct 1970 pp 126-7).

* Linda Clark-Health writer: Low level radiation seems to remove basic minerals from the body, causing mineral deficiencies that give a variety of symptoms like constunt fatigue, head aches, numbness to bands and feet, and loss of appetite.

WORKERS CONTAMINATION IN USA:

Legally allowed radiation:	170milli rems
General public receives	500 ,, ,,
Workers receive	5000 ,, ,

This study compilation of radiation exposures to workers in the nuclear industry prepared by citizen activist GErtrude Dixon of Wisconsin shows that higher levels of exposures have taken place.

* Irvin Bross: has challenged the corruntly permitted radiation levels for workers on the bases of his reseamrch that shows significant genetic damage at exposures near 1rad(1000 milli rads).

* H.W.Iosor: Professor of physics at the University of California asks "Would nuclear industry workers be avoided as marriage partners as the Hibakusha have been in Japan?. A nucleat worker over 27 years of age is legally allowed to accumulate the 50,000 milli rems that would double the genetic risks to his or her progeny.

*Report by Robert Gillette in science magazin Oct.1974- about transient workers---- job that often expose the temporary worker to a full quarterly or yearly dose of radiation in less than a day, - some times less than an hour. NRC had long condoned the use of untrained transient workers in potentially hazardous radiation jobs, as long as they receive some instruction in safty procedure and close supervision.(Science 11 oct 1974).

Inspite of this at Indian point I the reactor owned by consolidated Edison Newyork city Electric utility Company more than 1,500 transient workers who receive upto 15 rems per hour even after using lead shielding.

As records on health histories of transient workers has never been kept. Nuclear industries claim "No harm".

FULL TIME WORKERS STUDY - 1975data on workers ar Oak Ridge, Tennessee, Savnnha river, South Carolina and Hanford, Washington-plutonium contamination in 30 workers (aotopsies) , the cancer was detected in 11 out of 30, was twice the rate generally found amoung white males.(David Burnhamop cit)

*The Mancuso study: June 1965, Dr Thomas F Mancuso, the principal researcher in major project to determine the biological effects,if any, of low level ionising radiation among workers employed in Atomic facilities.

The study examined the death certificates of ~~3,5~~ 3,520 workers who died between 1944 and 1972. The project has shown that very small amount of ionising radiation amounts at and below a proved levels ~~of~~ for workers have caused cancers in workers at the Hanford, Washington plants and nuclear facilities.

The study shows that there is a definate relationship between low level ionising radiation and development of cancer, Data from Hanford study ~~that~~ have shown that sensitivity to the cancer is more in the age group of 25 to 45 years. Bone marrow cancers are more than other neoplasms and cancers of the pancreas and lung more than solid tumores.(Ibid p.4.)

At the Hanford nuclear facility mortality rate duely associated with radiation is 6 to 7 %.The dose requred to double a person's normal chances of contracting cancer is less than half of the legal dose allowed for nuclear workers.(Letter to environmentalists and concer- ned citizens from Bob Alvarez, environmental policy centre, 317 Penn ~~xx~~ Ave S.E. Washington D.C. 20003,22 nov.1977)

* Dr.Sam Milham of the Washington state health department review of a occupational causes of death in the State:
 Finding:
   Too much canwer in Hanford workers.("William Hines" Cancer risk in nuclear plants ~~as~~ government hushes up alarming study," Chikago Sun Times" 19 nov.1977.

Dr. Edward Radford:? Chairman of the national academy of Sciences advosory commette on the biological effectd of ~~xda~~ radiation are ten times too high and can lead to a 100 % greater chances over 40 years period(Washington post, 10 Februaru 1977.)

* Dr Thomas Najarian : In december 1977 "There may be as many as 20,000 people who worked radiation during those years. All I can do is open the door and get some one interested in starting the study".
He became aware of the ship yard exposre question when he treated a retire nuclear welder who had worked with three other nuclear welders on the Nautilus in Akron,Ohio, 20 years ago. His patient had develope hairy cell leukaemia and other three died at an early age.(Ibid)

* A former sholdier claimed for compensation for his leukaemia from his presence at a 1957 Neveder bomb test,. This has lead to a study by the National Cancer Control in Atlanta of other veterns present at the tests. It was estimated that about 3 lakhs people were exposed to radiation at bomb test sides.

* Dr Jeanne Stellman Presidential asst for health and safty of the oil, chemical and atomic workers union Said- I am very greatly conserned about the health and safty of our workers, unfortunately the area of atomic health is more political than scientific. We have been fighting a losing bettlte to obtain compensation for exposed workers, who have developed leukaemia or other forms of cancers---. The effects on our member are devasting.(from a letter by Dr.Jeanne Stellman,Phd, to Dr. Gerald Drake, 1st March 1974 quoted in Dixon's paper op cit p. 15)

* From time Oct 31st 1988 :

   CHarles Zinser, 38, rented a vegetable guarden neat the nuclear plant in Cincinnatti, suburb of South green hills, some ten miles east of department of energy's Fernald nuclear waepen's plant. He often took his two young sons to garden during his work . Two years later both were found to have cancer. Samwel then 8 had leukaemia and Louis, 2 had part of a leg amputated.

   Tests of his garden soil showed it was contaminated with enriched uraniu 235. And the doctor who tested his sons amputated leg told him, it contained ten times more uranium than would be expected to acculate naturally over a life time.

* Ohio's Senator; John Glemn sommed up the situation with ironic clarity "We are poisoning our people in the name of"National Security".

* Steve RitchieA highschool teacher in Idaho falls, who is conserned about waste piling up at the INEL site might affect near by residence. " I don't think they are ever going to br honoest".

*Professor Mickel Blair Boise state university: Studied the health impact of the Idaho Repository on residents of clark county near the site contents thatxxxxxxcancer deaths and br ast m lignancies there have fun about twice the norm l rate.

* A newly arrosed DOE(Department of Energy) bureaucracy struggls with massive task of trying to clean up improperly stored radio active wastes from 40 years of bomb making. No solution is in sight for a demonstrably safe permanent disposal system that will last for the equired Millenniums. At just two facilities Hanford and Savannah river nearly 100 million galon of highly radiactivex waste have been generated.

*Idaho governer Cecil Andrus a former secretory of the interior say, " If xxx we can't resolve what we are going to do with the waste then we have no business generating it."

* Documents secured in the past three years by a spokane environmental group under the Freedom of Information act revealed that between 1944 and 1956 a xxxxxxxx startling 530,000 Curies, a measure of emitted radioactivity of iodine were released int the air by the facility - an amount greater than any ever recorded at a United State nuclear x plant. In 1953 and 1954 a larege quantity of radioactive material was emitted, depositing particle near the ranching town of Mese about 15 miles from Hamfors boundry.

The revelations left local residents badly shaken. Some refered to on stretch near hamford as " death Milo", where they claim to have counted an unusually high number of xxxxx cancer deaths. Other point to this " down winder" neck scars as evidence of thyroid operations that they blem on radioactive iodine releasedxx from the weapen plants. Robert Perks, a farmer near Mesa, his wife and three of daugher, all take medicine for under artive thyroid glands. " They did 'nt tell us the things thatx were going on ", Parkes complains " They were xxxxxxxxxx letting it all fall on us. They used us as guinae pigs". (Time, Oct.1988).

Tom Bailie, born in 1947 is strile and has lung disease, his father had srugery for cancer of colon when he was 39.His mother had skin cancer. His two sisters had partial colectomy due to cancer. They stay near Hanford nuclear plant.

The federal centres for disease control in Atlanta plan to study the effect of radiation on individuals staying near Hanford plant.In preliminary estimate CDC researchers suggsted that about xx 20,000 children in easten Washington may have been exposed tox unhealthy levels of radioactive iodine by drinking milk from cows grazing in contaminated grasslands, Other scientists are already attempting to determine the actual doses of radiation recieved by the residents, that may take 5 years and cost upto $ 10 milliom.

RECHARD SHANK, xxx direcetr of Ohio's environmental protection agency estimates that the Fernald operation has realised 293,000 lbs waste into the air, since the plant started , and deliberately it has released 167,000 lbs waste into the Great Maimi River over 37 yearAdditional 12.7 million lbs waste have been dumped into pits,which may leak into underground water.

The DOE has admitted th t the government is fully aware of all these facts and is inactive and mum on this vital problem.It is also innert to tje suits in the supreme court.

Ohio Governer Richard Caleste charges" The United State is thr biggest polluter in xxxx Ohio and probebly in the Nation"

The the umbrella of thr government the Richard Heckert, chairman of DU point says of his company's operation of plant" "No body was ever injured or kiled".

Charles Zinsers correcly says that "If you have a government that is not accoutable to its citizens, then you do not have a rebublic".

Now my question is "Do we have Republic in our Nation ?" Development in our country is being concentrated on big cities and on big industries, under which normal life of 80 % of the the people living in villages ~~as~~ on normal resources is being disturbed and distroyed totally.Do the planners ever experience the burning sun,the draught and the hunger created in the name of science and development, through immoral attacks on the nature?Have they ever given a thought to the fact they in the name of "creating job oportunity " are making crores of hands unemployed to which the nature has given self employment?" Do they realise that any living creature can survive in nature and ~~a~~ not on nation. Have they ever studied the Rural national economy, ecoloy and plant, animal and human life chain ?. They are well versed only with Nuclear Chain, and are blind towards the hazards. Our Government is concerned only in making our country Capitalists Country and least botherd about the safty and happiness of the people.

My question is how honest our Goverment and Scientists are?. What education have given to the people of India about Nuclear energy?. Despite all the above facts in the world Dr. Rajaramanna says " It is the cleanest saftest and cheapest energy source " and our honourable Prime Minister Shri Rajiv Gandhi says that there can never be an accidnt like Churobyl in India, because over technology is far superior† . And we are purchasing nuclear plants from USSR and that too of Churnobyl model, to establish in Kaija which is within 50kms of Supa dam where there is big fracture in earth prove that it is a siesmc region.

quake ~~Narora Plant~~ is 54mils avay from the active Moradabad (Which triggo off 1956 Earth~~which~~ was established inspite of the Vengurlekar Committee's report that Narora unsutablo and dangerous site for nuclear plant as this in seisimc ~~zone IV~~. zone IV.

In our country people have rights to die but norights to question the Atomic energy. Facts like leak in the coolant tube in Tarapur nuclear plant is an "incidence" and not 'accident' to our Scientists because "Road accidents and Air accidents are much more and kill the persons immediatly. Where as nuclear 'incidences' do not do so !. We understand that there are nearly 300 such accidents have happened in India, but not even one is being reported to the people. Do our Scientists feel that people of India are fit only to understand about a bicycle accident and a fire to a hut? or they are afraid of peoples wisdem which might raise the voice againste their Claverness? The DAE keeps no records of the exposed radiation either of the workers permanant and transisnt or of the people around the plants.

On October 23rd 1984 the heavy water plant at RAPS Kota was again shut down after leakage of Hydrogen Sulphide resulting in the death of an engineer and injured three workers (Indian Express December 2 1984). Today almost all the nucloar plants in India are nonfunctioning due to repeated ~~tough~~ technogical faults in plants continuous repair process is going on leading to serious radiation leaks and accidents. Still, the chief executive of DAE's heavy water project(N. Srinivasan) claims "The highest safty standards being maintained". Yes due to Atomic act DAE is in highest safty and people of India are in highest danger.
The maximum benifit of DAE projects go to two establishments TATA and Larsen and Tuberos. L&T in 1978 had a turn over to the tune of 140 crores!. The growth rate of L & T over one decade (1967-68 and 1976-77) was 400to 600 percent. Where as the growth rate of people of India is not more than 3 % though our Government claims it to be 6%.

Our Government Policy is to Punish the Scientists who try to x educate the people by exposing the 'Secrets' of Atomic Energy. One of such example is that of Dr. Dhirendra Sharma, an Associate Proffessor at centre for studies in Science Policies (CSSP) for ten years the University went on giving funds and facilities to doctor Dhirendra Sharma conducting research. His participation in seminars in India and abroad were sponsored. His credentials were never questioned. His articles recived great appriciation But when his book 'India's Nuclear Estate' cameout all his facilities were withdrown and he was transfured to the school of languages for away from Nuclear Science! . because this book was first eye opener to the people about the 'National Secret(of A of Atomic Energy.

It is regretable that the Scientists occupying the top possitions in DAE & AEC have been aliented from the working scientists within and without BARC & the DAE facilities 'A BARCOA memorandum to the Kuppuswamy Committee (I979) has asserted that the top scientists cannot be totally free from the blemishes which have led to miserable state of affairs at the DAE for those top ranking scientists who were expected to provide necessary leadership have succumbed to "The lure of administrative power and position" in the name of secracy they asked for freedom of nepotism corrolption and arbitrariness. Instead of providing inspiration to the working scientific Community, the top Scientific administrators have acted without necessary public policy perspection. (The Indian Atom Power and proliferation Editor. Dr. Dhirendra Sharma).

BARC, AEC, DAE and now AEB are all political rather than scientific establishments. That is why the National and International voice of honest medical scientists and nuclear scientis biologists, Ecologists, Environmentalists, economists and other scientists have been supressed under the power and politics.

THIS Answers the common man's question, " Why inspite of thousands of clear evidence of health dangers, envirommental dangers and the national economic dangers the government of Indina is insisting on establishing the Actomic plants.

Now the right time for the government of India, and state governments has come to realise that they can now play any more tricks to blind-fold the people of this Democratic country and lead the nation to distruction in the name of devolepment. Let them realise that this country belongs to the people.xxx The pwerholders in the government are the representatives and not the masters of the people.Let them ~~xxxxxxxxxx~~ remomber that India is a republic country. Our GOVERNMENT IS OF THE PEOPLE, BY THE PEOPLE, AND FOR THE PEOPLE.Let the peoples' honest and sincere voice got the regards and the Democract suvive in our country.

**** !!!! ****

Documentation & Dissemination Centre for Disarmament Information
21, Railway Parallel Road, Nehru Nagar, BANGALORE 560 020

36

AGREEMENT ON THE PROHIBITION OF ATTACK AGAINST NUCLEAR INSTALLATIONS AND FACILITIES BETWEEN THE REPUBLIC OF INDIA AND THE ISLAMIC REPUBLIC OF PAKISTAN

The Government of the Republic of India and the Government of the Islamic Republic of Pakistan, hereinafter referred to as the Contracting Parties,

Reaffirming their commitment to durable peace and the development of friendly and harmonious bilateral relations;

Conscious of the role of confidence building measures in promoting such bilateral relations based on mutual trust and goodwill;

Have agreed as follows :

Article I

1. Each party shall refrain from undertaking, encouraging or participating in, directly or indirectly, any action aimed at causing the destruction of, or damage to, any nuclear installation or facility in the other country.

2. The term "nuclear installation or facility" includes nuclear power and research reactors, fuel fabrication, uranium enrichment, isotopes separation and reprocessing facilities as well as any other installations with fresh or irradiated nuclear fuel and materials in any form and establishments storing significant quantities of radio-active materials.

Article II

Each Contracting Party shall inform the other on 1st January of each calendar year of the latitude and longitude of its nuclear installations and facilities and whenever there is any change.

Article III

This Agreement is subject to ratification. It shall come into force with effect from the date on which the Instruments of Ratification are exchanged.

Done at Islamabad on this Thirty-First day of December 1988, in two copies each in Hindi, Urdu and English, the English Text being authentic in case of any difference or dispute of interpretation.

(K.P.S. Menon)
Foreign Secretary
For the Government of the
Republic of India

(Humayun Khan)
Foreign Secretary
For the Government of the Islamic
Republic of Pakistan

Dear Friends

Greetings.

The Instruments of Ratification of the Treaty on the Prohibition of attack against Nuclear installations and facilities, is to be signed shortly.

This Treaty, however does not prohibit any covert nuclear weapons programme, nor does it allow for the inspection of each others' nuclear facilities-areas of mutual suspicion.

We must assess this Treaty in relation to the United Nation's Non-proliferation Treaty (Fourth and last review Conference scheduled for 20 Aug.-14 Sept. 1990), which has not been signed by both countries-thereby enabling them to keep their nuclear weapons option open.

May we request you to welcome the Ratification, but express our concerns at the shortcomings of this Treaty-which may continue to hinder true normalisation of relations between India and Pakistan. Address your letters to Shri V.P. Singh, the Prime Minister, Shri I.K. Gujral the Minister of External Affairs (South Block, New Delhi 110 011) and Prof. M.G.K. Menon, Minister of State for Science and Technology and Atomic Energy (Anusandhan Bhavan, Rafi Marg, New Delhi 110 001). Also write to the High Commissioner of Pakistan to India (Shantipath, Chanakayapuri, New Delhi 110 021).

Kindly make copies of this letter and send to other concerned friends and to your local press.

Let's hear from you as to what action you have taken.

With warm regards

Yours sincerely

Hemachandra B.

HEMACHANDRA BASAPPA

Bangalore
16th January 1990

Documentation & Dissemination Centre for Disarmament Information

21, Railway Parallel Road,
Nehru Nagar,
Bangalore-560 020, INDIA
Phone : 364689

PRESS RELEASE

UNITED NATIONS REGIONAL CONFERENCE ON CONFIDENCE BUILDING

We are encouraged at the rapid and immediate steps taken by the National Front Government to improve and normalise our relations with our neighbours. This is evident with the quick visits of the Foreign Ministers of Nepal and Sri Lanka, followed by the King of Bhutan and the special envoy of the Pakistani Prime Minister, to the Capital. To be followed by the visit of the Foreign Minister Shri I.K. Gujral to the Maldives.

We hope that these talks will have established a permanent rapport based on true friendship, peace and cooperation in South Asia. The opportunity to express their determination, should be at the forthcoming United Nations Regional Conference on Confidence Building Measures, at Kathmandu, Nepal.

The aspirations and hopes of the peoples of South Asia have been dashed from time to time by short-sighted politicians. The peoples of South Asia who share a common heritage and background have been kept apart for too long.

To express their true concern to their peoples, the Kathmandu, U.N. Conference on Confidence Building Measures, should be the platform where they re-dedicate themselves to the objectives to the Charter of the SAARC:

> " to promote the welfare of the peoples of SOUTH ASIA and to improve their quality of life,
>
> to promote and strengthen collective self reliance among the countries of SOUTH ASIA."

We call on the Government of India, being the largest in the Region and who besides has the fourth largest army in the world to:

1. An immediate moratorium on all new Defence Industries/Weapons systems, including nuclear.
2. To immediately freeze and gradually reduce the military budget
3. To work towards removing travel restrictions to enable the people of South Asia to move freely (SAARC Declaration of Bangalore)
4. To encourage the formation of Peoples Forums
5. To resolve all outstanding bilateral issues without the use or threat to use arms.
6. To strive to propose common SAARC statements in future international Forums like the United Nations, Non-aligned Summits and at the Commonwealth Meetings.

We also call on the Government of Pakistan to take similar steps. The visit of the Prime Minister of Pakistan to India as Chairperson of SAARC should usher in a new era of friendship and cooperation.

Hemachandra. Basappa.

HEMACHANDRA BASAPPA
COORDINATOR

10 January, 1990
Bangalore.

Dear Friends

Warm New Year Greetings. Please write to the Prime Minister and External Affairs Minister (South Block, New Delhi 110 011) your concerns and views. Let us know what action you take. Thanks.

Documentation & Dissemination Centre for Disarmament Information
21, Railway Parallel Road, Nehru Nagar, BANGALORE 560 020

11.38

AGREEMENT ON THE PROHIBITION OF ATTACK AGAINST NUCLEAR INSTALLATIONS AND FACILITIES BETWEEN THE REPUBLIC OF INDIA AND THE ISLAMIC REPUBLIC OF PAKISTAN

The Government of the Republic of India and the Government of the Islamic Republic of Pakistan, hereinafter referred to as the Contracting Parties,

Reaffirming their commitment to durable peace and the development of friendly and harmonious bilateral relations:

Conscious of the role of confidence building measures in promoting such bilateral relations based on mutual trust and goodwill;

Have agreed as follows :

Article I

1. Each party shall refrain from undertaking, encouraging or participating in, directly or indirectly, any action aimed at causing the destruction of, or damage to, any nuclear installation or facility in the other country.

2. The term "nuclear installation or facility" includes nuclear power and research reactors, fuel fabrication, uranium enrichment, isotopes separation and reprocessing facilities as well as any other installations with fresh or irradiated nuclear fuel and materials in any form and establishments storing significant quantities of radio-active materials.

Article II

Each Contracting Party shall inform the other on 1st January of each calendar year of the latitude and longitude of its nuclear installations and facilities and whenever there is any change.

Article III

This Agreement is subject to ratification. It shall come into force with effect from the date on which the Instruments of Ratification are exchanged.

Done at Islamabad on this Thirty-First day of December 1988, in two copies each in Hindi, Urdu and English, the English Text being authentic in case of any difference or dispute of interpretation.

(K.P.S. Menon)
Foreign Secretary
For the Government of the
Republic of India

(Humayun Khan)
Foreign Secretary
For the Government of the Islamic
Republic of Pakistan

Dear Friends

Greetings.

The Instruments of Ratification of the Treaty on the Prohibition of attack against Nuclear installations and facilities, is to be signed shortly.

This Treaty, however does not prohibit any covert nuclear weapons programme, nor does it allow for the inspection of each others' nuclear facilities-areas of mutual suspicion.

We must assess this Treaty in relation to the United Nation's Non-proliferation Treaty (Fourth and last review Conference scheduled for 20 Aug.-14 Sept. 1990), which has not been signed by both countries-thereby enabling them to keep their nuclear weapons option open.

May we request you to welcome the Ratification, but express our concerns at the shortcomings of this Treaty-which may continue to hinder true normalisation of relations between India and Pakistan. Address your letters to Shri V.P. Singh, the Prime Minister, Shri I.K. Gujral the Minister of External Affairs (South Block, New Delhi 110 011) and Prof. M.G.K. Menon, Minister of State for Science and Technology and Atomic Energy (Anusandhan Bhavan, Rafi Marg, New Delhi 110 001). Also write to the High Commissioner of Pakistan to India (Shantipath, Chanakayapuri, New Delhi 110 021).

Kindly make copies of this letter and send to other concerned friends and to your local press.

Let's hear from you as to what action you have taken.

With warm regards

Yours sincerely

Hemachandra Ra.

HEMACHANDRA BASAPPA

Bangalore
16th January 1990

Documentation & Dissemination Centre for Disarmament Information

21, Railway Parallel Road,
Nehru Nagar,
Bangalore-560 020, INDIA.
Phone : 364689

PRESS RELEASE

UNITED NATIONS REGIONAL CONFERENCE ON CONFIDENCE BUILDING

We are encouraged at the rapid and immediate steps taken by the National Front Government to improve and normalise our relations with our neighbours. This is evident with the quick visits of the Foreign Ministers of Nepal and Sri Lanka, followed by the King of Bhutan and the special envoy of the Pakistani Prime Minister, to the Capital. To be followed by the visit of the Foreign Minister Shri I.K. Gujral to the Maldives.

We hope that these talks will have established a permanent rapport based on true friendship, peace and cooperation in South Asia. The opportunity to express their determination, should be at the forthcoming United Nations Regional Conference on Confidence Building Measures, at Kathmandu, Nepal.

The aspirations and hopes of the peoples of South Asia have been dashed from time to time by short-sighted politicians. The peoples of South Asia who share a common heritage and background have been kept apart for too long.

To express their true concern to their peoples, the Kathmandu, U.N. Conference on Confidence Building Measures, should be the platform where they re-dedicate themselves to the objectives to the Charter of the SAARC:

> " to promote the welfare of the peoples of SOUTH ASIA and to improve their quality of life,
>
> to promote and strengthen collective self reliance among the countries of SOUTH ASIA."

We call on the Government of India, being the largest in the Region and who besides has the fourth largest army in the world to:

1. An immediate moratorium on all new Defence Industries/Weapons systems, including nuclear.
2. To immediately freeze and gradually reduce the military budget
3. To work towards removing travel restrictions to enable the people of South Asia to move freely (SAARC Declaration of Bangalore)
4. To encourage the formation of Peoples Forums
5. To resolve all outstanding bilateral issues without the use or threat to use arms.
6. To strive to propose common SAARC statements in future international Forums like the United Nations, Non-aligned Summits and at the Commonwealth Meetings.

We also call on the Government of Pakistan to take similar steps. The visit of the Prime Minister of Pakistan to India as Chairperson of SAARC should usher in a new era of friendship and cooperation.

HEMACHANDRA BASAPPA
COORDINATOR

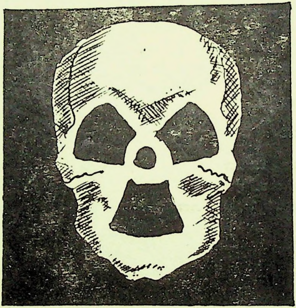
10 January, 1990
Bangalore.

Dear Friends

Warm New Year Greetings. Please write to the Prime Minister and External Affairs Minister (South Block, New Delhi 110 011) your concerns and views. Let us know what action you take. Thanks.

11.40

ಅಣುಶಕ್ತಿ



10 ಕರಾಳ ಮುಖಗಳು 10 ವಕ್ರ ಸತ್ಯಗಳು

ನಾಗೇಶ್ ಹೆಗಡೆ

ಜನಜಾಗೃತಿ ಪುಸ್ತಕಮಾಲೆ

ANU-SHAKTI : HATTU KARALA MUKHAGALU, HATTU VAKRA SATYAGALU (Ten dark aspects of nuclear energy). Kannada. By NAGESH HEGDE.

Jointly published by Anushakti-Virodhi-Nagarika-Shakti (AVINASHA: Citizens Against Nuclear Energy), Bangalore, Mannu Rakshana Koota ('Save Soil' Fourm,) Bangalore, and Samaja Parivartana Samudaya, Dharwad-580 001 (India)
Pages: 23 1987

ಸಂಪಾದಕ ಮಂಡಲಿ :

ಎಲ್. ಟಿ. ಶರ್ಮಾ, ಕುಮಟಾ
ಎಸ್. ಆರ್. ಹಿರೇಮಠ, ಧಾರವಾಡ
ಎಸ್. ಆರ್. ರಾಮಸ್ವಾಮಿ, ಬೆಂಗಳೂರು

ಮುದ್ರಣ : ಆರ್ಕ್ ಎಂಟರ್‌ಪ್ರೈಸಸ್, ರಾಜಾಜಿನಗರ, ಬೆಂಗಳೂರು-೫೬೦ ೦೧೦

ಅಣುಶಕ್ತಿ—
10 ಕರಾಳ ಮುಖಗಳು,
10 ವಕ್ರ ಸತ್ಯಗಳು

ನಾಗೇಶ್ ಹೆಗಡೆ

ಸಹ–ಪ್ರಕಾಶನ :

ಅಣುಶಕ್ತಿ ವಿರೋಧಿ ನಾಗರಿಕ ಶಕ್ತಿ (ಅವಿನಾಶ), ಬೆಂಗಳೂರು

ಮಣ್ಣು ರಕ್ಷಣಾ ಕೂಟ, ಬೆಂಗಳೂರು

ಸಮಾಜ ಪರಿವರ್ತನ ಸಮುದಾಯ, ಧಾರವಾಡ

ಅರಿಕೆ

1986ರ ಫೆಬ್ರುವರಿ 16 ರಿಂದ 18ರ ವರೆಗೆ ಬೆಂಗಳೂರು ಸಮೀಪದ ಅರಸಿನಕುಂಟೆಯಲ್ಲಿ 'ಪರ್ಯಾಯ ಅಭಿವೃದ್ಧಿ ನೀತಿ' ಕುರಿತ ಕಾರ್ಯಾಗಾರವೊಂದು ನಡೆಯಿತು. ಅದನ್ನು ಸಂಯೋಜಿಸಿದ್ದುದು ಮಣ್ಣು ರಕ್ಷಣಾ ಕೂಟ, ಜನತಂತ್ರ ಸಮಾಜ (ಸಿಟಿಜನ್ಸ್ ಫಾರ್ ಡೆಮಾಕ್ರಸಿ ಕರ್ನಾಟಕ) ಮತ್ತು ಸಮಾಜ ಪರಿವರ್ತನ ಸಮುದಾಯ. ಅರಣ್ಯಗಳು, ಇಂಧನ, ವಿಜ್ಞಾನ, ಮಹಿಳಾಭಿವೃದ್ಧಿ ಮುಂತಾದ ವಿವಿಧ ವಿಷಯಗಳ ಬಗೆಗೆ ಅಲ್ಲಿ ಅಭಿಪ್ರಾಯ ವಿನಿಮಯ ನಡೆಯಿತು. ತಜ್ಞರೂ ಸಾಮಾಜಿಕ ಕಾರ್ಯಕರ್ತರೂ ಗಣನೀಯ ಸಂಖ್ಯೆಯಲ್ಲಿ ಭಾಗವಹಿಸಿದ್ದ ಆ ಕಾರ್ಯಕ್ರಮದಲ್ಲಿ ಕರ್ನಾಟಕ ಮಾತ್ರವಲ್ಲದೆ ಬೇರೆ ರಾಜ್ಯಗಳ ಹಲವರೂ ತಮ್ಮ ಚಿಂತನೆಯನ್ನು ಹಂಚಿಕೊಂಡರು. ವಿವಿಧ ಕ್ಷೇತ್ರಗಳಿಗೆ ಸಂಬಂಧಿಸಿದಂತೆ ಸರ್ಕಾರಿ ಹಾಗೂ ಸಾಮಾಜಿಕ ಧೋರಣೆಗಳು ಬದಲಾಗಬೇಕಾಗಿದೆಯೆಂದು ಎಲ್ಲರ ಅಭಿಪ್ರಾಯವಾಗಿತ್ತು. ಈ ಪರಿವರ್ತನೆಗೆ ದಾರಿಮಾಡಲು ಸಾಮಾಜಿಕ ಜಾಗೃತಿ ಹರಡಬೇಕಾಗಿದೆ. ಅದಕ್ಕೆ ಅನುಕೂಲವಾದ ಭೂಮಿಕೆಯನ್ನು ನಿರ್ಮಿಸಲು ಕೆಲವು ಕಿರುಹೊತ್ತಿಗೆಗಳ ಮೂಲಕವೂ ಜ್ಞಾನಪ್ರಸಾರ ಮಾಡಬೇಕೆಂದು ತೀರ್ಮಾನಿಸಲಾಯಿತು. ಆ ದಿಶೆಯ ಒಂದು ಪ್ರಯತ್ನ—ಅಣುವಿದ್ಯುತ್ತನ್ನು ಕುರಿತ ಈ ವಿಶ್ಲೇಷಣ ಪ್ರಬಂಧ. ಇದನ್ನು ಪ್ರಕಟನೆಗಾಗಿ ಸಿದ್ಧಪಡಿಸಿ ಕೊಟ್ಟ ನಾಗೇಶ್ ಹೆಗಡೆ ಅವರಿಗೆ ನಾವು ಕೃತಜ್ಞರಾಗಿದ್ದೇವೆ. ಗ್ರಾಮೀಣ ಜೀವನದ ಬಗೆಗೆ ಕಾಳಜಿಯಿರುವ ಅನ್ಯಾನ್ಯ ವ್ಯಕ್ತಿಗಳಿಂದಲೂ ಸಂಘಟನೆಗಳಿಂದಲೂ ಪ್ರೋತ್ಸಾಹ ಕೋರುತ್ತೇವೆ.

ಏಪ್ರಿಲ್ 5, 1987 —ಪ್ರಕಾಶಕರು

1. ಅಣುಶಕ್ತಿಯ 10 ಕರಾಳ ಮುಖಗಳು :

1. ಅಣು ವಿಕಿರಣ ಜೀವಪರಿಸರಕ್ಕೆ ಅಪಾಯಕಾರಿ. ಅದು ಜೀವವಿಕಾಸಕ್ಕೇ ವಿರೋಧಿ.
2. ವಿಕಿರಣದ ಪರಿಣಾಮ ಪ್ರತ್ಯಕ್ಷ ಕಾಣುವುದಿಲ್ಲ. ಶೀಘ್ರ ಗೊತ್ತಾಗುವುದೂ ಇಲ್ಲ. ರೋಗಕ್ಕೆ ತುತ್ತಾದರೆ ಪರಿಹಾರ ಇಲ್ಲ.
3. ಅಣುಶಕ್ತಿಯಿಂದ ವಿದ್ಯುತ್ ಉತ್ಪಾದಿಸಿದರೆ ಆರ್ಥಿಕ ಲಾಭಕ್ಕಿಂತ ಹಾನಿಯೇ ಹೆಚ್ಚು.
4. ಕೇಂದ್ರೀಕೃತ ವ್ಯವಸ್ಥೆಯಲ್ಲೇ ಅದು ಕಾರ್ಯಾಚರಣೆ ನಡೆಸುತ್ತದೆ. ಅದು ಮನುಷ್ಯರನ್ನು ದಾಸ್ಯತ್ವದಲ್ಲಿಡುತ್ತದೆ.
5. ಅಣುಶಕ್ತಿಯು ಶಾಂತಿವಿರೋಧಿ. ಬಾಂಬ್ ಉತ್ಪಾದನೆಗೆ ಹಾಗೂ ಭಯೋತ್ಪಾದಕರಿಗೆ ಪ್ರಚೋದನೆ ನೀಡುತ್ತದೆ.
6. ಅದು ಪ್ರಜಾತಂತ್ರ ವಿರೋಧಿ. ರಕ್ಷಣೆಯ ನೆಪದಲ್ಲಿ ಹಾಗೂ ರಹಸ್ಯದ ನೆರಳಲ್ಲಿ ಅದು ವ್ಯಕ್ತಿಸ್ವಾತಂತ್ರ್ಯವನ್ನು ಹತ್ತಿಕ್ಕುತ್ತದೆ.
7. ಮುಂದಿನ ಪೀಳಿಗೆಯ ಮೇಲೆ ಅದು ಋಣಭಾರ ಹೇರುತ್ತದೆ. ನಮ್ಮ ತಪ್ಪಿಗೆ ಮರಿಮಕ್ಕಳನ್ನು ಬಲಿ ತೆಗೆದುಕೊಳ್ಳುತ್ತದೆ.
8. ಇಂದಿನವರು ಮಾಡಿದ ತಪ್ಪನ್ನೇ ಮುಂದಿನ ಜನಾಂಗದವರೂ ಕಡ್ಡಾಯ ಮುಂದುವರಿಸಬೇಕಾಗುತ್ತದೆ.
9. ಅಣುಶಕ್ತಿ ದುಂದುವೆಚ್ಚವನ್ನು ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
10. ಬದಲೀ ಶಕ್ತಿಮೂಲ ಶೋಧಕ್ಕೆ ತಡೆ ಒಡ್ಡುತ್ತದೆ. ಶೋಧ ನಿಧಿಯನ್ನೆಲ್ಲ ತಾನೇ ಕಬಳಿಸುತ್ತದೆ.

2. ಭೂಚರಿತ್ರೆಯಲ್ಲಿ ಅಣುಶಕ್ತಿ

ಸುಮಾರು 450 ಕೋಟಿ ವರ್ಷಗಳ ಹಿಂದೆ ಆದೇ ತಾನೇ ಸೂರ್ಯನಿಂದ ಸಿಡಿದು ಬಂದು ಬುಧ, ಶುಕ್ರ, ಭೂಮಿ, ಮಂಗಳ, ಗುರು, ಶನಿ ಇತ್ಯಾದಿ ನವಗ್ರಹಗಳು ಕೆಂಡದ ಉಂಡೆಯ ರೂಪದಲ್ಲಿ ಜನ್ಮ ತಾಳಿದವು. ಭೂಮಿಯಂತೂ ಸುಡುವ ಸೂರ್ಯನ ತುಣುಕಾಗಿತ್ತು. ಆದರಿಂದ ಸೂಸುವ ವಿಕಿರಣ ವಸ್ತುಗಳೆಲ್ಲ ಅಳಿದು ಭೂಮಿಯ ಮೇಲ್ಮೈ ತಂಪಾಗಲು 250 ಕೋಟಿ ವರ್ಷಗಳೇ ಬೇಕಾದವು. ಜ್ವಾಲಾಮುಖಿಗಳೆಲ್ಲ ಅಳಿದು, ಮೋಡ-ಮಳೆ-ಸರೋವರ-ಸಮುದ್ರಗಳೂ ನಿರ್ಮಾಣವಾದವು. ನೀರಲ್ಲಿ ಪಾಚಿ, ಜಲಚರಗಳು ಸೃಷ್ಟಿಯಾದವು. ವಿಕಿರಣ ಸೂಸುವ ಖನಿಜಗಳು ಭೂಮಿಯ ಒಡಲಲ್ಲಿ ಮಾತ್ರ ಉಳಿದವು. ಬಾಹ್ಯ ವಿಶ್ವದಿಂದ ಬರುವ ಅಪಾಯಕಾರಿ ಕಿರಣಗಳನ್ನು ತಡೆಗಟ್ಟುವಂತೆ ಭೂಮಿ ತನ್ನ ಸುತ್ತ ಹವಾ ಕವಚ ನಿರ್ಮಿಸಿಕೊಂಡಿತು. ಜೀವಸೃಷ್ಟಿಗೆ ನೆಲ ಹದವಾಯಿತೆಂದಾಗ, ಸುಮಾರು 40 ಕೋಟಿ ವರ್ಷಗಳ ಹಿಂದೆ, ನೀರಿನ ಜೀವಿಗಳು ಮೆಲ್ಲಗೆ ದಡ ಏರಿದವು. ಅಣುಶಕ್ತಿಯ ಕಾವು ನಿಸರ್ಗದಲ್ಲಿ ಕಮ್ಮಿಯಾಗುತ್ತಾ ಬಂದಹಾಗೆ, ಜೀವಿಗಳು ವಿಕಾಸಗೊಳ್ಳುತ್ತಾ ಬಂದು ಮತ್ಸ್ಯ, ಕೂರ್ಮ, ವರಾಹಗಳಿಂದ ಹಿಡಿದು ಕೃಷ್ಣ ರಾಮರವರೆಗೂ ಹಂತ ಹಂತವಾಗಿ ಬುದ್ಧಿಶಕ್ತಿ ವರ್ಧಿಸುತ್ತ ಬಂತು. ನಂತರ ಕಲಿಕಾಲ ಬಂತು.

ಜೀವಿಗಳಿಗೆ ಮಾರಕ ಆಗಬಲ್ಲ ಎಲ್ಲ ವಸ್ತುಗಳನ್ನೂ ಭೂಮಿ ತನ್ನ ಮಡಿಲಲ್ಲಿ ಅಡಗಿಸಿಕೊಂಡಿತ್ತು. ಆದರೆ ಬುದ್ಧಿವಂತ ಮಾನವ ಅವುಗಳನ್ನೆಲ್ಲ ಒಂದೊಂದಾಗಿ ಮತ್ತೆ ಹೊರತೆಗೆಯ ತೊಡಗಿದ. ಗಂಧಕ ಹೊರತೆಗೆದು ಸಿಡಿಮದ್ದು ತಯಾರಿಸಿದ, ಕಲ್ಲಿದ್ದಲು ಅಗೆದು ಉದ್ಯಮಕ್ರಾಂತಿ ಮಾಡಿದ. ಇನ್ನೂ ಆಳಕ್ಕಿಳಿದು ಪೆಟ್ರೋಲಿಯಂ ದ್ರವ್ಯಗಳನ್ನು ಭೂಗರ್ಭದಿಂದ ಹೊರಗೆಳೆದು ತನ್ನ ಶಕ್ತಿಯನ್ನು ನೂರ್ಮಡಿ ಹೆಚ್ಚಿಸಿಕೊಂಡ. ಹೊಗೆ, ವಿಷಾನಿಲಗಳನ್ನು ಸೃಷ್ಟಿಸಿ ಗಾಳಿಗೆ, ನೀರಿಗೆ, ಮಣ್ಣಿಗೆ ತೂರಿದ. ನಿಸರ್ಗ ಅತ್ಯಂತ ನಿಗೂಢವಾಗಿ ಬಚ್ಚಿಟ್ಟಿದ್ದ ಅಣುಶಕ್ತಿಯನ್ನೂ ತನ್ನ ಅಗಾಧ ಬುದ್ಧಿಮತ್ತೆಯಿಂದ ಪತ್ತೆಹಚ್ಚಿ ಪಶುಪ್ರವೃತ್ತಿಗೆ ಕುಮ್ಮಕ್ಕು ಕೊಟ್ಟು ಬಾಂಬ್ ತಯಾರಿಸಿಬಿಟ್ಟ.

ಹಿರೋಶಿಮಾ - ನಾಗಾಸಾಕಿಯ ಮುಗ್ಧ ಜನರ ಮೇಲೆ ಅಣ್ವಸ್ತ್ರ ಝಳಪಿಸಿ ಅನೇಕ ಲಕ್ಷ ಜನರನ್ನು ಹೊಸಕಿಹಾಕಿದ. ಅವರ ವಂಶವೂ ತಲೆತಲಾಂತರ ನರಳು

ವಂತೆ ಮಾಡಿದ. ಕೊನೆಗೆ, ಈ ದೈತ್ಯಶಕ್ತಿಗೇ ಅವತಾರ ಪುರುಷನ ವೇಷ ತೊಡಿಸಿ, ಮಾನವ ಕಲ್ಯಾಣಕ್ಕೆಂದೇ ಸೃಷ್ಟಿಸಿದ್ದೆಂದು ಹೇಳುತ್ತ ತನ್ನವರ ಮೇಲೆ ಮಂಕುಬೂದಿ ಎರಚುತ್ತ, ಬಂದ. ನಿಸರ್ಗದಲ್ಲಿ ಹಿಂದೆಂದೂ ಇಲ್ಲದಿದ್ದ 'ಪ್ಲುಟೋನಿಯಂ' (ನರಕದೇವತೆ) ಎಂಬ ಮೂಲವಸ್ತುವನ್ನು ಸೃಷ್ಟಿಮಾಡಿ ಶಾಂತಿಯ ಹೆಸರಿನಲ್ಲಿ ಇನ್ನಷ್ಟು ಬಾಂಬ್‌ಗಳನ್ನು ತಯಾರಿಸುತ್ತ ಬಂದ.

3. ಜೀವವಿರೋಧಿ ಅಣುಶಕ್ತಿ

ಈ ಶತಮಾನದ ಪ್ರಾರಂಭದಲ್ಲೇ ರೇಡಿಯಂ ಎಂಬ ವಿಕಿರಣ ಸೂಸುವ ವಸ್ತುವಿನ ಸಂಶೋಧನೆಯಾಯಿತು. ಆಗ ವಿಕಿರಣ ಎಷ್ಟು ಅಪಾಯಕಾರಿ ಎಂಬುದು ಯಾರಿಗೂ ತಿಳಿದಿರಲಿಲ್ಲ. ವರ್ಷ ಕಳೆದಂತೆ ಸ್ವತಃ ಅದರ ಮೂಲ ಸಂಶೋಧಕ ಪಿಯರಿ ಕ್ಯೂರಿ ತಾನೇ ವಿಕಿರಣರೋಗಕ್ಕೆ ತುತ್ತಾದ. ಆತ ಅಪಮೃತ್ಯುವಿಗೆ ಈಡಾದ ಮೇಲೆ ಅವನ ಪತ್ನಿ ಮೇಡಮ್ ಕ್ಯೂರಿ ಸಂಶೋಧನೆ ಮುಂದುವರಿಸಿ ಎರಡೆರಡು ನೊಬೆಲ್ ಪ್ರಶಸ್ತಿ ಗೆದ್ದರೂ ಹತ್ತು - ಹನ್ನೆರಡು ಬಗೆಯ ವಿಕಿರಣ ಕಾಯಿಲೆಗಳಿಗೆ ಗುರಿಯಾಗಿ ದಾರುಣ ನೋವು ಅನುಭವಿಸುತ್ತ ಅಸುನೀಗಬೇಕಾಯಿತು. ಅಂದಿನ ದಿನಗಳಲ್ಲಿ ವಾಚಿನ ಡಯಲ್‌ಗಳಿಗೆ ರೇಡಿಯಂ ಬಣ್ಣ ಬಳಿಯುತ್ತಿದ್ದ ಅಸಂಖ್ಯಾತ ಮಹಿಳಾ ಕಾರ್ಮಿಕರು ಚಿತ್ರವಿಚಿತ್ರ ರೋಗಗಳಿಗೆ ಸಿಲುಕಿದರು.

ರೇಡಿಯಂ ಅಂಥದೇ ಯುರೇನಿಯಮ್ ಎಂಬ ಅದುರನ್ನು ಶುದ್ಧೀಕರಿಸಿದರೆ ತನ್ನ ಕಿರಣದಿಂದ ಅದು ತಾನೇ ಜ್ವಲಿಸುತ್ತದೆ ಎಂದು ತಿಳಿದು ಬಂದಾಗ, 1940 ರಲ್ಲಿ ಅಮೆರಿಕ ಮತ್ತು ಇಂಗ್ಲೆಂಡ್‌ಗಳಲ್ಲಿ ಅದನ್ನು ಬಾಂಬ್ ತಯಾರಿಕೆಗೆಂದು ರಹಸ್ಯವಾಗಿ ಶುದ್ಧೀಕರಿಸುವ ಕೆಲಸ ಪ್ರಾರಂಭವಾಯಿತು. ಜರ್ಮನಿಯ ಹಿಟ್ಲರ್ ಕೂಡಾ ಅದೇ ಕೆಲಸವನ್ನು ವಿಜ್ಞಾನಿಗಳಿಂದ ಮಾಡಿಸುತ್ತಿದ್ದಾನೆಂಬ ವದಂತಿಯೂ ಇತ್ತು. ಆದರೆ ಬಾಂಬ್ ತಯಾರಿಸಿ, ಅಮೆರಿಕದ ಮರುಭೂಮಿಯಲ್ಲಿ ಪರೀಕ್ಷಾರ್ಥ ಸಿಡಿಸುವ ಹೊತ್ತಿಗೆ ಎರಡನೇ ಮಹಾಯುದ್ಧ ಮುಗಿದಿತ್ತು. ಹಿಟ್ಲರ್ ಸತ್ತು ಜರ್ಮನಿ ಶರಣಾಗತಿ ಪಡೆದಿತ್ತು. ಜಪಾನ್ ಕೂಡಾ ಶರಣಾಗುತ್ತೇನೆಂದು ರಹಸ್ಯ ಸಂದೇಶ ಕಳುಹಿಸಿತ್ತು. ಬಾಂಬ್ ತಯಾರಿಸಿದ್ದನ್ನು ಪ್ರಯೋಗಿಸಿ ನೋಡುವ ಚಪಲದಿಂದ ಅಮೆರಿಕನ್ ಪ್ರಭುಗಳು ಜಪಾನ್‌ನ ಹಿರೋಶಿಮಾ ನಾಗರಿಕರ ಮೇಲೆ ಯುರೇನಿಯಂ ಬಾಂಬ್ ಹಾಕಿದರು. ಒಂದೂವರೆ ಲಕ್ಷ ಜನ ಗತಿಸಿ, ನಗರ

ಸಪಾಟಾಯಿತು. ಅಮೆರಿಕ, ಯುರೇನಿಯಂ ಭಸ್ಮ ಪ್ಲುಟೋನಿಯಂ ಬಳಸಿ ರಚಿಸಿದ್ದ ಇನ್ನೂ ಒಂದು ಬಾಂಬನ್ನು ಮೂರು ದಿನಗಳ ನಂತರ ನಾಗಾಸಾಕಿಯ ಮೇಲೆ ಆಸ್ಫೋಟಿಸಿತು.

ವಿಶ್ವಾದ್ಯಂತ ಛೀಮಾರಿ ಹಾಕಿಸಿಕೊಂಡ ಅಮೆರಿಕಕ್ಕೆ ಅಣುಶಕ್ತಿಯಿಂದ ನೀರು ಕಾಯಿಸಿ ವಿದ್ಯುತ್ ಕೂಡಾ ಉತ್ಪಾದನೆ ಮಾಡುವ ತಂತ್ರ ಲಭಿಸಿತ್ತು. ಇತರ ರಾಷ್ಟ್ರಗಳಿಗೂ ಈ ತಂತ್ರ ಹಣವನ್ನೂ ಮಾನವನ್ನೂ ಗಳಿಸುವ ಹಂಚಿಕೆ ಹೂಡಿತು. "ಅಣು ವಿದ್ಯುತ್ ಎಷ್ಟು ಅಗ್ಗದ್ದೆಂದರೆ ಅದಕ್ಕೆ ಮೀಟರ್ ಜೋಡಿಸುವ ಅಥವಾ ಬಿಲ್ ಪಾವತಿ ಮಾಡುವ ಅಗತ್ಯವೇ ಇಲ್ಲ-ಅಷ್ಟು ಪುಕ್ಕಟೆ" ಎಂದೆಲ್ಲ ಶ್ಲಾಘಿಸಿತು. ಇತರ ದೇಶಗಳ ಪ್ರತಿಭಾವಂತ ವಿಜ್ಞಾನಿಗಳನ್ನು ಕರೆಸಿ, ಅಣು ತಂತ್ರದ ಪಾಠ ನೀಡಿತು. ಪ್ರಶಸ್ತಿ ಪುರಸ್ಕಾರ ನೀಡಿ ಶಾಭಾಸ್ ಹೇಳಿ ಅವರವರ ದೇಶಗಳಲ್ಲಿ ಅಣು ಬೀಜ ಬಿತ್ತಲು ಪುಸಲಾಯಿಸಿ ಕಳುಹಿಸಿತು. ತಾನು ಬ್ರಿಟನ್ ಮತ್ತು ಫ್ರಾನ್ಸ್ ಜತೆಗೂಡಿ ಅಣುಸ್ಥಾವರಗಳನ್ನು ನಿರ್ಮಿಸಿ ಅದರಿಂದ ಸಿಗುವ ಭಸ್ಮದಿಂದ ಬಾಂಬ್ ತಯಾರಿಸಿ ಪೇರಿಸುತ್ತ ಬಂತು. ಅಣುಕಾರ್ಮಿಕರ ಆರೋಗ್ಯಕ್ಕೆ ಹಾಗೂ ರಾಷ್ಟ್ರದ ಬೊಕ್ಕಸಕ್ಕೆ ಉಂಟಾಗುವ ನಷ್ಟವನ್ನೆಲ್ಲ ಮರೆಮಾಚುತ್ತ ಬಂತು.

ಅಣುಕಿರಣ ಸೋಂಕಿದರೆ ಕೂದಲು ಉದುರುತ್ತದೆ. ನಪುಂಸಕತ್ವ ಬರುತ್ತದೆ. ರಕ್ತದ ಕ್ಯಾನ್ಸರ್, ಕರುಳಿನ ಕ್ಯಾನ್ಸರ್, ಶ್ವಾಸಕೋಶದ ಕ್ಯಾನ್ಸರ್ ಮುಂತಾದ 2000ಕ್ಕೂ ಹೆಚ್ಚು ಬಗೆಯ ರೋಗಗಳು ತಲೆದೋರುತ್ತವೆ. ಯುರೇನಿಯಂ ಗಣಿಯಲ್ಲಿ ಕೆಲಸ ಮಾಡುವವರು ಕ್ರಮೇಣ ಪುಪ್ಪುಸದ ಕ್ಯಾನ್ಸರ್‌ಗೆ ತುತ್ತಾಗುತ್ತಾರೆ. ಗಣಿಯಿಂದ ತೆಗೆದ ಅದುರನ್ನು ತೊಳೆದ ನೀರು ನದಿಗೆ ಸೇರಿದರೆ ಜಲಚರಗಳಿಗೆ ಅಪಾಯ. ಗಣಿಬಳಿ ಬಿಸಾಕಿದ ಮಣ್ಣಿನ ರಾಶಿಯಲ್ಲಿ ಬಿಡಾರ ಹೂಡಿಕೊಂಡವರಿಗೆ ವಿಕಾರ ರೂಪದ ಮಕ್ಕಳು ಜನಿಸಿದ ಉದಾಹರಣೆಗಳಿವೆ. ಆದರೆ ಈ ಯಾವ ರೋಗ ಬಂದರೂ ಸರಕಾರವಾಗಲೀ, ಗಣಿ ಗುತ್ತಿಗೆದಾರರಾಗಲೀ ಪರಿಹಾರ ನೀಡುವುದಿಲ್ಲ. ಏಕೆಂದರೆ, ಈ ರೋಗಗಳು ತಕ್ಷಣ ತಲೆದೋರುವುದಿಲ್ಲ. ನಿಧಾನವಾಗಿ ಆಕ್ರಮಿಸಿದರೂ, ಅಣುವಿಕಿರಣದಿಂದಾಗಿಯೇ ರೋಗ ಬಂತೆಂದು ಯಾವ ವೈದ್ಯನೂ ಹೇಳುವ ಹಾಗಿಲ್ಲ.

ಅಣುವಿಕಿರಣದಿಂದ ಬರುವ ರೋಗಕ್ಕೂ ಅಣುಶಕ್ತಿಯ ಇಲಾಖೆಗೂ ಯಾವ ಸಂಬಂಧವೂ ಇರುವುದಿಲ್ಲ. ಅಣುಸ್ಥಾವರದಿಂದ ಹತ್ತಾರು ಮೈಲು ದೂರ

ದಲ್ಲಿ ತನ್ನ ಪಾಡಿಗೆ ತಾನು ಬದುಕುತ್ತಿದ್ದರೂ, ಗಾಳಿಯ ಮೂಲಕ, ನೀರಿನ ಮೂಲಕ, ತರಕಾರಿ ಅಥವಾ ಹಸುವಿನ ಹಾಲಿನ ಮೂಲಕ ರೋಗಗಳು ಬರುತ್ತವೆ. ರೋಗದ ಲಕ್ಷಣಗಳು ಗೊತ್ತಾಗುವ ಮೊದಲೇ ನಾವು ಸತ್ತುಹೋದರೂ, ನಮ್ಮ ಮಕ್ಕಳು-ಮರಿ ಮಕ್ಕಳಿಗೆ ಬಾಲ್ಯದಲ್ಲಿಯೇ ರಕ್ತದ ಕ್ಯಾನ್ಸರ್ ಬರಬಹುದು. ನಮ್ಮ ದೇಶದ ಆಚೆ ಸಾವಿರಾರು ಮೈಲು ದೂರದಲ್ಲಿ ಅಣುಸ್ಥಾವರ ಸ್ಫೋಟವಾದರೂ ನಾವು ರೋಗಕ್ಕೆ ಬಲಿಯಾಗಬಹುದು. ರಷ್ಯದ ಚೆರ್ನೊಬಿಲ್ ಅಣುಸ್ಥಾವರ ಸಿಡಿದು ಒಂದು ವರ್ಷವಾದರೂ ಈಗಲೂ ಎರಡು ಸಾವಿರ ಕಿಲೋಮೀಟರ್ ಆಚೆ ನಾರ್ವೆ ದೇಶದ ಒಡ ಮೂಲ ನಿವಾಸಿಗಳು ತಮ್ಮ ಬದುಕಿನ ಏಕೈಕ ಆಧಾರವಾದ ರೇನ್ ಡಿಯರ್ ಪ್ರಾಣಿಯ ಹಾಲು ಕುಡಿಯುವಂತಿಲ್ಲ, ಮಾಂಸ ತಿನ್ನುವಂತಿಲ್ಲ. ಅಲ್ಲಿಯ ಹುಲ್ಲೂ ವಿಕಿರಣ ಪೂರಿತವಾಗಿದೆ. ಆದರೆ ವಿಕಿರಣ ವಿಷ ಕಣ್ಣಿಗೆ ಕಾಣುವುದಿಲ್ಲ ; ಬಣ್ಣ-ವಾಸನೆ-ರುಚಿ ಏನೂ ಅದಕ್ಕಿರುವುದಿಲ್ಲ. ವಿಜ್ಞಾನಿಗಳು ಬಂದು ಪರೀಕ್ಷೆ ಮಾಡಿದರೆ ಬದಲೀ ಆಹಾರ ಹುಡುಕಬೇಕು. ಇಲ್ಲವಾದರೆ ವಿಕಿರಣ ವಸ್ತುವನ್ನೇ ಹೊಟ್ಟೆಗೆ ಸೇವಿಸುತ್ತ, ಏನೇನೋ ರೋಗಗಳಿಗೆ ತುತ್ತಾಗಿ, ವಿಕಲಾಂಗ ಮಕ್ಕಳಿಗೆ ಜನ್ಮ ಕೊಡಬೇಕು.

4. ಅಣುಶಕ್ತಿಯಿಂದ ಆರ್ಥಿಕ ಹಾನಿ

ನೀರಿನಿಂದ ವಿದ್ಯುತ್ ಉತ್ಪಾದಿಸಿದರೆ ಪ್ರತಿ ಯೂನಿಟ್‌ಗೆ 30 ಪೈಸೆ ವೆಚ್ಚ ಬರುತ್ತದೆಂದು ಅಂದಾಜಿದೆ. ರಾಯಚೂರಿನ ಥರ್ಮಲ್ ವಿದ್ಯುತ್ ಘಟಕದಲ್ಲಿ ಕಲ್ಲಿದ್ದಲನ್ನು ಉರಿಸಿ, ನೀರು ಕುದಿಸಿ ಆವಿಯಿಂದ ವಿದ್ಯುತ್ ಉತ್ಪಾದಿಸಿದರೆ ಪ್ರತಿ ಯೂನಿಟ್‌ಗೆ 60 ಪೈಸೆ ವೆಚ್ಚವಾಗುತ್ತದೆ. ಅಣು ವಿದ್ಯುತ್ ಕೂಡಾ ಅಷ್ಟೇ ವೆಚ್ಚದ್ದೆಂದೂ, ಹೆಚ್ಚೆಂದರೆ 80 ಪೈಸೆ ಆದೀತೆಂದೂ ಅಣುವಿಜ್ಞಾನಿಗಳು ಹೇಳುತ್ತಾರೆ. ಬಹುಶಃ ಬಳಕೆದಾರನಿಂದ ನೇರವಾಗಿ ಅಷ್ಟೇ ದರದಲ್ಲಿ ವಿದ್ಯುತ್ ಶುಲ್ಕ ವಸೂಲು ಮಾಡಬಹುದು. ಆದರೆ ಸರಕಾರಕ್ಕೆ ಅಣುವಿದ್ಯುತ್ ಉತ್ಪಾದನೆಯಿಂದ ನಿಜಕ್ಕೂ ಪ್ರತಿ ಯೂನಿಟ್‌ಗೆ 2 ರೂಪಾಯಿಗಳಷ್ಟು ವೆಚ್ಚ ಬೀಳುತ್ತದೆಂದು ಆರ್ಥಿಕ ತಜ್ಞರು ಲೆಕ್ಕ ಹಾಕಿದ್ದಾರೆ: ಏಕೆಂದರೆ ಸಂಶೋಧನೆಯ ವೆಚ್ಚ, ಗಣಿ ಅಗೆತದ ವೆಚ್ಚ, ಭಸ್ಮ ಹೂಳುವ ವೆಚ್ಚ, ಅಣು ಸ್ಥಾವರವನ್ನು ಭವಿಷ್ಯದಲ್ಲಿ ಕಳಚಿ ಹೂಳುವ ವೆಚ್ಚ ಇತ್ಯಾದಿಗಳನ್ನು ಲೆಕ್ಕಕ್ಕೆ ಪರಿಗಣಿಸುವ ಪದ್ಧತಿ ಇಲ್ಲ. ಅಂದರೆ ಪ್ರತಿ ಯೂನಿಟ್ ವಿದ್ಯುತ್ತಿಗೆ ನಾವು ನೇರ

80 ಪೈಸೆ ನೀಡಿದರೂ, ಪರೋಕ್ಷವಾಗಿ ತೆರಿಗೆ ರೂಪದಲ್ಲಿ ಅದರ ದುಪ್ಪಟ್ಟು ನೀಡಬೇಕಾಗುತ್ತದೆ. ವಿದ್ಯುತ್ ಬಳಸದೇ ಇದ್ದರೂ ಸರಕಾರೀ ವೆಚ್ಚವೆಂದರೆ ನಾವೇ ಬೊಕ್ಕಸಕ್ಕೆ ಹಣ ಭರ್ತಿ ಮಾಡಬೇಕಾಗುತ್ತದೆ.

ಅಷ್ಟೇ ಅಲ್ಲ, ಅಣುಸ್ಥಾವರವೊಂದು ತನ್ನ ಜೀವಿತದ 20 ವರ್ಷ ಅವಧಿಯಲ್ಲಿ ಉತ್ಪಾದಿಸುವ ವಿದ್ಯುತ್ತಿಗಿಂತ, ತಾನು ನುಂಗುವ ಶಕ್ತಿಯ ಮೊತ್ತವೇ ಹೆಚ್ಚಾಗಿರುತ್ತದೆಂದು ವಾದಿಸುವವರೂ ಇದ್ದಾರೆ. ಅಣುಸ್ಥಾವರದ ನಿರ್ಮಾಣದ ಹತ್ತು ವರ್ಷದ ಅವಧಿಯಲ್ಲಿ ಸಿಮೆಂಟು, ಉಕ್ಕು, ಸಾಗಾಟ, ಅಗೆತ, ವಿದ್ಯುತ್ ಜಾಲ ನಿರ್ಮಾಣ, ಯುರೇನಿಯಮ್ ಸಂಸ್ಕರಣ ಇತ್ಯಾದಿಗೆಲ್ಲ ಎಷ್ಟು ಶಕ್ತಿ ವ್ಯಯ ಮಾಡುತ್ತದೆಂದು ಯಾರೂ ಈವರೆಗೆ ಲೆಕ್ಕ ಒಪ್ಪಿಸಿಲ್ಲ. ಪ್ರತಿ ಬಾರಿ ಅಣುಸ್ಥಾವರ ಕೆಟ್ಟುಕೂತಾಗಲೂ ಬೇರೆ ಕಡೆಯಿಂದ ವಿದ್ಯುತ್ತನ್ನು ಎರವಲು ತಂದು ಸ್ಥಾವರದ ಯೋಗಕ್ಷೇಮ ನೋಡಿಕೊಳ್ಳಬೇಕು. ಅಣುಸ್ಥಾವರವನ್ನು ಆಮೇಲೆ ಸಮಾಧಿ ಮಾಡುವಾಗಲೂ ಶಕ್ತಿಯನ್ನು ಎರವಲು ತೆರಬೇಕು. ಇವೆಲ್ಲವನ್ನೂ ಪರಿಗಣಿಸಿದರೆ ಜಮೆಗಿಂತ ಖರ್ಚೇ ಹೆಚ್ಚಾದೀತೆಂದು ಸುಲಭವಾಗಿ ಊಹಿಸಬಹುದು. ತಾರಾಪುರದ ಸ್ಥಾವರ 11 ವರ್ಷಗಳಲ್ಲಿ 344 ಬಾರಿ. ರಾಜಸ್ಥಾನದ ಕೋಟಾ ಸ್ಥಾವರ 10 ವರ್ಷಗಳಲ್ಲಿ 251 ಬಾರಿ ಕೆಟ್ಟು ಕೂತು ವಿದ್ಯುತ್ತನ್ನು ಎರವಲು ಪಡೆದಿತ್ತು. ಅಣು ಶಕ್ತಿ ಇಲಾಖೆ ಈವರೆಗೂ ಶಕ್ತಿಯ ಜಮಾಖರ್ಚಿನ ಲೆಕ್ಕ ತೋರಿಸಿಲ್ಲ. ತನ್ನನ್ನು ನಂಬಿದವರಿಗೆ ಅದು ಎಂದೂ ನಿರಂತರ ವಿದ್ಯುತ್ ಸರಬರಾಜು ಮಾಡಿಲ್ಲ. ರಾಜಸ್ಥಾನದ ಎರಡೂ ಸ್ಥಾವರ ಕೆಟ್ಟುಕೂತು ಇಡೀ ರಾಜ್ಯದಲ್ಲಿ ಒಮ್ಮೆ ಶೇ. 85 ರಷ್ಟು ವಿದ್ಯುತ್ ಕಡಿತ ಮಾಡಬೇಕಾಗಿ ಬಂದು ಅಂಧಕಾರ ಕವಿದಿತ್ತು.

5. ಅಣುಶಕ್ತಿ ಶಾಂತಿವಿರೋಧಿ

ಅಣುಶಕ್ತಿ ಹುಟ್ಟಿದ್ದೇ ಯುದ್ಧಾಸ್ತ್ರ ನಿರ್ಮಾಣಕ್ಕಾಗಿ, ವಿದ್ಯುತ್ ಉತ್ಪಾದನೆ ಆನಂತರ ಉಳಿಯುವ ಭಸ್ಮವನ್ನು (ಪ್ಲುಟೋನಿಯಮ್) ಬಾಂಬ್ ತಯಾರಿಕೆಗೆ ಬಳಸಲಾಗುತ್ತದೆ. ಅಮೆರಿಕ, ಇಂಗ್ಲೆಂಡ್, ಫ್ರಾನ್ಸ್, ರಷ್ಯ, ಚೀನ ಎಲ್ಲವೂ ಬಾಂಬ್ ತಯಾರಿಸುತ್ತಿವೆ. ಭಾರತವೂ 1974ರಲ್ಲಿ ಯಾವ ಬಾಹ್ಯ ಪ್ರಚೋದನೆಯೂ ಇಲ್ಲದಿದ್ದರೂ, ಅಂತರರಾಷ್ಟ್ರೀಯ ಒಪ್ಪಂದವನ್ನು ಕಡೆಗಣಿಸಿ ಅಣುಸ್ಫೋಟ ಮಾಡಿತು. ಪ್ಲುಟೋನಿಯಮ್ ಉತ್ಪಾದನೆ ಆಗುತ್ತಿದ್ದರೆ ಬಾಂಬ್

ತಯಾರಿಸುವ ಚಪಲ ಹೆಚ್ಚುತ್ತದೆ. ಅಣುಭಸ್ಮವನ್ನು ಬಾಂಬ್‌ಗೆಂದು ಸಂಸ್ಕರಿಸುವಾಗ ವೆಚ್ಚದ ಹೊರೆ ಪ್ರಜೆಗಳ ತಲೆಯಮೇಲೆ ಬೀಳುತ್ತದೆ. ಬಾಂಬ್ ತಯಾರಾದರೆ ಅದನ್ನು ಬಳಸುವ ಚಪಲವೂ ಹೆಚ್ಚುತ್ತದೆ. ಗಡಿರಾಷ್ಟ್ರಗಳ ಜತೆ ಬಿಕ್ಕಟ್ಟು ತೀವ್ರವಾಗುತ್ತದೆ. ಗಡಿಯಲ್ಲಿ ಮಾತ್ರವಲ್ಲ, ಇಡೀ ರಾಷ್ಟ್ರವೇ ರಣರಂಗವಾಗುತ್ತದೆ.

ಅಣುಸ್ಥಾವರ ಇದ್ದಲ್ಲೆಲ್ಲ ಬಾಂಬ್ ದಾಳಿಯ ಭಯ ಇದ್ದೇ ಇರುತ್ತದೆ. ಹಾಗಾಗಿ ಅಣುಸ್ಥಾವರದ ಸುತ್ತ ರಕ್ಷಣಾದಳಗಳ ಕಾವಲು ಇರಬೇಕಾಗುತ್ತದೆ. ಪ್ಲುಟೋನಿಯಂ ಭಸ್ಮದ ಕಳ್ಳಸಾಗಣೆ ಆಗದಂತೆ ಸದಾಕಾಲ ಕಣ್ಣಿಟ್ಟಿರಬೇಕಾಗುತ್ತದೆ. ಭಯೋತ್ಪಾದಕರಿಗಾಗಲಿ, ದುರ್ಬುದ್ಧಿಯ ಕಾರ್ಮಿಕರಿಗಾಗಲಿ ಒಂದು ಚಿಟಿಕೆ ಪ್ಲುಟೋನಿಯಂ ಸಿಕ್ಕರೂ ಅನರ್ಥಕ್ಕೆ ಕಾರಣವಾಗುತ್ತದೆ. ಕಳೆದ ವರ್ಷ ಹೈದರಾಬಾದ್‌ನ ಅಣು ಇಂಧನ ಸಂಸ್ಕರಣ ಕಾರ್ಯಾಗಾರದಲ್ಲಿ ಕುಡಿಯುವ ನೀರಿಗೆ ಯಾರೋ ಪ್ಲುಟೋನಿಯಂ ಬೆರೆಸಿದ್ದರು. ಕೊಳಾಯಿಗಳನ್ನೇ ಬದಲಿಸುವ ಪ್ರಸಂಗ ಬಂದಿತ್ತು. 1980ರಲ್ಲಿ ಇರಾಕ್ ದೇಶದ ಅಣುಸ್ಥಾವರವೊಂದು ನಿರ್ಮಾಣ ಹಂತದಲ್ಲಿದ್ದಾಗ ಇಸ್ರೇಲೀ ಯುದ್ಧವಿಮಾನಗಳ ದಾಳಿಗೆ ಬಲಿಯಾಯಿತು. ಅದೇ ಅಣುಸ್ಥಾವರ ಕಾರ್ಯನಿರತವಾಗಿದ್ದಿದ್ದರೆ ಬಾಂಬ್ ದಾಳಿಯಿಂದ ಚೆರ್ನೊಬಿಲ್ ನಂಥದೇ ದುರಂತವಾಗಬಹುದಾಗಿತ್ತು. ಇಂಥ ಅನರ್ಥದ ಕೆಲಸ ಮಾಡಿದ ಮೇಲೂ ಇಸ್ರೇಲ್ ಸರಕಾರಕ್ಕೆ ಫ್ರಾನ್ಸ್ ದೇಶ ಅಣುಸ್ಥಾವರ ನಿರ್ಮಾಣಕ್ಕೆಂದು ತಾಂತ್ರಿಕ ಸಹಕಾರ ನೀಡುತ್ತಿದೆ.

ತೃತೀಯ ಜಗತ್ತಿನ ಬಡರಾಷ್ಟ್ರಗಳ ಜನತೆಗೆ ಊಟ, ವಸತಿ, ಆರೋಗ್ಯ, ಶಿಕ್ಷಣದಂಥ ಮೂಲಭೂತ ಸೌಕರ್ಯಗಳೂ ಇಲ್ಲದಿರುವಾಗ ಅವರಿಗೆ ಅಣುಸ್ಥಾವರ, ಅಣುಬಾಂಬ್ ತಯಾರಿಕಾ ತಂತ್ರವನ್ನು ಲಭ್ಯವಾಗುವಂತೆ ಮಾಡಿ ಈ ರಾಷ್ಟ್ರಗಳು ತಂತಮ್ಮಲ್ಲಿ ಕಾದಾಡುವಂತೆ ಪ್ರೇರೇಪಿಸುವಲ್ಲಿ ಧನಿಕ ರಾಷ್ಟ್ರಗಳ ಯುದ್ಧಾಸ್ತ್ರದಲ್ಲಾಳಿಗಳಿಗೆ ಹೇರಳ ಲಾಭವಿದೆ. ಬಡರಾಷ್ಟ್ರಗಳ ಧುರೀಣರು ತಮ್ಮ ಮೂಲಭೂತ ಸಮಸ್ಯೆಗಳನ್ನು ಬಗೆಹರಿಸುವ ಬದಲು, ಯುದ್ಧ ಯುದ್ಧವೆಂದು ಜನತೆಯ ಗಮನವನ್ನು ಸದಾ ಗಡಿಯತ್ತ ಸೆಳೆಯುತ್ತ ಶಸ್ತ್ರಾಸ್ತ್ರ ಖರೀದಿಗೆ ಅಮೂಲ್ಯ ಸಂಪನ್ಮೂಲವನ್ನು ಸುರಿಯುತ್ತ ಜನರನ್ನು ಇನ್ನಷ್ಟು ಸಂಕಟಕ್ಕೆ ಗುರಿ ಮಾಡುತ್ತಾರೆ. ಶಾಂತಿ ಎಂದೂ ನೆಲಸದಂತೆ ನೋಡಿಕೊಳ್ಳುತ್ತಾರೆ. ದಕ್ಷಿಣ ಆಫ್ರಿಕಾ, ಅರ್ಜೆಂಟಿನಾ, ಭಾರತ, ಪಾಕಿಸ್ತಾನ, ಇಸ್ರೇಲ್, ಇರಾಕ್‌ನಂಥ ರಾಷ್ಟ್ರಗಳಲ್ಲಿ ಅಣುಸ್ಥಾವರಗಳು ಶಾಂತಿ ಕದಡುವ ಕಡೆಗೋಲಾಗುತ್ತಿವೆ.

6. ಅಣುಶಕ್ತಿ ಪ್ರಜಾತಂತ್ರವಿರೋಧಿ

ಅಣುಶಕ್ತಿಯ ಅಗೋಚರ ಅಪಾಯಗಳಿಂದಾಗಿ ಅದಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಕಾರ್ಯಾಚರಣೆಗಳನ್ನೂ ರಹಸ್ಯವಾಗಿ ನಡೆಸುವ ಪರಿಪಾಠ ಬೆಳೆದು ಬಂದಿದೆ. ಅದರಿಂದ ನಾಗರಿಕರಿಗೆ ರಕ್ಷಣೆ ನೀಡುವ ಬದಲು ನಾಗರಿಕರಿಂದ ಅಣುಸ್ಥಾವರಕ್ಕೆ ಅಪಾಯ ಒದಗೀತೆಂಬ ವಿಪರ್ಯಾಸಕರ ಭಯವೇ ಅಧಿಕಾರಿಗಳಿಗೆ ಹಾಗೂ ತಂತ್ರಜ್ಞಾನಿಗಳಿಗೆ ಇದ್ದಂತಿದೆ ಆದ್ದರಿಂದಲೇ ಭಾರತದಲ್ಲಿ 1972ರಲ್ಲಿ ಅಣುಶಕ್ತಿ ಕಾಯಿದೆಯನ್ನು ಜಾರಿಗೊಳಿಸಿದ್ದಾರೆ. ಯಾರೂ ಅಣುಶಕ್ತಿಯ ಬಗ್ಗೆ ಮಾಹಿತಿ ಕೇಳುವಂತಿಲ್ಲ. ಖರ್ಚು ವೆಚ್ಚದ ಲೆಕ್ಕಪತ್ರ ಕೇಳುವಂತಿಲ್ಲ. ಸ್ವತಂತ್ರವಾಗಿ ಯಾವ ವಿಶ್ವವಿದ್ಯಾಲಯ ಕೂಡಾ ಸಂಶೋಧನೆ ನಡೆಸುವಂತಿಲ್ಲ. ಅಣುಶಕ್ತಿ ಕುರಿತು ಯಾರೂ ಮಾಹಿತಿಯನ್ನು ಸಂಗ್ರಹಿಸುವಂತಿಲ್ಲ, ಸಂಗ್ರಹಿಸುವ ಯತ್ನ ಮಾಡುವಂತಿಲ್ಲ, ಅಥವಾ ಇತರರಿಗೆ ಮಾಹಿತಿ ನೀಡುವಂತಿಲ್ಲ. ಯಾರ ಆಸ್ತಿಯನ್ನಾಗಲಿ ಯಾವುದೇ ವಿವರಣೆ ನೀಡದೇ ಅಣುಶಕ್ತಿ ಇಲಾಖೆ ಮುಟ್ಟುಗೋಲು ಹಾಕಿಕೊಳ್ಳಬಹುದು. ಅಣುಶಕ್ತಿಯಿಂದಾಗಿ ಆರೋಗ್ಯಕ್ಕೆ ಧಕ್ಕೆ ತಗಲಿದರೆ ಪರಿಹಾರ ಕೊಡದೇ ಇರಬಹುದು.

ಇಂಥ ಕಾನೂನುಗಳ ಭದ್ರ ಕೋಟೆಯಲ್ಲಿ ಅವಿತಿಟ್ಟುಕೊಂಡ ಅಣುಶಕ್ತಿ ಇಲಾಖೆ ಜನಶಕ್ತಿಯನ್ನೂ ಪ್ರಜಾತಂತ್ರವನ್ನೂ ಹತ್ತಿಕ್ಕುತ್ತದೆ. ಅಣುಶಕ್ತಿಯ ಕರಾಳ ಸ್ವರೂಪದ ಬಗ್ಗೆ ಜನರಿಗೆ ತಿಳಿಹೇಳುವವರನ್ನು ಶಿಕ್ಷಿಸುತ್ತದೆ. ಹೈದರಾಬಾದ್‌ನ ಅಣು ಇಂಧನ ಸಂಸ್ಕರಣ ಕಾರ್ಯಾಗಾರದಿಂದ ಭೂಗರ್ಭಕ್ಕೆ ಸೇರಿದ ವಿಕಿರಣ ವಸ್ತುಗಳು ಅಲ್ಲಿಂದ ನಾಲ್ಕು ಕಿಲೋಮೀಟರ್ ದೂರದಲ್ಲಿನ ಬಾವಿಯಲ್ಲಿ ಪತ್ತೆಯಾದುದನ್ನು ವಾರ್ತಾಸಂಸ್ಥೆಗಳಿಗೆ ತಿಳಿಸಿದ ಆರೋಗ್ಯ ಅಧಿಕಾರಿಯನ್ನು ಕೆಲಸದಿಂದ ತೆಗೆದುಹಾಕಲಾಯಿತು. ಇತ್ತೀಚೆಗೆ ಮುಂಬೈನಲ್ಲಿ ವಿಕಿರಣಪೂರಿತ ಪೆನ್ಸಿಲ್ ಹಿಡಿದು ಕೆಲಸ ಮಾಡುತ್ತಿದ್ದ ಕಾರ್ಮಿಕನೊಬ್ಬನ ಬೆರಳುಗಳನ್ನು ಒಂದೊಂದಾಗಿ ಕತ್ತರಿಸಬೇಕಾಗಿ ಬಂದಾಗ, ಆ ಕುರಿತು ಪತ್ರಕರ್ತರೊಡನೆ ಮಾತನಾಡಿದ ಅಧಿಕಾರಿ ಕೆಲಸ ಕಳೆದುಕೊಳ್ಳಬೇಕಾಯಿತು.

ಅಣುಸ್ಥಾವರವನ್ನು ರಕ್ಷಿಸುವ ನೆಪದಲ್ಲಿ ರಕ್ಷಣಾ ಅಧಿಕಾರಿಗಳು ಯಾರ ಮನೆಯನ್ನೂ ಶೋಧಿಸಬಹುದು. ಯಾರನ್ನೂ ಬಂಧಿಸಬಹುದು ಅಥವಾ ಯಾರ ಆಸ್ತಿಯನ್ನೂ ಮುಟ್ಟುಗೋಲು ಹಾಕಿಕೊಳ್ಳಬಹುದು. ಅಣುಶಕ್ತಿ ಇದ್ದಲ್ಲಿ ಜನಶಕ್ತಿ ನಿರ್ವೀರ್ಯವಾಗುತ್ತದೆ.

7. ಅಣುಶಕ್ತಿ ಮುಂದಿನ ಪೀಳಿಗೆಗೆ ಹೊರೆಯಾಗುತ್ತದೆ

ಅಣುವಿಕಿರಣದ ದುಷ್ಪರಿಣಾಮ ಮುಂದೆ ಹುಟ್ಟಲಿರುವ ಮಕ್ಕಳ ಮೇಲೂ ಆಗುತ್ತದೆಂಬುದಕ್ಕೆ ಹಿರೋಶಿಮಾ-ನಾಗಾಸಾಕಿಯ ವಿಕೃತ ಸಂತಾನಗಳೇ ಸಾಕ್ಷಿಯಾಗಿವೆ. ಹುಟ್ಟುವಾಗಲೇ ಹಲವು ಬಗೆಯ ರೋಗ ರುಜಿನಗಳನ್ನೂ ವಿಕಲಾಂಗಗಳನ್ನೂ ಪಡೆದು, ಯಾವ ತಪ್ಪನ್ನೂ ಮಾಡದ ಮುಗ್ಧ ಜೀವಿಗಳು ಶಾಪಗ್ರಸ್ತ ಜೀವನ ನಡೆಸಬೇಕಾಗುತ್ತದೆ. ಅದಷ್ಟೇ ಅಲ್ಲ, ನಾವು ನಾವು ಇಂದು ಸೃಷ್ಟಿಸಿರುವ ಅಣು ಕೊಳೆಗಳನ್ನು ಚೊಕ್ಕಟ ಮಾಡಲು ಮುಂದಿನ ಪೀಳಿಗೆಯವರು ಪರದಾಡಬೇಕಾಗುತ್ತದೆ. ಅಪಾರ ಹಣ ವ್ಯಯಿಸಬೇಕಾಗುತ್ತದೆ. ಇಂದು ವಿಶ್ವಾದ್ಯಂತ ಸುಮಾರು 315 ಅಣುಸ್ಥಾವರಗಳು ಭಸ್ಮವನ್ನು ಸೃಷ್ಟಿಸುತ್ತಿವೆ. ಅದನ್ನು ಎಲ್ಲಿ ಬಚ್ಚಿಡಬೇಕು, ಎಲ್ಲಿ ಬಿಸಾಡಬೇಕು ಎಂಬ ಸಮಸ್ಯೆಗೆ ಇನ್ನೂ ಉತ್ತರ ಸಿಕ್ಕಿಲ್ಲ. ಮುಂದಿನ ಪೀಳಿಗೆಯ ಮೇಲೆ ಈ ಸಮಸ್ಯೆಯ ಭಾರ ಕೂರಲಿದೆ. ಜೊತೆಗೇ ಇನ್ನು 15 ವರ್ಷಗಳಲ್ಲಿ 300 ಅಣುಸ್ಥಾವರಗಳು ನಿವೃತ್ತಿ ಪಡೆದು ಸಮಾಧಿಯ ಸ್ಥಿತಿಗೆ ಬರುತ್ತವೆ. ಅಂಥ ನಿಷ್ಕ್ರಿಯ ಅಣುಸ್ಥಾವರಗಳನ್ನು ಕಳಚಿ ದೂರ ಸಾಗಿಸಿ ಹೂಳುವ ತಂತ್ರ ಇನ್ನೂ ಕರಗತವಾಗಿಲ್ಲ. ಅದರ ಸಂಶೋಧನೆಯ ವೆಚ್ಚವನ್ನು ಮುಂದಿನ ಜನಾಂಗದವರೇ ಭರಿಸಬೇಕು. ಉತ್ತರ ಸಿಗುವವರೆಗೆ ಇಂಥ ಮೃತ ಸ್ಥಾವರಗಳಿಗೆ ಭದ್ರ ಕಾವಲು ಹಾಕಿರಬೇಕು. ಅಂತೂ ಅಣುಶಕ್ತಿಯ "ಫಲ ನಮಗೆ, ಮಲ ಮುಂದಿನವರಿಗೆ."

ಭಾವೀ ಜನಾಂಗದ ಮೇಲೆ ದುಃಸ್ಥಿತಿಯಲ್ಲಿರುವ ಸ್ಥಾವರಗಳನ್ನೂ ಸಾಲದ ಹೊರೆಯನ್ನೂ ಹೊರಿಸಿದರೆ ಅಷ್ಟಕ್ಕೇ ಮುಗಿಯುವುದಿಲ್ಲ ಅಣು ಕತೆ. ಇನ್ನು ಇಪ್ಪತ್ತು ವರ್ಷಗಳಲ್ಲಿ ಅಣುಶಕ್ತಿ ಇಲಾಖೆಯ ಶಾಖೋಪಶಾಖೆಗಳೂ, ಪಳಗಿದ ತಂತ್ರಜ್ಞರ ಸಂಖ್ಯೆಯೂ ಎಷ್ಟು ಹೆಚ್ಚಾಗುತ್ತವೆಂದರೆ ಅಣುವಿಗೆ ಇತಿಶ್ರೀ ಹಾಕುವುದು ತೀರ ಕಠಿಣವಾಗುತ್ತದೆ. ಅಣುಶಕ್ತಿ ಅಪಾಯವೆಂದು ಎಲ್ಲರಿಗೂ ಮನದಟ್ಟಾದರೂ ಕೂಡ ಈ ದೈತ್ಯಶಕ್ತಿಗೆ ಹಣ ಸುರಿಯುತ್ತಲೇ ಇರಬೇಕಾಗುತ್ತದೆ. ಅಣುಭಸ್ಮ ಹೂಳುವ ತಂತ್ರಕ್ಕಾಗಿ ಶೋಧ ನಡೆಸಲೇಬೇಕಾಗುತ್ತದೆ. ಮೃತ ಸ್ಥಾವರಗಳು ಭೂಕಂಪಕ್ಕೋ, ಮಹಾಪೂರಕ್ಕೋ ಗುರಿಯಾಗದಂತೆ ಸದಾ ಎಚ್ಚರದಿಂದಿರಲೇಬೇಕಾಗುತ್ತದೆ. ಆ ವೇಳೆಗೆ ಬದಲೀ ಶಕ್ತಿಮೂಲಗಳಿಂದ ತೀರ ಅಗ್ಗದರದಲ್ಲಿ ವಿದ್ಯುತ್ ಉತ್ಪಾದನೆ ಸಾಧ್ಯವಾದರೂ ಕೂಡ ಅಣುಸ್ಥಾವರಗಳ ಹೆಣ ಕಾಯುವ ಕೆಲಸಕ್ಕೆಂದು ವಿಜ್ಞಾನಿಗಳನ್ನು ತರಬೇತುಗೊಳಿಸುತ್ತಲೇ ಇರಬೇಕಾಗು

11.40

ತ್ತದೆ. ಬಜೆಟ್‌ನಲ್ಲಿ ಭಾರೀ ಮೊತ್ತದ ಹಣವನ್ನು ಅಣು ಇಲಾಖೆಗಾಗಿ ಮೀಸಲಾಗಿಡಲೇಬೇಕಾಗುತ್ತದೆ. ದೇಹ ಸತ್ತರೂ ಹುಣ್ಣಿನ ಆರೈಕೆ ಮುಂದುವರಿಸಲೇಬೇಕಾಗುತ್ತದೆ. ಇಂದಿನವರ ತಪ್ಪನ್ನೇ ಮುಂದಿನವರೂ ಮಾಡುತ್ತ, ಹೋಗಬೇಕಾದ ವಿಪರ್ಯಾಸ ಸಂದರ್ಭ ಎದುರಾಗುತ್ತದೆ.

8. ಅಣುಶಕ್ತಿ ದುಂದುವೆಚ್ಚವನ್ನು ಪ್ರೇರೇಪಿಸುತ್ತದೆ

ರಹಸ್ಯ ರಕ್ಷಣೆಯ ನೆಪದಲ್ಲಿ ಅಣುಶಕ್ತಿ ಇಲಾಖೆಯ ಖರ್ಚುವೆಚ್ಚವನ್ನು ಯಾರೂ ಕೇಳುವಂತಿಲ್ಲ. ರಾಷ್ಟ್ರರಕ್ಷಣೆಯ ನೆಪದಲ್ಲಿ ಅದು ಯಾವ ಬಾಬ್ತಿನಲ್ಲಿ ಎಂಥ ಸಂಶೋಧನೆಯಲ್ಲಿ ನಿರತವಾಗಿದೆ, ಎಷ್ಟು ಹಣ ವೆಚ್ಚವಾಗುತ್ತಿದೆ ಎಂಬುದನ್ನು ಯಾರೂ ತಪಶೀಲು ಮಾಡುವಂತಿಲ್ಲ. ತನಗಿಷ್ಟವಾದ ಸಾಧನಗಳನ್ನು ತನಗಿಷ್ಟ ಬಂದ ಕಂಪನಿಗಳಿಂದ ತನಗಿಷ್ಟವಾದ ಬೆಲೆಗೆ ಖರೀದಿಸುವ ಸ್ವಾತಂತ್ರ್ಯ ಈ ಇಲಾಖೆಗಿದೆ. ಭ್ರಷ್ಟಾಚಾರ ತಾಂಡವವಾಡುತ್ತಿರುವ ಈ ದೇಶದಲ್ಲಿ ಮೇಯುವ ಸವಲತ್ತು ಈ ಇಲಾಖೆಗೆ ಇದ್ದಷ್ಟು ಬೇರೆ ಇಲಾಖೆಯಲ್ಲಿ ಇರುವಂತಿಲ್ಲ. ಇದರಿಂದ ಅಪಾರ ದುಂದುವೆಚ್ಚದ ಪ್ರವೃತ್ತಿ ಬೆಳೆಯುತ್ತದೆ. ಮದ್ರಾಸ್‌ನ ಕಲ್ಪಾಕ್ಕಮ್ ಅಣುಸ್ಥಾವರ ನಿರ್ಮಾಣಕ್ಕೆ 250 ಕೋಟಿ ರೂಪಾಯಿ ಖರ್ಚಾದರೆ, ಅದೇ ಗಾತ್ರದ ಕೈಗಾ ಸ್ಥಾವರಕ್ಕೆ 800 ಕೋಟಿ ರೂಪಾಯಿ ಖರ್ಚಾಗುತ್ತದೆಂದು ಅಂದಾಜು ಮಾಡಲಾಗಿದೆ.

ಹಣದ ದುಂದುವೆಚ್ಚ ಅಷ್ಟೇ ಅಲ್ಲ, ವಿದ್ಯುತ್ ಶಕ್ತಿಯ ದುಂದುವೆಚ್ಚಕ್ಕೂ ಅಣುಸ್ಥಾವರಗಳು ಮೂಲಪ್ರೇರಕಗಳಾಗುತ್ತವೆ. ವಿದ್ಯುತ್ ಸೋರಿಕೆಯನ್ನು ತಡೆಗಟ್ಟುವ ವಿಧಾನ ಹುಡುಕುವ ಬದಲು, ಇನ್ನೊಂದು ಅಣುಸ್ಥಾವರವನ್ನೆ ನಿರ್ಮಿಸುವ ಮನೋವೃತ್ತಿ ನಮ್ಮ ಧುರೀಣರಲ್ಲಿ ಕಾಣಬರುತ್ತಿದೆ. ಅಪಾಯದ ಅಣುಸ್ಥಾವರಗಳನ್ನು ದೂರ ಏಕಾಂತದಲ್ಲಿ ಸ್ಥಾಪಿಸಿ ಅಲ್ಲಿಂದ ನೂರಾರು ಕಿಲೊಮೀಟರ್‌ವರೆಗೆ ವಿದ್ಯುತ್ತನ್ನು ಸಾಗಿಸಿ ತರುವಾಗ ಉಂಟಾಗುವ ಸೋರಿಕೆಯೂ ದುಂದುವೆಚ್ಚದ ಬಾಬ್ತಿಗೇ ಸೇರುತ್ತದೆ.

9. ಬದಲೀ ಶಕ್ತಿಯನ್ನು ಬದಿಗೊತ್ತುವ ಅಣು

ಅಣುಶಕ್ತಿಯ ಉತ್ಪಾದನೆಗೆಂದು ಭಾರೀ ಹಣ ವೆಚ್ಚಮಾಡುವ ಸರಕಾರಕ್ಕೆ ಬದಲೀ ವಿದ್ಯುತ್ ಮೂಲಗಳ ಬಗ್ಗೆ ತಾತ್ಸಾರ ಮನೋಭಾವ ಇರುವುದನ್ನು

ನಾವಿಂದು ಎಲ್ಲ ಕಡೆ ಕಾಣಬಹುದಾಗಿದೆ. ಚಿಕ್ಕಪುಟ್ಟ ಅಣೆಕಟ್ಟುಗಳನ್ನು ನಿರ್ಮಿಸು ವಲ್ಲಿ ಯಾರಿಗೂ ಆಸಕ್ತಿ ಇಲ್ಲ. ಪರಿಸರದ ದೃಷ್ಟಿಯಿಂದ ಸುರಕ್ಷಿತವಾದ ಸೌರಶಕ್ತಿ ಯನ್ನೋ, ಚಿಕ್ಕಪುಟ್ಟ ಗಾಳಿಯಂತ್ರಗಳನ್ನೋ, ಸಮುದ್ರದ ಭರತಿಯಿಂದ ವಿದ್ಯುತ್ ಉತ್ಪಾದಿಸುವ ತಂತ್ರವನ್ನೋ ಬಳಕೆಗೆ ತರಲು ಬೇಕಾದಷ್ಟು ಹಣ ಲಭ್ಯವಾಗುತ್ತಿಲ್ಲ. ಅಂಥ ಸಂಶೋಧಕರಿಗೆ ಮಾನ್ಯತೆಯಾಗಲಿ, ಗೌರವವಾಗಲಿ, ವಿದೇಶ ಯಾತ್ರೆಯ ಸೌಲಭ್ಯಗಳಾಗಲಿ ಸಿಗುತ್ತಿಲ್ಲ. ಭಾರತದಂಥ ದೇಶದಲ್ಲಿ ವಿದ್ಯುತ್ ಬಳಕೆ ಪ್ರಮಾಣ ಒಟ್ಟು ಶಕ್ತಿ ಬಳಕೆಯ ಕೇವಲ ಶೇಕಡಾ 20 ರಷ್ಟಿದ್ದರೂ, ಬದಲೀ ಶಕ್ತಿ ಮೂಲಗಳ ಶೋಧನೆಗೆ ಸೂಕ್ತ ಪ್ರಮಾಣದ ಹಣ ಲಭಿಸುತ್ತಿಲ್ಲ. ಒಲೆ ಉರಿಸಲಿಕ್ಕೆ ಸೌದೆ, ಗೊಬ್ಬರ ಅನಿಲ ಸ್ಥಾವರಗಳೆಂದರೆ ತಾತ್ಸಾರ ವ್ಯಕ್ತವಾಗುತ್ತಿದೆ. ವಿದ್ಯುತ್ ಬಳಕೆಯ ತಲಾ ಪ್ರಮಾಣವೇ ದೇಶದ ಪ್ರಗತಿಯ ಲಕ್ಷಣವೆಂದು ಭಾವಿಸಿ, ಫ್ಯಾಕ್ಟರಿಗಳಲ್ಲಿ ನೀರು ಕಾಯಿಸುವಂಥ ಯಃಕಶ್ಚಿತ ಕೆಲಸಕ್ಕೂ ವಿದ್ಯುತ್ತನ್ನೇ ಬಳಸಲಾಗುತ್ತಿದೆ. ಅಂಥ ಬಾರೀ ಬಳಕೆದಾರರೇ ಅಣುಸ್ಥಾವರ ಬೇಕೆಂದು ಬೊಬ್ಬೆ ಇಡುತ್ತಾರೆ; ಅಣು ಸ್ಥಾವರದ ಎಲ್ಲ ಅನಿಷ್ಟಗಳನ್ನೂ ಮುಗ್ಧ ಜನರ ಮೇಲೆ, ಮುಂದಿನ ಪೀಳಿಗೆಯ ಮೇಲೆ ಹೊರಿಸಿ ನಿಶ್ಚಿಂತರಾಗಿ ವಿದ್ಯುತ್ತಿನ ದುಂದು ಬಳಕೆಯಲ್ಲಿ ನಿರತರಾಗಿರುತ್ತಾರೆ.

ಅಣುಶಕ್ತಿ ಇಲಾಖೆಗೆ ಈ ವರೆಗೆ ಸುರಿದ ಅನೇಕ ಸಹಸ್ರ ಕೋಟಿ ರೂಪಾಯಿ ಗಳನ್ನು ಬೇರೆ ಶಕ್ತಿಮೂಲಗಳಿಗೆ ವಿನಿಯೋಗಿಸಿದ್ದರೆ, ಈಗಿರುವಂಥ ಶಕ್ತಿಕ್ಷಾಮದ ಸಮಸ್ಯೆಯೇ ಎದುರಾಗುತ್ತಿರಲಿಲ್ಲ. ನಮ್ಮಲ್ಲಿ ಇನ್ನೂ 200 ವರ್ಷಗಳಿಗೆ ಸಾಕಾಗು ವಷ್ಟು ಕಲ್ಲಿದ್ದಲು ಇದೆ. ಅದರ ಗುಣಮಟ್ಟವನ್ನು ವರ್ಧಿಸಿ, ಮಾಲಿನ್ಯವನ್ನು ಕಡಿಮೆ ಮಾಡುವತ್ತ ಸಂಶೋಧನೆ ನಡೆಸಿದ್ದರೆ ರಾಯಚೂರಿನಲ್ಲಿರುವಂಥ ಅನೇಕ ಶಾಖೋತ್ಪನ್ನ ವಿದ್ಯುದಾಗಾರ ಸ್ಥಾಪಿಸಬಹುದು. ನಮ್ಮಲ್ಲಿ ಈಗಿನ ಜಲವಿದ್ಯುತ್ ಸಾಮರ್ಥ್ಯವನ್ನು ಇನ್ನೂ ಆರುಪಟ್ಟು ಹೆಚ್ಚಿಸಿಕೊಳ್ಳುವ ಸಾಧ್ಯತೆ ಇದೆ. ಚಿಕ್ಕ ಚಿಕ್ಕ ವಿದ್ಯುತ್ ಘಟಕಗಳ ಮೂಲಕ ವಿದ್ಯುತ್ ಉತ್ಪಾದನೆ ಮಾಡಬಹುದು. ವಿದ್ಯುತ್ ಶಕ್ತಿಯನ್ನು ಬಳಸುವ ಯಂತ್ರೋಪಕರಣಗಳನ್ನು ಸುಸ್ಥಿತಿಯಲ್ಲಿಟ್ಟು ಅವುಗಳ ದಕ್ಷತೆ ಹೆಚ್ಚಿಸಿದರೆ ಈಗಿನ ವಿದ್ಯುತ್ ಬಳಕೆಯನ್ನು ಶೇಕಡಾ 30 ರಷ್ಟು ಕಮ್ಮಿ ಮಾಡಬಹುದು. ನಮ್ಮಲ್ಲಿ ವಿದ್ಯುತ್ ತಂತಿಗಳಲ್ಲೇ ಶೇಕಡಾ 25ರಷ್ಟು ಶಕ್ತಿ ಸೋರಿಹೋಗುತ್ತಿದೆ. ಸುಧಾರಿತ ದೇಶಗಳ ಹಾಗೆ ನಾವು ಉತ್ತಮ ಗುಣ ಮಟ್ಟದ ಟ್ರಾನ್ಸ್‌ಫಾರ್ಮರ್ ಹಾಕಿದರೆ ಈ ಸೋರಿಕೆಯ ಬಹುಭಾಗವನ್ನು ತಡೆಗಟ್ಟಬಹುದು. ನಮ್ಮಲ್ಲಿ ವರ್ಷಕ್ಕೆ 8 ತಿಂಗಳ ಕಾಲ ಹೇರಳ ಸೌರಶಕ್ತಿ ಲಭ್ಯವಿದೆ. ಗಾಳಿ, ಬಿಸಿಲು, ಅಲೆ ಅಬ್ಬರಗಳಲ್ಲಿ ಅಗಾಧ ಶಕ್ತಿಸಂಚಯವಿರುವ

ಸುದೀರ್ಘ ಸಮುದ್ರತೀರವಿದೆ. ಇವೆಲ್ಲವುಗಳ ಬಳಕೆಗೆ ಅಣುಶಕ್ತಿ ಅಡ್ಡಿ ಒಡ್ಡುತ್ತಿದೆ.

10. ಮಿಥ್ಯೆ, ತಥ್ಯ

ಈವರೆಗೆ ಅಣುಶಕ್ತಿಯ 10 ಕರಾಳ ಮುಖಗಳನ್ನು ನೋಡಿದ್ದಾಯಿತು. ತನ್ನ ವೈಫಲ್ಯಗಳನ್ನೂ ಅಜನ್ಮದುರ್ಗುಣಗಳನ್ನೂ ಮುಚ್ಚಿಕೊಳ್ಳಲೆಂದು ಅಣುಶಕ್ತಿ ಇಲಾಖೆ ಆಗಾಗ ಅನೇಕ ವಕ್ರ ಹೇಳಿಕೆಗಳನ್ನು ನೀಡುತ್ತಿರುತ್ತದೆ. ಇಂಥ ಹೇಳಿಕೆಗಳಲ್ಲಿ ಏನೇನೂ ಹುರುಳಿಲ್ಲದಿದ್ದರೂ ಸೋಗಲಾಡಿ ರಾಜಕಾರಣಿಗಳು ಅದನ್ನು ನಿಜವೆಂದೇ ನಂಬುತ್ತಾರೆ, ತಾವೂ ಅಂಥದೇ ಗಿಣಿಪಾಠ ರೂಢಿಸಿಕೊಳ್ಳುತ್ತಾರೆ. ಅಂಥ ಹತ್ತು ಪ್ರಮುಖ ವಕ್ರ ಹೇಳಿಕೆಗಳು ಇಲ್ಲಿವೆ. (ನಿಜಾಂಶ ಏನೆಂಬುದನ್ನು ಆವರಣದಲ್ಲಿ ಕೊಡಲಾಗಿದೆ.)

1. ನಮ್ಮ ಅಣುಸ್ಥಾವರಗಳು ಇತರ ದೇಶಗಳ ಸ್ಥಾವರಗಳಿಗಿಂತ ಹೆಚ್ಚು ಭದ್ರವಾಗಿವೆ. ಇಲ್ಲಿ ಅಪಘಾತ ಆಗದು. ಯಾರೂ ಭಯಪಡುವ ಕಾರಣವಿಲ್ಲ.

(ನಮ್ಮ ಅಣುಸ್ಥಾವರಗಳಲ್ಲೂ ಒಂದಲ್ಲ ಹತ್ತಾರು ಬಾರಿ ಅಪಘಾತ ಆಗಿವೆ. ರಾಜಸ್ಥಾನದ ಘಟಕವನ್ನು ಸರಿಪಡಿಸಲು ಸಾಧ್ಯವೇ ಆಗದೆ, ಐದೇ ವರ್ಷಗಳಲ್ಲಿ ಮುಚ್ಚಲಾಗಿದೆ. ಅಪಘಾತಗಳ ಸುದ್ದಿಯನ್ನು ಮಾತ್ರ ಭದ್ರವಾಗಿ ಬಚ್ಚಿಡಲಾಗುತ್ತಿದೆ.)

2. ನಿಸರ್ಗದಲ್ಲಿ ಸಹಜವಾಗಿಯೇ ವಿಕಿರಣ ಸಾಕಷ್ಟಿದೆ. ಯಾರಿಗೂ ಅಪಾಯ ಆಗಿಲ್ಲ.

(ನೈಸರ್ಗಿಕ ವಿಕಿರಣ ತುಂಬ ದುರ್ಬಲವಾಗಿರುತ್ತದೆ. ಕೇರಳದ ಥೋರಿಯಂ ಮರಳುರಾಶಿಯ ಬಳಿ ಮನೆ ಕಟ್ಟಿಕೊಂಡವರಲ್ಲಿ ಅನೇಕ ಬುದ್ಧಿಮಾಂದ್ಯರೂ ರೋಗಗ್ರಸ್ತರೂ ಇದ್ದಾರೆಂಬುದಕ್ಕೆ ದಾಖಲೆಗಳಿವೆ. ಅಷ್ಟಕ್ಕೂ ನಿಸರ್ಗದಲ್ಲಿ ವಿಕಿರಣ ಇದೆಯೆಂಬ ಮಾತ್ರಕ್ಕೇ ಇನ್ನೂ ಹೆಚ್ಚು ವಿಕಿರಣವನ್ನು ಸೃಷ್ಟಿಸುವ ಅಧಿಕಾರ ನಮಗಿಲ್ಲ. ನಿಸರ್ಗದಲ್ಲಿ ಜ್ವಾಲಾಮುಖಿಗಳಿವೆಯೆಂದ ಮಾತ್ರಕ್ಕೇ ನಾವೂ ಬಾಂಬ್ ಆಸ್ಫೋಟಿಸಿ ಇನ್ನಷ್ಟು ಜ್ವಾಲಾಮುಖಿ ಸೃಷ್ಟಿಸಬಹುದೆ?)

3. ಅಣುಸ್ಥಾವರಗಳಲ್ಲಿನ ಅಪಘಾತಕ್ಕಿಂತ ರಸ್ತೆ ಅಪಘಾತಗಳಲ್ಲೇ ಹೆಚ್ಚು ಜನ ಸಾಯುತ್ತಾರೆ.

(ರಸ್ತೆ ಅಪಘಾತ ಪ್ರತ್ಯಕ್ಷ ಕಾಣುತ್ತದೆ. ಸ್ವಯಂ ಇಚ್ಛೆಯಿಂದ ರಸ್ತೆಗೆ ಇಳಿದವರು ಅಪಾಯ ಎದುರಿಸುತ್ತಾರೆಯೇ ವಿನಾ ದೂರದಲ್ಲಿರುವ ಮುಗ್ಧ ಜನರನ್ನೂ ದೇಶದ ಗಡಿಯಾಚೆ ಇರುವವರನ್ನೂ ವಾಹನಗಳು ಬಲಿತೆಗೆದು ಕೊಳ್ಳುವುದಿಲ್ಲ. ಅಣುಸ್ಥಾವರಗಳ ಅಧ್ವಾನಕ್ಕೆ ತಟಸ್ಥರೂ ಬಲಿಯಾಗುತ್ತಾರೆ.)

4. ಶಕ್ತಿಯ ಕ್ಷಾಮ ಹೆಚ್ಚುತ್ತಿದೆ. ಶಕ್ತಿ ಮೂಲಗಳೆಲ್ಲ ಬತ್ತುತ್ತಿವೆ. ಅಣು ಶಕ್ತಿಯೊಂದೇ ಮುಂದಿನ ಜನಾಂಗಕ್ಕೆ ಬೆಳಕು ತೋರಿಸುವ ಸಾಮರ್ಥ್ಯ ಪಡೆದಿದೆ.

(ಶಕ್ತಿಯ ದುಂದುವೆಚ್ಚ ಹೆಚ್ಚುತ್ತಿದೆ. ಶಕ್ತಿಯ ಬದಲಿ ಮೂಲಗಳನ್ನು ಹುಡುಕುವಲ್ಲಿ ಆಸಕ್ತಿ ಕುದುರಿಲ್ಲ. ಮುಂದಿನ ಜನಾಂಗಕ್ಕೆ ಅಣುಶಕ್ತಿ ಶಾಪವಾಗಲಿದೆ.)

5. ಕಲ್ಲಿದ್ದಲಿನಿಂದಲೂ ಪರಿಸರ ಮಾಲಿನ್ಯ ಹೆಚ್ಚುತ್ತದೆ. ದೊಡ್ಡ ಅಣೆ ಕಟ್ಟುಗಳಿಗೂ ಪರಿಸರಪ್ರೇಮಿಗಳ ವಿರೋಧ ಹೆಚ್ಚುತ್ತಿದೆ.

(ಕಲ್ಲಿದ್ದಲಾಗಲೀ, ದೊಡ್ಡ ಅಣೆಕಟ್ಟುಗಳಾಗಲೀ ನಮಗೆ ನಪುಂಸಕತ್ವ ಬರಿಸುವುದಿಲ್ಲ. ವಿಕೃತ ಸಂತಾನವನ್ನು ಸೃಷ್ಟಿಸುವುದಿಲ್ಲ.)

6. ಅಣುಶಕ್ತಿ ಅಷ್ಟೇನೂ ವೆಚ್ಚದ್ದಲ್ಲ. ಗಣಿಯ ಬಳಿ ಕಲ್ಲಿದ್ದಲನ್ನು ಉರಿಸಿ ವಿದ್ಯುತ್ ಉತ್ಪಾದಿಸಿದಷ್ಟೇ ವೆಚ್ಚ ತಗಲುತ್ತದೆ.

(ಅಣುಶಕ್ತಿಯ 'ಇತರ' ವೆಚ್ಚಗಳನ್ನು ಮರೆಮಾಚಲಾಗುತ್ತದೆ. ಸ್ಥಾವರ ಸಮಾಧಿಗೆ ತಗಲುವ ವೆಚ್ಚವನ್ನು ಮುಂದಿನ ಜನಾಂಗದವರ ತಲೆಗೆ ಕಟ್ಟಲಾಗುತ್ತಿದೆ.)

7. ಅಣುಶಕ್ತಿಗೆ ಸ್ಥಳೀಯ ಜನರ ವಿರೋಧ ಇಲ್ಲ. ನಗರಗಳ ಕೆಲವೇ ಬುದ್ಧಿಜೀವಿಗಳು ಮುಗ್ಧರ ದಾರಿ ತಪ್ಪಿಸುತ್ತಾರೆ.

(ಸ್ಥಳೀಯ ಜನರಿಗೆ ಅಣುಶಕ್ತಿಯ ನಿಜಸ್ವರೂಪ ಗೊತ್ತಾಗಿಲ್ಲ. ಚೆರ್ನೊಬಿಲ್ ಅಥವಾ ಮುರೂರೊವಾ ದ್ವೀಪಗಳಲ್ಲಿ ಅಣುವಿಕಿರಣ ಹಾವಳಿಯ ಬಗ್ಗೆ ಯಾರೂ ಅವರಿಗೆ ಹೇಳಿಲ್ಲ.)

8. ಅಣುಸ್ಥಾವರದ ಸುತ್ತಮುತ್ತ ಮಾಮೂಲು ದಿನಗಳಲ್ಲಿ ವಿಕಿರಣ ಸೂಸುವುದಿಲ್ಲ.

(ಸೂಸಿದರೂ ಅದನ್ನು ಪತ್ತೆಮಾಡುವ ಸಲಕರಣೆ ಜನಸಾಮಾನ್ಯರಿಗೆ ಲಭ್ಯವಿಲ್ಲ. ಅಷ್ಟಕ್ಕೂ 'ಮಾಮೂಲು' ದಿನಗಳು ತುಂಬ ಕಮ್ಮಿ. ಕಲ್ಪಾಕ್ಕಮ್‌ನಲ್ಲಿ

1984ರ ಇಡೀ ವರ್ಷದಲ್ಲಿ 65 ದಿನಗಳು ಮಾತ್ರ ಮಾಮೂಲು ದಿನಗಳಾಗಿದ್ದವು)

9. ಪರಿಸರ ಪ್ರೇಮಿಗಳೂ ಅಣುವಿದ್ಯುತ್ ವಿರೋಧಿಗಳೂ ಹಳೇ ಸುದ್ದಿ, ತಪ್ಪು ಸುದ್ದಿ ಹಾಗೂ ಸುಳ್ಳು ಸುದ್ದಿಗಳನ್ನು ಸೃಷ್ಟಿಸುತ್ತಾರೆ.

(ಇದು ಹಳೇ ಆಪಾದನೆ, ತಪ್ಪು ಆಪಾದನೆ ಹಾಗೂ ಸುಳ್ಳು ಆಪಾದನೆ.)

10. ಅಣುವಿರೋಧಿಗಳು ಸಿಐಎ ಏಜಂಟರು. ಭಾರತದ ಪ್ರಗತಿಯನ್ನು ಸಹಿಸಲಾರದ ವಿದೇಶಿ ಶಕ್ತಿಗಳ ಕೈಗೊಂಬೆಗಳು.

(ಅಣುಸ್ಥಾವರಗಳ ಸಂಖ್ಯೆ ಹೆಚ್ಚಾದರೇನೇ ವಿದೇಶೀ ಶಕ್ತಿಗಳ ಅಭೀಷ್ಟ ನೆರವೇರುತ್ತದೆ. ಹಣದ ಹೊಳೆ ಹರಿಯುತ್ತದೆ. ಭಯೋತ್ಪಾದಕರಿಗೆ ಅನುಕೂಲ ವಾಗುತ್ತದೆ. ರಾಷ್ಟ್ರದ ಭದ್ರತೆಯನ್ನು ಶಿಥಿಲಗೊಳಿಸುವ ವಿಪುಲ ಅವಕಾಶಗಳು ಲಭಿಸುತ್ತವೆ. ವಿದೇಶೀ ಶಕ್ತಿಯ ಕೈವಾಡ ಇರುವುದೇ ನಿಜವಾದರೆ ಅದು ಅಧಿಕಾರಸ್ಥರ ವಲಯದಲ್ಲಿ ಇರುತ್ತದೆಯೇ ಹೊರತು ಪರಿಸರಪ್ರೇಮಿಗಳ ಬಳಿ ಸುಳಿಯುವುದಿಲ್ಲ.

ಕೈಗಾ ವಿರೋಧಕ್ಕೆ 10 ಕಾರಣಗಳು

1. ಪಶ್ಚಿಮ ಘಟ್ಟದ ಸದಾಹಸಿರಿನ ದಟ್ಟ ಮಳೆಕಾಡಿನ ಸೂಕ್ಷ್ಮಜೀವ ಪರಿಸರದ ಮಧ್ಯೆ ಕೈಗಾ ಸ್ಥಾವರ ತಲೆಯೆತ್ತಲಿದೆ. ಅರಣ್ಯ ಜೀವಜಾಲಕ್ಕೆ ಉಂಟಾಗುವ ನಷ್ಟವನ್ನು ಯಾರೂ ತುಂಬಿಕೊಡಲು ಸಾಧ್ಯವಿಲ್ಲ.

2. ಒಮ್ಮೆ ಅಣುಸ್ಥಾವರದ ಸ್ಥಾಪನೆ ಆಯಿತೆಂದರೆ, ಅಣುಸ್ಥಾವರಗಳ ಸರಮಾಲೆಯೇ ನಿರ್ಮಾಣವಾಗುತ್ತದೆ. ನಾಗರಿಕರ ಯಾವ ನಿಯಂತ್ರಣಕ್ಕೂ ಒಳಪಡದೇ ಒಂದರ ಹಿಂದೊಂದು ಸ್ಥಾವರ ಸೃಷ್ಟಿಯಾಗುತ್ತಲೇ ಇರುತ್ತದೆ. ಸಹಸ್ರಾರು ವರ್ಷಗಳ ಕಾಲ ಕಾಳಿಕಣಿವೆ ಮೃತ ಅಣುಸ್ಥಾವರಗಳ ಗೋರಿಯಾಗಿ ಉಳಿಯುತ್ತದೆ.

3. ಏಳು ದೊಡ್ಡ ಅಣೆಕಟ್ಟುಗಳ ಕೆಳಭಾಗದಲ್ಲಿ ಅಣುಸ್ಥಾವರದ ನಿರ್ಮಾಣ ಆಗಲಿದೆ. ಭೂಕಂಪ, ಶಿಲಾಸ್ತರ ಭಂಗದಂಥ ಯಾವ ನೈಸರ್ಗಿಕ ಪ್ರಕೋಪ

ದಿಂದಲೂ ಅಪಾಯ ಉಂಟಾಗದಂತೆ ಸಹಸ್ರಾರು ವರ್ಷಗಳ ಕಾಲ ಅಣುಸ್ಥಾವರಗಳನ್ನು ಕಾಪಾಡುವ ಹೊಣೆ ಮುಂದಿನ ಜನಾಂಗದವರ ಮೇಲೆ ಬೀಳುತ್ತದೆ.

4. ಕಾಳಿಯಿಂದ ಹರಿದು ಬರುವ ಅಣುವಿಕಿರಣಮಿಶ್ರಿತ ನೀರಿನಿಂದಾಗಿ ಅಳಿವೆಯ ಬೆಸ್ತರಿಗಷ್ಟೇ ಅಲ್ಲ, ಗೋವಾದಿಂದ ಭಟ್ಕಳ-ಮಂಗಳೂರಿನವರೆಗೂ ಕಡಲ ತೀರಕ್ಕೆ ಅಪಾಯ ಎದುರಾಗಲಿದೆ.

5. ಸ್ಥಳೀಯ ಬಡವರನ್ನು ನಿರಾಶ್ರಿತರನ್ನಾಗಿ ಇನ್ನಷ್ಟು ಬಡವರನ್ನಾಗಿ ಮಾಡಿ, ದೂರದ ಧನಿಕರನ್ನು ಮತ್ತಷ್ಟು ಧನಾಢ್ಯರನ್ನಾಗಿ ಮಾಡುವ ಯೋಜನೆ ಇದು.

6. ನಿರ್ಮಾಣ ಹಂತದ ಮೊದಲ 15 ವರ್ಷಗಳಲ್ಲಿ ಇದು ಕರ್ನಾಟಕದಿಂದ ಭಾರೀ ಪ್ರಮಾಣದ ವಿದ್ಯುತ್ತನ್ನು ಕಬಳಿಸುತ್ತದೆ.

7. ನಿರ್ಮಾಣ ಪೂರ್ತಿಗೊಂಡಮೇಲೆ ಇದರಿಂದ ಲಭ್ಯವಾಗುವ ವಿದ್ಯುತ್ತಿಗೆ ನೆರೆಯ ಎಲ್ಲ ರಾಜ್ಯಗಳೂ ಪಾಲುದಾರರಾಗುತ್ತವೆ. ಕರ್ನಾಟಕದ ವಿದ್ಯುತ್ ಬಳಕೆ ಕೇಂದ್ರಗಳೆಲ್ಲ ಅತಿ ದೂರದಲ್ಲಿದ್ದು ಸಾಗಾಣಿಕೆಯಲ್ಲೇ ಬಹುಪಾಲು ವಿದ್ಯುತ್ ಸೋರಿಕೆಯಾಗುತ್ತದೆ.

8. ಉತ್ತರ ಕನ್ನಡ ಜಿಲ್ಲೆಯ ರಾಜಮಾರ್ಗಗಳಲ್ಲಿ ಅಣು ಇಂಧನ, ಅಣು ಕಚಡಾ ಪದಾರ್ಥಗಳ ಸಾಗಾಟ ಹೆಚ್ಚಾಗಿ ಅಪಘಾತಗಳ ಸಂಭವ ವ್ಯಾಪಕವಾಗುತ್ತದೆ. ಜನರ ವೈಯಕ್ತಿಕ ಸ್ವಾತಂತ್ರ್ಯಕ್ಕೆ ಧಕ್ಕೆ ತಗಲುತ್ತದೆ.

9. ಅಣುಸ್ಥಾವರಗಳಿಂದ ಸದಾ ಹೊರಸೂಸುವ ಹಾಗೂ ಅಪಘಾತ ಸಂದರ್ಭದಲ್ಲಿ ಭುಗಿಲೇಳುವ ವಿಕಿರಣ ಮೋಡಗಳಿಂದಾಗಿ ಇಡೀ ಜಿಲ್ಲೆಯ ತೋಟದ ಬೆಳೆಗಳು ನಿರುಪಯುಕ್ತವಾಗುತ್ತವೆ. ಅಪಘಾತದ ಸುಳ್ಳು ವದಂತಿಯಿಂದಲೂ ಅಡಿಕೆ, ಮೆಣಸು, ಏಲಕ್ಕಿ ಧಾರಣೆ ಕುಸಿಯುತ್ತದೆ.

10. ವೈರಿದೇಶಗಳ ಹಾಗೂ ಭಯೋತ್ಪಾದಕರ ದೃಷ್ಟಿಯೆಲ್ಲ ಈ ಜಿಲ್ಲೆಯ ಕಡೆ ಹರಿಯುತ್ತದೆ. ಅಣೆಕಟ್ಟುಗಳ ಸರಮಾಲೆ, ಅಣುಸ್ಥಾವರ ಹಾಗೂ ನೌಕಾ

ನೆಲೆಗಳಂಥ ಗಂಡಾಂತರಕಾರೀ ಯೋಜನೆಗಳು ಒಂದೇ ಕಡೆ ಕೇಂದ್ರೀಕೃತವಾದರೆ ಯಾರಿಗೂ ಕ್ಷೇಮವಲ್ಲ.

* * *

ಜಗತ್ತಿನಾದ್ಯಂತ ಇಂದು ಮಳೆಕಾಡುಗಳು ತೀವ್ರಗತಿಯಲ್ಲಿ ನಾಶವಾಗುತ್ತಿವೆ. ಇಲ್ಲಿನ ಕೋಟ್ಯಾನುಕೋಟಿ ಜೀವ ಜಂತುಗಳು ಮಾನವನ ಅತಿಕ್ರಮಣದಿಂದಾಗಿ ಕಣ್ಮರೆಯಾಗುತ್ತಿವೆ. 'ಜೀವವಿಕಾಸದ ತೊಟ್ಟಿಲು' ಎಂದೇ ಹೆಸರುಗೊಂಡ ಈ ಸದಾಹಸಿರಿನ ಅರಣ್ಯಗಳಲ್ಲಿ ಜೀವವೈವಿಧ್ಯ ಕಮ್ಮಿಯಾಗುತ್ತ ಬಂದರೆ ಎಂಥ ಪ್ರಯತ್ನದಿಂದಲೂ ಜೀವಿಗಳನ್ನು ಮತ್ತೆ ಸೃಷ್ಟಿಸಲು ಸಾಧ್ಯವಿಲ್ಲ. ಜೀವಜಾಲದ ನಾಶದಿಂದ ನಾಳಿನ ಪರಿಸರದ ಮೇಲಾಗುವ ಪರಿಣಾಮಗಳನ್ನು ಊಹಿಸಲು ಸಾಧ್ಯವಿಲ್ಲ.

ಅದಕ್ಕೇ ಇಂದು ಅಳಿದುಳಿದ ಈ ಮಳೆಕಾಡುಗಳನ್ನು ಹೇಗಾದರೂ ರಕ್ಷಿಸಿಕೊಳ್ಳಬೇಕೆಂದು ಎಲ್ಲ ದೇಶಗಳ ಜೀವತಜ್ಞರೂ ಕರೆ ನೀಡುತ್ತಿದ್ದಾರೆ. ಕೋಟಿಗಟ್ಟಲೆ ವರ್ಷಗಳಿಂದ ತಾನೇತಾನಾಗಿ ವಿಕಾಸಗೊಂಡಿರುವ ಈ ಕಾಡುಗಳಲ್ಲಿ ಮಾನವನ ಹಸ್ತಕ್ಷೇಪ ನಿಲ್ಲಬೇಕು; ಯಾವುದೇ ಬಗೆಯ 'ಅಭಿವೃದ್ಧಿ' ಕಾರ್ಯಗಳನ್ನೂ ಇಲ್ಲಿ ಪ್ರಾರಂಭಿಸಬಾರದು—ಎಂಬುದಾಗಿ ವಿಶ್ವಸಂಸ್ಥೆಯ ತಜ್ಞರು ಎಲ್ಲ ದೇಶಗಳಿಗೆ ವಿನಂತಿಸಿಕೊಂಡಿದ್ದಾರೆ.

ಕೈಗಾ ಹಳ್ಳಿಯ ಸುತ್ತಮುತ್ತ ಇಂಥ ಸದಾಹಸಿರಿನ ದಟ್ಟ ಮಳೆಕಾಡು ಇದೆ. ಸೂರ್ಯರಶ್ಮಿಯೂ ನೆಲತಲುಪದಂಥ ಈ ಗೋಂಡಾರಣ್ಯದಲ್ಲಿ ಎಂತೆಂಥ ಸಸ್ಯರಾಶಿ ಜೀವಜಂತು ಇವೆಯೆಂಬುದನ್ನು ಸರ್ವೆ ಮಾಡುವ ಮೊದಲೇ ಅಣುಸ್ಥಾವರಕ್ಕೆಂದು, ಅಣೆಕಟ್ಟೆಗೆಂದು ಅರಣ್ಯ ಕಡಿಯುವ ಕೆಲಸ ಪ್ರಾರಂಭವಾಗಿದೆ. ಅಣುಸ್ಥಾವರಕ್ಕೆಂದು ಕೇವಲ 4 ಸಾವಿರ ಹೆಕ್ಟೇರ್ ಭೂಮಿಯನ್ನು ಬಳಸುತ್ತೇವೆಂದು ಅಣುಶಕ್ತಿ ಇಲಾಖೆಯ ಅಧಿಕಾರಿ ಹೇಳಿದ್ದನ್ನು ನಂಬುವಂತಿಲ್ಲ. ಏಕೆಂದರೆ ಅಣುಸ್ಥಾವರ ನಿರ್ಮಾಣದ ಹಂತದಲ್ಲಿ ಕಾರ್ಮಿಕರ ವಸತಿಗೆಂದು, ನೀರು-ರಸ್ತೆ-ವಿದ್ಯುತ್ ಪೂರೈಕೆಗೆಂದು ಇನ್ನೂ ಎಷ್ಟೋ ಪಟ್ಟು ಹೆಚ್ಚು ಅರಣ್ಯ ನಾಶವಾಗುತ್ತದೆ. ಅಣುಸ್ಥಾವರ ನಿರ್ಮಾಣ ಆದಮೇಲೆಯೂ ತಂತ್ರಜ್ಞರ ಕಾಲೋನಿಗೆಂದು, ವಿದ್ಯುತ್ ಸಾಗಾಟಕ್ಕೆಂದು, ಕಚಡಾ ವಸ್ತುಗಳ ಸಂಗ್ರಹಕ್ಕೆಂದು, ಮಿಲಿಟರಿ ತುಕಡಿಗಳ ವಸಾಹತಿಗೆಂದು ಅರಣ್ಯ ಇನ್ನಷ್ಟು ಮತ್ತಷ್ಟು ನಾಶವಾಗುತ್ತಲೇ ಹೋಗುತ್ತದೆ. ಅಣುಸ್ಥಾವರಗಳ ಸಮಾಧಿ ಆದನಂತರವೂ ಭಗ್ನ ಸ್ಥಾವರಗಳ ರಕ್ಷಣೆಗೆಂದು ಇನ್ನಷ್ಟು

ಹೊಸ ಸ್ಥಾವರಗಳನ್ನು ನಿರ್ಮಿಸಬೇಕಾಗುತ್ತದೆ. ಈ ಸರಪಳಿಕ್ರಿಯೆ ನಿರಂತರ ನಡೆಯುತ್ತ ಹೋಗಿ ಅರಣ್ಯಗಳ ಕಬಳಿಕೆಯೂ ಎಗ್ಗಿಲ್ಲದೆ ಸಾಗುತ್ತದೆ.

ಕೃತಕವಾಗಿ ಅರಣ್ಯ ಬೆಳೆಸುತ್ತೇವೆಂದು ಅಣುತಜ್ಞರು ಹೇಳುತ್ತಾರಾದರೂ ಅದು ಎಂದಿಗೂ ನೈಸರ್ಗಿಕ ಅರಣ್ಯಕ್ಕೆ ಸರಿಸಾಟಿಯಾಗಲಾರದು. ಕೋಟ್ಯಂತರ ವರ್ಷಗಳಿಂದ ತಂತಾನೇ ವಿಕಾಸಗೊಂಡ ಸಂಕೀರ್ಣ ಜೀವರಾಶಿಯನ್ನು ಮತ್ತೆ ನಿರ್ಮಿಸಲು ಮಾನವನಿಂದ ಸಾಧ್ಯವಿಲ್ಲ.

ಜಗತ್ತಿನಲ್ಲಿ ಈವರೆಗೆ ಯಾವ ಮಳೆಕಾಡಿನಲ್ಲೂ ಅಣುಸ್ಥಾವರ ಸ್ಥಾಪಿಸಿದ ದಾಖಲೆ ಇಲ್ಲ. ಅಣುವಿಕಿರಣದಿಂದಾಗಿ ವಿಕೃತರೂಪದ ಮಾನವ ಶಿಶುಗಳು ಜನಿಸಿದ್ದು ನಮಗೆ ಗೊತ್ತು. ಪ್ರಯೋಗಶಾಲೆಯಲ್ಲಿ ನೊಣಗಳು ಅಣುವಿಕಿರಣದ ಪರಿಣಾಮದಿಂದ ತಲೆಯ ಮೇಲೆ ಕಾಲುಗಳನ್ನು ಬೆಳೆಸಿಕೊಂಡಿದ್ದು ನಮಗೆ ಗೊತ್ತು. ಕಾಡಿನ ಕೋಟ್ಯಂತರ ಜೀವಿಗಳು ಎಂತೆಂಥ ವಿಕೃತ ರೂಪ ಪಡೆಯುತ್ತವೋ ಗೊತ್ತಿಲ್ಲ. ಅಳಿವೆ ನೀರಿನ ಜಲಚರಗಳು ಯಾವ ಬಗೆಯ ವಿಕಾರ ಸಂತತಿಗೆ ಜನ್ಮ ಕೊಡುತ್ತವೋ ಗೊತ್ತಿಲ್ಲ. ಅಂಥ ಯಾವ ಪರೀಕ್ಷೆಯನ್ನೂ ನಡೆಸದೆಯೇ ಏಕಾ ಏಕಿಯಾಗಿ ಅಣು ಸ್ಥಾವರ ನಿರ್ಮಿಸುವ ಯೋಜನೆ ಹಾಕಲಾಗಿದೆ. ಇದು ಸಾಧುವಲ್ಲ. ಜೀವ ಕೋಟಿಯ ನಾಶ ಅಥವಾ ವಿಕೃತ ಜೀವಕೋಟಿಯ ಸೃಷ್ಟಿ ಎರಡೂ ಭವಿಷ್ಯಕ್ಕೆ ಗಂಡಾಂತರ ಒಡ್ಡುವ ಯೋಜನೆಯೇ ಆಗುತ್ತದೆ.

ಅಣುಸ್ಥಾವರಗಳ ಸರಮಾಲೆ ಹಾಗೂ ಅಪಾಯಗಳ ಸರಮಾಲೆ ಎರಡೂ ಪ್ರಾರಂಭವಾಗುವ ತುಂಬ ಮುಖ್ಯ ನಿರ್ಧಾರ ಕೈಗೊಳ್ಳುವ ಈ ಸಂದರ್ಭದಲ್ಲಿ ಕಣ್ಣುಮುಚ್ಚಿ ಮೌನ ಸಮ್ಮತಿ ನೀಡುವಂತಾದರೆ ನಾಳಿನ ಪೀಳಿಗೆಯ ದುರದೃಷ್ಟ ಜೀವಿಗಳು ನಮ್ಮನ್ನು ಪ್ರಶ್ನಿಸುತ್ತಾರೆ. ನೀವೇಕೆ ಸುಮ್ಮನಿದ್ದಿರೆಂದು ಕೇಳುತ್ತಾರೆ. ಕೈಗಾ ಯೋಜನೆಯ ಸ್ಥಾಪನೆ ಸುಸೂತ್ರವಾಯಿತೆಂದರೆ, ಅಣುಶಕ್ತಿ ಇಲಾಖೆಯವರು ದೇಶದ ಇನ್ನೂ 21 ಕಡೆಗಳಲ್ಲಿ ಹೊಸ ಸ್ಥಾವರಗಳನ್ನು ನಿರ್ಮಿಸುವವರಿದ್ದಾರೆ. ಇಷ್ಟೇ ನಿರ್ಲಕ್ಷ್ಯತನದಿಂದ, ಇಷ್ಟೇ ಹೊಣಗೇಡಿ ನಿರ್ಧಾರವನ್ನು ಒರಿಸ್ಸಾ, ಬಿಹಾರ್, ಆಂಧ್ರಪ್ರದೇಶ, ಮತ್ತಿತರ ರಾಜ್ಯಗಳ ಬಡ ಪ್ರಜೆಗಳ ಮೇಲೂ ಹೇರಲಾಗುತ್ತದೆ. ಅವೆಲ್ಲ ದುರಂತಗಳಿಗೆ ಪ್ರಾರಂಭದಲ್ಲೇ ತಡೆಯೊಡ್ಡುವ ನೈತಿಕ ಹೊಣೆಗಾರಿಕೆ ನಮ್ಮ ಮೇಲಿದೆ.

ಕಾಳಿನದಿ ಪ್ರದೇಶದಲ್ಲಿ ಭೂಕಂಪಗಳಾಗುವ ಸಾಧ್ಯತೆ ಇದೆ. ಇಡೀ ನದಿಯೇ ಪುರಾತನ ಬಿರುಕಿನ ಮೇಲೆ ಹರಿಯುತ್ತಿದೆ. ಈ ಪ್ರದೇಶದಲ್ಲಿ ಕೇವಲ 25 ಕಿಲೋಮೀಟರ್ ತ್ರಿಜ್ಯದ ಕ್ಷೇತ್ರದಲ್ಲಿ ದೊಡ್ಡಗಾತ್ರದ ಏಳು ಅಣೆಕಟ್ಟುಗಳ ನಿರ್ಮಾಣ ಆಗಲಿಕ್ಕಿದೆ. ಒಟ್ಟೂ 13 ಜಲಾಶಯಗಳ ನಿರ್ಮಾಣ ಆಗಲಿಕ್ಕಿದೆ. ಅಷ್ಟೆಲ್ಲ ನೀರಿನ ಭಾರದಿಂದಾಗಿ ಭೂಕಂಪವಾಗಬಹುದು. ಬೇರೆಲ್ಲೋ ದೂರದಲ್ಲಿ-ಕೊಯ್ನಾ ಪ್ರದೇಶದಲ್ಲಿ-ಭೂಕಂಪವಾದರೂ ಅದರ ಪರಿಣಾಮ ಈ ಕ್ಷೇತ್ರಕ್ಕೆ ತೀವ್ರವಾಗಿ ತಟ್ಟುತ್ತದೆ. ಕಾಳಿನದಿಗೆ ನಿರ್ಮಿಸಲಾಗುತ್ತಿರುವ ಅನೇಕ ಅಣೆಕಟ್ಟುಗಳಿಗೆ ಭದ್ರಬುನಾದಿ ಇಲ್ಲ. ಶಿಲಾಸ್ತರಗಳು ಅನೇಕ ಕಡೆ ಬಿರುಕು ಬಿಟ್ಟಿವೆ. ಭೂಕಂಪದಿಂದಾಗಿ ಸ್ವತಃ ಕೈಗಾ ಅಣುಸ್ಥಾವರ ಭಗ್ನವಾಗಿ ಆಸ್ಫೋಟಿಸಬಹುದು; ಅಥವಾ ಮೇಲ್ಗಡೆಯ ಅಣೆಕಟ್ಟುಗಳು ಒಡೆದು ಜಲಪ್ರವಾಹದಲ್ಲಿ ಅಣುಸ್ಥಾವರ ಸಿಕ್ಕಿಕೊಳ್ಳಬಹುದು. ಅದರೊಳಗಿನ ವಿಕಿರಣ ಇಂಧನವೆಲ್ಲ ನೀರುಪಾಲಾಗಿ ಕರಾವಳಿಯುದ್ದಕ್ಕೂ ಅಪಾಯ ಉಂಟಾಗಬಹುದು. ಈಗೊಂದೇ ಅಲ್ಲ, ಮುಂದಿನ ಹತ್ತುಸಾವಿರ ವರ್ಷಗಳವರೆಗೂ ಈ ಅಣುಸ್ಥಾವರಗಳ ಗೋರಿಗಳೂ, ಭಗ್ನ ಅವಶೇಷಗಳೂ, ಪಳೆಯುಳಿಕೆಗಳೂ ಕಾಳಿ ತೀರದಲ್ಲಿ ಅಪಾಯಕಾರಿ ವಿಕಿರಣಗಳನ್ನು ಸೂಸುತ್ತಲೇ ಇರುತ್ತವೆ. ಅಷ್ಟು ದೀರ್ಘ ಅವಧಿಯಲ್ಲಿ ಅಣೆಕಟ್ಟುಗಳು ಹೂಳಿನ ಒತ್ತಡಕ್ಕೆ ಎಂದೋ ಕುಸಿದಿರುತ್ತವೆ. ನದಿಯ ಪಾತ್ರ ಬದಲಾಗಿರುತ್ತದೆ, ಸಮುದ್ರ ಪಾತಳಿ ಮೇಲೇರಿರುತ್ತದೆ. ಭೂಕಂಪ ಆಗದಿರುತ್ತದೆಯೆ? ಅಷ್ಟು ದೀರ್ಘ ಅವಧಿಯವರೆಗೆ ಈ ಎಲ್ಲ ನೈಸರ್ಗಿಕ ಪ್ರಕೋಪಗಳಿಂದ ಅಣುಸ್ಥಾವರಗಳನ್ನು ರಕ್ಷಿಸಿಡಬೇಕು. ಬದಲೀ ವಿಧಾನಗಳಿಂದ ಪುಕ್ಕಟೆ ವಿದ್ಯುತ್ ಸಿಗುವಂತಾದರೂ ಕೂಡ, ಈ ಅಣುಸ್ಥಾವರಗಳನ್ನು ದಾನವ ಮಂದಿರಗಳಂತೆ (ದೇವಮಂದಿರಗಳಲ್ಲ) ಕಣ್ಣಲ್ಲಿ ಕಣ್ಣಿಟ್ಟು ಕಾಪಾಡಿಕೊಂಡಿರಬೇಕು. ನಾವು ಇಂದು ಮಾಡುವ ದುಷ್ಕೃತ್ಯಕ್ಕೆ, ಪಡೆದ 'ಲಾಭ'ಕ್ಕೆ ಮುಂದಿನ ಪೀಳಿಗೆಯವರು ದಂಡ ತೆರುತ್ತಲೇ ಇರಬೇಕು.

ಕಾಳಿನದಿ ಸಮುದ್ರಕ್ಕೆ ಕೂಡುವ ಅಳಿವೆಯಲ್ಲಿ ಅಪರೂಪದ ಜಲಚರಗಳು ಜೀವಿಸುತ್ತವೆ. ಉಪ್ಪುನೀರು-ಸಿಹಿನೀರಿನ ಮಿಶ್ರಣದಲ್ಲಿ ಮಾತ್ರ ಸಂತಾನೋತ್ಪತ್ತಿ ಮಾಡುವ ಶೀಗಡಿ ಮೀನುಗಳೂ, ವಿಶ್ವದಲ್ಲೇ ಅತ್ಯಂತ ರುಚಿಕರವೆನ್ನುವ ಮ್ಯಾಕರೆಲ್ ಮೀನುಗಳೂ ಇಲ್ಲಿನ ಸಹಸ್ರಾರು ಬೆಸ್ತರ ಕುಟುಂಬಗಳಿಗೆ ಜೀವನಾಧಾರ ಒದಗಿಸಿವೆ. ಅಳಿವೆಯ ಈ ಹದ ನೀರಿಗೆ ಅಣುಸ್ಥಾವರದಿಂದ ಹೊರಬರುವ ನಂಜುಮಿಶ್ರಿತ ಬಿಸಿನೀರು ಸೇರಿದಾಗ ಜಲಚರಗಳ ಸ್ಥಿತಿಗತಿ ಹೇಗಾಗುತ್ತದೆಂದು ಯಾರೂ ಅಧ್ಯಯನ ಮಾಡಿಲ್ಲ. ಮೀನುಗಳ ಸಂತಾನೋತ್ಪತ್ತಿ ಸಾಮರ್ಥ್ಯ ಏರುಪೇರಾಗ

ಬಹುದು. ಅಣೆಕಟ್ಟುಗಳಿಂದಾಗಿ ಸಿಹಿನೀರಿನ ಅಭಾವ ಉಂಟಾಗಿ ಮೀನುಗಳ ತತ್ತಿ ಇಡುವ ಪರಿಸರ ಅಧ್ವಾನವಾಗುತ್ತದೆ. ಅದಕ್ಕೆ ಬಿಸಿನೀರಿನ ಸೇಚನವಾದರೆ ಹೇಗಿರುತ್ತದೆ? ಒಂದೊಂದು ಬಾರಿ ಅಣುಸ್ಥಾವರ ಕೆಟ್ಟು ಸ್ಥಗಿತವಾದಾಗಲೂ ಅಣುವಿಕಿರಣ ಮಿಶ್ರಿತ ಕೊಳಚೆ ಜಲ ಸೇರಿಹೋಗಿ ನೀರನ್ನು ಕಲುಷಿತ ಮಾಡುತ್ತದೆ. ತಾರಾಪುರದಲ್ಲಿ ನೂರಾರು ಬಾರಿ ಹೀಗಾಗಿದೆ. ಕಲ್ಪಾಕ್ಕಮ್ ಸ್ಥಾವರದಲ್ಲಿ ವಿಷಾಕ್ತ ಭಾರಜಲ ಸೇರಿಹೋಗಿ ಅನೇಕಬಾರಿ ಸಮುದ್ರಕ್ಕೆ ವಿಕಿರಣ ಸೇರಿದೆ. ಹೀಗಾದರೆ ಮೀನುಗಳು ಮನುಷ್ಯರ ಬಳಕೆಗೆ ಅಯೋಗ್ಯವಾಗುತ್ತವೆ. ಮೀನು ಸಂಕುಲ ಹೇರಳವಾಗಿದ್ದರೂ, ಅದಕ್ಕೆ ಗಿರಾಕಿ ಇಲ್ಲದೇ ಬೆಸ್ತರು ಕಷ್ಟ ಎದುರಿಸಬೇಕಾಗುತ್ತದೆ. ಕಾಲಕ್ರಮೇಣ ಬೆಸ್ತರು ಒಬ್ಬೊಬ್ಬರಾಗಿ ತಮ್ಮ ಜೀವಾಶ್ರಯವನ್ನು ತೊರೆದು ಗುಳೆ ಹೋಗಬೇಕಾಗುತ್ತದೆ. ಅಪರಿಗಾದ ನಷ್ಟಕ್ಕೆ ಯಾರೂ ಪರಿಹಾರ ನೀಡುವುದಿಲ್ಲ.

ಅಣುಶಕ್ತಿಯಿಂದಾಗಲೀ, ಅಣೆಕಟ್ಟುಗಳಿಂದಾಗಲೀ ಸ್ಥಳೀಯರಿಗೆ ಕಷ್ಟ ಕಾರ್ಪಣ್ಯಗಳ ಹೊರತು ಬೇರೇನೂ ಲಭಿಸುವುದಿಲ್ಲ. ರೈತರಿಗೆ ಜಮೀನಿಗೆ ಬದಲಾಗಿ ನಗದು ರೂಪದಲ್ಲಿ ಪರಿಹಾರ ಸಿಕ್ಕರೂ ವಕೀಲರು, ಮಧ್ಯವರ್ತಿಗಳು ತಮ್ಮ ಪಾಲನ್ನು ಪಡೆದ ಮೇಲೆ ಉಳಿದ ಹಣ ನೋಡ ನೋಡುತ್ತ ಕರಗಿರುತ್ತದೆ. ಅಣುಸ್ಥಾವರ ನಿರ್ಮಾಣಕ್ಕೆಂದು ದೂರದಿಂದ ಬಂದ ಅನೇಕ ಸಹಸ್ರ ಕಾರ್ಮಿಕರು ಕ್ರಮೇಣ ಸುತ್ತಮುತ್ತ ಲಭ್ಯವಿದ್ದ ಸ್ಥಳಾವಕಾಶ ಹಾಗೂ ಉದ್ಯೋಗಾವಕಾಶಕ್ಕೆ ಪೈಪೋಟಿ ನಡೆಸುತ್ತಾರೆ. ಸ್ಥಳೀಯರು ತಮ್ಮ ನೆಲದಲ್ಲೇ ಪರಕೀಯರಾಗುತ್ತಾರೆ. ಅಣುಸ್ಥಾವರವೇಕೆ, ಶಕ್ತಿ ಉತ್ಪಾದನೆಯ ಯಾವ ಯೋಜನೆಯಲ್ಲಾದರೂ ಉದ್ಯೋಗಾವಕಾಶ ತುಂಬಾ ಕಡಿಮೆ ಎಂಬುದನ್ನು ತಜ್ಞರು ಒಪ್ಪಿಕೊಂಡರೂ, ವಿದ್ಯುತ್ತಿನ ಬಳಕೆಯಾಗುವಲ್ಲಿ ಉದ್ಯೋಗಾವಕಾಶ ಹೆಚ್ಚುತ್ತದೆ ಎನ್ನುತ್ತಾರೆ. ಕೈಗಾದಲ್ಲಿ ಉತ್ಪಾದನೆಯಾಗುವ ವಿದ್ಯುತ್ತು ಬಳಕೆಯಾಗುವುದು ಮಾತ್ರ ದೂರದ ಬೆಳಗಾವಿ, ಪಣಜಿ, ದಾವಣಗೆರೆಗಳಲ್ಲಿ. ಗ್ರಾಮೀಣ ಜನರನ್ನು ನಿರಾಶ್ರಿತರನ್ನಾಗಿ ಮಾಡಿ ಅವರನ್ನು ನಗರದ ಕೊಳೆಗೇರಿಗೆ ವಲಸೆಗೆ ಪ್ರೇರೇಪಿಸಿ, ಇತ್ತ ಹಳ್ಳಿ ಪರಿಸರವನ್ನೂ ಅತ್ತ ನಗರ ಪರಿಸರವನ್ನೂ ಏಕಕಾಲಕ್ಕೇ ಅಧ್ವಾನ ಮಾಡುವ ಯೋಜನೆ ಇದಾಗುತ್ತದೆ.

ಕೈಗಾದಿಂದ ಲಭ್ಯವಾಗುವ ವಿದ್ಯುತ್ತೆಲ್ಲ ಕರ್ನಾಟಕಕ್ಕೇ ಸಿಗುತ್ತದೆಂಬ ಯಾವ ಗ್ಯಾರಂಟಿಯೂ ಇಲ್ಲ; ಏಕೆಂದರೆ ಆ ವೇಳೆಗಾಗಲೇ ವಿದ್ಯುತ್ತಿನ ರಾಷ್ಟ್ರೀಯ ಜಾಲ ನಿರ್ಮಾಣವಾಗಿ, ಎಲ್ಲ ರಾಜ್ಯಗಳಿಗೆ ವಿದ್ಯುತ್ತಿನ ಏಕರೂಪ ಹಂಚಿಕೆ

ವ್ಯವಸ್ಥೆ ಜಾರಿಗೆ ಬಂದಿರುತ್ತದೆ. ಗೋವಾ, ಮಹಾರಾಷ್ಟ್ರ, ಆಂಧ್ರಪ್ರದೇಶ ಹಾಗೂ ಕೇರಳ ರಾಜ್ಯಗಳಿಗಿಂತ ತುಸು ಹೆಚ್ಚಿನ ಪ್ರಮಾಣದಲ್ಲಿ ಕೈಗಾ ವಿದ್ಯುತ್ ಕರ್ನಾಟಕಕ್ಕೆ ಲಭಿಸಿದರೂ, ಅದನ್ನು ಬಳಸುವ ಘಟಕಗಳೆಲ್ಲ ಕೈಗಾದಿಂದ 200-300 ಕಿಲೋಮೀಟರ್ ದೂರದಲ್ಲಿವೆ. ಮಾರ್ಗದಲ್ಲೇ ಶೇಕಡಾ 25 ರಷ್ಟು ವಿದ್ಯುತ್ ಸೋರಿ ಹೋಗುವುದರಿಂದ ಒಟ್ಟಿನ ಮೇಲೆ ರಾಜ್ಯಕ್ಕೆ ಈ ಯೋಜನೆಯಿಂದಾಗಿ ನಷ್ಟವೇ ಹೊರತು ಲಾಭವಿಲ್ಲ.

ಕೈಗಾ ಸುತ್ತಮುತ್ತಲ ಹಳ್ಳಿಗಳ ರೈತರು ಹಾಗೂ ಕಾಳಿ ಅಳಿವೆಯ ಬೆಸ್ತರು ಮಾತ್ರ ನಷ್ಟಕ್ಕೆ ಗುರಿಯಾಗುತ್ತಾರೆ ಎಂದು ಭಾವಿಸಬಾರದು. ಜಿಲ್ಲೆಯ ಇತರ ಜನ ಸ್ತೋಮವೂ ವಿಧವಿಧದ ಕಿರುಕುಳಕ್ಕೆ ಬಲಿಯಾಗಬೇಕಾಗುತ್ತದೆ. ಮೊದಲನೆಯ ದಾಗಿ, ಅಣುಸ್ಥಾವರದ ಕ್ಷೇತ್ರ ಕ್ರಮೇಣ ವಿಸ್ತೀರ್ಣವಾದಂತೇ ಅದರ ದಿಗ್ಬಂಧನ ಕ್ಷೇತ್ರವೂ ವಿಸ್ತಾರವಾಗುತ್ತ, ಜನಸಾಮಾನ್ಯರ ಮುಕ್ತ ಸಂಚಾರಕ್ಕೆ ಅಡೆತಡೆ ಉಂಟಾ ಗುತ್ತದೆ. ಅಣುಸ್ಥಾವರದ ಯಾವುದೇ ಚಿಕ್ಕಪುಟ್ಟ ಚೌರ್ಯ ದುಷ್ಕೃತ್ಯಗಳಿಗೂ ಅಮಾಯಕ ಪ್ರಜೆಗಳ ಶೋಧನೆ ನಡೆಯುತ್ತದೆ. ವಿಶೇಷವಾಗಿ ಅರಣ್ಯವಾಸಿಗಳಾ ಗಿರುವ ಹಾಲಕ್ಕಿ, ಸಿದ್ದಿ ಹಾಗೂ ಗೌಳಿಗರಂಥ ಬಡ ಜನಾಂಗ ಇನ್ನಷ್ಟು ಶೋಷಣೆಗೆ ಒಳದಾಗುತ್ತದೆ. ಆಕಸ್ಮಾತ್ ಅಣುಸ್ಥಾವರದಲ್ಲಿ ಸ್ಫೋಟವಾಗಲೀ, ವಿಸ್ಫೋಟಕ ಅವಘಡವಾಗಲೀ ಸಂಭವಿಸಿದಾಗ, ಅಲ್ಲಿ ಸಂಚಯವಾದ ಅಣುಶಾಖ ಹಾಗೂ ಅಣು ವಿಕಿರಣವನ್ನು ಮೆಲ್ಲಗೆ ವಾತಾವರಣಕ್ಕೆ ಹರಿಬಿಡುತ್ತಾರೆ. ಗಾಳಿ ಮೋಡಗಳ ಮೂಲಕ ಗುಡ್ಡಕಣಿವೆಗಳಲ್ಲಿ ಪಸರಿಸುವ ವಿಕಿರಣ ಧೂಮದಿಂದಾಗಿ ತೆಂಗು, ಅಡಿಕೆ, ಮೆಣಸು, ಏಲಕ್ಕಿ, ಬಾಳೆಯಂಥ ತೋಟದ ಬೆಳೆಗಳೆಲ್ಲ ಬಳಕೆಗೆ ಅನರ್ಹವಾಗುತ್ತವೆ. ಕಣ್ಣಿಗೆ ಕಾಣದ ಈ ಅಪಾಯ ಸಂಭವಿಸದೇ ಇದ್ದರೂ, ಗಾಳಿ ವರ್ತಮಾನ ಹಬ್ಬಿ ದರೂ ಸಾಕು. ಮುಂಬೈನ ಮಾರುಕಟ್ಟೆಗಳಲ್ಲಿ ಉತ್ತರ ಕನ್ನಡ ಜಿಲ್ಲೆಯ ವಾಣಿಜ್ಯ ಬೆಳೆಗಳಿಗೆ ಬಹಿಷ್ಕಾರ ಹಾಕಲಾಗುತ್ತದೆ. ಇಡೀ ಜಿಲ್ಲೆಯ ವಾಣಿಜ್ಯ ವ್ಯವಹಾರ ಅಧ್ವಾನವಾಗುತ್ತದೆ. ಅಣುಸ್ಥಾವರದ ಒಳಿ ಬಿಸಾಕಿದ ಲೋಹದ, ಪ್ಲಾಸ್ಟಿಕ್ಕಿನ ವಸ್ತುಗಳು ಜನ ಬಳಕೆಗೆ ಬಂತೆಂದರೆ ಸಹಸ್ರಾರು ಜನ ತಮಗರಿವಿಲ್ಲದೆಯೇ ನಪುಂಸಕ ರಾಗಬಹುದು. ಕ್ಯಾನ್ಸರ್ ರೋಗಕ್ಕೆ ತುತ್ತಾಗಬಹುದು.

ಅಣುಸ್ಥಾವರ ಇದ್ದಲ್ಲೆಲ್ಲ ವೈರಿ ದೇಶಗಳ ದಾಳಿಯ ಸಂಭವ ಇದ್ದೇ ಇರುತ್ತದೆ. ಭಯೋತ್ಪಾದಕರೂ, ಗೂಢಚಾರರೂ, ದೇಶದ ಅಭದ್ರತೆಗೆ ಹೊಂಚು ಹಾಕಿ ಅರಾಜ ಕತೆ ಉಂಟುಮಾಡಬಯಸುವ ವಿಧ್ವಂಸಕ ಮನೋವೃತ್ತಿಯವರೂ ಅಣುಸ್ಥಾವರದ

ಸುತ್ತ ಕಾರ್ಯಾಚರಣೆ ಪ್ರಾರಂಭಿಸುತ್ತಾರೆ. ಅದನ್ನು ತಡೆಗಟ್ಟಲೆಂದು ಸಹಜವಾಗಿಯೇ ಸರಕಾರೀ ರಕ್ಷಕದಳ ಹಾಗೂ ಮಿಲಿಟರಿ ತುಕಡಿಗಳು ಜಿಲ್ಲೆಯ ಬಹು ಭಾಗದಲ್ಲಿ ಸದಾಕಾಲ ಸಂಚರಿಸುತ್ತಿರಬೇಕಾಗುತ್ತದೆ. ಪ್ರಜಾಪ್ರಭುತ್ವದ ಮೌಲ್ಯಗಳಾದ ವಾಕ್‌ಸ್ವಾತಂತ್ರ್ಯ, ಸಂಚಾರ ಸ್ವಾತಂತ್ರ್ಯ, ಆಸ್ತಿ ಸ್ವಾತಂತ್ರ್ಯಗಳೆಲ್ಲ ಕ್ರಮೇಣ ಮೊಟಕಾಗುತ್ತಾ ಹೋಗುತ್ತವೆ. ಜಿಲ್ಲೆಯ ಭಾವೀ ಜನಾಂಗದ ಪಾಲಿಗೆ ಸದಾ ತೂಗಾಡುವ ಅಪಾಯದ ಕತ್ತಿಯಾಗುತ್ತದೆ. ಕತ್ತಿಯನ್ನು ತೂಗುಹಾಕಿದ ಹಗ್ಗ ಶಿಥಿಲವಾಗುತ್ತ ಹೋಗುತ್ತದೆ.

ಹೇಳಿ - ಯಾರಿಗಾಗಿ ಈ ಅಣುಸ್ಥಾವರ ?

"ಗ್ರಾಮೀಣ ಬಡಜನತೆಗೋಸ್ಕರವೆಂದೇ ಎಷ್ಟೋ ಯೋಜನೆಗಳು ರೂಪಿತವಾಗಿವೆ. ಆದರೆ ವಾಸ್ತವ ಆಚರಣೆಯಲ್ಲಿ ಅವು ಜನರನ್ನು ಮತ್ತಷ್ಟು ಬಡತನದತ್ತ ತಳ್ಳುತ್ತಿವೆ ; ತಾತ್ಕಾಲಿಕ ಆಮಿಷಗಳಿಂದ ಹಳ್ಳಿಗರನ್ನು ತಪ್ಪುದಾರಿಗೆಳೆಯುತ್ತಿವೆ. ಬಡವರ ಹೆಸರಿನಲ್ಲಿ ಖರ್ಚಾಗುವ ಸಾವಿರಾರು ಕೋಟಿ ರೂಪಾಯಿ ತೆರಿಗೆದಾರರ ಹಣದ ಪ್ರಯೋಜನ ಬೆರಳೆಣಿಕೆಯಷ್ಟು ಉದ್ದಿಮೆಪತಿಗಳಿಗಷ್ಟೇ ದೊರೆಯುವಂತಾಗಿದೆ."

"ಜನರ ಅವನತಿಗೆ ಕಾರಣವಾಗಿರುವಂತೆ ಪ್ರಕೃತಿ ಸಂಪನ್ಮೂಲಗಳ ಶೀಘ್ರವಿನಾಶಕ್ಕೂ ಈ ಯೋಜನೆಗಳು ದಾರಿಮಾಡಿವೆ. ಅರಣ್ಯನಾಶ, ನದೀಮಾಲಿನ್ಯ ಮೊದಲಾದವುಗಳ ದುಷ್ಪರಿಣಾಮ ಎಲ್ಲರನ್ನೂ ಆವರಿಸುತ್ತದಾದರೂ ಬಡಜನರ ಜೀವನದ ಮೇಲೆ ಅವುಗಳ ಪರಿಣಾಮ ಮತ್ತಷ್ಟು ಉಗ್ರ.

"ಇದು ಯಾವುದೊ ಒಂದು ಜನವರ್ಗಕ್ಕಷ್ಟೆ ಸಂಬಂಧಿಸಿದ ಸಮಸ್ಯೆಯಲ್ಲ. ನಮ್ಮ, ನಿಮ್ಮ, ಎಲ್ಲರ ನಾಳಿನ ಅಳಿವು-ಉಳಿವಿನ ಪ್ರಶ್ನೆ. ಜನ ಸುಮ್ಮನೆ ಕುಳಿತಂತೆಲ್ಲ ಸ್ಥಿತಿ ಮತ್ತಷ್ಟು ಉಲ್ಬಣಗೊಂಡೀತೇ ಹೊರತು ಸುಧಾರಿಸಲಾರದು. ಈಗಾಗಲೆ ಕಾಡುಗಳಿಗೆಲ್ಲ ಕೊಡಲಿ ಹಾಕಿ ಮುಗಿಸಿರುವ ರಾಕ್ಷಸ ಕೈಗಳು ಈಗ ಬೇಸಾಯದ ಭೂಮಿಯನ್ನೂ ಆಲಿಂಗಿಸಲು ಕಾತರಗೊಂಡಿವೆ.

"ಆದ್ದರಿಂದ ಈಗಲೇ ಜಾಗೃತಗೊಳ್ಳೋಣ. ಪರಿಸರವನ್ನು ಉಳಿಸೋಣ ; ಪರಿಸರವರ್ಧನೆಯ ಮೂಲಕ ಜೀವನವನ್ನು ಸಮೃದ್ಧಗೊಳಿಸೋಣ."

—ಮಣ್ಣು ರಕ್ಷಣಾ ಕೂಟ

ಪ್ರತಿಗಳು ದೊರೆಯುವ ಸ್ಥಳ :

1) ಮಣ್ಣು ರಕ್ಷಣಾ ಕೂಟ
ದ್ವಾರಾ : ಕರ್ನಾಟಕ ಗಾಂಧಿ ಸ್ಮಾರಕ ನಿಧಿ
ಗಾಂಧಿ ಭವನ, ಕುಮಾರ ಪಾರ್ಕ್ ಪೂರ್ವ
ಬೆಂಗಳೂರು-560 001

2) ಸಮಾಜ ಪರಿವರ್ತನ ಸಮುದಾಯ
ಜಯನಗರ ಕ್ರಾಸ್, ಸಪ್ತಾಪುರ
ಧಾರವಾಡ-580 001

Friends of the Earth Trust Ltd.

11.4.1

Nuclear Waste and Sellafield

Nuclear power produces radioactive waste that can be lethal for thousands of years, while pollution from Sellafield has made the Irish Sea into the world's most radioactive sea.

nuclear power...sellafield...radioactive waste...leaks...sea dumping...land disposal...

Introduction

Nuclear energy has been used to generate electricity for the last thirty years, yet no long term method for the disposal of its waste has been found. Every year the amount in storage increases. By the end of the century there will be the equivalent of 2,500 averaged sized houses, or about 600,000 cubic metres of radioactive waste. At the same time there are plans to build more nuclear power stations which will in turn produce more waste.

Radioactive waste comes in many forms. Some wastes lose their potential to cause cancers and genetic defects in a few years; others are lethal for thousands of years.

The Sellafield reprocessing plant (formerly Windscale) produces 69% of all low-level wastes and 40% of intermediate-level wastes.

Types of Waste

Nuclear waste can be classified according to how radioactive it is. There are essentially three types: low, intermediate, and high level. Intermediate level waste is also divided into waste which loses its radioactivity over a relatively short period (between several decades and a century), and waste which contains longer-lived radioactive elements such as plutonium, which must be permanently isolated from the environment.

Nuclear Waste Transport

Low Level Waste includes dilute gases and liquids which may be discharged directly into the environment; solid wastes such as paper, plastics, and building materials which may be buried in shallow trenches on land or dumped at sea; and some very dilute industrial nuclear wastes which may be disposed of with ordinary refuse.

Intermediate short-lived waste is solid and semi-solid items such as glove boxes, process cabinets, sludges, resins and other contaminated pieces of equipment. In the past some of this waste was dumped at sea, but the majority of it is stored on the nuclear power station sites, or at Sellafield.

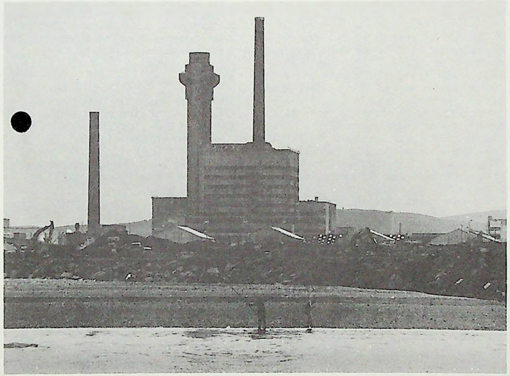
Intermediate long-lived waste is mainly spent fuel cladding – a by-product of fuel reprocessing and it is stored at Sellafield.

High level waste comes from the nuclear power stations' spent fuel. The waste will either be intact spent fuel rods or liquid wastes resulting from reprocessing the fuel. High level waste is intensely radioactive and generates large quantities of heat, and has to be continually cooled.

Sources of Nuclear Waste

Nuclear power produced 80% of Britain's radioactive waste. From the mining of the uranium fuel to the reprocessing of used fuel rods, considerable amounts of nuclear wastes are produced at all stages. Other, smaller sources include the nuclear weapons programme, medical, research and industrial uses of radioactive materials.

Mining uranium, the fuel for nuclear power stations, produces huge amounts of solid and liquid waste. For every 1,000 tonnes of uranium fuel 100,000 tonnes of radioactive solid waste (known as tailings) and 3,500,000 litres of liquid waste are produced. The radioactivity, carried by wind and water, can contaminate the environment and increase the local rate of cancers. For example, an investigation carried out by the U.S.



Sellafield Reprocessing Plant – formerly Windscale

Government estimated that the rate of lung cancer within 1.5km of a pile of tailings is likely to increase by 14%.

Uranium is mined all over the world. Although Britain has some low-grade uranium in the Orkneys, there are no plans at present to mine it.

In Britain the uranium is processed and manufactured into fuel. This produces some low level solid waste. The nuclear power stations themselves routinely produce small discharges of both liquid and gaseous wastes, as well as both low and intermediate solid wastes.

After 2 or 3 years in the power station, the fuel is removed and eventually transported to Sellafield for what is known as reprocessing. In this process two elements, uranium and plutonium, are separated out from the large number of waste products.

Much of the waste from reprocessing fuel is highly radioactive and is the most dangerous of all nuclear waste. This waste must be isolated from the environment for extremely long periods and in the early years it generates so much heat that it must be continuously cooled.

Reprocessing also produces gaseous and liquid wastes. These are discharged directly into the air and the Irish Sea.

Sellafield

All reprocessing of spent fuel is carried out at Sellafield, which is one of only two commercial reprocessing plants in the world.

The original purpose of reprocessing was to produce plutonium for Britain's nuclear weapons. In theory, the plutonium from nuclear power stations is kept separate from military plutonium, and is stored or used for research and development of a new type of nuclear reactor – the fast breeder reactor.

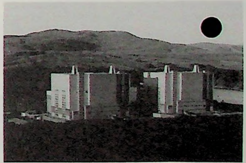
At present, only the nuclear fuel from Britain's first generation of power stations, the Magnox reactors, can be reprocessed. In 1973, 35 Sellafield workers were accidentally contaminated during reprocessing of fuel from Britain's Advanced Gas Cooled Reactors (AGR), permanently halting reprocessing of this type of fuel. A new plant is being constructed to process AGR fuel (the Thermal Oxide Reprocessing Plant, or THORP). This plant was the subject of the 1977 Windscale Public Inquiry. The state-owned reprocessing company, British Nuclear Fuels Ltd, insisted at the time that THORP was urgently needed, but construction only began in 1984.

The high-level waste from reprocessing is in the form of an acid solution which is kept in specially designed storage tanks. Removal of the heat is necessary for a few hundred years; failure to do so would cause the solution to boil dry and the radioactive materials to disperse.

There are plans to incorporate the high level waste into a specially made glass (a process called vitrification) which would then be stored for 50 years or so before it is finally disposed of. In the past there have been various 'science fiction' suggestions for its disposal, such as sending it into outer space, and burying it under the Antarctic ice. Today there are serious proposals to bury it in suitable rocks, under the sea bed and on the sea bed. In 1981, the Government had to abandon test drilling on land due to public opposition. There is likely to be equally strong international opposition to the other two proposals.

To date, an estimated ⅓ of a tonne of plutonium has been discharged through the pipeline into the Irish Sea. It was thought that this plutonium ends up safely on the sediments on the sea bed, but more recent evidence is pointing to significant amounts being transported back to land. In 1983 Sellafield became the centre of the media's attention when a Yorkshire TV documentary showed a higher than normal occurrence of leukaemia amongst local children. A subsequent inquiry, chaired by Professor Black, found no clear link between these cancers and the radioactive emissions from Sellafield. However, no other cause has been suggested. It has, therefore, been neither definitely proved nor disproved that Sellafield's pollution is causing these leukaemias.

In the same year, the beaches near to Sellafield had to be closed for ten weeks due to contamination following an accidental release of higher level waste into the sea which was subsequently washed ashore. This accident is just one of about 300 that have occurred at Sellafield, although not all have involved radioactivity.



Nuclear Power – Produces 80% of Nuclear Waste

...radioactive pollution...leaks...health risks...sellafield...

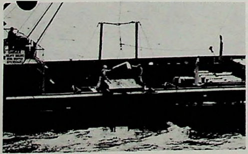
Sea Dumping

Since 1949 Britain has disposed of low and intermediate level nuclear wastes in the sea. In the last annual dump, in 1982, nearly three thousand tonnes were disposed of in this way, at a site about 500 miles from the northwest coast of Spain.

The disposal of nuclear waste is controlled by an international agreement, the London Dumping Convention. Early in 1983 a two year ban, later to be extended, was agreed, while scientific investigations were undertaken. Initially, the 1983 annual British dump was to go ahead using a new, specially designed ship. However, action taken by a number of trade unions prevented it, and subsequently the Government announced its intention to abide by the decision of the London Dumping Convention. The Trade Union Congress now has a ban on all dumping of nuclear waste at sea.

In recent years it has been increasingly recognised that the world's seas are an invaluable resource, to be shared by all nations. It is likely that in the future there will be continued international opposition, especially from those countries without nuclear power, to the use of international waters for the disposal of radioactive waste.

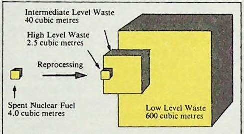
At home, opposition is growing to a new proposal that intermediate-level radioactive waste be dumped at sea close to the Orkneys.



Radioactive Waste Disposal at Sea

Land Disposal

At present, low-level waste is disposed of in a shallow trench at Drigg, a few miles south of Sellafield. There are no long-term disposal sites for intermediate level wastes, only temporary storage sites, until a long term solution is found for their disposal.



Annual Volumes per 1000 megawatts of electricity generated by a pressurised water reactor.

Volume of spent nuclear fuel before and after reprocessing.

Since 1982, NIREX (Nuclear Industry Radioactive Waste Executive) has been responsible for the disposal of low and intermediate level radioactive waste. The following year two sites were announced: Billingham, in Teeside (for intermediate, long-lived, wastes) and Elstow, near Bedford (for short-lived intermediate and low level waste). Early in 1985 the Government announced that the Billingham site was no longer being considered. A combination of public and trade union pressure had forced the withdrawal of the proposal. Five new sites are now under investigation.

Nuclear waste dumps pose a number of potential hazards to the public. The radioactivity may leak from the site and find its way into rivers and reservoirs used for drinking water. Half the commercial waste dumps in the United States have been closed down due to contamination spreading outside the site. Even if the radioactivity is safely contained under normal conditions, the site may be disturbed by infrequent events such as earthquakes. These occasionally occur in Britain. There is also the possibility that, some time in the future, people either deliberately or accidentally may interfere with a nuclear waste site. A dump containing long-lived radioactivity will have to be isolated for thousands of years.

Solutions

Nuclear waste is potentially very dangerous, and not surprisingly, no-one wants it disposed of close to their home. The problem of where to put it will become increasingly serious as greater volumes are created, especially if more nuclear power stations are built.

Something must be done with the waste already created, and further research is urgently needed to find the safest place to put it. Experience with leakage of radiation from Drigg suggests that even low-level waste needs to be isolated well away from people and potential drinking water supplies.

Whatever is decided for the final disposal of radioactive waste, reducing the volume of waste generated will undoubtedly do a great deal to reduce the problem. Reprocessing spent fuel increases the volume of nuclear waste produced over 150 times. A realistic alternative to reprocessing is the dry-storage of intact spent fuel rods for 50-100 years on the nuclear power station sites. Essentially this means storing the rods under gas – carbon dioxide or air – instead of under water which corrodes the fuel rods, and is therefore only suitable for a limited time period. Dry-storage would allow time for research into the best means for its final disposal.

As reprocessing is an expensive option the uranium recovered has a very low market value and there is ample plutonium for the fast breeder reactor research and development programme for at least 30 years. There are no good reasons to continue reprocessing. There are very good reasons to stop.

Further Reading:

Radioactive Waste: The Gravediggers Dilemma, Renee Chudleigh & William Cannell, Friends of the Earth, 1984, £4.
Nuclear Power, Walter Patterson, Pelican Books, 1983, £2.95.
Radioactive Waste Management Advisory Committee Annual Reports, HMSO, 1980-1984, £3.00

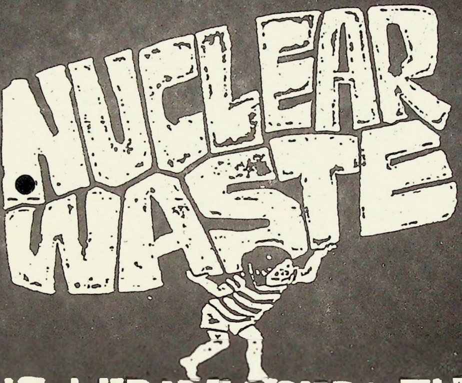
What You Can Do

- Join your local Friends of the Earth group (address from 377 City Road, London EC1V 1NA), and help organise exhibitions, publicity and fundraising events to inform the public of the dangers of radioactive waste and the need to protect the environment.
- Encourage your school, college or local library to mount an exhibition based on this information sheet.
- Ask your local newspaper to print an article about nuclear waste.
- Send a donation to Friends of the Earth Trust to help us in our work to protect the environment.

Friends of the Earth Trust Ltd
377 City Road, London EC1V 1NA
Telephone 01 837 0731

Local Group Contact:

Design: Outhouse Graphics. Printed by Robendene on 100% recycled paper. Photos: Martin Bond, Greenpeace, Friends of the Earth. Registered Charity No. 281681



IS A HEAVY BURDEN
TO LAY ON OUR CHILD-
REN AND THEIR CHILDREN
AND THEIR CHILDREN'S CHILD-
REN AND THEIR CHILDREN'S CHILD-
REN'S CHILDREN AND THEIR CHILDREN'S
CHILDREN'S CHILDREN'S CHILDREN AND THEIR

THE DARKER SIDE OF NUCLEAR POWER

THE
DARKER
SIDE OF
NUCLEAR
POWER

Hullo there ! We are anti-nuclear activists.

"Nice meeting you. I appreciate your concern for humanity. The madness of this arms race has brought the entire human race close to extinction..."

Just a minute please. We are, of course, against the arms build up. But in India we are also concerned about the so called peaceful uses.

"You mean you are against atomic power stations also ?"

Yes indeed. And so should you be.

"You must be crazy ! This is like throwing the baby away with the bath water. Atomic energy is a perfect example of what good science can do for us. Our scientists have tamed the destructive power of the atom and harnessed it for our development. We should all be proud of their achievements."

We are afraid reality is far more complex than simplistic ideas of good science vs. evil. Our nuclear power programme has been a colossal failure and should be wound up immediately.

"I think you are totally wrong. We should, in fact, build more and more atomic power stations to augment our sources of electricity. This is one field in science and technology where we are on par with the developed nations."

There are hundreds of reactors all over the developed world which have been abandoned at different stages of construction. The most illustrious among them is the Shoreham reactor near New York. This was abandoned after being completely built at a cost of $5.1 billion (nearly Rs 10,000 crores). Finally it has been sold to the State of New York for a sum of $1 !

"You must be exaggerating. Probably there are ten reactors built for every one that has been given up."

Most of the developed nations have said a final goodbye to nuclear power long ago. United States has stopped building nuclear plants since 1975. Canada has stopped it in 1978. During the 80's many European nations have either curtailed or altogether abandoned their nuclear projects. In countries like Sweden, Austria and Yugoslavia public referendums have been held and the people have voted against nuclear power.

"This is surprising. Were any reasons given for the rejection? Don't they need electricity ?"

Of course they do. But they do not want it to come from nuclear plants. There is a whole range of reasons from radiation hazards, poor performance, cost overruns, lack of safety assurances to unsolved technological problems. All over the world nuclear power has been one massive environmental disaster.

"But our own scientists say that atomic power plants are a boon to the environment. They are very clean compared to thermal power plants because..."

Shall we tell you the rest? A super thermal power plant burns several thousand tons of coal everyday to produce carbon dioxide, acid rain and greenhouse effects, hydro electric projects submerge thousands of hectares of natural forests and displace people. In contrast, nuclear power plants occupy very little space, can be set up anywhere, consume small quantities of fuel and do not generate any pollutants.

"Yes. That is exactly what they say. Are you telling me that it is all a bunch of lies ?"

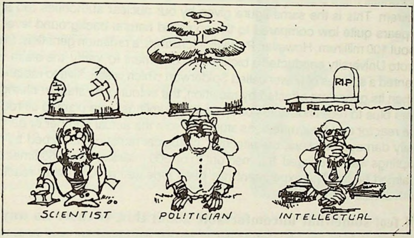
As a rule, our nucleocrats never tell obvious lies. Instead, they make excellent use of half truths and disinformation. Nuclear power plants pollute the environment by releasing radioactivty. You must remember that this is a *biological* form of pollution and should not be compared with the *chemical* pollutants produced by other plants. Radiation is invisible, but it can pollute our lives with effects far more devastating than any chemical pollutant.

"I have heard of radiation. Is it not present naturally all around us?"

That is a good example of the disinformation used by our nucleocrats to mislead people. Technically speaking, radiation is a burst of electromagnetic energy emitted by unstable atoms in the process of disintegration. The background radiation present around us is quite different in nature and effect. It cannot be compared with the radioactivity released by nuclear power plants.

Nuclear plants spread their pollution by releasing radioactive substances, or the radionuclides, into air, water and soil. These enter the natural food chain and tend to concentrate in the human body. Most of the radionuclides are chemically similar to the normal elements that the human body requires. So the body 'accepts' them and tries to assimilate them. Once inside, these atoms can disintegrate and damage the neaby cells. Many radioactive gases are also released, which are ultimately inhaled by human beings. In addition, nuclear power plants also emit radiation continuously all round them. This radiation can directly attack human beings and cause damage.

The Great Indian Nuclear Scene



"But our scientists have always assured us that radiation released by them is negligibly small."

It *may* be small but certainly not negligible. For half a century nucleocrats have perpetuated the myth that low level radiation is quite harmless. They always talk of the high radiation doses sufficient to kill a person and then claim that the radiation from their plants is a small fraction of the fatal dose.

"Isn't that safe ?"

One fact that has been established beyond doubt is that there is no 'safe' threshold below which radiation can be considered truly harmless. Every atom has the potential to kill. Very few studies have been conducted on the long term effects of low level radiation on large population, which is the crux of the radiation problem. Low level radiation, high level cover up - that is the nuclear industry practice everywhere.

"Even in India ?"

In India we have just one group of individuals who decide everything about radioactivity. They decide what is the 'permitted' level of radiation, decide how much should be released, release it, decide how to measure it, do the actual measurements, interpret the results and finally blow their own trumpets in public. People like us who have to absorb this radioactivity and expose ourselves to risk have no say in the matter.

"But they are our own scientists. Do we have any reason to disbelieve them ?"

Perhaps we should tell you the story of Hamaoka reactor in Japan. The authorities there claimed that the radiation released by the plant was only 5 millirem. This is the same figure given by our nuclear authorities too and appears quite low compared to the so called natural background level of about 100 millirem. However, Professor Ichikawa, a radiation geneticist from Kyoto University conducted a biological experiment to verify the claim. He planted a species of flower called Spiderwort which is sensitive to radiation. When its genes are affected by radiation, the colour of its stamen changes from blue to red. Thousands of Spiderwort saplings were planted all round the reactor and their mutations studied. From the actual number of genetically damaged flowers, the effective biological radiation absorbed by the saplings was calculated. It turned out to be 300 millirem, about 60 times the claimed figure. The experiment has been repeated around other reactors with similar results.

"I feel somewhat uncomfortable about this. Is there no way of knowing how much radiation is being released by our reactors ?"

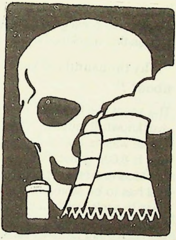
in 1962, our Parliament has passed the Atomic Energy Act that forbids the citizens from acquiring any knowledge whatever related to nuclear activities. The Atomic Energy Commission works under the direct control of the Prime Minister and is answerable to none, including the Parliament. All documents relating to nuclear activities, such as the Site Selection Report, Environmental Impact Assessment, Safety Analysis, Emergency Evacuation Plan are kept away from public view as if they contain military secrets. Our nucleocrats work behind a thick shroud of secrecy. Considering their miserable performance so far, they probably need it.

"What do you mean 'miserable'? Are we not producing electricity from our reactors ?"

The average plant load factor for all our reactors put together is a mere 43%. Almost all our reactors suffer from generic problems like faulty fuel rods, fuel bundle misalignments, rupturing end-shields, bursting pipes and massive leaks of heavy water etc. Reactors are shut down dozens of times during the year or, for a change, for years together. The MAPS–II reactor has established a record of sorts, with 125 outages in the first three years of operation. Even the 'conventional' components like turbine generators are more prone to failure in our nuclear power plants.

Instead of improving over the years, more and more reactors are becoming terminally ill. Of the seven reactors commissioned so far, one each in Tarapur and Rajasthan have been virtually written off. Another one near Madras is expected to follow them soon.

"This performance is indeed poor. But there must be some explanation for it."



The reason implied by our nucleocrats is that greater emphasis has been laid on safety and lower radiation at the cost of power generation. But the radiation doses from our reactors to the public are also quite high, nearly six times more compared to Canadian reactors of similar design. In case of Tarapur, they are twelve times higher, justifying the dubious distinction of being the world's 'dirtiest' reactors.

Radiation in any quantity extracts its price. Independent studies by researchers have uncovered massive radiation damage around all our nuclear installations, whether it is Jaduguda in Bihar, Alwaye in Kerala, Rawatbhata in Rajasthan or Cherlapally in Andhra.

"What kind of damage ?"

Widespread incidences of cancer, leukemia, thyroid disórders, sterility, infertility, distorted children with genetic deformities – the list is quite long and rather technical. Not only humans but animals and plants are also susceptible to damage by radiation. This is a matter of great concern in Kaiga where the reactor complex is being set up in the midst of a tropical rainforest. Infants, children, pregnant women and elderly persons, whose immunity systems are naturally weak are the most vulnerable to damage by radiation. Researchers working outside the nuclear establishment elsewhere in the world have shown definite links between radiation and bizarre diseases like herpes, septicemia, Lyme disease, Epstein Barr Virus and of course, AIDS. All these are diseases related to immune deficiency and can be traced to increased nuclear activities.

"But if the radiation is so dangerous, why is it released at all? Can't they neutralise it or make it harmless by some process ?"

That, unfortunately is impossible even in theory. We must repeat that radiation is a different form of pollution and radioactive wastes cannot be compared with any other kind of industrial waste. This is a fact fully exploited by our nucleocrats who insist on comparing the two dissimilar materials to their own advantage. If you have a bottle of radioactive milk, no matter how much you pasteurise or boil it, it will never become fit for human consumption. The only solution is to bury it deep underground in a concrete container and hope for the best. Every year our reactors generate some of the deadliest wastes ever created by man. We, our children, grandchildren, great-great- great grandchildren ... all have to learn to live with them. It is a burden that mankind has to carry for thousands of years."

"Why thousands of years ? What kind of burden are you talking about ?"

The spent fuel from nuclear reactors is one of the most dangerous wastes ever known. It remains extremely radioactive for several thousands of years. Those wastes containing plutonium are active for nearly 2,00,000 years - that is 8,000 generations to come. During this entire period they must be guarded in a safe repository isolated from human environment. The spent fuel has to be stored in huge containers of steel and concrete and buried deep in geologically stable locations. The containers themselves have to be changed every few hundred years. For over two hundred thousand year the waste site must be continuously monitored for radiation hazards. It is one of the major unsolved problems of nuclear tecnhology.

"What are our scientists doing to overcome this problem ?"

To put it bluntly, nothing. They do not even acknowledge that spent fuel is a serious problem. Instead, they continue to misguide the people by making irrelevant comparisons between nuclear wastes and other industrial wastes. Nuclear waste may be very low in volume, yet there is no place on our earth for storing it. Should we not feel guilty about creating something so dangerous that we have no control over it ? What justification can we offer for imposing a burden on the coming thousands of generations ? Our nuclear scientists are totally unconcerned with the ethics of the issue and pretend that there is no such thing as a nuclear waste problem.

Not only the spent fuel, but the spent reactor is also a major problem. It is not easy to get rid of an atomic power station once its useful life is over. During its working, a typical reactor accumulates so much radioactivity that it cannot be left alone. Brick by brick it must be dismantled and buried deep in the ground. This decommissioning operation can take nearly a century and is an immediate burden on our next four generations. It is one of the main hidden costs of a nuclear power programme.

"It seems to me that a lot is hidden in nuclear power. But what do you mean by the 'hidden' costs ?"

There is much more to a nuclear power programme than the reactor. The reactor with its massive dome is only the visible part, like the tip of the proverbial iceberg. Technologists talk of the Uranium Fuel Cycle. This involves mining, milling, processing the ore and fuel fabrication before it is loaded into the reactor. Separate plants have been set up for these purposes. And each one them releases its own radioactivity into the environment causing massive contamination. We also need additional plants for producing heavy water for our CANDU reactors. All these are in the front end of the programme.

The back end begins with decommissioning of the reactor. Apart from the spent fuel every reactor produces several thousand tons of low to medium level radioactive wastes that have to be stored for periods ranging from a few years to thousands of years. Then comes the cost of managing the spent fuel for 2,00,000 years.

"But what is the final cost of nuclear electricity at the end of this fuel cycle ?"

No one knows. What kind of cost estimation can be done for a project that has to run for thousands of years ? All nuclear activities in our country are indirectly but heavily subsidised by the government. Our scientists have made no plans for decommissioning and waste management operations, so their cost is not accounted for. In spite of all this, the nucleocrats have gone to great lengths in manipulating their accounts, just to prove that nuclear electricity is only marginally cheaper than thermal power.

Once upon a time in the U.S., nuclear scientists had assured the people that their electricity would be "too cheap to meter". Today, escalating cost is one of the main reasons for abandoning nuclear projects. Last year electric power generation was privatised in Britain. But the private industry there refused to operate any of the nuclear plants. The reason ? Atomic energy is viable only as a government enterprise - where you have unlimited public money to squander.

"Well, not all that unlimited. Government accounts are subject to audit"

It is only from 1988 that the Comptroller and Auditor General (CAG) has begun to audit the accounts of AEC. This has resulted in the exposure of gross mismanagement, cost overruns and delays that charecterise all our nuclear projects. For example, the reactors at Kalpakkam have been commissioned 8 years behind schedule at a cost of Rs 245 crores against the budgeted Rs 132 crore. The Narora plant is also 8 years behind schedule and has a 100% cost overrun. But all these costs, whether hidden or displayed, are valid only if the reactors complete their life without any major accidents. The impact of an exploding reactor can crush the economy of a nation as the Soviets have discovered in Chernobyl.

"Why is so much fuss being made about Chernobyl ? After all it took place in some remote corner of Russia and only 37 people have died in the accident..."

Whereas more people die everyday in road accidents ! Nuclear scientists have gone out of their way to disseminate disinformation about Chernobyl. They would like us to believe the myths that Chernobyl was a 'freak, it cannot happen anywhere else, the reactor there was of poor design and did not have adequate containment, the operators were too careless and 'only' 37 people have died in the accident and so on. The real number of Chernobyl victims will never be known, though the estimates vary from a hundred thousand to a million. Many of these victims are not even born today.

"I don't understand at all. Why such discrepancy in casualty estimates ? How can an accident claim victims who are not yet born ?"

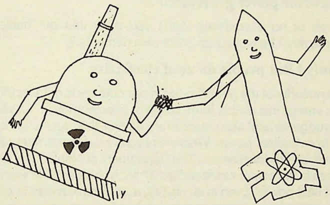
That is the bizarre reality of nuclear accidents. It has been said that a nuclear accident anywhere is a nuclear accident everywhere. When the Chernobyl reactor exploded, it spewed out tons of deadly fission products into the air. In the next few days, wherevr it rained in Europe, it poured radionuclides. Large areas in Poland, Sweden, Hungary, Germany and France are now contaminated with the Chernobyl fallout. Immediately after the disaster, thousands of tons of foodgrains, fruits, vegetables and animal produce had to be destroyed because of the high radioactivity. Even Ireland, 3000 km away from the disaster was so contaminated that thousands of animals had to be killed and buried deep underground.

But the long lived radionuclides have already got into the food chain through soil and water and there is precious little that can be done about it. Because of the increased contamination it is expected that the incidences of cancer, genetic distortions, sterility etc., will rise during the coming decades. But no one is able to predict with any precision the ultimate loss in human terms. Friends of Earth,-UK, have estimated an extra 1,50,000 deaths in the next two generations. And these are the casualty figures outside USSR. No one knows the extent of contamination inside that country. Five years after the disaster, the authorities there are still discovering new townships that have to be evacuated because of excessive radiation.

"This is really terrible. Can a Chernobyl-like accident happen here ?"

The first reaction of nucleocrats all over the world to Chernobyl was that IT CANNOT HAPPEN HERE. Dr. Raja Ramanna has gone to the extent of dismissing it as a 'curious fire accident'. It is true that in Chernobyl, the operators violated all the safety norms and the reactor itself was of an unconventional design. Both these factors have been highlighted by the nucleocrats ad naseum. But the real issue is, how safe is nuclear technology and what is the credibility of nuclear scientists who claim that it is impossible for their reactors to explode? In the 70's, a study sponsored by the US

Together, we can destroy this world



Atomic Energy Commission claimed that the possibility of an uncontrolled accident in a nuclear reactor was one in 17,000 years. Within ten years of the report two such accidents have already happened.

Of the several types of reactors in the world today, our own CANDU designs are considered the closest operating cousins of Chernobyl. They suffer from the Positive Coefficient of Void, a charecteristic that played a crucial role in the Chernobyl disaster. But whether it is CANDU or any other kind of design, the ultimate safety of the reactor is still a question mark.

"And we all have to live under that question mark ! But tell me, why are we still at it ? Why is there so much enthusiasm for such a worthless, costly and disastrous power programme ?"

Unfortunately in our country the nuclear power programme has been linked to the national pride. With thousands of crores being poured into unviable nuclear projects, a powerful lobby has been built up to perpetuate the nuclear myths. But whatever the pretensions, the real and unstated reason for nuclear power programmes anywhere in the world is same - it gives a veneer of respectability to the nuclear weapons programme.

The spent fuel containing plutonium may be an environmental nightmare, but it is excellent weapons grade material. All the nations who run nuclear reactors also have secret fuel reprocessing plants to extract the materials for the bombs. In our own country such a plant exists at Ratnahalli near Mysore. Our nuclear scientists refuse even to acknowledge its existence in public. Many of the facilities set up for the so called peaceful nuclear programmes are also common to the weapons programme. Nuclear power and nuclear weapons are two sides of the same coin. One cannot exist without the other.

"But if we stop all the atomic power projects what alternatives do we have for power generation ?"

Alternatives or no alternatives, don't you think that our nuclear power programme must be wound up on its own demerits ?

"Certainly ! But people do need electricity."

What the majority of the people need in our country is not electricity per se but basic energy in a usable form. Lakhs of poor women in our villages who have to trudge several kilometers every day for their fuel will not benefit in any way from nuclear power. What we need are decentralised and localised projects which fufil local needs. The Department of Non-conventional Energy Sources in the centre has identified 37 such sources which include solar, wind and tidal power. Even in elecrticity, a 2% improvement in efficiency of usage or reduction in losses can make atomic energy unnecessary. What is lacking is funding for research and implementation. With 85% of the energy budget going down the nuclear drain, such truly environment friendly and sustainable approaches to development continue to be ignored.

"How do we change this situation ?"

Nuclear power is anti people. It has to be opposed with people's power. It is the common people like you and us who have to raise our voice and demand a sane energy programme. Non violent agitations to register your opposition to disastrous nuclear projects will also be required. Can we expect your active participation in our common efforts to rid this country of the nuclear menace ?

"Certainly you can. I am willing to do everything possible."

Think again ! Our people have been conditioned for the last forty years into believing that atomic energy is a matter of national pride. You will find it hard to convince them merely with facts and sensible arguments. Anti nuclear activists are branded anything from the misguided to anti-national. Many of them have been persecuted for their convictions. Are you really willing to take up the challenge ?

"I will be betraying my own children and grandchildren if I don't. They have a right to a radiation free world. Tell me how to start."

You can start by distributing copies of this booklet ! It is important to educate our people on the true horrors of nuclear power. Make sure that your MLAs and MPs also get a copy. Demand that they raise questions in the legislature and the parliament about our nuclear projects. There are probably other people and organisations already active in your area on these issues. Join hands with them. Remember it is our common future at stake.

NAVA publishes for

Citizens for Alternatives to Nuclear Energy (CANE)
809, 17th E Main, 5th Block, Rajajinagar
BANGALORE 560 010

ಅಣುಸ್ಥಾವರ – ಭೂಮಿಗೆ ಭಾರ

ಅಣುಸ್ಥಾವರ – ಭೂಮಿಗೆ ಭಾರ

ನಮಸ್ಕಾರ, ನಾವು ಅಣು ವಿರೋಧಿ ಕಾರ್ಯಕರ್ತರು.....

"ನಿಮ್ಮ ಪರಿಚಯವಾದದ್ದು ಸಂತೋಷ. ನಿಮ್ಮ ವಿಚಾರಗಳಿಗೆ ನಮ್ಮ ಸಂಪೂರ್ಣ ಬೆಂಬಲವಿದೆ. ಈ ಅಣ್ವಸ್ತ್ರಗಳ ಪೈಪೋಟಿಯಲ್ಲಿ ಇಡೀ ಪೃಥ್ವಿಯೇ ವಿನಾಶದ ಅಂಚಿಗೆ ಬಂದು ಬಿಟ್ಟಿದೆ."

ಒಂದು ನಿಮಿಷ. ನಾವು ವಿರೋಧಿಸುವುದು ಅಣುಬಾಂಬುಗಳನ್ನು ಮಾತ್ರವಲ್ಲ. ನಮ್ಮ ದೇಶದಲ್ಲಿ ಅಣುಶಕ್ತಿಯ 'ಶಾಂತಿಯುತ ಬಳಕೆ' ಎಂಬ ಸೋಗಿನಲ್ಲಿ ನಡೆಯುತ್ತಿರುವ ಇತರ ಚಟುವಟಿಕೆಗಳನ್ನೂ.

"ಎಂದರೆ ನೀವು ಅಣುವಿದ್ಯುತ್ ಕೇಂದ್ರಗಳಿಗೂ ವಿರುದ್ಧವಾಗಿದ್ದೀರಾ?"

ಖಂಡಿತವಾಗಿ. ನಮ್ಮ ಅಣುಶಕ್ತಿಯ ಕಾರ್ಯಕ್ರಮಪೂರ್ತಿಯಾಗಿ ವಿಫಲಗೊಂಡಿದ್ದು ಅದನ್ನು ಸಾಧ್ಯವಿದ್ದಷ್ಟು ಬೇಗ ಸಮಾಪ್ತಗೊಳಿಸುವುದೇ ನಮ್ಮ ಗುರಿ.

"ನಿಮಗೆಲ್ಲೋ ತಲೆ ಕೆಟ್ಟಿದೆಯೆಂದು ಕಾಣುತ್ತದೆ! ವಿಜ್ಞಾನವೆನ್ನುವುದು ಎರಡು ಅಲಗಿನ ಕತ್ತಿಯಿದ್ದಂತೆ. ವಿನಾಶಕ್ಕಾಗಿ ಕಂಡುಹಿಡಿದ ಅಣುವಿನ ಸಾಮರ್ಥ್ಯವನ್ನು ನಮ್ಮ ವಿಜ್ಞಾನಿಗಳು ಪಳಗಿಸಿ ವಿದ್ಯುತ್ತಿನ ಉತ್ಪಾದನೆಯಲ್ಲಿ ತೊಡಗಿಸಿದ್ದಾರೆ. ನಾವೆಲ್ಲ ಅವರ ಸಾಧನೆಗಳ ಬಗ್ಗೆ ಹೆಮ್ಮೆ ಪಡಬೇಕು. ಜಗತ್ತಿನ ಮುಂದುವರೆದ ರಾಷ್ಟ್ರಗಳೆಲ್ಲ ಅಣುಶಕ್ತಿಯಿಂದ ಹೆಚ್ಚು ಹೆಚ್ಚು ವಿದ್ಯುತ್ತನ್ನು ಉತ್ಪಾದಿಸುತ್ತಿರುವಾಗ ನಾವೇಕೆ ಹಿಂದುಳಿಯಬೇಕು?"

ಕ್ಷಮಿಸಿ, ವಿಜ್ಞಾನಿಗಳು ಮತ್ತು ವಿಜ್ಞಾನದ ಸದುಪಯೋಗ ಅಥವಾ ದುರುಪಯೋಗದ ಕುರಿತು ನಿಮ್ಮ ವಿಚಾರಗಳು ಇನ್ನಷ್ಟು ಪ್ರಬುದ್ಧವಾಗಬೇಕೆಂದು ನಮಗೆ ತೋರುತ್ತದೆ. ಇತರ ರಾಷ್ಟ್ರಗಳ ಪ್ರಸ್ತಾಪ ಮಾಡಿದ್ದೀರಿ. ಜಗತ್ತಿನ ಹೆಚ್ಚಿನ ಮುಂದುವರಿದ ದೇಶಗಳು ಈಗಾಗಲೇ ಅಣುಶಕ್ತಿಗೆ ವಿದಾಯ ಹೇಳಿವೆ. ೧೯೭೫ರಿಂದ ಅಮೇರಿಕೆಯಲ್ಲಿ ಯಾವ ಹೊಸ ಅಣುಸ್ಥಾವರ ನಿರ್ಮಿಸುವ ನಿರ್ಣಯವನ್ನೂ ತೆಗೆದುಕೊಂಡಿಲ್ಲ. ಅದಕ್ಕೂ ಮುಂಚೆ ಆರಂಭಿಸಿದ ನೂರಕ್ಕೂ ಹೆಚ್ಚು ಸ್ಥಾವರಗಳನ್ನು ಅರ್ಧದಲ್ಲಿಯೇ ಕೈ ಬಿಟ್ಟಿದ್ದಾರೆ. ಯುರೋಪಿನ ಬಹುತೇಕ ರಾಷ್ಟ್ರಗಳು ತಮ್ಮ ಅಣುವಿದ್ಯುತ್ ಯೋಜನೆಗಳನ್ನು ನಿಲ್ಲಿಸಿವೆ. ಈಗ ನಡೆಯುತ್ತಿರುವ ಸ್ಥಾವರಗಳನ್ನೂ ಮುಚ್ಚಿ ಹಾಕುವ ಯತ್ನದಲ್ಲಿವೆ. ನಮ್ಮ ದೇಶದಲ್ಲಿ ನಾವು ನಿರ್ಮಿಸುತ್ತಿರುವುದು 'ಕಾಂಡು' ಎಂಬ ಮಾದರಿಯ ಅಣುಸ್ಥಾವರಗಳನ್ನು. ಇವುಗಳನ್ನು ಮೊದಲು ಅಭಿವೃದ್ಧಿ ಪಡಿಸಿದ ಕೆನಡಾ ದೇಶವೇ ೧೯೭೮ರಿಂದ ಈಚೆಗೆ ಕಾಂಡು ಸ್ಥಾವರಗಳನ್ನು ಕೈ ಬಿಟ್ಟಿದೆ.

"ಆದರೆ ಏಕೆ? ಅವರಿಗೆಲ್ಲ ವಿದ್ಯುತ್ತು ಅಗತ್ಯವಿಲ್ಲವೆ?"

ಖಂಡಿತವಾಗಿ ಅಗತ್ಯವಿದೆ. ಆದರೆ ಆ ವಿದ್ಯುತ್ತು ಎಲ್ಲಿಂದಾದರೂ ಬರಲಿ, ಅಣುಸ್ಥಾವರಗಳಿಂದ ಮಾತ್ರ ಬೇಡ ಎನ್ನುವುದೇ ಅವರ ತೀರ್ಮಾನ.

"ನಮಗಂತೂ ನೀವು ಹೇಳುವುದು ಅರ್ಥವಾಗುತ್ತಿಲ್ಲ. ಅಣುವಿದ್ಯುತ್ತಿನಲ್ಲಿ ಅಂಥದೇನು ಕೇಡಿದೆ?"

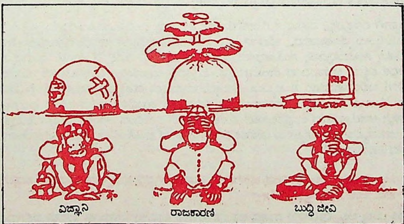
ಜಗತ್ತಿನುದ್ದಕ್ಕೂ ಅಣುಶಕ್ತಿ ತಿರಸ್ಕೃತವಾದದ್ದಕ್ಕೆ ಹಲವಾರು ಬಲವಾದ ಕಾರಣಗಳಿವೆ. ಮಿತಿಮೀರಿದ ವೆಚ್ಚ, ಕಳಪೆ ಮಟ್ಟದ ಉತ್ಪಾದನೆ, ವಿಕಿರಣದ ಅಪಾಯಗಳು, ಬಗೆ ಹರಿಸಲಾಗದ ತಾಂತ್ರಿಕ ಸಮಸ್ಯೆಗಳು, ಅಪಘಾತದ ಸಾಧ್ಯತೆಗಳು ಇವುಗಳನ್ನು ಮುಖ್ಯವಾಗಿ ಹೇಳಬಹುದು. ಮನುಷ್ಯ ಸೃಷ್ಟಿಸಿದ ತಂತ್ರಜ್ಞಾನಗಳಲ್ಲಿ ಪರಿಸರಕ್ಕೆ ಅತ್ಯಂತ ಮಾರಕವಾದದ್ದು ಬಹುಶಃ ಅಣುಶಕ್ತಿಯೇ.

"ಆದರೆ ನಮ್ಮ ಅಣುವಿಜ್ಞಾನಿಗಳು ಹೇಳುವುದು ಬೇರೆಯೇ ಇದೆಯಲ್ಲ. ಅವರ ಪ್ರಕಾರ ಅಣುಶಕ್ತಿ ಪರಿಸರಕ್ಕೆ ಪೂರಕವಾದದ್ದು. ಕಲ್ಲಿದ್ದಲನ್ನು ಉರಿಸುವ ಶಾಖೋತ್ಪನ್ನ ಸ್ಥಾವರಗಳಿಗೆ ಹೋಲಿಸಿದರೆ ,...."

ಮುಂದಿನದನ್ನು ಬೇಕಿದ್ದರೆ ನಾವೇ ಹೇಳುತ್ತೇವೆ. ಶಾಖೋತ್ಪನ್ನ ಸ್ಥಾವರಗಳು ಪ್ರತಿ ದಿನವೂ ಸಾವಿರಾರು ಟನ್ ಕಲ್ಲಿದ್ದಲನ್ನು ಉರಿಸಿ ಅದರ ಬೂದಿಯನ್ನು ವಾತಾವರಣಕ್ಕೆ ಬಿಡುಗಡೆ ಮಾಡುತ್ತವೆ. ಅದರಿಂದ ಹಸಿರು ಮನೆ ಪರಿಣಾಮ, ಆಮ್ಲ ಮಳೆಯ ಪ್ರಕೋಪಗಳಾಗುತ್ತವೆ. ಜಲವಿದ್ಯುತ್ ಯೋಜನೆಗಳಲ್ಲಿ ಸಾವಿರಾರು ಹೆಕ್ಟೇರ್ ದಟ್ಟ ಅರಣ್ಯಗಳ ಮುಳುಗಡೆಯಾಗುತ್ತದೆ, ಇನ್ನೆಷ್ಟೋ ಸಾವಿರ ಜನ ನಿರಾಶ್ರಿತರಾಗುತ್ತಾರೆ. ಆದರೆ ಅಣುವಿದ್ಯುತ್ ಯೋಜನೆಗಳಿಗೆ ಬೇಕಾಗುವ ಸ್ಥಳ ಅತ್ಯಂತ ಕಡಿಮೆ. ಅವುಗಳನ್ನು ಎಲ್ಲಿ ಬೇಕಾದರೂ ಸ್ಥಾಪಿಸಬಹುದು. ಅಣು ಸ್ಥಾವರಗಳು ಅತ್ಯಂತ ಕಡಿಮೆ ಇಂಧನವನ್ನು ಬಳಸಿಕೊಳ್ಳುತ್ತವೆ ಮತ್ತು ಯಾವ ಬಗೆಯ ಪ್ರದೂಷಕಗಳನ್ನೂ ಸೃಷ್ಟಿಸುವುದಿಲ್ಲ.

"ಹೌದು. ನಮ್ಮ ವಿಜ್ಞಾನಿಗಳು ಹೀಗೆಯೇ ಹೇಳುತ್ತಾರೆ. ಇದೆಲ್ಲ ಹಸೀ ಸುಳ್ಳು ಎಂದು ನಿಮ್ಮ ಅಭಿಪ್ರಾಯವೇ?"

ಸಾಮಾನ್ಯವಾಗಿ ನಮ್ಮ ಅಣುವಿಜ್ಞಾನಿಗಳು ನೇರವಾದ ಸುಳ್ಳುಗಳನ್ನು ಹೇಳುವುದಿಲ್ಲ. ಅದರ ಅಗತ್ಯವೂ ಅವರಿಗಿಲ್ಲ. ಬದಲಿಗೆ ಅರ್ಧ ಸತ್ಯಗಳು ಮತ್ತು ನಿರ್ಮಾಹಿತಿಯ ಪ್ರಸಾರದಲ್ಲಿ ಅವರು ನಿಸ್ಸೀಮರು. ಅಣುಶಕ್ತಿಯ ಯೋಜನೆಗಳಲ್ಲಿ ಪರಿಸರ ಕಲುಷಿತಗೊಳ್ಳುವುದು ವಿಕಿರಣ ಪ್ರಸಾರದಿಂದ. ವಿಕಿರಣ ಎನ್ನುವುದು ಜೈವಿಕ ಪ್ರದೂಷಣ. ಇತರ ಸ್ಥಾವರಗಳಿಂದ ಉತ್ಪನ್ನವಾಗುವ ಹೊಗೆ, ರಾಡಿಗಳಂಥ ರಾಸಾಯನಿಕ ಪ್ರದೂಷಣಗಳ ಜೊತೆಗೆ ಅದನ್ನು ಹೋಲಿಸಲಾಗದು. ವಿಕಿರಣ ನಮ್ಮ ಕಣ್ಣಿಗೆ ಕಾಣುವುದಿಲ್ಲ. ಆದರೆ ಅತ್ಯಂತ ಕಡಿಮೆ ಪ್ರಮಾಣದಲ್ಲಿಯೂ ಅದು ನಮ್ಮ ಜೀವಗಳನ್ನು ಕಲುಷಿತಗೊಳಿಸಿ ನಾಶ ಮಾಡಬಹುದು.



"ವಿಕಿರಣದ ಕುರಿತು ನಾವೂ ಕೇಳಿದ್ದೇವೆ. ಅದು ನೈಸರ್ಗಿಕವಾಗಿ ನಮ್ಮ ಸುತ್ತಲೂ ಇರುವಂಥದಲ್ಲವೇ?"

ನೈಸರ್ಗಿಕ ವಿಕಿರಣದ ಸ್ವರೂಪ ಮತ್ತು ನಮ್ಮ ಮೇಲೆ ಅದು ಉಂಟುಮಾಡಬಹುದಾದ ಪರಿಣಾಮಗಳೇ ಬೇರೆ. ಅಣುಶಕ್ತಿಯ ಯೋಜನೆಗಳಲ್ಲಿ ಬಿಡುಗಡೆಯಾಗುವ ವಿಕಿರಣದ ಪರಿಣಾಮಗಳೇ ಬೇರೆ. ಎರಡಕ್ಕೂ ಒಂದೇ ಹೆಸರನ್ನಿಟ್ಟು ಹೋಲಿಸುವುದು, ಜನರನ್ನು ತಪ್ಪು ದಾರಿಗೆಳೆಯಲು ಅಣುವಿಜ್ಞಾನಿಗಳು ಹರಡುವ ಅರ್ಧಸತ್ಯಕ್ಕೆ ಒಳ್ಳೆಯ ಉದಾಹರಣೆಯಾಗಿದೆ. ಅಣುಸ್ಥಾವರಗಳಿಂದ ವಿಕಿರಣಶೀಲ ಪರಮಾಣು ಅಥವಾ ರೇಡಿಯೋನ್ಯೂಕ್ಲೈಡುಗಳು ನಿರಂತರವಾಗಿ ಬಿಡುಗಡೆಯಾಗಿ ನೆಲ, ನೀರು ಮತ್ತು ಗಾಳಿಯಲ್ಲಿ ಸೇರಿಕೊಳ್ಳುತ್ತವೆ. ಅಲ್ಲಿಂದ ಅವು ನಮ್ಮ ಉಸಿರಿನಲ್ಲಿ, ಆಹಾರ ಚಕ್ರದಲ್ಲಿ ಸೇರಿಕೊಂಡು ದೇಹದಲ್ಲಿ ಸಂಗ್ರಹವಾಗತೊಡಗುತ್ತವೆ. ಜೊತೆಗೆ ಅಣುಸ್ಥಾವರಗಳಿಂದ ಗಾಮಾ ವಿಕಿರಣದ ತರಂಗಗಳು ನಿರಂತರವಾಗಿ ಸೋರಿ ಹೋಗುತ್ತಿರುತ್ತವೆ. ಕೆಲಸಗಾರರು ಮತ್ತು ಸುತ್ತಲೂ ವಾಸವಾಗಿರುವ ಜನರ ಮೇಲೆ ಇದರಿಂದ ದುಷ್ಪರಿಣಾಮಗಳಾಗಲು ಸಾಧ್ಯ.

"ಆದರೆ ನಮ್ಮ ವಿಜ್ಞಾನಿಗಳ ಪ್ರಕಾರ ಅಣುಸ್ಥಾವರಗಳಿಂದ ಬಿಡುಗಡೆಯಾಗುವ ವಿಕಿರಣದ ಪ್ರಮಾಣ ಅತ್ಯಲ್ಪ, ವೈಜ್ಞಾನಿಕವಾಗಿ ನಿರ್ಧರಿಸಲ್ಪಟ್ಟ ಮಿತಿಗಳಿಗಿಂತಲೂ ತುಂಬ ಕಡಿಮೆ, ಅದರಿಂದ ಆರೋಗ್ಯದ ಮೇಲೆ ಯಾವ ದುಷ್ಪರಿಣಾಮವಾಗಲೂ ಶಕ್ಯವಿಲ್ಲ ಎಂದು ಭರವಸೆ ನೀಡುತ್ತಾರಲ್ಲ ?"

ಕಳೆದ ಐವತ್ತು ವರ್ಷಗಳಿಂದ ಅಣುಶಕ್ತಿಯ ಸಮರ್ಥಕರು 'ಅಲ್ಪ ವಿಕಿರಣ ನಿರಪಾಯಕಾರಿ' ಎಂಬ ಮಿಥ್ಯೆಯನ್ನು ಪ್ರತಿಪಾದಿಸುತ್ತ ಬಂದಿದ್ದಾರೆ. ವಿಕಿರಣ ಎಷ್ಟೇ ಅಲ್ಪ ಪ್ರಮಾಣದಲ್ಲಿದ್ದರೂ ಅಪಾರವಾದ ಜನಸಂಖ್ಯೆಯ ಮೇಲೆ ಹರಡಿದಾಗ ಅಪಾಯಕಾರಿ ಎನ್ನಿಸಿಕೊಳ್ಳುತ್ತದೆ. ಯಾವ ವಿಕಿರಣಕ್ಕೂ 'ಸುರಕ್ಷಿತ ಮಿತಿ' ಎನ್ನುವುದೇ ಇಲ್ಲ. ಎಂಥ ಕಡಿಮೆ ಪ್ರಮಾಣದಲ್ಲಿಯೂ ಅದರಿಂದ ಜೀವನಾಶ ತಪ್ಪಿದ್ದಲ್ಲ.

"ಅದು ಹೇಗೆ ? ವಿಕಿರಣ ನಿಜಕ್ಕೂ ಅತ್ಯಲ್ಪ ಪ್ರಮಾಣದಲ್ಲಿದ್ದರೆ ಅದರಿಂದ ಜೀವನಾಶ ಹೇಗೆ ಸಾಧ್ಯ?"

ದೇಹದಲ್ಲಿ ಸೇರಿಕೊಂಡ ವಿಕಿರಣಶೀಲ ಪರಮಾಣುಗಳು ಅಲ್ಲಿಯೇ ಒಡೆದು ವಿಕಿರಣದ ತರಂಗಗಳನ್ನು ಹೊರಡಿಸಬಹುದು. ಇದೂ ತಕ್ಷಣವೇ ಆಗುವ ಕ್ರಿಯೆಯಲ್ಲ. ಕೆಲವೇ ದಿನಗಳಿಂದ ಹಿಡಿದು ಮುಂದಿನ ಹಲವಾರು ವರ್ಷಗಳಲ್ಲಿ ಯಾವಾಗ ಬೇಕಾದರೂ ಆದೀತು. ದೇಹದಲ್ಲಿ ವಿಕಿರಣಶೀಲ ಕಲ್ಮಷ ಸಂಗ್ರಹವಾದಂತೆ ಅಪಾಯದ ಸಾಧ್ಯತೆಯೂ ಹೆಚ್ಚುತ್ತದೆ. ವಿಕಿರಣದ ತರಂಗಗಳು ಸುತ್ತಲಿನ ಜೀವಕೋಶಗಳಿಗೆ ಅಪ್ಪಳಿಸಿ ಅವುಗಳನ್ನು ನಾಶ ಮಾಡಬಹುದು ಅಥವಾ ವಿಕೃತಗೊಳಿಸಬಹುದು. ಪರಿಣಾಮವಾಗಿ ನಾನಾ ಬಗೆಯ ಕ್ಯಾನ್ಸರುಗಳು, ಲುಕೇಮಿಯಾ, ಥೈರಾಯ್ಡ್ ಗಂಟು, ನಪುಂಸಕತ್ವ, ಬಂಜೆತನದಂಥ ವ್ಯಾಧಿಗಳು ಉಂಟಾಗಬಹುದು. ವಿಕಿರಣವನ್ನುಂಡ ತಂದೆ ತಾಯಿಯರು ಬುದ್ಧಿಮಾಂದ್ಯ ಮತ್ತು ವಿಕಲಾಂಗ ಮಕ್ಕಳಿಗೆ ಜನ್ಮ ನೀಡುವ ಸಾಧ್ಯತೆಗಳಿವೆ.

ಪ್ರತ್ಯಕ್ಷವಾಗಿ ಮಾತ್ರವಲ್ಲ, ಮನುಷ್ಯನ ರೋಗನಿರೋಧಕ ಶಕ್ತಿಯನ್ನು ಕುಂದಿಸಿ ಪರೋಕ್ಷವಾಗಿಯೂ ವಿಕಿರಣ ಹಾನಿಯನ್ನುಂಟು ಮಾಡಬಹುದು. ಹರ್ಪಿಸ್, ಸೆಪ್ಟಿಸೆಮಿಯಾ ಮತ್ತು ಏಡ್ಸನಂಥ ಭೀಕರ ಕಾಯಿಲೆಗಳಿಗೂ ವಿಕಿರಣಕ್ಕೂ ನಂಟಿರುವುದನ್ನು ಸಂಶೋಧಕರು ತೋರಿಸಿ ಕೊಟ್ಟಿದ್ದಾರೆ. ಇವೆಲ್ಲ ರೋಗಗಳು ಮನುಷ್ಯನಲ್ಲಿ ನಿರೋಧಕ ಶಕ್ತಿಯ ಅಭಾವದಿಂದ ಉಂಟಾಗುತ್ತವೆ. ಜಗತ್ತಿನಲ್ಲಿ ಅಣುಶಕ್ತಿಯ ಚಟುವಟಿಕೆಗಳು ಹೆಚ್ಚಿದಂತೆ ಅವುಗಳಿಗೆ ಬಲಿಯಾಗುವವರ ಸಂಖ್ಯೆಯೂ ಏರುತ್ತಿದೆ. ಮನುಷ್ಯರು ಮಾತ್ರವಲ್ಲ ಸಾಕುಪ್ರಾಣಿಗಳು ಮತ್ತು ಸಸ್ಯಗಳ ಮೇಲೂ ವಿಕಿರಣದ ಪ್ರಭಾವವಾಗುತ್ತದೆ. ಕರ್ನಾಟಕದ ಕರಾವಳಿಗೆ ಸೇರಿದ ಪಶ್ಚಿಮ ಘಟ್ಟಗಳಲ್ಲಿ ಜಗತ್ತಿನಲ್ಲೇ ಅಪರೂಪವಾದ ಉಷ್ಣವಲಯದ ಮಳೆಕಾಡುಗಳಿವೆ. ಕೈಗಾದಿಂದ ಆರಂಭಿಸಿ ಘಟ್ಟಗಳ ಉದ್ದಕ್ಕೂ ತಮ್ಮ ಅಣುಸ್ಥಾವರಗಳನ್ನು ಸ್ಥಾಪಿಸಲು ಅಣುಶಕ್ತಿ ನಿಗಮ ಯೋಜನೆ ಹಾಕಿಕೊಂಡಿದ್ದು ಪರಿಸರ ಪ್ರೇಮಿಗಳಿಗೆಲ್ಲ ಕಳವಳದ ವಿಷಯವಾಗಿದೆ.

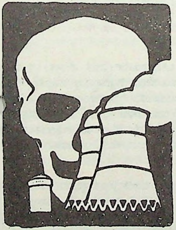
"ನನಗಿನ್ನೂ ನಂಬಿಕೆಯಾಗುತ್ತಿಲ್ಲ. ನೀವು ಹೇಳುವುದು ನಿಜವೇ ಆಗಿದ್ದಲ್ಲಿ ನಮ್ಮ ಅಣುಸ್ಥಾವರಗಳ ಸುತ್ತಲೆಲ್ಲ ಜನರು ಪಟಪಟನೇ ಸಾಯುತ್ತಿದ್ದಾರೆಯೇ?"

ಅಣುಶಕ್ತಿ ಮತ್ತು ಅಲ್ಪ ವಿಕಿರಣಗಳ ವಾಸ್ತವ ಅತ್ಯಂತ ಸಂಕೀರ್ಣವಾದದ್ದು ಎಂದು ಈ ಸಂದರ್ಭದಲ್ಲಿ ನಾವು ಮತ್ತೊಮ್ಮೆ ಹೇಳಬಯಸುತ್ತೇವೆ. ತೀವ್ರವಾದ ವಿಕಿರಣಕ್ಕೆ ಒಳಗಾದವರಲ್ಲಿ ಪರಿಣಾಮಗಳು ತಕ್ಷಣ ಕಾಣಿಸಿಕೊಳ್ಳುತ್ತವೆ. ಆದರೆ ಅಲ್ಪ ವಿಕಿರಣದ ವಿಷಯ ಹಾಗಲ್ಲ. ಮನುಷ್ಯನ ದೇಹದಲ್ಲಿ ಅದು ಹಂತ ಹಂತವಾಗಿ ಶೇಖರಗೊಂಡು ಎಷ್ಟೋ ವರ್ಷಗಳ ನಂತರವೇ ತನ್ನ ಪರಿಣಾಮಗಳನ್ನು ತೋರಿಸುತ್ತದೆ. ಅದರಲ್ಲೂ ವೃದ್ಧರು, ಗರ್ಭಿಣಿಯರು, ಚಿಕ್ಕ ಮಕ್ಕಳು, ರೋಗಿಗಳು ಹೀಗೆ ಸ್ವಾಭಾವಿಕವಾಗಿ ದುರ್ಬಲ ಸ್ಥಿತಿಯಲ್ಲಿರುವವರೇ ವಿಕಿರಣಕ್ಕೆ ಬಲಿಯಾಗುವ ಸಾಧ್ಯತೆ ಅತಿ ಹೆಚ್ಚು. ಯುರೇನಿಯಮ್ ಗಣಿಗಳಲ್ಲಿ, ಅದರ ಸಂಸ್ಕರಣ ಕೇಂದ್ರಗಳಲ್ಲಿ, ಕೆಲಸ ಮಾಡುವ ಬಡ ಕೂಲಿಗಳು ೧೫–೨೦ ವರ್ಷಗಳ ನಂತರ ಕ್ಯಾನ್ಸರಿಗೆ ಬಲಿಯಾದರೆ, ಹದಿ ಹರೆಯದ ಯುವಜನರು ವಿಕಿರಣ ತಟ್ಟಿಸಿಕೊಂಡು ತಮ್ಮ ಮುಂದಿನ ಜೀವನದಲ್ಲಿ ನಪುಂಸಕರಾದರೆ ಅಥವಾ ವಿಕೃತ ಶಿಶುಗಳಿಗೆ ಜನ್ಮವಿತ್ತರೆ ಅದರ ಸಾಮಾಜಿಕ ಜವಾಬ್ದಾರಿ ಯಾರದು?

"ಖಂಡಿತವಾಗಿ ನಮ್ಮ ಅಣು ವಿಜ್ಞಾನಿಗಳದ್ದೇ. ಆದರೆ ಇಂಥದು ನಿಜಕ್ಕೂ ನಮ್ಮ ದೇಶದಲ್ಲಿ ನಡೆದಿದೆಯೇ?"

ನಡೆದಿದೆ, ನಡೆಯುತ್ತಿದೆ. ನೀವು ಸುಮ್ಮನಿದ್ದರೆ ನಡೆಯುತ್ತಲೇ ಇರುತ್ತದೆ. ಬಿಹಾರದ ಜಾದುಗುಡಾದಲ್ಲಿ ಯುರೇನಿಯಮ್ ಗಣಿಗಳಿವೆ. ಅಲ್ಲಿ ಯುರೇನಿಯಮ್ ಅದಿರನ್ನು ಅಗೆದು ತೆಗೆಯುವಾಗ ರೇಡಾನ್ ಎಂಬ ವಿಷಾನಿಲವೂ ಬಿಡುಗಡೆಯಾಗಿ ವಾತಾವರಣದಲ್ಲಿ ಸೇರಿಕೊಳ್ಳುತ್ತದೆ. ಅದಿರನ್ನು ಶುದ್ಧೀಕರಿಸಿ ಉಳಿದ

ಕಲ್ಮಷಗಳನ್ನು ಅಲ್ಲಿನ ನದಿಯಲ್ಲಿ ಬಿಡಲಾಗುತ್ತಿದೆ. ಕೇರಳದ ಆಳ್ವಾಯಿ ಎಂಬಲ್ಲಿ ಇಂಧನ ಸಂಸ್ಕರಣ ಕೇಂದ್ರವೊಂದನ್ನು ಸ್ಥಾಪಿಸಲಾಗಿದ್ದು ಅಲ್ಲಿ ಯಾವುದೇ ಸುರಕ್ಷತಾ ಸಾಧನಗಳನ್ನು ಒದಗಿಸದೇ ಬಡ ಕಾರ್ಮಿಕರನ್ನು ದುಡಿಸಿಕೊಳ್ಳಲಾಗುತ್ತಿದೆ. ಇವೆರಡೂ ಸ್ಥಳಗಳಲ್ಲಿ ವಿಕಿರಣಕ್ಕೆ ಬಲಿಯಾಗಿ ಜನ ಪ್ರಾಣ ಕಳೆದುಕೊಂಡಿದ್ದಾರೆ, ವಿಕೃತ ಸಂತಾನದ ಪೀಳಿಗೆಯನ್ನು ಸೃಷ್ಟಿಸಿದ್ದಾರೆ.



೧೯೯೦ರಲ್ಲಿ ಪರಿಸರ ಕಾರ್ಯಕರ್ತರು ರಾಜಸ್ಥಾನದ ಅಣುಸ್ಥಾವರಗಳ ಸುತ್ತಲಿನ ಹಳ್ಳಿಗಳಲ್ಲಿ ಮಿತಿ ಮೀರಿದ ವಿಕಿರಣ ಸೋರುವಿಕೆಯಿಂದ ಆಗಿರುವ ಅನಾಹುತಗಳನ್ನು ದಾಖಲೆ ಮಾಡಿದ್ದಾರೆ. ಅಲ್ಲಿನ ಕೆಲ ಹಳ್ಳಿಗಳಲ್ಲಿಯಂತೂ ಮನೆಗೊಬ್ಬರಂತೆ ವಿಕಿರಣಕ್ಕೆ ಜನ ಬಲಿಯಾಗಿದ್ದಾರೆ. ನಿಶ್ಶಕ್ತಿ, ನಪುಂಸಕತ್ವ, ಅಂಗಾಂಗಗಳು ಶಿಥಿಲವಾಗುವುದು, ವ್ರಣಗಳು, ಡುವರ್ಣಂಸಗಳು, ನಾನಾ ವಿಧದ ಚರ್ಮರೋಗಗಳು, ಗಂಟುಗಳು ಮತ್ತು ಇನ್ನೂ ಅನೇಕ ಹೆಸರಿಲ್ಲದ ರೋಗಗಳಿಗೆ ಗುರಿಯಾಗಿ ನರಳುತ್ತಿದ್ದಾರೆ. ಅಂಗಾಂಗಗಳು ತಿರುಚಿಕೊಂಡ, ಬುದ್ಧಿಮಾಂದ್ಯ ಶಿಶುಗಳಂತೂ ಅಲ್ಲಿ ಗಾಬರಿಯಾಗುವ ಪ್ರಮಾಣದಲ್ಲಿ ಜನಿಸುತ್ತಿವೆ. ಮಕ್ಕಳಲ್ಲಿ ಪೋಲಿಯೋ ನಿರೋಧಕ ಶಕ್ತಿಯೂ ಕುಂಠಿತಗೊಂಡಿದೆ. ಅಣುಶಕ್ತಿಯ ಕರಾಳ ಛಾಯೆಯಲ್ಲಿ ಜನಸಾಮಾನ್ಯರ ಬದುಕು ಹೇಗೆ ವಿಕೃತಗೊಳ್ಳುತ್ತದೆ ಎನ್ನುವುದಕ್ಕೆ ರಾಜಸ್ಥಾನದ ಹಳ್ಳಿಗಳು ದುರಂತ ನಿದರ್ಶನಗಳಾಗಿವೆ.

"ಈ ಬಗ್ಗೆ ನಮ್ಮ ಅಣು ವಿಜ್ಞಾನಿಗಳು ಏನು ವಿವರಣೆ ನೀಡುತ್ತಾರೆ?"

ಸಾರಾ ಸಗಟಾಗಿ ಎಲ್ಲವನ್ನೂ ನಿರಾಕರಿಸಿ ಬಿಟ್ಟಿದ್ದಾರೆ. ಬಿಹಾರದಲ್ಲಾಗಲೀ ಕೇರಳದಲ್ಲಾಗಲೀ ವಿಕಿರಣದಿಂದ ಯಾರಿಗೂ ಏನೂ ಆಗಿಲ್ಲ. ರಾಜಸ್ಥಾನದಲ್ಲೂ ಅಷ್ಟೇ. ರೋಗಗಳೇನಾದರೂ ಇದ್ದರೆ ಜನರ ಅಜ್ಞಾನ, ಅಂಧಶ್ರದ್ಧೆಗಳೇ ಕಾರಣ. ಅದಕ್ಕೆ ವಿಕಿರಣವನ್ನು ಹೊಣೆಮಾಡಲು ಯಾವ 'ವೈಜ್ಞಾನಿಕ' ಆಧಾರವೂ ಇಲ್ಲ. ಸ್ವಚ್ಛವಾದ ಕುಡಿಯುವ ನೀರು, ಪ್ರಾಥಮಿಕ ಆರೋಗ್ಯ ಸೌಲಭ್ಯಗಳನ್ನು ಒದಗಿಸಿಕೊಳ್ಳಬೇಕು, ನೈರ್ಮಲ್ಯ ಕಾಪಾಡಿಕೊಳ್ಳಬೇಕು, ಅಂಧಶ್ರದ್ಧೆಗಳನ್ನು ತ್ಯಜಿಸಬೇಕು ಅಂದರೆ ಎಲ್ಲವೂ ಸರಿಹೋಗುತ್ತದೆ ಎಂದು ಭರವಸೆ ನೀಡಿದ್ದಾರೆ.

"ಆದರೆ ಭರವಸೆ ನೀಡಿದವರು ನಮ್ಮವರೇ ಆದ ಗೌರವಾನ್ವಿತ ವಿಜ್ಞಾನಿಗಳು. ಅವರ ಮಾತನ್ನು ನಾವೇಕೆ ನಂಬಬಾರದು?"

ನಂಬಿಕೆ ಎನ್ನುವುದು ಬೇಡಿ ಪಡೆಯುವಂಥ ವಸ್ತುವಲ್ಲ. ಆಕಾಶವಾಣಿ, ದೂರದರ್ಶನಗಳಂಥ ಸರಕಾರಿ ಮಾಧ್ಯಮಗಳಲ್ಲಿ ಪ್ರಚಾರ ಮಾಡಿಕೊಂಡ ಮಾತ್ರಕ್ಕೆ ಅದು ದೊರೆಯುವುದಿಲ್ಲ. ನಮ್ಮ ದೇಶದಲ್ಲಿ ಅಣುಶಕ್ತಿಗೆ ಸಂಬಂಧಿಸಿದ್ದೆಲ್ಲವೂ ಕೇವಲ ಕೆಲವೇ ಪಟ್ಟಭದ್ರ ಹಿತಾಸಕ್ತಿಗಳ ಕೈಯಲ್ಲಿದೆ. ವಿಕಿರಣದ 'ಸುರಕ್ಷಿತ' ಮಿತಿಗಳನ್ನು ನಿರ್ಧರಿಸುವವರೂ ಅವರೇ, ಅದನ್ನು ಹರಡುವವರೂ ಅವರೇ, ಹರಡಿದ್ದನ್ನು ಅಳೆಯುವವರೂ ಅವರೇ, ಅಳೆದದ್ದನ್ನು ವಿಶ್ಲೇಷಿಸಿ ಎಲ್ಲವೂ ಸುರಕ್ಷಿತವಾಗಿದೆಯೆಂಬ ತೀರ್ಪನ್ನೂ ಅವರೇ ಕೊಟ್ಟು ಬಿಡುತ್ತಾರೆ. ವಿಕಿರಣ ತಟ್ಟಿಸಿಕೊಂಡು ಪ್ರಾಣ ತೆರಬೇಕಾದ ಜನಸಾಮಾನ್ಯರಿಗೆ ಈ ವಿಷಯಗಳಲ್ಲಿ ಯಾವ ನಿರ್ಣಯವನ್ನು ತೆಗೆದುಕೊಳ್ಳುವ ಅಧಿಕಾರವೂ ಇಲ್ಲ.

"ನನಗೇಕೋ ಇದರ ಬಗ್ಗೆ ಕಳವಳವಾಗುತ್ತಿದೆ. ವಿಕಿರಣ ನಿಜಕ್ಕೂ ನಿರಪಾಯಕಾರಿಯೇ? ನಮ್ಮ ಅಣುಸ್ಥಾವರಗಳಿಂದ ಎಷ್ಟು ವಿಕಿರಣ ಹರಡುತ್ತಿದೆ? ಅದರಿಂದ ನಮ್ಮ ಮೇಲೆ ಏನು ಪರಿಣಾಮಗಳಾದಾವು? ಇದನ್ನೆಲ್ಲ ನಾವು ಖಚಿತವಾಗಿ ತಿಳಿದುಕೊಳ್ಳಲು ಸಾಧ್ಯವೇ ಇಲ್ಲವೇ?"

ಇಲ್ಲ. ೧೯೬೨ರಲ್ಲಿ ನಮ್ಮ ಸರಕಾರ ಅಣುಶಕ್ತಿಯ ಕುರಿತ ಎಲ್ಲ ಮಾಹಿತಿಯನ್ನು ರಹಸ್ಯವಾಗಿಡುವ ಕಾನೂನನ್ನು ಜಾರಿಗೆ ತಂದಿದೆ. ಅದರ ಪ್ರಕಾರ ಅಣುಶಕ್ತಿಗೆ ಸಂಬಂಧಿಸಿದ ಯಾವುದೇ ಮಾಹಿತಿಯನ್ನು ಸ್ವತಂತ್ರವಾಗಿ ತಿಳಿದುಕೊಳ್ಳುವ ಅಧಿಕಾರ ಜನ ಸಾಮಾನ್ಯರಿಗೆ ಇಲ್ಲ, ಅವರ ಪ್ರತಿನಿಧಿಗಳಿಗೂ ಇಲ್ಲ. ಸರಕಾರದ ಎಲ್ಲ ಇಲಾಖೆಗಳ ಕುರಿತು ನಮ್ಮ ವಿಧಾನಸಭೆ, ಲೋಕಸಭೆಗಳಲ್ಲಿ ಚರ್ಚಿಸಬಹುದು. ಆದರೆ ಅಣುಶಕ್ತಿ ಇಲಾಖೆಯ ಕಾರ್ಯವೈಖರಿ ಮಾತ್ರ ಅವುಗಳ ವ್ಯಾಪ್ತಿಗೆ ಮೀರಿದ್ದು. ನಮ್ಮ ದೇಶದಲ್ಲಿ ಅಣುವಿದ್ಯುತ್ತಿನ ಯೋಜನೆಗಳು ಹೇಗೆ ಪೂರ್ತಿಯಾಗಿ ವಿಫಲಗೊಂಡಿವೆ ಎಂಬ ಸತ್ಯವನ್ನು ಮುಚ್ಚಿಡಲು ಇಂಥ ಕಪ್ಪು ಕಾನೂನುಗಳು ನೆರವಾಗುತ್ತಿವೆ.

"ಪೂರ್ತಿ ವಿಫಲವಾಗಿವೆ ಎಂದೇಕೆ ಹೇಳುತ್ತೀರಿ? ನಮ್ಮ ಅಣುಕೇಂದ್ರಗಳು ವಿದ್ಯುತ್ತನ್ನಂತೂ ಉತ್ಪಾದಿಸುತ್ತವಲ್ಲವೇ?"

ಇಂದು ನಮ್ಮ ದೇಶದಲ್ಲಿ ಏಳು ಅಣುಸ್ಥಾವರಗಳಿವೆ. ಅವುಗಳ ಒಟ್ಟು ಕಾರ್ಯಕ್ಷಮತೆ ಶೇಕಡಾ ೪೩ ಮಾತ್ರ. ರಾಜಸ್ಥಾನದ ಒಂದು ಸ್ಥಾವರವನ್ನು ಬಿಟ್ಟರೆ ಬೇರೆ ಯಾವುದೂ ಶೇಕಡ ೫೦ರಷ್ಟನ್ನೂ ಸಾಧಿಸಿಲ್ಲ. ಯಾವ ಅಣುಕೇಂದ್ರವೂ ನಿಗದಿ ಮಾಡಿದ ಸಮಯ ಅಥವಾ ವೆಚ್ಚದಲ್ಲಿ ನಿರ್ಮಾಣವಾಗಿಲ್ಲ. ಕಲ್ಪಕ್ಕಂನ ಎರಡು ಸ್ಥಾವರಗಳ ಅಂದಾಜು ವೆಚ್ಚ ರೂ. ೧೩.೨ ಕೋಟಿ ಇದ್ದರೂ ತಗಲಿದ್ದು ರೂ. ೨೪೫ ಕೋಟಿ. ಎಂಟು ವರ್ಷಗಳಲ್ಲಿ ಮುಗಿಯಬೇಕಿದ್ದ ಯೋಜನೆ ಹದಿನೈದು ವರ್ಷಗಳನ್ನು ತೆಗೆದುಕೊಂಡಿದೆ. ನರೋರಾದ ಇತ್ತೀಚಿನ ಸ್ಥಾವರದ ಕಥೆಯೂ ಅದೇ. ನಿರ್ಮಾಣದಲ್ಲಾದ ವಿಳಂಬ ಎಂಟು ವರ್ಷಗಳಿಗಿಂತಲೂ ಹೆಚ್ಚು. ಯೋಜಿಸಿದ ವೆಚ್ಚ ೨೩.೨ ಕೋಟಿಯಾಗಿದ್ದರೆ ತಗಲಿದ ಖರ್ಚು ರೂ. ೫೩೪ ಕೋಟಿ.

ನಿರ್ಮಾಣವಾದ ಮೇಲೂ ನಮ್ಮ ಅಣುವಿದ್ಯುತ್ ಕೇಂದ್ರಗಳು ಕೆಲಸ ಮಾಡಿದ್ದಕ್ಕಿಂತ ಸ್ತಬ್ಧವಾಗಿರುವ ದಿನಗಳೇ ಹೆಚ್ಚು. ಕಲ್ಪಕ್ಕಂನ ಸ್ಥಾವರ ತನ್ನ ಮೊದಲ ಮೂರು ವರ್ಷಗಳಲ್ಲಿ ಸರಾಸರಿ ೯ ದಿನಗಳಿಗೊಮ್ಮೆ ಮುಚ್ಚಲ್ಪಟ್ಟಿದ್ದರೆ ರಾವತಭಾಟಾದ ಕೇಂದ್ರವನ್ನು ಹಲವಾರು ವರ್ಷ ಮುಚ್ಚಿಟ್ಟು ರಿಪೇರಿ ಮಾಡಬೇಕಾಯಿತು. ಅತ್ಯಂತ ಕಡಿಮೆ ವಿದ್ಯುತ್ತನ್ನು ಉತ್ಪಾದಿಸುವ ಕಾರಣಕ್ಕಾಗಿ ತಾರಾಪುರ, ರಾವತಭಾಟಾಗಳಲ್ಲಿ ತಲಾ ಒಂದು ಸ್ಥಾವರ ಶಾಶ್ವತವಾಗಿ ನಿಲುಗಡೆಯಾಗುವ ಸ್ಥಿತಿಗೆ ಬಂದಿವೆ. ಕಲ್ಪಕ್ಕಂನ ಇನ್ನೊಂದು ಸ್ಥಾವರಕ್ಕೂ ಅದೇ ಗತಿ ಬರಲಿದೆ.

"ಯಾವ ಮಾನದಂಡದಿಂದ ಅಳೆದರೂ ಇದು ವಿಫಲವೇ. ಆದರೆ ಈ ಕಳಪೆ ಸಾಧನೆಗೆ ಏನಾದರೂ ವಿಶೇಷ ಕಾರಣಗಳಿವೆಯೇ? ನಮ್ಮ ಅಣುವಿಜ್ಞಾನಿಗಳು ಈ ಕುರಿತು ಏನು ವಿವರಣೆ ನೀಡುತ್ತಾರೆ?"

ಅಣುಶಕ್ತಿ ಒಂದು ದುಬಾರಿ, ವಿಕೃತ ತಂತ್ರಜ್ಞಾನವೆಂಬುದನ್ನು ಬಿಟ್ಟರೆ ಬೇರೆ ಯಾವ ಕಾರಣವೂ ಬೇಕಾಗಿಲ್ಲ. ಸೋರುವ ಭಾರಜಲ, ಸೀಳಿ ಹೋಗುವ ರಕ್ಷಾಕವಚಗಳು, ಒಡೆಯುವ ಪೈಪುಗಳು, ಮೇಲಿಂದ ಮೇಲೆ ಮುರಿಯುವ ಟರ್ಬೈನಿನ ರೆಕ್ಕೆಗಳು, ದೋಷಪೂರ್ಣ ಇಂಧನ ಶಲಾಕೆಗಳು, ಸಣ್ಣ ಪುಟ್ಟ ಸ್ಫೋಟಗಳು, ಬೆಂಕಿಗಳು, ನಮ್ಮ ಅಣುಸ್ಥಾವರಗಳಲ್ಲಿ ಸಾಮಾನ್ಯವಾಗಿವೆ. ಅದಕ್ಕಾಗಿಯೇ ಅವುಗಳನ್ನು ಪದೇ ಪದೇ ಮುಚ್ಚಬೇಕಾಗುತ್ತದೆ. ಆದರೆ ತಮ್ಮ ಒಂದು ಜಾಹೀರಾತಿನಲ್ಲಿ ನಮ್ಮ ವಿಜ್ಞಾನಿಗಳು ಹೇಳಿಕೊಂಡಿರುವ ಪ್ರಕಾರ, ಸುರಕ್ಷತಾ ಕ್ರಮಗಳಿಗೆ ಅವರು ಹೆಚ್ಚಿನ ಆದ್ಯತೆ ನೀಡಿರುವುದರಿಂದ ವಿದ್ಯುತ್ತಿನ ಉತ್ಪಾದನೆಯಲ್ಲಿ ನಷ್ಟವಾಗಿದೆ. ಇದು ನಿಜಕ್ಕೂ ಅರ್ಥಹೀನ ವಿವರಣೆ. ಅದೇ ಜಾಹೀರಾತಿನಲ್ಲಿ ಅವರೇ ಕೊಟ್ಟ ಮಾಹಿತಿಯ ಪ್ರಕಾರ ನಮ್ಮ ಅಣುಸ್ಥಾವರಗಳಿಂದ ಸೋರುವ ವಿಕಿರಣ, ಅವುಗಳಿಗೆ ಹೋಲಿಸಬಹುದಾದ ಕೆನಡಾದ ಸ್ಥಾವರಗಳಿಗಿಂತ ೫-೬ ಪಟ್ಟು ಹೆಚ್ಚಿಗೆ ಇದೆ. ತಾರಾಪುರದಲ್ಲಿಯಂತೂ ಅದು ಹನ್ನೆರಡು ಪಟ್ಟು ಹೆಚ್ಚಿಗೆ ಇದ್ದು ಅವು 'ಜಗತ್ತಿನ ಅತ್ಯಂತ ಹೊಲಸು ವಿಕಿರಣಶೀಲ ಸ್ಥಾವರ' ಗಳೆಂಬ ಅಪಖ್ಯಾತಿಗೆ ಅಧಿಕೃತ ಪುರಾವೆಯನ್ನು ಒದಗಿಸುತ್ತವೆ.

ವಿದ್ಯುತ್ತಿನಲ್ಲಿ ಅನುತ್ಪಾದಕವಾದರೂ ನಮ್ಮ ಪರಮಾಣು ಕೇಂದ್ರಗಳು ವಿಕಿರಣ, ಕಲ್ಮಷಗಳನ್ನು ಮಾತ್ರ ಧಾರಾಳವಾಗಿ ಉತ್ಪಾದಿಸುತ್ತವೆ. ಪ್ರತಿ ವರ್ಷವೂ ನಮ್ಮ ಅಣುಶಕ್ತಿ ಯೋಜನೆಗಳು ಹಲವಾರು ಟನ್ನುಗಳಷ್ಟು ಯುರೇನಿಯಮ್ ಇಂಧನದ ಕಲ್ಮಷವನ್ನು ಸೃಷ್ಟಿಸುತ್ತವೆ. ನಮ್ಮ ಮಕ್ಕಳು, ಮೊಮ್ಮಕ್ಕಳು, ಮರಿ ಮಕ್ಕಳು, ಅವರ ಮರಿ ಮಕ್ಕಳ ಮರಿ ಮಕ್ಕಳು... ಮುಂದಿನ ಸಹಸ್ರಾರು ಪೀಳಿಗೆಯವರು ಈ ಕಲ್ಮಷದ ಹೊರೆಯನ್ನು ಹೊರಲಿದ್ದಾರೆ.

"ನೀವು ಉತ್ಪ್ರೇಕ್ಷೆ ಮಾಡುತ್ತಿದ್ದೀರಿ. ವರ್ಷಕ್ಕೆ ಕೆಲವೇ ಟನ್ನುಗಳಷ್ಟು ಕಲ್ಮಷವನ್ನು ಶುದ್ಧ ಮಾಡುವುದು ಯಾವ ಮಹಾ ಸಮಸ್ಯೆ? ಅದಕ್ಕೂ ಮುಂದಿನ ಸಹಸ್ರಾರು ಪೀಳಿಗೆಗಳಿಗೂ ಏನು ಸಂಬಂಧ?"

ಅಣುಕಲ್ಮಷ ಇತರ ಔದ್ಯೋಗಿಕ ಕಲ್ಮಷಗಳಂತಲ್ಲ. ಗಾತ್ರದಲ್ಲಿ ಕಡಿಮೆಯೆನ್ನಿಸಿದರೂ ಪರಿಣಾಮದಲ್ಲಿ ಅತ್ಯಂತ ತೀಕ್ಷ್ಣವಾದದ್ದು. ಉದಾಹರಣೆಗೆ ಅದರಲ್ಲಿರುವ ಪ್ಲುಟೋನಿಯಮ್ ಎಂಬ ವಸ್ತು ಎಷ್ಟು ಅಪಾಯಕಾರಿಯೆಂದರೆ ಕೇವಲ ಐದು ಕಿಲೋಗ್ರಾಂನಷ್ಟನ್ನು ಉಪಯೋಗಿಸಿ ಜಗತ್ತಿನ ಪ್ರತಿಯೊಬ್ಬ ವ್ಯಕ್ತಿಯನ್ನೂ ಕೊಲ್ಲಬಹುದು. ಅಣುಕಲ್ಮಷವನ್ನು ಶುದ್ಧೀಕರಿಸುವ ಅಥವಾ ಸುರಕ್ಷಿತಗೊಳಿಸುವ ಯಾವ ತಂತ್ರಜ್ಞಾನವೂ ಇಲ್ಲ. ಪ್ರಕೃತಿಯ ನಿಯಮಗಳಿಗೆ ಅನುಸಾರವಾಗಿ ಅದು ತಂತಾನೇ ಕೊಳೆಯಬೇಕು. ಇದು ಒಂದೆರಡಲ್ಲ, ಲಕ್ಷಾಂತರ ವರ್ಷಗಳ ವರೆಗೆ ನಡೆಯುವ ಕ್ರಿಯೆ. ಅಲ್ಲಿಯವರೆಗೆ ಜೀವಜಗತ್ತಿಗೆ ಸೋಂಕದಂತೆ ಅದನ್ನು ದಪ್ಪದ ಕಾಂಕ್ರೀಟ್ ಅಥವಾ ಉಕ್ಕಿನ ಸಂದೂಕಗಳಲ್ಲಿ ಭದ್ರವಾಗಿಡಬೇಕು. ವಿಕಿರಣ ಸೋರುತ್ತಿದೆಯೋ ಇಲ್ಲವೇ ಎಂದು ನಿರಂತರವಾಗಿ ಪರೀಕ್ಷಿಸುತ್ತಿರಬೇಕು. ಹಲವು ಶತಮಾನಗಳಿಗೊಮ್ಮೆ ಸಂದೂಕಗಳನ್ನೇ ಬದಲಿಸಬೇಕು. ಕಲ್ಮಷದ ನಿರ್ವಹಣೆ ಅಣುಶಕ್ತಿಯ ಅತ್ಯಂತ ಗಂಭೀರ ಮತ್ತು ನಿವಾರಿಸಲಾಗದ ಸಮಸ್ಯೆಯಾಗಿದೆ.

ಉರಿದು ಹೋದ ಇಂಧನವಷ್ಟೇ ಅಲ್ಲ, ಕುಸಿದು ಬೀಳುವ ನಮ್ಮ ಅಣುಸ್ಥಾವರಗಳೂ ಮುಂದಿನ ಪೀಳಿಗೆಗಳ ಮೇಲೆ ಹೊರೆಯಾಗಲಿವೆ. ಯಾವ ಸ್ಥಾವರವಾದರೂ ಕೆಲಸ ಮಾಡುವುದು ೨೦-೨೫ ವರ್ಷ ಮಾತ್ರ. ಅಷ್ಟರೊಳಗೆ ಅದರಲ್ಲಿ ಪೂರ್ತಿ ವಿಕಿರಣ ತುಂಬಿಕೊಂಡು ಎಷ್ಟು ಶಿಥಿಲವಾಗಿರುತ್ತದೆಂದರೆ ಅದನ್ನು ಹಾಗೆಯೇ ಬಿಡುವುದು ಅಪಾಯಕಾರಿ. ಅದರ ಒಂದೊಂದು ಇಟ್ಟಿಗೆಯನ್ನೂ ತೆಗೆದು ಸಹಸ್ರಾರು ವರ್ಷಗಳವರೆಗೆ ಆಳವಾಗಿ ಭೂಮಿಯಲ್ಲಿ ಹೂಳಿಡಬೇಕು. ನಮ್ಮ ಇಂದಿನ ಅಣುಸ್ಥಾವರಗಳನ್ನು ಕಳಚುವ ಇಂಥ ಯೋಜನೆಗಳು ಮುಂದಿನ ಶತಮಾನದುದ್ದಕ್ಕೂ ನಡೆಯಲಿದ್ದುಅದರ ಹೊರೆ ನಮ್ಮ ಮಕ್ಕಳು, ಮೊಮ್ಮಕ್ಕಳ ಮೇಲೆ ಬೀಳಲಿದೆ.

"ಈ ಸಮಸ್ಯೆಗಳ ಪರಿಹಾರಕ್ಕಾಗಿ ನಮ್ಮ ಅಣುವಿಜ್ಞಾನಿಗಳು ಏನು ಮಾಡುತ್ತಿದ್ದಾರೆ?"

ಸ್ಪಷ್ಟವಾಗಿ ಹೇಳಬೇಕೆಂದರೆ, ಜನರಿಗೆ ತಪ್ಪು ಮಾಹಿತಿ ನೀಡುತ್ತಿದ್ದಾರೆ. ಅಣುಕಲ್ಮಷಕ್ಕೂ ಉಳಿದ ಔದ್ಯೋಗಿಕ ಕಲ್ಮಷಗಳಿಗೂ ಏನೂ ಸಂಬಂಧವಿರದಿದ್ದರೂ ಅವೆರಡನ್ನೂ ಮತ್ತೆ ಮತ್ತೆ ಹೋಲಿಸುವ ಪ್ರಯತ್ನಗಳನ್ನು ಮಾಡುತ್ತಾರೆ. ಅವರ ಕಲ್ಮಷದ ಗಾತ್ರ, ಕೆಲವೇ ಘನ ಮೀಟರುಗಳಷ್ಟಿರಬಹುದು, ಆದರೆ ಅದನ್ನು ಲಕ್ಷಾಂತರ ವರ್ಷಗಳ ವರೆಗೆ ಹೂತಿಡಬಹುದಾದ ಸುರಕ್ಷಿತ ಸ್ಥಳ ಮಾತ್ರ ಈ ಭೂಮಿಯ ಮೇಲೆ ಎಲ್ಲಿಯೂ ಇಲ್ಲ.

ಅಣುಕಲ್ಮಷ ಕೇವಲ ತಾಂತ್ರಿಕ ಸಮಸ್ಯೆಯಲ್ಲ. ಅದಕ್ಕೊಂದು ನೈತಿಕ ಆಯಾಮವೂ ಇದೆ. ನಮ್ಮ ಅಲ್ಪ ವಿದ್ಯುತ್ತಿನ ದಾಹಕ್ಕಾಗಿ/ಮುಂದಿನ ಸಹಸ್ರಾರು ಪೀಳಿಗೆಗಳ ಮೇಲೆ ವಿಷದ ಹೊರೆಯನ್ನು ಹೊರಿಸಲು ನಮಗೆ ಯಾವ ಅಧಿಕಾರವಿದೆ? ತಾವು ಸ್ವತಃ ನಿರ್ವಹಿಸಲಾಗದಷ್ಟು ಅಪಾಯಕಾರಿ ಕಸವನ್ನು ಸೃಷ್ಟಿಸುವ ಬಗ್ಗೆ ನಮ್ಮ ಅಣುವಿಜ್ಞಾನಿಗಳನ್ನು ಯಾವ ರೀತಿಯ ಪಾಪಪ್ರಜ್ಞೆಯೂ ಕಾಡುವುದಿಲ್ಲ. ಉರಿದು ಹೋದ ಯುರೇನಿಯಂ ಇಂಧನವಾಗಲೀ, ಶಿಥಿಲವಾದ ಅಣುಸ್ಥಾವರವಾಗಲೀ ಒಂದು ಸಮಸ್ಯೆಯೆಂದು ಒಪ್ಪಿಕೊಳ್ಳಲೂ ಅವರು ಸಿದ್ಧರಿಲ್ಲ. ನೀವಾಗಿ ವಿಚಾರಿಸಿದರೆ "ಅಣುಕಲ್ಮಷವೇ? ಅದೊಂದು ಸಮಸ್ಯೆಯೆಂದು ನಿಮಗೆ ಯಾರು ಹೇಳಿದರು? ವಿಷಯ ತಿಳಿದುಕೊಂಡು ಮಾತನಾಡಿ"ಎಂಬ ಅಸಡ್ಡೆಯ ಉತ್ತರ ಸಿಗುತ್ತದೆ. ವಿಕಿರಣಶೀಲ ಸ್ಥಾವರ ಮತ್ತು ಅಣುಕಲ್ಮಷದ ನಿರ್ವಹಣೆ, ಅಣುಶಕ್ತಿಯ ಬಚ್ಚಿಟ್ಟ ವೆಚ್ಚಗಳಲ್ಲಿ ಪ್ರಮುಖವಾಗಿವೆ.

"ಅಣುಶಕ್ತಿಯ ಯೋಜನೆಗಳಲ್ಲಿ ಬಚ್ಚಿಟ್ಟದ್ದೇ ಬಹಳವೆಂದು ಕಾಣುತ್ತದೆ. ಆದರೂ ವೆಚ್ಚದ ವಿಷಯದಲ್ಲಿ ಅಣುಶಕ್ತಿ ಕಲ್ಲಿದ್ದಲಿನ ಸ್ಥಾವರಗಳಿಗಿಂತ ಅಗ್ಗವೆಂದು ಹೇಳುತ್ತಾರಲ್ಲ?"

ಅಗ್ಗವಾಗಿ ನಿಮಗೆ ಸಿಗುವುದು ಅಣುಶಕ್ತಿಯ ಪ್ರಚಾರವೊಂದೇ. ೧೯೮೮ರಿಂದ ಈಚೆಗೆ ಮಾತ್ರ, ನಮ್ಮ ದೇಶದ ಪ್ರಧಾನ ಲೆಕ್ಕಿಗರು ಅಣುಶಕ್ತಿ ಇಲಾಖೆಯ ಲೆಕ್ಕಪತ್ರಗಳನ್ನು ಶೋಧಿಸುತ್ತ ಬಂದಿದ್ದಾರೆ. ಪರಿಣಾಮವಾಗಿ ನಮ್ಮ ಪ್ರತಿಯೊಂದು ಅಣು ಯೋಜನೆಗಳ ದುಂದುವೆಚ್ಚ, ವಿಳಂಬ, ವೈಫಲ್ಯಗಳು ಬೆಳಕಿಗೆ ಬರುತ್ತಿವೆ. ಅಣುಶಕ್ತಿಯ ಎಲ್ಲ ಯೋಜನೆಗಳಿಗೆ ಸರಕಾರ ಭಾರೀ ಪ್ರಮಾಣದಲ್ಲಿ ಸಬ್ಸಿಡಿಗಳನ್ನು ನೀಡುತ್ತಿದೆ. ಅಣುವಿದ್ಯುತ್ತಿನ ಉತ್ಪಾದನೆಯ ವೆಚ್ಚದಲ್ಲಿ ಅದನ್ನು ಸೇರಿಸುವುದಿಲ್ಲ. ಸ್ಥಾವರಗಳ ಕಳಚುವಿಕೆ ಮತ್ತು ಅಣುಕಲ್ಮಷದ ನಿರ್ವಹಣೆಯ ಜವಾಬ್ದಾರಿಯನ್ನು ನಮ್ಮ ಅಣುವಿಜ್ಞಾನಿಗಳು ಮುಂದಿನ ಪೀಳಿಗೆಗಳಿಗೆ ಹೊರೆಸಿದ್ದು ಅವುಗಳ ಖರ್ಚನ್ನು ತಮ್ಮ ಲೆಕ್ಕಕ್ಕೆ ಸೇರಿಸಿಲ್ಲ. ಇಷ್ಟೆಲ್ಲ ಕಸರತ್ತಿನ ನಂತರವೂ ಅಣುಶಕ್ತಿಯ ವೆಚ್ಚ ಕಡಿಮೆಯೆಂದು ಸಿದ್ಧಮಾಡಲು ನಮ್ಮ ಅಣುವಿಜ್ಞಾನಿಗಳಿಗೆ ಸಾಧ್ಯವಾಗುತ್ತಿಲ್ಲ.

“ಹಾಗಾದರೆ ಅಣುವಿದ್ಯುತ್ತಿನ ನಿಜವಾದ ವೆಚ್ಚ ಎಷ್ಟಾಗುತ್ತದೆ?”

ಅದನ್ನು ಬಲ್ಲವರಾರು? ಲಕ್ಷಾಂತರ ವರ್ಷಗಳ ವರೆಗೆ ನಡೆಯುವ ಅಣುಕಲ್ಮಷದ ನಿರ್ವಹಣೆಯ ವೆಚ್ಚವನ್ನು ಯಾವ ಅರ್ಥಶಾಸ್ತ್ರಜ್ಞನೂ ಊಹಿಸಲಾರ. ಒಂದು ಕಾಲಕ್ಕೆ ಅಮೇರಿಕೆಯ ಅಧಿಕಾರಿಗಳು, ಅಣುವಿದ್ಯುತ್ತು ಎಷ್ಟು ಅಗ್ಗವಾಗಿರುತ್ತದೆಂದರೆ ಜನರಿಗೆಲ್ಲ ಅದನ್ನು ಉಚಿತವಾಗಿ ಹಂಚಬಹುದೆಂದು ಹೇಳಿಕೊಂಡಿದ್ದರು. ಇಂದು ಅಣು ಯೋಜನೆಗಳನ್ನು ಕೈ ಬಿಡಲು ಅದರ ಮಿತಿಮೀರಿದ ವೆಚ್ಚಗಳೇ ಪ್ರಮುಖ ಕಾರಣವಾಗಿವೆ. ಇತ್ತೀಚೆಗೆ ಬ್ರಿಟನ್ನಿನಲ್ಲಿ ಸರಕಾರ ವಿದ್ಯುತ್ ಉತ್ಪಾದನೆಯ ಕೇಂದ್ರಗಳನ್ನೆಲ್ಲ ಖಾಸಗಿ ಸಂಸ್ಥೆಗಳಿಗೆ ವಹಿಸಿಕೊಟ್ಟಿತು. ಜಲವಿದ್ಯುತ್ ಮತ್ತು ಕಲ್ಲಿದ್ದಲಿನ ಸ್ಥಾವರಗಳನ್ನು ಕೊಳ್ಳಲು ಕಂಪನಿಗಳು ಮುಂದೆ ಬಂದವಾದರೂ ಅಣುವಿದ್ಯುತ್ತಿಗೆ ಯಾವ ಗಿರಾಕಿಯೂ ಇರಲಿಲ್ಲ. ಸಾರ್ವಜನಿಕರ ಹಣವನ್ನು ಪೋಲು ಮಾಡಲು ಸಿದ್ಧವಿರುವ ಸರಕಾರಗಳು ಮಾತ್ರ, ಅಣುಶಕ್ತಿಯ ಯೋಜನೆಗಳನ್ನು ಹಮ್ಮಿಕೊಳ್ಳಬಹುದಾಗಿದೆ.

ಮೇಲೆ ಹೇಳಿದ ಖರ್ಚುಗಳೆಲ್ಲ ಬರುವುದು ಅಣುಸ್ಥಾವರಗಳು ಸುರಕ್ಷಿತವಾಗಿ ಕೆಲಸ ಮಾಡಿದರೆ ಮಾತ್ರ. ಸ್ಫೋಟಗೊಳ್ಳುವ ಒಂದೇ ಒಂದು ಅಣುಸ್ಥಾವರ ಅಸಂಖ್ಯ ಪ್ರಾಣಹಾನಿಯೊಡನೆ ಇಡೀ ದೇಶದ ಅರ್ಥ ವ್ಯವಸ್ಥೆಯನ್ನು ಶಾಶ್ವತವಾಗಿ ಊರ್ಧ್ವಸ್ತಗೊಳಿಸಬಹುದು. ಅದಕ್ಕೆ ಚೆರ್ನೋಬಿಲ್ ದುರಂತವೇ ಸಾಕ್ಷಿ.

“ಚೆರ್ನೋಬಿಲ್ ಕುರಿತು ನಾವೂ ಕೇಳಿದ್ದೇವೆ. ರಶಿಯಾದ ಯಾವುದೋ ಮೂಲೆಯಲ್ಲಾದ ಒಂದು ಅಪಘಾತದ ಬಗೆಗೆ ಇಷ್ಟೇಕೆ ಚರ್ಚೆಯಾಗುತ್ತಿದೆ? ಅಲ್ಲಿ ನಿಜವಾಗಿ ನಡೆದದ್ದು ಏನು?”

ಅಸುರಕ್ಷಿತ ತಂತ್ರಜ್ಞಾನ ಮತ್ತು ಅದರ ನಿರ್ವಹಣೆಯಲ್ಲಿನ ವೈಫಲ್ಯಗಳ ಪರಿಣಾಮವಾಗಿ ಚೆರ್ನೋಬಿಲ್ ಅಣುಸ್ಥಾವರ ಒಂದು ಅಣು ಬಾಂಬಿನಂತೆ ಆಸ್ಫೋಟಿಸಿತು. ಅದರ ಕುಲುಮೆಯೊಳಗಿನ ಇಂಧನರಾಶಿ ವಿಷಾನಿಲಗಳನ್ನು ಉಗುಳುತ್ತಿದ್ದ ಜ್ವಾಲಾಮುಖಿಯಾಗಿ ಮಾರ್ಪಟ್ಟಿತು. ಅದನ್ನು ಮುಚ್ಚಿ ಹಾಕಲು ರಶಿಯದವರು ೫೦೦ ಹೆಲಿಕಾಪ್ಟರುಗಳ ಮೂಲಕ ಸತತ ಆರು ದಿನಗಳ ವರೆಗೆ ೫೦೦೦ ಟನ್ ಗಾಜು, ಸೀಸ, ಮರಳು, ಸಿಮೆಂಟ್, ಬೋರಾನ್, ಡೋಲೋಮೈಟುಗಳ ಮಿಶ್ರಣವನ್ನು ಸ್ಥಾವರದ ಕುಲುಮೆಯಲ್ಲಿ ಸುರಿದರು. ಮೂರು ದಿನಗಳಲ್ಲಿ ಸಾವಿರಾರು ಬಸ್ಸುಗಳನ್ನು ಒದಗಿಸಿ ಲಕ್ಷಾಂತರ ಜನರನ್ನು ಸ್ಥಳಾಂತರಿಸಿದರು. ಮುಂಜಾಗ್ರತಾ ಕ್ರಮವಾಗಿ ಚೆರ್ನೋಬಿಲ್ ಸುತ್ತಲಿನ ಊರುಗಳಲ್ಲಿನ ಗರ್ಭಿಣಿಯರಿಗೆ ಕಡ್ಡಾಯವಾಗಿ ಗರ್ಭಪಾತ ಮಾಡಿಸಿದರು, ೧೩೦ ಕಿ.ಮೀ. ದೂರದಲ್ಲಿದ್ದ ಕೀವ್ ನಗರದ ಲಕ್ಷಾಂತರ ಮಕ್ಕಳನ್ನು ಬೇರೆಡೆ ಕಳಿಸಿದರು. ಯುರೋಪಿನ ಎಷ್ಟೋ ದೇಶಗಳು ತಮ್ಮೆಲ್ಲ ನಾಗರಿಕರ ವೈದ್ಯಕೀಯ ಪರೀಕ್ಷೆ ನಡೆಸಬೇಕಾಯಿತು, ಚಿಕ್ಕ ಮಕ್ಕಳಿಗೆಲ್ಲ ಐಯೋಡೀನ್ ಲಸಿಕೆಗಳನ್ನು ಒದಗಿಸಬೇಕಾಯಿತು.

“ಆದರೂ ಚೆರ್ನೋಬಿಲ್ ಅಪಘಾತದಲ್ಲಿ ಸತ್ತವರು ಕೇವಲ ೩೧ ಜನ ಎಂದು ಕೇಳಿದ್ದೇವಲ್ಲ?”

ಮತ್ತು ಅದಕ್ಕೂ ಹೆಚ್ಚು ಜನ ದಿನವೂ ನಮ್ಮ ರಸ್ತೆ ಅಪಘಾತಗಳಲ್ಲಿ ಸಾಯುತ್ತಾರೆ ಎಂದೂ ನಿಮಗೆ ಹೇಳಿದ್ದಾರಲ್ಲವೇ? ಅಣುವಿಜ್ಞಾನಿಗಳು ಚೆರ್ನೋಬಿಲ್ ಬಗ್ಗೆ ಹರಡಿರುವ ನಿರ್ಮೂಹಿತಿಗೆ ಇದೊಂದು ಉದಾಹರಣೆ ಮಾತ್ರ. ಅವರ ಪ್ರಕಾರ ಚೆರ್ನೋಬಿಲ್ ಒಂದು ಅಪವಾದ, ಅಂಥ ಅಪಘಾತ ಬೇರೆ ನಡೆಯಲೂ ಸಾಧ್ಯವೇ ಇಲ್ಲ, ಚೆರ್ನೋಬಿಲ್ ಸ್ಥಾವರದ ವಿನ್ಯಾಸವೇ ದೋಷಪೂರ್ಣವಾಗಿತ್ತು, ಅದರ ಸುರಕ್ಷತಾ ಸಾಧನಗಳು ಸಮರ್ಪಕವಾಗಿರಲಿಲ್ಲ, ಅಲ್ಲಿನ ತಂತ್ರಜ್ಞರು ತೀರ ಬೇಜವಾಬ್ದಾರಿಯಿಂದ ವರ್ತಿಸಿದರು, ಅಪಘಾತಕ್ಕೆ ‘ಕೇವಲ’ ೩೧ ಜನ ಬಲಿಯಾಗಿದ್ದಾರೆ ಇತ್ಯಾದಿ ಮಿಥ್ಯೆಗಳನ್ನು ನಿಮ್ಮ ಸಮಾಧಾನಕ್ಕಾಗಿ ಸೃಷ್ಟಿಸಲಾಗಿದೆ. ವಾಸ್ತವವೆಂದರೆ ಚೆರ್ನೋಬಿಲ್ ಅಪಘಾತಕ್ಕೆ ಬಲಿಯಾಗುವವರ ನಿಜವಾದ ಸಂಖ್ಯೆ ಯಾರಿಗೂ ತಿಳಿಯದು. ತಜ್ಞರ ಅಂದಾಜುಗಳು ಕೆಲವು ಸಾವಿರದಿಂದ ಹತ್ತು ಲಕ್ಷದ ವರೆಗೂ ಇವೆ. ಬಲಿಪಶುಗಳಲ್ಲಿ ಎಷ್ಟೋ ಜನ ಇನ್ನೂ ಹುಟ್ಟಿಯೇ ಇಲ್ಲ.

“ಅದು ಹೇಗೆ ಸಾಧ್ಯ? ಅಂದಾಜುಗಳಲ್ಲಿ ಇಷ್ಟೊಂದು ವ್ಯತ್ಯಾಸ ಎಲ್ಲಿಂದ ಬರುತ್ತದೆ? ಇನ್ನೂ ಹುಟ್ಟದವರು ಸಹ ಅಪಘಾತಕ್ಕೆ ಹೇಗೆ ಬಲಿಯಾಗುತ್ತಾರೆ?”

ಅದುವೇ ಅಣುಶಕ್ತಿಯ ಅಪಘಾತಗಳ ಭೀಕರ ವಾಸ್ತವ. ೧೯೮೬ರಲ್ಲಿ ಚೆರ್ನೋಬಿಲ್ ದುರಂತ ನಡೆದು ಹೋಗಲಿಲ್ಲ, ಆರಂಭವಾಯಿತಷ್ಟೇ. ಅಲ್ಲಿನ ಅಣುಸ್ಥಾವರ ಸ್ಫೋಟಗೊಂಡಾಗ ಅದರೊಳಗಿನ ವಿಕಿರಣಶೀಲ ಇಂಧನವೆಲ್ಲ ಆಕಾಶದಲ್ಲಿ ೨-೩ ಕಿಲೋಮೀಟರುಗಳ ವರೆಗೆ ಸಿಡಿದು ಮೋಡಗಳಲ್ಲಿ ಸೇರಿಕೊಂಡಿತು. ಮುಂದಿನ

ಹಲವಾರು ವಾರಗಳ ವರೆಗೆ ಯುರೋಪಿನ ಉದ್ದಕ್ಕೂ ಚೆರ್ನೋಬಿಲ್ ವಿಕಿರಣದ ಮಳೆ ಸುರಿಯಿತು. ಪರಿಣಾಮವಾಗಿ ದಕ್ಷಿಣ ಭಾರತಕ್ಕಿಂತ ವಿಸ್ತಾರವಾದ ಪ್ರದೇಶ ಎಲ್ಲ ವಿಧದಲ್ಲಿಯೂ ಕಲುಷಿತಗೊಂಡಿತು. ನದಿಯ ನೀರು, ಮೀನು, ಹುಲ್ಲು, ಹಣ್ಣು, ತರಕಾರಿಗಳಲ್ಲೆಲ್ಲ ವಿಕಿರಣ ಬೆರೆತು ಮನುಷ್ಯನ ಉಪಯೋಗಕ್ಕೆ ಬಾರದಂತಾದವು. ಲಕ್ಷಾಂತರ ಟನ್ ಧಾನ್ಯ, ಹಣ್ಣು, ತರಕಾರಿಗಳನ್ನು ನಾಶಪಡಿಸಬೇಕಾಯಿತು. ವಿಕಿರಣಶೀಲ ಹುಲ್ಲು, ಎಲೆಗಳನ್ನು ತಿಂದ, ನೀರನ್ನು ಕುಡಿದ ಪ್ರಾಣಿಗಳು ಸ್ವತಃ ವಿಕಿರಣ ಪೀಡಿತವಾದವು. ಅವುಗಳ ಹಾಲು ಮಾಂಸಗಳನ್ನು ಸೇವಿಸುವಂತಿರಲಿಲ್ಲ. ಹಸು, ಕರು, ಕುರಿ, ರೇನಡಿಯರ್, ಎಲ್ಕ್ ಮುಂತಾದ ಪ್ರಾಣಿಗಳನ್ನು ಲಕ್ಷಾಂತರ ಸಂಖ್ಯೆಯಲ್ಲಿ ಕೊಂದು ಭೂಮಿಯಲ್ಲಿ ಆಳವಾಗಿ ಹೂಳಬೇಕಾಯಿತು.

ಯುರೋಪಿನ ಉದ್ದಗಲಗಳಲ್ಲಿ ಆಳವಾಗಿ ತುಂಬಿರುವ ವಿಕಿರಣ ಮುಂದಿನ ಶತಮಾನದಲ್ಲಿಯೂ ಚೆರ್ನೋಬಿಲ್ ದುರಂತವನ್ನು ಮುಂದುವರೆಸಿಕೊಂಡು ಹೋಗುತ್ತದೆ. ಬ್ರಿಟನ್ನಿನ 'ಇಳೆಯ ಗೆಳೆಯ' ರ (ಫ್ರೆಂಡ್ಸ್ ಆಫ್ ದಿ ಅರ್ಥ್) ಸಂಸ್ಥೆಯ ತಜ್ಞರು, ವಿಕಿರಣದಿಂದ ಮುಂದಿನ ೭೫ ವರ್ಷಗಳಲ್ಲಿ ೧,೫೦,೦೦೦ ಜನ ಕ್ಯಾನ್ಸರುಗಳಿಗೆ ಬಲಿಯಾಗಿ ಅವರಲ್ಲಿ ಅರ್ಧದಷ್ಟು ಸಾವುಗಳಾಗಬಹುದು ಎಂದು ಅಂದಾಜು ಮಾಡಿದ್ದಾರೆ. ಇದೂ ಯುರೋಪಿನ ಇತರ ದೇಶಗಳಲ್ಲಿ ಮಾತ್ರ. ಚೆರ್ನೋಬಿಲ್ ಸುತ್ತಮುತ್ತ ಹರಡಿರುವ ವಿಕಿರಣದ್ದಾಗಲೀ ಅದರ ಪರಿಣಾಮಗಳದ್ದಾಗಲೀ ಅಂದಾಜು ಸಹ ಇನ್ನೂ ಸಿಕ್ಕಿಲ್ಲ.

"ಇದು ನಿಜಕ್ಕೂ ಭೀಕರ. ಚೆರ್ನೋಬಿಲ್ ಮಾದರಿಯ ಅಪಘಾತ ನಮ್ಮ ಸ್ಥಾವರಗಳಲ್ಲೂ ಸಂಭವಿಸಬಹುದೇ?"

ಚೆರ್ನೋಬಿಲ್ ಅಪಘಾತವಾದ ಕೂಡಲೇ ಜಗತ್ತಿನ ಎಲ್ಲಾ ರಾಷ್ಟ್ರಗಳ ಅಣು ತಜ್ಞರು ಹಾಡಿದ್ದು ಒಂದೇ ರಾಗ – "ಇಂಥದ್ದು ನಮ್ಮಲ್ಲಿ ನಡೆಯಲು ಶಕ್ಯವೇ ಇಲ್ಲ." ಡಾ॥ ರಾಜಾ ರಾಮಣ್ಣನವರು 'ಅದೊಂದು ವಿಚಿತ್ರ, ಅಗ್ನಿ ಪ್ರಕೋಪ' ಎಂದು ಹಗುರವಾಗಿ ತೇಲಿಸಲು ಯತ್ನಿಸಿದರು. ಆದರೆ ಜಗತ್ತಿನ ಯಾವ ಎರಡು ಅಣು ಅಪಘಾತಗಳೂ ಒಂದೇ ರೀತಿಯವಾಗಿರುವುದಿಲ್ಲ. ಅಣುಸ್ಥಾವರಗಳು ಅತ್ಯಂತ ಸಂಕೀರ್ಣ ವ್ಯವಸ್ಥೆಗಳು. ಹಲವಾರು ವೈಫಲ್ಯಗಳು, ದೋಷಗಳು ಒಟ್ಟಿಗೆ ಸಂಭವಿಸಿದರೆ ಮಾತ್ರ ಅಲ್ಲಿ ಅಪಘಾತಗಳಾಗುತ್ತವೆ ಎನ್ನುವುದು ನಿಜ. ಆದರೆ ಅಂಥ ವೈಫಲ್ಯಗಳು ಒಟ್ಟಿಗೆ ಸಂಭವಿಸಲು ಅಣುಸ್ಥಾವರಗಳಲ್ಲಿ ಹೆಚ್ಚಿನ ಆಸ್ಪದವಿದೆ. ಅಣುಶಕ್ತಿ ಇರುವವರೆಗೆ ದುರಂತಗಳು ಅನಿವಾರ್ಯ.

೭೦ರ ದಶಕದ ಮಧ್ಯದಲ್ಲಿ ಅಮೇರಿಕೆಯಲ್ಲಿ ಮಾಡಿದ ಅಧ್ಯಯನದ ಪ್ರಕಾರ, ಅಣುಸ್ಥಾವರವೊಂದರಲ್ಲಿ ನಿಯಂತ್ರಣ ಮೀರಿದ ಅಪಘಾತವಾಗುವ ಸಾಧ್ಯತೆ ೧೭೦೦೦ ವರ್ಷಗಳಲ್ಲಿ ಒಮ್ಮೆ ಮಾತ್ರ. ಆದರೆ ಅಧ್ಯಯನ ಪ್ರಕಟವಾದ ಹತ್ತು ವರ್ಷಗಳಲ್ಲಿಯೇ ಅಂಥ ಎರಡು ದುರಂತಗಳು ಸಂಭವಿಸಿವೆ. ಜಗತ್ತಿನಲ್ಲಿ ಇಂದು ಕಾರ್ಯಾಚರಣೆಯಲ್ಲಿರುವ ಯಾವ ಅಣುಸ್ಥಾವರಕ್ಕೂ 'ಪೂರ್ತಿ ಸುರಕ್ಷಿತ' ಎಂಬ ಭರವಸೆಯನ್ನು ಕೊಡಲು ಸಾಧ್ಯವಿಲ್ಲ. ಆದರಲ್ಲೂ ನಮ್ಮ ದೇಶದ ಕಾಂಡು ಸ್ಥಾವರಗಳನ್ನು ವಿನ್ಯಾಸದಲ್ಲಿ "ಚೆರ್ನೋಬಿಲ್ ಸ್ಥಾವರದ ಅತ್ಯಂತ ನಿಕಟ ಬಂಧುಗಳು" ಎಂದು ಬಣ್ಣಿಸಲಾಗಿದೆ.

"ಅವುಗಳೇನಾದರೂ ಸ್ಫೋಟಗೊಂಡರೆ ನಮ್ಮ ಗತಿ ಏನು?"

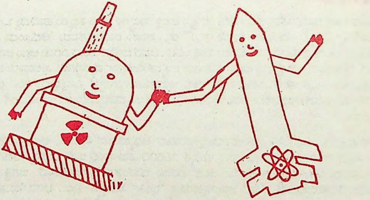
ಒಂದು ಉದಾಹರಣೆ ಬೇಕೆಂದರೆ ಕೈಗಾದಲ್ಲಿ ನಡೆಯುವ ಅತ್ಯಂತ ಭೀಕರ ವಿಸ್ಫೋಟದ ಪರಿಣಾಮಗಳನ್ನು ಪ್ರೊ. ಶಿವಾಜಿರಾವ್ ಎಂಬ ಪರಿಸರ ತಜ್ಞರು ಲೆಕ್ಕ ಹಾಕಿದ್ದಾರೆ. ಅಪಘಾತವಾದ ೨೪ ಗಂಟೆಗಳಲ್ಲಿ ಸುಮಾರು ೭೫ ಕಿ.ಮೀ. ಫಾಸಲೆಯೊಳಗಿನ ಜನರನ್ನು ಸ್ಥಳಾಂತರಿಸಬೇಕಾಗುತ್ತದೆ. ಇದರಲ್ಲಿ ಉತ್ತರ ಕನ್ನಡ ಜಿಲ್ಲೆಯ ಬಹು ಭಾಗವಲ್ಲದೇ ಗೋವೆಯ ಅರ್ಧ ಪ್ರದೇಶವೂ ಸೇರುತ್ತದೆ. ಈ ಪ್ರದೇಶದಲ್ಲಿ ತುಂಬಿಕೊಳ್ಳುವ ವಿಕಿರಣವನ್ನು ಶೋಧಿಸಿ 'ಸ್ವಚ್ಛಗೊಳಿಸುವ' ಕಾರ್ಯಕ್ಕೆ ಸಾವಿರಾರು ಕಾರ್ಮಿಕರು ೨೦ ವರ್ಷ ದುಡಿಯಬೇಕು. ಕೈಗಾದ ಸುಂದರ ಕಣಿವೆಯನ್ನು ರಾಸಾಯನಿಕವಾಗಿ ಪೂರ್ತಿ ಧ್ವಂಸ ಮಾಡಬೇಕು. ೪೮ ಗಂಟೆಗಳಲ್ಲಿ ವಿಕಿರಣ ಪ್ರಸಾರ ನಿಲ್ಲದಿದ್ದರೆ ಸುತ್ತಲಿನ ಧಾರವಾಡ, ಬೆಳಗಾಂವಿ, ಶಿವಮೊಗ್ಗ, ದಕ್ಷಿಣ ಕನ್ನಡ ಜಿಲ್ಲೆಯ ಭಾಗಗಳನ್ನು ಖಾಲಿ ಮಾಡಿಸುವ ಅಗತ್ಯ ಉಂಟಾದೀತು. ಜನರ ಪುನರ್ವಸತಿ, ಪರಿಹಾರ ಕಾರ್ಯಗಳಿಗೆ ಸುಮಾರು ರೂ ೬೦೦೦ ಕೋಟಿ ವೆಚ್ಚವಾದೀತೆಂದು ಪ್ರೊ. ಶಿವಾಜಿರಾವ್ ಅಂದಾಜು ಮಾಡಿದ್ದಾರೆ.

"ಇದಕ್ಕೆಲ್ಲ ನಮ್ಮ ಸರಕಾರ ಸಿದ್ಧವಾಗಿದೆಯೆ?"

ಯಾರಿಗೂ ಗೊತ್ತಿಲ್ಲ. ಅಣುಶಕ್ತಿಗೆ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ವಿಷಯಗಳಂತೆ ಆದರ ಆಪತ್ತಿನ ಕಾಲದ ಯೋಜನೆಗಳನ್ನೂ ರಹಸ್ಯವಾಗಿಡಲಾಗಿದೆ.

"ಹಾಗಾದರೆ ಅಣುವಿದ್ಯುತ್ತಿನ ಯೋಜನೆಗಳಿರುವಷ್ಟು ಕಾಲ ನಾವೆಲ್ಲ ಭಯದ ನೆರಳಿನಲ್ಲಿ ಬದುಕು ನಡೆಸಬೇಕೆ? ಇಂಥ ಅನರ್ಥಕಾರಿ ಯೋಜನೆಗಳನ್ನು ನಾವೇಕೆ ಮುಂದುವರೆಸಿಕೊಂಡು ಹೋಗುತ್ತಿದ್ದೇವೆ?"

ಯಾವ ಸರಕಾರವೂ ಅಣುವಿದ್ಯುತ್ತಿನಿಂದ ಜನರ ಉದ್ಧಾರವಾಗುತ್ತದೆಂದು ಪ್ರತಿವರ್ಷ ಸಾವಿರಾರು ಕೋಟಿಗಳನ್ನು ಖರ್ಚು ಮಾಡುವುದಿಲ್ಲ. ಜಗತ್ತಿನ ಎಲ್ಲ ದೇಶಗಳಲ್ಲಿಯೂ ಅಣುಶಕ್ತಿಯ ಯೋಜನೆಗಳಿಗೆ ಇರುವ ಕಾರಣ ಒಂದೇ – ಅಣ್ವಸ್ತ್ರ ತಯಾರಿಕೆಯ ಕಾರ್ಯಕ್ರಮಕ್ಕೆ ಸಹಾಯಕವೆಂದು. ಅಣುವಿದ್ಯುತ್ ಮತ್ತು ಅಣುಬಾಂಬು ಒಂದೇ ನಾಣ್ಯದ ಎರಡು ಮುಖಗಳಿದ್ದಂತೆ. ಅಣುಕಲ್ಮಷ ಯುಗಯುಗಾಂತರಕ್ಕೂ ಪರಿಸರಕ್ಕೆ ಹಾನಿಕರವಾಗಿರಬಹುದು. ಆದರೆ ಬಾಂಬ್ ತಯಾರಿಕೆಗೆ ಅದು ಉತ್ತಮ ಕಚ್ಚಾ ಸಾಮಗ್ರಿಯಾಗಿದೆ. ಅಣುವಿದ್ಯುತ್ ಯೋಜನೆಗಳಿರುವ ಪ್ರತಿಯೊಂದು ರಾಷ್ಟ್ರದಲ್ಲೂ ಯುರೇನಿಯಂ ಇಂಧನವನ್ನು ಸಂಸ್ಕರಿಸಿ ಬಾಂಬ್ ಸಾಮಗ್ರಿಯನ್ನು ಉತ್ಪಾದಿಸುವ ಘಟಕಗಳಿವೆ. ನಮ್ಮ ದೇಶದಲ್ಲಿ ಅಂಥ ಒಂದು ಘಟಕವನ್ನು ಅತ್ಯಂತ ಗುಟ್ಟಾಗಿ ಮೈಸೂರಿನ ಬಳಿಯ ರತ್ನಹಳ್ಳಿ ಎಂಬಲ್ಲಿ, ಕಾವೇರಿ ನದಿಯ ದಡದಲ್ಲಿ ಸ್ಥಾಪಿಸಲಾಗಿದೆ. ಬಹಿರಂಗವಾಗಿ ಅದರ ಅಸ್ತಿತ್ವವನ್ನು ಒಪ್ಪಿಕೊಳ್ಳಲೂ ನಮ್ಮ ಅಣುವಿಜ್ಞಾನಿಗಳು ಸಿದ್ಧರಿಲ್ಲ.



ನಾವಿಬ್ಬರೂ ಸೇರಿ ಈ ಜಗತ್ತನ್ನೇ ನಾಶ ಮಾಡೋಣ

ಇನ್ನೊಂದು ವಿಷಾದದ ಅಂಶವೆಂದರೆ ನಮ್ಮ ದೇಶದಲ್ಲಿ ಅಣುಶಕ್ತಿಗೂ ರಾಷ್ಟ್ರೀಯ ಭಾವನೆಗಳಿಗೂ ಅದು ಹೇಗೋ ಗಂಟು ಹಾಕಿ ಬಿಟ್ಟಿದ್ದಾರೆ. ನಾವು ಸ್ಥಾಪಿಸುವ ಅಣುಸ್ಥಾವರಗಳ ಒಟ್ಟು ಸಂಖ್ಯೆಯೇ ವೈಜ್ಞಾನಿಕ ಕ್ಷೇತ್ರದಲ್ಲಿ ನಾವು ಸಾಧಿಸಿರುವ ಪ್ರಗತಿಯ ಸೂಚ್ಯಂಕವೆಂಬ ಭ್ರಾಂತಿಯನ್ನು ಅಣುವಿಜ್ಞಾನಿಗಳು ಸೃಷ್ಟಿಸಿದ್ದಾರೆ. ರಾಜಕಾರಣ, ಬಂಡವಾಳಶಾಹಿ, ಸೈನಿಕ ಆಸಕ್ತಿಗಳೆಲ್ಲ ವ್ಯವಸ್ಥಿತವಾಗಿ ಅಣುಶಕ್ತಿಯ ಮಿಥ್ಯೆಗಳನ್ನು ಪ್ರಚಾರ ಮಾಡುತ್ತವೆ.

"ಆದರೆ ನಾವು ಅಣುವಿದ್ಯುತ್ ಯೋಜನೆಗಳನ್ನು ನಿಲ್ಲಿಸಿಬಿಟ್ಟರೆ ವಿದ್ಯುತ್ತಿಗೆ ಬೇರೆ ಏನು ಮಾರ್ಗವಿದೆ?"

ಪರ್ಯಾಯಗಳಿರಲಿ ಇಲ್ಲದಿರಲಿ, ಎಲ್ಲ ವಿಧದಲ್ಲಿಯೂ ವಿಫಲಗೊಂಡಿರುವ ಅನರ್ಥಕಾರಿ ಅಣುಶಕ್ತಿ ಯೋಜನೆಗಳನ್ನು ಈಗಿಂದೀಗ ನಿಲ್ಲಿಸಬೇಕೆಂದು ನೀವು ಒಪ್ಪುತ್ತೀರಾ?"

"ಖಂಡಿತವಾಗಿ! ಅದನ್ನು ಪ್ರತ್ಯೇಕವಾಗಿ ಕೇಳುವ ಅಗತ್ಯವೇ ಇಲ್ಲ. ಆದರೆ ನಮ್ಮ ಅಭಿವೃದ್ಧಿಗೆ ವಿದ್ಯುತ್ತಂತೂ ಬೇಕಲ್ಲವೇ?"

ನಮ್ಮ ಪ್ರಗತಿಯನ್ನು ನಾವು ಪೋಲು ಮಾಡುವ ವಿದ್ಯುತ್ತಿನ ಯೂನಿಟ್ಟುಗಳಲ್ಲಿ ಅಳೆಯಲಾಗದು. ನಮ್ಮ ದೇಶದಲ್ಲಿ ನಿಜವಾದ ಅಭಾವವಿರುವುದು ವಿದ್ಯುತ್ತಿನದಲ್ಲ, ನೇರವಾಗಿ ಬಳಸಬಹುದಾದ ಪ್ರಾಥಮಿಕ ಶಕ್ತಿ ಮೂಲಗಳದ್ದು. ಒಂದು ಕೊಡ ಕುಡಿಯುವ ನೀರಿಗಾಗಿ, ಒಂದು ಹೊರೆ ಸೌದೆಗಾಗಿ ದಿನವೂ ಹಲವಾರು ಕಿ.ಮೀ. ನಡೆಯಬೇಕಾಗಿರುವ ಲಕ್ಷಾಂತರ ಹೆಂಗಸರು ನಮ್ಮ ಹಳ್ಳಿಗಳಲ್ಲಿದ್ದಾರೆ. ಅಣುಶಕ್ತಿ ಅವರ ಮೂಲಭೂತ ಅಗತ್ಯಗಳನ್ನು ಯಾವ ವಿಧದಲ್ಲಿಯೂ ಪೂರೈಸುವುದಿಲ್ಲ. ಅವರಿಗೆ ಬೇಕಾದದ್ದು ವಿಕೇಂದ್ರೀಕೃತ ಸ್ಥಳೀಯ ಯೋಜನೆಗಳು. ಸೌರ ಶಕ್ತಿ, ಗಾಳಿ ಮುಂತಾದ ೩೭ ನಿರಂತರ ಶಕ್ತಿ ಮೂಲಗಳನ್ನು ಕೇಂದ್ರದ ಅಸಾಂಪ್ರದಾಯಿಕ ಶಕ್ತಿಮೂಲಗಳ ಇಲಾಖೆ ಗುರುತಿಸಿದೆ. ಆದರೆ ಅವುಗಳ ಕುರಿತು ಸಾಕಷ್ಟು ಸಂಶೋಧನೆ ನಡೆಯುತ್ತಿಲ್ಲ. ಶಕ್ತಿಯ ಬಜೆಟ್ಟಿನ ೮೫% ಅಣುಶಕ್ತಿಯ ಅನುತ್ಪಾದಕ ಯೋಜನೆಗಳಿಗೆ ಮೀಸಲಾಗಿರುವಾಗ ಪರಿಸರ ಹಿತೈಷಿ ಕಾರ್ಯಕ್ರಮಗಳು ಸೊರಗುತ್ತಿವೆ.

ವಿದ್ಯುತ್ತನ್ನು ದಕ್ಷವಾಗಿ ಬಳಸಲು ನಾವು ಕಲಿತರೆ ಅಣುಶಕ್ತಿಯ ಅಗತ್ಯವೇ ಇರುವುದಿಲ್ಲ. ಇಂದು ನಮ್ಮ ದೇಶದಲ್ಲಿ ಉತ್ಪಾದನೆಯಾಗುವ ವಿದ್ಯುತ್ತಿನಲ್ಲಿ ೨೨%ದಷ್ಟು ಸಾಗಾಣಿಕೆಯಲ್ಲಿ ವ್ಯರ್ಥವಾಗುತ್ತದೆ. ಅದರಲ್ಲಿ ೨% ಉಳಿಸಿಕೊಂಡರೂ ನಮ್ಮ ಎಲ್ಲಾ ಅಣುಸ್ಥಾವರಗಳು ಉತ್ಪಾದಿಸುವಷ್ಟೇ ವಿದ್ಯುತ್ತನ್ನು ಗಳಿಸಿದಂತಾಗುತ್ತದೆ. ಕೈಗಾದ ಒಂದೊಂದು ಸ್ಥಾವರಕ್ಕೆ ಮಾಡುತ್ತಿರುವುದರ ಅರ್ಧಕ್ಕೂ ಕಡಿಮೆ ಖರ್ಚಿನಲ್ಲಿ, ನಾವು ಹೆಚ್ಚು ದಕ್ಷತೆಯ ಟ್ಯೂಬಲೈಟುಗಳನ್ನು ಉಪಯೋಗಿಸಿ, ಸ್ಥಾವರದಲ್ಲಿ ಉತ್ಪಾದನೆಯಾಗುವಷ್ಟೇ ವಿದ್ಯುತ್ತನ್ನು ಉಳಿಸಬಹುದು. ಆದರೆ ಇಂಥ ಸರಳ ಸಾಧನಗಳಿಗಿಂತ ಅಣುಶಕ್ತಿಯಂಥ ಕರಾಳ ತಂತ್ರಜ್ಞಾನಕ್ಕೇ ನಾವು ಆದ್ಯತೆ ನೀಡುತ್ತಿದ್ದೇವೆ.

"ಈ ಪರಿಸ್ಥಿತಿಯನ್ನು ಬದಲಿಸುವುದು ಹೇಗೆ?"

ಅದು ನಿಮ್ಮಿಂದಲೇ ಸಾಧ್ಯ. ಅಣುಶಕ್ತಿ ಜನವಿರೋಧಿ ಶಕ್ತಿ, ಅದನ್ನು ಜನಶಕ್ತಿಯಿಂದ ವಿರೋಧಿಸಬೇಕು. ದಕ್ಷ, ಸುರಕ್ಷಿತ ತಂತ್ರಜ್ಞಾನಗಳ ಅಭಿವೃದ್ಧಿಗಾಗಿ ಹಕ್ಕೊತ್ತಾಯ ಮಾಡಬೇಕು. ಅಣುಶಕ್ತಿಯ ಅಧ್ವಾನದ ಯೋಜನೆಗಳ ವಿರುದ್ಧ ಸ್ಪಷ್ಟ ನಿಲುವು ತಳೆದು ಅದನ್ನು ದೃಢವಾಗಿ, ಆದರೆ ಶಾಂತಿಯುತವಾಗಿ ವ್ಯಕ್ತಪಡಿಸಬೇಕು. ಈ ದೇಶವನ್ನು ಅಣುಮುಕ್ತಗೊಳಿಸುವ ನಮ್ಮೆಲ್ಲರ ಹೋರಾಟದಲ್ಲಿ ನೀವು ಸಕ್ರಿಯವಾಗಿ ಭಾಗವಹಿಸುತ್ತೀರಾ?

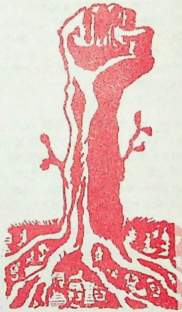
"ಅಗತ್ಯವಾಗಿ. ನನ್ನಿಂದ ಏನಾಗಬೇಕೋ ಹೇಳಿ"

ಇನ್ನೊಮ್ಮೆ ಯೋಚಿಸಿ! ಅಣುಶಕ್ತಿಯನ್ನು ವಿರೋಧಿಸುವುದು ಅಷ್ಟು ಸುಲಭವಲ್ಲ, ಕಳೆದ ನಲವತ್ತು ವರ್ಷಗಳಿಂದ ನಮ್ಮ ಜನ ಅಣುಶಕ್ತಿಯನ್ನು ಒಂದು ಮಹತ್ವದ ರಾಷ್ಟ್ರೀಯ ಸಾಧನೆಯೆಂದು ಭ್ರಮಿಸಿದ್ದಾರೆ. ಕೇವಲ ಕಟುಸತ್ಯ ಮತ್ತು ವಾಸ್ತವಿಕ ವಾದಗಳಿಂದ ಅವರನ್ನು ಒಪ್ಪಿಸುವುದು ಸುಲಭವಲ್ಲ. ಅಣುವಿರೋಧಿಗಳನ್ನು ಅಜ್ಞಾನಿಗಳು, ಭಾವುಕರಿಂದ ಹಿಡಿದು ದೇಶದ್ರೋಹಿಗಳೆನ್ನುವ ವರೆಗೆ ನಾನಾ ರೀತಿಯ ಅಪಪ್ರಚಾರಗಳನ್ನು ಮಾಡಲಾಗಿದೆ. ಎಷ್ಟೋ ಸಂದರ್ಭಗಳಲ್ಲಿ ಅವರಿಗೆ ಕಿರುಕುಳ ಕೊಡಲಾಗಿದೆ. ನೀವು ಅಣುವಿರೋಧಿ ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ನಿಜಕ್ಕೂ ಭಾಗವಹಿಸ ಬಯಸುತ್ತೀರಾ?

"ಇನ್ನು ಮೇಲೆಯೂ ನಾನು ಸುಮ್ಮನಿದ್ದರೆ ನನ್ನ ಮಕ್ಕಳು, ಮೊಮ್ಮಕ್ಕಳಿಗೆ ದ್ರೋಹ ಬಗೆದಂತಾಗುತ್ತದೆ. ನಮ್ಮ ಸ್ವಾರ್ಥ, ಅಜ್ಞಾನಗಳ ಹೊರೆಯನ್ನು ಅವರು ಹೊರಬೇಕೆ? ನಾನು ಹೇಗೆ, ಎಲ್ಲಿಂದ ಪ್ರಾರಂಭಿಸಲಿ?"

ಈ ಪುಟ್ಟ ಪುಸ್ತಕದ ಪ್ರತಿಗಳನ್ನು ಹಂಚುವುದರಿಂದ! ಅಣುಶಕ್ತಿಯ ಕರಾಳ ಮುಖಗಳು, ವಿಕೃತ ಸತ್ಯಗಳನ್ನು ಜನರಿಗೆ ಪರಿಚಯಿಸುವುದು ಇಂದಿನ ಮೊದಲನೇ ಅಗತ್ಯವಾಗಿದೆ. ನಿಮ್ಮ ಶಾಸಕರು, ಲೋಕಸಭಾ ಪ್ರತಿನಿಧಿಗಳಿಗೆ ಇದರ ಪ್ರತಿಯನ್ನು ಕಳಿಸಿಕೊಡಿ. ನಿಮ್ಮ ಸ್ಥಳೀಯ ಪರಿಸರ ಸಂಘಟನೆಗಳಿಗೂ ಅಣುಶಕ್ತಿಯ ನಿಜವಾದ ಪರಿಚಯ ಬಹುಶಃ ಇರುವುದಿಲ್ಲ. ಅವರನ್ನು ಸಂಪರ್ಕಿಸಿ, ಅಣುವಿರೋಧಿ ಚಟುವಟಿಕೆಗಳನ್ನು ಅವರ ಕಾರ್ಯಕ್ರಮಗಳಲ್ಲಿ ಸೇರಿಸಿಕೊಳ್ಳಲು ಒತ್ತಾಯ ಮಾಡಿರಿ. ಇನ್ನೂ ಹೆಚ್ಚಿನ ಮಾಹಿತಿಯನ್ನು ನೀಡುವ ವೀಡಿಯೋ ಚಿತ್ರಗಳು, ಸ್ಲೈಡುಗಳು ನಮ್ಮಲ್ಲಿ ಲಭ್ಯವಿವೆ. ಅವುಗಳನ್ನು ಪ್ರದರ್ಶಿಸಲು ಮತ್ತು ಅಣುಶಕ್ತಿಯ ಕುರಿತ ಸಾರ್ವಜನಿಕ ಚರ್ಚೆಗಳಲ್ಲಿ ಭಾಗವಹಿಸಲು ನಮ್ಮ ಕಾರ್ಯಕರ್ತರನ್ನು ಆಮಂತ್ರಿಸಬಹುದು. ಈಗಾಗಲೇ ನಿಮ್ಮಲ್ಲಿ ಅಣುವಿರೋಧಿ ಚಟುವಟಿಕೆಗಳು ನಡೆಯುತ್ತಿದ್ದರೆ ತಪ್ಪದೇ ಅವುಗಳಲ್ಲಿ ಭಾಗಿಯಾಗಿರಿ.

ನೆನಪಿಡಿ – ಇಂದು ಕಾರ್ಯಶೀಲರಾಗದಿದ್ದರೆ ನಾಳೆ ವಿಕಿರಣಶೀಲರಾಗುವಿರಿ.



ಅಣುಶಕ್ತಿ ಜನ ವಿರೋಧಿ ಶಕ್ತಿ
ಜನಶಕ್ತಿಯಿಂದಲೇ ಅದನ್ನು ವಿರೋಧಿಸಿ.

ನಮ್ಮ ವಿಳಾಸ

ಅಣು ವಿರೋಧಿ ನಾಗರಿಕ ಶಕ್ತಿ (ಅವಿನಾಶ)
೮೯, ೧೭ನೇ ಇ ಮುಖ್ಯ ರಸ್ತೆ, ೫ನೇ ಘಟ್ಟ
ರಾಜಾಜಿನಗರ, ಬೆಂಗಳೂರು – ೫೬೦ ೦೧೦

1. The following articles from the Science Age Oct-Nov 1983 (Journal)

A Medical Marvel in the making ?: The body's own naturally
Produce drug might tame several diseases
By P.B. Sehgal & M.V.N. Shirodkar
Science Age Vol. 1 No.3 & 4 Oct-Nov. 1983 pp19- 24

The foot maker : A surgeon and craftsman give walking on
two feet" a new meaning
By Ritta Kapur Science Age Vol. 1 No. 3 & 4 1983 pp 41 - 45

PANORAMA pp 49 to 53

How serious is the plagu Threat in India : If there are ~~xx~~
rats can plague be fa behind?
By D M Renapurkar Science Age Vol. 1 No.3 & 4 Oct-Nov. 1983 pp72-74

How can you cope with dehydration ? By R K Anand
Science Age Vol. 1 No. 3 & 4 Oct-Nov. 1983 pp80-81

~~Nuclear allergy spreads to canada?~~ ~~SANITY October 1987 pp6~~ 7

2. SANITY for a Nuclear-free world : CUBA 1962 Third world warning
No.10 October 1987

Aricles

Nuclear allergy sprea o to canada ? p6-7
The other side of the summit~~t~~ ~~by~~ Dan smith on the dangers
opportunities of political change p13-18

CUBA CRISIS 1962: If you read this, then presumable we
are both alive by Diana Shelley p26-31

Bradwell bombshell hits nuclear industry by Patrick van den Bluck
and Cha les searle 32-36

3. Newsweek December 5, 1983 :Nuclear war ; can the risk be cut ?

Articles

a. can we cut the risk ? pp8-16

b. Who has the bomb - p17-21

c. Walled city beyond the law p27-31

d.

4. Nuclear Power on the Run (Typed material)

160
161

medico friend circle bulletin

February-March 1990

RADIATION AND HEALTH

Anant R. S. Phadke

(A position-paper, based on the background papers and discussions of the XVIth Annual MFC—meet on Radiation and Health.)

It is customary to give a brief report of the discussion on the theme of the MFC—annual meet in the MFC Bulletin. But it was felt that these reports are too brief, hardly do justice to the various view points and arguments presented. Many times the report does not convey even the consensus in a clear manner. It was, therefore, decided that this time we change this custom and publish a position—paper or consensus paper in the Bulletin to give a clear idea to the readers about the consensus (alongwith major differences, if any) emerged and the basis of such a consensus. In doing so, the paper should draw liberally from the background—papers so that those who could not attend and hence did not get these background papers would get some idea about them.

The discussion in this meet was divided into four broad areas :—

i) Basics of radiation and health and the experience of nuclear power plants;

ii) Health—hazards of common radiological investigations;

iii) Food irradiation;

iv) Other sources of radiation from consume products—Electronic Display screens.

Most of the discussion and background material was focussed on the first area; a clear consensus also emerged and hence this paper will focus mainly on this aspect. In the second topic there was a clear, balanced presentation and not much debate took place after it. It would, therefore, suffice to reproduce this paper alongwith a few additional comments based on the discussion at the annual meet. On food irradiation also, there was a lone background paper. The author, A.T. Dudani had not, however come and Surendra Gadekar made a brief extempore presentation. There was a lively debate and issues raised would be reported at the end of this background paper. Only a few lines are in order about the fourth subtopic. I would end this introduction by reiterating that this position paper is not a report of the discussions at the annual meet. But since there were no sharp differences of opinion, none of the deletions are of major importance.

HEALTH HAZARDS OF NUCLEAR POWER PLANTS

Radiation :

Radiation is the emission and propagation of energy through space of tissue in the form of waves / Sub-atomic particles. Radiation is basically of two types—ionizing and non—ionizing. Ionizing radiation has enouh energy to knockout an electron out of its normal orbit around the nucleus of an atom. This results into two 'ions', i. e. electrically charged particles — one the negatively charged electron and the other, the rest of the atom which now has a net positive electric charge. When unstable atoms are split in a nuclear reactor or in atom bomb, the splitting releases in the form of heat, blast, and radiation. Radiation is in the form of Alpha, Gamma rays, X—rays, neutrons. These cause ionization in surrounding area and hence are called ionizing radiations. Visible light, infrared, and ultraviolet rays are non-ionizing radiations. Chemicals releasing ionizing radiations are called radio-active and they have deleterions effects on health on account of their radio-activity.

Effect of radiation at cellular lelel and on health :

Release of energy through radio-activity works through two mechanisms : influx of random energy and ionizations. Dr. Rosalie Bertell in her book, 'No Immediate Danger' describes briefly and lucidly the effect of this energy-transfer on cells and hence on health.

"The result of cell exposure to these microscopic explosions with the resultant sudden influx of random energy and ionization may be either cell death or cell alteration. The change or alteration can be temporary or permanent. It can leave the cell unable to reproduce (or replace) itself. Radiation damage can cause the cell to produce a slightly different hormone or enzyme that was originally designed to produce, still leaving it able to reproduce other cells capable of generating this same altered hormone or enzyme. In time there may be millions of such altered cells. This latter mechanism, called biological magnification, can usually associate with old age. One very specific mutation which can occur within the cell is the destruction of the cell-mechanism for resting which normally causes it to cease reproductive activities after cell division. This inability to rest results in a runaway proliferation of cells in one place, which, if not destroyed, will form a tumour, either benign or malignant. The abnormal proliferation of white blood cells is characteristic of leukaemias; red blood cell proliferation results in what is called polycythemia vera.

If the radiation damage occurs in germ cells, the sperm or ovum, it can cause defective offspring. The defective offspring will in turn produce defective sperm or ova, and the genetic 'mistake' will be passed on to all succeeding generations, reducing their quality of life until the family line terminates in sterilisation and / or death. A blighted or abnormal embrynonic growth can result in what is called a hydatidiform mole instead of a baby.

Exposure to radiation is also known to reduce fertility, i. e. women become unable to conceive or give birth.

Radiation can olso damage an embryo or foetus while it is developing within the mother's womb. This is called teratogenic damage, or the child is said to have a congenital malformation rather than genetic damage. This means the damage is not automatically transmitted. For example, a deaf person, made so by a pre-birth injury may hvae children with normal hearing..

The complex molecules making up living organisms are composed of long strands of atoms forming proteins, carbohydrates and fats. They are held together by chemical bonds involving shared electrons. If the ionising radiation displaces one of the electrons in a chemical bond, it can cause the chain of atoms to break apart splitting the long molecule into fragments, or changing its shape by elongation. This is an 'ungluing' of the complex chemical bonds so carefully structured to support and perpetuate life. The gradual breakdown of these molecular bonds destroys the templates used by the body to make DNA and RNA (the information — carrying molecules in the cell) or causes abnormal cell division. The gradual natural breakdown of DNA & RNA is probably the cellular phenomenon associated with what we know as 'ageing'. It occurs gradually over the years with exposure to natural backgrond radiation from the radioactive substances which have been a part of the earth for all known ages. There is evidence that exposure to medical X-rays accelerates this breakdown process. There is ample reason to think that fission products within the body will cause the same kind of acceleration of ageing. However, unlike medical X—rays, these radioactive chemicals damage cells by their chemical toxicity as well as their radiological properties.

The gradual breakdown of human bio-regulatory integrity through ionising and breakage of the DNA & RNA molecules, gradually makes a person less able to tolerate environmental changes, less able to recover from diseases or illness, and generally less able to cope physically with habitat variations.

When the DNA of germ plasm is affected by radiation it can result in chromosomal diseases. such as trisomy 21, more commonly known as Down's Syndrome." (1)

" In order to have a quantitative sense of the frequency of the different cell effects caused by radiation exposure, imagine a colony of 1000 living cells exposed to a 1 rad X—ray (about the dose for one X—ray spinal examination). There would be two or three cell deaths, two or three mutations or irreparable changes in cell DNA & about 1 lac ionisation in the whole colony of cells ranging from 11 to 460 ionisations per cell. While cells can repair some damage, no one claims that there is perfect repair even after only one such X—ray." (2)

Radiation and Heredity

" In 1943 Hermann Muller received a Nobel Prize for his work on the genetic effects of radiation and was a dominant figure in developing early radiation exposure recommendations made by the International Commission on Radiological Protection (ICUP).

" Muller predicted the gradual reduction of the survival ability of the human species, as several generations were damaged through exposure to ionising radiation. This problem of genetic damage continues to be mentioned in official radiation-health documents under the heading " mild mutation " but these matations are not 'counted' as health effects when standards are set or predictions of health effects of exposure to radiations are made. There is a difficulty in distinguishing mutations caused artificially by radiation from nuclear activities from those which occur naturally from earth or cosmic radiation. A mild mutation may express itself in humans as an allergy, ashtma, juvenile diabetes, hypertension, arthritis, high blood cholesterol level, slight muscular or bone defects, or other genetic 'mistakes'. (3)

It should be obvious from the above account that accelerated cancers is only the tip of the iceberg of health—hazard of radiation. But so far the debate about radiation —hazards has been primarily focussed on whethar there has been cancers or not.

Safe level and Permissible level :

There is in fact, no safe level of of radiation. There is always some cellular damage from any radiation and part of it cannot be repaied. Regulatory agencies have therefore set up permissible levels of radiation for workers in nuclear—industry and general population. Permissible level is a trade off between the facilities made possible by nuclear-industry and 'acceptable' level of damage to health. Uniformed, helpless citizens give passive consent to the unnecessary bartering of health for 'progress' as defined by the powers that be. As scientific knowledge of health—hazards of radiation increased and people's consciousness rose, the permissible level for workers decreased from 50—70 REM per year in 1934 to 5 REM per year in 1956 .... (4) (REM is the measure of radiation absorbed in human tissue. It may by noted that 5 REM is equivalent to 170 chest X—rays.) For the general people, the permissible level is one tenth of the occupational permissible level. Recently, the National Research council of the U. S., the official research agency in this field, found that the risk of getting cancer from low levels of radiation appears to be four times as high as previously estimated. The permissible level is therefore likely to be reduced from 5 REM to 1—2 REM per year......(5) Permissible limits have changed so much that the whole exercise has turned out to be arbitrary and meaningless.

HEALTH HAZARDS OF NUCLEAR FUEL CYCLE

Production of electricity by nuclear power plants involves a few steps of cycle nature—mining of uranium ore; its concentration; manufacture of fuel-rods; 'burning' of these nuclear-fuel-rods in the reactor to get heat; treatment and storage of 'spent, fuel rods after this burning; disposal of this nuclear-waste or reprocessing of these spent fuel rods to recover adequate concentration of uranium for reuse; transport of radio-active material [during these steps ot the cycle. All these steps together constitute the Nuclear Fuel Cycle and each step has its own radiation hazards.

Mining, milling, enrichment :

Uranium mining releases radio-active random gas which causes lung cancer. But hardly any effective protective measures are adopted even in developed countries.

The mined uranium is broken into small pieces (milling) and this also releases much radon. The concentration of uranium inthe ores is extremely low : 0.07%. This ore is therfeore processed to increase the concentration of uranium to 3%. This enriched uranium is then injected into fuel—rods. Nuclear reactors 'burn' these fuel rods to produce heat which is used to produce steam to rotate the turbines. At each of these steps, radio-active uranium has to be handled. If there is any laxity in the necessary precautions, dangerous uranium causes damage to the workers. This is especially true after the enrichment of uranium. There are numerous instances all over the world of this laxity. Potentially the most hazardous of all these steps is the 'burning' of the fuel-rods. This process is the controlled chain—reaction which produces intense heat. In case of the major accident or a 'electromelt down' due to uncontrolled heat, the reactor can explode and intensely radio-active elements enter the surrounding area in large proportions. The Chernobyl accident was not a full blown melt down, yet lacs of people over hundreds of square-kilometers had to be evacuated and thousands of tonnes of soil had to be scraped and would have to be stored separately for hundreds of years till its radio-activity is exhausted,. The possibility of such a major accident happening was estimated in 1975 to be in ten thousand reactor-years. With one hundred reactors operating then, it meant one accident in one hundred years. But in reality, the experience shows that a major accident would occur one in two thousand reactor-years. There are many minor accident leaks, giving out radio-activity in small dosages. It is because of these leaks that higher rates of blood and other cancers have been found in clusters, in areas surrounding these plants in workers employed in them. But the nuclear industry has questioned these findings and the debate is continuing.

Once the fuel is burnt to a specified level, it is taken out of the reactor and kept in water tanks to cool down for about 3 to 4 months. After initial cooling, the spent fuel is reprocessed to separate unburnt uranium, and a valuable fuel material—plutonium from fission products. Reprocessing stage with high degree of remote handling is a chemical step, and the scale of this remote handling operation is that of a highly sophisticated chemical industry. The low level liquid waste from this industry has to be constantly monitored and activity levels kept under control. The high level liquid and soild waste is chemically treated, vitrified (converted in to glass like material), sealed and buried at specially designed grave yards, where it will remain for generations together. These need to be kept watch upon for a period of a few hundred of years, so that the space is not used for any other purposes. Leakage and seepage in the waste containments can pose problems any time for future generations if they fail to take proper precautions Reprocessing of spent fuel and waste disposal are the crucial problems faced by the nuclear industry world over.

Throughout the fuel cycle, transporation of radioactive material is involved, requiring tremendous care, shielding and safety precautions. Any mishap due to inadequate care can lead to spread of contamination or avoidable exposure to people.

The limits on personal exposures force the nuclear managers to employ people on temporory basis for some specific jobs involving radiation hazard. Civil workers or workers from forces are used for risky jobs. These persons remain inexperienced inspite of short training given, if at all. The problem of temporary workers becomes all the more acute in developing countries. due to compelling unemployment. Fake names, faulty records of doses, and total apathy towards the unskilled temporary workers multiply their health problems. These people being not in the regular service cannot be kept track of for further check—ups even if it is wished so. In such circumstances correlation of radiation and its effects is totally out of question.

The pronuclear lobby has maintained that the dose of radiation due to tho nuclear power plants is too small;even less than natural background radiation. Thus in the U. S. the avarage natural background radiation is 99 milli REM per years per person, whereas that due to atmospheric weapons testing and nuclear industry is 4-5 and 1 milli Rem per year per person, respectively. (7) There is a statistical gimmick in there figures. Whereas every citizen does receive natural background radiation, only a miniscule proportion of the citizens are employed in the nuclear industry and hence receive radiation from this source. By dividing the total dose received by all these workers, by total population of the country (not by number of workers employed in the industry) a misleading averaging is done. The fact is that those employed in the nuclear industry receive a dose far far higher then natural background radiation. For example. table 1 gives the dose received by different category of workers.

Table—1 (8)

Radiation received by workers U. S. A., 1975

Sr. No.	*Occupational Group*	*Mean whole body dose in Milli Rem*
1.	*Industry other than power plants*	*530*
2.	*Power reactors*	*760*
3.	*Fuel fabrication and reprocessing*	*560*
4.	*Nuclear waste disposal*	*700*
5.	*Uranium mills*	*60*
6.	*Uranium enrichment*	*70*

In India, the data are scare to come by. In the absence of crucial information, let us resort to table—2 which presents the overall view of the personal dose monitoring services throughout our country This service covers roughly 94%, 31%, 20% and 20% of the radiation workers from DAE, industry, medical and research units. It should be borne in mind that in the category 'medical', the patients are not included. The incidences of overexposures in non—DAE are 200 per year. The incidences involving exposures more that 10 Rem are between 25—39 per year. Of these acute over exposures half the countribution is from the radiation workers from medical field. A similar breakup for DAE workers is not readily available to public.

TABLE—2 (9)

Number of Radiation workers monitored and average dose/ year (in India)

Year	*1985*		*1986*	
	Monitored Persons	*Annual Ave. (mRem)*	*Monitored Persons*	*Annual ave. (mRem)*
DAE.	*12683*	*429*	*12032*	*456*
Industry	*4898*	*227*	*5255*	*191*
Medical	*13480*	*79*	*14292*	*66*
Research	*1803*	*22*	*1992*	*26*

The above table gives average figures. The record of some of the plants is extremely bad. For example. the average dose per employee per year in the Tarapur plant has increased by 35 times, from 117 m. Rem in 1969 to 4069 m. Rems in 1982. Radiation received by Indian workers measured as human Rems per megawatt, per year has increased in India from 21.5 m. Rem in 1969 to 2125 m. rems in 1980, a level 27% more than that in the U. S. (10)The exposure to Indian workers is high because minor leaks due the 'unusual occurance' are more common.

Lastly, the problem of Nuclear waste disposal has not been solved at all. There is no foolproof mechanism yet discovered which will completely isolate the radio-active waste for thousands of years. What is more no solution seems to be in sight.

REFERENCES :—

1) No Immediate Danger, Rosalie Bartell, the Womens'. Press, 1985, pp. 27, 29, 30; 2) Rosalie Bartell, op. cit ps 30. 37; 3) Rosalie Bartell, op cit p. 43, 44; 4) Radiation and Health, Indian Situation, Background paper for MFC—meet, 1990, p. 5; 5) New York Times, 20-12-89; 6) Radiation and Health — Indian situation, op cit p,6-7; 7) Radiation and Health, op. cit. Table—2 8) Radiation and Health, op. cit. Table—7; 9) Radiation and Health, op. cit. p—11: 10) State of Indian Environment, Citizens report, 1987 p. 290.

II

HAZARDS OF COMMON RADIOGRAPHIC TECHNIQUES TO STAFF AND PATIENTS

Dr. Sham Ashtekar

Introduction :

Diagnostic radiographic techniques constitute an extremely important tool in the hands of the physican today all over world. Exposure rates as 868 exposures per year per thousand population are prevalent in European countries (1). In developing countries the rate is quite less as compared to these. However it also constitutes major source of radiation to mankind only next to N weapons and Nuclear Energy processors. Precisely therefore it has to be used with a lot of discretion and energy since radiation has proved to be a major determinant of cancers and genetic mutations.

The X-ray Units In India are mainly operated at two levels. The first is the X—ray Units in hospitals and consultant Radiologists processing a good number of exposures-even 100 a day-required for a range of diagnostic needs. Such installations normally use high output, low time exposure machines with a resonable safety organisation. The second lavel is that of the taluka level nursing homes / clinics, some urban 'Bazar' X-ray clinics that operate low output, longer time exposure machines with poor safety organisation.

The general consensus among experts indicates that properly used, the usual diagnostic X-ray procedures do not cause much harm to the patients/ staff considering the contribution they offer in patient management. But badly organised units can harm the population in the long run. This paper attempts to outline some isssues in this context.

2. Biologic effects of X-rays :

The biologic effects of X—ray can be summed up as follows :

i) There is no 'tolerance level' for exposure since even small doses are biologically not 'lost'. As far as biological effects are concerned there is no 'adjustment dose' for radiation.

ii) The probablility of occurrance of X-ray hazards shows a linear relationship with exposure. More the dose proportionately, more shall be the occurrence of hazardous effects.

iii) There is a sigmoid relationship between the exposure dose and the severity of the effects. Thus after an initial threshhold and then steady rise of dose-severity curve, there is a steep rise for subsequent dosages till there Is a plateau of steady rise again. The last segment of steady rise is accounted for by selective elimination of affected persons due to deaths.

iv) There are some somatic 'certainty effects' like radiation erythema bone marrow fibrosis, radiation ulcers, skin cancers etc. which almost certainly occur after a latency period, provided the dose is more than 10 and 100 rads for whole body and partial body irradiation respectively. These show a sigmoid dose-effect relationship. In the early days of radiodiagno[illegible] these were of frequent occurrences because of poor protection measures. In almost all cases of such effects, event can be traced back to some past exposure. These effects are more severe with time concentrated dose as compared to a time spreaded exposure.

v) There are some somatic stochastic effects like organ cancers and leukemias that show a linear relation as for dose effect. These effects occur at their respective age profiles, only much more commonly in the exposed population.

vi) The genetic effects are always stochastic and there are two modalities. First the effect is mostly lethal to gonadal cells so that there is a lower birth rate in the exposed population. Second—less frequently there are chromos[illegible] abnormalities and mutations. Mutations are recessive that show up in later generations if the other partner also carries recessive trait. Such chances increase with accumutation of abnormal genes in the total genetic pool of the child bearing (prospective or current) age groups. Older parents carrying such abnormlities do not alter the gene pool. The somatic expression of these abnormalities can be very severe and in this sense X—rays are a major threat to to genetic constitution of the population if effective gonad protection is not offered. Children/persons below 18 years are 10 times prone to such abnormalities as compared to the adults. (1)

vii) These biologic risks to patients have tobe weighed against the possible benefits of radiodiagnosis and those on the staff compared to level of occupational hazards in other professions to get a balanced picture of the risk profile.

3. The dose in Radiodiagnosis .

The dose of the exposure is a function of many factors. The output of the machine in milliampere, the time of exposure, the distance of the subject from the X—ray tube all decide the dose of the exposure.

Maximum Permissible Dose (MPD) is defined as : The Permissible dose for an individual is that dose, accumulated over a long period of time or resulting from a single exposure, which, in the light of the present knowledge, carries a negligible probability of severe somatic injuries; furthermore it is such a dose that any effects that ensue more frequently are of a minor nature that would not be considered unacceptable by the exposed individual and by the competent medical authorities (1).

It is estimated that in the last two decades in most countries 75—96% of the exposed staff did not receive more than one tenth of the MPD. It is also estimated that in no country the genetically significant dose from this source is more than 1% of the natural background radiation. However, the same MPD level can not be accepted for children since children are about 10 times susceptible as compared to adults. (1)

4. The Estimation of Cancer risk.

There can be no generalisation about cancer risk from X—rays. Much depends upon the dose, the organs receiving X—rays, the age of the subject, positioning of subjects and some other factors. When a subject is exposed whole body-all organs may get irradiation but the risk is not similar in all the organs. Generally extremities are not sensitive and so also skin, bones and thyroid. As for dose, every procedure involves different dosages. Chest radiographs, extremities and thinner parts/need much less exposure than abdomen. Thick set individuals need more exposure than thin ones. An AP chest view harms the bone marrow much more than a PA view. A 'repeat' doubles the dose and the risk thereof. Exposure of abdomen in an 18 - year subject causes cancers with manyfold frequency as compared to the same procedure in a 60 year old subject. An elderly can take much more dose without cancer risk since there is relatively shorter survival period for cancers to develop. Therefore multiple radiographs for diagnosis of gastric ulcers, renal stones, barium shadows involve much less risk than a single exposure in a child. Risk changes to more than 10,000 times from one situation to another situation (2).

The variation in risk due to these factors is quite sizeable as will be evident from the risk in the appendix.

5. Gonadal Doee :

Almost every exposure, save dental or similarly skin close exposures and well limited (collimated), exposures result in some irradiation of the gonads. Appendix II shows the Gonadal dose grouping and also bone marrow dose grouping (1). This will underline the need to lead-shield the gonads whenever possible.

6. The risk factors, the X-ray machine, design factors, shielding :

i) The useful beam size : The X—ray beam directed towards the target / film is known as the useful (Primary) beam. The useful beamsize depends upon the design of the X—ray tube head output and the distance of the subject from the tube head. Most often unless optical devices are used to show the field of the beam the useful beam irradiates. regions that surround the target region. This can be avoided by optical devices and adjusting the distance factor.

ii) Back radiation / scattered radiation : Radiation other than the useful beam is known as the back / scattered radiation. This mainly affects the staff. Adequate distancing of the operators control panel, lead apron are all necassary to avoid the exposure to this radiation it can also affect the patient and suitable position is necessary to minimise this dose (1).

iii) Fluroscopy : The machine output In fluroscopy operation is very low but time factor offsets this advantage. Moreover. staff doing fluoroscopy is necessarily exposed to the useful beam in a routine manner. Proper darkroom facility, timer—indicators; apring switch, lead flaps, lead gloves, proper dark adaptation and good training are all necessary to minimise dose.

iv) Calculated Vs actual dose exposure : It is possible to calculate individual exposure doses as per the readings of MA; Kv time in secs. But actual doses are found to vary between 0.1 to 0.4 times the calculated dose due to equipment doctors. This is known to happen even in best of units (2). The real way of estimating actual exposure dose is to use special instruments like Gigar counters, crystal dosimeters, ionisation chambers etc. which is usually not done in India though BARC can help do this on request. It is estimated that much smaller doses than are actually delivered are really necessary for most of the procedures.

v) Leakages from Tube head : There is no other way to detect leakages from tube head (that will give substantially more radiation than the week back radiation) than special detectors like the Geiger counters. Whenever new installations / changes are made it is mandatory to check for this with the help of special services. BARC can help in this.

vi) Film and screens : Insensitive films / screens entail a longer exposure of the subject and staff and also reduce machine life. It is necessary to use suitable films/screen to minimise exposure.

vii) Design and shielding : X—rays can penetrate and have to be stopped from affecting surrounding people by special design and devices. As far as design is concerned, adequate spacing is the first important thing. Since rediation at a given point is inversely proportional to distance from the source, a unit housed in a 10 x 10 feet room is more hazardous to outside people than the same unit housed in a 15 x 15 feet room. Unfortunately this is a restraint in many X—ray clinics. Secondly the useful beam has to be primarily directed at exterior wall so that minimum exposure occurs o the surrounding life. Thus it should not be directed at the waiting room, wards, street, passages unless adequately shielded. The control panel should be outside the X—ray room in units operating more than 50 kv machines. As for shielding, lead and wall thickness are two principal considerations. For every 50 kv rating of the machine a 0.5mm lead thickness is necessary to the useful beam (eg the fluroscopy procedures) Stray radiation can be taken care of by putting a 0.25 mm lead barrier (the usual lead aprons) provided the staff is distanced at about 10 ft from the source.A 9 inch brick mortar wall is equivalent to 1mm lead thickness and so is a 6 inch concrete slab. All walls should be designed to stop the primary radiation of the useful beam. Since machine position, direction of beam, installation etc. can change subsequently and this should be kept in mind. Doors / windows should be shielded with a 1mm lead thickness with adequate overlap so that radiation does not escape the gaps. It is always better to seek help of radiation engineers while designing the unit.

viii) Staff Monitoring for radiation : X—ray u staff and other staff routinely comming in contact of X—ray units (Nurses / ward-servants etc.) are expossd to radiation. Unless proper precautions are taken to restrict staff entry in 'switch-on' time, a great risk awaits the operating staff by way of cancers, leukemias and gonadal irradiation. Standing behind the X—ray tube. lead aprons, control panel, adequate distance are all necessary. The film badge monitoring is a routine method in upper strata X—ray clinics. In the lower category of taluka level units, bazar clinics and minor units operating in small nursing homes no such monitoring is ever done; perhaps with the idea that the dose involved is low. In this context, the conditions in the latter category are quite bad since most of the operators have little knowledge the potential risk of this invisible menace. At pressnt there is no working mechanism of regulating the conditions at such clinics. Although the total work load is quite small in this category, the neglect of basic protective factors understandbly constitutes a very real threat to both patients end operators.

7. Conclusion :

X—ray are a great help in patient management. Generally speaking MPD is not exceede

APPENDIX—I

CANCER RISK ESTIMATION USING VARIOUS FACTORS FOR CHEST VIEW. (2)

Age yrs	Entry dose	Beam AVL	PA VIEW Male Cancer Risk	PA VIEW Female Cancer Risk	AP VIEW Male Cancer Risk	AP VIEW Female Cancer Risk
New born	0.010 R	2.5 mm AL	37* per million	49 per million	90 per million	260 per million
One year	0.012 R	2.5 mm AL	37 —„—	49 —„—	95 —„—	283 —„—
Ten Yrs.	0.016 R	2.5 mm AL	31 —„—	35 —„—	105 —„—	280 —„—
15 Yrs.	0.021 R	2.5 mm AL	16 —„—	16 —„—	86 —„—	242 —„—
20 Yrs	0 026 R	2.5 mm A2	15 —„—	13 —„—	44 —„—	124 —„—

* A Value of male risk of 37 per million means one cancer case in about 27,000 exposures.

both in case of staff and patients since there is a relative paucity of facilities in developing countries. As for the well equipped clinics with adequate shielding and care little harm is done to staff and the risk is acceptable. As for the lower rung units conditions are apalling; with potential risk for both the patients and staff and much needs be done to regulate these units. Gonadal irradiation must be avoided in early and middle age group whenever not necessary. A long term projection of gonadal irradiations to a fair portion of population (that is going to bear progeny) indicates accumulation of abnormal elements in the genetic pool and this can be real cause of concerns cancer risks in the exposed populations is going to increase but no generalisation can be possible in this regard. Early age of exposure, no of exposures, procedures involving high dose to susceptible organs are all risk factors to be watched.

(*Ctd. Page 14*)

A BOMBAY journalist and the Medico Friends Circle, an organisation wedded to protecting medical ethics, have done well to challenge the legal validity of the stand taken by the Maharashtra Medical Council (MMC) that journalists and members of the public cannot attend inquiries conducted by it against doctors. What is more heartening is that the Bombay high court has granted permission to the petitioners to attend a specific inquiry in which they had evinced interest, even though the petition has yet to be admitted. It is difficult to understand how a statutory body can routinely hold in-camera inquiries in matters relating to medical ethics, which are of utmost importance to the people. The act establishing the MMC grants it powers of a civil court, which makes it all the more necessary that the proceedings be open to all except in extraordinary cases.

(Source : The Times of India, 8 March 90)

III

FOOD IRRADIATION — THE NEW TOY ?

A. T. Dudani

Although food irradiation has been in use in U. S. A. for almost 30 years it has not caught up largely on account of the now well known, small but crucial Delaney Amendment in 1958 to the Food, Drugs and cosmetic Act which described food irradiation as an "additive" instead of "Process". This puts the onus of proving safety of any additives squarely on the manufactures. The rationale being that irradiation resulted in new molecules in food that were not present before. To date some 30 countries have permitted commercial irradiation of 28 different food items. World–wide annual capacity of food irradiation is about 4 724 lakh tonnes - bulk of which is being used for wheat (4 lakh tonnes) and the balance for spices, fruits and vegetables and seafoods.

Canada has so far sold some 134 Food Irradiators world-wide, including 4 to India largely for use in sterilisation of medical products· However in 1979, India exported one Irradiator to Indonesia. This country is endeavouring to enter food irradiation in a big way and some 5 Food Irradiators are at present in the process of fabrication and installation in addition to 4 already in operation.

How Irradiation works ?

When radiation strikes other material it transfers energy. At a certain level this radiation knocks out elections from the atoms of the material exposed-which in turn breaks the molecular structure of the material yielding ions or free radicals-hence the term ionising radiation. The ions being chemically very active, easily re-combine with surrounding material. These give rise to potentially toxic material products (URPs for short). While many of the URPs are similar to those that occur in cooking of food, some are unique to irradiation and have been implicated in causation of cancer. Formation of URPs has been found to be relared to the dose of irradiation used. For example 10 KG. results in about 306 mg of URPs per kg of food. Thus, irradiation triggers chemical reactions causing gross disruption of the DNA in the cells, thereby inhibiting cell growth or division. Whereas USA permits at present 1 KGy (equivalent of ten million chest X—Rays) in India dose of upto 10 KGy has been permitted.

Irradiation Process :

This itself is not very complicated. Food is placed on a conveyer belt which takes it to a chamber and source of ionising irradiation. Protective casing is removed enabling rays to go through the food and its packing.

The dosage as also the amount of exposure ranging from several minutes to several hours is pre-determined.

Radiation doses are expressed in terms of Grays (Gy) or in rads (radiation absorbed dose); one Gy equalling 100 rads (1 Kgy equal to 100,000 rads).

Areas of concern :

There are essentially 4 main areas of concern regarding widespread use of ionising radiation to sterilise, disinfest or stabilse food.

Firstly the chemical impact of heavy doses on the food itself to ensure that mutagenic or carcinogenic compounds or URPs are not formed.

Secondly Whether the food is rendered safe from spoilage microbes and pathogens like botulinum and that irradiation does not give rise to mutants which produce increased amounts of highly undesirable products such as aflatoxins.

Thirdly that vitamins and amino acids, minerals are not destroyed. A new area of concern is the possible deleterious effect of irradiation on antioxidants and other additives in foods.

Fourthly that Irradiation plants do not create any threat either to environment or any undue occupational health hazards by way of accidents, disposal of waste or transport or radioactive material.

What is the record ?

There is irrefutable evidence that irradiated foods suffer a significant loss of vitamins A, B, C & E and some essential amino acids, Depending on doses, in apples 70% loss of Vit. C has been reported. in case of wheat flour, 67% of thiamine was lost on irradiation and 8 months storage as against 25% loss in the non-irradiated control. Likewise in rolled oats the corresponding loss of Vit. E was 85% and 26% respectively.

USDA has reported that thiamine content of bacon in raw cooked or freeze dried form degraded at significantly highter rate during cooking if the bacon had been irradiated.

Some dangers :

Studies have also shown that gamma irradiation was unable to inhibit botulinal toxin production in frankurters if normal salt content was reduced

Stimulation and rapid division of naturally occuring aflatoxin-producing moulds has also been observed in irradiated foods. Aflatoxins are 1000 times more carcinogenic than the banned pesticide Ethyl dibromide for which irradiation has been suggested as a possible substitute. That fact you cannot see it, taste it, smell it or even test for it, also poses problems of misuse.

Call for Ban :

It is not therefore surprising that British Medical Association. and more recently the European Parliament has called for a ban on food irradiation. Several scientists, including 2 Nobel Laureates, Linus Pauling and George Ward have also supported a ban on food irradiation specially in view of results of trials at National Institute of Nutrition (NIN) Hyderabad during 1973-75 which showed polyploiding in blood, which has been linked with cancer. Although this work was caught up in a fierce controversy, recent evidence notably from Canada, U. K. & Australia supports the results obtained at NIN. Studies from US and Japan Radiation Research Foundation, Tokyo also show that harmful effects of nuclear radiation from Atomic bomb 42 years ago had been grossly under-estimated due to faulty calculations and US reluctance to provide information.

Moratorium pending safety assurance :

A conference of delegates from 9 Asia—Pacific countries co-sponsored by International Organisation of Consumer Union, Penang which met at Cenberra 9-11 November, 88 has in a Declaration urged W. H. O. to re-open the issue and also called for a world-wide moratorium on further use and development of food irradiation until various issues were sorted out. This is considered feasible since safe alternatives already exist, which can be further developed. Agency has been created under the Secretary, Ministry of Health, as Chairman to deal with all matters relating to irradiation or foodstuffs.

It does seem surprising that while this country faces the imminent prospect of its irradiated food exports being banned in several countries and boycotted in others, it is going ahead with building 5 new commercial irradiators (hopefully not for exports).

(*Background Paper for XVI Annual Meet of MFC*)

REPORT OF XVI ANNUAL GENERAL BODY MEETING OF MEDICO FRIEND CIRCLE

The XVI annual general body meeting of Medico Friend Circle held on 29th January 1990 at Gandhigram Rural Institute, Dindigul Dt.,Tamilnadu. Aronnd 35 members attended. The meeting started at 11.00 A. M. A brief report of the proceedings is given below.

Annual meet in 1991 :

Medico Friend Circle in its last meeting of the core group at Sevagram, Wardha critically looked at the relevance of one-theme annual meets so far organised by it. Many members felt that :

—the topics for meet are chosen one year in advance on the basis of their topical importance. However by the time of the annual meet many other important issues emerge, for which there is no time for discussion.

—one theme discussion in annual meet also does not let the expertise available even within MFC members on different health aspects to be shared with other participants and interested members.

—one theme meet has restrictied the discussion on a particular topic for one time. It does not allow follow-up discussions and not provide the interest and the expertise on the issue to grow. This has led to a very high incidence of change in membership and also the participation in the meet.

Hence, after discussion in this meeting, it was decided that annual meet in 1991 will be of three days duration and shall have multiple themes for debate / discussion. Different topics on which discussions will be organised are :

—primary health care revisited

—alcoholism and health

—sexually transmitted diseases

—privatisation of health care

Persons within MFC have taken up responsibility to prepare on these themes. The dates and venue of the meet shall be decided latter.

Core Group /Mid-Annual Meet

This will be held from June 9 to 11, 1990 at Sevagram, Wardha. "Role of MFC like group in contemporary health movement and how it can become a more active and vibrant organisation of health activism" are some of the important issues nagging the members of MFC since quite sometime. In last few core groups, some discussion on these issues have taken place. Many members have felt that in order to work out a detailed strategy to revitalise MFC, there is need to have a lengthy discussion. Hence, it has been decided to devote all three days in mid annual meet for this purpose. The meeting will be an extended core group in which all the current members and other interested persons will be invited.

Involvement in the issues Related to Bhopal

During the non-theme discussion, Sathya and Nishith reported in detail about the current health problems of Bhopal victims, the secretive attitude of Government research institutes towards the data generated by them and new possibilities of work in Bhopal because of changed political scene. After discussion it was felt that the work among Bhopal victims is sensitive and demanding and so far experience of such a work has not been encouraging. In this context given MFC's loose and complex organisational structure today, MFC as a body will not be able to undertake any major or continuous responsibility in Bhopal in near future. MFC would however co-operate with other groups and individuals whenever possible. Nevertheless, MFC has decided to demand from Indian Council of Medical Research ond other research bodies involved in research studies among Bhopal victims to release the reports and conclusions of their studies for the knowledge of victims and to supplement the medical work and research undertaken by non-governmental organisations for the benefits of victims. It was also decided that MFC would request to those advisors of ICMR who are sympathetic, to suggest ICMR to release the reports of its studies conducted by it, If ICMR does not respond favourably, MFC will take recourse to legal action. MFC would also encourage members to cooperate and assist other groups and individuals in medical work in Bhopal, in their individual capacities.

MFC Bulletin

"The present circulation of tho bulletin is around 350 and there is an urgent need to increase it". It was also discussed that members, especially core group members should take up responsibility to write articles for publications in the bulletin regularly.

Anthology : Medical Education-Reexamined

The manuscript of this book is ready and will be printed soon. An active search for cheaper press and necessary funds is on. March has been fixed as deadline for printing.

NET-EN Booklet

Initial big report on Net-En was prepared by Sathya and Nalini for writ petition filed in the Supreme Court to stop the pre-market trial, unless proper and long term studies have been done. Later on Anant condensed the report for publication as a booklet. All comments on the draft has been received and it is left on the editor of the booklet to decide which of the comments to publish alongwith the draft. Hopefully, it will be ready soon for sale.

Problem of Foreign Contribution Registration

Nimitta Bhatt of the Trust for Reaching the Unreached, Baroda through a letter informed about the problems of newly created organisation to get registration under the Foreign Contribution Regulation Act of the Govt. of India. She also sent a copy of the resolution passed by their organisation. The general body decided a resolution to be sent to relevent authorities to provide registration to newly created organisations as soon as possible and also to simplify the procedure of getting it.

All India Meet of Health Activists-

The third all India People's Science Congress to be held at Bangalora from 8th to 11th March 1990 is also organising First All India Meet of Health Activists. MFC has been invited and requested to send 5 delegates. Amar, Anant and Narendra volunteered to participate. Ravi and Thelma will be requested to participate on behalf of MFC.

ORGANISATIONAL MATTERS

Budget-

Audited accounts of the year 1981 and till 31st March 1989 were placed and passed by the general body. M/s. V. K. Bansal and Associates was once again appointed to audit the accounts of MFC for the year 1989—90. A new budget for the year 1990—91 was worked out and passed.

Selection of Executive Committee Members-

Ravi Narayan, Sathya and Dhruv retired by rotation after completing two years. Anil Pilgaonkar, S. Sirdhar, Unnikrishnan and Narendra Gupta continue to be the members in their second year.

Election of New Convenor

Narendra Gupta completed his two year term in February 1990 and wished to be relieved. Anil Pilgaonkar has been elected as the new Convenor of Medico Friend Circle and he will take over from April 1990 after the end of current financial year. From April 1990 the organisational office of Medico Friend Circle will shift to 34-B, Noshir Bharucha Road, Bombay 400 007.

Narendra Gupta
Convenor

PRESS RELEASE

HEALTH BODY SAYS NO TO NUCLEAR ENERGY

Medico Friend Circle (MFC) in its XVI th Annual meet on "Radiation and Health" held at Gandhigram Rural University from 26th to 28th January resolved to oppose the production and use of nuclear energy as being too hazardous for the health of human beings and to demand that existing nuclear facilities be de-commissioned and no new nuclear plants be built.

MFC held an indepth critical discussion primarily on the health hazards of nuclear power plants. During this discussion, it was pointed out the authorities all over the world have concluded that the quantum of radiation, how so ever small, invariably cause damage to human tissues and that there is no level of radiation that can be considered safe. Production of nuclear energy damages the health of the people through exposure to ionising radiation at all stages of operation. Mining and milling, transport of radioactive material, burning of nuclear fuel in the reactors, storage of spent nuclear fuel etc. cause radioactive contamination of the environment. There is enough scientific evidence to this end. Moreover what is of grave concern is the nature of the health hazards caused by ionising radiations which could range from cancers, damage to the foetus, genetic mutation after many generations and would be carried over to future generations as well.

The MFC meet underlines the special significance of these health hazards which would affect the very quality of human race in the future generations to come. Added to this is the predicted adverse effect on the power to resist infectious organisms and other stresses. These alarming health hazards are reasons enough to outright reject nuclear power.

The participants of MFC meet emphasised that apart from these major health hazards, there are many other important health problems like increased incidence of allergies, asthma, high blood pressure, hypothyroidism, reduced fertility, spontaneous abortion etc. Thus on health grounds alone, nuclear energy is to be rejected in absolute terms with little need to base our judgement on the comparative analysis of health hazards of different sources of energy. Any source of energy which threatens the very survival and quality of human species has to be rejected and human society must find a model of development compatible with safe energy sources. During the course of the discussion it became clear that the health hazards of

MEDICO FRIEND CIRCLE BULLETIN

Editorial Committee :

Abhay Bang
Anil Patel
Binayak Sen
Dhruv Mankad
Dinesh Agrawa
Padma Prakash
Sathyamala
Vimal Balasubrahmanyan
SP Kalantri, editor

Editorial Office :

Block B/8, Vivekanand Colony, Sevagram, Wardha—442 102

Subscription/Circulation Enquiries :

UN Jajoo, Bajajwadi, Wardha–442 001

Subscription Rates:

	Annual	Life
Inland (Rs.)		
a) Individual	30	300
b) Institutional	50	500
Asia (US dollars)	6	75
Other Countries (US dollars)	11	125

Please add Rs 5 to the outstation cheques.

Cheques to be drawn in favour of MFC Bulletin Trust.

Published by Ulhas Jajoo and SP Kalantri for MFC bulletin trust, 50 LIC quarters, University road, Pune 411 016 and Printed at Samyayog Press, Wardha.

nuclear energy cannot be minimized despite claims to the contrary. Above all, the problem of safe disposal of radioactive waste for thousands of years has yet to be solved.

Today, nuclear energy constitutes only 1% of total electricity produced in India, shutting down of nuclear power plants will thus not result in a crisis on the energy front. The 1% deficit for which the nuclear energy is being produced can easily be overcome by saving electricity losses in transmission.

The MFC meet has also drawn attention to the health hazards of repeated exposure of pregnant women for prolonged periods to visual Display Terminals (Screens) attached to Computers.

The MFC meet, while affirming the well established immense value of radiological investigations has drawn attention to the fact that additional cancers do in fact occur due to exposure to X—rays. The incidence of additional cancers is extremely low and depends upon the age, sex of the person exposed and the quality of radiological apparatus. It has been estimated that in case of adult male persons exposed to these X—rays, there would be 15 additional cancers per million X—rays. Compared to the number of lives saved, & diseases diagnosed this risk is extremely low. But nevertheless it follows that X—rays must be kept to as minimum as necessary and secondly all the precautions necessary to maintain the X—rays units properly have to be meticulously followed. On both these counts the situation in India especially in Taluka places etc., is much worse than in the developed countries. Screening machines are much more hazardous because their exposure is many times more and hence it should be restricted to the absolute minimum. Atomic Energy Regulatory Board must exercise its powers to regulate the quality of radiology units.

(Ctd Page 9)

8. References :

1) Manual on Radiation protection in hospital and General Practice : Volume 1 By C B Braestrup & K J Viktelof. WHO Publication. Geneva 1974 PP 28, 29, 31, 27.

2) X—RAY. HEALTH EEFECTS OF COMMON EXAMS ; By John W Gofman & Egan O 'Connor, Sierra Club books, San Fransisco 1985 PP 86, 87, 2. 349

(Background Paper for XVI Annual Meet of MFC)

Reserve file
Nuclear weapons

Name of Disease :

Madness of Nuclear Weapons

Area of Recent Outbreak :

South Asia

Two Essays By Bharat Dogra

Nuclear Weapons - Never Say Yes

Nuclear Frenzy In South Asia

1998

519
1/9/98

Nuclear Weapons - Never Say Yes

Hiroshima, August 6, 1945 : Father Kleinsorge, a German missionary, heard pathetic voices of people asking for water. When he managed to reach the place from where the voice had come, he saw nearly 20 persons, all of them in similar condition - their faces were wholly burned, their eye sockets were hollow, the fluid from their melted eyes had run down their checks.

It is images such as these from Hiroshima and Nagasaki which lead several people to conclude that the luckiest people in a place hit by an atomic bomb are those who die instantly.

Temperature at the hypocentre of the explosion reaching the double of what it takes to melt iron, the face of a schoolgirl sitting almost a kilometer away from this hypocentre being burnt beyond recognition, skin sloughing off scalded bodies, badly injured starving people unable to swallow anything because of the stench of dead bodies - this was the devastation caused by a 12.5 Kiloton bomb in Hiroshima which killed and wounded as many people as a mass raid of 279 aircrafts, laden to capacity with bombs, striking at a city ten times as populous.

Nearly one hundred thousand people were killed within a few minutes in Hiroshima and Nagasaki after being hit by nuclear weapons in 1945, but if we count the longer-term deaths, those caused by internal bleeding, leukaemia, various other forms of cancer, then the death toll is likely to be as high as 3,50,000. In addition the next generation continued to pay for this cruelty in the form of children born with mental retardation, physical deformities and other serious health problems.

So cruel was the devastation that all of us must necessarily ask - we certainly do not want Hiroshima to happen to our friends, but do we want it to happen even to our worst enemies?

This much is certain - any one who participates in or assists in a nuclear weapons attack will never be at peace with himself.

Despite this, the incredibly cruel fact remains that humankind now possesses nuclear weapons which are many times more powerful than the ones used in Hiroshima and Nagasaki, and efforts are constantly on to increase the destructiveness of these weapons.

Time magazine (May 25, 1998) has provided the following data on the nuclear weapons and their reach:

Country	Number of Warheads	Range (In Kms)
USA	12070	13000
Britain	45	12000
France	500	5300
Russia	22500	11000
China	450	11000
India	About 65	2500
Israel	About 64 to 112	1500
Pakistan	About 15 to 25	1500

From this table it is evident that

1. The world has over 35,500 nuclear warheads and

2. Today almost no part of the world is safe from nuclear weapons as the range of the existing nuclear warheads reaches almost all parts of the world.

As for the real progress of nuclear disarmament the Human Development Report (HDR), 1994 has informed, "The reductions envisaged in the START I and II treaties called for the removal of more than 20000 warheads from the arsenals of nuclear weapons states - but not a single warhead has been dismantled so far... Indeed neither the United States nor Russia has a technically or politically feasible plan to dismantle warheads or dispose off their nuclear components - so the warhead could represent a threat for generations to come." Further the report says that the breaking up of the Soviet Union has complicated matters by creating three more nations with nuclear weapons on their territory -Ukraine, Kazakhstan and Belarus.

The smuggling of plutonium, specially from the successor state of the former USSR has added a new dimension to the nuclear threat. It has been estimated that in another 10 years there will be enough plutonium in storage worldwide to build 42,000 atom bombs. (Reported in a cover story in Time magazine, 1994).

The nuclear electricity generation programme of some countries entails several risks and in addition it is not cost effective, yet it is supported because it provides the materials needed for atomic weapons programme. The same can be said for several other parts of the nuclear establishment. Thousands of people are subjected to slow poisoning by innumerable nuclear installations in various parts of the world.

In 1990 Senator John Glenn, a Democrat from Ohio and the spokesman of a US Congress Committe released its findings, saying : "The US nuclear weapons programme was exposing large number of workers to potentially dangerous health risks but did nothing to warn them and swept the problem under the carpet." The findings come at a time when lawsuits accusing the programme of damaging public health and the environment are increasingly common.

Construction workers, technicians and soldiers suffered the worst exposures, between 1945 and 1954. Most were due to leaks of plutonium and other radionuclides. Once, however, radioactive iodine-131 and xenon-113 were deliberately released into the air by researchers near a plutonium processing plant at Hanford in Washington State. Vegetation in nearby dairy-farming areas was contaminated at 20 times the allowable level at the time.

Health officials at Hanford knew in September 1947 that exposure to radiation among workers could be common and extensive. An inquiry by Robert Parker of General Electric, which managed Hanford, found leaks from corroded ducts in stacks at the processing plant. Parker estimated that 7.4 billion radioactive particles, mostly plutonium, had been escaping form the plant each month. "The critical hazard is the inhalation and lung retention of particles," he said.

Although the ducts were repaired, more serous problem ensued : much finer radioactive particles escaped form other parts of the plant. These were considered more dangerous, because they penetrate deeper and stay longer in the lung. Parker warned of potential health problems among workers at the time, and did so again in 1951.

In December 1948, a committee of health advisers to the US government's Atomic Energy Commission was told that hundreds of worker at Hanford and Oak Ridge, a weapons site in Tennessee, were being dangerously contaminated with uranium, radium and radon. Some were getting 125 times the limit set during the Second World War for exposure to uranium.

In 1990 a federal court in Nevada ruled that workers who were present at bomb tests may sue for damage to their health. The case covers about 218 people, 200 of whom have died of cancer. (Reported In New Scientist, 6 January, 1990)

Matthias Finger writes in a widely quoted paper 'The Military, the Nation State and the Environment' (The Ecologist, September-October, 1991) : "In the US, 99 percent by volume of all high level radioactive waste and 75 percent of low level radioactive waste...has come form nuclear reactors operated for military purposes, including ship and submarine pollution. The US General Accounting Office admits that information about low level nuclear waste at its military bases is simply unavailable. With regard to both nuclear and chemical waste, the most severely poisoned area could prove impossible to 'clean up' or otherwise rehabilitate."

The USA has recently been in the forefront of speaking against nuclear explosions, but the reality is that this country alone has conducted more nuclear explosions (1031) than the total nuclear explosion conducted by all other counties (1025).

According to M. Finger, weapons tests and accidents have been the most significant military source of global radioactive pollution. From 1945 to 1989, more than 1800 nuclear bombs were exploded in over 35 sites. Roughly one-quarter of the tests were conducted in the atmosphere. About one-third of the US underground tests may have leaked radiation, the proportion may be higher for French and Soviet tests. In addition, more than 230 nuclear weapons accidents involving the USA, the USSR and the UK took place between 1950 and 1988."

The world has already seen some very disturbing nuclear accidents such as Windscale (UK), Three Mile Island (USA) and Chernobyl (former Soviet Union).

B. Seshadri, a leading writer on science related issues in India wrote about the Chernobyl accident : "The prime cause of the accident was a number of violations of operational practice - on an inferior design of reactor - by technicians at the plant. The explosion was the result of a runaway chain reaction of the kind that is used in an atomic bomb explosion. To add to the horrors, thousands of people, including scientists and army personnel, were put to work inside the growing Sarcophagus - a fact not know to the world until a long time after - to brave the radiations and the plutonium dust (a by-product of nuclear power production and the most toxic substance on earth). The men were foredoomed to slow and agonising deaths in the days, weeks, month and years to come. The final death toll in the countries of the former Soviet Union and the rest of Europe as a direct consequence of radioactive contamination is likely to run into tens of thousands. Adverse genetic effects on the children who will be born to these men are also feared."

Zhoren Medvedev has described the following effects of Chernobyl disaster in his paper published in the Ecologist in January-February, 1990 : "Six hundred thousand people who have already been exposed to radiation doses of between 10 and 200 rems will be required to undergo frequent medical checks until the end of their lives. In 1989, 38 percent of this number were reported to be in need of some form of medical attention, whether in hospitals, as outpatients, or in sanatoria. A significant part of the heavily contaminated area is far from the accident site - in some cases between 100 and 400 kilometers to the south-west,

west, north-west and north-east. The radioactive fallout here was caused mainly by rain which fell during the period when radioactivity was belching form the damaged reactor. In Byelorussia alone, the loss of agricultural production in 1989 due to Chernobyl cost 700 million roubles. By 1989, the total cost of the accident was officially (and modestly) estimated to be 11 billion roubles (about $ 20 billion)."

According to B. Seshadri, even in an advanced and industrial safety-conscious nation as the former West Germany there were some 300 minor accident in a single year, 1988. It is thought that the statistics are no better anywhere else, if not readily available. The risk of a major accident is now put at 70 percent every six years, an alarming prospect."

Thus it is clear that even without the wartime use of nuclear weapons, merely maintaining a huge nuclear complex either for direct military purposes or for supporting it can pose a threat to the health and well being of hundreds of thousands of people. As for the actual wartime potential of nuclear weapons, it is clear that a monstrous force which is several hundred times more destructive than what was seen in Hiroshima can be unleashed in a future nuclear war. The destructive potential of nuclear weapons is already adequate to destroy almost all life on earth, by its immediate effect and longer-term impacts of environmental ruin, cancers, genetic damage, starvation and worse. So no matter where these are being produced - in which country and for what purpose - there should always be only one answer to nuclear weapons - **No, no, no.**

Nuclear weapons programme of all countries should be opposed, including those of the USA, Russia, China, France and Britain. These countries have been using their nuclear hegemony to exercise undue control over other countries. In particular the USA has been pursuing policies of economic exploitation towards developing countries and using its military strength, including its nuclear arsenal, to force other countries to submit to these policies. What is more, while the USA makes a big show of opposing nuclear proliferation, in a selective way it sometimes even encourages this. For example, when the USA badly needed

Pakistan's support to oppose the Soviet presence in Afghanistan, on some occasions it turned a blind eye to the illegal acquisition of equipment and technology by Pakistan for its nuclear weapon programme.

The World Commission on Environment and Development said, "Beyond the five recognised nuclear-weapon states, at least six others have a widely acknowledged potential nuclear weapons capability, a dozen others are not far behind. The nuclear weapon states cannot expect the non-nuclear weapon states to abstain form exercising the nuclear option in the absence of real progress on the road to nuclear disarmament."

The real path to disarmament requires that nuclear weapons of any and all countries should be opposed firmly so that the world gets relief, peace as well as freedom from economic exploitation based oh special weapons.

So let us say a firm no to all nuclear weapons.

Nuclear Frenzy In South Asia

The month of May 1998 will go in the history of South Asia as one of the most dangerous months for this sub-continent which took nuclear frenzy to the streets of India and Pakistan and brought the threat of nuclear warfare between these two nations closer to reality than ever before. The five nuclear test explosions in India's Pokharan followed by six in Pakistan's Chagai, as also the flaunting of jingoistic nationalism by leaders of both countries, made South Asia a leading flash-point of a world which remains highly insecure despite the end of cold war.

Since India's single nuclear detonation in 1974, no country outside the 'five nation nuclear club' had tested a nuclear device, and now suddenly there were 11 nuclear test explosions within the span of less than three weeks. What is more, these tests were accompanied by aggressive rhetoric on both sides, with leaders, technocrats and media persons boasting about their own nuclear might and what can it do to the other side.

Those who had been expressing concern about the possibility of a nuclear weapons race in the sub continent were proved right. There have been plenty of such warnings during the last decade.

In June 1989 two scientists David Albright and Tom Zamora wrote in 'The Bulletin of Atomic Scientists',

"For years India and Pakistan have been perched on the brink of an all-out nuclear arms race. Both countries are known to be accumulating relatively large stockpiles of nuclear explosive materials - plutonium and highly enriched uranium (uranium concentrated to over 20 percent uranium-235). Now, as a result of West German investigations into a series of illegal exports of sensitive nuclear technology, evidence is mounting that both countries have even more extensive nuclear weapons research, development, and production programs than previously thought."

This review went on to say that investigations and other recent public revelations about India's and Pakistan's programs indicate the following :

● India probably decided several years ago to acquire the know-how to make a thermonuclear weapon (hydrogen bomb) as a hedge against Pakistan's growing atomic ability, and to be prepared to test such a device within a few months of a Pakistani nuclear test.

● Both India and Pakistan have imported beryllium - a material useful in designing smaller, lighter, and more sophisticated nuclear weapons. India is also producing beryllium in its own facilities.

● Pakistan has acquired sophisticated tritium processing equipment from West Germany, and India is building a plant that will be able to produce large amounts of tritium.

● Pakistan is reported to have perfected the design of a nuclear aerial bomb for its US supplied F-16 attack aircraft, and India has apparently been working on the design of a nuclear aerial bomb since 1984.

● India is reportedly preparing to test an intermediate range ballistic missile with a range of 1,500 miles; in February, Pakistan said it had test-fired two short-range missiles.

On the basis of this evidence this review concluded, "Since the leaders appear unwilling or unable to constrain their nuclear weapons programs, these countries remain in a nuclear standoff. A military crisis might compel them to deploy nuclear arsenals, and risk a nuclear confrontation in South Asia. And if either country tests a nuclear explosive, the other will undoubtedly follow, unleashing a race for increasingly sophisticated nuclear weapons, including thermonuclear weapons."

In June 1989 Jozef Goldblat expressed similar concerns for this region in a paper titled 'Nuclear non-proliferation: The Status and Prospects' written for the Canadian Institute for International Peace and Security : "Evidence has accumulated in the past few years that both countries possess all the essential elements for the manufacture of nuclear weapons. It is thus now an established fact that, with the help of technology and hardware obtained from abroad clandestinely or with the indulgence of the supplier's authorities, Pakistan is producing highly enriched, weapon-grade uranium. It may not yet have assembled a complete nuclear explosive device but, according to independent experts, its unsafeguarded enrichment plant has the capacity to produce enough fissile material for one to four weapons annually.

"India tested a nuclear device in 1974. Since then, it has greatly increased its plutonium production capacity (owing partly to clandestine imports of heavy water), has acquired uranium-enrichment technology, and is considered by some analysts to be able to produce over fifteen nuclear weapons per year."

In 1990 Leonarde S. Spector and Jacqueline R. Smith wrote in a book titled 'Nuclear Ambitions', "If nuclear proliferation has been unannounced, it is real nonetheless. Indeed, the years since 1964 have seen the advent of Israel, India, Pakistan and S. Africa as de facto nuclear weapon states i.e. countries that have deployed nuclear weapons or could do so rapidly in a crisis... If a breakthrough of the de facto moratorium on nuclear testing by the nuclear threshold states occur, it would mean the end of one of the few remaining restraints on their nuclear activities."

It appears likely that there will be a race for nuclear arms between India and Pakistan. In its issue dated May 25, 1998 Time magazine published estimates of the likely number of warheads existing in the nuclear arsenals of eight countries. This report said that India has about 65 nuclear warheads while Pakistan has between 15 to 25 warheads.

According to this report India has a missile range of 2500 Kms while Pakistan has a range of 1500 Kms. This implies that India and Pakistan already have the capacity to reach each other's leading cities - mega cities with a population of around 10 million or so.

The risk for South Asia increases due to a number of other reasons. In both countries the peace movement is weak. In both countries democracy - which allows the voice of reason to be heard - is weak. Pakistan immediately followed its nuclear explosions at Chagai with the imposition of emergency which further curbs democratic rights of citizens to a large extent. In both countries religious fanatic groups are powerful.

The present governments of both countries appear to be unwilling or incapable of solving the real problems of the people and instead resort to dangerous and aggressive rhetoric against each other to cover up their failures on the domestic front.

Both countries have very thickly populated cities - millions of people concentrated in a very small area - where loss of human lives from a nuclear attack can be very heavy.

These two countries have already fought three wars and tensions between them have escalated rapidly on several occasions in recent years.

Recently, the US Air Force has estimated that in the event of a full-scale nuclear war between India and Pakistan, as many as 100 million people will die. The first hour of such a war itself would claim 17 million lives in Pakistan and 29 million in India. (Reported in the Statesman, 22 June, 1998)

Economic Costs

Apart from the threat of nuclear war, a nuclear weapons programme particularly when added to already high military expenditure can prove very harmful for the economic well-being of the people of both countries.

Although South Asia contains nearly 40% of the world's poor people, it spends around $14 billion a year on military. Global military spending declined by about 37% during the period 1987-94 but military spending during the same period in South Asia went up by 12%. The world's military expenditure is 37% of its spending on education and health but this percentage is as high as 72% for S. Asia, according to 1990-91 data.

Between 1987 and 1994, military holdings (combat aircraft, artillery, ship and tanks) declined by 14.5 percent in the world, but these increased by 43% in S. Asia.

When to this we add the very high costs of maintaining an arsenal of nuclear weapons, competing with each other to get more weapons and more destructive weapons, developing the delivery systems, improving these constantly - then the economic costs of all this for the people of India and Pakistan can be very heavy indeed. In addition, of course, there will be the costs of the sanctions imposed by developed countries and the financial institutions controlled by them.

Lastly, we should not forget that the maintenance of a large-scale nuclear complex, including nuclear plants meant ostensibly for peaceful use but in reality used to supply the essential materials for atomic weapons, entails large-scale regular and accidental exposure to radiation which itself can claim a very large number of lives, particularly when we include the longer-term impacts such as those of various types of cancers.

According to a study 'Nuclear Power - Safety, Economic and Strategic Issues' by V. Ranganathan and Sanjay Kanoongo (Economic Times, April 12, 1989), "Department of Atomic Energy is yet to evolve the safety limits of the different types of pollutants that are released in the nuclear fuel cycle. No continuous monitoring of the level of pollutants is done in actual practice."

The study informs us that the effluents from the Nuclear Fuel Complex at Hyderabad contain high amounts of toxic substances, especially nitrates, and frequently some waste uranium. These have caused the contamination of groundwater in neighbouring villages with high levels of nitrates because of water seepage. High levels of nitrate in drinking water can cause blood disorders. In neighboruing Mallapuram village abortions have become more frequent.

According to another expert Dr. Dhirendra Sharma, "In spite of the fact that many abnormal deaths and deformities have been reported, no information or manual is available to citizens and administrators living in the neighborhood of nuclear plants."

A study of the workers at the Indian Rare Earth Plant at Alwaye by V. T. Padmanabhan, a researcher who has specialized in occupational health issues, found that there is a significant increase in cancers and in mortality due to all causes among I.R.E workers as compared to the control population.

In the villages near Jadugora uranium mining area located in Singhbum districts of Bihar, villagers suffer from several mental and physical disorders related to radioactivity exposure. Poor workers are forced to work in highly hazardous conditions due to their poverty.

The siting of Narora atomic power plant has come in for maximum criticism - due to its location in a seismic zone, due to unsuitability of its foundation, its nearness to the Ganga river and big cities including Delhi. All these factors together have resulted in this project becoming one of the most controversial power projects in India. The proposed siting of a nuclear power plant near the Nagarjunsagar dam site has also faced a lot of criticism.

The present location of Narora project was strongly opposed by the Vengurlekar Committee on site selection in 1972, and A. K. Ganguly, formerly head of BARC's chemical group, had publicly warned of the risk.

According to the study by Rangnathan and Kanungo, "Large number of Rajasthan Atomic Plant Workers have been exposed to hazards from both ionizing radiation and tritium. Contamination of RAPS can only increase with time. Even its present level remains unacceptably high."

According to the same study, design faults led to an explosion at the Baroda heavy water plant during the trial run in 1977 and it was put out of action until 1981. There was also a blast in the same plant, leading to a major fire in the high pressure section of the plant. Several workers reported symptoms of inhaling the gas that had leaked from the plant.

According to Dr. Dhirendra Sharma, the pressurized heavy reactor (also known as CANDU because of its Canadian origin) at the Rajasthan Atomic Power Station Unit I was damaged in August 1981. About 2000 workers are estimated to have suffered from unusually heavy levels of radiation and it is reported that about 300 personnel were hospitalized as a result of exposures at RAPS.

Behind many accident and safely violations, critics allege, is corruption in construction work and procurement of equipment.

Another adverse factor is the tendency to discourage criticism and warnings from honest scientists and engineers.

In Pakistan the risks are even higher than in India because secrecy is higher and the possibility of democratic protest is lesser.

Nuclear explosions in both countries have already been linked to adverse effects. In India several serious health problem including higher risk of cancer have already been reported by villagers of Pokharan region, which was also the site of India's first nuclear explosion in 1974.

The Pakistan nuclear explosions at Chagai on May 28 have been mentioned as a cause of the highly destructive earthquake which claimed 5000 lives in Afghanistan. On May 30 Janarthan Negi, scientists emeritus at the National Geophysical Research Institute (NGRI) in Hyderabad (India) said : "The fact that nuclear explosions could trigger natural earthquakes in the Chaman fault system in the Hindukush-Pamir block was already know to Chinese, American and Russian scientists."

He said the Pakistani test should not have been carried out in the Chagai Hills area. Quoting published information by the North Atlantic Treaty Organisation (NATO) in 1995, Mr. Negi said 80 percent of the 272 nuclear explosions carried out by the Russians between 1963 and 1986 in the "semi-Palatinsk" area (50 degrees North and 72 degrees East), were followed by earthquakes of magnitude greater than 3.4.

The block where the earthquake occurred was found to be extremely sensitive to Russian underground tests conducted 1,400 Km away. The Pakistani test site was only 700 Km away and its influence could have been greater, Mr. Negi said. He said that in the case of the Russian tests, quakes followed after five and again after 15 to 30 days. Mr. Negi said the Afghan earthquake "is a unique example of an extremely devastating environmental effect of underground nuclear explosions whose body waves had caused he triggering effect."

This booklet has been published jointly by
Rural Litigation and Entitlement Kendra (RLEK)
21, East Canal Road, Dehradun-248001 (India)
and
Bharat Dogra
C-27, Raksha Kunj, Paschim Vihar, New Delhi-110 063
Phone : 5575303

Composed at Sharma Computers
4/5 Moti Nagar, New Delhi-110015

Printed by Kulshreshtha Printers
11 Tyagi Vihar, Nangloi, Delhi

OH - 2

ACTION VIEWS

Newsletter Against Nuclear Weaponisation

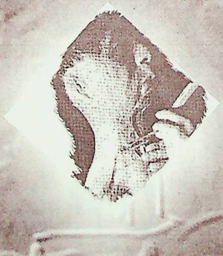
YOUTH FOR NUCLEAR DISARMAMENT

THEN....

THE PAIN OF HIROSHIMA

Some nights
my eyes open
and I think that
those scientists who invented
atomic weapons:
when they heard the news of
the terrible genocide of Hiroshima-
Nagasaki,
How did they sleep at night ?
Did they, for a second even,
Get the feeling that what they had done
Was not right ?
If so, then time will not put them in the clock
But if not then history will never
Forgive them.

-A.B. Vajpayee



NOW....

झुक नहीं सकते

"जूझने का प्रण,
पुनः अंगद ने बढ़ाया चरण।
प्राण-पण से करेंगे प्रतिकार,
समर्पण की मांग अस्वीकार।
दांव पर सब कुछ लगा है, रुक
नहीं सकते।
टूट सकते हैं मगर हम झुक नहीं
सकते।"

अटल बिहारी वाजपेयी
प्रधानमंत्री

ACROSS the BORDER

AN OPEN LETTER TO THE PRIME MINISTER OF PAKISTAN

Mr. Prime Minister,

It was a tragic day for the People of South asia when India exploded its first set of nuclear devices on May 11, 1998. This one act put the freedom and security of the region in serious jeopardy. It is our belief that the economic security and well being of all people are the sole guarantors of territorial integrity and national sovereignty. The lessons to be drawn from the collapse of the Soviet Union, show us ambiguously that no amount of nuclear weapons can promote security. On the other hand the rise of Germany and Japan as Great Powers with no defence expenditures, bears testimony to the fact that the well being of a people is not dependent on nuclear arsenals.

There is an urgent need for a responsible and bold leadership, which does not succumb to jingoism and war mongering, but in fact has the ability and strength to resist pressure in the larger interests of the nation. Given the implications of nuclear warfare, the leadership can no longer afford to ponder to ill considered war hysteria. It takes a strong and visionary leader to educate the people that the theory of deterrence has been widely discredited and it has been proved beyond doubt that peaceful dialogue is the only resolution for conflict.

We strongly urge you to return, with greater sincerity and earnestness, to your earlier policy of dialogue at all responsible levels between the people of the two countries, with a view to lessening tensions and eschewing war. This is the only way to counter the war-mongering that has been unleashed in the region. We appeal to you to take the lead in toning down the rhetoric of war and violence which is standing in the way of peaceful resolution of our problems.

The People of Pakistan wants its leadership to encourage a mood of soberself reflection rather than taking recourse in false euphoria. We have brought ourselves to the brink of a nuclear holocaust and feel that it is the responsibility of the government and aware individuals to educate the nation on the horrifying implications of nuclearisation.

Joint Action Committee For People's Rights,
Lahore. 11 June, 1998

Peace Petition from Pakistan

(Dated: June 2,1998)

"...........We reject the claim by the government of Pakistan that it's nuclear weapons tests were justified because of the existence and testing of nuclear weapons in India.

"........We believe there can be no justification for any state to engage in activities that allow it to design, develop, test and maintain nuclear weapons since these are fundamentally weapons of terror and mass destruction.

" ....We call on the government of Pakistan to give a binding commitment that it will not further test, develop or deploy nuclear weapons."

Signed by:

Some 200 eminent personalities have already signed on this campaign and the figure is still increasing.

Joint Statement by the Indian and Pakistani Doctors for Peace and Development

"...........The Indian Doctors for Peace and Development (IDPD) and the Pakistan Doctors for Peace and Development (PDPD) -- affiliates of the 1985 Nobel Peace Prize winning International Physicians for the Prevention of Nuclear War -- share a deep sense of disappointment and profound regret that India and Pakistan have tested nuclear devices and thereby fired the starting gun in a suicidal nuclear arms race.

Signed By:

Dr. S S. Shrivastwa
IDPD International Councilor, India
IPPNW * Co-Vice-President for South Asia

Prof. S. Tipu Sultan
PDPD International Councilor, Pakistan
IPPNW * Co-Vice-President for South Asia
Joint Action Committee for People's Rights, Lahore.

PAKISTANIS ACROSS THE WORLD CONDEMN NUCLEAR TESTS

To:
Mr. Muhammad Nawaz Sharif
P.M. of Pakistan

and
Mr. Atal Behari Vajpayee
P.M. of India

"............We, Pakistanis (included are persons of Pakistani origin and expatriates), therefore exhort the two governments to seek other ways and means of promoting peace and security. They must focus on the ethical and material well-being of their peoples. It is especially shameful that while the vast majority of the people in these two countries have to wage a daily struggle for survival their governments waste scarce resources on building weapon arsenals. The ancient Indian tradition of ahimsa is part of the common heritage of all the people of this region. Many Sufi ideas are also supportive of peace, tolerance and respect for life. The ultra-nationalist and militarist postures of the present regimes, however, negate these humane values. This must change. Relations between Pakistan and India and their peoples should be based on goodwill and a commitment to resolve all controversial issues through discussion and mutual accommodation.

We do not, therefore, find the present policies of the governments of Pakistan and India on defence and security, especially the acquisition of nuclear weapon capabilities, justifiable on any grounds. We also find that the present arrangement that the USA, Russia, France, Britain and China can continue to possess nuclear weapons, arbitrary and flawed. We urge, therefore, the two governments to work towards a global regime dedicated to bringing about the total destruction of all nuclear weapons within a specified period of time, without linking it to their own right to nuclearize. As an immediate step, both countries should declare that they will not embark upon a programme of building nuclear weapon systems.

[More than 200 Pakistanis - scientists, academics, educationists, architects, doctors, editors, engineers, journalists, jurists, lawyers, publishers, teachers, writers, poets, artists, filmmakers, cultural workers, human rights activists, women rights activists, anti-child labour and anti-bonded labour activists, development and environment experts, human submit a petition against nuclear tests and weapons.]

Women's Action Forum (WAF) Working Committee, Pakistan (June 03, 1998)

"............We appeal to the leadership of India and Pakistan to put a stop to this madness. There can be no justification, moral or otherwise, for an act that imperils the future of the human race. Women's Action Forum, Lahore, is deeply distressed by the explosion of nuclear devices in India and Pakistan."

ACAAR (Action Committee Against Arms Race) organised a Peace Rally and Peace March in Karachi on 6th August to mark Hiroshima Day. Some two hundred working children led the Rally to commemorate the anniversary of the dropping of nuclear bomb on Hiroshima on the unfortunate day of August 6th, 1945 as well as to protest against the recent nuclear tests by India and Pakistan. Besides the children, the participants included a large number of women and human rights activists, trade unionists, political workers, teachers, students and representatives of political parties and professional organisations.

PRESS STATEMENT ON HIROSHIMA DAY, AUGUST 6, 1998, PAKISTAN

"..........India and Pakistan tested their own nuclear devices in May 1998, thereby choosing a path that can lead only to mutual destruction.

We believe that the manufacture, testing and deployment of nuclear weapons devastate the health and security of people as well as the planet.

We therefore call for the complete elimination of nuclear weapons. We call others to join in the challenge to achieve a total ban on the research, development, testing, production, deployment use and stockpiling of nuclear weapons.

Peace-loving citizens of Islamabad/ Rawalpindi join others from around the country to demand that :

Pakistan and India immediately declare an official moratorium on further nuclear tests, stop the production of material for nuclear weapons, and commit themselves to cease weaponizing and deployment."

DEMONSTRATIONS

- 16th May '98- Organised by different NGOs of Delhi in which people from all walks of life participated to show their resentment over nuclear tests conducted by India.

- Regular demonstration on every Friday at different places in Delhi organised by **Parmanu Bomb Virodhi Andolan** till 6th of August'98 (Hiroshima Day).

- 24th June '98- *Dharna* was held against the nuclear tests conducted by India and Pakistan by **Anu Parmanu Hathiyaar Evam Yudhonmad Virodhi Manch** at Udaipur Court Crossing in Rajasthan.

- 6th August '98- On the 53rd anniversary of US atomic bombing of Hiroshima peace marches were organised all over India.

- 6th August '98- Peace march was organised at Jaipur by **Anu Parmanu Hathiyaar Evam Yudhonmad Virodhi Manch** on the Hiroshima Day.

CONVENTIONS

- 17th June '98- Seminar in which Mr. Takhita San an atomic bomb suvivor of Hiroshima bombing from Japan shared his experiences.This was organised by **Movement in India for Nuclear Disarmament (MIND)** at ISI, New Delhi.

- 29th June '98- A symposium on nuclear weapons was organised at the Press Club of India, New Delhi by **Pakistan-India People's Forum for Peace and Democracy (PIPFPD).**

- 10th July'98- A seminar was organised by **Jan Hastakshep** at Gandhi Peace Foundation. The topic of seminar was **From Bomb to Budget** in which eminent scholars presented their views.

- 18th-19th July '98- A national convention on the nuclear issue was organised at Sabarmati (Gujarat) by **Anu Virodhi Shanti Sthapana Samiti** in which activists from different NGOs participated.

- 26th July '98- Convention against nuclear weapons was held at the Music Academy Auditorium, Chennai.

EXHIBITIONS

- 26th-30th June'98- A photo exhibition of Nuclear Victims was organised by **PEACE BOAT,** a NGO from Japan at National Gandhi Museum, New Delhi

- 28thOct.-2ndNov.'98-An atom-bombs Photo Exhibition was organised by **Japan Congress Against A-and H-Bomb,** Japan in collaboration with **India National Trade Congress (INTUC), Hind Mazdoor Sabha (HMS)** and **International Transport Worker's Federation (ITF)** at India Habitat Centre, Lodhi Road, New Delhi.

PLAYS

- 17th-28th Aug'98- **Trojan Women,** a greek play on war was staged at different venues in Delhi by **PRAVAH.** Along with the play a street poster exhibition on nuclear weapons was also displayed at the venues. In preparation of which **YND** also helped.

PUBLICATIONS

- **Facts against Myths** an information bulletin published regularly by **Vikas Adhyayan Kendra, Mumbai** covered in its latest issue the myths about Nuclear Deterrence, which will be covered in next issue also.

- "Parmanu Bam Virodhi Andolan" has published a booklet in Hindi **'Parmanu Bam se Ek Mulakat'** which conveys message about the hazards of possessing nuclear weapons. Language of the booklet is very simple to understand.

- A book has been published by YND on Disarmament in Hindi as well as in English called **"Ek Khoobsurat Jahaz"** and **"A Beautiful Ship in The Sky"** respectively.

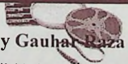
FILMS

- **"Ek Khoobsurat Jahaz"** a documentary film on disarmament produced by **TVI** and written and directed by Gauhar Raza.

- **"Darkness of A Thousand Suns"** a documentary film on Nuclear arms race produced by **Delhi Science Forum** with help of **Department of Science And Technology, Govt. of India.**

A Film on Nuclear Disarmament

EK KHOOBSURAT JAHAZ



by Gauhar Raza

Available in Hindi & Tamil

Duration - 20 minutes Cost - Rs.150/- only

The script of the film is also available in Book form in Hindi and English

(Cost: Rs. 15/- only)

For copies: contact YND, F-93, Katwarai Sarai, New Delhi 110 016

designed and printed by : aman graphics, 6420204

शर्मिन्दा इतने हुए कि....

मई का महीना अठ्ठानवे का साल
किया अटल जी ने पोखरन फिर लाल
पांव जमाने की कोशिश में कर दिए धमाके झट
सुन उनकी आवाज़ रह गई सारी मानवता स्तब्ध
खर्च की गर वो जरा भी करते परवाह
बह न जाती उनकी कश्ती बीच बहाव
जंग और मोहब्बत में है सब कुछ वाजिब
यही सोच वो नहीं हुए धमाकों से आजिज
बहका दिया अवाम को यह कह कि
धमाकों को सुन मुस्कराए बुद्ध
काश देख पाते शर्मिन्दा इतने हुए कि
सिर भी न उठा पाए बुद्ध
उनका है मानना झूठ को गर बोला जाय बार बार
हो जाता है वो सच नहीं खाता फिर कोई खार

लेकिन हो गई इस बार झूठी यह कहावत
बहुत लोग रह गए जो समझ पाए उनकी शरारत
उनमें हैं आप, हम और वो सारे
हालांकि उनकी नज़र में है बेचारे
पर, मुल्क के नौजवान सिर्फ नाचते गाते ही नहीं
पड़ती है जब जरूरत डरते शैतानों से भी नहीं
ऐसे ही सोच से उपजे कई संस्थान
प्रवाह, माइंड, इंसाफ और वाई एन डी हुए प्रवहमान
इन सब की मंजिल और मकसद है एक
उम्मीद है धीरे धीरे बढ़कर हो जाएंगे अनेक
हमने बांटी अपनी जानकारियां प्रवाह के साथ
उन्होनें बिखेरा उन्हें औरों के साथ
चल ही पड़ा है ये सिलसिला
स्कूल और कालेज करने लगे हैं पूछताछ
मदर्स इंटरनैशनल और ब्ल्यू बैल्स ने बुलाया
वहां जब हमने खुद को बच्चों के बीच पाया
समझ आ गया नहीं हम अकेले
बच्चे भी परेशान थे उन सवालों से, हम हो गए दुकेले
कुछ उन्होंने कहा, कुछ हमने बताया
उन्होंने पूछा हमने समझाया
और आखिर में यही पाया
कि हर कोई चाहता शांति
इस बारे में नहीं रही अब कोई भ्रांति
सिर्फ कुछ सिर और कुछ पांव चाहिए
मंजिल हमारे इंतजार में है।

हम हंसना चाहते हैं
हम गाना चाहते हैं
हम जीना चाहते हैं
हम युद्ध नहीं चाहते हैं।

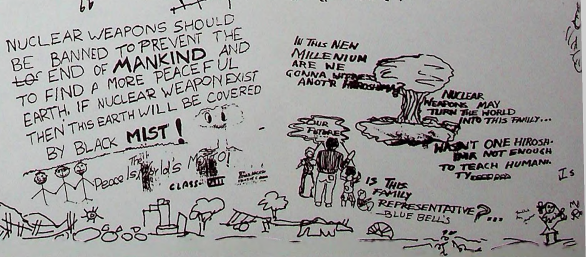
भारत के माननीय प्र

एक बच्चे

प्रिय प्रधानमंत्री,

श्री अटल विहारी बाजपेयी जी,

प्रधानमंत्री का मतलब होता है कि दुनिया को सही रखना पर आप तो दुनिया को बुरा से बुरा बना रहे हैं, कहीं झगडे शुरू हो जाते हैं तो कही मार पीट शुरू हो जाती है, कभी सोचा है आपने, क्यों बहुत से बच्चे आइसक्रीम नहीं खा पाते हैं? क्यों बहुत से बच्चे स्कूल नहीं जां पाते हैं? क्यों बहुत से बच्चे घूमने नहीं जा प्राते हैं ? क्यों बहुत से बच्चे ट्रेन में नहीं घूम पाते हैं ? क्यों बहुत से बच्चे अच्छे–अच्छे कपड़े नहीं पहन पाते हैं ? क्यों बहुत सारे बच्चों को मजदूरी करनी पड़ती है ? क्यों बहुत सारे बच्चे इलाज बिना ही मर जाते हैं ? क्यों बहुत सारे बच्चे मां–बाप का प्यार नहीं पा पाते हैं? क्यों बहुत सारे बच्चों को मारा–पीटा जाता है ? क्यों बहुत सारे बच्चे नंगे या भूखे घूमते रहते हैं ?



हम हंसना चाहते हैं
हम गाना चाहते हैं
हम जीना चाहते हैं
हम युद्ध नहीं चाहते हैं।

भारत के माननीय प्रधानमंत्री जी के नाम
एक बच्चे का पत्र

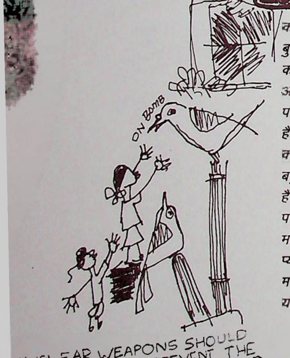
प्रिय प्रधानमंत्री,

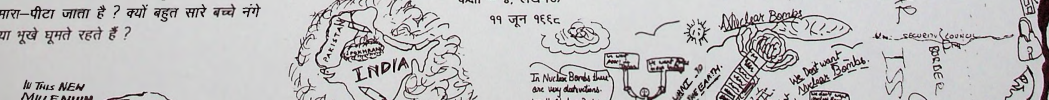
श्री अटल विहारी बाजपेयी जी,

प्रधानमंत्री का मतलब होता है कि दुनिया को सही रखना पर आप तो दुनिया को बुरा से बुरा बना रहे हैं, कहीं झगडे शुरू हो जाते हैं तो कही मार पीट शुरू हो जाती है, कभी सोचा है आपने, क्यों बहुत से बच्चे आइसक्रीम नहीं खा पाते हैं? क्यों बहुत से बच्चे स्कूल नही जा पाते हैं? क्यों बहुत से बच्चे घूमने नहीं जा पाते हैं ? क्यों बहुत से बच्चे ट्रेन में नहीं घूम पाते हैं ? क्यों बहुत से बच्चे अच्छे–अच्छे कपड़े नहीं पहन पाते, हैं ? क्यों बहुत सारे बच्चों को मजदूरी करनी पड़ती है ? क्यों बहुत सारे बच्चे इलाज बिना ही मर जाते हैं ? क्यों बहुत सारे बच्चे मां–बाप का प्यार नहीं पा पाते हैं? क्यों बहुत सारे बच्चों को मारा–पीटा जाता है ? क्यों बहुत सारे बच्चे नंगे या भूखे घूमते रहते हैं ?

तो खूब सोंच समझकर बताइये अटल जी, आप ऐसे–वैसे बम क्यों बनवा रहे हैं। क्यों नही आप सडके बनवा रहे हैं ? क्यों इतनी पानी की समस्या है ? क्यों इतना प्रदूषण है ? क्यों इतनी बिजली की समस्या है ? क्यों सब्जियों का दाम इतना बढ़ गया है ? अटल जी क्यों इस संसार में दुख है ? कहीं कुछ लोग बीमार हैं तो अस्पताल नहीं है। क्यों नहीं आप अस्पताल बनवाते हैं। क्यों आप ऐसे–वैसे बम बनवा रहे हैं ? क्या आप को कुछ पता नही कि इस कारण से कितने लोग मरे हैं। किस लिए आप प्रधानमंत्री बने हैं कि सबको दुख दें कि आप पूरे संसार में सुख नहीं देखना चाहते हैं। फिर, फिर से पूंछती हूँ कि ऐसे –वैसे बम क्यों बनवा रहे हैं।

चैती प्रभाकर
कक्षा – ४. लखनऊ
११ जून १९९८





YND, F-93, Katwaria Sarai, New Delhi - 110016

OH-2

Subject: **The Y2K World Atomic Safety Holiday (WASH) campaign**
Date: Fri, 24 Dec 1999 12:05:42 +0530
From: Vinay Baindur <v_baindur@hotmail.com>
To: il-rti@ilban.ernet.in, il-nuke@ilbom.ernet.in

http://www.y2kwash.org/home.html

The Y2K World Atomic Safety Holiday (WASH) Campaign

Sign our On-line petition to make Nuclear Installations Safe for Y2K

The WASH Campaign At A Glance - Goals & Strategy

THE SITUATION

Based on a recent U.S. State Department study of 161 nations, the Department's Inspector General, J.L. Williams-Bridgers concluded, "...that Y2K-related failures are inevitable, both here and abroad."

There are 433 nuclear reactors worldwide, all but 12 in the Northern Hemisphere. Virtually all reactors are vulnerable internally to Y2K-related software and embedded system malfunctions. They are also vulnerable externally because of their interconnectedness with other key sectors such as telecommunications and power grids.

Library - Nuclear issues file
Jn
3/1/2000

1312
31/12/99

map supplied by International Nuclear Safety Center at Argonne National Laboratory

Most reactors, (103 in US), are dependent on outside power supplied from the grid to keep cooling systems running (a) for the reactor core and (b) for the spent fuel pools. For the typical US reactor, there are back-up diesel generators (not 100% reliable) for the core cooling system , but NO back-up power for cooling the spent-fuel pools, which have 5 times the radioactivity of the reactor core. These radioactive spent fuel rods could melt-down if there is loss of incoming power to cool them, within a few hours to two weeks, depending on how recently the reactor has refueled.

Effects from Y2K on the grid are unpredictable and all 433 reactors will be challenged on the same day. Even one nuclear reactor accident is unacceptable - we know from the Chernobyl accident that the consequences are global. Governments, the International Atomic Energy Agency (IAEA) and the U.S. Nuclear Regulatory Commission (NRC) are not, as yet, dealing responsibly with the grave humanitarian and environmental dangers posed by this situation.

Additionally, the U.S. and Russia continue to maintain their nuclear missile systems on hair-trigger alert, despite serious vulnerabilities to Y2K-related malfunctions in command and control systems.

THE RESPONSIBLE RESPONSE

1) De-Alert and De-Couple: Take nuclear weapons off hair-trigger alert and remove warheads from delivery systems;

2) Stand-By for Rollover: Temporarily shut down all nuclear reactors and other nuclear installations during Rollover weekend and bring them back online after January 1, 2000 only when they are fully tested and verified Y2K compliant and the stability of the electricity grid has been re-established;

3) Beef-Up the Back-Up: Provide reliable and redundant backup generators with at least 60 days fuel supply in every nuclear installation, to keep them stable and under control;

4) Freeze Transport: Suspend transport of all nuclear materials until the "inevitable" Y2K disruptions are over;

5) Prepare the Public: Make certain that emergency procedures are in place to inform and protect the public in every community with nuclear facilities;

6) Pay Atomic Workers: Compensate the staff of nuclear facilities for lost overtime or wages and extra hazardous conditions.

The Y2K WASH Campaign in-a-nutshell:

STAND-BY for ROLLOVER
BEEF-UP the BACK-UP
DE-ALERT and DE-COUPLE

Back to Y2KWASH home

OH-2

The lack of response from President Clinton -- and the fact that only nine days are left -- doesn't daunt activist Branagan.

"You have to expect a miracle. It has to happen," she said.

And if it doesn't? Branagan and the other demonstrators plan to hold a "Y2K Nuclear Countdown" vigil in front of the White House from noon to 5 p.m. The flyer didn't explain why they'd be ending early.

Related Wired Links:

Nuke Data a Nest of Lies
17.Dec.1999

Y2K: Dispatches from Earth
16.Dec.1999

Nuclear Plant Licensed to Kill
10.Dec.1999

All Systems Go for US Nukes
8.Nov.1999

Russia Not Rushing to Y2K Crisis
8.Sep.1999

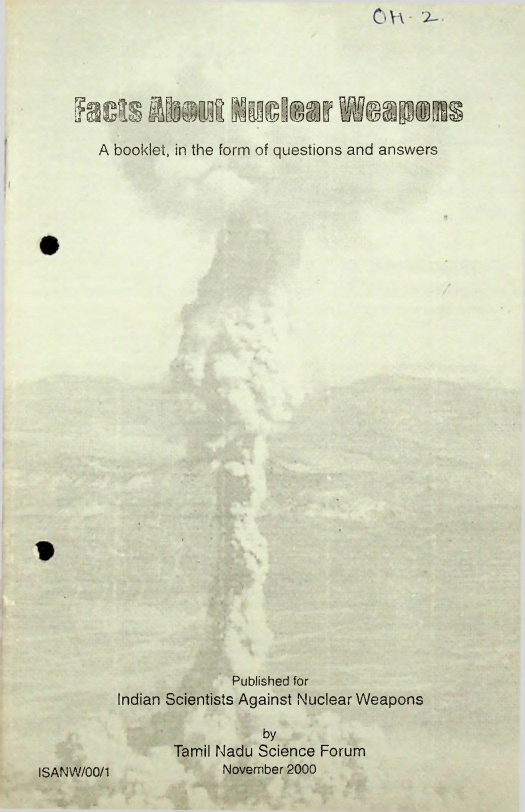
Y2K Military Minutiae on Track
14.Jul.1999

2000 Looms for US Nuclear Plants
30.Apr.1999

OH-2.

Facts About Nuclear Weapons

A booklet, in the form of questions and answers



Published for
Indian Scientists Against Nuclear Weapons

by
Tamil Nadu Science Forum

ISANW/00/1

November 2000

Facts against nuclear weapons
1st edition — July 1998
2nd edition — May 1999
2nd edition, 2nd printing — November 2000

Published for Indian Scientists Against Nuclear Weapons
by Tamil Nadu Science Forum
130/3 Avvai Shanmugam Salai, Chennai 600 086.

Contents

1 Facts about Nuclear Weapons

Science and technology has taken several leaps over the centuries, and more so in this century. As scientists, we take pleasure in unravelling the workings of Nature and appreciate its beauty. We take pleasure in explaining the way Nature works and how such an understanding leads to progress benefiting humankind.

Many such scientific discoveries, like atomic energy, often possess a dual aspect—one that is beneficial and the other implying devastation and death. In the words of Albert Einstein, one of the most famous scientists of our times, "Through the release of atomic energy, our generation has brought into the world the most revolutionary force since prehistoric man's discovery of fire". The past half-century has been a witness to an aspect of science that would be abhorrent by any reasonable moral yardstick—namely, the development of nuclear weapons and other weapons of mass destruction. For the first time in the history of humankind, we have the power to wipe out the entire human race, either intentionally or accidentally, several times over.

In May 1998, India, followed by Pakistan, conducted nuclear tests and announced their intention to become nuclear weapons states. We scientists are dismayed and angered by these events. We are convinced that nuclear weaponisation decreases the security of both the countries and increases the risk of the population of South Asia being subject to the horrendous effects of a nuclear war.

> "We scientists recognise our inescapable responsibility to carry to our fellow citizens an understanding of atomic energy and its implications for society. In this lies our only security and our only hope—we believe an informed citizenry will act for life and not for death" (Albert Einstein, January 22, 1947).

This booklet is an expanded and revised form of the original version released in July 1998. It is a continuation of the effort to inform the citizens of India about nuclear weapons, their deadly effects and the global consequences associated with them. We believe along with Einstein and several eminent scientists, that our only hope now lies with an informed citizenry.

2 Nuclear Weapons

2.1 What are nuclear weapons ?

We will take the word weapon to mean an *explosive* weapon, such as a bomb, the warhead of a missile or an artillery shell. All weapons contain explosive material which explode when suitably triggered. In conventional weapons, the explosive material is something that can undergo some chemical reaction that proceeds very fast and releases a lot of energy. Basically it can 'burn' so fast that it explodes. The first explosive material used in weapons was gunpowder, nowadays more powerful explosives like TNT and RDX are used.

The explosive material in a nuclear weapon can undergo a nuclear reaction at a very fast rate. What a nuclear reaction is and why it releases so much energy is explained later.

2.2 How do nuclear weapons differ from conventional ones ?

An important difference between a chemical and a nuclear reaction is that the latter releases about a *million times more energy* than a chemical reaction. This difference makes nuclear weapons much more powerful than conventional ones.

One measure of the power of a weapon is given by the total amount of energy released in the explosion. This is called the yield of the weapon. The yield of nuclear weapons is usually expressed in terms of the equivalent amount of TNT which would release the same amount of energy. So a single 'small' nuclear weapon whose yield is ten kilotons releases the same amount of energy as ten kilotons, i.e. 10,000,000 (one crore) kilograms of TNT.

To get a better idea of what these numbers mean, let us see how many conventional bombs would release the same amount of energy as one such small nuclear bomb. A 10 kiloton nuclear bomb weighs about 500 kg whereas a conventional bomb of the same weight contains about 250 kg of explosives. So a single small nuclear bomb releases as much energy as about 40,000 conventional bombs. The explosion of such a bomb is then like *forty thousand conventional bombs exploding simultaneously at the same point.*

Nuclear weapons are tremendously more powerful than conventional ones. They cause death and destruction on a much larger scale. They are indeed *weapons of mass destruction.*

The second major difference is that a nuclear explosion produces large amounts of "radioactive" material that give out deadly rays of nuclear radiation. (This is also called the *fallout.*) A large dose of radiation can kill a human instantly. Exposure to a somewhat smaller amount can have even worse consequences. It can cause severe illness leading to slow death after days or even years of suffering. Radiation can cause genetic damage leading to babies being born deformed. It contaminates large areas of land, making it useless for agriculture for years or even decades. These aspects of nuclear weapons thus introduce a new dimension of horror. The poisoning of humans and their environment by radiation makes the process of recovering from a nuclear attack a long and painful one.

These are the reasons why a large section of informed and sensible people in the world consider nuclear weapons to be unacceptable, much more so than biological and chemical weapons, which are already banned by international agreement.

2.3 What are the different types of nuclear weapons ?

Two types of nuclear reactions are used in nuclear weapons. The nuclei of some heavy elements like uranium or plutonium can split into two roughly equal sized nuclei with the release of energy. Such a process is known as nuclear fission. On the other hand, two light nuclei can undergo nuclear fusion to combine and form a single nucleus, again with the release of energy. These reactions are explained in detail later. All nuclear weapons use fission and fusion reactions in different combinations.

From the point of view of military usage, the weapons fall into two classes. The first are called tactical weapons. These are meant to be used in the battlefield against military formations and are typically low-yield weapons. The second class are called strategic weapons. These are high-yield weapons designed to kill civilian populations in cities. The different types of weapons that have been built or thought of are described below.

Pure Fission Weapons

Weapons in which only the fission reaction takes place are called pure fission weapons or simply fission weapons. Such were the bombs dropped on Hiroshima and Nagasaki. These are the simplest nuclear weapons to design and build. They form the basis for developing other types of weapons. Their yield can range from a few tons to about a few hundred kilotons. They can be both tactical and strategic weapons. The largest pure fission weapon tested is believed to be a 500 kiloton bomb called Mk-18 which was tested by the USA on the 15^{th} November 1952.

Boosted Fission Weapons

The efficiency of a fission weapon can be dramatically increased by introducing a small amount of material that can undergo fusion. Such weapons are called boosted fission weapons. In boosted weapons, the fission reaction takes place first and produces the required temperatures and densities for the fusion reaction. The fusion in turn accelerates the fission reaction. The fusion only serves to help the fission process go faster and makes the weapon more 'efficient'. It contributes to only about 1% of the yield. Since boosted fission weapons are more efficient than pure fission weapons, they can be made lighter for the same yield. So most of the strategic fission weapons deployed today are boosted fission weapons.

Thermonuclear Weapons

Thermonuclear weapons, also called *hydrogen bombs*, get most of their yield from the fusion reaction. As in the case of boosted fission weapons, they require a fission explosion (called the primary stage) to trigger the fusion (the secondary stage). However, unlike the boosted weapons, thermonuclear weapons contain a substantial amount of fusion fuel and most of their yield comes from fusion. These are the most powerful nuclear weapons, often with yields of a few megatons (a megaton is a million tons). A third fission stage can also be added to produce very high yield weapons. The most powerful nuclear weapon to have been tested so far is the Tsar Bomba, a 50 megaton three-stage weapon exploded by the USSR on 30^{th} October, 1961. However it is not necessary for a thermonuclear weapon to have such high yields. The B61 (Mk-61) class of tactical thermonuclear weapons deployed by the USA have yields which can be adjusted to be as small as 0.3 kilotons (300 tons).

Enhanced Radiation Weapons

Enhanced radiation weapons, also called *neutron bombs*, are small thermonuclear weapons which are designed to produce intense nuclear radiation. These are tactical weapons designed to kill soldiers protected by armour (for example, inside tanks). The radiation produced by the neutron bombs can easily penetrate the armour of tanks and kill the humans inside.

Salted Nuclear Weapons

Salted nuclear weapons, or *cobalt bombs*, are thermonuclear weapons which are designed to produce a large amount of long lasting radioactive fallout. This would result in large scale radioactive contamination of the area they are dropped in. The fallout from salted weapons is much more intense and lasts much longer than from unsalted weapons. The long term effects of such weapons would therefore be much worse. These weapons are called 'Doomsday Devices' since they could possibly kill everyone on earth. Fortunately, though these weapons have been conceived of and discussed, none have been built or tested (as far as we know).

Pure Fusion Weapons

These are fusion weapons that would not need a fission trigger for the thermonuclear explosion. Active research is going on in the US to develop these weapons, but with no success so far. Since there is no fission trigger, pure fusion weapons could be made with very low yields. Yet, the lethality of these weapons due to nuclear radiation and explosive force would still be great. For instance, a pure fusion weapon with an explosive force equivalent to one ton of TNT would kill people in an area nearly a hundred times larger than a conventional bomb with the same explosive force.

Another feature of these weapons is that since they do not use fissile material, their development would not be restricted by the FMCT (FMCT is discussed later).

2.4 What is the difference between a nuclear weapon and a reactor?

Nuclear reactors harness the energy produced in nuclear reactions to generate electrical power. They are also used to power the motors of ships and submarines. In order to do this, reactors are designed to precisely control the rate of the nuclear reactions taking place in them. The energy is then released at a controlled rate and can be used to run turbines which generate electricity or run motors. The reactors at Kalpakkam, for instance, produce electricity in this manner.

Although nuclear reactions take place in a reactor just as they do in weapons, the crucial difference is that the rate of the nuclear reaction is *controlled* in a reactor whereas in a weapon, once triggered, the reaction proceeds in an uncontrolled way leading to the explosion.

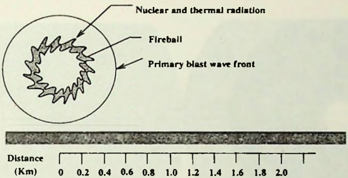


Figure 1: Half a second after a nuclear explosion

As an analogy, in a car engine petrol is burned in a controlled way inside the cylinder to drive the motor. On the other hand if a lighted matchstick is dropped into the fuel tank the same petrol will burn in a completely uncontrolled way and could lead to an explosion.

As can be visualized from the analogy, a nuclear reactor is a complex mechanism compared to a bomb.

3 Effects of Nuclear Weapons

To understand the effects of a nuclear weapons attack, let us consider the sequence of death and devastation that unfolds when a ten kiloton range weapon is exploded at some point which we shall call ground zero. The weapons are exploded slightly above the ground for maximum effect. (For a detailed account of the effects of a nuclear weapons attack on Chennai, see the article at the end of this booklet.)

Because of the tremendous amount of energy released in a nuclear detonation, temperatures of several crore degrees C develop in the immediate area (contrast this with the few thousand degrees of a conventional explosion). This compares with the highest temperature inside the core of the Sun. At these temperatures, every thing near ground-zero (a few hundred meters) vaporises. The remaining gases of the weapon, surrounding air and other material form a fireball. The fireball begins to grow rapidly and rise like a balloon. The combination of this rise, and subsequent expansion as it cools gives the appearance of the familiar mushroom cloud. The vapourised debris, contaminated by radioactivity, falls over a vast area after the explosion subsides—a deadly fallout with long term effects.

The energy of a nuclear explosion is released in the form of a blast wave, thermal radiation (heat) and nuclear radiation. The distribution of energy in these three forms depends on the yield of the weapon. For nuclear weapons in the kiloton range (as in Pokhran II), the energy is divided in various forms, roughly as 50% blast, 35% thermal

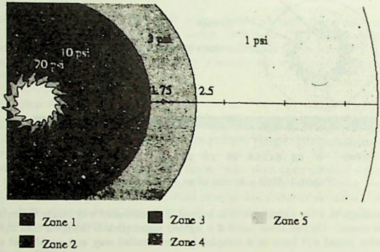


Figure 2: Illustration of blast effects for a 15 kiloton explosion. Zones 1 and 2 correspond to the "killing field" where the fatalities are universal.

and 15% nuclear radiation. Each one of these forms causes devastation on a scale that is unimaginable. Below we discuss these effects separately for a 15 kiloton bomb.

3.1 What are blast effects?

Because of the very high temperatures and pressures at ground zero, the gaseous residues of the explosion move outward. The effect of these high pressures is to create a blast wave travelling several times faster than sound. The pressure created is in excess of 10 Psi (pounds per square inch) with wind speeds in excess of 800 kmph up to about 1.2 radius. Most buildings are demolished and there will be almost no survivors. This is the real killing field. Beyond this distance, and up to about 2.5 km the pressure gradually drops to 3 Psi and the wind speed comes down to about 150 km as in a severe cyclonic storm. There will be injuries on a large scale and some fatalities. Beyond this zone of fatalities, the pressure drops to less than 1 Psi, enough to shatter windows and cause serious injuries. It is the high speed combined with high pressures which causes the most mechanical damage in a nuclear explosion. Human beings are quite resistant to pressure, but not to being thrown over against hard objects nor to buildings falling on them. This damage is clearly more serious in built-up areas.

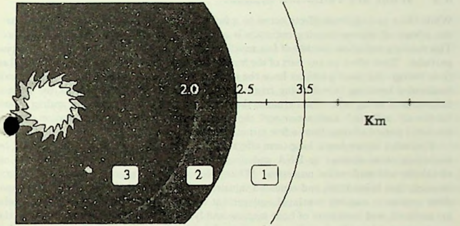


Figure 3: Illustration of thermal effects for a 15 kiloton bomb. Regions 1,2,3 refer to the degree of burns sustained during the explosion. People who sustain third degree burns are unlikely to survive without immediate medical attention

3.2 What are thermal effects?

The surface of the fireball also emits large amounts of infrared, visible and ultraviolet rays in the first few seconds. This thermal radiation travels outward at the speed of light. As a result this is by far the most widespread of all the effects in a nuclear explosion and occurs even at distances where blast and nuclear radiation effects are minimal.

The intensity of the thermal radiation can exceed 1000 Watts per square cm. This is similar to getting burnt by an acetylene torch used for welding metals. For a 15 kiloton bomb, almost everybody up to a distance of 2 km will suffer third degree burns (which damage the skin and tissues below it). There will be almost no survivors since no immediate medical attention will be available. Because the radiation is so intense, direct viewing of the fireball causes injury to the eye. Beyond this region people suffer from second degree burns, up to about 2.5 km, which is normally serious but may not be fatal. The effects persist even up to 3.5 km, with people suffering first degree burns (such as redness of the skin and pain).

The intense heat will also cause the burning of petrol, diesel and other fossil fuels along with wood, paper, fabrics etc. This could start a tremendous firestorm as happened in Hiroshima.

3.3 What are radiation effects?

While blast and thermal effects occur to a far lesser degree in other types of explosions, the release of intense ionising radiation is a phenomenon unique to nuclear explosions. This ionising radiation consists of fast moving neutrons, gamma rays, electrons and alpha particles. Their effect on any part of the human body depends upon the particles as well as their energy. All these particles have the effect of creating chemically active free radicals (molecules breaking into ionising fragments) in living beings. This affects the normal behaviour of living cells. Furthermore, the initial radiation makes the surrounding atoms (of the air, soil etc.) radioactive and they in turn could emit nuclear radiation over an extended period of time from a few minutes to a few years.

Radiation injury has a long-term effect on survivors. Reactive chemicals released by ionization cause damage to DNA and disrupt cells by producing immediate effects on metabolic and replication processes. While cells can repair a great deal of the genetic damage, that takes time, and repeated injuries make it that much more difficult. Immediate treatment requires continual replacement of blood so that the damaged blood cells are replaced, and treatment of bone marrow and lymphatic tissues which are amongst the most sensitive to radiation. One must remember in this context that there are very few hospitals equipped to carry out such remedial procedures.

Radiation injury is measured in a unit called **rem**. The long-term effects depend not only on a single exposure, but also on *accumulated* exposure. Some authorities consider 5 rem/year tolerable for workers who are occupationally exposed to radiation —a typical value for a single exposure to medical X-rays is 0.08 rem. 1.5 rem/year is considered tolerable for pregnant women. In the case of a nuclear explosion the radiation levels, up to several hundred metres away from ground zero, are from hundreds to thousands of rem, depending upon the weapon. (It should be remembered that natural radiation is always present in the atmosphere over most places on the earth, but at lower levels. But there is no universally agreed threshold on a dose of radiation which can be declared safe.)

That is not all. Things which get irradiated by this "prompt" radiation themselves become radioactive and people in the area of a nuclear explosion, who are exposed to these radioactive materials, stand more risk of contracting cancer. A 1000 rem exposure for the whole body over a lifetime (which is entirely possible) brings about an 80% chance of contracting cancer.

3.4 What are electromagnetic effects?

Ionising radiation from the fireball produces intense currents and electromagnetic fields, usually referred to as the **electromagnetic pulse** (EMP). This pulse is felt over very large distances. Electrical grids will be subjected to voltage surges far exceeding those caused by lightning. Modern VLSI chips, present in most communication equipment. TVs, radios, computers and other electronic equipment are extremely sensitive to these surges and immediately get burnt out. So all possible communication links to the outside world are cut off. Restoring these facilities will be an arduous (and expensive) task.

3.5 What are the effects on climate?

There are also long term effects on the atmosphere and climate. These are not as direct as the fallout. The high temperature of the fireball can cause large amounts of nitrogen oxides to form during the cooling process, causing a depletion of the ozone layer in the stratosphere.

The famous proposal of a potential *nuclear winter* cannot be easily ruled out. This effect is caused when a large amount of soot is emitted during the burning of various material like petroleum. The soot effectively blocks sunlight, affecting the climatic conditions over a macroscopic domain. When the volcano Tambora (on the island of Sumbawa in Indonesia) erupted in 1815, it threw out so much soot that the next year was a "year without a summer" as far away as Europe and America—the coldest year in a few centuries. Although the proposal of nuclear winter was initially received with some skepticism, later studies have confirmed almost all the details. An immediate effect is the decrease in food production since most of the food in the world is produced in subtropical regions, leading to famine, starvation deaths, etc. Smaller weapons may not produce a nuclear winter, but a mild 'nuclear autumn' cannot be ruled out.

4 Nuclear Weaponisation

4.1 What is nuclear weaponisation ?

A country that wants to have nuclear weapons as a part of its defence forces, has to also build up a lot of accompanying infrastructure. Along with having nuclear weapons, it needs a delivery system and a C^3I system (see below). Apart from this hardware, it needs to formulate a nuclear doctrine and strategy. All this constitutes weaponisation.

So nuclear weaponisation is a long process. It starts with the designing and testing of the weapons and delivery systems. This is the stage India is in May 1999. The next step would be actual large-scale production of these systems. Along with this, the C^3I has to be set up. The next step is the induction of these systems into the armed forces, the training of the personnel and finally the deployment of the weapons.

4.2 What is a delivery system ?

A delivery system is the means by which the nuclear weapon is "delivered" to the victims. It could consist of aircraft carrying nuclear bombs and missiles with nuclear warheads. These missiles could be either launched from land, ships or submarines. Some tactical nuclear weapons are small enough to be made into artillery shells and fired from cannons.

Missiles are the preferred means of delivery for strategic weapons since it is virtually impossible to set up a system of defence against them. They travel so fast that there is no way to reliably detect and shoot them down before they hit the target.

4.3 What is C^3I ?

C^3I stands for command, control, communications and intelligence. When a country has nuclear weapons and a delivery system, it automatically consitutues a nuclear threat to other countries and therefore increases the chances of being itself subject to a nuclear attack. So it has to set up a complicated system of radars and satellites to keep a constant watch, and to issue a warning of an impending attack. This is the intelligence part.

If such a warning comes, then decisions have to be taken very quickly. First, it has to be decided if the warning is genuine, and if so what should the response be (what missiles have to fired, etc). These orders have to be conveyed quickly and reliably to the personnel who are actually manning the weapons. A procedure to do all this has to rely on a reliable and robust communication network. This procedure has to also ensure that no weapon is fired without proper authorisation or by mistake. This is the command, control and communications aspect. All this together constitutes the C^3I system.

4.4 What is PAL ?

Given the devastation that can be caused by nuclear weapons, it is clearly very important that great precaution be taken to prevent their unauthorised use. PAL, which stands for permissive action links, are systems that make it impossible to activate the weapon without proper authorization. These are electronic devices that prevent the activation or arming of the weapon unless the correct codes are inserted into it. Typically two codes should be inserted, simultaneously or close together. The codes are usually changed regularly.

4.5 What is one-point safety ?

Apart from preventing unauthorised use, it is equally important to ensure that the weapons do not explode accidentally. For example, if it is accidentally dropped during transportation (such incidents have occurred), it should not explode. One-point safety is a safety criterion to prevent such accidents. It states that if one of the many *conventional* explosives in the weapon detonates by accident, then the *nuclear* explosive should not go off.

4.6 Is is possible to have a reliable defence against a nuclear attack ?

As mentioned earlier, it is impossible to have a system which can reliably detect and shoot down missiles. Therefore, there is no reliable defence against a missile attack. Since missiles are used to deliver nuclear weapons, there is no defence against a nuclear attack.

4.7 Can the population be protected in a nuclear attack ?

The only way to survive a nuclear attack would be to have underground shelters. These shelters would have to have to be stocked with enough food and water to last for about a week, since it would take that much time before the radiactivity levels come down to relatively safe levels. Constructing such shelters for the entire population is impossible, especially in India. It is impossible to protect any population from a nuclear attack.

4.8 What are the relative costs of the different components of the weaponisation ?

An analysis of the costs of the nuclear weapons program of the USA by the Brookings Institution revealed that the relative costs of the different components was as follows:

Development and Production of the weapons	7%
Development and Production of the Delivery systems and C^3I	86%
Civil Defence measures	7%

An estimate of the Indian programme made by C. Ramamanohar Reddy of *The Hindu* indicates a similar break-up. He conservatively estimates the total cost of the programme to be about 40,000 crore rupees spread over ten years.

It may be noted that nuclear weapons expenditure is not likely to be shown directly in the government's budget under such a heading, to keep it secret from other countries.

5 Fissile Material

5.1 What are fissile materials ?

Materials that readily undergo fission are called fissile materials. Those usually used in nuclear weapons are *uranium* and *plutonium*. Many types of uranium and plutonium exist—these are called isotopes. The U-235 isotope of uranium the Pu-239 isotope of plutonium are used in weapons. (Section 9 tells you what these numbers mean.)

5.2 What is highly enriched uranium ?

Naturally occurring uranium contains only 0.7% of U-235, the rest is not fissile and consists mainly of U-238. Natural uranium can be refined in many ways to increase the proportion of U-235. This process of increasing the percentage of U-235 is called enrichment.

Some reactors (and all Indian ones) run on natural uranium. Others need uranium with about 2% to 5% U-235—this is called enriched uranium.

Weapons need uranium enriched to the level of 80% to 90% U-235. Such uranium is called highly enriched uranium (HEU).

5.3 What is weapons grade plutonium ?

Plutonium does not occur naturally and has to be made in nuclear reactors. It contains the isotopes Pu-239, Pu-240 and other higher isotopes. For weapons applications, Pu-240 and higher isotopes are contaminants. (They make the fission start too early, reducing the total yield of the weapon.)

The normal reactor grade plutonium, produced in power reactors, contains about 65% Pu-239. Weapons require above 94% of Pu-239. Making this in a normal reactor is not energy-efficient, so usually weapons grade plutonium is produced in "research" reactors.

5.4 Can weapons be made from reactor grade plutonium ?

It is generally felt that it should be possible to make low-yield weapons (upto a few kilotons) from reactor grade plutonium.

Some weapons experts are of the opinion that, with a sophisticated design, a reactor grade plutonium fission weapon can have as much yield as one made with weapons grade plutonium (upto about 20 kilotons). However, a reactor grade weapon would use more plutonium for the same yield. Reactor grade plutonium is also more difficult to handle and engineer.

6 Nuclear tests

6.1 Why are nuclear tests necessary ?

In order to design a nuclear weapon, it is necessary to mathematically model the processes that lead to the explosion. The device is then simulated on a computer. In fact, a large amount of computing is required. Several assumptions go into the modelling and one cannot be absolutely sure how accurate the model is without actually testing it.

The more complicated the design, the less reliable the modelling and the more the testing required. Thus the simple "gun assembly" design (used in the Hiroshima bomb) does not require testing. It is generally felt that an implosion device needs to be tested (as was done for the Nagasaki bomb).

A thermonuclear weapon is significantly more complicated and requires more testing than a fission device.

6.2 What are the different types of tests ?

Apart from a full scale test of the weapon, several other tests are done to check different aspects of the device and the mathematical modelling.

1. Hydrodynamic tests : These are tests which do not use fissile material (an inert material with similar properties is substituted). These tests could, for example, be used to determine how well the conventional explosives in an implosion design work. Such tests are not banned by the CTBT (Section 8).

2. Hydronuclear tests : In these tests actual fissile material is used, but the nuclear yield is kept low. The yield could vary from a few kg to a few tons. These tests are banned by the CTBT.

3. Sub-critical tests : These are tests where actual fissile material is used, but the nuclear yield is zero (the material never attains criticality, see Section 9). These tests are also not banned by the CTBT.

6.3 How can underground nuclear tests be monitored ?

An underground nuclear explosion shakes the ground as much as an earthquake does. Thus the shock produced by the explosions causes vibrations of the earth which can be detected far away by seismic stations which monitor earthquakes. The signal produced by a nuclear explosion can be clearly distinguished from that produced by earthquakes.

There is now a network of seismic stations all over the world which are constantly monitoring the vibrations of the ground. Thus any underground explosion of a significant strength will get detected. The yield of the explosion can also be estimated from the signal but this measurement is not very accurate.

7 Deterrence, doctrine and strategy

7.1 What is deterrence ?

Deterrence is the rationale used by the nuclear weapons states to justify their weapons. The argument says that if a nation has capability to inflict unacceptable damage on another, then the latter will refrain from attacking the former—it will be *deterred* from doing so. The proponents of deterrence claim that it is responsible for the fact that there has been no war between the nuclear weapons states so far.

Given the nature of strategic nuclear weapons, deterrence relies on holding the civilian population hostage. Any peace brought about by it is like the peace that exists between two persons who are holding guns to each other's heads with their fingers on the triggers: an uneasy, tense peace which is fraught with danger. So the fact that no nuclear war has occurred in the last fifty years is no guarantee that it will not occur in the next fifty or hundred years despite deterrence.

7.2 What is a nuclear doctrine ?

Since a nuclear weapon can destroy a city within minutes of its being launched, it is necessary for a nuclear weapons state (at least one believing in nuclear deterrence) to clearly declare the circumstances under which it will use its weapons and the manner in which it will do so. This is its nuclear doctrine. The doctrine specifies if the state retains the option of initiating a nuclear attack (first use) or if it will use its weapons only in retaliation of a nuclear attack (no first use). The state also specifies the extent of use it will make of its nuclear weapons in different situations.

7.3 What is a second strike capability ?

If a nation is subjected to a nuclear attack, it is presumed that the initial targets would be its own nuclear weapons facilities. A second strike capability means that the nation should have enough weapons and have them deployed in a manner that enough of them survive the initial attack and can be used for a retaliatory attack.

Thus the weapons that make up the second strike capability could be missiles that are launched from mobile launchers that are constantly on the move. Or they could be missiles launched from nuclear submarines which can stay submerged for long periods of time and are therefore difficult to locate and destroy.

8 Treaties

8.1 What is NPT?

The Non-Proliferation Treaty (NPT) was negotiated in 1968, became effective in 1970 and was indefinitely extended in 1995. As of 1997, nearly 185 countries have signed NPT.

NPT introduced the definition of nuclear weapons states: those which had tested a nuclear explosive device before January 1, 1967. The key principle of NPT is that possession of nuclear weapons be limited to only these states. This was sought to be enforced by ensuring that these nuclear 'haves' do not transfer nuclear weapons capabilities to nuclear 'have-nots'.

Discussions on NPT centred around the fact that while non-proliferation was sought to be enforced, the weapons states were in no way being constrained from producing more weapons. Eventually, under pressure from non-nuclear states and disarmament groups, a clause was added (*Article VI*) which urged the weapons states to pursue negotiations "in good faith" towards nuclear disarmament.

As formulated, NPT is blatantly discriminatory and legitimises the weapons of the five nuclear weapons states. India has refused to be a party to it because of this discriminatory nature and has not signed NPT so far.

8.2 What is CTBT?

Negotiations on the Comprehensive Test Ban Treaty (CTBT) concluded recently in 1996.

The main purpose of CTBT is to put an end to nuclear explosions which seek to test weapons technology. Signatories to the treaty cannot conduct any nuclear explosions.

Two key features of CTBT stand out. One is that the treaty bans only explosions, allowing *sub-critical* (non-explosive) weapons tests as well as detailed computer simulations which make explosions unnecessary. (Weapons states like the U.S. do possess such capabilities.) The second feature is that the treaty comes into force only if and when *all* countries having nuclear capabilities sign the treaty. In particular, this has meant that unless India and Pakistan sign CTBT, the treaty will not come into force at all (leading to international pressure on India and Pakistan).

Since CTBT does not distinguish between weapons states and others, it is not explicitly discriminatory. However, India has argued that CTBT is merely a corollary of NPT and that it perpetuates a discriminatory order: the weapons states will only stop a form of testing which perhaps they do not need anyway, without committing them to any time-bound programme of disarmament. In 1996, India refused to sign CTBT on these grounds, while at the same time committing to the self-restraint of not producing weapons. This Indian stand was widely seen as a moral one, and acclaimed.

However, after the Pokhran explosions, the earlier restraint has been abandoned, and now there is again international pressure on India to sign the CTBT.

8.3 What are the implications of CTBT ?

For the nuclear weapons states, the CTBT would restrict the ability to design new types of weapons though it will not completely eliminate it. It will be possible to modify existing designs but a completely new design will be very difficult to implement reliably in absence of explosive nuclear tests.

It is possible to make reliable nuclear weapons of a simple design without explosive nuclear tests. Thus the CTBT will not be able to prevent non-nuclear states from doing so. However more sophisticated designs (which would be more efficient) require testing to make sure that they are safe and reliable.

8.4 What is FMCT ?

The Fissile Materials Cut-off Treaty (FMCT) is currently being negotiated. This treaty seeks to put an end to the production of fissile materials like enriched uranium and plutonium, which could be used for the production of nuclear weapons.

A nuclear explosion by a country can be detected by other countries, whereas a country's production of fissile material can be checked by another only by physically entering the former's installations. So a crucial feature of FMCT is the verification regime accompanying it which will bring in "full scope safeguards". Such observation of indigenous atomic energy programmes is likely to be unacceptably intrusive.

A similarity between CTBT and FMCT may be in that again weapons states may agree for the simple reason that they will not be affected. Most of the weapons states are suspected to have high stock piles of fissile materials and hence may not require further production of such material. Thus again, the constraint would only be on non-weapons states. Further, the FMCT will not restrict the production of pure fusion weapons (Section 2), if it becomes feasible.

India has not been party to FMCT negotiations so far.

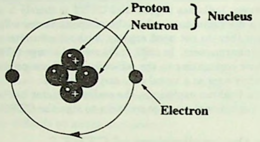


Figure 4: Schematic of a typical atom

9 Physics

9.1 What are chemical and nuclear reactions ?

Now we examine in some detail the physics involved in nuclear weapons. First we take a look at the structure of an atom.

All matter is made up of atoms. Atoms consist of a small dense positively charged core called the nucleus which is surrounded by a cloud of negatively charged electrons. The nucleus is made up of electrically neutral particles called neutrons and positively charged particles called *protons* (see Figure 4). The number of protons in the nucleus is equal to the number of electrons, making the atom electrically neutral. For example, the nucleus of a hydrogen atom is made up of a single proton and has no neutrons. The oxygen nucleus (O-16) consists of eight protons and eight neutrons. The uranium nucleus (U-235) has 92 protons and 143 neutrons. Heavier atoms have a larger excess of neutrons over protons than lighter ones.

The protons and neutrons in nuclei are held together by strong nuclear forces which are stronger than any other force that acts between them, such as gravity. Surprisingly, the total mass of a nucleus is less than the total mass of the individual constituents (see Figure 5)! For example, the total mass of an oxygen nucleus is less than the total mass of eight protons and eight neutrons. The interaction between neutrons and protons in a nucleus is such that it effectively reduces, on the average, their mass, by a small fraction. Einstein's theory of relativity explains that mass can be converted to energy, this energy being quantified by the famous formula, $E = mc^2$, for a mass m (c is the speed of light). Since the speed of light is extremely high (300,000 km/second), even a very small amount of missing mass gets converted to a large amount of energy. This large amount of energy thus released is called the binding energy.

Let us compare this to another kind of binding energy involving atoms. Atoms tend to bind to each other to form molecules. For example, water is made up of molecules

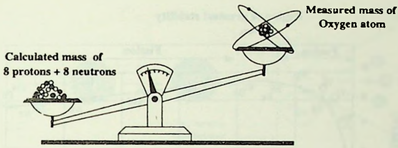


Figure 5: The missing mass

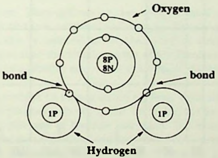


Figure 6: The water molecule H_2O

which contain two atoms of hydrogen and one of oxygen (see Figure 6). The atoms in a molecule are held together by chemical bonds which form due to the way electrons distribute themselves in the molecule. The binding energy of a nucleus is about a million times more than this energy.

In chemical reactions, the atoms of the reacting molecules—but not their nuclei—rearrange themselves to form the product molecules. If the total amount of energy used by all the chemical bonds of the reactants is less than the amount used by the bonds in the products, then the excess energy is released in the form of heat and light. (This is what school textbooks call an *exothermic* reaction.)

Nuclear reactions involve a rearrangement of the neutrons and protons of the reacting *nuclei* to form the product nuclei. If the binding energy of the reactants is less than the binding energy of the products, then the excess energy is released in the form of radiation.

Because the binding energy of nuclei is about a million times more than the energy taken up by a chemical bond, the energy released in nuclear reactions is correspondingly about a million times more than what is released in chemical reactions.

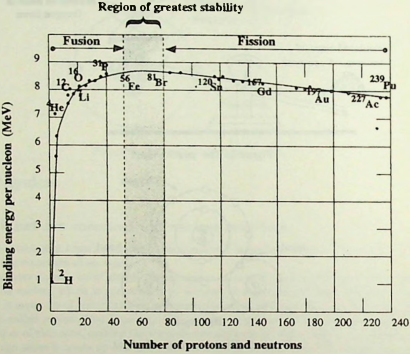


Figure 7: Binding energy per particle (nucleon) in a nucleus

9.2 What are fission and fusion reactions ?

As we saw earlier, energy will be released in a nuclear reaction if the total binding energy of the reactants is less than the binding energy of the products. Careful measurements of the binding energy of nuclei show that the binding energy per constituent particle (proton or neutron, collectively called nucleon) of a nucleus increases for light nuclei as their weight increases, whereas for heavy nuclei it decreases as their weight increases (see Figure 7). For example, the binding energy per particle in deuterium (1 proton, 1 neutron) is less than in helium (2 protons, 2 neutrons). However as the atom becomes heavier (exceeding about 26 protons in its nucleus, corresponding to the iron nucleus), the trend reverses. Hence, the binding energy per nucleon in uranium (92 protons, 143 neutrons) is less than in iron (26 protons, 30 neutrons).

There are therefore two possible kinds of nuclear reactions in which energy may be released. If a heavy nucleus splits into two roughly equal sized nuclei, energy will be released. Such a reaction is called a fission reaction. Heavy nuclei like uranium and

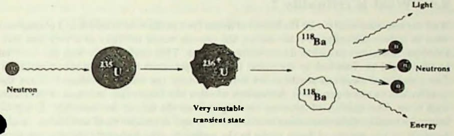


Figure 8: The fission process

plutonium undergo fission. They split up into two roughly equal sized nuclei, accompanied by the emission of two to three neutrons and energy. Fission of these nuclei can occur spontaneously but can also be induced by the absorption of a neutron. These nuclei have such low binding energies that the kinetic energy of the incident neutron may be enough to split up the nucleus into smaller nuclei which are more stable and have higher binding energy.

If two light nuclei combine to form a single nucleus, then also there will be a release of energy. Indeed, such processes do occur and are called fusion reactions. These are the reactions that occur in the core of the sun and stars. An example of a fusion reaction that is used in nuclear weapons is one in which deuterium (1 proton, 1 neutron) combines with tritium (1 proton, 2 neutrons) to give helium (2 protons, 2 neutrons), accompanied by the release of a neutron and energy. In order for two light nuclei to fuse together they have to collide at very high speeds. Therefore the fusion fuel has to be heated to extremely high temperatures for the reaction to take place. Thus, most nuclear weapons which mainly rely on fusion reactions also have fission reactions taking place which trigger the subsequent fusion reaction.

9.3 What is a chain reaction ?

As stated above, the fission of nuclei like uranium and plutonium is accompanied by the emission of neutrons. We have already seen that heavier nuclei have a larger neutron excess than lighter ones. So, when a heavy nucleus fissions into two light nuclei, there will be some excess, "free" neutrons left over. Neutrons emitted by the fission of one nucleus can be absorbed by nearby ones, thus inducing them to split. This process will then proceed like an avalanche. The first nucleus to split will induce one or two nearby nuclei to split, each of which will induce one or two more to split, etc. These continually induced fissions form a chain reaction.

9.4 What is criticality ?

If all the neutrons emitted by the fission of nuclei (two or three in uranium and plutonium) were to induce fissioning of other nuclei, the process would multiply at a very fast rate. However, neutrons can be lost due to various reasons. They could escape from the material or they could be absorbed by the nuclei in various processes that do not result in fission. The number of neutrons available for fission, namely the number produced minus the number lost to other processes, determines whether the fission rate increases or decreases with time. The number of neutrons lost depends on the size of the assembly. It will be larger for smaller sizes since more neutrons will escape in smaller sized assemblies. It also depends on the density of fissile nuclei in the assembly—the higher the density, the more the chances of a neutron being captured by other nuclei and so the number of neutrons lost will be smaller. For the same reason, fewer neutrons will be lost with increasing purity of the material.

If, on the average, more neutrons are lost than produced, then the rate of fission would decrease with time and the whole process would die out. Such an assembly is said to be subcritical. If the number lost is exactly equal to the number produced, the assembly is critical. The chain reaction will then proceed at a constant rate. Finally, if the number produced exceeds the number lost, then the assembly is supercritical.

An idea of the amount of material required for an assembly to be critical is given by the critical mass, the mass of pure material for which this self-sustaining chain reaction occurs. A typical critical mass for a sphere of pure uranium could be anything from 16 to 52 kg, depending on the particular isotope considered.

In a nuclear reactor, the assembly is designed so that the criticality can be precisely controlled. It can be adjusted to be subcritical, critical or slightly supercritical.

A nuclear weapon is designed so that a subcritical assembly can suddenly be made supercritical. The critical mass of a fissile material decreases rapidly when the density of the material increases. A sub-critical assembly can be made critical or super-critical merely by compressing it, a process used in many weapons.

10 The Effect of a Nuclear Bomb on Chennai

Most nuclear bombs are strategic bombs. They are meant to be used against civilian populations. What might happen if a small nuclear bomb fell on Chennai? Imagine that it has a yield of only 16 kilotons of TNT— this is what destroyed the city of Hiroshima.

So imagine that early one morning, at 8 AM, a 16 kiloton nuclear bomb is dropped on Pondy Bazar in T.Nagar. This is one of the main shopping areas in the city bustling with shoppers most of the time. This is ground zero. Within 3 microseconds a chain reaction starts inside the Plutonium bomb. In another microsecond the bomb is vaporised and its energy is released to devastate our city.

Four microseconds after the bomb is dropped, a hot blast of light vaporises everything within a short radius around ground zero. The shoppers in the Market Complex, the thousands coming into the crowded shopping area, are the luckiest— a few thousand people are gone even before they can see the blast. The metal of buses, overhead electrical lines and in stocks in many shops melts away in this heat but has no time to form puddles.

Behind this flash comes a blast— a huge thunderclap of sound so intense that it travels many times faster than any sound we can hear. This is called the blast wave, and does most of the damage. It disperses the molten metal and travels on, battering everything in its path. There is a zone in which the sound is intense enough to tear apart a human body— this is called the killing over-pressure zone. Up to about 300 meters from ground zero, people may see a flash of light and the beginning of the mushroom cloud, but are dead before they can hear the blast. Nearly five thousand people live and work in the killing over-pressure zone around Pondy Bazar. For all of these people death is certain— there is no time to run, no place to hide.

Less than a second after the bomb was dropped, nearly ten thousand people are dead and a radioactive mushroom cloud is rising above the Bazar. The electro-magnetic pulse (EMP) formed in the first few milliseconds of the expansion of the fireball has already fried electronics over a large area. Singara Chennai has begun to die.

The blast rages on for one and a half kilometres, destroying brick buildings, hurling people and things into the air, killing by slamming buses, buildings and bodies into people. The blast travels faster than sound, and no person can run that fast. Nearly a lakh people in this zone are affected. Maybe a tenth of them die immediately, maybe more; but the survivors are badly injured. Less than 5 seconds have passed— twenty thousand dead and nearly a lakh more are injured.

Beyond this the blast declines to mere cyclone speeds, destroying brick houses and objects of equal weight, up to a distance of 3 kilometres from Pondy Bazar which includes all of Mambalam, Vani Mahal to the west and almost touching Adyar in the east. Another three lakhs of people are affected. Perhaps one percent die. Nine seconds after the blast there are nearly twenty three thousand dead and nearly three lakhs of people need help.

The survivors would be found outside this area, where the shock wave reduces to a hurricane, a gale and eventually just a nuclear breeze. Around ground zero is an expanse of rubble at the heart of one of the bustling shopping areas in the city. The area as far as Adyar, Besant Nagar, Thiruvanmiyur on the one side, and Ashok Nagar, KK Nagar, Anna Nagar on the other, and a similar distance in all directions has become a killing field. Vital links between various parts of the city are cut, communications equipment slagged by the Electro Magnetic Pulse. Over the days the nuclear poison sowed by the mushroom cloud would be blown inland— radioactive dust settling over most of Thiruvallur and Kanchipuram districts and as far south as Mamallapuram.

But before that, within a minute, the world would realize that communications from Chennai have ceased. The country must start up a massive machinery to aid the city. What is needed? Rapid and extensive engineering services to repair the major road and train links into the devastated area— remember that several lakhs of wounded are trapped here and will die unless aid reaches them soon. Many families have been separated since the bread-earners travelled to work in different parts of the city, leaving their families. Communications must be restored, lists of the living and dead must be made and communicated to the remainder of the population, to prevent further panic and perhaps riots.

Most of the city's population would be trapped in parts where food cannot be sent without repairing roads. We must think about these, and many more questions. We have grasped a deadly weapon— we must look at the face of death and make our plans to last beyond it.

The enemy's bomb may have killed several tens of thousands and injured several lakhs more. The wielders of our bombs will certainly avenge the death of Chennai, but it is the remainder of the 50 lakh residents of Chennai who will have to deal with the consequences— slow death from radiation poisoning, starvation perhaps, higher incidence of cancers, the birth of deformed children, the poisoning of Chengalpattu, Gummidipoondi, Mamallapuram areas and the waters of the sea that wets the sands of southern shores.

In the final analysis it is we who must make certain that such a massive disaster will not happen. The laws of physics do not care for humans, they are the laws of unthinking matter and energy. The time has come to go beyond euphoria at our demonstrated control of the laws of the universe, and to embark on the much harder struggle to create humane and just laws to bind the nations of the world.

Much of the material of this book has been compiled from the High Energy Weapons Archive website. The website also has links to numerous other websites. The address (URL) is:

`http://www.fas.org/nuke/hew.`

"... We scientists recognise our inescapable responsibility to carry to our fellow citizens an understanding of atomic energy and its implications for society. In this lies our only security and our only hope—we believe an informed citizenry will act for life and not for death."

Albert Einstein, January 22, 1947

"... the world will be a better place if those who made these deadly bombs destroyed themselves...."

C. V. Raman, 30 December, 1954

"... it is immoral because the very persons in whose interest atomic weapons are proposed to be used would be its first victims..."

M. N. Saha, 1954, on military strategy based on nuclear weapons.

This booklet is an effort in the direction of informing the Indian citizens of the deadly effects of nuclear weapons. We believe that our only hope now lies with an informed citizenry.

OH-2

Subject: **N-Accident May Occur Anytime In India: Expert**
Date: Fri, 22 Oct 1999 05:27:00 PDT
From: "Vinay Baindur" <v_baindur@hotmail.com>
To: il-rti@ilban.ernet.in

FYI
(South Asians Against Nukes)

Times of India
22 October 1999

N-Accident May Occur Anytime In India: Expert

HYDERABAD: Former chief of the Atomic Energy Regulatory Board (AERB) A Gopalakrishnan has warned that India is ``likely to face a serious nuclear accident in the not too distant future''.

He was replying to a question whether an accident similar to the one that occurred in a uranium processing plant in Japan last month could occur in India.

Mr Gopalakrishnan said a report prepared by AERB in 1995, which listed 130 defects in various nuclear installations, ``did include some identified problems related to reprocessing plants''.

``I am not permitted to discuss the specifics openly but suffice to say that the degree of automation and cross-checks on safety in our older plants are very minimal and one cannot assert at all that an accident like the one which occurred in Japan will not happen in India,'' he said.

The Department of Atomic Energy (DAE) has so far not made the AERB report public in spite of legal pressure from the People's Union of Civil Liberties, and DAE officials were not available for comment on whether Indian fuel processing plants faced any risk as in Japan.

The September accident at the Japanese facility in Tokaimura occurred when too much uranium was fed into a container, setting off an uncontrolled chain reaction. It continued for hours spewing radioactivity into the air leaving 49 people exposed to deadly r adiation.

Mr Gopalakrishnan said excessive secrecy in DAE and inability of AERB to function independently alone took care of the safety of nuclear installations in India.

``With a captive AERB from which the DAE can in effect withhold information as they wish, coupled with the shelter the DAE enjoys through invoking the national security bogey and the Official Secrets Act, we are likely to face a serious nuclear accident in the not too distant future,'' he said.

``But, with the prevailing cover of secrecy and lack of public awareness none of us may ever come to know that such an accident has happened unless the roof of a plant blows out or a visible fire rages there,'' he said.

According to Mr Gopalakrishnan, the AERB report, among other things, had urgently called for modification of emergency core cooling systems (ECCS). Emergency cooling is vital to prevent melting of the reactor core in the event of breakdown in the circulation of primary coolant.

India had two close calls, one in 1979 - when primary coolant pipe in Tarapur reactor burst. Luckily, the reactor was not operating at the time and so an accident was averted.

In 1993, explosion of leaking hydrogen blew up the turbine building of

For Library Resource File
on Nuclear Issues

1005

R-1
231.

Jn 26/10

Apnm
23/10/99

the atomic plant at Narora and the resulting power blackout stopped the coolant pump. This time, the core melting was averted by whatever natural circulation that prevailed due to what is known as the ``thermosyphon'' effect.

While the Narora fire ranked three in the international event scale of 1 to 7, DAE installations had experienced smaller incidents that had the potential to become serious, he said.

These include cable fire in Rajasthan atomic power plant in 1985, escape of coolant heavy water in Madras station in June 1986 and as recently as in March 1999, six tonnes of heavy water gushed out exposing seven workers to radiation.

While a fire gutted Kakrapar switch yard and flooded the turbine in 1994, the concrete dome of Kaiga atomic plant collapsed in May 1994 - an incident which would have been a disaster had it happened while the reactor was running.

In an official statement in April 1999, the Nuclear Power Corporation (NPC) said the Narora fire was ``beyond the control of NPC as the fire happened in the turbines'', and that the Kaiga dome collapse was ``unfortunate''.

In May 1987, a mistake during a routine refuelling operation resulted in a fuel assembly getting entangled with control rod forcing closure of the second unit of the Madras station for two years.

Four tonnes of heavy water spilled out of Dhruva research reactor in 1985 because a valve did not close and in 1991, six vital valves in the ECCS of Dhruva were found to be in wrong positions.

Another serious human error occurred in 1989, when a technician was locked inside the Dhruva vault as the reactor was being started.

A recent DAE study had listed all possible accidents that could occur in Indian atomic power stations due to human error, but its findings, like the AERB report appear to be secret since efforts to obtain the report also failed.

Information about the number of workers exposed to more than normal radiation was also not available.

With so much secrecy, Mr Gopalakrishnan said he feared that the public would never know even if there was a serious nuclear accident in India. ``Anything which the DAE can hush up and sweep under the carpet, one can be sure they will cover up promptly,'' he said.

``Nuclear power is an unforgiving technology,'' cautioned B P Rastogi, a retired reactor designer. ``It allows no room for error. It requires perfection if one wants to prevent accidents,'' he said.(PTI)

RN
23/10

OH-2.

Subject: Wired News : Nuke Opponents Fear Y2K Worst
Date: Thu, 23 Dec 1999 06:03:17 -0800 (PST)
From: v_baindur@hotmail.com (Vinay Baindur)
To: il-rti@ilban.ernet.in, il-nuke@ilbom.ernet.in (RTI discussion list)
CC: v_baindur@hotmail.com

From Wired News, available online at:
http://www.wired.com/news/print/0,1294,33228,00.html

Nuke Opponents Fear Y2K Worst
by Declan McCullagh

3:00 a.m. 22.Dec.1999 PST
If you have any doubt that Y2K has lost its ability to inspire public panic, consider this week's protest in front of the White House.

It had everything going for it: A catchy shut-down-nuke-plants theme, foreign visitors imported for the event, and a letter to President Clinton demanding prompt action.

See also: Social Security Secure for Y2K
Read ongoing Y2K coverage
Read more Politics -- from Wired News

The only thing it lacked was, well, protesters. Just seven people showed up, and that's counting two peace activists living in Lafayette Park who decided to rally to this cause, too.

Still, what the demonstrators lacked in numbers they made up for in conviction.

"We want to take the weapons off of hair-trigger alert," said Mary Beth Branagan, a San Francisco activist who runs the World Atomic Safety Holiday site. "We want to shut down the reactors and other nuclear facilities."

She says Clinton should order diesel locomotives to be parked near nuke plants where they can provide backup power to cool reactors.

Longtime peacenik James McGuiness feels the same way.

"I'd like them shut down, personally. I think they're not safe," said McGuiness, who was wearing a Santa hat for the occasion and said he'd been participating in the 18-year disarmament vigil in the park since summer.

For the demonstrators, the highlight of the event was mid-afternoon, when a representative of the mayor of Tokaimura, Japan, was hoping to hand a letter to White House staff. In September, the village of Tokaimura, less than 100 miles north of Tokyo, was the location of Japan's worst-ever nuclear reactor accident.

"I hope from my heart that all the people in the world will have the peace of mind of having the nuclear power facilities shut down during the year 2000 rollover," said the letter from the Honorable Tatsuya Murakami.

Fat chance. The Nuclear Regulatory Commission is not only allowing power plants to operate on New Year's Eve -- officials have drafted a policy that lets the facilities operate with technical problems that would normally mean a shutdown.

This comes after over a year of effort from activists. In December 1998, one anti-nuclear group asked federal regulators to pull the plug on suspect nuclear plants. And disarmament advocates say the uncertainty about 1-1-00 is an excellent reason for America and Russia to shut down their nuclear arsenals.

Library - Nuclear-Issues file.
3/1/2000

OH-2.

Main Identity

From: "Prof. S. K. Biswas" <skbis@mecheng.iisc.ernet.in>
To: <abhamahila_21@yahoo.co.in>; <abhayraj_naik@hotmail.com>; <addfilms@usa.net>; <ader@vsnl.com>; <ahzkin@yahoo.com>; <aishawajit@hotmail.com>; <akilanu@hotmail.com>; <akmal@malsacarpets.com>; <akusi@rediffmail.com>; <aleem-222@rediffmail.com>; <alforum@vsnl.net>; <alforum@vsnl.net>; "Amulya Reddy" <amulya1@vsnl.com>; <amulya@giasbg01.vsnl.net.in>; <anant@cts.iisc.ernet.in>; <anasuyas@yahoo.com>; <andal@rri.res.in>; <anilprakashganga@indiatimes.com>; <annbritto@yahoo.com>; <annbritto@yahoo.com>; <anuradha_banerjee@hotmail.com>; <aparna599@rediffmail.com>; <apsabangalore@vsnl.net>; <aptantri@hotmail.com>; <archana@cdotb.ernet.in>; <ark786@hotmail.com>; <arlene_manoharan@hotmail.com>; "Prof.Arnab Rai Choudhuri" <arnab@physics.iisc.ernet.in>; <arundhatikatju@nls.ac.in>; <arvindnarrain@hotmail.com>; <asb_india@hotmail.com>; <avijit@ada.ernet.in>; <avinash_KM@infy.com>; <awhrci@giasbg01.vsnl.net.in>; <awhrei@vsnl.com>; <ayat@playforpeace.org>; <backer_aboo@rediffmail.com>; <balagala@hotmail.com>; <balk@sify.com>; <basujain@blr.vsnl.net.in>; "Saraswathy Ganapathy" <belaku@blr.vsnl.net.in>; <bgvs_kar@hotmail.com>; <bgvs_kar@hotmail.com>; <bhanu_das@yahoo.com>; <bhat@isibang.ac.in>; <bmathew@nls.ac.in>; <bmathew@nls.ac.in>; <bnambiar@vsnl.com>; <bnpramodh@hotmail.com>; <bpfound@vsnl.com>; <bpfound@vsnl.com>; <brajeev@isibang.ac.in>; <bubblzz@bubblemail.com>; <casblr@bgn.vsnl.net.in>; <ccl@nls.ac.in>; "Centre for Documentation" <cedban@doccentre.org>; <challops@eth.net>; <chandra@physics.iisc.ernet.in>; <chandru@csa.iisc.ernet.in>; <chat@bgl.vsnl.net.in>; <chat@bgl.vsnl.net.in>; <chegareddy_fc@hotmail.com>; <cherian@isibang.ac.in>; <chirpy_smiles@hotmail.com>; "C.K. Meena" <ckooms@vsnl.com>; <csparun@vsnl.com>; <dabang@bgl.vsnl.net.in>; <das@iiap.ernet.in>; <davcosta@bgl.vsnl.net.in>; <deame_lu@yahoo.ac.uk>; <diptiman@cts.iisc.ernet.in>; <drgsanjay@yahoo.com>; <drparvezimam@yahoo.com>; "Mr. Jagadish" <dudiyorahoraata@vsnl.net>; <esparun@vsnl.com>; "evangeline" <evangeline@satyam.net.in>; <fevordk@vsnl.com>; "Mr. Alvitto" <focusgroup@vsnl.net>; <fury@isibang.ac.in>; "gail hart" <gailph1@hotmail.com>; "gail hart" <gailph1@hotmail.com>; "Dr. Vinod Gaur" <gaur@cmmacs.ernet.in>; <ghjbas@bgl.vsnl.net.in>; <gm@isibang.ac.in>; <gp@css.cmmacs.ernet.in>; <habib@isibang.ac.in>; <hajiramateen@yahoo.com>; <hakkinasangha@yahoo.com>; <hanstap@aol.com>; <hari_narayan@i2.com>; <harshithmshetty@hotmail.com>; <hittalu@bgl.vsnl.net.in>; <hp_chami@yahoo.com>; <hpchamy@yahoo.com>;

> PANEL DISCUSSION ON NUCLEAR WEAPONS

Orient Longman
cordially invites you
to a panel discussion
on

JH
4/6

"India's Dangerous Tryst with Nuclear Weapons"

Lib - Anti war file
6/6

on the occasion of the publication of the book

"Prisoners of the Nuclear Dream"
edited by
M. V. Ramana and Mr Rammanohar Reddy

on 5 June 2003, at 6.30 pm
at Ashirwad, Loyola Hall, St Marks Road, Bangalore

RSVP
Mr Sirigiri Srinivas Orient Longman
Tel (080) 6690258/ 6691907

PANEL DISCUSSION WILL BE CHAIRED BY

Professor Amulya Reddy

PANELISTS

Professor Sanjay Biswas

Dr Ramchandra Guha

Dr Vishwambhar Pati

Dr C. Rammanohar Reddy

Tea will be served at 6 pm.

++
Dr. S.K. Biswas
Professor
Department of Mechanical Engineering
Indian Institute of Science
Bangalore - 560 012, INDIA.

Phone: 0091 80 293 2512, 293 2332
293 2351
Fax: 0091 80 3600648, 3600683
Email: skbis@mecheng.iisc.ernet.in
++

OH-2.

TIME

China's Labor Pains

State-run industries are collapsing. Tens of millions are already unemployed. How will authorities deal with the worst social unrest since Tiananmen?

completely with the D.A.'s investigation." Tyco says it is conducting an internal probe into allegations of misused funds.

Last week's revelations, which helped push down Tyco's already-sinking stock, only added to a cloud of suspicion that has been hanging over the conglomerate. For years, critics like Prudent Bear Fund manager David Tice have alleged that Kozlowski was using aggressive, although not illegal, accounting methods to overstate the earnings of a collection of slow-growth businesses. By encouraging a company to depress its earnings just before it was acquired, usually in the form of large write-offs of intangible assets, the critics assert, Tyco made its subsequent growth appear that much stronger.

After looking for accounting irregularities, the Securities and Exchange Commission gave Tyco a clean bill of health two years ago. But in the wake of the Enron scandal, the company's complex books—filled with footnotes about thousands of offshore subsidiaries—sent a lot of shareholders to the exits. In February, company filings revealed that Kozlowski and his top deputy, chief financial officer Mark Swartz, had between them sold more than $500 million in stock back to Tyco since 1999, even as they publicly declared that they rarely, if ever, unloaded their shares. Around the same time, Tyco disclosed that it had made some 700 small acquisitions worth $8 billion in the previous three years without informing shareholders. Then in April, the company backed away from a previously announced breakup plan that was supposed to simplify matters, which destroyed any remaining credibility.

Since Jan. 1, Tyco shares have fallen some 80%, hitting a six-year low of $10.10 on Friday. Late last week the debt-rating agencies S&P and Moody's downgraded Tyco's debt, fueling worries that the company, which is trying to trim its $27 billion in debt—$12.8 billion of it coming due in the next 18 months—could be caught in a cash squeeze. Tyco announced last week that it may have to delay the IPO of its CIT financial division—which was expected to raise $5 billion in cash—because of concerns by the SEC.

For much of the 1990s, investors didn't want to let Tyco's improbably high reported growth rate of nearly 40% spoil their fun. Before last week's free fall, Tyco shares (with dividends reinvested) had still gained almost 400% in the decade since Kozlowski took over and turned the company into a merger machine, according to Harvard Business School associate professor Robert Kennedy. Along the way, Kozlowski snapped up electronics manufacturer AMP, security firm ADT and medical-products maker U.S. Surgical.


TED THAI FOR TIME


ADRIAN DENNIS—AFP


LOUIS LANZANO—AP

A CEO'S SPOILS
Dennis Kozlowski has been indicted for evading sales taxes on paintings, including Monet's *Près Monte-Carlo*, that he bought for his Fifth Avenue apartment. He's not likely to have much chance to sail on his 1934 yacht, the *Endeavor*

The son of a police detective, Kozlowski grew up in Newark, N.J., where he played basketball in high school. He majored in accounting at nearby Seton Hall University, living at home to save money, and worked his way through college playing guitar in a wedding band and occasionally waiting tables. At one of his first restaurant jobs, the staff pooled tips, which didn't seem fair to a hard worker like him. Within a month, he had moved to another restaurant, where he got to keep every cent he earned. "There seems to have been a fanaticism about getting every last nickel. That was his Achilles' heel," says Marc Feigen, managing partner of Katzenbach Partners, a consulting firm in New York City, who got to know Kozlowski through a business-school leadership program.

Kozlowski landed at Tyco in 1976, hired by legendary hostile-takeover-artist Joseph Gaziano to fix some floundering acquisitions. At the time, Tyco Laboratories was a small manufacturer of everything from undersea cables to fire sprinklers. (It is unrelated to Mattel's Tyco line of toys.) But when Kozlowski took over in 1992, he re-created Tyco in his spirited image.

Hostile takeovers, for starters, weren't an option under his regime. To get a detailed look at his target's finances and pick up the best talent, the deal had to be friendly. And it had to be fast, finished in a matter of weeks, not months. Going after underperforming firms that were "fat, dumb and happy," in the words of a former Tyco employee, Kozlowski would move in quickly to slash costs and consolidate and close factories; top executives were usually shown the door in favor of eager, young middle managers willing to work long hours. To make sure his charges made their numbers, Kozlowski dangled rich performance bonuses. And he insisted on running a lean, decentralized operation. Memos are practically forbidden, as are lengthy meetings. Only about 150 employees—mainly top executives, lawyers, accountants and bankers—work at headquarters in Exeter.

Kozlowski liked to think of himself as a budding Jack Welch, but unlike Welch, he never developed a set of business practices that brought real synergy to his disparate businesses. He had little patience for GE's vaunted Six Sigma quality-control doctrine, nor did he make enough investments in information technology. And he apparently didn't do a good job of nurturing a new generation of managers: retired chairman John Fort had to return as interim CEO last week. Some analysts think that in his passion for quick deals, Kozlowski often overpaid, most notably for CIT, which may fetch just half the $10 billion Tyco paid for it in 2001.

Though he has been celebrated on the covers of *Forbes* and *Business Week*, Kozlowski is, by most accounts, a relatively shy, unassuming guy, more content to ride his Harley, fly the company helicopter or sail his boat than work the room at a cocktail party. If you didn't have a deal to talk to him about, the conversation probably wasn't going to last long. "Dennis looked like he was always restless," says a business acquaintance. "I wonder if he was close to anybody, including his board."

Apparently not. Late last week Tyco's interim CEO, Fort, emphasized that "Dennis is gone." Then he repeated it: "Dennis is gone." —*With reporting by Daren Fonda/New York and Adam Zagorin/Washington*

WORKERS' WASTELAND

China's prosperous surface masks a rising sea of joblessness that could threaten the country's stability

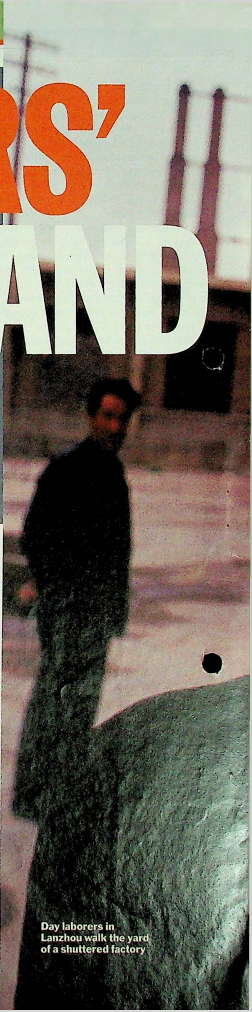
By **MATTHEW FORNEY** ZHENGZHOU

APRIL WAS A GRIM MONTH IN Wei Jianzhong's sooty, barracks-like neighborhood in Zhengzhou, the capital of central Henan province. That's when the Henan No. 5 Provincial Construction Co. fired its latest round of workers. The victims have gathered in Wei's cramped living room to commiserate. There's Xiong, a 53-year-old former steamfitter who is trying to survive on $12 a month in unemployment benefits. He reminisces about the time two years ago when thousands of workers from a nearby factory blocked railroad tracks and erected huge posters of the patron saint of Chinese workers—Chairman Mao—to demand their jobs back. He participated in the protest "to stand with them," he says. Today he is out of work too. He wonders aloud "Who will stand with me?" Kong Qingbin, who worked for 30 years as a guard at the same factory, chimes in with an idea: "Execute the factory leaders. Then maybe we'll be satisfied."

Wei shrugs, gets up and leaves the flat to saunter through his neighborhood in his plastic sandals and unbuttoned shirt. At 51, he sells bags of Betty Crocker Bugles for pennies apiece through his first-floor apartment window. It's all he can do to augment the $40 monthly stipend he and his wife receive from the company that laid them off eight weeks ago. Out on the street, he passes idle ex-colleagues, working-age men playing cards on empty fruit boxes. Layoffs by the construction company touch nearly every household. Wei introduces Mrs. Xie, whose husband was fired in April. He came unhinged under the strain of supporting his wife and daughter, grew paranoid and delusional. Convinced that the police would charge him with murder, he tried to drown himself in a barrel of water. Today he's in a mental institution while his wife peddles dumplings of fatty pork and mustard greens under the soot-covered trees. "People here have sympathy," Mrs. Xie says, "but I can't eat sympathy and they don't eat enough dumplings."

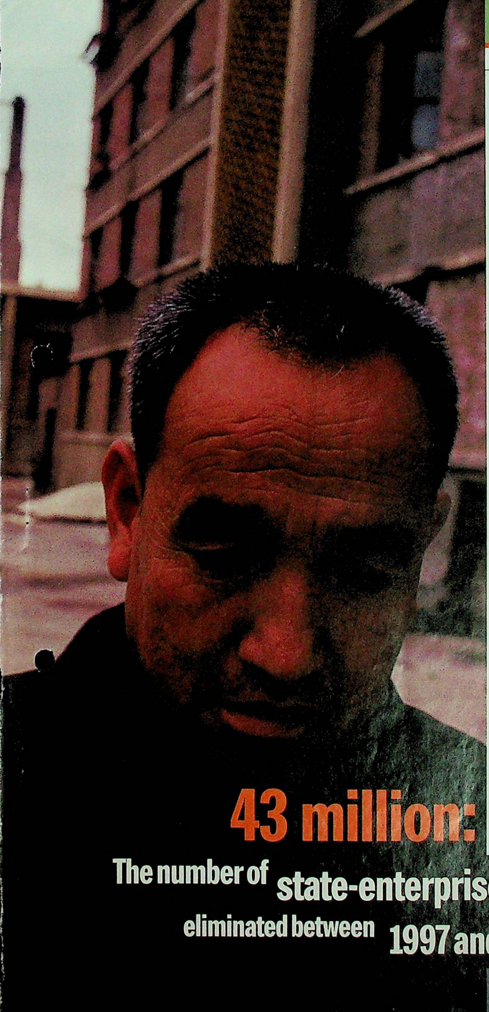
If this is China's century, it's getting off to a bleak start for millions of jobless mainlanders. The country has dazzled the world with its remarkable progress since embarking on the capitalist road in 1978. The economy has quadrupled in size in two decades. China is rapidly replacing Asia's tiger economies as a global center of manufacturing, and coastal cities such as Shanghai sparkle with skyscrapers, five-star hotels and modern electronics factories. The streets clog with the private cars of the newly prosperous.

But for every Chinese who has escaped poverty into the emerging middle and upper classes, there are many others, young and old, trapped in hellholes that



MARK LEONG—MATRIX FOR TIME

Day laborers in Lanzhou walk the yard of a shuttered factory



43 million:

The number of state-enterprise jobs eliminated between 1997 and 2000

blight the outskirts of population centers like Zhengzhou. China's headlong rush to join the global economy is creating new jobs in the private sector, but it is simultaneously breeding a gigantic underclass of have-nots—citizens the government fears could one day rise up in open revolt.

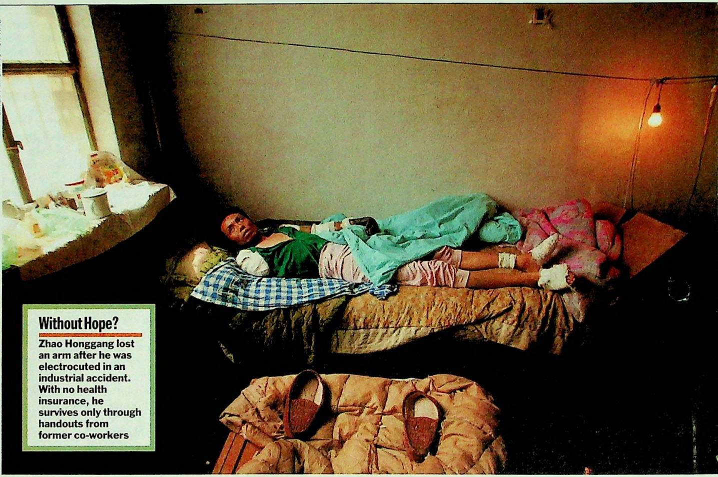
Urban joblessness, unheard of when the Maoist government provided cradle-to-grave employment, now averages around 8-9%, according to scholars at the Beijing-based Development Research Center (DRC), a government think tank. (The official rate, by contrast, is a rosy 3.6%.) Joblessness is much higher, perhaps 20%, in industrial rust belts that cut great swaths across the north, where outmoded, bankrupt factories are being shut down and communist-era work units eliminated at a breathtaking pace. Reliable numbers aren't available, but some estimate there are at least 19 million Chinese who are out of work; tens of millions more are unaccounted for by Labor Department statisticians.

And these staggering numbers are getting worse. China has entered what is perhaps the most dangerous phase yet in its transition to a free market economy. Beijing's recent commitment to play by World Trade Organization rules lowers trade barriers. That means more foreign competition pressuring China's most vulnerable industries, such as the country's steel smelters, coal producers and 120 carmakers. If the government lives up to its vow to cut bank lending to money-bleeding state enterprises—something it must do to salvage its woefully indebted banking sector—and curb deficit spending, factory layoffs will soar still higher.

Meanwhile, struggling Manchurian farmers who have spent a lifetime planting grain for the state stand little hope of competing with mechanized agro-businesses in the U.S. Forced off the land, they will decamp for the coastal factories, only to collide with millions of laid-off state workers seeking the same jobs. "In the next 10 years, I predict 150 million farmers will move to cities looking for work," says Chen Huai, a senior research fellow at the DRC. That's a mass of unemployed migrants larger than the total U.S. workforce.

After years of downplaying its unemployment problems, now even Vice Minister Wang Dongjin from the Ministry of Labor and Social Security describes China's

CHIEN-MIN CHUNG FOR TIME



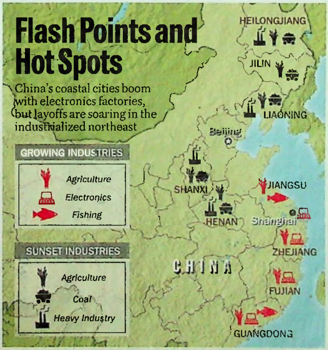
Without Hope?

Zhao Honggang lost an arm after he was electrocuted in an industrial accident. With no health insurance, he survives only through handouts from former co-workers

jobs crunch as "grim." The ministry acknowledges it must create 17 million jobs a year just to maintain its current unemployment rate. Hu Angang, a professor at Tsinghua University in Beijing, warns that China is careering toward nothing less than "an unemployment war, with people fighting for jobs that don't exist."

Beijing's worst nightmare is that job warfare will spin out of control and combatants will challenge the government itself—that a countrywide labor movement will coalesce and become a destabilizing political force. To date, authorities have managed to contain the labor protests that break out like brush fires throughout the nation. It has helped that many laid-off workers are managing to earn enough at odd jobs to eat. "The private economy is providing enough jobs for people to live, so it's less urgent for them to protest," says Ching Kwan Lee, a sociologist at the University of Michigan who researches China's labor market.

Even so, this year, the government has faced its biggest outbreaks of labor unrest since the Tiananmen Square protests of 1989, with tens of thousands of workers simultaneously demonstrating against state-sector layoffs in China's northeastern provinces. Censors kept the news out of the official media—Jiang Xueqin, a Canadian freelance journalist who worked on this story for TIME, was deported last week for helping an American documentary crew record a workers' demonstration. But the *xiaodao xiaoxi*, the news on the street rings with fresh reports that quickly reach workers in other cities. In 2000, the last year of complete statistics, "labor disputes" of all kinds rose 12% to 135,000. "If the employment situation doesn't improve, there will be a serious impact on social stability," says Mo Rong, a researcher at the Ministry of Labor and Social Security. The DRC's Chen Huai warns. "When these people have nowhere to turn, they'll defend their rights, even with violence."



Increasingly, they have nowhere to turn. China lacks effective institutions that can administer job programs and stipends for the out-of-work. Beijing has been trying to placate the laid-off with severance pay on a case-by-case basis. But the country lacks a national unemployment benefits system—and state enterprises and local governments can no longer afford to support the jobless. Instead, Beijing plans to begin forcing laid-off workers back onto the job market more quickly by cutting their benefits, in hopes the idle will be motivated to find private-sector opportunities. In northeastern Liaoning province, the tarnished buckle of Manchuria's rust belt, the unemployed collect about $30 a month for two years. After that, they're on their own. The rest of the country will join the experiment next year. "I'm not optimistic the measure will solve much," says Luo Yuan-[illegible]n, a professor at Liaoning University who monitors the results and reports back to Beijing. One reason: foreign steel will decimate mills like the Anshan Iron and Steel Works in Liaoning and its bloated workforce of nearly a quarter of a million people—according to official estimates, the foundry could cut 39 of every 40 workers and, by installing modern equipment common elsewhere in the world, still increase production. "There are too many people chasing too few jobs," says Luo.

The government is trying to buy time for a select few companies deemed too important to flounder. First Auto Group, the single biggest employer in Jilin province, is really a city: a population of 250,000 workers and dependents, 23 schools, a general hospital and a TV station beaming the latest company news to the world's most inefficient autoworkers. An average employee produces just two-and-a-half cars a year; a General Motors worker makes nearly 10 times as many. First Auto could easily cut seven of every 10 workers, estimates U.S. management consultancy A.T. Kearney. But the company muddles along through government subsidies, policy loans and profits from a joint venture with Volkswagen. So far, layoffs have hit only one in 10. "We at First Auto must be responsible to our staff," contends Wo Zongsheng, its deputy director of corporate strategy.

These days First Auto is an exception. Beijing is running out of resources and can no longer main-

WOMEN IN THE WORKFORCE

China's Layoff Policy: Ladies First

Wang Xiaohong spends her nights in the ballroom of the Workers' Cultural Palace in Shenyang's industrial Tiexi district. The hall is the sort of place where factory laborers once gathered to study Mao Zedong Thought and to cheer propaganda operas. Today, waltzes from a cheap keyboard echo crazily from walls stained with decades of cigarette smoke. Wang, 34, hopes her tight green sweater will win her an invitation to dance—she charges a dollar for four songs. A man reeking of sorghum liquor and rotten teeth sidles by, inspecting her. Wang lost her job in a state-owned department store in March, two years after her husband's last paycheck. Now she's the family breadwinner. Rotten Teeth approaches again. "I can't do anything else, and this pays the bills," Wang says, and heads to the dance floor with him.

Lifted by ideology from their historical roles as property or prostitutes, China's women arguably gained the most from Chairman Mao's revolution. Under communism, nearly all urban females who wanted work found employment in state-run factories, which offered free schools and day care. More Chinese women took senior government positions than in any other Asian nation.

But during the country's push to build a free market economy, women such as Wang are increasingly finding themselves back where they started, victims of a post-commune misogynistic backlash. When state enterprises cut staff or go broke, women are the first to lose their jobs. And while laid-off men grab the best private-sector positions or choose to remain unemployed in hopes of finding suitable work later, women are being forced to take whatever menial jobs they can find to support their families. "Men won't work for a pittance," says Hu Guirong, who works a $30 a month job scrubbing backs in a Shenyang bathhouse while her unemployed boyfriend watches over her eight-year-old child. "I'll do what it takes to keep my daughter in school."

Walk through the industrial district in just about any city in China and you can see women falling from loftier economic stations: the vendors peddling cheap calculators and fake Hello Kitty notebooks, restaurant helps, street sweepers and ragpickers are all disproportionately female. "Most bosses would rather hire men, so for too many women these are the only jobs available," says Liu Suling, herself a former street vendor who now runs an employment agency. Since 1994 the number of women working for government or state enterprises has plunged 24%. While job retraining centers teach men to become chefs, mechanics and carpenters, women learn less lucrative trades like haircutting and cosmetics. A recent Ministry of Labor and Social Security study concluded that the re-employment rate for women is 19% lower than that for men.

Yet to some, China's fallen women retain a certain dignity, representing a capitalist-era replacement for communism's selfless "model workers." Cut loose from the security blanket of the state, they continue to provide by any means possible. "What happens when it's time for school? I can't disappoint my child," says a woman selling name-card holders in a Tiexi market. Says Li Hongtao of the China Women's College, who has researched how men and women handle job loss: "Men will hold out for factory work, even if it doesn't exist. Women rise to the occasion." These days China's unemployed women are holding up more than their half of the sky. —*M.F./Shenyang. Reported by Jiang Xueqin/Shenyang*


MARK LEONG—MATRIX FOR TIME

Many women, like this one selling umbrellas, are just getting by

tain life support for its relics. China's banking system has built a mountain of bad loans—nearly all to state enterprises that had little expectation of ever repaying them—that now totals as much as half of China's GDP. By normal accounting standards the country's biggest state banks are insolvent. Then there's the debt China will incur when it has to follow through on promises to pay worker pensions, which equals another 70% of GDP, according to the World Bank. Add in debts that the government has raised by selling bonds—another 24% of GDP—and the country's balance sheet looks dicey. Alarmed by China's soaring debts, Finance Minister Xiang Huaicheng warned at a news conference this spring that the government must "make sure we don't spend like rich men."

Squeezing subsidies to state enterprises is necessary if China is to put its financial house in order. But the cost on the street is high. The jobless are deprived of services that were once free and that they can't afford themselves—like medical insurance. They are expected to buy their own, and those without it risk ending up like Zhao Honggang, who spends his days on a stinking cot in a bare room in an abandoned building at the Shenyang Antibiotics Factory in Liaoning. Doctors treated him briefly for electrocution after he touched a live wire while walking alone on a rainy night this February, then turned him out when no one paid the bills. Now he can barely walk to the toilet.

Before Zhao lost his job at the factory in 1998, it would have provided care for him. But without that or family support, his condition has drastically deteriorated. Suffering from severe burns, his blackened right arm twisted completely off in March. He keeps it in a bag across the room and spends his days slipping into insanity, babbling and eating steamed buns that former colleagues provide him. "He spent his life at the factory and this is how

ECONOMIC MIGRANTS

China Can't Keep 'em Down on the Farm

The beacons of prosperity in China—Shanghai, Beijing, the Pearl River Delta—are irresistible to residents of the impoverished interior provinces. But when they make it to a place like Shenzhen, across the border from Hong Kong, the bright lights grow less attractive. Lian (not her real name) is one of more than 5 million migrant workers here in China's richest city. After two years in a local sweatshop making TV transformers, she and 50 of her 160 co-workers quit when their boss decided to move them to even bleaker premises. Lian, now jobless and without welfare, is sharing a room with her 16-year-old brother, who hopes to go to school. "Sometimes I despise this place, this city," she seethes. "Everybody's out for money." Taking the 1,500-kilometer train ride home isn't an option. A year ago her father gave up the ghost of the family farm; the last she heard he was working in construction in nearby Dongguan. Maybe she shouldn't have quit. The $3 a day was better than nothing.

Lian is an economic refugee, part of one of the largest migrations in human history. More than 100 million people have abandoned the dirt-poor countryside, with 30 million alone heading to the Pearl River Delta, mostly to find low-level factory jobs. They do so illegally: China uses a draconian residential permit system to keep people in their places. That exposes economic migrants to exploitation by ruthless factory bosses. Li Liming, a 24-year-old from the southwest province of Sichuan, has worked six years in factories along the Pearl River Delta. He remembers his first job on a Dongguan production line when he was fresh from the countryside, netting more than a dollar a day. "Sometimes it was 30-hour shifts. The only way you could get a break was to faint," he says. "People would turn their eyelids inside out to stay awake."

Migrants sleep rough, left; Li Liming's big-city dreams are dying, bottom

FROM TOP: DERMOT TATLOW—PANOS PICTURES; DAVID G. MCINTYRE—BLACK STAR FOR TIME

Workers at Shenzhen's Zhufeng Electronics Factory—some of them in their early teens—endure 90-hour weeks, more than twice the legal limit, making telephones for export to South Korea. They live in a company dorm: a 10-square-meter room sleeps nine people in eight beds. The sole decoration is a tiny wall calendar suspended by telephone wiring. When a group launched a strike last month, says a worker from Hubei, "The boss said, 'If you're not going to work, then get out of here.' We said we'd leave as soon as we got our backpay, and he replied: 'And if I don't pay you, what are you going to do about it?'" Forging ahead with the strike, they were denied meals, were rebuffed by the local labor bureau, and eventually evicted from the dormitory. The worker from Hubei holds a sweat-stained copy of *China's Labor Law, 2000* between her hands as she speaks. "We haven't got our money. Now we have nothing to eat, nowhere to live."

These gritty factories and cramped dorms are where China's grapes of wrath are fermenting. Shenzhen-based researchers say the plants, though multiplying quickly and for the most part profitably, are paying less now than in 1992—largely because so many workers keep streaming in from the countryside. And while Beijing has taken steps to revise the nationwide residence permit system to give migrants access to social services, the results have been slow in coming. For now and the foreseeable future, migrant workers are China's largest group of disfranchised citizens.

Li Liming isn't sure what he'll do next. He has a small amount of money and a friend he can stay with for a few weeks. But, he says, "I want to try and do something for myself." Sitting on the corner of a busy intersection at dusk, eyeing the gray Shenzhen skyline, he adds, "I have nothing to my name," quoting the title of a popular song that became a post-Tiananmen anthem of destitution. "Working in factories these past few years, I've come to realize there's no way to get ahead. The factories are crazy places, and being stuck in there month after month you lose all grasp on the outside world." One fact Li and his fellow migrants know all too well: they can't go home again. —*By Neil Gough/Shenzhen*

MARK LEONG—MATRIX FOR TIME

Petty Crimes

After Li Yuxing lost his job, he began picking pockets at the train station to make ends meet. The 32-year-old lives with his parents and is looking for work

There are at least 19 million unemployed in China's cities

it cares for him," mutters one.

Today the great hope for China's able-bodied workers is the private sector, the fastest-growing part of China's economy. Private companies, ranging from the biggest real estate developers to the humblest street sweepers, provide a fifth of all recorded nonfarm jobs in China. There are twice as many private-sector jobs today as there were five years ago. Yet it's not clear that enough are being generated to keep pace with unemployment. Between 1997 and 2000, according to the Labor and Social Security Ministry, jobs in state-owned enterprises and collectives decreased by 43 million, or almost one-third. Over the same period, private-sector and other non-state jobs increased by about 16.5 million.

For many the gap is being filled by petty crime, prostitution and menial labor that can barely be called real employment. A 32-year-old former glassworker in Lanzhou in Gansu province, Li Yuxing made ends meet for a time by picking pockets at the train station. He swears he's given it up, but he can't find honest employment. Li has been relegated to China's army of street hawkers and shoe shiners, people who live day-to-day doing subsistence jobs that make up an informal subeconomy—untaxed and unrecorded.

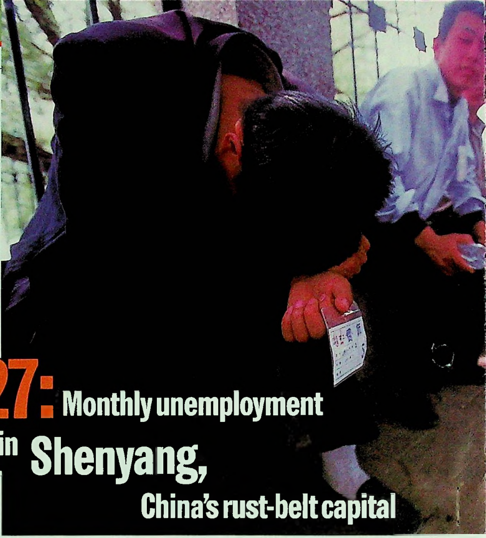
Some local governments are encouraging this kind of job formation, absent any viable alternatives. Recently, Tieling, a small city nestled among cornfields in central Liaoning where most state factories have closed in the past five years, gave workers a onetime severance payout but stopped all other benefits. Instead, it issued licenses to the laid-off allowing them to pedal tricycle-like rickshaws around town. Everywhere today these pedicabs clog the streets; competition is so fierce that even the best drivers earn just $2 in a 10-hour day. It's enough for ex-factory workers to survive, but not much more. Yet Li Dianjun, a corn farmer from a nearby village, considers it a windfall. Li spent the past two months sneaking a pedicab into the city and, for the first time, competing with city dwellers for customers. He carefully avoids policemen who might confiscate his vehicle. "Of course I'll keep going back," he says. "If I couldn't work in the city, my family would go under."

Circumstance turns farmers into reluctant entrepreneurs. Genuine entrepreneurship, however, goes begging. Although small businesses can play a crucial role in generating jobs, there are no programs nurturing small business formation. Three-quarters of all bank loans go to state enterprises, starving private businesses of cash. Yang Qingtao knows well how difficult it is to get seed money. He runs a successful beauty parlor in Shenyang in Liaoning, and wanted to open a shop selling cell phones. After many dinners and many beers Yang finally convinced a bank official to lend him money—to buy an apartment. He put it into his enterprise instead. "It's almost like the banks don't want us to do business," he says from behind the Nokia counter of his new shop. Today Yang employs 10 young clerks, most of whom devote part of their salaries to helping laid-off relatives.

The lack of options forces some of China's jobless to take desperate risks. In

1999, Zhang Xu was laid off from a plastics factory in western Lanzhou, China's most polluted city. His wife lost her job this April. Zhang now heads every morning to the place where he's pinned his hopes: the stock exchange. On Labor Day, the most auspicious date he could think of, he plunged his entire savings of $5,000 into China's notoriously fickle market. Late in the morning he arrives at the Lanzhou trading center, watches prices blink across the large screen and searches for tips among the hundreds of unemployed workers who have also bet everything on stocks. Zhang has lost 10% of his money to the market's slide this year. But he's convinced the government will intervene and prop up ailing stocks. "So many of us put our money here, the government knows what the consequences would be if we lose everything," he says. "It can't let the market slip farther."

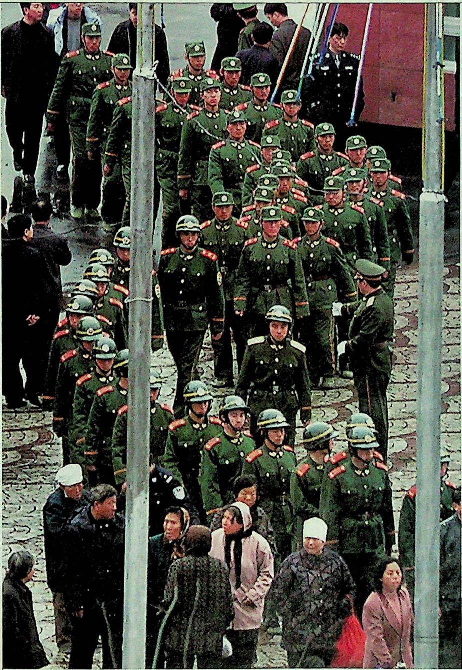
That thinly veiled threat of "consequences" is beginning to reverberate. This March, in the northeastern city of Liaoning in Liaoning, angry workers protested outside the city hall for back wages and pensions in demonstrations that began at a handful of factories and



$27: Monthly unemployment payment in Shenyang, China's rust-belt capital

MARK LEONG—MATRIX FOR TIME

CHIEN-MIN CHUNG FOR TIME



FREDERIC J. BROWN—AFP

Help Wanted

Vocational programs like this chef school, left, are rare; Shenyang's jobless, above; the P.L.A. quells a Liaoyang protest, right

quickly drew workers from all over the city. At the same time, 30,000 workers from China's biggest oil company, PetroChina, besieged their factory in the northeastern province of Heilongjiang to demand more severance pay even though they had received more than $10,000 each—a fortune by the standards of most unemployed. Encouraged, thousands of workers in other cities such as Fushun in Liaoning and Lanzhou also launched protests against layoffs. That it all took place during the annual meeting of China's rubber-stamp parliament showed workers wanted to send a message that carried farther than their local leaders.

Beijing will not tolerate an organized labor movement, however. While the government generally pays off protesters who are genuinely owed money, it also arrests those who lead demonstrations. At least 41 labor activists are being detained in China and another 60 were briefly held during the past three months, according to the International Confederation of Free Trade Unions. The carrot-and-stick strategy—placate the workers, jail the organizers—seems to work for now as a deterrent. Demonstrations continue to flare up, but they have yet to turn ugly enough for authorities to resort to mass arrests or head bashing.

Meanwhile, millions of additional layoffs are looming in the next few years. If China's economy continues to outperform, then the country just might be able to accommodate wrenching social changes without a political crisis and without bloodshed. But the outlook for the ordinary worker is not bright. The best most can hope for is that they will be as lucky as Wang Shanbao, who lost his job at a diesel refinery in Zhengzhou four years ago. In silent protest, the 55-year-old began sketching chalk drawings of Chairman Mao on the sidewalk outside his factory. Crowds gathered every day to admire his work. "The managers became so embarrassed that they gave me my job back," says Wang. Score a rare victory for China's unemployed millions. —*With reporting by Allen Cheng/Changchun and Jiang Xueqin/Shenyang*

AGONY AND ECSTASY

From Soweto to Kashmir, Calcutta to Buenos Aires: the world watches the Cup


PETER J. JORDAN—AP

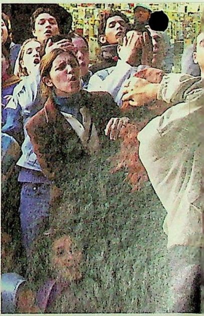
England's victory was its biggest triumph since the Falklands War

England

THE PATH TO BUCKINGHAM PALACE IS STILL HUNG WITH flags to celebrate 50 years of Queen Elizabeth's reign, but last week England had a new monarchy. As King Sven and Prince Beckham led England to a pivotal 1-0 upset over mighty Argentina, more than four million people across the country were skipping work, cutting class and generally shirking their obligations to be a part of the most nationalistic moment since the Falklands War with Argentina in 1982. "I'm definitely more excited about this than the Jubilee," said an 11-year-old named Sam, who had traveled from Manchester with his older brother to join the nearly 2,000 people who had gathered in the Odeon Cinema, at London's Leicester Square, to watch the match. "It's a sacred day," says Susie Stanford, a student at St. Paul's school in London who finished her exams in time to don head-to-toe England regalia and watch the game. "It's a national holiday, basically." Within half an hour of the victory, as taxis, trucks, and groups of young men roamed the streets flying England flags, T shirts reading "England 1 Argies 0" were being sold on the streets. Never mind the Jubilee—God Save The Team. *—By Blaine Greteman/London*

Argentina

IN BUENOS AIRES' FINANCIAL district, scores of people standing in line to change pesos for dollars watched the duel with England on televisions set up on a makeshift worktable. "Football helps us forget our problems," says Ricardo Gandin, the newsstand owner who had brought the TVs. But when Argentina fell behind, these sidewalk spectators let out a deep, collective groan of despair. Tempers soon began to flare. "To even suggest we might lose is like insulting my mother," hissed Orlando Maldonado, 30, a government employee who watched the game from the street "because it

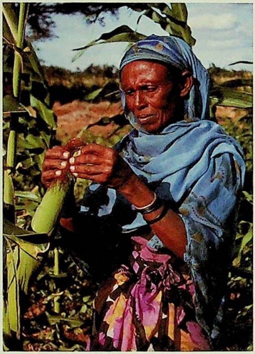

DANIEL LUNA—AP

Simon Robinson

Charity Begins at Home

New farm subsidies in the U.S. will hit developing countries hard

HANNAH NJERI MAY NOT KNOW MUCH ABOUT THE intricacies of global trade, but she does know the power of "free marketing," as she calls it. Njeri, 45, sells vegetables outside the gas station on the Nairobi street where I live. Every morning she collects a few tomatoes, onions or beans from her tiny plot and spends the rest of the day selling what she can to passers-by and people who stop for petrol. Margins are small: Hannah makes just a few dollars a day, which she uses to help put her children through school. She would like to own her own greengrocery, but capital is a problem. "Competition is tough. Everything depends on the market," she says, sitting next to her friend Margaret Wajeru, who is shelling peas. "Sometimes you can't get tomatoes, so we are going to sell them for more. Or everyone has potatoes, so you have to cut your price a lot. Prices go up and down just like that."



LISA TAYLOR—CORBIS

African farmers don't have the benefit of subsidies

Farmers hate price fluctuations. It makes it hard to plan ahead. But most farmers in the developing world have little choice: like Njeri, they sell at the price the market sets. Farmers in Europe, the U.S. and Japan are luckier: they receive massive government subsidies in the form of guaranteed prices or direct handouts. Last month President Bush signed a new farm bill that gives American farmers $190 billion over the next 10 years, or $83 billion more than they had been scheduled to get, and pushes U.S. agricultural support close to crazy European levels. Bush said the step was necessary to "promote farmer independence and preserve the farm way of life for generations." It is also designed to help the Republican Party win control of the Senate in November's mid-term elections. One person it won't help is Hannah.

Agricultural production in most poor countries accounts for up to 50% of GDP, compared to only 3% in rich countries. But most farmers in poor countries grow just enough for themselves and their families. Those who try exporting to the West find their goods whacked with huge tariffs or competing against cheaper subsidized goods. The World Bank calculates that the annual cost to poor countries of industrial-country trade barriers is six times the amount developed countries spend on aid. In 1999 the United Nations Conference on Trade and Development concluded that for each dollar developing countries receive in aid they lose up to $14 just because of trade barriers imposed on the export of their manufactured goods. It's not as if the developing world wants any favors, says Gerald Ssendawula, Uganda's Minister of Finance. "What we want is for the rich countries to let us compete."

Agriculture is one of the few areas in which the Third World can compete. Land and labor are cheap, and as farming methods develop, new technologies should improve output. This is no pie-in-the-sky speculation. The biggest success in Kenya's economy over the past decade has been the boom in exports of cut flowers and vegetables to Europe. Kenya is now the biggest source of cut flowers for the E.U., and the horticulture industry, which employs 70,000 people, last year became the country's second-biggest foreign-exchange earner after tea. But that may all change in 2008, when Kenya will be slightly too rich to qualify for the "least-developed country" status that allows African producers to avoid paying stiff European import duties on selected agricultural products. With trade barriers in place, the industry in Kenya will shrivel as quickly as a discarded rose. And while agriculture exports remain the great hope for poor countries, reducing trade barriers in other sectors also works: America's African Growth and Opportunity Act, which cuts duties on exports of everything from handicrafts to shoes, has proved a boon to Africa's manufacturers. The lesson: the Third World can prosper if the rich world gives it a fair go.

This is what makes Bush's decision to increase farm subsidies last month all the more depressing. Poor countries have long suspected that the rich world urges trade liberalization only so it can wangle its way into new markets. Such suspicions caused the Seattle trade talks to break down three years ago. But last November members of the World Trade Organization, meeting in Doha, Qatar, finally agreed to a new round of talks designed to open up global trade in agriculture and textiles. Rich countries assured poor countries, who felt they had been ripped off under the previous Uruguay trade round that finished in 1994, that their concerns were finally being addressed. Bush's handout last month makes a lie of America's commitment to those talks and his personal devotion to free trade. Or as Hannah puts it, "Getting money from the government is cheating." ■

Simon Robinson is TIME*'s Nairobi bureau chief*

By MICHELLE ORECKLIN

P E O P L E

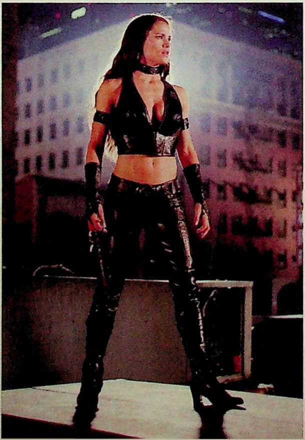
GO FIGURE

CHRIS PIZZELLO—AFP

ANNA NICOLE SMITH told Larry King last week that she is 27. She also said that her son is 16 and that she was 17 when he was born. With luck, her math skills will improve when she receives the $88 million she was awarded in March from the estate of her late husband, oil tycoon Howard Marshall. If not, starting in August, viewers can watch her squander the cash when the E! channel airs a reality series of her life. E! says it had the idea before *The Osbournes* (though that show's success probably sped up production). Smith's once sybaritic ways have abated since Marshall died at age 90 in 1995 and she gave up modeling to become a full-time litigant, battling his sons over the money. But she told King she wants more children and hopes to conceive via a one-night stand. Let's see the Osbournes top that.

Nonmutant Ninja

For the role of Elektra in the upcoming film *Daredevil,* **JENNIFER GARNER** plays a wealthy student by day and an avenging ninja by night. Both personas sport great clothes, says Garner, currently shooting the movie while on hiatus from the TV show *Alias.* The outfit below is what she wears to "go out killing." Elektra is particularly keen to off Daredevil, played by Ben Affleck, and to do so, she employs pronged knives called sais, which she spent months training to use. "At first I was a danger to myself and everyone else," she says. "It was extremely cool, but next summer I'll probably be looking to do a comedy."



ZADE ROSENTHAL—20TH CENTURY FOX

THE PERFECT BOND GIRL

ANA M[...]Z—REUTERS, INSET: IGOR AKIMOV—AP

The first Miss Russia to win the title of Miss Universe would impress both Tsar Nicholas and Comrade Khrushchev. **OXANA FEDOROVA,** crowned last week in Puerto Rico, trained at the Russian police academy and boasts among her talents hand-to-hand combat and the ability to assemble a Kalashnikov rifle in a matter of seconds. Her victory caused typically gloomy Russian souls to bloom with pride, with her triumph leading all national newscasts. One report aired snippets from her school records, including such praise as "Physically in good condition. Knows the rules for maintaining and firing weapons. Knows how to keep state secrets." Proving that Fedorova is also heir to her country's imperial past, she favors luxurious evening wear and exhibited during her victory walk a flair for moving gracefully while sporting a jewel-encrusted tiara.

YOU NEVER KNOW WHO YOU'LL MEET

What, you may ask, is Olympic speed skater **APOLO OHNO** doing hanging out with **THE CLINTONS**? And why is he wearing his gold medals at the beach? Reasonable questions, and ones for which there are in fact answers. For its July issue, *W* magazine brought Ohno to the Dominican Republic where, serendipitously, the Clintons and Chelsea's boyfriend **IAN KLAUS** happened to be on vacation. When *W* asked them to pose together, the Clintons eagerly agreed. "They were in awe of Apolo, treating him like a celebrity," says *W* fashion director Joe Zee. In return, Ohno apparently made no snide comments about Bill's shirt.

BRUCE WEBER—W MAGAZINE

(1)

OH-2

HEALTH HAZARDS OF NUCLEAR TECHNOLOGY

The development of nuclear technology both for peace and for war has significant health implications which all of us need to understand. This article seeks to convey some basic information about the health hazards of nuclear technology, presented in a question and answer format.

Why do I need to know what to do in the event of a nuclear disaster?

At the time of the Bhopal gas tragedy, most people in India did not know about the toxic effects of MIC (methyl-isocyanate) and its treatment. Both the company and the government failed to release information immediately. This resulted in delayed treatment or no treatment at all for many people, and a high death toll.

A number of different kinds of nuclear disasters could occur in our country:

1. a nuclear bombing by another country,
2. nuclear bomb testing within our country, by our country;
3. a nuclear reactor explosion or leak;
4. leakage of radioactive wastes from storage sites,
5. loss of radioisotope source material used for medical purposes.

Any such disasters could have widespread effects, including serious medical consequences. We need to know how to respond if a disaster occurred, and how to protect ourselves.

What kind of irradiation is produced by nuclear bombs and reactors?

Irradiation [radiation??] produced by nuclear explos c ns include:

1. X - rays and gamma rays
2. alpha rays
3. beta rays
4. neutrons

Gamma rays, like X-rays, have no mass and travel long distances in the body before losing their energy. Alpha and beta rays have mass and charge (alpha rays consist of protons and beta rays of electrons) and travel [only?] long distances in the body.

What are the materials used for producing radioactivity ?

Uranium is the primary fuel used for nuclear reactors and atom bombs. Uranium is the heaviest naturally occurring element; when it is bombarded with neutrons, its mass becomes even heavier, making it unstable. This results in the splitting of uranium atoms, the release of energy in the form of irradiation, and the formation of elements, such as plutonium, which continue to emit irradiation. This process is known as fission. The energy harnessed is made into electricity in nuclear reactors.

How does radiation damage the body ?

As these rays hit the body, they transfer energy which damages DNA, the molecules of genetic memory contained in each cell. This can result in cell death; those cells which survive may behave abnormally. The resulting defects in genetic memory may make victims prone to cancer, and such defects can be passed on from one generation to another.

What are the natural sources of irradiation?

[Small amounts?] of radiation are produced by natural sources in the earth; another source of radiation is [the earth's atmosphere? outer space? the sun?]. The x-rays used for medical diagnosis also produce small amounts of radiation. The average individual's total annual exposure to radiation is approximately equivalent to about four chest x - rays. For most people, this amount of radiation does not have any significant medical consequences.

How much radiation exposure is required to produce "acute radiation syndrome"?

Acute radiation syndrome is caused by massive exposure to radiation, equivalent to 20,000 chest x-rays at one time; this level of exposure is possible only under one of the disaster scenarios described above.

What were the medical consequences of the Hiroshima and Nagasaki bombings?

The U.S. dropped a uranium bomb on Hiroshima on August 6, 1945, and a plutonium bomb on Nagasaki on August 9,1945. Out of the total combined populations of Hiroshima and Nagasaki of nearly 6 lakhs, nearly 2 lakhs died in the immediate aftermath of the bombing.

Those in the immediate vicinity of the bomb blast sustained burns from the heat and mechanical [??] injuries. Many people [%?], even those who had no immediate injuries from the blast, developed a mysterious illness of nausea, vomiting, and diarrhea which lasted for hours to days; this was followed by a phase of apparent normalcy which lasted for days to weeks. The symptoms then recurred with severe diarrhea, nausea, vomiting, falling blood counts, impaired immunity and infections which resulted in death. [Add??--This sequence of symptoms was later identified as acute radiation syndrome.]

Those who survived the bombing and the post-radiation illness had a greater risk of developing different types of cancers, especially leukemia and multiple myeloma. Survivors continued to sustain an increased risk of cancer even 35 years after the bombings occurred. Women who were pregnant at the time of the explosions had a higher than average rate of children with birth defects, and researchers believe that some of these genetic defects may be passed down over generations.

How many nuclear accidents have taken place ?

Since the Hiroshima and Nagasaki bombings there have been 305 nuclear accidents which have exposed lakhs of people, resulting in 1,871 acute radiation syndrome cases and 101 deaths.

Are nuclear disasters associated with nuclear bomb testing, storage of missiles and disposal of nuclear waste?

A nuclear bomb testing by the U.S. in the Bikini atoll in 1954 resulted in radiation exposure of most of the residents of the islands, leading to delayed cataract and thyroid tumours.

So far there have been 50 nuclear weapon accidents, including a plane that crash-landed while carrying missiles, a missile-carrying plane involved in an air collision, and leakage from missile storage sites. None of these has resulted in radioactive exposure. The best known accidents involving nuclear waste leakage occurred in the U.S.S.R. between 1950 and 1957.

What are the consequences of radioisotope source loss [explain what this means] used for medical purposes?

The best known accident of this type occurred in Brazil in 1987. People in the street found a shiny radioactive substance which they took home. The result was that 112,000 people were exposed to radiation; 28 developed acute radiation syndrome and four died.

Why are nuclear reactors hazardous to the environment?

A normal nuclear power reactor releases small quantities of its contents via the cooling water and intermittent gaseous emissions. The waste produced by the reaction process is highly radioactive and has to be isolated from the environment for thousands of years. If the waste is accidently released into the environment, it has widespread devasting effects throughout the natural ecosystem and foodchains, and remains in human bodies for a lifetime. A reactor "melt down" occurs when the fuel is not adequately cooled; the fission reaction then becomes uncontrolled, resulting in an explosion such as occurred at Chernobyl in the USSR or at Three Mile Island in the U.S.

What kind of medical response is required in the event of a nuclear accident?

(3)

The Chemobyl accident provides a model for the kind of medical response that is required. While the nuclear reactor itself did not have sufficient safeguards, there was a well-defined protocol in place for a medical response in the event of a nuclear disaster. It is believed that the mortality in the Chemobyl accident was so low because of tho swift and coordinated medical response.

In the early morning hours of April 26, 1986, the Chernobyl nuclear reactor in the then-U.S.S.R. exploded, releasing radioactivity 10 kilometers into the sky and all over [central??] Asia and [eastern??] Europe. Of the 444 workers in the plant, 350 developed acute radiation syndrome and 30 died. Within minutes after the accident a medical response was initiated. Those who were seriously ill were transferred to nearby hospitals in the region, all other workers were given first aid and started on several cycles of decontamination by showering with water. Those who were hospitalised received complete medical support and were monitored every few hours with blood counts. Two hundred and three of the most seriously ill workers were transferred to specialty hospitals in Moscow and Kiev. Nineteen people who had persistently low blood counts underwent bone marrow transplants.

Meanwhile, the 135,000 residents of Chernobyl and those of another nearby town were evacuated. Within days about 6,000 medical personnel from all over the country arrived and started medical evaluation and treatment of the evacuees. This included 100,000 blood-count examinations and thyroid isotope scans. All the evacuees were treated with a potassium iodide solution to prevent the radiation from effecting their thyroid glands.

What has been our experience with handling other medical disasters?

One of the most recent medical disaster occurred in Gujarat [on ________--give date]; people were not forewarned about a tidal wave that hit there, and the official mortality count is so far more than 1,000. A medical response is only now being organised.

The response to the plague epidemic in Surat was highly confused. First of all, there was insufficient documentation to show that the epidemic was unequivocally plague. Seventy five percent of the doctors fled the city on the first day. City officials were confused about whether or not to seal [quarantine?] the city, and information about the epidemic was poorly disseminated. While tetracycline was universally administered to everyone, whether exposed or not, few got the correct dose of the drug.

In the case of the Bhopal gas tragedy, the exact medical consequences still are not known, even 13 years later. The survivors are still suffering and have not received proper compensation from the government or from Union Carbide.

Are we prepared medically for a nuclear disaster?

The answer to this question is not clear. As with most aspects of nuclear technology, the safety issue is surrounded by secrecy. It is not known, for instance, what safeguards are in place at our nuclear installations and bomb sites. However, concern has been expressed about potential exposure of staff to radiation at nuclear plants, and about the effects of radiation waste on tribes in Orissa where the waste is dumped. Therefore, it is important to ask the government to do the following:

1. Disseminate information to the public regarding health hazards surrounding nuclear installations.
2. Disseminate information on existing or planned safeguards at our nuclear plants.
3. Give the Indian public answers to the following questions :

   a. Does each nuclear installation have a medical facility for treating radiation exposure in the event of a nuclear accident?

   b. Are the health personel connected with nuclear facilities trained in the treatment of radiation exposure?

   c. What is the country's medical disaster plan in the event of a nuclear accident?

   d. What are the medical consequences of the recent Pokharan test blasts?

OCCUPATIONAL HEALTH: TWO SIDES OF THE COIN*

DR D P NAG
Officer-in-Charge
Regional Occupational Health Centre (Southern)
Bangalore

I think those who have insight into the status of Occupational Health in this country would like to agree with me that it is in a sad state inspite of sporadic achievements in the past to its credit. A disquieting feature in my view is the definite decline of support for this area in recent past. I am afraid it is at the cross roads and faces the possibility of going further down the hill. A sort of vacuum in the professional support joined with lack of political backing spells danger to further progress and places in jeopardy the prospect of even maintaining the present level of work in this area. In short, Occupational Health is marginalised and is getting more and more marginalised. This deserves serious consideration, deeper contemplation, wider discussion and assertive action. Why is Occupational Health marginalised? Why it did not take off? Why there is no commitment on the part of policy makers and managements? Why this disbelief among workers about the value of occupational health and safety? Several obvious issues and many more questions.

One may say what is the use of rising all these questions? What can we do in this regard? After all it is the responsibility of the Government and managements. This is all because of ineffective and muddled policies of the Government and regulatory bodies. Without hesitation in my opinion to fault the policy makers for several of these ills is only one side of the coin. Even more than this, equally to fault is the elements of identity and image we have built for ourselves. The critical need of the hour lies only in certain knowledge of the abyss into which the occupational health has slipped. Let us make an objective assessment of the malady. Let us examine the issue with a better insight and in a wider perspective. This is the time for introspection than for inquest.

---

* L & T Oration Lecture presented at the 43rd National Conference of Indian Association of Occupational Health, held on 31st January 1993 at Ahmedabad.

Expectations and Experience

During the last four decades in our country there has been a phenomenal growth of industries in public and private sectors. Such development has led to progress and improved quality of life but also resulted in some negative effects like environmental pollution, off-site industrial disasters and occupational health and safety problems in the work environment.

Industrialisation is indispensible. We cannot be untrue to industrialisation as it represents the basic fact of life. Still less can we be untrue to the essentiality of ensuring positive health to the workers. Healthy workers and the physical energy they spend are vital for the successful industrial development. The promotion and protection of workers' health should therefore be one of the objectives of any such efforts for rapid economic progress. Economic policies without adequate consideration for occupational health aspects and environmental safeguards can prevent improvement of living conditions of the very people whom the developmental process is intended to benefit. In their eagerness to circumvent the actue difficulties of balance of payments, policy makers are further tempted to take short-cuts for rapid economic progress thereby further undermining the interests of Occupational Health and Safety.

The need to take measures, to avoid negative effects of rapid industrialisation, is even more so in our country, as our workers are more vulnerable to these hazards in view of other factors such as mal-nutrition and diseases, which prevent the individual from performing at his full capacity. Truly we are in the "best of times and worst of times" to quote the inmitable Charles Dickens.

The negative aspects of industrialisation pose a challenge and have added new dimensions in terms of responsibilites and competencies on the part of medical profession, particularly Industrial Medical Officers. More and more industrial medical officers are required to imbibe the newer concepts and techniques to overcome challenges in ensuring physical, mental and social well being of the industrial workers in the country. Analysis of the growth pattern of occupational health and safety indicates a gap between expectations of 1950s and experience in 1990s. This gap between experience and expectations needs to be bridged rather than widened. Unfortunately atleast to me it appears that there is not even no emotive echo - let alone substantive effort from any corner to harness the situation.

Role of Industrial Medical Officers

The industrial medical officer as a part of management has to play a definite role. He is a vital link between the workers and management that can provide necessary stimulus to accelerate 'management motive force' to the theme of "Positive health profits production". Today medical officers in industries have greater focus on medical diagnosis and routinised treatment. They are ought to develop from physicians to occupational health physicians. This is of utmost importance because modern occupational health is trying to do things which are more stimulating and creative rather than routinised dispensary practices. Present day occupational medicine, therefore, necessarily needs not only the knowledge of medicine but also tools and techniques of toxicology, epidemiology, communication sciences, information sciences and management skills. Yet another aspect which needs to be attended to is that the task lies not merely in the art of "healing" but also in the art of "man management". Both these qualities are essential if occupational health has to take deeper roots in industrial setups in the country and narrow the gap between desired expectations and observed experience. Industrial medical officers constitute the back bone of occupational health services in the country and have to shape their activities in the scenario of pressing urgent problems which are in the nature of challenges to their competence and their process of development and the growth of their descipline. There is a need to usher in a spirit of "positive health" in the minds of management and the industrial medical officers have to deliver the goods. One can say without second thought "never before have so many owed so much to so few" - workers' health which is nations' wealth is in the hands of these few industrial medical officers.

What ails Occupational Health Research

India has third biggest body of medical man power in the world. Yet it appears as though the "body is without head". Our research output is sporadic and our successes few and far between. What could be the relevant reasons? Barring exceptional few, may be many of us in the field of occupational health and research have probably failed in originality, innovativeness and conceptualisation. And may be those few who measure to these standards are being sidelined and sidetracked. As an eminent researcher observed "Many a reputation in our country has been built around mere pretension of excellence and mere intentions to work for a goal". The research is required to be decision-linked in the field of occupational health and human resources development. The malady lies in the system of medical education which encourages mediocrity throughout. It is up to the teachers of medical education to reverse the trend and build foundations on which occupational health can raise. Medical classes should not be "lecture shops" but "work shops" and "competence - based " education should become the main stay.

Pilot MPT Programme

Today in occupational health, whether research or industrial medical services, we require people with ability, integrity, professional knowledge, honesty of purpose, depth of conviction, sense of proportion and managerial skills. When we want innovative outputs we also have to have innovative inputs.

As the occupational medicine is more than diagnosis and treatment Multi Professional Training (MPT) is one of the means whereby industrial medical officers can acquire and improve the skills needed for working in industrial set-ups. The All India Association of Occupational Health can play a great promotional role in this support area. The main objective of the programme should be to provide an opportunity to industrial medical officers and managers to collaborate and increase appreciation of the role of each profession in caring for the health of workers. This permits the integration of new skills and areas of knowledge that have a role to play in total occupational health care and safety like toxicology, information sciences, communication sciences, health economics and management techniques. Multi professional training also promotes interprofessional, interdepartmental and intersectoral understanding and cooperation within the management and generates and promotes new roles, competencies, responsibilities and areas of interest.

To survey the medical education landscape and identify dominant issues is a daunting task, however, it is apparent that if industrial medical officers are to be equipped to meet real occupational health needs and demands of work environment, reorientation-educational- training programmes are required. Then only the development of necessary competencies will be possible.

Operation OH

The time has come for the ongoing activites to be transformed into a mass campaign - Operation OH - for achieving the expected goals. I know that it is easier said than done. For the campaign to succeed there is a need to build necessary professional movement. The operation OH will not succeed unless it is sustained by the professional movement for the progress. There have been many such experiences in our profession namely family welfare programmes being one.

Structurally conducive professional movement is single most important prerequisite for the success of the Operation OH.

One of the relevent factors for the non take-off of occupational health is the prevalance of shared disbelief and conviction on the part of the management and workers about the questionable value of occupational health and safety services in the industrial settings. Such a shared disbelief is required to be replaced with shared commitment by extensive use of available instrumentalities in a manner acceptable to individual managements and workers. For this, a cadre of selfless and dedicated industrial medical officers are necessary to carry the message and movement to the workers and management.

The question before us today is whether we can promote spontaneous but locally grounded professional movement in favour of Operation OH. I am afraid that we have not succeeded so far even in reasonable manner. Therefore only very carefully drawn up and planned campaign sustained over a reasonably long period of time may deliver the goods.

Operation OH is to be sufficiently broad based so that no sector is elbowed out whether it is medical, managerial, or comunication science. I therefore suggest a cautious and a realistic approach:

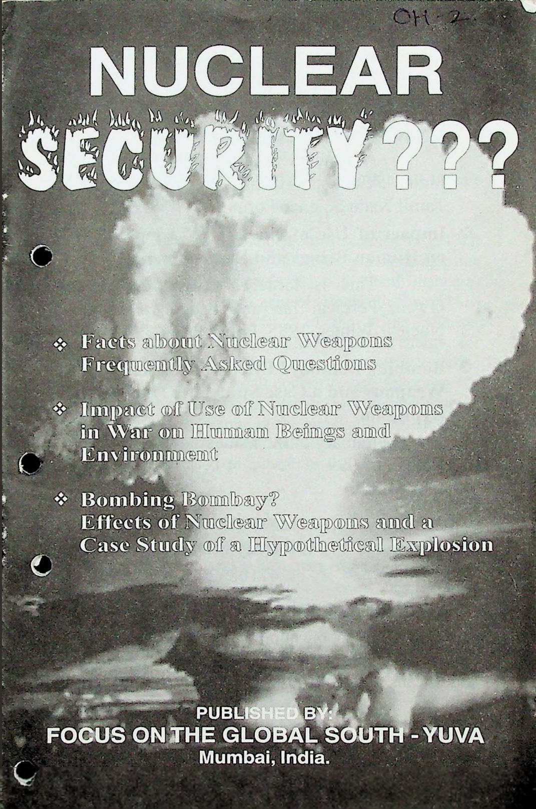
1. Organisational arrangements under the overall control of the Indian Association of Occupational Health which will be responsible as nodal agency for programme planning and implementation of Operation OH.

2. Formation of working groups and allocation of identified work areas and target industries.

3. Restructured basic and post-basic medical education

4. Environment building in Government Departments, State regulatory agencies, industrial managements, workers unions and voluntary bodies.

Finally, to conclude with words of the great Indian Physician-Surgeon Charaka "Weapons, Learning and Water are wholly dependent on their user for their merits and demerits". Thus the success or failure of occupational health in this country wholly depends on the medical officers in the industry.



NUCLEAR SECURITY???

- Facts about Nuclear Weapons
  Frequently Asked Questions
- Impact of Use of Nuclear Weapons in War on Human Beings and Environment
- Bombing Bombay?
  Effects of Nuclear Weapons and a Case Study of a Hypothetical Explosion

PUBLISHED BY:
FOCUS ON THE GLOBAL SOUTH - YUVA
Mumbai, India.

❖ **Facts about Nuclear Weapons**
Frequently Asked Questions

Abstracted from a study published for Indian Scientists Against Nuclear Weapons by Tamil Nadu Science Forum

❖ **Impact of Use of Nuclear Weapons in War on Human Beings and Environment**

This is largely drawn from Greene Owen, Percival Ian and Ridge Irene, (eds.) Nuclear Winter, 1985, Polity Press.

❖ **Bombing Bombay? Effects of Nuclear Weapons and a Case Study of a Hypothetical Explosion**

A summary of the main study by M.V. Ramana, 1999

Edited by	:	Varsha Rajan Berry
Printed by	:	Uday Print Arts
Telephone	:	4710862.

First Published, April 2001

Facts about Nuclear Weapons
Frequently Asked Questions

(A) Give a brief account of the evolution of India's nuclear history.

India emerged as a free and democratic country in 1947. It entered into the nuclear age in 1948 by establishing the Atomic Energy Commission (AEC), with Homi Bhabha as the Chairman. The Department of Atomic Energy (DAE) was created under the Office of the Prime Minister Jawaharlal Lal Nehru to explore nuclear energy for developmental purposes. He was the first world leader to call in 1954 for an end to all nuclear testing following US hydrogen bomb tests in the Pacific and their disastrous radioactive fallout. In spite of the humiliating defeat in the border war by China in 1962 and China's nuclear testing in 1964, India continued to adhere to the peaceful uses of nuclear energy.

However, India's civilian nuclear energy programme also had a 'dual use' or military capacity, of which other major figures were aware and which they wanted to develop. Initially the AEC and DAE received international cooperation, and by 1963 India had two research reactors and four nuclear power reactors. Between 1962 and 1974 India's nuclear programme under Homi Bhabha underwent a significant shift at the ground level. Bhabha in 1964 commissioned a plant to reprocess spent fuel to extract plutonium from the CIRUS (Canada-India Research

Reactor. United States) reactor built in 1960. In spite of this the policy of India on nuclear weapons did not change and the nuclear doctrine remained intact.

India's policy pronouncements in the post-Nehru period underwent a subtle shift, especially when India did not sign the Non-Proliferation Treaty (NPT), when it was opened for signature in 1968.The major reasons for India's non-signature were China's decision not to sign the treaty and India's new reluctance to commit itself to complete or permanent future abstinence. Behind the curtain of criticism of the NPT from the moral high ground, however India intensified nuclear preparations at the ground level. This along with the unsafeguarded production of plutonium gave Indira Gandhi an opportunity to conduct Pokhran –I in May 1974. On May 18, 1974 India performed a 15 kt Peaceful Nuclear Explosion (PNE). The western powers considered it to be the proliferation of nuclear weapons and cut off all financial and technical help, even for the production of nuclear power.

In 1978, under Morarji Desai, the Indian government distanced itself from PNE and the DAE's importance was downgraded within the government. After the mid-1980's, hawkish pressure mounted on India to respond to Pakistan's nuclear preparations by going overtly nuclear. During the period 1983-1993, India rejected a total of seven proposals by Pakistan for nuclear restraint and regional disarmament and rejected a number of proposals for nuclear dialogue involving P5 (USA, UK, France, China, Russia), India and Pakistan. But still, India did join the Five-Continent Six-

Nation Initiative for Nuclear Disarmament and in 1986 signed the important 'Delhi Declaration' for nuclear weapons free world with Gorbochev and put forward a Rajiv Gandhi Plan for the total elimination of nuclear weapons in the UN General Assembly in 1988.

It did start the nuclear dialogue with US in 1992, but to no avail. In 1993, India and the US co-sponsored a resolution in the UN calling for an early completion of the CTBT in the Conference on Disarmament. As the negotiations for the CTBT reached its final stage, India stalled and in 1995, it made the signature of the CTBT conditional upon a commitment to disarmament within a time bound framework by the P-5. The slippages became evident from India's commitment to nuclear restraint and global nuclear disarmament. The BJP and the right wing commentators seize in the anti CTBT rhetoric, to which there was little resistance from the political left and centre.

Having yielded much ground to hawkish positions, nuclear and defence establishments got hyperactive in lobbying for a policy break that would permit full weaponisation of the Indian nuclear option through test explosions. It used existing infrastructure to build nuclear power reactors and exploded both fission and fusion devices on May 11 and 13, 1998 under the BJP regime and the aegis of A.P.J. Abdul Kalam, Defence Research Development Organization (DRDO), Chief, DAE and the armed forces. The international community viewed the later activity as a serious roadblock for the Non-Proliferation Treaty and the Comprehensive Test Ban Treaty; both deemed essential to stop the spread of nuclear weapons and global disarmament.

Post Pokharan – II India joined the Nuclear Club and digressed from its earlier policy of using nuclear power for peaceful developmental purposes and to stop the spread of nucleaar weapons and global disarmament.,

1. Nuclear Weapons

1.1 What are nuclear weapons?

The word weapon here means an explosive weapon, such as a bomb, the warhead of a missile or an artillery shell. All weapons contain explosive which explode when suitably triggered. In conventional weapons, the explosive material is something that can undergo some chemical reaction that proceeds very fast and releases a lot of energy. Basically it can burn so fast that it explodes. Earlier explosive material used in weapons was gunpowder; nowadays more powerful explosives like TNT[1] and RDX[2] are used.

The explosive material used in a nuclear weapon can undergo a nuclear reaction at a very fast rate.

1.2 How do nuclear weapons differ from conventional ones?

An important difference between a chemical and a nuclear reaction is that the latter releases about a

[1] TNT – trinitrotoluene
[2] RDX – Cyclotrimethylenetrinitramine
These are standard explosives

million times more energy than a chemical reaction. This difference makes nuclear weapons more powerful than conventional ones.

A 10-kiloton nuclear bomb weighs about 500 kg whereas a conventional bomb of the same weight contains about 250 kg of explosives. So a single small nuclear bomb releases as much energy as about 40,000 conventional bombs. They are more powerful than conventional weapons and are weapons of mass destruction.

The second major difference is that a nuclear explosion produces large amounts of radioactive material that give out deadly rays of nuclear radiation. This is also called fallout. A large dose of radiation can kill human beings instantly. A smaller dose has worse consequences. It can cause severe illness leading to slow death after days or even years of suffering. Radiation can cause genetic damage leading to deformed babies. It contaminates large areas of land, making it useless for agriculture for years or even decades. These aspects of nuclear weapons thus introduce a new dimension of horror. The poisoning of humans and their environment by radiation makes the process of recovering from a nuclear attack a long and painful one.

1.3 What is the difference between a nuclear weapon and a reactor?

Nuclear reactors harness the energy produced in nuclear reactions to generate electrical power. They are also used to power the motors of ships and submarines. In order to do this, reactors are designed to precisely control the rate of the nuclear reactions taking place in them. The energy is then released at a controlled rate and can be used to run turbines, which generate electricity or run motors. The reactors in Kalpakkam, for instance, produce electricity in this manner.

Although nuclear reactions take place in a reactor just as they do in weapons, the crucial difference is that the rate of the nuclear reaction is controlled in a reactor whereas in a weapon, once triggered, the reaction proceeds in an uncontrolled way leading to the explosion.

2. Effects of Nuclear Weapons

2.1 What are blast effects?

Because of very high pressures at ground zero, the gaseous residues of the explosion move outward. The effect of these high pressures is to create a blast wave traveling several times faster than sound. Most buildings are demolished and there will be almost no survivors. As we go further away from ground zero[3] the effects are large-scale injuries and some fatalities. It is the high speed combined with high pressures, which cause the most mechanical damage in a nuclear explosion. Human beings are quite resistant to pressure, but not to being thrown over against hard objects or to buildings falling on them. This damage is clearly more serious in build- up areas.

2.2 What are radiation effects?

While blast and thermal effects occur to far lesser degree in other types of explosions, the release of intense ionizing radiation is a phenomenon unique to nuclear explosions. The ionizing radiation consists of fast moving neutrons, gamma rays, electrons and alpha particles. All these particles have the effect of creating chemically active free radicals in living beings. This affects the normal behaviour of living cells. Furthermore, the initial radiation makes the surrounding atoms radioactive and they in turn could emit nuclear radiation over a period of time from a few minutes to a few years. Radiation has long-term effects on survivors; it causes damage to DNA and disrupts cells by producing immediate effects on metabolic and replication processes.

---

3 Ground Zero - Also known as hypocenter. is the point on the ground directly below the nuclear explosion.

It should be remembered that natural radiation is always present in the atmosphere over most places in the earth, but at lower levels. But, there is no universally agreed threshold on a dose of radiation, which can be declared safe.

Things, which get irradiated by this "prompt" radiation they become radioactive and people in the area of nuclear explosion, who are exposed to these radioactive materials, stand more risk of contracting cancer.

2.3 What are the effects on climate?

There are also long term effects on the atmosphere and climate. These are not as direct as the fallout. The high temperature of the fireball can cause large amounts of nitrogen oxides to form during the cooling process, causing a depletion of the ozone layer in the stratosphere.

A potential nuclear winter cannot be ruled out. An immediate effect is the decrease in food production since most of the food in the world is produced in subtropical regions, leading to famine, starvation deaths, etc. Smaller weapons may not produce a nuclear winter, but a mild nuclear autumn cannot be ruled out.

3. <u>Nuclear Weaponisation</u>

3.1 What is nuclear Weaponisation?

A country that wants to have nuclear weapons as part of its defence forces has to build a lot of accompanying infrastructure. Along with having nuclear weapons, it needs a delivery system and a C3I system (Command, Control, Communication and Intelligence). Apart from this hardware, it needs to formulate a nuclear doctrine and strategy. All this together constitutes Weaponisation.

It is a long process, which starts with designing and testing of the weapons and delivery systems. This is the stage in which India is right now. The next stage is actual large-scale production of these systems. The next step is the induction of these systems into the armed forces, the training of the personnel and finally the deployment of the weapons.

3.2 Is it possible to have a reliable defence against a nuclear attack?

It is impossible to have a system, which can reliably detect and shoot down missiles. Therefore, there is no reliable defence against a missile attack. Since missiles are used to deliver nuclear weapons, there is no defence against a nuclear attack.

3.3 Can the population be protected in a nuclear attack?

The only way to survive a nuclear attack would be to have underground shelters. These shelters would have to be stocked with enough food and water to last for about a week, since it would take that much time before the radioactivity levels come down to relatively safe levels. Constructing such shelters for the entire population is impossible, especially in India. It is in fact impossible to protect any population from a nuclear attack.

3.4 What are the relative costs of the different components of the Weaponisation?

An analysis of the costs of the nuclear weapons programme of the USA by the Brookings Institution revealed that the relative costs of the different components was as follows:

Development and the Production of the weapons	–	7%
Development and the Production of the Delivery systems and C3I	–	86%
Civil Defence measures	–	7%

An estimate of the Indian programme made by C. Ramamanohar Reddy of The Hindu indicates a similar break up. He conservatively estimates the total cost of the programme to be about 40,000 crore rupees spread over ten years.

It may be noted that nuclear weapons expenditure is not likely to be shown directly in the government's budget under such a heading, to keep it a secret from other countries.

3.5 What is the burden of the Nuclear weapons programme?

The estimates made in a report prepared by the

Centre of Development and Women's Studies are the following:

- ❖ The cost of each nuclear-armed Agni missile (Rs. 45 crores) can finance the annual operation of 13,000 primary health care centres.
- ❖ The cost of one nuclear bomb (Rs.15 crore) can finance the construction of 6000 houses for the rural poor under the Indira Awas Yojana
- ❖ The cost of producing an arsenal of 200 bombs (Rs. 3000 crores) can provide drinking water to 2.50 lakh villages under the accelerated rural water supply scheme. This is about one-half of the number of villages, which remain without drinking water.
- ❖ The cost of a nuclear missile force of 50 Agnis and 150 Prithvis (Rs. 5100 crores) can meet the cost of providing mid-day meal schemes to 9 crore school going children for 5 years.
- ❖ The cost of five nuclear powered submarines (Rs. 20,000 crores) is eight times what the Central Government will spend on elementary education.
- ❖ The estimated cost of the Radar and Defence systems for the nuclear weapon launch sites – Rs. 5000 crores is enough to finance 7 years of operation of the National Social Assistance Programme which provides pensions to 5 million rural poor, maternity allowances to 3 million expectant mothers and one time grants

to 300,000 poor families where the main bread winner has suddenly died.

- The funds that will be used for a nuclear Weaponisation programme – Rs. 43000 crores can be used to remove the entire rural housing shortage estimated at 15 million units in 1991.
- Alternatively, the same Rs. 42000 crores can be used to set in place an educational system that provides primary education for all Indian children of school going age.

This is the real burden of a nuclear weapons programme on the people of India.

4 Nuclear Tests

4.1 Why are nuclear tests necessary?

In order to design a nuclear weapon, it is necessary to mathematically model the processes that lead to the explosion. The devise is then simulated on a computer. Several assumptions go into the modeling and one cannot be absolutely sure how accurate the model is without actually testing it. A thermonuclear weapon is significantly more complicated and requires more testing than a fission device.

5 Treaties

5.1 What is NPT?

The Non-Proliferation treaty (NPT) was negotiated in 1968, became effective in 1970 and was indefinitely extended in 1995. As of 1997, nearly 185 countries have signed NPT.

NPT introduced the definition of nuclear weapon states: those, which had tested a nuclear explosive device before January 1, 1967. The key principle of NPT is that possession of nuclear weapons be limited to only these states. This was sought to be enforced by ensuring that these nuclear 'haves' do not transfer nuclear weapons capabilities to nuclear 'have-nots'.

Discussions on NPT centered around the fact that while non-proliferation was sought to be enforced, the weapon states were in no way being constrained from producing more weapons. Eventually, under pressure from non-nuclear weapon states and disarmament groups, a clause was added (Article VI) which urged the weapon states to pursue negotiations "in good faith" towards nuclear disarmament.

As formulated, NPT is blatantly discriminatory and legitimizes the weapons of the five nuclear weapon states. India has refused to be a party to it because of this discriminatory nature and has not signed NPT so far.

5.2 What is CTBT?

Negotiations on the Comprehensive Test Ban Treaty (CTBT) concluded in 1996.

The main purpose of CTBT is to put an end to nuclear explosions, which seek to test weapons technology. Signatories to the treaty cannot conduct any nuclear explosions.

Two key features of CTBT stand out. One is that the treaty bans only explosions, allowing sub-critical (non-explosive) weapons tests as well as detailed computer simulations, which make explosions unnecessary. Weapon states like the US do possess such capabilities. The second feature is that the treaty comes into force only if and when all countries having nuclear capabilities sign the treaty. In particular, this means that unless India and Pakistan sign CTBT, the treaty will not come into force at all.

Since CTBT does not distinguish between weapon states and others, it is not explicitly discriminatory. However India has argued that CTBT is merely a corollary of NPT and that it perpetuates a discriminatory order: the weapon states will only stop a form of testing which perhaps they do not need anyway, without committing them to any time-bound programme of disarmament. In 1996 India refused to sign CTBT on these grounds, while at the same time committing to the self-restraint of not producing weapons. This stand was regarded as a moral and acclaimed.

However, after Pokhran explosions, the earlier restraint has been abandoned and now there is international pressure on India to sign the CTBT.

5.3 What are the implications of CTBT?

For the nuclear weapon states, the CTBT would restrict the ability to design new types of weapons though it will not completely eliminate it. It will be possible to modify existing designs but a completely new design will be difficult to implement reliably in absence of explosive nuclear tests.

It is however possible to make reliable nuclear weapons of a simple design without explosive nuclear tests. Thus the CTBT will not be able to prevent non-nuclear weapon states from doing so.

Chronological events leading to nuclear development in India and Pakistan

INDIA

1948	: India establishes an Atomic Energy Commission for exploration for uranium ore.
1953	: President Eisenhower launches ``Atoms for Peace" program, offering access to exchange atomic technology for pledges to use it for civilian use, not weapons.
1954	: Head of India's AEC, rejects safeguards, oversight by new International Atomic Energy Agency.
1956	: India completes negotiations to build 40 megawatt ``Canadian-Indian Reactor, U.S." research reactor. United States supplies heavy water, used to control nuclear fission.
1958	: India begins designing and acquiring equipment for its own Trombay plutonium reprocessing facility, giving the nation a dual-use capability that could lead to atomic weapons.
1959	: U.S. trains Indian scientists in reprocessing, handling plutonium.
1963	: Two 210-megawatt boiling-water reactors are ordered for the Tarapur Atomic Power Station from General Electric. United States and India agree

	plutonium from India's reactors will not be used for research for atomic weapons or for military purposes.
1964	: First plutonium reprocessing plant operates at Trombay.
1965	: Chairman of India's AEC proposes subterranean nuclear explosion project. China, one of five declared nuclear states, detonates first atomic explosive device. U.S. withdraws military aid from India after the India-Pakistan War.
1966	: India declares it can produce nuclear weapons within 18 months.
1968	: Non-Proliferation Treaty completed. India refuses to sign.
1969	: France agrees to help India develop breeder reactors.
1974	: India tests a device of up to 15 kilotons and calls the test a ``peaceful nuclear explosion." Canada suspends nuclear cooperation. The United States allows continued supply of nuclear fuel, but later cuts it off.
1976	: Soviet Union assumes role of India's main supplier of heavy water. Canada formally halts nuclear cooperation.
Early 1980s	: India acquires and develops centrifuge technology, builds uranium enrichment plants at Trombay and Mysore. -
1991	: India enters agreement with Pakistan prohibiting attacks on each other's nuclear

	installations, a measure to ease tensions.
1992	: Rare Metals Plant at Mysore begins producing enriched uranium. Nuclear Suppliers Group, organization of nations with nuclear materials, stops supplying India.
1997	: India announces development of supercomputer technology that can be used to test nuclear-weapon designs. Fuel reprocessing plant at Kalpakkam, a large-scale plutonium separation facility, completes ``cold commissioning" in last phase of pre-operating trials.
1998	: India announces plans to sign deal with Russia for two 1,000 megawatt nuclear reactors.
May 11-13	: India conducts five underground nuclear tests, declares itself a nuclear state.
PAKISTAN	
1972	: Following its third war with India, Pakistan secretly decides to start nuclear weapons program to match India's developing capability. Canada supplies reactor for the Karachi Nuclear Power Plant, heavy water and heavy-water production facility.
1974	: Western suppliers embargo nuclear exports to Pakistan after India's first test of a nuclear device.
1975	: Purchasing of components and technology for Kahuta uranium-enrichment centrifuge

	facility begins after return of Dr. Abdul Qadeer Khan, German-trained metallurgist who takes over nuclear program.
1976	: Canada stops supplying nuclear fuel for Karachi.
1977	: German seller provides vacuum pumps. equipment for uranium enrichment. Britain sells Pakistan 30 high-frequency inverters for controlling centrifuge speeds. United States halts economic and military aid over Pakistan's nuclear-weapons program.
1978	: France cancels deal to supply plutonium-reprocessing plant at Chasma.
1979	: United States imposes economic sanctions after Pakistan is caught importing equipment for uranium enrichment plant at Kahuta.
1981	: Smuggler arrested at U.S. airport while attempting to ship two tons of zirconium to Pakistan. Nevertheless, Reagan administration lifts sanctions and begins generous military and financial aid because of Pakistani help to Afghan rebels battling Soviets.
1983	: China reportedly supplies Pakistan with bomb design. U.S. intelligence believes Pakistani centrifuge program intended to produce material for nuclear weapons.
1985	: Congress passes Pressler amendment. requiring economic sanctions unless White House certifies that Pakistan is not

	embarked on nuclear weapons program. Islamabad is certified every year until 1990.
1986	: Pakistan, China sign pact on peaceful use of nuclear energy, including design, construction, and operation of reactors.
1987	: Pakistan acquires tritium purification and production facility from West Germany.
1989	: A 27-kilowatt research reactor is built with Chinese help and comes under international monitoring.
1990	: Fearing new war with India, Pakistan makes cores for several nuclear weapons. Bush administration, under Pressler amendment, imposes economic, military sanctions against Pakistan.
1991	: Pakistan puts ceiling on size of its weapons-grade uranium stockpile. It enters into agreement with India, prohibiting the two states from attacking each other's nuclear installations.
1993	: Report by the Stockholm International Peace and Research Institute says about 14,000 uranium-enrichment centrifuges installed in Pakistan. German customs officials seize about 1,000 gas centrifuges bound for Pakistan.
1996	: Pakistan buys 5,000 ring magnets from China to be used in gas centrifuges for uranium enrichment. China tells U.S. government it will stop helping Pakistan's

	unsafe guarded nuclear facilities. Islamabad completes 40-megawatt heavy-water reactor that, once operational, could provide the first source of plutonium-bearing spent fuel free from international inspections.
1998	: Reacting to fresh nuclear testing by India, Pakistan conducts its own atomic explosions.

Impact of Use of Nuclear Weapons in War on Human Beings and Environment

Introduction

Immense resources have been devoted to the design of nuclear weapons, but relatively few to studies of the drastic impact on human beings and environment of using these in war.

The principal effects that would be expected if a significant fraction of the world's nuclear arsenals were used in war are:

- Nuclear explosions would send dust, radioactivity and various gases into the atmosphere.
- The explosions would ignite fires, burning cities, forests, fuel, and grasslands in the countries of the nuclear alliances.
- The fires would send plumes of smoke and gases tens of thousands of feet into the atmosphere.
- Within a week or two, some of the dust, radioactivity and smoke would be carried by the wind around the earth. It might stay in the atmosphere for days, months or even years, depending on its height.

- Daylight could be reduced to darkness for weeks, months or years.
- Temperatures would drop drastically, the difference could be as large as summer and winter and the climate might be disturbed for years.
- There would be serious and widespread radioactive fallout and pollution in most of the heavily populated parts.

To summarize the above:

- **There could be twilight at noon**
- **There could be a nuclear winter**
- **The extinction of the human race could not be ruled out**

War on the Living

We here consider the effects of a nuclear war on plants, animals and living systems. For living things the immediate effects would be devastating. The multitude of problems that would afflict human populations – disease, economic, social and agricultural collapse and probably most serious of all, starvation cannot be fully understood without first examining the effects on animals, plants and ecosystem.

Effects on Plants

To summarize the effects of plants of a nuclear war leading to atmospheric disturbances are:

- Growth and food storage by plants could be zero due mainly to shortage of light and reduced temperatures.
- Many species of plants would die due to drops in the temperature, including virtually all-temperate annuals and chilling sensitive tropical species, all major crop plants would be affected. Widespread damage to tropical perennials is also likely.
- Regeneration of vegetation would be slow and patchy, with possible damage from UV-B, radioactive fallout and chemical pollution.

Effects on Animals

The populations of nearly all-terrestrial animals that lived above ground would be greatly reduced. Cold-blooded animals, especially insects and species that live and fed on the soil would be more likely to survive than warm blooded animals.

Ultimately, species survival would depend on whether or not individuals lasted out until conditions suitable for breeding returned. Among mammals and birds survival would be quite probable for a few highly adaptable type of mammals, such as mice and rats, but very uncertain for most wild species, there would be widespread extinction and population would be reduced everywhere. Overall a very impoverished and unbalanced fauna seems to be the most likely outcome.

Effects on Ecosystems

A full assessment of biological damage is possible only by considering possible effects on ecosystems. An ecosystem is all the living things in a given area together with their non-living environment. The functioning and survival of an ecosystem depends on innumerable interactions between its components. Perhaps the most devastating and long lasting effect of a nuclear war would be on these interactions.

A nuclear war reduces energy inputs by decreasing the amount of plant photosynthesis and the major dislocation of the energy relationships of terrestrial ecosystems basically spells starvation for most animals, with damaging consequences for plants and freshwater ecosystems like streams, rivers and lakes.

Pollution

Pollution is certain to be a long-term problem after nuclear war. Nearly all factories contain stores of toxic chemicals and some have very large quantities indeed. These could be released in target areas and acute pollution of the atmosphere would be the first effect.

The death of over 2,400 people in Bhopal late in 1984 is a grim parallel, and this was a result of an accidental release of toxic gas from just one factory.

With toxic fluids drained away and dry toxins dispersed as dust, wider pollution of the soil and wastes would occur. There would also be global pollution by radioactive fallout. The long-term ecosystem effects of this pollution would depend on the persistence of the chemicals. Plants are more resistant than mammals to these radioactive pollutants.

The Human Cost

In terms of human cost and suffering the effects could be more serious and certainly more widespread with grave implications for people in every country of the world. Considering the early effects on the human beings the following can be short-listed:

- Cold – to what extent human death from cold is a likely outcome of a nuclear winter. When people are in a state of shock or have low reserves of body fuels and no food available for consumption, it leads to voluntary and involuntary breakdown temperature regulation that causes hypothermia. These conditions are likely in a nuclear winter, which could lead to death more likely in babies, children and old people.

- The problem of food supply - starvation and bare subsistence which is already the fate of many developing countries would further augment during a nuclear war and mass starvation would be the immediate effect due to destruction of harvest and food crop and flow of aid stopped.
- Longer-term health problems – although shortage of food could be most widespread and serious problem among human survivors, poor health would certainly be another. For several years after a nuclear war, chronic and acute health problems are predicted. These would arise from a combination of three main factors: the breakdown of medical and public health services, the effects of world wide pollution with exposure to radioactivity fallout immediately after the attack and probably the most important factor, the spread of epidemic diseases, due to poor living conditions, malnutrition, lack of sanitation and severe psychological stress.

People have for long known the immediate effects of a nuclear war, what is now clear is also the long-term effects of the same. Evidence from history shows a point of no return for societies and civilizations. The global effects of a nuclear war will be so severe and weaken human species so much so that that the human populations would not survive at all. If it happened this would probably be the gradual fading away over many years rather than a sudden event. The ultimate cost of a nuclear war would be human extinction.

A new type of thinking is essential if mankind is to survive and with the development of nuclear weapons and the realized danger of a nuclear war this thinking has become an urgent necessity. We have to rethink the meaning of peace and of war, of defence and security and of conflict and cooperation between nations. If we do not, we may well be the last generation to have the choice.

Bombing Bombay?

Effects of Nuclear Weapons and a Case Study of a Hypothetical Explosion (A Summary)

M.V. Ramana*

OVERVIEW

The nuclear tests by India and Pakistan in May 1998 signaled the beginning of a dangerous new era in South Asia. Nuclear war in this part of the world that is home to over a billion people would be catastrophic. Nor would the effects of such a war be limited to just the region. Long-lasting radioactive fallout respects neither spatial nor temporal boundaries.

This article describes the effects of nuclear explosions and the consequences of a hypothetical nuclear detonation over Bombay (Mumbai).

The leading causes of casualties following a nuclear explosion are:

- Thermal (heat) radiation and resulting large scale firestorms that could cause burns and other severe injuries;
- Shock waves and accompanying high speed winds that could crush people or throw them around;

- Prompt radiation and radioactive fallout that could cause radiation sickness.

Depending on the population density in the part of the city that is targeted, the number of deaths would range between 160,000 to 866,000 for a 15 kiloton explosion – approximately the same destructive power as the weapon dropped on Hiroshima in 1945. A 150 kiloton weapon – typical of more modern hydrogen bombs – could cause somewhere between 736,000 and 8,660,000 deaths. The estimates do not include the long-term effects like cancers that would afflict thousands of people in the following years or genetic mutations that could affect future generations.

The first part of the article is a technical description of the effects of a general nuclear explosion. The second part describes the effects of a hypothetical explosion over Bombay.

THE EFFECTS OF NUCLEAR WEAPONS

There is a basic difference between nuclear explosions and those involving conventional chemical explosives. The energy output of any explosion comes from the release of the binding energies of the constituents. Nuclear binding energies are so much higher than chemical binding energies that there is a huge increase in the output of energy and destruction. Because of this increase, nuclear weapons can never be 'discriminating'.

The energy released in a nuclear explosion is initially in the form of high energy x-rays, which heat the air to create a fireball in which temperatures exceed 300,000 degrees Celsius. In comparison, temperatures in chemical explosions are unlikely to exceed 5000 degrees Celsius. The enormous amount of radiation (light and heat) that comes out of the fireball is sufficient to cause blindness. As the fireball expands rapidly, the shell of air that has been compressed and accelerated outward by the expansion separates from the fireball and propagates outward as a 'blast' or 'shock' wave. Besides thermal radiation and shock, a third effect that causes damage to health is prompt nuclear radiation that results from the nuclear reactions that are responsible for the explosion.

The shock wave from a nuclear explosion subjects everything in its path to high "overpressures". Even with 'very small' nuclear weapons of a kiloton or so, the overpressure suffices to destroy 'kutccha' housing up to nearly a kilometre from the point of explosion; the wind speed due to the shock wave at this distance is greater than 60 kilometres/hour. Due to the complicated nature of the blast and varying standards of construction, it is difficult to predict exact levels of damage at various levels of overpressure. Typically light housing can be destroyed at 5psi or more, wooden or brick houses can be destroyed at overpressures of 10psi or more and RCC buildings can withstand overpressures of up to 20psi.

The light and heat from the explosion leads to a very high 'radiant' exposure for many miles around. This causes burns on people and animals and starts fires at distances far from the site of the blast, burning paper, leaves, grass etc. Over the next 15-30 minutes, these small fires coalesce to create 'firestorms'. Due to the large area of the fire, the fire zone would act as a huge pump, sucking in air from the surrounding areas and driving heated air upwards. This pumping action would create winds with velocities as high as 50-80 kilometres/hour. The temperature in the fire zone would reach several hundred degrees, making it almost certain that there would be no survivors.

Exposure to neutron and gamma radiation, resulting from the nuclear reactions responsible for the explosion, would occur almost immediately after the explosion. High levels of radiation exposure could lead to a variety of symptoms such as nausea, bloody diarrhea, and hemorrhages within a few days. At lower levels of radiation exposure, there could be other consequences of radiation that appear years later. These health effects are often fatal and include leukemia, thyroid cancer, breast cancer, and lung cancer, as well as non-fatal diseases such as birth defects, cataracts, mental retardation in young children, keloids, and others.

If the nuclear bomb explodes near the ground, a large amount of material is vaporized and carried aloft into the mushroom cloud. This material then mixes with the fireball's radioactive materials, which results in a cloud of highly radioactive dust. This radioactive 'fallout' can travel large distances on the winds created by the explosion, as well as in the atmosphere, before ultimately falling back to earth. Exposure to this fallout will result in a radiation dose, with similar consequences as described above.

HYPOTHETICAL CASE STUDY

To better appreciate the effects of a nuclear explosion, the effects of a hypothetical nuclear explosion over Bombay is considered. As the largest commercial center in India with a huge population of about 100 lakhs, the city does present itself as a possible target of attack. The aim is to further understanding of the consequences that result from a nuclear explosion.

It is assumed that the weapon used has the same yield (15 kilotons) and is exploded at the same altitude (600 metres) as the weapon dropped on Hiroshima. With such a small yield, it is not possible to destroy the whole city. The location of the attack determines which region of Bombay is destroyed. For e.g., an attack in the Fort area, would destroy most of the buildings from Colaba to Victoria Terminus, along the entire width of the island, but there is unlikely to be much damage in, say, Chembur.

For a 15 kiloton explosion at an altitude of 600 m, the resulting shock wave would destroy everything within a circle with a radius of 1.1 km. Up to 1.7 km from the point of explosion, all houses not built with concrete would be destroyed. The quality of construction has a great effect on the amount of damage inflicted in an attack. Buildings in Bombay tend to collapse by themselves during the rainy season and are therefore unlikely to withstand even small overpressures. These collapses, therefore, are likely to occur over a much wider area.

Over and above the destruction due to the shock wave is the damage due to the firestorm. In the case of a Hiroshima-sized explosion over a city like Bombay, the radius of the region under flames would be 1.7 to 2 kilometers. Fire-fighting would be almost impossible due to the combination of hurricane-force winds, thick smoke, the destruction of water mains and tanks by the shock wave, and the presence of debris from the blast blocking roads and access routes. The explosions of

LPG cylinders and other explosive household materials, due to the firestorm or blast, will increase the damage.

Given the population densities in Bombay, a conservative estimate of only the immediate casualties (i.e. within the first few weeks following the explosion) due to such an explosion ranges from 160,000 to 866,000 depending on the population density of the area that is destroyed.

If, instead of assuming that the weapon is detonated at a height of 600 meters, the explosion were assumed to happen at ground level, the areas destroyed by blast and fire would be smaller. However, the area subject to levels of radioactive fallout that have a high likelihood of being fatal would be between 25 and100 square kilometers. The wind direction during the period that the fallout is aloft (which could be fluctuating) would determine which areas would be subject to these levels of radioactivity. The regions subject to high levels of fallout would have high levels of casualties and radiation sickness.

These estimates are extremely conservative. The toll could be even greater because of the possibility of damage to chemical industries leading to toxic spills of extremely hazardous chemicals reminiscent of the Union Carbide accident in Bhopal, or of the possibility that there would be either intended or unintentional damage to the nuclear reactor at Trombay. Hospitals and medical care in an overcrowded city such as Bombay are limited to begin with, and facilities within the affected area would be destroyed or damaged during the attack. The injured would be unlikely to find medical treatment to help them survive.

CONCLUSION

Nuclear weapons are, clearly, extremely destructive. The immense scale of these effects, and that too resulting from just a single fission weapon with a low yield, should make it clear that any use of such weapons would lead to a major catastrophe. The only guarantee that such a tragedy would never occur is complete elimination of nuclear weapons, both from the region and from the world, and the means to manufacture them.

** M.V. Ramana has a Ph.D. in Physics from Boston University and has held research appointments at the University of Toronto, Massachusetts Institute of Technology and Princeton University. This study was done for the International Physicians for the Prevention of Nuclear War. The complete report is available on the internet at http://www.ippnw.org/bombay.pdf.*

Focus Publications

Focus Files

This is a monthly printed bulletin of recent articles written by Focus staff. Write to us for more details. Focus also produces two electronic bulletins, Focus-on-Trade and Focus-on Security. Subscriptions are free. You can send in your request by email to: admin@focusweb.org

Focus Papers

These are project and programme discussion papers; institutional progress reports and staff research papers. The published papers are:

- Economic Reforms and the Poor: A Study from Madhya Pradesh, India
- The Debate on Capital Account Convertibility: Theoretical Issues and Policy Options

These can be made available on request.

Focus Files – India Programme

This is a quarterly published by Focus-IP. Subscriptions are free. Send in your request to: focusweb@mantraonline.com.

Focus on the Global South was established in Thailand in January 1995. It is dedicated to the regional and global policy analysis, micro-macro issues linking and advocacy. It is affiliated to the Chulalongkorn University Social Research Institute (CUSRI). It is a non-profit organization supported by independent institutions and individual donors in both the South and the North.

Focus aims to strengthen the capacity of organizations of marginalized people to better analyze and understand the impact of globalization. Focus India Programme is majorly involved in developing a position on Human Security & Comprehensive Security. The two major programmes of Focus are Micro-Macro Linking Programme and Regional and Global Paradigm Programme.

Focus- India Programme became operational in 1996 in Mumbai. Since then, the India Programme, using the programmatic framework discussed earlier has been able to stimulate alternative critical thinking on the following issues: the national and state level impact of Structural Adjustment Programmes and new economic policies, the understanding of the World Bank and the International Monetary Fund, security issues concerning the South Asia region, with a special emphasis on nuclear weaponisation, various dimensions of gender security and the holistic conception of human security.

Focus on the Global South – YUVA

53/2, Nare Park Municipal School, Opp. Nare Park Ground, Parel, Mumbai – 400012

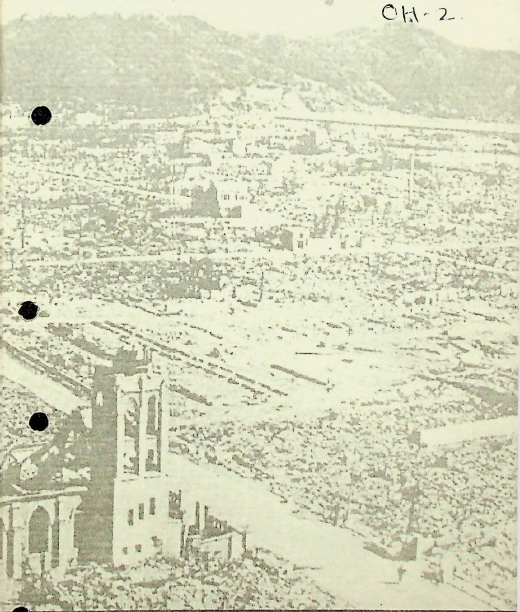
Telephone: 4155250, 4143498, 6312889, 6351271

Fax: 4135314 • Website: www.focusweb.org

Email: yuva@vsnl.com & focusweb@mantraonline.com

The TRAGEDY of Hiroshima & Nagasaki

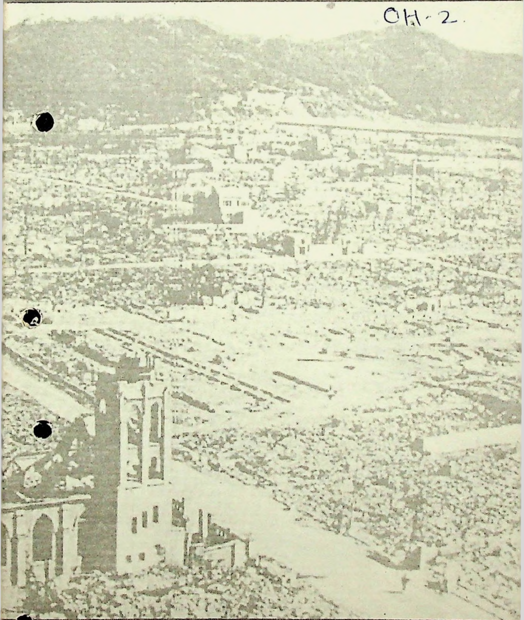
OH-2



Compiled and Edited by D.Indumathi, M.V.N. Murthy, R.Shankar.
Published for Indian Scientists Against Nuclear Weapons by TNSF

The TRAGEDY of Hiroshima & Nagasaki

OH-2.



Compiled and Edited by D.Indumathi, M.V.N. Murthy, R.Shankar.
Published for Indian Scientists Against Nuclear Weapons by TNSF

ISANW/00/2
November 2000

The Tragedy Of Hiroshima And Nagasaki

Compiled and Edited by
D. Indumathi, M.V.N. Murthy, R. Shankar

Published for
Indian Scientists Against Nuclear Weapons
by
Tamil Nadu Science Forum

TNSF: Tamil Nadu Science Forum (TNSF) is a voluntary group committed to the popularisation of science and the use of science only for constructive purposes. For more information, contact:

Tamil Nadu Science Forum,
130/3 Avvai Shanmugam Salai,
Gopalapuram,
Chennai 600 086.
http://www.tnsf.org

MANW: Movement Against Nuclear Weapons (MANW) is a forum in Chennai, committed to building and strengthening the campaign for abolition of nuclear weapons around the world. Thirty three groups, including Indian Scientists Against Nuclear Weapons, are members of MANW. For more information, contact:

Convener: J. Sri Raman,
G-2 Seashore Apartments,
12 (Old No. 3) Jayaram Chetty Street,
Thiruvanmiyur, Chennai 600 041.

Price: Rs 10/-

Contents

Preface

Fifty five years after the first atomic bombings devastated Hiroshima and Nagasaki, it is still difficult to understand how the decision to bomb these cities was taken.

Since 1995, the top secret documents leading to the decision (now declassified) are publicly available. This booklet attempts to tell that story and juxtaposes it with eye-witness accounts of the resulting horror. Rather than argument and analysis, the account relies on blandly-stated official records and survivors' accounts, leaving readers to draw their own conclusions.

For Indian readers, there are many deeply disturbing parallels here, in the context of nuclear weapons in South Asia. As the story unfolds, it becomes clear that the use of the bomb was **not dictated by military necessity**. Indeed, the U.S. military does not seem to have been formally involved in a decision of such magnitude.

It was the scientists who understood the cataclysmic potential of the bomb. This booklet records how some of them initiated the project to build atomic bombs, as well as how a number of them foresaw the nuclear arms race, proliferation, and the danger to humanity from these weapons. Despite the articulated entreaty of a few, to desist from using these weapons (as recorded in petitions to the U.S. President), the decision to bomb was taken. What emerges is a picture of a political decision, backed by one section of scientists and opposed by another, and not involving military leadership in any significant way.

On the other hand, the story of the bombing itself and the horror recorded by eye-witness accounts, reminds us of how easily such decisions can be taken and executed, and at what cost. When photographer Matsushige talks of high-school children running through the raging fire, skin burst open, and hanging like rags, we realise fully that the war was not about bombing military bases, or saving lives.

It is clichéd to assert that history repeats itself. Only in revisiting history, in attempting to understand the truth and its distortions, can we have hope for the future.

Chapter 1

Introduction

On August 6, 1945, the first atomic bomb was dropped on Hiroshima in Japan. Three days later, another followed, this time on Nagasaki. These two bombs killed thousands of civilians including infants, children and the elderly, as well as devastated the two cities. By the end of that year, nearly two lakh people were dead. This large-scale destruction of civilian populations was on an unprecedented scale, unknown in the history of mankind upto that time.

The events leading to this tragedy began in another part of the world and nearly four years earlier. In the United States of America, some of the top scientists of the day assembled to begin the process of creating the weapons dropped on Hiroshima and Nagasaki. **While it took a few years to make these bombs, it took less than a month to make the decision about its actual use.** Dropped from a height of 600 meters above Hiroshima, it took only a few seconds to reduce the city of Hiroshima to rubble. Few survivors remained to tell the tales of suffering and horror.

Many questions remain: How did this tragedy occur? Why was it allowed to happen? Did the creators of these weapons of mass destruction know the real nature of these weapons? Many answers have become known (or clarified) over the years. Indeed, many classified documents related to this issue have become declassified and available to the public only since 1995. Since then, the movement to correctly record the history of the bombing decision has gained strength.

Let us summarise the salient points: It is now part of history that the whole project started after Albert Einstein wrote a letter to U.S. President Roosevelt. At that time there was a real fear among scientists that possible research on these weapons was being done by German scientists. The so-called Manhattan project in the U.S. was begun, as a response to this fear. However, the project gathered a momentum of its own. It did not stop even after the very reason for its existence evaporated when Germany surrendered in May 1945. This was a good three months before the bombing of Hiroshima. By the middle of July, several intercepted communications between Japan and its foreign minister in Russia clearly indicate that Japan was also willing to sue for peace, "on the basis of the Atlantic Charter". In spite of this, the go-ahead was given to drop the atomic bomb on not one but two cities, and especially, on civilian populations.

Mr. Kosuke Shishido, one of the "Hibakusha" or survivors of the bomb attack on Hiroshima, says,

"I personally do not blame the U.S.A. It was a war. Japan might have done a similar thing in a different situation. However, I believe it was a sin to kill so many people instantly. On the basis of my research, I have concluded that the major reasons why the bomb was dropped on Hiroshima are as follows. There was a group of people (military people and scientists) who wanted to experiment with the bomb that they had developed. Some high level people in the government wanted to show the world the military power of the country (in the sense of using A-bomb politically). Some people who played a significant role in the development of the first A-bomb in history wanted to kill as many people as possible to get even with Japan for Pearl Harbor and the Phillipines war. The project that developed the first two A-bombs had spent a significant amount of money and they needed a justification ..."

Indeed several documents reveal that many established and senior scientists played an active role in identifying the targets and that they were very much aware of the deadly consequences of their use. Intricate details as to the height of detonation, weather conditions, etc., were discussed in great detail by these eminent men. Voices against the use of the bombs, from some distinguished colleagues, were dismissed by appealing to lack of competence on matters of social, political and military importance while at the same time recommending that the use of these weapons should be such as to have impact on the future international situations.

The declaration of amorality in matters related to science and its uses raises the important and disturbing question about the role of ethics in the practice of sciences. Should one extend the presumed value-neutrality in the practice of science, all the way from the laboratory environs to the social domain, where it often concerns the very existence of societies? Such a view, held as valid by a section of scientists, has often led to disastrous consequences. For example, scientist Fritz Haber's research helped in the manufacture and use of deadly gases during the first world war and earned him the epithet—father of chemical warfare. He logically analysed the "advantages" of chlorine gas in warfare. Indeed once these became clear, both sides used it with devastating effect on each other. Much like Haber, some of our protagonists of nuclear weapons, as we shall see soon, logically analysed the advantages of using nuclear weapons while their opponents invented technologically sophisticated methods of torture and murder which were used in concentration camps. Even corpses were not spared from further studies.

It is still heartening that several eminent scientists in this century have held strongly humanitarian views. Einstein for one believed in the "inescapable responsibility" of scientists to create an "informed citizenry" which will "act for life and not for death". Closer home, Raman was an outspoken critic of militarisation of science in all its aspects. In particular he was very vocal about his opposition to weapons of mass destruction—**"The atom-bomb is the latest weapon created by science for the benefit of war-mongers"**, he said. He reflected deeply about aspects of science in relation to society and believed that it must be used for humane ends.

Where does one draw the line? Scientist Leo Szilard said the following in an interview,"... suppose Germany had developed ... and dropped one bomb, say, on Rochester ... and having run out of bombs she would have lost the war. Can any one doubt that we would have then defined the dropping of atomic bombs on cities as a war crime, and that we would have sentenced the Germans who were guilty of this crime to death at Nuremberg and hanged them?" The Nuremberg trials upheld the fact that individuals are responsible for what they do, and are accountable for committing serious crimes under international law. Ironically, the International Military Tribunal at Nuremberg was established on August 8, 1945, two days after the bombing of Hiroshima when 90,000 had already died, and thousands more were about to be killed in Nagasaki.

We leave the question open, but not before we hear the witnesses. The witnesses are the Hibakusha, the survivors of the Hiroshima and Nagasaki bombings. Many of these survivors were children in 1945 and have recorded their experiences of that time. It is about time we heard them before their experiences fade into distant memory.

This booklet is mainly about what the protagonists said and is almost entirely in their words. How was this cataclysmic event allowed to happen? In trying to find an answer, we found many original, now unclassified documents on the Internet. These relate to

- the making of the bomb,
- the decision to drop the bomb, and the targets chosen, and
- the eye witness accounts of the actual bombing.

Much of the story about the making of the decision, the bombing, and the aftermath, is told by these documents. In the entire booklet we have let the original writing speak of the events and experiences with as little intrusion as possible. **In trying to understand how it happened, more importantly why it happened, perhaps lies the hope that the "right sense of judgement will prevail so that we will not lead mankind to annhilition. That is our responsibility"** in the words of Yoshitaka Kawamoto, one of the survivors.

We are indebted to many sources, now freely available, on many websites. These are mentioned at the end of each section. We are grateful to all those people who have spared time and effort to put together these websites. While we have made use of the available material freely in this booklet, the responsibility for any errors lies solely with us.

J.R. Oppenheimer, scientific leader of the Manhattan project, who also played a major role in the decision to drop the bombs

Major General L.R. Groves, looking at Japan on a map of the Pacific. Groves was the military leader of the Manhattan project, where the first atomic bombs were developed

Chapter 2

The Decision

The beginning

In the summer of 1939, six months after the discovery of uranium fission by German scientists, the prospect of atomic energy and its military use was being discussed. No official U.S. atomic energy project existed as yet. Physicist Leo Szilard was profoundly disturbed by the possibility that Nazi Germany might make atomic bombs using the new developments in nuclear fission, leading to disastrous consequences for the rest of the world. He was troubled by the fact that Germany had stopped the sale of uranium ore from occupied Czechoslovakia. Convinced of the need to continue experiments, Szilard turned to Albert Einstein for help.

As a life-long pacifist, Einstein was opposed the making of weapons, but he could not allow the Nazis sole possession of such destructive power. He agreed to write the letter marking the beginning of the atomic age. The letter was sent to the President of United States, F. D. Roosevelt, on 2nd August 1939. In his letter Einstein wrote,

> "Some recent work by E. Fermi and L. Szilard, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation which has arisen seem to call for watchfulness and, if necessary, quick action on the part of the Administration. I believe therefore that it is my duty to bring to your attention the following facts and recommendations:
>
> In the course of the last four months it has been made probable- through the work of Joliot in France as well as Fermi and Szilard in America- that it may become possible to set up a nuclear chain reaction in a large mass of uranium, by which vast amounts of power and large quantities of new radium-like elements would be generated. Now it appears almost certain that this could be achieved in the immediate future.
>
> This new phenomenon would also lead to the construction of bombs, and it is conceivable- though much less certain- that extremely pow-

erful bombs of a new type may thus be constructed. A single bomb of this type, carried by boat and exploded in a port, might very well destroy the whole port together with some of the surrounding territory. However. such bombs might very well prove to be too heavy for transportation by air.

The United States has only very poor ores of uranium in moderate quantities. There is some good ore in Canada and the former Chechoslovakia, while the most important source of uranium is Belgian Congo.

In view of this situation you may think it desirable to have some permanant contact maintained between the Administration and the group of physicists working on chain reactions in America. One possible way of achieving this might be for you to entrust with this task a person who has your confidence and who could perhaps serve in an unofficial capacity. His task might comprise the following:

a) to approach Government Departments, keep them informed of the further development, and put forward recommendations for Government action giving particular attention to the problem of securing a supply of uranium ore for the United States.

b) to speed up the experimental work, which is at present being carried on within the limits of the budgets of University laboratories, by providing funds, if such funds be required, through his contacts with private persons who are willing to make contributions for this cause, and perhaps also by obtaining the co-operation of industrial laboratories which have the necessary equipment.

I understand that Germany has actually stopped the sale of uranium from the Chechoslovakian mines which she has taken over. That she would have taken such early action might perhaps be understood on the ground that the son of the German Under-secretary of State, von Weisacker, is attached to the Kaiser-Wilhelm Institut in Berlin where some of the American work on uranium is now being repeated."

For the next two years, official skepticism continued to stall U.S. research efforts. A large-scale U.S. atomic project did not begin until December 6, 1941, one day before the bombing of Pearl Harbor. It became the "Manhattan" Project in August 1942 and thus begins the most active phase of the atomic age.

Unfolding of the Tragedy

By the beginning of 1945 it was clear that the atom bomb was a reality. Most of the loose ends had been fixed and work was in full swing towards the actual testing of the bomb. The details of the "Manhattan Project" has been documented by both historians and the scientists who were involved in the project directly. In what follows we reproduce several original documents related to the decision to use the atomic bomb.

We should however note that with the surrender of Germany in early May 1945, the European war had ended. The focus had shifted to the Pacific where Japan was still at war with U.S. and allies. A target committee was entrusted with the task of identifying the bomb targets. The committee consisted of many military personnel involved in the Manhattan Project and several Scientist Leaders of the projects. The document produced by the committee is detailed and goes into various aspects of target selection. Excerpts from the original top secret minutes are given below:

Target Committee, Los Alamos, May 10-11, 1945
12 May 1945

Memorandum For: Major General L. R. Groves

Subject: Summary of Target Committee Meetings on 10 and 11 May 1945

1. The second meeting of the Target Committee convened at 9:00 AM 10 May in Dr. Oppenheimer's office at Site Y with the following present:

General Farrell, Dr. C. Lauritsen, Colonel Seeman, Dr. Ramsey, Captain Parson, Dr. Dennison, Major Derry, Dr. von Neumann, Dr. Stearns, Dr. Wilson, Dr. Tolman, Dr. Penne, Dr. Oppenheimer.

Dr. Bethe and Dr. Brode were brought into the meeting for discussion of Item A of the agenda. During the course of the meeting panels were formed from the committee members and others to meet in the afternoon and develop conclusions to items discussed in the agenda. The concluding meeting was held at 10:00 AM 11 May in Dr. Oppenheimer's office with the following present:

Colonel Seeman, Dr. Stearns, Captain Parsons, Dr. Von Neumann, Major Derry, Dr. Dennison, Dr. Tolman, Dr. Penney, Dr. Oppenheimer, Dr. Ramsey, Dr. Wilson.

After the technical discussions in section A-C, the report comes to the reasoning behind the choice of targets,

D: Status of Targets:

A. Dr. Stearns described the work he had done on target selection. He has surveyed possible targets possessing the following qualification: (1) they be important targets in a large urban area of more than three miles in diameter, (2) they be capable of being damaged effectively by a blast, and (3) they are unlikely to be attacked by next August. Dr. Stearns had a list of five targets which the Air Force would be willing to reserve for our use unless unforeseen circumstances arise. These targets are:

(1) Kyoto - This target is an urban industrial area with a population of 1,000,000. It is the former capital of Japan and many people and industries are now being moved there as other areas are being destroyed. From the psychological point of view there is the advantage that Kyoto is an intellectual center for Japan and the people there are more apt to appreciate the significance of such a weapon as the gadget. (Classified as an AA Target)

(2) Hiroshima - This is an important army depot and port of embarkation in the middle of an urban industrial area. It is a good radar target and it is such a size that a large part of the city could be extensively damaged. There are adjacent hills which are likely to produce a focussing effect which would considerably increase the blast damage. Due to rivers it is not a good incendiary target. (Classified as an AA Target)

(3) Yokohama - This target is an important urban industrial area which has so far been untouched. Industrial activities include aircraft manufacture, machine tools, docks, electrical equipment and oil refineries. As the damage to Tokyo has increased additional industries have moved to Yokohama. It has the disadvantage of the most important target areas being separated by a large body of water and of being in the heaviest anti-aircraft concentration in Japan. For us it has the advantage as an alternate target for use in case of bad weather of being rather far removed from the other targets considered. (Classified as an A Target)

(4) Kokura Arsenal - This is one of the largest arsenals in Japan and is surrounded by urban industrial structures. The arsenal is important for light ordnance, anti-aircraft and beach head defense materials. The dimensions of the arsenal are 4100' x 2000'. The dimensions are such that if the bomb were properly placed full advantage could be taken of the higher pressures immediately underneath the bomb for destroying the more solid structures and at the same time considerable blast damage could be done to more feeble structures further away. (Classified as an A Target)

(5) Niigata - This is a port of embarkation on the N.W. coast of Honshu. Its importance is increasing as other ports are damaged. Machine tool industries are located there and it is a potential center for industrial dispersion. It has oil refineries and storage. (Classified as a B Target)

(6) The possibility of bombing the Emperor's palace was discussed. It was agreed that we should not recommend it but that any action

for this bombing should come from authorities on military policy. It was agreed that we should obtain information from which we could determine the effectiveness of our weapon against this target.

B. It was the recommendation of those present at the meeting that the first four choices of targets for our weapon should be the following:

a. Kyoto b. Hiroshima c. Yokohama d. Kokura Arsenal

C. Dr. Stearns agreed to do the following: (1) brief Colonel Fisher thoroughly on these matters, (2) request reservations for these targets, (3) find out more about the target area including exact locations of the strategic industries there, (4) obtain further photo information on the targets, and (5) to determine the nature of the construction, the area, heights, contents and roof coverage of buildings. He also agreed to keep in touch with the target data as it develops and to keep the committee advised of other possible target areas. He will also check on locations of small military targets and obtain further details on the Emperor's palace.

E. Psychological Factors in Target Selection

A. It was agreed that psychological factors in the target selection were of great importance. Two aspects of this are (1) obtaining the greatest psychological effect against Japan and (2) making the initial use sufficiently spectacular for the importance of the weapon to be internationally recognized when publicity on it is released.

B. In this respect Kyoto has the advantage of the people being more highly intelligent and hence better able to appreciate the significance of the weapon. Hiroshima has the advantage of being such a size and with possible focussing from nearby mountains that a large fraction of the city may be destroyed. The Emperor's palace in Tokyo has a greater fame than any other target but is of least strategic value.

F. Use Against "Military" Objectives

A. It was agreed that for the initial use of the weapon any small and strictly military objective should be located in a much larger area subject to blast damage in order to avoid undue risks of the weapon being lost due to bad placing of the bomb.

The report goes on to discuss other technical and operational aspects of the bombing mission. While the target committee, consisting of scientists and military personnel from the Los Alamos division of the Manhattan Project, was discussing the use of the gadget, several other scientists else where were beginning to worry about the consequences of its use. The Franck Report, written by a seven-man panel of scientists at the University of Chicago, urged that the bomb be demonstrated "before the eyes of representatives of all United Nations, on a desert or a barren island". The report is long, detailed and addresses extremely complex and important questions. In many ways the pronouncement of the members was prophetic if one looks back at the last fifty years of the atomic age. We reproduce the summary of the report.

The Franck Report
June 11, 1945

> Report of the Committee on Political and Social Problems, Manhattan Project "Metallurgical Laboratory", University of Chicago, June 11, 1945
>
> Members of the Committee: James Franck (Chairman), Donald J. Hughes, J. J. Nickson, Eugene Rabinowitch, Glenn T. Seaborg, J. C. Stearns, Leo Szilard
>
> **Summary:**
>
> The development of nuclear power not only constitutes an important addition to the technological and military power of the United States, but also creates grave political and economic problems for the future of this country.
>
> Nuclear bombs cannot possibly remain a "secret weapon" at the exclusive disposal of this country, for more than a few years. The scientific facts on which their construction is based are well known to scientists of other countries. Unless an effective international control of nuclear explosives is instituted, a race of nuclear armaments is certain to ensue following the first revelation of our possession of nuclear weapons to the world. Within ten years other countries may have nuclear bombs, each of which, weighing less than a ton, could destroy an urban area of more than five square miles. In the war to which such an armaments race is likely to lead, the United States, with its agglomeration of population and industry in comparatively few metropolitan districts, will be at a disadvantage compared to the nations whose population and industry are scattered over large areas.
>
> We believe that these considerations make the use of nuclear bombs for an early, unannounced attack against Japan inadvisable. If the United States would be the first to release this new means of indiscriminate destruction upon mankind, she would sacrifice public support throughout the world, precipitate the race of armaments, and prejudice the possibility of reaching an international agreement on the future control of such weapons.
>
> Much more favorable conditions for the eventual achievement of such an agreement could be created if nuclear bombs were first re-

vealed to the world by a demonstration in an appropriately selected uninhabited area.

If chances for the establishment of an effective international control of nuclear weapons will have to be considered slight at the present time, then not only the use of these weapons against Japan, but even their early demonstration may be contrary to the interests of this country. A postponement of such a demonstration will have in this case the advantage of delaying the beginning of the nuclear armaments race as long as possible. If, during the time gained, ample support could be made available for further development of the field in this country, the postponement would substantially increase the lead which we have established during the present war, and our position in an armament race or in any later attempt at international agreement will thus be strengthened.

On the other hand, if no adequate public support for the development of nucleonics will be available without a demonstration, the postponement of the latter may be deemed inadvisable, because enough information might leak out to cause other nations to start the armament race, in which we will then be at a disadvantage. At the same time, the distrust of other nations may be aroused by a confirmed development under cover of secrecy, making it more difficult eventually to reach an agreement with them.

If the government should decide in favor of an early demonstration of nuclear weapons it will then have the possibility to take into account the public opinion of this country and of the other nations before deciding whether these weapons should be used in the war against Japan. In this way, other nations may assume a share of the responsibility for such a fateful decision.

To sum up, we urge that the use of nuclear bombs in this war be considered as a problem of long-range national policy rather than military expediency, and that this policy be directed primarily to the achievement of an agreement permitting an effective international control of the means of nuclear warfare.

The vital importance of such a control for our country is obvious from the fact that the only effective alternative method of protecting this country, of which we are aware, would be a dispersal of our major cities and essential industries.

Despite the arguments against the bomb made by the Franck report, a scientific panel composed of Oppenheimer, Fermi, Compton and Lawrence found "no acceptable alternative to direct military use":

Recommendations on the Immediate Use of Nuclear Weapons, by the Scientific Panel of the Interim Committee on Nuclear Power

A. H. Compton, E. O. Lawrence, J. R. Oppenheimer, E. Fermi
(signature) J. R. Oppenheimer, For the Panel

June 16, 1945

> You have asked us to comment on the initial use of the new weapon. This use, in our opinion, should be such as to promote a satisfactory adjustment of our international relations. At the same time, we recognize our obligation to our nation to use the weapons to help save American lives in the Japanese war.
>
> (1) To accomplish these ends we recommend that before the weapons are used not only Britain, but also Russia, France, and China be advised that we have made considerable progress in our work on atomic weapons, that these may be ready to use during the present war, and that we would welcome suggestions as to how we can cooperate in making this development contribute to improved international relations.
>
> (2) The opinions of our scientific colleagues on the initial use of these weapons are not unanimous: they range from the proposal of a purely technical demonstration to that of the military application best designed to induce surrender. Those who advocate a purely technical demonstration would wish to outlaw the use of atomic weapons, and have feared that if we use the weapons now our position in future negotiations will be prejudiced. Others emphasize the opportunity of saving American lives by immediate military use, and believe that such use will improve the international prospects, in that they are more concerned with the prevention of war than with the elimination of this specific weapon. We find ourselves closer to these latter views; we can propose no technical demonstration likely to bring an end to the war; we see no acceptable alternative to direct military use.
>
> (3) With regard to these general aspects of the use of atomic energy, it is clear that we, as scientific men, have no proprietary rights. It is true that we are among the few citizens who have had occasion to give thoughtful consideration to these problems during the past few years. We have, however, no claim to special competence in solving the political, social, and military problems which are presented by the advent of atomic power.

Surprisingly, an important warning against the use of the atom bomb also came from some members of the administration. Undersecretary of the Navy Ralph A Bard wrote the following memorandum:

Memorandum on the use of S-1 Bomb
June 27, 1945

> Ever since I have been in touch with this program I have had a feeling that before the bomb is actually used against Japan that Japan should have some preliminary warning for say two or three days in advance of use. The position of the United States as a great humanitarian nation and the fair play attitude of our people generally is responsible in the main for this feeling.
>
> During recent weeks I have also had the feeling very definitely that the Japanese government may be searching for some opportunity which they could use as a medium of surrender. Following the three-power conference, emissaries from this country could contact representatives from Japan somewhere on the China Coast and make representations with regard to Russia's position and at the same time give them some information regarding the proposed use of atomic power, together with whatever assurances the President might care to make with regard to the Emperor of Japan and the treatment of the Japanese nation following unconditional surrender. It seems quite possible to me that this presents the opportunity which the Japanese are looking for.
>
> I don't see that we have anything in particular to lose in following such a program. The stakes are so tremendous that it is my opinion very real consideration should be given to some plan of this kind. I do not believe under present circumstances existing that there is anyone in this country whose evaluation of the chances of the success of such a program is worth a great deal. The only way to find out is to try it out.

While the scientific leadership of the Manhattan Project was hawkish in recommending the targets for actual use of the bomb, the scientists in Chicago. Oakridge and other laboratories were more concerned. The first version of Leo Szilard's petition was circulated around on July 3, 1945.

The July 3 version received 59 signatures at the Chicago Metallurgical Laboratory, but it was not submitted to the President in this form. Szilard sought to broaden support, and rewrote it into the final version of July 17. Some excerpts from the original petition:

The Szilard petition
July 3, 1945

> We, the undersigned scientists, have been working in the field of atomic power for a number of years. Until recently we have had to reckon with the possibility that the United States might be attacked by atomic bombs during this war and that her only defense might

> lie in a counterattack by the same means. Today with this danger averted we feel impelled to say what follows:
>
> The war has to be brought speedily to a successful conclusion and the destruction of Japanese cities by means of atomic bombs may very well be an effective method of warfare. We feel, however, that such an attack on Japan could not be justified in the present circumstances. We believe that the United States ought not to resort to the use of atomic bombs in the present phase of the war, at least not unless the terms which will be imposed upon Japan after the war are publicly announced and subsequently Japan is given an opportunity to surrender....
>
> Atomic power will provide the nations with new means of destruction. The atomic bombs at our disposal represent only the first step in this direction and there is almost no limit to the destructive power which will become available in the course of this development. Thus a nation which sets the precedent of using these newly liberated forces of nature for purposes of destruction may have to bear the responsibility of opening the door to an era of devastation on an unimaginable scale.
>
> In view of the foregoing, we, the undersigned, respectfully petition that you exercise your power as Commander-in-Chief to rule that the United States shall not, in the present phase of the war, resort to the use of atomic bombs.
>
> (Signed by Leo Szilard and 58 co-signers)

The Szilard petition immediately inspired a similar petition at the Manhattan project laboratory at Oak Ridge. Excerpts of the Oak Ridge:

The Oak Ridge petition
mid-July 1945

> We, the undersigned scientific personnel of the Clinton Laboratories, believe that the world-wide social and political consequences of the power of the weapon now being developed on this Project impose a special moral obligation on the government and people of the United States in introducing the weapon in warfare.
>
> It is further believed that the power of this weapon should be made known by demonstration to the peoples of the world, irrespective of the course of the present conflict, for in this way the body of world opinion may be made the determining factor in the absolute preservation of peace.
>
> (Signed by 67 personnel)

By now it was also becoming clear that Japan, while still being at war, was suing for peace through the Russians. Several communications between the

Japanese ambassador to Russia and the Japanese Prime Minister were intercepted by the U.S. Military.

Intercepted cables on July 12-13 showed Japan's Emperor had intervened to attempt to end the war. They also showed Japan responding positively to a U.S. offer of a surrender based on the "Atlantic Charter" as put forward in an official American radio broadcast on July 21, 1945.

The Atlantic Charter was the declaration of peace aims set forth by Roosevelt and Churchill on August 14, 1941 and later (January 1942) affirmed by representatives of 26 nations. Its key passage and promise lay in the third point, a declaration that the signatory nations "respect the right of all peoples to choose the form of government under which they will live; and they wish to see sovereign rights and self-government restored to those who have been forcibly deprived of them." (This would have allowed Japan to keep its Emperor). The broadcast was allowed to stand with Presidential sanction, but U.S. officials chose to ignore this indication of Japan's willingness to surrender.

On July 25, an intercepted message from Japanese Foreign Minister Togo to Ambassador Sato in Moscow cited the radio broadcast–and stated without reservation:

> "The fact that the Americans alluded to the Atlantic Charter is particularly worthy of attention at this time. It is impossible for us to accept unconditional surrender, no matter in what guise, but it is our idea to inform them by some appropriate means that there is no objection to the restoration of peace on the basis of the Atlantic Charter."

The Trinity Test tower; the explosion took place at the top

The success of the first atomic bomb test changed the political climate of the day and the years to follow for ever. The Trinity Test, the test of the atomic bomb in the New Mexico desert, that took place on July 16, 1945 was a spectacular success. The test date itself was set in such a way that the President of the United States, Harry Truman, would have the results on hand before the beginning of the meeting of the superpower leaders at Potsdam in Germany.

Many accounts of the period recounted by the civilian and political leadership of the time indicate that after the Trinity Test, the diplomatic end to the Pacific war was not even seriously considered. The main focus shifted to the role Russia would play in such a scenario (and the importance gained therefrom). The immense desire to be the sole superpower of the world in control of all international affairs seems to have overridden any humanitarian or moral obligations.

Even in the background of this powerplay, Truman did think for a while that he was actually ordering the atomic bombing of a military target, as he noted in his diary:

The Truman diary entry
July 25, 1945

> We have discovered the most terrible bomb in the history of the world. It may be the fire destruction prophesied in the Euphrates Valley Era, after Noah and his fabulous Ark.
>
> Anyway we "think" we have found the way to cause a disintegration of the atom. An experiment in the New Mexico desert was startling - to put it mildly. Thirteen pounds of the explosive caused the complete disintegration of a steel tower 60 feet high, created a crater 6 feet deep and 1,200 feet in diameter, knocked over a steel tower 1/2 mile away and knocked men down 10,000 yards away. The explosion was visible for more than 200 miles and audible for 40 miles and more.
>
> This weapon is to be used against Japan between now and August 10th. I have told the Sec. of War, Mr. Stimson, to use it so that military objectives and soldiers and sailors are the target and not women and children. Even if the Japs are savages, ruthless, merciless and fanatic, we as the leader of the world for the common welfare cannot drop that terrible bomb on the old capital or the new.
>
> He and I are in accord. The target will be a purely military one and we will issue a warning statement asking the Japs to surrender and save lives. I'm sure they will not do that, but we will have given them the chance. It is certainly a good thing for the world that Hitler's crowd or Stalin's did not discover this atomic bomb. It seems to be the most terrible thing ever discovered, but it can be made the most useful...

Note that the diary entry says that a warning was to be issued and also that it should not target women and children. Nevertheless, when the actual order of bombing was issued, there was no mention of Truman's concerns:

The Handy Order
July 25, 1945

25 July 1945

To: General Carl Spaatz
Commanding General
United States Army Strategic Air Forces

1. The 509 Composite Group, 20th Air Force will deliver its first special bomb as soon as weather will permit visual bombing after about 3 August 1945 on one of the targets: Hiroshima, Kokura, Niigata and Nagasaki. To carry military and civilian scientific personnel from the War Department to observe and record the effects of the explosion of the bomb, additional aircraft will accompany the airplane carrying the bomb. The observing planes will stay several miles distant from the point of impact of the bomb.

2. Additional bombs will be delivered on the above targets as soon as made ready by the project staff. Further instructions will be issued concerning targets other than those listed above.

3. Discussion of any and all information concerning the use of the weapon against Japan is reserved to the Secretary of War and the President of the United States. No communiques on the subject or releases of information will be issued by Commanders in the field without specific prior authority. Any news stories will be sent to the War Department for specific clearance.

4. The foregoing directive is issued to you by direc- tion and with the approval of the Secretary of War and of the Chief of Staff, USA. It is desired that you personally deliver one copy of this directive to General MacArthur and one copy to Admiral Nimitz for their information.

(Sgd) Thos. T. Handy
Thos. T. Handy, General, G.S.C. Acting Chief of Staff

The actual bombing of Hiroshima took place on August 6, 1945. Followed by Nagasaki on August 9. Even in his radio speech, after the bombing on August 9, 1945, Truman referred to Hiroshima as a military base:

"...The world will note that the first atomic bomb was dropped on Hiroshima, a military base. That was because we wished in this first attack to avoid, insofar as possible, the killing of civilians. But that attack is only a warning of things to come. If Japan does not

> surrender, bombs will have to be dropped on her war industries and, unfortunately, thousands of civilian lives will be lost. I urge Japanese civilians to leave industrial cities immediately, and save themselves from destruction."

But Hiroshima was not a military base, as the Target Committee had already noted. Indeed it was a thickly populated city, which was one of the reasons why it was chosen; it had been kept apart from earlier bombing raids to provide a clean target for atomic bombings. Nor were the lives of civilians spared subsequently, since Nagasaki was bombed three days later.

In many recorded interviews, members of the U.S. administration later claimed that these bombings achieved an end of the Pacific war and saved nearly a quarter of a million American lives.

In various statements, President Truman asserts that he "made that decision because I thought 200,000 of our young men would be saved by making that decision, and some 300,000 or 400,000 of the enemy would be saved by making that decision" (April 6, 1949). He repeats this figure in several of his subsequent addresses as also for the offical history of the Air Force in World War II.

These numbers appear to have been invented as a post-facto justification. The primary source of this figure seems to be based on the estimate of nearly million casualities offered by Truman's secretary Henry Stimson- "the major fighting would not end until the latter part of 1946, at the earliest. I was informed that such operations might be expected to cost over a million casualities, to American forces alone." (Harper's Magazine, 1947.)

Not only do later studies not offer any convincing evidence of these estimates, the highest estimate given in earlier planning reports (prepared prior to the bombings), was in the range of 40,000–60,000 and this assumed full scale invasion. In fact, if the same terms of surrender had been given prior to the bombing of Hiroshima and Nagasaki as those that were offered later, perhaps much fewer casualities would have resulted.

The Military View

In all the original accounts of the crucial four month period from May 1945 to August 1945, we have not encountered the Military point of view, in particular of the Generals and others who were actually present in the Pacific theatre of war. Many of these were recounted later in many interviews and memoirs written by the military leaders.

The Joint Chiefs of Staff never formally studied the decision and never made an official recommendation to the President. Brief informal discussions may have occurred, but no records exist of these. There is no record whatsoever of the usual extensive staff work and evaluation of alternative options by the Joint Chiefs, nor did the Chiefs ever claim to be involved.

In official internal military interviews, diaries and other private as well as public materials, literally every top U.S. military leader

involved subsequently stated that the use of the bomb was not dictated by military necessity.

We reproduce below excerpts from some of these views:

Navy Admirals

In his memoirs Admiral William D. Leahy, the President's Chief of Staff—and the top official who presided over meetings of both the Joint Chiefs of Staff and the Combined U.S.-U.K. Chiefs of Staff—minced no words:

> "The use of this barbarous weapon at Hiroshima and Nagasaki was of no material assistance in our war against Japan. The Japanese were already defeated and ready to surrender. . . .
>
> In being the first to use it, we . . . adopted an ethical standard common to the barbarians of the Dark Ages. I was not taught to make war in that fashion, and wars cannot be won by destroying women and children."

Air Force Generals

The commanding general of the U.S. Army Air Forces, Henry H. "Hap" Arnold, gave a strong indication of his views in a public statement only eleven days after Hiroshima was attacked. Asked on August 17 by a New York Times reporter whether the atomic bomb caused Japan to surrender, Arnold said:

> "The Japanese position was hopeless even before the first atomic bomb fell, because the Japanese had lost control of their own air."

General Carl Spaatz, who commanded the U.S. Army Strategic Air Force in July 1945 stated in an official 1962 interview:

> "I thought that if we were going to drop the atomic bomb, drop it on the outskirts—say in Tokyo Bay—so that the effects would not be as devastating to the city and the people. I made this suggestion over the phone between the Hiroshima and Nagasaki bombings and I was told to go ahead with our targets."

Spaatz insisted on receiving written orders before going forward with the atomic bombings in 1945. He also commented that the decision to drop the bomb was purely a political decision and not a military one.

Army Generals

On the 40th Anniversary of the bombing former President Richard M. Nixon reported that:

> "[General Douglas] MacArthur once spoke to me very eloquently about it, pacing the floor of his apartment in the Waldorf. He thought it a tragedy that the Bomb was ever exploded. MacArthur

believed that the same restrictions ought to apply to atomic weapons as to conventional weapons, that the military objective should always be limited damage to noncombatants. . . . MacArthur, you see, was a soldier. He believed in using force only against military targets, and that is why the nuclear thing turned him off. . . ."

In his memoirs Dwight D. Eisenhower reports the following reaction when Secretary of War Stimson informed him the atomic bomb would be used:

"During his recitation of the relevant facts, I had been conscious of a feeling of depression and so I voiced to him my grave misgivings, first on the basis of my belief that Japan was already defeated and that dropping the bomb was completely unnecessary, and secondly because I thought that our country should avoid shocking world opinion by the use of a weapon whose employment was, I thought, no longer mandatory as a measure to save American lives. . . ."

The Final Word

We began this article with Szilard's prodding of Einstein regarding the developments in the field of nuclear fission and its deeper underpinnings. Szilard reflected on many developments during the crucial months of 1945 and had this to say in an interview on August 15, 1960 (some excerpts):

Leo Szilard, photographed at Oxford

How the other scientists felt: "Very many other scientists felt this way. This is particularly true of Oak Ridge and the Metallurgical Laboratory of the University of Chicago. I don't know how the scientists felt at Los Alamos."

Did he get a full hearing: "When I was asked to go to the White House and see Matt Connelly, Truman's Appointments Secretary, I suggested to Walter Bartky, associate director of our project, that he accompany me. Mr. Connelly read my memorandum with attention ... He told us that the President had an inkling of what our business might be and that he wanted us to go to Spartanburg and see James Byrnes. We didn't know why we were sent to see Byrnes, since at that point Byrnes held no Government position."

"... When I saw Mr. Byrnes I was very much concerned about the fact that no governmental policy had been developed on the issue of how to cope with the problem that the bomb would pose to the world. I raised the question of whether it might be wise to gain time for developing such a governmental policy by postponing the testing of the bomb. It seemed to me that once the bomb had been tested its existence could not be kept secret for long. Byrnes did not think that postponing the test was a good idea, and, in retrospect, I am inclined to agree with him. In retrospect, I don't think that postponing the test would have solved our problem."

"Byrnes was concerned about Russia's having taken over Poland, Rumania and Hungary, and so was I. Byrnes thought that the possession of the bomb by America would render the Russians more manageable in Europe. I failed to see how sitting on a stockpile of bombs, which in the circumstances we could not possibly use, would have this effect, and I thought it even conceivable that it would have just the opposite effect."

"When I returned to Chicago and learned that Byrnes had been appointed Secretary of State, I concluded that the arguments that I regarded as important would receive no consideration. I didn't realize at that time that Secretary Stimson would play a major role in the final decision and that he might be able to understand my point of view better than Mr. Byrnes had done."

"In Chicago I collaborated in the writing of the so-called Franck Report. This report was addressed to Secretary Stimson, but none of those who participated in the writing of the report, including Prof. James Franck, had an opportunity to see Mr. Stimson."

"In the meantime I drafted a petition to the President which did not go into any considerations of expediency but opposed, on purely moral grounds, the use of atomic bombs against the cities of Japan. This petition was signed by about 60 members of the Chicago project. Some of those who signed insisted that the petition be transmitted to the President through "official channels." To this I reluctantly agreed. I was, at this point, mainly concerned that the members of the project had an opportunity to go on record on this issue, and I didn't think that the petition would be likely to have an effect on the course of events. The petition was sent to the President through official channels, and I should not be too surprised if it were discovered one of these days that it hadn't ever reached him."

Was a demonstration of the bomb feasible?: "It is easy to see, at least in retrospect, how an effective demonstration could have been staged. We could have communicated with Japan through regular diplomatic channels - say, through Switzerland - and explained to the Japanese that we didn't want to kill anybody, and therefore proposed that one city—say, Hiroshima—be evacuated. Then one single bomber would come and drop one single bomb."

"But again, I don't believe this staging a demonstration was the real issue, and in a sense it is just as immoral to force a sudden ending of a war by threatening violence as by using violence. My point is that violence would not have been necessary if we had been willing to negotiate. After all, Japan was suing for peace."

How the bomb boomeranged: "I think it made it very difficult for us to take the position after the war that we wanted to get rid of atomic bombs because it would be immoral to use them against the civilian population. We lost the moral argument with which, right after the war, we might have perhaps gotten rid of the bomb."

"Let me say only this much to the moral issue involved: Suppose Germany had developed two bombs before we had any bombs. And suppose Germany had dropped one bomb, say, on Rochester and the other on Buffalo, and then having run out of bombs she would have lost the war. Can anyone doubt that we would then have defined the dropping of atomic bombs on cities as a war crime, and that we would have sentenced the Germans who were guilty of this crime to death at Nuremberg and hanged them?"

"But, again, don't misunderstand me. The only conclusion we can draw is that governments acting in a crisis are guided by questions of expediency, and moral considerations are given very little weight, and that America is no different from any other nation in this respect."

About obligations of a great power: "Great power imposes the obligation of exercising restraint, and we did not live up to this obligation. I think this affected many of the scientists in a subtle sense, and it diminished their desire to continue to work on the bomb."

Truman did not understand: "I think it depends on the person of the President. Truman did not understand what was involved. You can see that from the language he used. Truman announced the bombing of Hiroshima while he was at sea coming back from Potsdam, and his announcement contained the phrase—I quote from the New York "Times" of August 7, 1945: "We have spent 2 billion dollars on the greatest scientific gamble in history—and won."

To put the atomic bomb in terms of having gambled 2 billion dollars and having "won" offended my sense of proportions, and I concluded at that time that Truman did not understand at all what was involved."

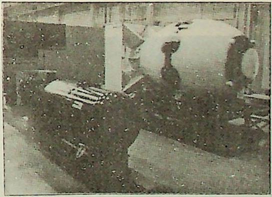
Sources

1. *http://www.dannen.com/decision/* - Atomic Bomb: Decision - contains the original, now declassified, documents on the decision to use atomic bombs on the cities of Hiroshima and Nagasaki.

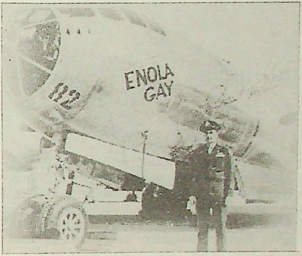
2. *http://www.dannen.com/szilard.html/* - The Leo Szilard page, which not only contains various reports of the time, but also has details on the role played by Leo Szilard and other scientists.

3. *http://www.peak.org/danneng/decision/usnews.html* - Authorised web-reprint of the full text of the Leo Szilard interview, "President Truman did not understand".

4. *http:/www.doug-long.com* - Hiroshima: Was it necessary? A personal exploration of morality and WW-II military history. An excellent analysis of the events in 1945.



The atomic bombs, Little Boy and Fat Man, that were dropped on Hiroshima and Nagasaki exactly 09:15 plus 15 seconds[2] the world's first atomic bomb exploded. The course of history and the nature of warfare was changed.



Col. Paul Tibbets, photographed with the Enola Gay

Nagasaki

Excerpts from the release written by William L. Laurence, Science writer for the New York Times, and Special Consultant to the Manhattan Engineer District and Pulitzer Prize winner are given below.

"We are on our way to bomb the mainland of Japan. Our flying contingent consists of three specially designed B-29 Superforts, and two of these carry no bombs. But our lead plane is on its way with another atomic bomb, the second in three days, concentrating its active substance, and explosive energy equivalent to 20,000, and under favourable conditions, 40,000 tons of TNT.

"We have several chosen targets. One of these is the great industrial and shipping center of Nagasaki, on the western shore of Kyushu, one of the main islands of the Japanese homeland ..."

"This atomic bomb is different from the bomb used three days ago with such devastating results on Hiroshima[3] ..."

"The briefing period ended with a moving prayer by the Chaplain. We then proceeded to the mess hall for the traditional early morning breakfast before departure on a bombing mission ..."

"In command of our mission is Major Charles W. Sweeney ... Major Sweeney's co-pilot is First Lieutenant Charles D. Albury ..."

[2]The time of explosion of both the Hiroshima and Nagasaki bombs, given in these accounts, are one hour ahead of Japanese local time: Ed.

[3]This was a plutonium bomb and not a uranium one unlike the one dropped on Hiroshima: Ed.

"The other two Superforts in our formation are instrument planes, carrying special apparatus to measure the power of the bomb at the time of explosion, high speed cameras and other photographic equipment ..."

"We took off at 3:50 this morning and headed northwest on a straight line for the Empire ... We reached Yakoshima at 9:12 and there, about 4,000 feet ahead of us, was "The Great Artiste"[4] with its precious load ..."

"The winds of destiny seemed to favour certain Japanese cities that must remain nameless. We circled about them again and again and found no opening in the thick umbrella of clouds that covered them. Destiny chose Nagasaki as the ultimate target ..."

"We flew southward down the channel and at 11:33 crossed the coastline and headed straight for Nagasaki about a hundred miles to the west. Here again we circled until we found an opening in the clouds. It was 12:01 and the goal of our mission had arrived."

"We heard the pre-arranged signal on our radio, put on our ARC welder's glasses and watched tensely the maneuverings of the strike ship about half a mile in front of us."

"'There she goes!' someone said. Out of the belly of the Artiste what looked like a black object came downward."

"Captain Bock swung around to get out of range, but even though we were turning away in the opposite direction, and despite the fact that it was broad daylight in our cabin, all of us became aware of a giant flash that broke through the dark barrier of our ARC welder's lenses and flooded our cabin with an intense light."

"We removed our glasses after the first flash but the light still lingered on, a bluish-green light that illuminated the entire sky all around. A tremendous blast wave struck our ship and made it tremble from nose to tail. This was followed by four more blasts in rapid succession, each resounding like the boom of cannon fire hitting our plane from all directions."

"Observers in the tail of our ship saw a giant ball of fire rise as though from the bowels of the earth, belching forth enormous white smoke rings. Next they saw a giant pillar of purple fire, 10,000 feet high, shooting skyward with enormous speed."

"By the time our ship had made another turn in the direction of the atomic explosion the pillar of purple fire had reached the level of our altitude. Only about 45 seconds had passed. Awe-struck, we watched it shoot upward like a meteor coming from the earth instead of from outer space, becoming ever more alive as it climbed skyward through the white clouds. It was no longer smoke, or dust, or even a cloud of fire. It was a living thing, a new species of being, born right before our incredulous eyes ..."

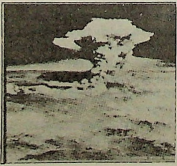
Note that Laurence's account could equally well have been describing the bombing of a desert, with no human inhabitation anywhere. To say that "destiny

[4] Actually, it was the "Bock's car" which carried the bomb. Captain Bock and Captain Sweeney had exchanged planes for the mission: Ed.

chose Nagasaki as the ultimate target" shows a callous disregard for life. The poetic description is devoid of any concern for the people of Nagasaki who were the most unfortunate victims of the second world war. Their misfortune acquires a more tragic dimension when it is realised that the bombing of Nagasaki was probably an experiment and not a military manouvre.

Sources

1. *http://www.csi.ad.jp/ABOMB* - This site contains the quotation from Paul Tibbet reproduced in this chapter (special report, "Hiroshima: August 6, 1945"). It also contains lots of other material including photographs related to the atomic bombings.
2. *http://www.theenolagay.com/* - For information on the Hiroshima bombing misison- also contains biographical details about Paul Tibbets.
3. *http://www.enviroweb.org/issues/nuketesting/hiroshim/laurencl.htm* - Trinity atomic web site. This site contains the eyewitness account of the Nagasaki bombing.



Mushroom clouds over Hiroshima and Nagasaki from the atomic bombing

Chapter 4

The Hibakusha

The Hiroshima bomb exploded 570 meters above the city and left about 1,40,000 people dead. The Nagasaki bomb, exploding 600 meters above the city, killed about 74,000[1]. Many "Hibakusha", the atom bomb survivors, have recorded their experiences in the hope that it would help in preventing a repetition of such a tragedy. We reproduce some of the Hiroshima accounts here. The stories from Nagasaki are frighteningly the same. They are presented in the order of increasing distance from the hypocenter (from the centre of the explosion).

Ms. Akiko Takakura

Ms. Akiko Takakura was 20 years old when the bomb fell. She was in the bank of Hiroshima, 300 meters away from the hypocenter. Ms.Takakura miraculously escaped death despite. She is one of the few survivors who was within 300 meters of the hypocenter.

Takakura: After the air-raid alarm was called off, I walked from Hatchobori to the bank of Hiroshima in Kamiya-cho. I arrived at the bank some time around 8:15 or so, and signed my name in the attendance book. When I was doing my morning routine, dusting the desks and things like that, the A-bomb was dropped. All I remember was that I saw something flash suddenly ... it was like a white magnesium flash. I lost consciousness right after or almost at the same time I saw the flash. When I regained consciousness, I found myself in the dark.

I heard my friends, Ms. Asami, crying for her mother. Soon after, I found out that we actually had been attacked. Afraid of being caught by a fire, I told Ms. Asami to run out of the building. Ms. Asami, however, just told me to leave her and to try to escape by myself because she thought that she couldn't make it anywhere. She said she couldn't move. I said to her that I couldn't leave her, but she said that she couldn't even stand up. While we were talking, the sky started to grow lighter. Then, I heard water running in the lavatory. Apparently the water pipes had exploded. So I drew water with my helmet to pour over Ms. Asami's head again and again. She finally regained consciousness fully and went out of the building with me.

[1] The population of the two cities at that time was 3,50,000 and 2,40,000.

We first thought to escape to the parade grounds, but we couldn't because there was a huge sheet of fire in front of us. So instead, we squatted down in the street next to a big water pool for fighting fires, which was about the size of this table. Since Hiroshima was completely enveloped in flames, we felt terribly hot and could not breathe well at all. After a while, a whirlpool of fire approached us from the south. It was like a big tornado of fire spreading over the full width of the street. Whenever the fire touched, wherever the fire touched, it burned ... The whirlpool of fire that was covering the entire street approached us from Ote-machi. So, everyone just tried so hard to keep away from the fire. It was just like a living hell.

After a while, it began to rain. The fire and the smoke made us so thirsty and there was nothing to drink, no water, and the smoke even disturbed our eyes. As it began to rain, people opened their mouths and turned their faces towards the sky and try to drink the rain, but it wasn't easy to catch the rain drops in our mouths. It was a black rain with big drops ... They were so big that we even felt pain when they dropped onto us. We opened our mouths just like this, as wide as possible in an effort to quench our thirst. Everybody did the same thing. But it just wasn't enough. Someone found an empty can and held it to catch the rain ...

What I felt at that moment was that Hiroshima was entirely covered with only three colors. I remember red, black and brown, but, nothing else.

The streetcar passengers

Seven hundred and fifty meters from ground zero, these are the testimonies of the passengers who were on a streetcar in Hatchobori area when the atomic bomb fell. A little after eight in the morning on August 6th, the streetcar for Koi left Hiroshima Station. And at 8:15 it approached Hatchobori Station, 780 meters from the hypocenter. An intense flash and blast engulfed the car, instantly setting it on fire. It is said that seventy cars were running in the city at the same time. They were an important means of transportation for the citizens, and all the trains were packed with people since it was the morning rush hour. Nearly 100 passengers are said to have been on board on the streetcar which was near Hatchobori. But the survival of only ten has been confirmed to date. Seven of these survivors have recorded their testimonies.

Eiko Taoka, then 21, was heading for Funairi with her one year old son to secure a wagon in preparation for her move out of the building which was to be evacuated. Her son died of radiation sickness on August 28.

Taoka: When we were nearing Hatchobori and since I had been holding my son in my arms, the young woman in front of me said, "I will be getting off here. Please take this seat." We were just changing places when there was a strange smell and sound. It suddenly became dark and before I knew it, I had jumped outside.
Interviewer: What about your son?

Taoka: I held him firmly and looked down on him. He had been standing by the window and I think fragments of glass had pierced his head. His face was a mess because of the blood flowing from his head. But he looked at my face and smiled. His smile has remained glued in my memory. He did not comprehend what had happened. And so he looked at me and smiled at my face which was all bloody. I had plenty of milk which he drank all throughout that day. I think my child sucked the poison right out of my body. And soon after that he died. Yes, I think that he died for me.

Tsutaichi Matsuzaka, then a 37 year old factory worker in Mukaihara, was on his way to the main office of his company in Hatsukaichi to get woodwork materials with three of his coworkers. His coworkers died one after another within two or three weeks after the bombing.

Matsuzaka: My hair fell off. I had a fever and spots appeared on my body. I heard all kinds of talk in those days, for instance, that one was doomed if these spots appeared. So I was in constant fear for my life.

Interviewer: Two out of your three coworkers died?

Matsuzaka: No, No. three.

Interviewer: All three?

Matsuzaka: Yes, Hayashi died the following week. The next man died two weeks later and the third, a little after that. I pray that there never be another nuclear war like that. It was a living hell.

Keiko Matsuda, then 14, was on her way to Miyajima with two friends since they had no mobilized labour on that day. One of her friends who had been closest to the front and received the worst burns died in the first-aid station in Nukushina.

Matsuda: It was very, very hot. I touched my skin and it just peeled right off. The driver of the streetcar was not in sight. I thought he had been quick to run away but now I think that he was probably hurled outside in the blast. It was around August 25 that a pile of my hair just fell off all at once. I had a high fever and maggots infested in my eyes.

Interviewer: In your eyes?

Matsuda: Yes. I was afflicted with erysipelas as well. I had two children, but I had not told them about this experience. And I don't want to talk about it. But this time many people are testifying together and since I've been asked, I will talk. But I have tried to avoid it until now.

Akira Ishida, then a 17 year old junior air-man in the army, had the day off and was going to Miyajima with his elder brother to pray for good luck in the war. His elder brother died in September 1945 of radiation sickness.

Ishida: Several months later, I can remember, I remember a cold morning, I don't know why but my mother always kept a round hand mirror by my pillow, which I picked up without thinking. I looked at my face and I saw something so shiny on the corner of my head. Using all my energy, I called out to my mother who was in the kitchen, and I said, "Mother! My hair is growing back!" She was so happy that she held me and she cried. I'll never forget that day and the feel of the tears that my mother shed for me while she held me in her arms. It still comes back to me even though the people here are of different ages, we are also all of the same age. On August 6th, 1945, all of us died once and then, we were brought back to life. We were all born again. And we're in our second life now. Everyone gathered here today is now 41 years old if you count the number of years from the bombing. It's like a class reunion. I feel that we must testify in the hope that our experience will help to keep mankind from perishing.

Mr. Yoshitaka Kawamoto

Mr. Yoshitaka Kawamoto was thirteen years old. He was in the classroom at Zakoba-cho, 0.8 kilometers away from the hypocenter. He is now working as the director of the Hiroshima Peace Memorial Museum, telling visitors from all over the world what the atomic bomb did to the people of Hiroshima.

Kawamoto: As the director of the Hiroshima Peace Memorial Museum, today, I am handing my message over to the children who visit. I want them to learn about Hiroshima. And when they grow up, I want them to hand down the message to the next generation with accurate information. I'd like to see him conveying the right sense of judgment so that we will not lead mankind to annihilation. That is our responsibility.

Mr. Mamoru Yukihiro

Mr. Mamoru Yukihiro was 36 years old when the bomb fell. He was at the agricultural office of Hiroshima prefecture, one kilometer away from the general affairs section at that time, rescued many people who were caught under the crumbled buildings. He lost two of his children because of the A-bomb.

Yukihiro: My daughter who was bombed when she was four years old lived in Hiroshima with us for a long time after the A-bomb fell. She went to a local elementary school attached to the university. When she was in the fourth grade, she began to lose weight. By the second term of her sixth grade year, she became very skinny.. She had to stay in bed and she couldn't go to school. I was afraid that my daughter had some illness caused by the A-bomb radiation. But the local doctor said that she just caught a cold, then I went to another doctor at Mizuno Clinic, west of the Kokusai Hotel. This doctor said that she was suffering from a serious case of anemia, not just a cold, and that she needed to be hospitalized. So she was hospitalized. When she was given a blood transfusion, she felt relief immediately. Her pillow was covered with three or four towels each night and these towels became bloody each morning because she was bleeding from her gums during the night. But she washed the towels by herself each morning to hide them from me. I think she was embarrassed. Since she was suffering from an illness caused by the atomic bomb radiation, the media including the television, the newspapers, NHK, Chugoku Broadcasting and many others came to interview her. At first she refused to meet the press because she didn't want other people to see her miserable condition. I told her that she was the first A- bomb survivor who suffered from an internal disease caused by the A-bomb radiation. Many other survivors had already died, hiding themselves from the public. I also said that she was the only person who could show the disease and help the other victims in the future. She understood what I was saying and decided to talk and to let them take pictures. Finally, at the beginning of February of 1954, she died. If one country drops a nuclear bomb, the other ones would do the same for sure. This is the fact. It will eventually destroy the entire world. I hope that the nations of the world stop nuclear war now and forever.

Mr. Akira Onogi

Mr. Akira Onogi was 16 years old when the bomb was dropped. He was at home 1.2 km away from center of explosion. The house was under the shade of the warehouse, which protected him from the first blast. All five members of the Onogi family miraculously survived an immediate fire at their house.

Onogi: When we were escaping from the edge of the bridge, we found this small girl crying and she asked us to help her mother. Just beside the girl, her mother was trapped by a fallen beam on top of the lower half of her body. Together with neighbors, we tried hard to remove the beam, but it was impossible without any tools. Finally a fire broke out endangering us. So we had no choice but to leave her. She was conscious and we deeply bowed to her with clasped hands to apologize to her and then we left.

... It was such an awful experience. You know for about 10 years after the bombing I always felt paralyzed whenever I saw the sparks made by trains or lightning. Also even at home, I could not sit beside the windows because I had seen so many people badly wounded by pieces of glass. So I always sat with the wall behind me for about 10 years. It was some sort of instinct to self-preservation.

Mr. Takehiko Sakai

Mr. Takehiko Sakai, 21 years old at that time, was at the west drill ground when the atomic bomb was dropped. He did not lose consciousness and remembers his military uniform catching fire. The bomb fell two days after Mr. Sakai had arrived in Hiroshima from his regiment in Yamaguchi. He has this to say about the days after the bombing.

The bomb fell on the sixth and we remained here until about 3 o'clock in the afternoon of the tenth. Then, on the evening of August 15, we heard that the war was over. I was happy, I was really happy that the war had ended. But I was also worried, I was worried about what would happen next. I didn't know if I could be useful to society or not, but I wanted to do something constructive and so I decided to become a teacher. The situation in Japan those days was quite pitiful. There was very little to eat. Everyone was very poor. During the period immediately after the bombing, because of my injuries, people had to look after me and it was through their care that I was able to get better. So I tried to repay this debt, by teaching my students to be kind and considerate whenever I had the opportunity to do so. Consequently, I think it was a good thing that I became a teacher and in this way to somehow pay back society.

Mr. Kosuke Shishido

Mr. Shishido is a business consultant who lives in Yokohama. He was a Colonel in the Japanese army at the time of the Bomb. He was a staff member of the area headquarters. He served as the president of the Chugoku Renovation Foundation immediately after his military service. He has published five books; two of them are related to the Atomic Bomb being dropped on Hiroshima.

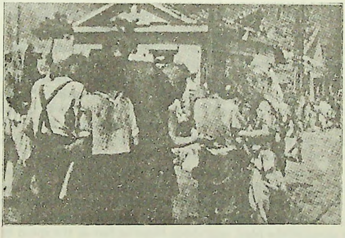
Shishido: I felt a huge explosion (sound, vibration and wind) near by. I thought a large conventional bomb had been dropped near the shelter. Later, I heard that many people on the street saw two B29s fly over the city. Those people saw a huge fire-ball in the sky soon after. It took a few moments for those people to feel the strong wind. Then people realized that they had been bombed.

The bomb generated a very strong wind at the moment of its explosion. The wind reflected when it hit the mountains surrounding the city. The houses and building near the mountains were destroyed by the reflected wind. Actually, I felt a strong wind twice; and the second one was stronger than the first.

Mr. Yoshito Matsushige

Yoshito Matsushige was a 32 year old cameraman for the Chugoku Newspaper at that time. He was at his home in Midori-cho, 2.7 kilometers from the hypocenter when the A-bomb was dropped. He walked around the city right after the bombing and took five photographs which have become important historical documents.

Matsushige: I had finished breakfast and was getting ready to go to the newspaper when it happened. There was a flash from the indoor wires as if lightning had struck ... Immediately after that, the blast came ... I could barely see the room because of all the dirt. I pulled my camera and the clothes issued by the military headquarters out from under the mound of the debris, and I got dressed. I thought I would go to either the newspaper or to the headquarters. That was about 40 minutes after the blast. Near the Miyuki Bridge, there was a police box. Most of the victims who had gathered there were junior high school girls from the Hiroshima Girls Business School and the Hiroshima Junior High School No.1. They had been mobilized to evacuate buildings and they were outside when the bomb fell. Having been directly exposed to the heat rays, they were covered with blisters, the size of balls, on their backs, their faces, their shoulders and their arms. The blisters were starting to burst open and their skin hung down like rags. Some of the children even had burns on the soles of their feet. They'd lost their shoes and run barefoot through the burning fire. When I saw this, I thought I would take a picture and I picked up my camera. But I couldn't push the shutter because the sight was so pathetic. Even though I too was a victim of the same bomb, I only had minor injuries from glass fragments, whereas these people were dying. It was such a cruel sight that I couldn't bring myself to press the shutter. Perhaps I hesitated there for about 20 minutes, but I finally summoned up the courage to take one picture. Then, I moved 4 or 5 meters forward to take the second picture. Even today, I clearly remember how the view finder was clouded over with my tears.



One of the photographs of Yoshito Matsushige, taken three hours after the bombing of Hiroshima

I felt that everyone was looking at me and thinking angrily, "He's taking our picture and will bring us no help at all." Still, I had to press the shutter, so I hardened my heart and finally I took the second shot. Those people must have thought me duly cold-hearted ...

After that, I walked around, I walked through the section of town which had been hit hardest. I walked for close to three hours. But I couldn't take even one picture of that central area. There were other cameramen in the army shipping group and also at the newspaper as well. But the fact that not a single one of them was able to take pictures seems to indicate just how brutal the bombing actually was. I don't pride myself on it, but it's a small consolation that I was able to take at least five pictures.

Mr. Isao Kita

Mr. Isao Kita was 33 years old when the bomb fell. He was working for the Hiroshima District Weather Bureau 3.7 km from the hypocenter. He was the chief weather man and his shift was from August 5 to 6. He observed the weather minutely during and after the explosion.

Kita: Well, at that time, I happened to be receiving the transmission over the wireless. I was in the receiving room and I was facing northward. I noticed the flashing light. It was not really a big flash. But still it drew my attention. In a few seconds, the heat wave arrived. After I noticed the flash, white clouds spread over the blue sky. It was amazing. It was as if blue morning-glories had suddenly bloomed up in the sky. It was funny, I thought. Then came the heat wave. It was very very hot. Even though there was a window glass in front of me, I felt really hot. It was as if I was looking directly into a kitchen oven. I couldn't bear the heat for a long time. Then I heard the cracking sound. I don't know what made that sound, but probably it came from the air which suddenly expanded in the room.

By that time, I realized that the bomb had been dropped. As I had been instructed, I pushed aside the chair and lay with my face on the floor ... I covered my eyes and ears with hands like this. And I started to count. You may feel that I was rather heartless just to start counting. But for us, who observed the weather, it is a duty to record the process of time, of various phenomena. So I started counting with the light flash. When I counted to 5 seconds, I heard the groaning sound. At the same time, the window glass was blown off and the building shook from the bomb blast. So the blast reached that place about 5 seconds after the explosion. We later measured the distance between the hypocenter and our place. And with these two figures, we calculated that the speed of the blast was about 700 meters per second. The speed of sound is about 330 meters per second, which means that the speed of the blast was about twice as fast as the speed of sound. It didn't move as fast as the speed of light but it moved quite rapidly.

There is a path which leads by here over there. And on that day, a large number of injured persons walked this way along the path toward the Omi Hospital. They were bleeding all over and some of them had no clothes. Many of them were carrying people on their shoulders. Looking at the injured, I realized how seriously the town had been damaged. The fire was its peak at around that time. It thundered 10 times between 10 and 11 o'clock. The sound of thunder itself was not so great but still I could see the lightning over the fire. When I looked down on the town from the top of that hill, I could see that the city was completely lost. The city turned into a yellow sand. It turned yellow, the color of the yellow desert ... The smoke was so thick that it covered the entire town. After about 5 minutes, fire broke out here and there. The fire gradually grew bigger and there was smoke everywhere and so we could no longer see towards the town ... It remained like this for some time.

From Koi, looking towards Hiroshima Station, you could see the black rain falling. But from here, I couldn't judge how much rain was falling. But based on the information I heard later, it seems that the rain fell quite heavy over a period of several hours. It was a black and sticky rain. It stuck to everything. When it fell on trees and leaves, it stayed and turned everything black. When it fell on people's clothing, the clothing turned black. It also stuck on people's hands and feet. And it couldn't be washed off ...

The atomic bomb does not discriminate. Of course, those who were fighting may have to suffer. But the atomic bomb kills everyone from little babies to old people. And it's not an easy death. It's a very cruel and very painful way to die. I think that this cannot be allowed to happen again anywhere in the world. I don't say this just because I'm a Japanese atomic bomb survivor. I feel that people all over the world must speak out.

Mr. Hiroshi Sawachika

Mr. Hiroshi Sawachika was 28 years old when the bomb was dropped. He was an army doctor stationed at the army headquarters in Ujina. When he was exposed, he was inside the building at the headquarters, 4.1 km from the hypocenter. Being rather far from the hypocenter, he was not seriously injured. Afterwards, he was very busy getting medical treatment to the survivors.

Sawachika: "... We first treated the office personnel for their injuries. Most of them had broken glass and pieces of wood stuck into them. We treated them one after another. Afterwards, we heard the strange noise. It sounded as if a large flock of mosquitoes were coming from a distance. We looked out of the window to find out what was happening. We saw that citizens from the town were marching towards us. They looked unusual. We understood that the injured citizens were coming towards us for treatment. But why, we thought that there should be Red Cross Hospitals and other big hospitals in the center of the town. So why should they come here, I wondered, instead of going there. At that time, I did not know that the center of the town had been so heavily damaged.

After a while, with the guide of the hospital personnel, the injured persons reached our headquarters. With lots of injured people arriving, we realized just how serious the matter was. We decided that we should treat them also. Soon afterwards, we learned that many of them had been badly burned. As they came to us, they held their hands aloft. They looked like they were ghosts. We made the tincture for that treatment by mixing edible peanut oil and something. We had to work in a mechanical manner in order to treat so many patients. We provided one room for the heavily injured and another for the slightly injured. Treatment was limited to first aid because there were no facilities for the patients to be hospitalized.

Interviewer: How many patients did you treat on August 6?

Sawachika: Well, at least 2 or 3 thousands on that very day if you include those patients whom I gave all directions to. I felt that as if once that day started, it never ended. I had to keep on and on treating the patients forever. It was the longest day of my life. Later on, when I had time to reflect on that day, I came to realize that we doctors learned a lot through the experience, through the suffering of all those people. It's true that the lack of medical knowledge, medical facilities, integrated organization and so on prevented us from giving sufficient medical treatment. Still there was a lot for us medical doctors to learn on that day. I learned that the nuclear weapons which gnaw the minds and bodies of human beings should never be used. Even the slightest idea using nuclear arms should be completely exterminated from the minds of human beings. Otherwise, we will repeat the same tragedy. And we will never stop being ashamed of ourselves.

Ms. Kinue Tomoyasu

Ms. Kinue Tomoyasu was 44 years old at the time of the A-bomb attack. Previously her husband had died of illness and her only son was sent to a battle field. She was living with her only daughter who died in the bombing. Ms. Tomoyasu was admitted to the Hiroshima Atomic Bomb Victims Nursing Home in 1973.

She was at home, 5 kilometers from the hypocenter, when the bomb was dropped. She then entered Hiroshima City to search for her daughter, so anxious to find her that she never even saw the mushroom cloud that rose over Hiroshima.

Tomoyasu: I didn't see the mushroom cloud. I was trying to find my daughter. They told me I couldn't go beyond the bridge. I thought she might be back home, so I went back as far as Nikitsu Shrine. Then, the black rain started falling from the sky. And I wondered what it was. And it was what's called the black rain.

It was like a heavy rain. And I had my air-raid hood on, so I didn't get it on my head fortunately, but it fell on my hands. And I ran and ran. I waited for her with the windows open. I stayed awake all night waiting and waiting for her, but she didn't come back ...

Around Hiroshima Station, I saw more people lying dead, more on the morning of the 7th than on the 6th. When I reached the (Ota) river bank I couldn't tell who was who. I kept wondering where my daughter was. B. then, she cried for me, "Mother!" I recognized her voice. I found her in a horrible condition. Her face looked terrible. And she still appears in my dreams like that sometimes. When I met her, she said, "There shouldn't be any war." ... And nine hours later, she died.

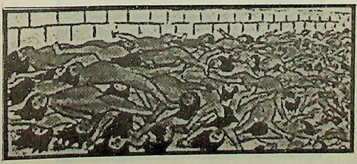
... I had bedding folded on the floor, but I held her in my arms. When I held her on my lap, she said, "I don't want to die." I told her, "Hang on Hang on." She said, "I won't die before my brother comes home." But she was in pain and she kept crying, "Brother. Mother." On August 15th, I held her funeral. And around early October, my hair started to come out. I wondered what was happening to me, but all my hair was disappearing. In November, I become bald. Then, purple spots started to appear around my neck, my body and my arms, and on the inner parts of my thighs, a lot of

them, all over, the purple spots all over my body. I had a high fever of forty degrees. I was shivering and I couldn't consult the doctor. I still had a fever when I was admitted here for a while, but now I don't have a fever so often.
Interviewer: After your son returned home from the war, what did he do?
Tomoyasu: He came back in February of 1946, and he took care of me. When he heard how his sister died, he said he felt so sorry for her. He told me he hated war. I understand. Many of his friends had died in the war. He told me he felt sorry that he survived. He was just filled with regret. My son got malaria during the war, also. He suffered a lot. I don't know why, but he became neurotic and killed himself, finally, by jumping in front of a train in October. I was left alone. I had to go through hardships, living alone. I have no family. I joined the white chrysanthemum organization at Hiroshima University, pledging to donate my body upon death for medical education and research. My registration number is number 1200. I'm ready ...

Sources

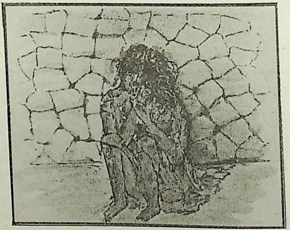
1. *http://www.konradh.net/jp/history/hibakusha* - This site, called "Voice of Hibakusha", contains eye-witness accounts of the bombing of Hiroshima, from the video HIROSHIMA WITNESS produced by Hiroshima Peace Cultural Center and NHK. The individual accounts were input and translated into English by Yumi Kodama, Junko Kato, Junko Kawamoto, Masako Kubota, Chiharu Kimura, and Kumi Komatsu, who were advised by Laurence Wiig.

2. *http://www.csi.ad.jp/ABOMB/hibakusha.html* - Some more eyewitness accounts may be found here.



Yoshitaka Kawamoto: "I stood up in the water and so many bodies were floating away along the stream. I can't find the words to describe it. It was horrible" (Artist's depiction).

Yoshito Matsushige: "The blisters were starting to burst open and their skin hung down like rags." (Artist's depiction)



Masato Yamashita: "With no one to help her, a girl died, leaning on the bank of the Enko River" (Artist's depiction).

Chapter 5

The Children of Hiroshima

An Appeal from the Children of Hiroshima was compiled by Professor Arata Osada (1887-1961) and published in 1951. He experienced the A-Bomb. He was appointed President of the Hiroshima University of Humanities and Science in 1945 and retired in 1949. The book is a collection of stories written by children who experienced the A-Bomb.

In his preface of the book, Professor Osada wrote:

> "There is a branch office of the Osaka Bank about five hundred yards away from the center of the explosion....If you look at it, you will find it encloses a dark silhouette of a man printed on the stone wall and the steps. Upon these steps at the moment of the blast, a man must have been sitting, perhaps with an elbow on one knee and one hand supporting his chin, in an attitude of deep thought. The powerful action of the radioactive waves "printed" the outline of this man on the wall, marking the moment of his death. The dark silhouette is gradually disappearing and, as time passes, memories of that tragic time will gradually be forgotten. But the shadows will never lift from the hearts of the people of Hiroshima who lost their parents, brothers and sisters and friends. Though they smile cheerfully in answer to inquiries after them from sympathizers and even appear carefree at times, the agony remains profound and lasting ...
>
> It is my purpose here to present to the public a collection of essays written by boys and girls who were living in Hiroshima at the time the atom bomb fell. The essays are accounts relating their personal experiences at the time."

Keiko Sasaki: 6 years old in 1945

She (Grandmother) heard from a man who escaped from Hiroshima that the city was completely destroyed by the bomb. When she heard that, she went to Hiroshima right away. When she came back after a week, I asked "Where's Mother?"

"I brought her on my back" was the answer.

I was very happy and shouted, "Mummy!" But when I looked closely, I saw she was only carrying a rucksack. I was disappointed. My sister and our neighbours began to cry. I couldn't understand why. Then my grandmother put the rucksack down and took some bones out of it and showed them to everybody. There were my mother's gold tooth and a piece of her elbow bone. I still didn't understand.

Kimiko Takai: 5 years old in 1945

I shiver whenever I think of August 6, 1945, the day when Hiroshima was destroyed in just a few minutes.

As we walked along, we saw soldiers with bloated stomachs floating down the river. They probably had to dive into the river to get away from the flames. A little farther on, we saw many dead people piled up at the side of the road. As we walked on, my father saw a woman whose leg was caught under a large timber. She couldn't get free so he shouted for help but no one came. Everyone was too busy trying to get away to pay any attention to anyone else. Finally, my father shouted angrily, "Aren't any of you Japanese?" Then he got the woman loose by sawing off her leg with a rusty, old saw.

Further on, we saw a man who must have been burned to death while he was walking.

Mother said that she couldn't go any further and told us to go on without her. She sat down to rest but we couldn't go on by ourselves, leaving her behind. Then she scooped up a handful of muddy water from the roadside and drank it. This must have made her feel better because she got up and joined us again.

As we got to the countryside, farmers stared at us in amazement and asked us what had happened. When we passed farm houses, people would come out and give us rice balls to eat, or ask us whether we would like to wash our faces.

We stayed with our relatives for about a month.

After we arrived, Mother complained that her back hurt. I looked at her back and found a piece of glass about 3/4 inches wide and 1 1/2 inches long stuck in it. It had gone in quite deep because she had been carrying my brother on her back. We went to see a doctor and learned that we had been rather lucky. Many people had died and hundreds had been injured.

From the next day, Father went out looking for my sister. The bomb had exploded over Aioi Bridge, near the Hiroshima post office where my sister worked. She must have died without time to call for her mother or even to say, "Oh!" My uncle and aunt had gone to a place near the post office to collect some manure that day and both were killed. Their ashes were brought back to us, though. Not even my sister's ashes have come back to us.

All but one of the workers at the post office was killed. He picked up the remains of the other workers and then took a little of the ashes to each of the dead persons' families. We put the ashes before God and prayed that my sister would rest in peace.

Yasuo Fujita: 5 years old in 1945

The saddest thing for me was that I lost my brother, sister and grandmother.

My grandmother was folding up some quilts and things and when the house fell she was caught under many beams. She screamed for help but the beams were too heavy for my father to lift alone.

They brought our sister to us about three days after the bombing but she had lost so much blood that she died two days later.

My brother was missing for about four months. Then one day, we heard they had found him but when we went to take a look all we saw was some buttons lying here and there.

Masatada Asaeda: Class 3 Student in 1945

When we were playing in the school ground, an airplane came, but we kept on playing, only saying "Why did they give the all-clear?" All of a sudden, there was something like lightning and I covered my face with my hands. When I opened my eyes and looked around, it was dark and I couldn't see anything. While I was feeling around in the darkness, it became light. I was thinking of going home, and I found that all the houses around me had been destroyed and fires were burning here and there.

I started running home, crying and calling, "Mother! Mother!" But I couldn't tell where my house had been. I just went around this way and that, and then I heard my sister calling my name. I was shocked when I saw her, because she was stained with blood all over. I looked at myself; the skin of both my arms and feet had peeled away and was hanging off. I didn't know what all this meant, and I was frightened, so I burst into tears. Meanwhile, Mother had crawled out from the pile of tiles and dragged an overcoat and Father's cloak out of a trunk and wrapped us in them.

We spent the night in Yasu Shrine in Gion. Because of their burns, everyone was crying for water all night. The next morning, we were taken by truck to a Buddhist temple in Kabe. That night, my sister died. How can I describe Mother's grief? How can I describe the horrible scenes I saw in the temple then? Who can imagine the miseries we went through except those who were there themselves? It is entirely beyond my power to put the terrible sight into words. Countless people suffering from burns and wounds, groaning with pain, their bodies covered with maggots, and dying in delirium, one after another. It was hell on earth.

Tadataka Kuribayashi: Class 6 student in 1945

Kuribayashi was evacuated, along with many other children of Hiroshima, to

Saihoji Temple in Tsutsuga Village before the bombing. Both his parents died from the bomb. The Radiation Effects Research Foundation (RERF) and RERF Labor Union distributed his note about his experiences of that time, where he also talks about going back to Hiroshima and seeing his mother die.

At the beginning of September, I received a wrinkled-up postcard. Though my mother's name was mentioned, the handwriting with a pencil, some parts of which were blurred, was not my mother's. The card simply said, "I am in the reception center in Miyajima. Come here immediately," and a simple map of the place was shown. I wondered why my mother had not written it herself, but was glad to know where she was. However, the date on the card showed that many days had passed since it had been written. Next day, I accompanied by Mr. Yamakawa, left for Miyajima. That was September 2.

I looked at the town of Hiroshima while I proceeded from Yokogawa to Koi. It was a field of charred ruins. The city streetcar which just began to run between Koami-cho and Koi had numerous flies on the ceiling. It was a strange sight. We took a boat from Miyajima-guchi. I saw the old big torii (Shinto shrine archway) and the beautiful Itsukushima Shrine, but they just looked a faded landscape painting to me. I wanted to go to the reception center and see the face of my mother as soon as possible. I was so eager to see her that I felt the boat was extremely slow. Soon we arrived at the center, which was a big building to the north of the shrine. When I stood at the entrance, I felt some kind of anxiety, which was an emotion difficult to express.

I looked for Mother with my teacher. It was a big room with tens of tatami mats, and the spaces between A-bomb survivors lying on futon (bedclothes) produced a forlorn atmosphere. We took one round, but couldn't find her. While I took the second round, looking into the face of each person, I was astonished to find Mother, lying on her face and exhausted. She was a small person, but she looked even smaller. Suppressing the tremor of my voice, I called her quietly. There was no answer. I called her again. Then she noticed and slightly raised her head. She saw the teacher behind me, and took out some bills to give to him. He refused to receive them, and left there after a short while saying that he had business at the school.

When Mother told me about the death of Father, I was not so surprised. I might have been somewhat ready to hear the news. Deprived of a flush of hope, I imagined my father being burnt to death in agony. My heart was wrung. We didn't know if my elder brother, who have gone abroad to war was dead or alive. I naturally had a dark prospect about our future, but resolved firmly to continue to live with my mother no matter how poor we would be. Mother told me to take the cloth off her back. I found brown burns all over her back. Because of the burns, she couldn't lie on her back. Why does my mother, as innocent as a person could be, have to be tortured like this? I could not suppress the anger I felt. From that day, I took care of her for 2 nights and 3 days. However, the only medicine provided was mercurochrome. We were even short of cresol. When Mother arrived at the center, she was fine and even washed other people's clothes, but when I got there she couldn't even move her body.

... Looking at the B-29 bomber which sometimes came flying, I shouted to myself "Idiot!" It was all the resistance I, as a boy, could offer. And I sometimes cried secretly in the lavatory.

At lunch-time on 4 September, the third day, Mother started to writhe in pain. Her unusual action completely upset me. All I could do was to absentmindedly look at my suffering Mother. After suffering for 30 minutes, she regained her calmness. However, it was the last calmness, the sign of the end of life. I continued calling her name, clinging to her body. Tears welled up in the eyes of my speechless mother and tears rolled down her cheek. I wondered if the tears were from the sorrow of eternal parting between mother and child or from an anxiety about my future. I shall never forget the tears of my Mother I saw on that day ...

I am over 30 years old now, but I can never forget my experiences in this village (Tsutsuga village) as a memory of stamped wheat plants. Is this nothing but my sentimentality?

Sadako Sasaki: 2 years old in 1945

We end this section with the moving story of Sadako Sasaki which carries a message of peace and hope.

Sadako Sasaki

Sadako Sasaki was almost two when the bomb exploded a mile from her home in Hiroshima. Seemingly unharmed, she fled with her mother and older brother to the Oto River, where they were drenched by the radioactive black rain that fell throughout the day.

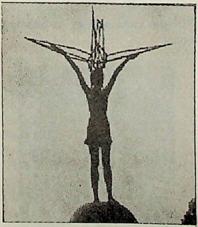
Until the age of twelve, Sadako appeared to be a normal, healthy girl. She was the best runner in her sixth grade class when she suddenly developed leukaemia or blood cancer.

"Tsuru" the crane, is an ancient Japanese symbol of long-life, hope, good luck and happiness. It is believed that if you fold a thousand paper cranes, they will protect you from illness. Sadako said of the cranes, "I will write peace on your wings and you will fly all over the world."

But Sadako did not have the strength to reach a thousand. After having folded nine hundred and sixty four, she died on October 25, 1955. Her friends added the missing paper cranes and placed them in the coffin with her. **Since then the paper crane has become an international symbol of the movement for nuclear disarmament.**

Sadako's class began a national campaign to build a monument to her. It was erected in 1958 and it honours all children who suffered from the bomb. On the top of the oval granite pedestal, which symbolizes the fabled Mountain of Paradise, Mt. Horai, a young girl stands holding a golden crane in her outstretched arms. Inside the pedestal is a space for the thousands of colorful paper cranes that people from all over Japan and the world send every year. On the monument is written,

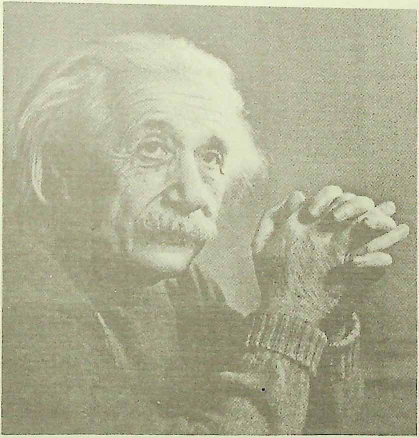
"This is our cry, this is our prayer: PEACE IN THE WORLD!"



Sadako Peace Monument in Japan

Sources

1. *http://www.csi.ad.jp/children.html* - This site contains the accounts of children of Hiroshima.
2. *http://www.csi.ad.jp/ABOMB/RERF/setb-4.html* - Tadataka Kuribayashi's detailed note appears here.



"... We scientists recognise our inescapable responsibility to carry to our fellow citizens an understanding of atomic energy and its implications for society. In this lies our only security and our only hope—we believe an informed citizenry will act for life and not for death."

Albert Einstein, January 22, 1947

MOTOR INDUSTRIES CO.LTD., BANGALORE

NOTICE 1.10.1976

We have been informed by the Director, Bureau of Economics and Statistics, Government of Karnataka, that the C.P.I. Number for the working class of Bangalore Centre, compiled by the Labour Bureau, Government of India, is 301, 312 and 312 points (base 1960) for the months of June, July and August 1976 respectively. These index numbers average out to 308 points (308.33), an increase of 6 points from the average C.P.I. Number for the previous quarter, and as a result, the existing all inclusive wages/salaries of hourly/monthly rated employees will be increased by Rs.8.40.

After making the above adjustment, the all inclusive wages/salaries in the various scales will be as follows for the months of October, November and December 1976.

A. Category and Scales of all inclusive wage for Hourly Rated Workmen :

Sl. No.	Category		Scale — Per Hour Per Month (208 working hours)					No. of Years
1.	G1	P. Rs.	218.350 454.17	2.350 4.89	241.860 503.07	2.650 5.51	268.350 558.17	20
2.	G2	P. Rs.	222.326 462.44	2.851 5.93	250.836 521.74	3.202 6.66	282.855 588.34	20
3.	G3	P. Rs.	228.293 474.85	3.900 8.11	267.284 555.95	4.399 9.15	311.274 647.45	20
4.	G4	P. Rs.	234.259 487.26	5.048 10.50	284.740 592.26	5.649 11.75	341.230 709.76	20
5.	G5	P. Rs.	240.221 499.66	6.250 13.00	302.721 629.66	7.048 14.66	373.201 776.26	20
6.	G6	P. Rs.	246.187 512.07	8.00 16.64	326.187 678.47	8.399 17.47	410.177 853.17	20
7.	G7	P. Rs.	261.100 543.09	9.101 18.93	352.110 732.39	10.250 21.32	454.610 945.59	20
8.	G8	P. Rs.	276.115 574.32	11.100 23.09	387.125 805.22	12.500 26.00	512.125 1065.22	20
9.	G9	P. Rs.	288.053 599.15	13.149 27.35	419.543 872.65	14.798 30.78	567.524 1180.45	20

B. Category and Scales of all inclusive salaries for Monthly Rated Employees :

Sl. No.	Category		Scale							No. of Years
1.	T1	Rs.	518.38	15	593.38	16	673.38	17	843.38	20
2.	T2	Rs.	599.37	20	699.37	21	804.37	22	1024.37	20
3.	T2a	Rs.	717.72	25	842.72	27	977.72	29	1267.72	20
4.	C1a	Rs.	488.29	10	538.29	11	593.29	12	713.29	20
5.	C1b	Rs.	518.38	15	593.38	16	673.38	17	843.38	20
6.	C1c	Rs.	559.94	17	644.94	18	734.94	19	924.94	20
7.	C1d	Rs.	559.94	19	654.94	20	754.94	21	964.94	20
8.	C1e	Rs.	590.03	21	695.03	22	805.03	23	1035.03	20
9.	C2	Rs.	658.54	23	773.54	24	893.54	25	1143.54	20

Increments are granted by the Company each year subject to efficiency, work, attendance and conduct being found satisfactory.

kkd/dnh

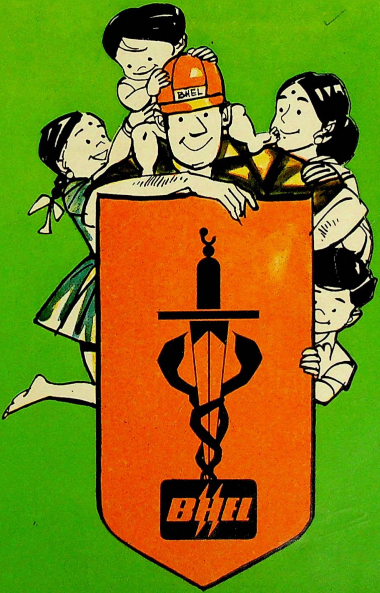
PSL

cc: Managers/Departments/Shops

cc: MEA

WIDENING HORIZONS

OCCUPATIONAL HEALTH IN BHEL



THE IMPORTANCE OF DOING WELL TO DO BETTER

Industry is not just production, machines and their maintenance, but a group — a special group of productive people at work, their anxieties and worries, their hopes and aspirations, their health and happiness.

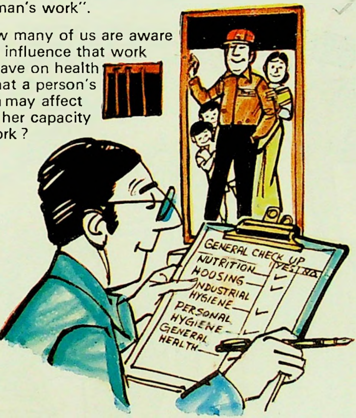
Therefore the promotion of "Positive Health" among the employees with special reference to work and the psychophysical environment inside the factory is an absolute essential for better output and happiness in industry. It is only a healthy, strong and productive work-force that can contribute to the national prosperity and the all-round development of the nation.

Indeed, Man Maintenance is more important than Machine Maintenance.

HEALTH HAS MANY FACETS

"Health depends on many factors. It depends on the circumstances, physical, social and psychological. It depends on the influence of home, on matters like nutrition, housing, happiness in industry, industrial hygiene, personal hygiene and most important of all on a man's work".

How many of us are aware of the influence that work may have on health and that a person's health may affect his or her capacity for work ?



And, so, our conception of health goes much, much farther ; farther than it is normally taken to be. Farther than you can even imagine.

The well-being and growth of an employee as a total man — 'A state of complete physical, mental and social well-being and not a mere absence of disease or infirmity'.

WIDENING HORIZONS : OCCUPATIONAL HEALTH IN BHEL

At BHEL-Tiruchi we believe that tapping our employees' chests perfunctorily when they fall sick and come to the hospital is not enough.

advocate an

That's why we have started our Occupational Health Service. Occupational Health deals with healthy people at work everyday and sees that they remain healthy, that fit people become more adapted to their work.

Occupational Health works while they work.

HOW TO MAKE PEOPLE HAPPIER

Considerable thought has been given to it and a seemingly simple formula has been chosen. It is 'adaptation of work to man and each man to his job'.

Simple ? Isn't it ??

But when the formula is expanded it opens up new vistas of healthful and happy living.

'Occupational Health Service'.

That's it.

WIDENING HORIZONS : OCCUPATIONAL HEALTH IN BHEL

At BHEL-Tiruchi we believe that tapping our employees' chests perfunctorily when they fall sick and come to the hospital is not enough.

That's why we have started our Occupational Health Service. Occupational Health deals with healthy people at work everyday and sees that they remain healthy, that fit people become more adapted to their work.

Occupational Health works while they work.

THE FABRIC OF OCCUPATIONAL HEALTH

Occupational Health can be defined as the promotion and maintenance of the physical and mental well-being of workers with particular reference to the jobs they are doing. This also includes the effort to achieve a psychophysical balance between an employee and his job.

Quite a complete health-care programme—a comprehensive approach to the total health needs of the employed population—starting right from the time of recruitment to extend throughout an employee's working life.

Here is a service which goes to the workspot and studies the man in action before he gets into in-action.

Here is a service which aims at the well-being and growth of an employee as a total man.

'What cannot be cured must be endured' is now a story of the past. It can be prevented.

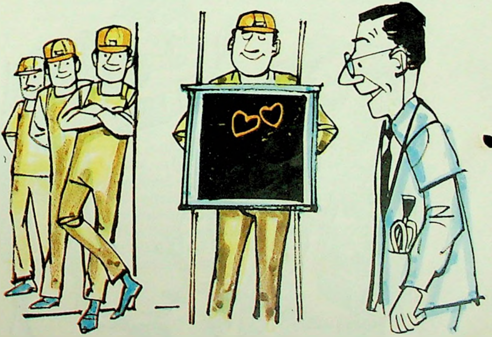
TIRELESS STRIVING STRETCHES ITS ARMS

WHAT OCCUPATIONAL HEALTH DOES —ITS CONTENT

Occupational Health Service of BHEL-Tiruchi conducts regular medical examinations of its employees —right from recruitment onwards. Positive promotion of health, specific protection against industrial health hazards and communicable diseases, medical aid, supervision of work places at intervals, health education, psychological guidance and the maintenance of health statistics are all included in this service.

As a first step, it protects the employees against any health hazard arising out of their jobs or the conditions in which they work.

Then it contributes to the employees' physical and mental adjustment, in particular by the adaptation of work to man and each man to his job.



HOW OCCUPATIONAL HEALTH WORKS

1. Placing people in suitable work. Through pre-placement and periodic medical examinations and placing employees in jobs that are suited to their physiological and psychological equipment. Preplacement examination also provides baseline data together with periodic examinations. Periodic examination is a monitoring procedure supplementary to environmental monitoring.

2. Providing treatment service—to maintain a safe and healthy working environment by providing prompt and efficient initial treatment of illnesses and injuries at work. This also provides epidemiological evidence of hazards.

3. Controlling recognised health hazards. Eliminating the hazard by substitution of the process or at least by successfully controlling the ill-effects.

4. Research and Development —
by identifying the unrecognized hazards. Detective work in identifying health hazards—from the apparently trivial that interfere with comfort and efficiency to those that endanger life. R & D on ways to control them.

This depends on two distinct types of enquiry :

(a) The clinical observation of sick individuals who seek treatment.

(b) Field surveys and other epidemiological methods.

R & D on ways to further our medical benefits also.

5. Avoiding potential risks of disease and injury by the application of ergonomics considering fatigue and adverse psycho-social factors.

6. Well-person screening and treatment by screening for early evidence of any disease that may be setting in—both occupational and non-occupational. In particular, occupational health service gives unrivalled opportunity for identifying and dealing with mental illness in its very early stages.

7. Executive health supervision.

8. Psychological guidance and counseling. Occupational health here serves by two different types of counseling—first at attendance for treatment and other routine examinations—this ranges from simple advice about a specific complaint to a more extensive counseling about personal, social, emotional and even economic problems—secondly when employees come voluntarily for advice about a much broader problem connected with their work or domestic life. Psychological guidance and counseling forms an important and useful function of Occupational Health Service.

P.T.O

9. Health education —

    Both individual and group by educating the employees towards healthier modes of living.

10. Supervision of welfare amenities especially canteen and periodic checks of kitchen. Special periodic examinations of food handlers and canteen staff.

    Thus we go on...
    Striving, tirelessly, stretching our arms and embracing health in all its aspects.

MOTTO IS POWER TO THE PEOPLE MOTIVE IS POWERFUL PEOPLE

BHEL's success in the power club is entirely due to its power—its 50,000 strong work force—*the power that creates power.*

A manufacturer of power equipment—its main and powerful motive is the health and happiness of the men who make the machines move.

Occupational Health Service is a means to the desired state of health and happiness.

A FEATHER IN THE CAP

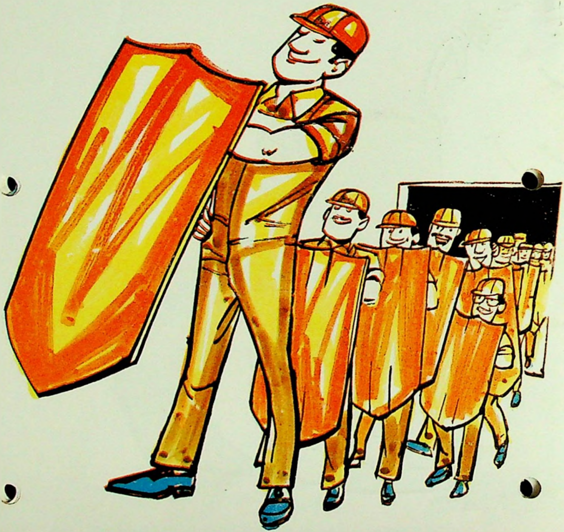
BHEL today is one of the pioneers in the field of Occupational Health too.

Yet another feather in the cap.

Not that it is so much fond of the 'feather in the cap'; as it is of the 'bird in the nest'.

It is the love of its men that prompts BHEL in anything it does. In this respect, BHEL is quite possessive too.

THE EMERGING POWER



India today is totally self-reliant in her power equipment needs. In the last two decades, India has experienced a seven-fold increase in power generation capacity. 140 power stations, thermal and hydel, dot the Indian countryside. Over and above, 79 hydel, 45 thermal and 3 nuclear power stations are in various stages of design, manufacture and erection.

Significantly, almost all the equipment for these power stations is being manufactured in India by BHEL.

Yes, India today is an emerging member of the international 'Power Club.' And is one of the 10 countries in the world which manufacture steam generating equipment.

Now, India has the technological know-how and production capability at BHEL to offer turn-key power projects to countries the world over.

The BHEL complex employs about 50,000 engineers, technicians and other staff. It has four production units located at Bhopal, Hardwar, Hyderabad and Tiruchi. The Corporate headquarters of BHEL at New Delhi co-ordinates the production and marketing of products emanating from the units. A full-fledged Research & Development Unit keeps abreast of the latest developments, standardises and—simplifies product designs to place at your service products that are economical to run. BHEL's Services & Spares Unit provides specialist after-sale services for maintenance and operation of sophisticated equipment. It has a Consultancy Wing and a Power Projects Division. And now it has a Comprehensive Occupational Health Service to take care of the total health needs of its man power—the power that creates power.

POWER TO THE PEOPLE

BHEL
TIRUCHIRAPALLI

Bharat Heavy Electricals Limited
(A Government of India Undertaking)
High Pressure Boiler Plant,
Tiruchirapalli 620 014

Hindu, 4 Sep 1978

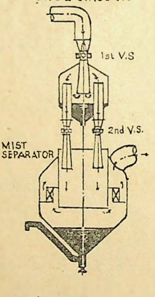
Efficient Dust Collector

THE plant and machinery division of Nippon Steel is a manufacturer as well as user of pollution control equipment.

One of the division's specialities is dust collectors. Detailed study of gas and dust compostion has enabled the division to manufacture a wide range of dust collectors.

To maintain constant dust collecting efficiency in the venturi scrubber, the rates of water injection and gas flow at the throat must be constant. If, for example,

DIAGRAM OF ONE TOWER TYPE 2-STAGE V.S



a venturi scrubber with a fixed throat is used for treatment of BOF gas, which is generated at highly fluctuating rates. the gas flow rate at the throat will change frequently, which will in turn affect the dust collecting efficiency. Therefore, it is important to make the gas throat adjustable to accommodate changes in gas flow rate.

To meet the above requirements, Nippon Steel developed and patented the R-damper type variable-throat venturi scrubber.

Since the function of the throat is to force the dust particles in the gas to collide with water spray, it must be followed by a section to separate the water and dust. These separation methods include cyclone, inertial impaction, and settling method. Nippon Steel has developed the Circular Louver System and the stuffed system.

Nippon Steel has developed a new type of second-stage venturi scrubber system.

The new system was developed due to (1) increase in the size of BF gas cleaning equipment, septum valve and muffler, and increase in noise level from septum valve due to increases in the size and pressure of blast furnaces, (2) necessity of reducing the noise level of the septum valve to cope with severer restriction for noise control, and (3) evasion of troubles arising in the septum valve due to shock waves. In conventional systems, the functions o gas cleaning, top pressure control and noise control are separately performed by V.S., septum valve, and muffler; whereas, in the new system, the functions are performed by a second V.S. to make the system compact.

The new system has the following advantages:

(1) The elimination of septum valve and muffler makes the system compact. Especially, the "One tower type" system employed by No. 1 BF of Kamaishi Works (Figure) where the first V.S. arranged above the second V.S., is useful for relining work to be done at a limited space.

(2) Elimination of the septum valve and muffler reduces the initial cost.

(3) Compared with conventional top pressure control by the septum valve (butterfly valve), the top pressure control at the throat of venturi scrubber generates lower noise due to the damping effect of water.

Science
Engineering
Technology

European Patent Office

THE European Patent Office, newly opened in Munich, Federal Republic of Germany, will revolutionise patent law.

A single patent application now protects inventions in Britain, France, Germany, Benelux, Sweden and Switzerland. Austria, Denmark, Ireland and Italy are shortly to join the club. Eventually all sixteen signatories of the 1973 European patent convention will be covered by an application to the Munich office.

The cost per application is substantially less than that of an individual application in each country, says George Vianes, administrative board chairman of the organisation. So it should interest not only the well-heeled multi-nationals but also smaller companies.

The legal position will be less complicated. Companies and individuals with new ideas to patent should feel more sure of themselves. The office will also be the first to deal directly with the general public.

Initially applications will be checked for formal accuracy at an office in The Hague. There and in West Berlin technical preliminaries will also be conducted. Once details of the technique or invention are published, further processing of the application will be from the Munich head office.

Automatic Tyre Pressure Detection

BRIDESTONE Tire Company, Japan's top auto tyre maker, has developed a unique alarm system for detection of abnormally low tyre pressure that results in flat tyres or causes other troubles.

The system is initially developed for use on heavy-duty vehicles but it can be adopted for passenger cars.

The device consists of a diaphragm, to be attached to the hub of a wheel, and a cell oscillator that sends pulse signals to the diaphragm and relay the return signals to the indicator.

The blip indicator, to be installed at the instrumtnts panel in front of the driver's seat is powered by the car battery.—Our Bombay Staff Sorrtspondent.

Laser Microscope

THE laser beam has become a scalpel in the hands of surgeons and dentists and an instrument of therapeutists. The coherent (narrowly directed) laser beam can produce a three-dimensional image on multi-layered X-ray films, which allows one to use the laser for giving diagnoses.

The laser has made its contribution to the development of microscopy, which started with the simple lens microscope. The systems of the laser projection microscope, designed over the past few years, are ever more widely applied. Such a microscope makes it possible to examine the object of studies directly on a large screen.

One of such systems, developed at the Physical Institute of the USSR Academy of Sciences, raises many times—with the aid of laser amplification—the brightness of the image without increasing the intensity of illumination of the object under observation. This is of great importance in many scientific investigations, especially in medicine and biology.

The Physical Institute also created a system of transmitting a television image by laser beam, where the signals of the image are transmitted through glass fibre only 0.15 mm thick.

In addition, the institute suggested that the conventional kinescope should be replaced by a kinescope with a laser screen, without changing the circuit of the television set. Such a screen is formed by a thin monocrystalline semiconductor plate grown and treated in a special way. A controllable electron beam, running on the surface of this plate line by line as in a kinescope, produces a glowing image. The brightness of the semiconductor screen, one square centimetre in area, is so great that the image can be projected to a cine-screen whose area is several square metres. Using plates of different materials, one can obtain emissions of any colour, while the combination of pictures of the elementary colours produces an excellent colour image.

Thermonuclear synthesis can become one of the most promising sources of energy. Scientists all over the world are trying to tame a thermonuclear reaction.

For this purpose the energy of lasers is also used. Such studies are being conducted at the Physical Institute which designed a unique laser installation—the Dolphin. In this device 54 laser beams with a total energy of about 5,000 joules are focused, in a vacuum chamber, on a special deuterium and tritium target. These laser beams must produce a very short (about 0.000,001 second) powerful light pulse. The capacity of the flash it will generate will exceed the capacity of all power stations in the world.—APN.

Continuous Ultrasonic Cleaning

A NEW ultrasonic system for the rapid and thorough cleaning of mass-produced parts prior to metallic surface coating has been developed by the Axel Johnson Institute for Industrial Research, Nynashamn. Soot, coke, oxides, oils, etc., are completely removed and pickling time can be cut by 80 per cent, it is stated.

The new ultrasonic cleaner works continuously, as opposed to the batchwise operation of conventional ultrasonic systems. It consists of a heat and sound insulated stainless steel tank, with the system's ultrasonic transducer being placed in a steel box. The latter's top doubles as slide for the goods.

The goods are evenly fed into the cleaning bath — normally plain water and detergent — and travel down an incline under the influence of gravity and of vibrations induced by an ultrasonic emitter. This is said to ensure that every single detail is exposed to ultrasonic waves. The goods are transported from the bath on a continuous belt conveyor.

In addition to drastically cutting pickling time, the new system eliminates the need for lye or electrolytic cleaning and the number of treatment steps is reduced, the Institute says.

TOOL &

The wage bill alone in the last cooperative year was Rs 12 crore and the sales turn-over Rs 20 crore. The workers who had to depend on the government for the initial share capital contribution not only repaid the amount but even created a Rs 2-crore deposit of their own which made the society do away with financial dependence on any other institution including commercial banks. In fact, the district cooperative bank in Cannanore depended on the society for the major portion of its deposits.

The achievement, however, had not been all that tearless. The beginnings of the society and its brand of beedis were marked by a long drawn confrontation with a private manufacturer on a trade mark issue. Perhaps deliberately, the society had branded its products similar to the one being marketed by an existing producer, whose was one of the bigger establishments in the district which were closed down. Even a contempt of court case was hurled against the chairman of the society, G.K. Panikkar, an IAS officer belonging to the industries department of Kerala, who was specially deputed to organise the society.

Another major problem that the society faced in later years followed the decision of the Government of India in the mid-seventies to levy an excise duty on branded beedis and shift the levy on tobacco too to the branded beedi. At present the levy comes to Rs 3.84 per thousand beedis and the Kerala Dinesh Beedi Cooperative is forced to pay nearly Rs 300 lakh a year to the government. But more than the levy itself, it was the appearance of spurious beedis in the market that posed a major challenge to the society. Private traders could easily evade the levy, taking advantage of the exemption given to manufacturers of up to 20 lakh unbranded beedis a year. Normally these products of the small manufacturers are being bought by the bigger ones who could make a clean extra profit of Rs 3.84 for every thousand beedis, evading excise levy.

The excise levy and the huge disparity in wage levels were an invitation for the unscrupulous traders in neighbouring states. All that they needed to do was to get the labels of Dinesh beedis printed and affix them to their own bundles of beedis before dumping them on the unsuspecting smokers. Already not less than 30 cases of such spurious Dinesh beedis have been detected and it is established that a thriving business has been going on in some Tamil Nadu towns in printing fake labels. The Government of India, too, has not heeded the distress pleas of the workers' cooperative urging it to shift the levy back to tobacco so that the competition between the private and workers' sectors became fairer.

Keeping the count. Women employees of the cooperative

A more recent problem for the cooperative was when the authorities insisted on Employees State Insurance coverage for the beedi workers of Cannanore. That would have entailed a liability of one crore rupees for the society without any commensurate benefit for the workers. The society has, however, been successful at least in temporarily warding off this danger, pointing out that beedi workers in other states were not generally covered by the ESI and that they could get medical aid through the special hospitals and dispensaries established under another scheme. The arithmetic of ESI coverage for beedi workers in the country proved their point. In Kerala, 23,154 beedi workers in 31 establishments are covered by ESI, while in Karnataka none came under the scheme, and in West Bengal only 56 beedi workers are covered.

The success of the cooperative venture has been not without its impact on the private sector in Kerala and outside. The immediate result had been the creation of an awareness on the part of the workers in the neighbouring areas that they deserved a much better deal. Private manufacturers were forced to fall in line and enhance the wage rates to a great extent. Said a spokesman of the Kerala Dinesh Beedi: "We are now capable of absorbing all the beedi workers in Cannanore district should the manufacturers resort to any drastic step like closure as they did in the sixties."

It is this possibility that has now emboldened the workers to challenge the employers based in Karnataka in their latest agitation. Even in Karnataka, the government had become aware of the miseries of the beedi workers and there is some effort to improve their condition. Already a cooperative society on the lines of the Kerala venture has been sponsored in the South Kanara district of Karnataka with eight primaries and a central society. More are on the anvil. In Kerala itself a second society, with headquarters at Shoranur and covering workers in two districts with large concentrations, has been formed.

The Government of India also was inspired by the Kerala experiment and asked G.K. Panikkar to chalk out a policy for the organisation of beedi workers in the country on cooperative lines. The action plan that Panikkar has formulated envisages the formation of at least 100 cooperatives covering a minimum of five lakh workers in various states.

Although the total commitment to be borne by the state governments was estimated to be a meagre Rs 17.5 crore, the powers that be appeared to lack the will and the drive to put through the plan to save the beedi workers, 90 per cent of whom live below the poverty line, from the clutches of exploiters and middlemen. Even the West Bengal government has not pursued it vigorously yet. The result is that the beedi workers continue to labour with ridiculously low wages, like the Rs 8 paid for rolling thousand beedis in West Bengal or the Rs 5 paid in the former Prime Minister's constituency of Rae Bareily in Uttar Pradesh. An intriguing reluctance on the part of the state governments, indeed!

—P. ARAVINDAKSHAN

Rolling up the sleeves

Kerala's beedi workers fight for survival

MISERY and militancy go with the nearly 80,000 beedi workers of Cannanore district which has the largest concentration of them. These people who roll the poor man's smoke also play one of the biggest roles in the sustained and heroic working class struggles in the country, interspersed with thrilling victories and frustrating defeats. It was they who provided the fertile ground for militant movements, from communism in the early stages to the Rashtriya Swayamsevak Sangh and the extremist Naxalite adventures in the late sixties. And they are at it again.

About 15,000 of them in the border areas of Kerala with Karnataka are on the war path, demanding a hike in the minimum wages. As in the past, the present confrontation also is with the beedi lords operating from Karnataka who take advantage of the comparatively low wages prevailing in that state—around nine rupees for rolling 1,000 beedis, the average daily output of a worker. Every time the workers demanded an increase in wages the manufacturers have been getting away with mass closure of factories located on the Kerala side.

The migration of factories from Kerala to the neighbouring Tamil Nadu and Karnataka has been a steady process ever since the workers started asserting their rights and demanded a fair deal in the late sixties. Then their demands were backed by the communist-led government of E.M.S. Namboodiripad. More than 12,000 workers were subsequently thrown out on the streets as several leading Karnataka-based manufacturers withdrew from Kerala when the state government's decided to enforce from November 1968 the provisions of the Central Beedi and Cigar Workers (Conditions of Employment) Act.

Although many among them despaired, the majority of the victimised workers were not cowed down by the cruel strategy of the manufacturers. The government came to their rescue and they started an organisation for beedi-making on cooperative lines, which led to the emergence of one of the biggest real workers' sector in the country at Cannanore.

Yet neither the Tamil Nadu government nor the Karnataka government showed the courage or inclination to give a similar helping hand to their weakest section of working class. The disparity in wage rates between these states, therefore, continued to grow with the consequent emigration of manufacturers from Kerala as in the case of some other traditional industries like coir and cashew. Moreover, the manufacturers began to resort increasingly to several undesirable practices. Most of them began operating invisibly through middlemen and contractors, with no employer-employee relationship between the manufacturers and the workmen.

In the sixties, when in a similar move the manufacturers closed shops in Kerala, the state government helped the workers to form the society with a share subscription of one rupee per head and another Rs 19 per head from the government. Though the beginning was with only 3,000 workers with the remaining put on the waiting list, because of the need to limit production in view of the initial difficulty of marketing a new brand of beedi, the growth of the society was indeed phenomenal. In just about five years it could absorb all the 12,000 unemployed workers and continued its further expansion enlisting more workers at the rate of 2,000 every year. Today the society has 35,000 workers organised in 22 primary societies, manufacturing and selling beedis worth Rs 10 lakh everyday. The average daily wage of Rs 25-30 paid by the society for rolling 1,000 beedis is the highest in the industry anywhere in the country.

A success story. A work centre of the Kerala Dinesh beedi cooperative

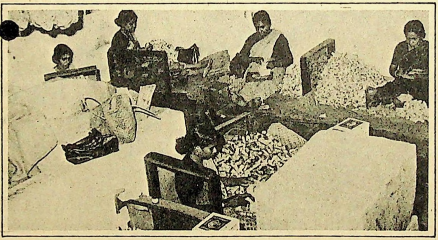
The latest agitation too is no more than another step in the continuing struggle of the workers, inspired by the exhilarating success of their counterparts in the cooperative society known as the Dinesh Beedi Workers' Central Cooperative Society based in Cannanore. A comparison of their own plight with the conditions of service under the society (which employs 35,000 workers and pays them an average daily wage of Rs 25-30) spurred the workers in the private sector into a sustained struggle which has become the nightmare of private manufacturers. Once again, the manufacturers' answer was to withdraw from Kerala, closing down many of their depots.

It did not take long for the society, which was essentially an organisation of militant trade unionists, to extend to the workers several benefits and incentives though under a phased programme. They included national festival holidays, Sunday wages, one day's wage extra for every twenty days of work, maternity leave, gratuity, provident fund and bonus, all of which remained the dream of the average worker in the private sector.

An index of the growth of the society is that its annual budget is Rs 45 crore, which is more than the annual budgets of all the universities in Kerala put together.

The wage bill alone in the last cooperative year was Rs 12 crore and the sales turn-over Rs 20 crore. The workers who had to depend on the government for the initial share capital contribution not only repaid the amount but even created a Rs 2-crore deposit of their own which made the society do away with financial dependence on any other institution including commercial banks. In fact, the district cooperative bank in Cannanore depended on the society for the major portion of its deposits.

The achievement, however, had not been all that tearless. The beginnings of the society and its brand of beedis were marked by a long drawn confrontation with a private manufacturer on a trade mark issue. Perhaps deliberately, the society had branded its products similar to the one being marketed by an existing producer, whose was one of the bigger establishments in the district which were closed down. Even a contempt of court case was hurled against the chairman of the society, G.K. Panikkar, an IAS officer belonging to the industries department of Kerala, who was specially deputed to organise the society.



Keeping the count. Women employees of the cooperative

Another major problem that the society faced in later years followed the decision of the Government of India in the mid-seventies to levy an excise duty on branded beedis and shift the levy on tobacco too to the branded beedi. At present the levy comes to Rs 3.84 per thousand beedis and the Kerala Dinesh Beedi Cooperative is forced to pay nearly Rs 300 lakh a year to the government. But more than the levy itself, it was the appearance of spurious beedis in the market that posed a major challenge to the society. Private traders could easily evade the levy, taking advantage of the exemption given to manufacturers of up to 20 lakh unbranded beedis a year. Normally these products of the small manufacturers are being bought by the bigger ones who could make a clean extra profit of Rs 3.84 for every thousand beedis, evading excise levy.

The excise levy and the huge disparity in wage levels were an invitation for the unscrupulous traders in neighbouring states. All that they needed to do was to get the labels of Dinesh beedis printed and affix them to their own bundles of beedis before dumping them on the unsuspecting smokers. Already not less than 30 cases of such spurious Dinesh beedis have been detected and it is established that a thriving business has been going on in some Tamil Nadu towns in printing fake labels. The Government of India, too, has not heeded the distress pleas of the workers' cooperative urging it to shift the levy back to tobacco so that the competition between the private and workers' sectors became fairer.

A more recent problem for the cooperative was when the authorities insisted on Employees State Insurance coverage for the beedi workers of Cannanore. That would have entailed a liability of one crore rupees for the society without any commensurate benefit for the workers. The society has, however, been successful at least in temporarily warding off this danger, pointing out that beedi workers in other states were not generally covered by the ESI and that they could get medical aid through the special hospitals and dispensaries established under another scheme. The arithmetic of ESI coverage for beedi workers in the country proved their point. In Kerala, 23,154 beedi workers in 31 establishments are covered by ESI, while in Karnataka none came under the scheme, and in West Bengal only 56 beedi workers are covered.

The success of the cooperative venture has been not without its impact on the private sector in Kerala and outside. The immediate result had been the creation of an awareness on the part of the workers in the neighbouring areas that they deserved a much better deal. Private manufacturers were forced to fall in line and enhance the wage rates to a great extent. Said a spokesman of the Kerala Dinesh Beedi: "We are now capable of absorbing all the beedi workers in Cannanore district should the manufacturers resort to any drastic step like closure as they did in the sixties."

It is this possibility that has now emboldened the workers to challenge the employers based in Karnataka in their latest agitation. Even in Karnataka, the government had become aware of the miseries of the beedi workers and there is some effort to improve their condition. Already a cooperative society on the lines of the Kerala venture has been sponsored in the South Kanara district of Karnataka with eight primaries and a central society. More are on the anvil. In Kerala itself a second society, with headquarters at Shoranur and covering workers in two districts with large concentrations, has been formed.

The Government of India also was inspired by the Kerala experiment and asked G.K. Panikkar to chalk out a policy for the organisation of beedi workers in the country on cooperative lines. The action plan that Panikkar has formulated envisages the formation of at least 100 cooperatives covering a minimum of five lakh workers in various states.

Although the total commitment to be borne by the state governments was estimated to be a meagre Rs 17.5 crore, the powers that be appeared to lack the will and the drive to put through the plan to save the beedi workers, 90 per cent of whom live below the poverty line, from the clutches of exploiters and middlemen. Even the West Bengal government has not pursued it vigorously yet. The result is that the beedi workers continue to labour with ridiculously low wages, like the Rs 8 paid for rolling thousand beedis in West Bengal or the Rs 5 paid in the former Prime Minister's constituency of Rae Bareily in Uttar Pradesh. An intriguing reluctance on the part of the state governments, indeed!

—P. ARAVINDAKSHAN


CHECKLIST OF COMMON ALLERGENS
A
Acetone
Alcohol
Antibiotics
Ant bites
Asbestos
Aspirin
B
Bacteria
Bee stings
Beverages
Blood transfusions
Boric Acid
C
Cats
Cereals
Chemicals
Cockroaches
Cosmetics
Cucumber
D
DDT
Detergent
Drugs
Dust
Dyes
E
Eau-de-cologne
Eggs
Elaichi
Ether
F
Feathers
Fish
Flowers
Foods
Fumes
Furs
G
Garlic
Gasoline
Gelatine
Grapes
Grass
Guavas
H
Hair
Haldi
Hay
Honey
Household pets
Husk
I
Ice-cream
Inks
Insecticides
Insects
Iodine
J
Jackfruit
Jaggery
Jasmine
Jeera
Jute
K
Kajal
Kerosene
Kesar
Kumkum
L
Latex
Leather
Lemon
Lipstick
Lobster
M
Mascara
Meat
Metals
Milk
Mosambi
Mustard
N
Nail polish
Naphthalene
Nuts
Nylon
BOEHRINGER-KNOLL LIMITED
O
Oats
Oils
Onions
Oranges
Oysters
OIL
P
Paint
Penicillin
Plants
Plastics
Pollen
Pomades
Q
Quill
Quilt
Quinine
R
Radiation
Rayon
Resins
Roses
Rubber
S
Sand
Silk
Smog
Spices
Sulpha
Sun
T
Talc
Tobacco
Tomato
Toothpaste
Turpentine
U
Ultra violet rays
Urea
Urethane
V
Vaccination
Vanilla
Varnish
Vaseline
W
Wasp
Wax
Weather changes
Weeds
Wheat
X
X-rays
Xylene
Xylocaine
Y
Yam
Yeast
Yew
Yolk
Z
Zinc Oxide
Zygospores
ZINC OXIDE
Calciluvin®
QUALITY
THE ONLY ANTI-ALLERGIC WITH
CALCIUM, LUVISTIN AND VITAMIN C

Calciluvin®

the only anti-allergic with Calcium, Luvistin and Vitamin C

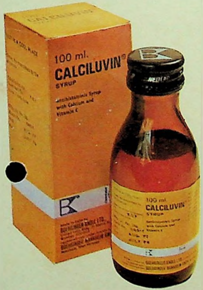
HOW MUCH AND WHEN

In allergic attacks

Children	Adults
1-2 teaspoonfuls thrice daily	1-2 tablespoonfuls or 1-2 dragees thrice daily

To prevent recurring allergies

Children	Adults
1-2 teaspoonfuls once a day	1-2 tablespoonfuls or 1-2 dragees once a day



Presentation

Bottle of 100 ml. Calciluvin Syrup

Bottles of 20 and 250 Calciluvin Dragees

BOEHRINGER-KNOLL LIMITED
United India Building, P. Mehta Road
Bombay 400 001

mannheim boehringer

8/1/73 Physiology I

Heat adaptation and acclimatization.

Importance of the study of thermal environment
1. Relation of temperature to accident frequency.
2. Need for comfortable environment for work

Thermal environment
1. Temperature of air
2. Insensible heat - water in air
3. Radiant heat

Factors responsible i) Amount of Heat
ii) Rate of exchange of heat from environment to body and v.v.

Heat conductivity of air.
Expt - Hand in water at 45°c (Pain Threshold)

Heat exchange
For thermal equilibrium.
Heat Balance equation for Man

$$\underset{M}{\text{Metabolism}} - \underset{W}{\text{Work}} = \underset{E}{\text{Heat lost by Evaporation of sweat}} \pm \underset{R}{\text{Radiant component (Sun)}}$$

$$\pm \underset{C}{\text{Convection (air)}} \pm \text{Conduction } K \text{ (solid components)}$$

$\pm$ S = Heat stored in the body

$$M - W = E \pm R \pm C \pm K \pm S$$

Metabolic Rates
1. Sleep - 45 watts/m²
~~Sl~~ Sitting - 50.
Walking slow 100
" fast - 200

Sources of Information
- Exercise
- Skin temperature
↑ Deep body ,
↑ Rate of change of Deep body temperature.
- Rate of change of skin temperature.
- Time of day

→ set information level reqd. for threshold

Sweating
1. Mechanism.
2. Relation to deep body temperature and skin temperature
3. Equilibrium between liquid and vapour phase or effect of humidity of environment on

sweating (Relative Humidity

Factors controlling evaporation of sweat from body.

1. Total available square area of skin
2. Humidity of environment
3. Wind movement.

Adaptation to Thermal environmental

1. Behavioural - change behaviour to reduce thermal load.

2. Clothing

3. Physiological

C.VS - i) Increase of blood volume

ii) ↑ of blood in skin.

Sweat glands

i) sweat out/pour ++

Physiological adaptation usually completed c̄ 10 days in Tropical environments

WBGT - Wet Bulb Globe Temperature

Index

·7wb ·2gt ·1db

Indices used to define

i) Working environment

ii) General environment.

Instruments

1. Sling-cyclometer - wet & dry bulb hygrometer

2. Globe thermometer - to measure radiant heat/wild heat

3. Air temperature and movement → Kata thermometer

4. WBT meter

29/1/73 HEAT DISORDERS Prof. Weiner

Ref. i) F.P Ellis Environmental Research 1972 Vol 5 March.
ii) "Heat Stress and Heat Disease" - Leithead and Lind
Cassell 1964

← rather long & confused
International Statistical classification of Heat illness
Heatstroke Heat apoplexy, thermoplegia.
Sunstroke Ictus solaris, insolation, siriasis, thermic fever.
Heat cramps
Heat exhaustion & collapse - heat prostration, heat syncope

Sunburn - Actinic dermatitis (by ultra violet rays)
Diseases of Sweat glands - Anhidrosis, heat rash, milaria rubra, prickly heat, other diseases of sweat gland.
Asthenic reaction, nervous debility, nervous exhaustion, nervous prostration, neurasthenia, psychogenic asthenia psychogenic general fatigue.
Other - excessive heat, heat effects not otherwise specified due to hot weather or overheated places.

Better classification

Systemic 1. Heat stroke (Hyperpyrexia)
2. Heat exhaustion i) — circulatory defficiency (Vasomotor / Acute heat syncope)
ii) water " H.E.
iii) salt " "
iv) Anhidrotic " "

Skin disorders
1. Prickly heat
2. (Sunburn)

Psychoneurotic
1. Mild or transient heat fatigue
2. Chronic or Tropical fatigue.

Heat aggravated illness
1. Diabetes
2. Coronaries & CVA

Heat stroke - serious condition - characterised by derangement of temp regulator mechanism - leading to very high body temp and derangements of the CNS.

Heat disorders occur in
1. Tropical environments
2. Industries & factories - (
3. Heat waves

Heat stroke - Signs & Symptoms
1. Coma
2. Convulsions.

Cause i) Cessation of sweating -
b) Damage to heat regulatory centre

Heat Syncope
Incidence 1/2000
- Studies done on agricultural labour, servicemen, industrial workers
- Uncomplicated (No signs of water or electrolyte defficiencies) - no rise in body temperature
- Vasovagal attack - usually after standing and working in a hot environment for a long time
- Fall in B.P & Pulse - due to pooling of blood in the dilated vasculature of the leg muscles after work

Water defficiency H.E
- loss of water c̄ out adequate replacement in a given time.
- e.g infants in tropics, long distance runners

Salt defficieny H.E
- Cramps in leg muscles and abd. muscles
- reported from i) iron foundries
ii) coal mines
iii) ship - boiler rooms
- Shrinkage of vascular compartment - due to increased fluid loss (urine & sweat) to keep up osmotic pressures of remaining salt in blood & tissue fluids. Plasma and urine chlorides are decreased.

Anhidrotic H.E
some impairment of sweating resulting from damage to the sweatglands. Anhidrosis is assoc c̄ prickly heat past or present
- Patchy sweating seen in Europeans in tropical countries
- Subject feels hot, does not feel like doing any exercise. Polyuria or oliguria
- Has a rash

Prickly heat
- blockage of sweat glands
- miliaria rubra → profunda → pustulosa.
- similar condition can be experimentally produced by damage to skin due to formaldehyde, maceration etc.

Psychoneurotic conditions
- outside comfort zone
- vague symptomatology
- very common among workers in industries
- Leads to fatigue, decreased production and increased absenteeism.

Tropical Fatigue - characterised by deterioration of character and performance - seen in white settlers and serviceman.
- Studied by Macpherson in Australia
- Psychological reaction to uncomfortable conditions of living and lack of social amenities
- other factors - increased consumption of alcohol. and may be "constitutional"
- vague condition perpetuated by novelists like Somerset maugham etc

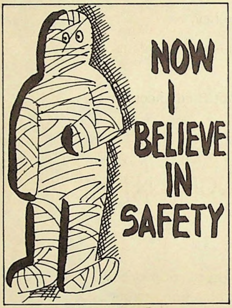
Odema of ankle - also reported as a heat disorder
- Seen in the first week of stay in a truly tropical environment
- Transient, disappears on acclimatization
- Due to local vasodilatation due to heat stimulation.
- No R_x - reassure patient

A

BEL

HEALTH EDUCATION PROGRAMME

INDUSTRIAL ACCIDENTS



A safe worker is a happy worker
His family is a happy family

BHARAT ELECTRONICS Ltd.
HOSPITAL

INDUSTRIAL ACCIDENTS

DO YOU KNOW THAT

- ★ There were 2,78,485 accidents in 1970 in recognised industries – 553 proved fatal — **A TRAGEDY !**
- ★ 500 to 600 persons are killed every year due to industrial accidents.
- ★ Rs. 19,60,00,000 were paid in 1970 by ESI Corporation as disability benefits — **COLOSSAL !**
- ★ Lower accident rate results in higher efficiency.
- ★ 17 Millions mandays were lost due to industrial accidents – in 1971 - 72 — **A NATIONAL WASTE !**
- ★ More mandays are lost on account of industrial accidents than any other cause.

CAUSES OF INDUSTRIAL ACCIDENTS

- ★ Safety Measures Unsatisfactory.
- ★ Safety Officer's warnings have been disregarded by the Supervisory Staff responsible for the achievement of production targets.
- ★ Workers are not cautioned against working without safety devices and supervisory staff are not held responsible for not providing them.
- ★ Protective appliances such as shoes, gloves, overalls, goggles etc. are not used.
- ★ Trade Unions do not take sufficient interest in instructing workers on Safety Measures.

Safety has to come about more as a habit and a way of life than by Compulsion.

Printed by BEL

BEL

HEALTH EDUCATION PROGRAMME

DIABETES

If you have some of these symptoms persisting, consult a doctor at once.

a history of diabetes in your family

frequent and excessive urination

persistent hunger

abnormal thirst

undue fatigue and drowsiness

recurring boils, carbuncles and other skin infections

loss of weight

persistent itching

visual blurring and other disturbances of sight

cuts, scratches and burns that heal slowly

BHARAT ELECTRONICS LTD
HOSPITAL

DIABETES

What is diabetes:

Diabetes is a metabolic disorder in which there will be persistent high blood sugar which spills out in urine due to deficiency of "insulin" in the body.

Who gets diabetes:

It is essentially a disease of the middle and old age, but it can affect even children or youth. Usually it runs in families and is passed on from generation to generation. About 1% of the population suffer from this disease in India. But 9 out of 10 cases go undetected as most patients do not have the knowledge of the disease.

Causes:

The exact cause or causes of Diabetes are still unknown. Something happens to the body due to which it is not able to use all the sugar that one eats. More than half of what you eat is carbohydrate which is ultimately converted into glucose (sugar) in the body and used to provide energy to the body. Due to inadequate secretion of insulin from pancreas in the body, the glucose fails to find its way into the muscle cells and the sugar level in the blood rises.

Symptoms:

In many cases no symptoms are found. But some of the symptoms, for which one should be on the look-out, are :—

1. Loss of body weight.
2. Sugar in urine.
3. Frequent urination and abnormal thirst.
4. Poor healing of wounds.
5. Itching in genitals.
6. Boils and infection of the skin and visual disturbances.
7. Drowsiness in young patient.
8. Weariness.

Any of the above symptoms, if present, may not be due to Diabetes—as such if any symptoms are present, please consult a doctor.

Treatment:

There is no complete cure for diabetes. The treatment at present is administration of insulin or other substitutes.

Control:

The disease can be effectively controlled by:—

(i) Regulated Diet
(ii) Exercise
(iii) Insulin treatment

Mild cases can be controlled just by regulating diet and exercises.

Diet:

The diabetic person has the same nutritional needs as any one else. His diet should contain less of carbohydrates and enough milk, cheese, butter, meat, eggs, fruits and leafy vegetables. He should avoid sugared coffee or tea or soft drinks. *Doctor's advice should be strictly followed.*

Exercise:

Exercise is very important as it helps to burn up sugar in the body and maintain general condition of the body. This should be decided in consultation with the doctor.

Insulin:

As insulin secretion in the body is insufficient, insulin is to be supplied in the form of injection or oral drugs regularly, as advised by the doctor.

Suggested Diet for Diabetic Patients

BREAKFAST–300 CALORIES

Chappatis with Chutney		Two Two spoons
	or	
Idlies		Two
	or	
Upma		4 ozs
	or	
Rice Rotti		One
	or	
Dosa (plain) with Chutney		Two Two spoons
Coffee		6 ozs

LUNCH–750 CALORIES

Broken wheat (cooked)	8 ozs
Rasam	4 ozs
Kootu or Sambar	4 ozs
Cooked vegetables	8 ozs
Curd (skimmed)	4 ozs
Pappad (not fried)	Two
or	
Chappatis	Two
Dall	4 ozs
Vegetables	4 ozs
Sambar or Curry (palya)	4 ozs
Rice (cooked)	4 ozs
Curds	4 ozs
Pappad (not fried)	Two
Pickle	2 pieces

TEA – 200 CALORIES

A cup of Coffee or Tea (6 oz) with saccharin, a plantain and any one of the following snacks:—

Vada	Two	Upma	4 oz
Rava Idli	Two	Pakoda	Six
Plain Dosa	One	Mixture (Chow Chow)	4 ozs

DINNER – 650 CALORIES

Same as lunch, but quantity of wheat or rice reduced to half.

Remember:

★ There is no known permanent cure for diabetes. It can be successfully controlled by

(i) insulin treatment
(ii) regulated diet and
(iii) exercise.

★ *A tendency towards obesity with a family history of diabetes should be considered as warning. Consult a doctor at once.*

★ Early diagnosis and treatment are important, lest subsequent complications should arise.

★ Once the disease is diagnosed, the patient should place himself under the care of a qualified physician.

★ Doctor-patient co-operation is an essential factor in the control of diabetes.

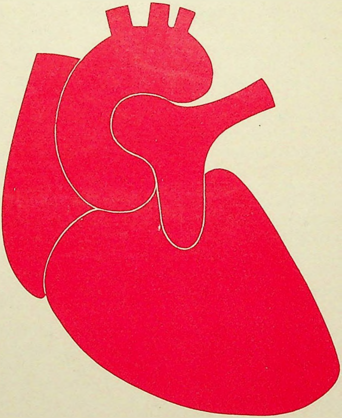
★ The patient should learn to live with the disease, and if proper precautions are taken, he can live a useful life as any other person.

If you are overweight you are more likely to get diabetes

Printed by BEL

HEALTH EDUCATION PROGRAMME

PREVENTION OF HEART DISEASES



YOUR HEALTH IS IN YOUR HEART

BHARAT ELECTRONICS LTD. HOSPITAL

Prevention of Heart Diseases

(A talk by Dr. C. R. Rao, MRCP)

OF all the ailments that may blow out life's little candle, heart disease is the chief. The main causes of death in advanced countries today are heart attacks, strokes and cancer. Heart attacks are due to Atherosclerosis, *i.e.*, the hardening and thickening, the clogging and narrowing of the vital arteries carrying nourishing blood to the muscle tissues of the heart and to the cells of the brain demanding life-sustaining Oxygen.

What are the types of heart diseases ? There are many congenital defects present since birth. A rheumatic heart is due to rheumatic fever. Then there is heart disease due to narrowing of the arteries by hardening and clogging; disease due to high blood pressure; coronary heart disease due to narrowing of the arteries by hardening and clogging; diseases of the heart secondary to diseases of the lungs and a few more types. Of all these, coronary heart disease is the one that causes the so-called heart attacks. and I am going to mention a few of its causes and prevention of the same.

Heart attack, Coronary Thrombosis. Myocardial Infraction and Angina Pectories are all different names or kinds of the same disease process, *i.e.*, Atherosclerosis affecting the coronary arteries, the arteries that supply vital blood to the heart itself.

Coronary heart disease is also known as Ischamic heart disease and has assumed enormous proportions throughout the world in recent years, particularly in the west and other economically advanced countries. Its incidence, the deaths and disability due to it, have reached an alarming level in these countries. Each day, on the average, this assassin called heart attack, kills not one, not one hundred, but 1,400 Americans. Of the various cardiovascular diseases, one stands out as the leading cause of death — coronary artery disease **heart attack**. It alone has accounted for more than 500,000 deaths in USA.

Men are affected more than women. The ratio between men and women is 4 : 1 between the ages of 40–50; 3 : 1 between 50–60; 2 : 1 between 60–70; and after 70, it is about equal. These figures are from USA. Similar figures are obtained in UK and other countries. No accurate figures are available for India. There is no doubt that heart attacks are increasing at a staggering rate, as one can see from the admissions to the hospitals and the longer growing lists of the obituary columns in the newspapers. The WHO Expert Committee recorded : "It will result in coming years in the greatest epidemic mankind has faced unless we are able to meet it by concentrated research into its causes and prevention".

A careful study of the natural history of the disease reveals more and more younger people in the prime of their life, when they are most needed by their family, society and country, are becoming victims of this great assassin — **heart attack.** The disease is spreading to developing countries too. It is generally a disease associated with **property.** The death rate from it is higher among the higher economic strata.

In India, heart attacks are certainly more common among professionals and businessmen But in my experience, it is becoming more frequent among the lower classes.

We know the name of the killer — Atherosclerosis or hardening of the arteries. Atherosclerosis is really due to a conspiracy of factors. There is not one single cause, but a constellation of causes. The chief criminal subjects in this deadly syndicate are:—

1. High blood pressure
2. High levels of cholesterol, a dangerous fatty material, particularly in the blood stream
3. Overweight
4. Excessive eating, especially of certain type of cholesterol-bearing fats.
5. Too little exercise and physical activity.
6. Diabetes
7. Excessive cigarette smoking
8. Tension and stress

and sometimes

9. Heredity.

Of the nine factors mentioned, high blood pressure increases the work of the heart which enlarges in size without corresponding adequate increase in blood supply. Diabetes, high cholesterol containing diet and consequently a high level of cholesterol in the blood precipitate Atherosclerosis, which narrows the blood vessels that supply the vital needs of the heart. The disease is more common among families who suffer heart attacks and may be due to common living habits, environment, etc., rather than due to heredity itself. In this connection, the results of the Framingham study are interesting. It has demonstrated that certain habits are associated with more risk of developing heart disease. The findings provide clues to possible causes of coronary heart disease and suggest means of prevention, since habits and environment can be made susceptible to change. Excessive cigarette smoking, over-weight and sedentary living are among suspect factors associated with increasing the chances of developing coronary heart disease.

PHYSICAL ACTIVITIES

In males, a sustained high level of physical activity may confer protection against heart attacks by stimulating development of additional channels to supply blood to the heart. It also prevents overweight with attendant benefits of lowering serum cholesterol and blood pressure, and reducing work for the heart. The risk of death from heart attacks is three times more in least active males as compared with most active males.

RELATIVE WEIGHT

Attacks of chest pains which are called angina are three times more in individuals who are more than 20 percent overweight compared with people 10 percent underweight. Grossly overweight individuals have an increased risk of sudden death.

CIGARETTE SMOKING

The risk of heart attack among heavy cigarette smokers is twice than in non-smokers. The lower risk among pipe and cigar-smokers suggests that tobacco smoke must be inhaled to produce its baneful effect. When an individual gives up the cigarette smoking habit, his risk quickly descends to a lower level. As far as heart disease is concerned, it pays to quit smoking now.

ALCOHOL

Alcohol consumed in moderation apparently has no harmful effects on circulation. However, it does not protect the blood vessels against the consequences of Atherosclerosis.

MODERATE AMOUNTS OF COFFEE

A moderate amount of coffee drinking does not seem to increase the coronary risk, neither the habitual lack of adequate sleep.

MARITAL STATUS

Marital status or the condition of a marriage is unrelated to risk of coronary heart disease, even though changes in marital status through separation, divorce or death of one of the partners would be regarded by many as evidence of long-standing emotional stress. Neither is the size of a family, small or large, related to the risk of developing coronary heart disease.

HIGH INTAKE OF FATS

It is well known that a high intake of fats leads to higher levels of blood cholesterol and other substances responsible for Atherosclerosis. Besides, rich diet high in calories, fat and protein may also lead to high blood pressure and high blood sugar, etc. Animal fat which is more saturated is more dangerous than fat of vegetable origins :

Substance	Fat Content	Substance	Fat Content
Ghee	58%	Gingely Oil	12%
Groundnut Oil	18%	Coconut Oil	91%
Mustard Oil	20%	Vanaspati	28%

From the above it can be seen that it is far better to use gingely oil, followed by groundnut oil, and mustard oil, than coconut oil and animal fat (ghee or butter.)

PREVENTION OF HEART DISEASE

Now let me tell you a few points concerning the prevention of heart attacks. First let us consider over-eating, overweight and taking too much food rich in cholesterol. You can easily eat yourself into a high risk of heart attack. What changes in one's habits should one adap to keep away the risk? It is simple.

You must reduce your intake of saturated fats. For example, less or no cream, butter, animal fats, eggs, cheese, chocolates and coconut oil. Hydrogenated oil fats may be better, but unsaturated oils of vegetable origin, such as groundnut oil, mustard oil, corn oil, saffola sunflower oil, soyabean oil, and cottonseed oil are superior.

In dairy products, you should prefer skimmed milk, buttermilk and cottage cheese to sweet creams, sourcreams, butter and other cheeses.

Egg yolk is very rich in cholesterol and consumption of eggs should be reduced to two or three a week.

Lean meat is also advisable. You should trim all the visible fat surrounding the meat. In the case of birds, lean white meat of chicken, turkey or game birds is preferable if the skin is avoided because their fat is concentrated under the skin.

Sea food, high in protein content but low in saturated fats, must be encouraged.

As also vegetables and fruits that are low in calories but rich in essential nutrients.

Sweets, cakes and pastries must be limited or avoided completely, if one is overweight.

It is acceptable to use white bread, as well as cereals and potatoes in the attempt to lower cholesterol. The only condition is to watch one's total calories if one is overweight.

Nuts of almost all kinds are good items in your diet for they are high in unsaturated fats and cholesterol-free. However, they are high in calories and weight-watchers should consume them sparingly.

You should spread your meals over the day rather than consume one huge meal with semi-starvation at other meals, because the single large dinner raises blood cholesterol.

Alcohol in moderation is neither harmful nor beneficial. It adds only calories if one is overweight.

Now, we come to the next point of how to lose extra pounds, if overweight. One is by means of diet and the other through exercise. I recommend to overweight patients to avoid alcohol, fried foods, sweets and sugar, potatoes and beetroots. Cut down rice or wheat to half of what you are taking at present. But consume a fair amount of vegetables and fruits.

This diet without the agency of cumbersome dietetics and calculation of calories helps in getting rid of unwanted weight.

Exercise is another step in shedding extra pounds. You can increase your physical activity by walking, avoiding automobiles whenever possible, walking up steps and avoiding lifts. Games and sports like tennis, golf, swimming, etc., played regularly, are a great help. But one of the simplest forms of exercise that I have come across is stationary running for 10 to 30 minutes daily. Regular exercise in some form or the other helps to control weight, maintain the tone of the muscles, and improve the blood circulation to the heart itself.

Smoking is not the critical factor in the epidemic of heart attacks. But statistical studies unanimously point to smoking as one important mal-influence, with significantly less risk encountered by non-smokers or those who have stopped smoking. Cigarette smoking is best given up.

Psychological, social, cultural or economic stress and tension by themselves do not produce heart attacks. But these stresses and strains could be a factor acting in concert with other influences to produce heart disease over a period of years. Hence, one should change one's way of life.

Routine annual medical check-up is particularly important for people like business executives and professionals, who are prone to heart disease after the age of 45. This, along with routine investigations and electrocardiograms, will help to pick-up knowledge of silent or early cases of diabetes, high blood pressure and heart disease in general. Once diagnosed early, these people can be treated and an attempt be made by them to avoid heart attacks.

In the case of heart disease, it is most imperative that once a man has had a heart attack, doctors invariably urge him to change his pattern of life with regard to diet, body weight, smoking etc., Then, why not try to protect the person who is heading for a heart attack before it happens?

Your defence at any age is in your own hands. The measures you have to take are simple, and alluring old habits can be modified. Therefore, one need not become a hypochondriac, fearful of every shadow of statistics, of every egg on his plate, of every cigar or cigarette smoked, and of every vague pain.

Reduce your weight if you are obese. Eat less in the hope that you will live longer to eat more. Increase the amount of daily exercise. Reduce blood pressure if it is moderately elevated. If blood cholesterol is high, see a doctor and change your dietary habits immediately.

Stress is man's challenge to greatness—meet it with equanimity. Avoid excess of all kinds but don't miss anything. Do not forbid things—they are for use—not for abuse.

Our error is over-indulgence in the easy pleasures of living.

Many men abuse cigarettes, food and liquor, and idle their muscles.

Adults must learn to distinguish between moderation and abuse. The answer lies in disciplining oneself and not in forbidding.

The best description now is one you can formulate yourself: stop abusing the good things of our modern life and use today's knowledge in the hope of saving your heart.

I would like to conclude with what Dr. Page says:

"Understand heart disease. You will not fear it"

Printed by BEL

IN CHASNALA 372 MINERS WERE ENTOMBED.

SPURT IN DOCK ACCIDENTS.

The Illustrated Weekly of India
Nov 2 1980

700 DEAD & 220,000 INJURED

Industrial accidents take a heavy toll because owners of factories and mines do not observe safety rules. Why this carelessness?

by Winifred Costa

*A maintenance superintendent at the Tarapur Atomic Power Station was overcome by fumes and killed while trying to rescue two of his colleagues from a nitrogen gas chamber.

*Ten persons died and twelve were injured in an explosion in a pharmaceutical factory in Ahmedabad some time ago. The chief chemist was among those killed. The blast occurred while the anti-tuberculosis vaccine was being prepared.

*Two workers were crushed to death and eleven seriously injured when the loft of a foundry in suburban Bombay collapsed. The bodies were buried under a heap of iron scrap, heavy metal pieces, coal and firewood. →

WELDING WITHOUT GOGGLES—A COMMON SIGHT.

•Eleven persons were injured when a hydrogen gas cylinder burst in a factory at Sion (Bombay) manufacturing vegetable food products.

•A chemist and his assistant were scalded to death in a factory while supervising the mixing of sodium salt with caustic soda in an open vessel. The chemist started the stirrer, the mixture frothed and the burning contents splashed on them.

All these tragedies need not have taken place if there were better safety measures in our factories and industrial establishments.

Out of five million industrial workers about 700 die every year and 220,000 receive injuries.

It was estimated that 83 per cent of such accidents were caused by negligence, 10 per cent by unsafe conditions and seven per cent could be termed "acts of God".

Safety has not attracted the same notice of the trade unions as their claims for higher wages. Accidents cause a lot of human suffering. Workers with serious injuries become cripples and human wrecks. They are left to their fate with the pittance they may receive as compensation.

Every management aims at obtaining optimum production. This is possible only when the workers are satisfied and properly motivated. In many cases, industrialists feel that once they provide a job and pay the worker, their obligation is over.

But what about the physical well-being of their workers? Why has there been a big decline in safety standards in our industrial establishments?

Seventy per cent of our mines and factories have obsolete machinery.

Because of toxic substances and chemicals used, the workers' lungs, kidneys and heart are seriously affected.

Cancer due to "occupational exposure" takes a heavy toll.

Human Life Is Cheap

Accidents in our factories, shipyards, mines and construction sites do not get the same newspaper coverage as plane crashes and rail smashes. Often the dependents of the victims secure only a pittance by way of compensation which is an insult to the dead and the bereaved.

A recent instance. A contractor engaged in carrying out repair work to a building in Bombay was required to pay only Rs 250 each to the families of two workers who were killed when a slab came down on them. Those injured were awarded Rs 50. How are the families of those who have lost their breadwinners to live while the authorities concerned decide about the compensation they are going to receive?

A safety adviser in a petroleum firm claimed that best results were achieved "when accident prevention efforts are built into executive decisions and blended with normal operating procedures".

During 1961-71, nearly 3,800 workers lost their lives and 1.3 million suffered serious injuries. The loss to the nation because of the absence of workers during this period was estimated at Rs 21 crores. There were 320,000 industrial accidents in 1971 alone.

Industrialists Do Not Care

Do employers, by and large, care for the lives of the workers who contribute to the welfare of their organisation? A noted industrialist deplored that a "humanitarian cause such as prevention of accidents in industrial concerns lacked support from the employers". He mentioned that out of several thousand employers he could mobilise support only from 300!

But the Chairman of Premier Automobiles claimed that industrial accidents could not be reduced "unless workers cooperated with the management". He deplored absenteeism among workers even when they suffered "minor injuries".

"The very idea of reducing absenteeism and accidents was vitiated by workers, their doctors and labour leaders," he added.

Wrong judgement about the speed of the machines, irresponsibility, lack of training, nervousness, fatigue, poor lighting, faulty supervision and defective machines are some of the causes for a growing number of accidents.

Another cause is inadequate inspection. Safety rules and regulations exist only on paper. In Orissa, Assam and Rajasthan a large number of factories are not inspected at all. Hundreds of small factories do not even have a licence to operate. Government inspectors are few and there are complaints that they are not averse to taking bribes from employers. Others seem to be overworked: having to inspect 200 factories or more at a time. Their visits are cursory.

Can industrial establishments escape the blame for the prevailing laxity? The problem of occupational exposure is serious because complex tools and manufacturing processes have brought in new hazards like noise, fumes, chemical dust, heat and harmful vapours.

These effects depend on the concentration of a particular toxic substance at the work place and the number of years he is exposed to it. Our workers have poor health and are prone to illness. Many a worker is the sole breadwinner in the family and in his anxiety to earn a little more he may take risks which are beyond his physical capacity.

Workers with a rural background may be slow to familiarise themselves with modern industrial operations. Sometimes because of the heat and humidity, they are unwilling to demand gloves, overalls, helmets, masks and glares which are vital to protect their persons.

What has been the attitude of our managements? There is a feeling that because the workers are available in plenty ("for every one who goes out there are a hundred ready to take his place", an industrialist claimed) their health and well-being have not received adequate attention. There is also no suitable deterrent for the increasing number of industrial accidents. The compensation paid is niggardly. One must consider that the chief executive and the top men of an industrial organisation do not run the same accident risk as the worker.

Records of successful enterprises reveal that productivity is linked with safety: a worker cannot be motivated into higher productivity unless he trusts that the management is genuinely interested in his welfare.

"When we buy a new car or a new machine, we train operators to look after them. Is the same attention given to a recruit when he joins a manufacturing plant?" asks a technical expert.

"Of all the Ms (money, materials, methods, machines and men) we should realise that Man is the most important of them all. But is Man in our factories and mines being treated as a resource or the creator and exploiter of resources? The feeling has grown that he is considered as a *resource* (like materials). Because of the prevailing unemployment there is a tendency to discount his value. This is tragic and undesirable."

Let us take the case of Maharashtra where there was an unprecedented spurt in industrial accidents last year. As many as 155 workmen lost their lives, 93,000 others sustained injuries while on duty—rendering a number of them disabled.

The Industrial Workers' Union has blamed this on the "criminal negligence and violation of statutory safety and preventive measures by employers" and the callous attitude and inefficient administration of the Factories Inspectorate Office. These deaths and accidents did not include those which occurred in the 4,000 factories (employing 28,000 workers) not covered by the Factories Act.

Nearly 650 cases were pending before the labour courts or civil judges under the Workmen's Compensation Act—that is compensation for labourers who died while on duty.

The chaotic conditions prevailing throughout the country even in the organised sector have been

HAZARDOUS TO WORK IN SUCH AN ENVIRONMENT

described in a random survey of the chemical industry which found that 47% of the units had no medical room and 73% had not held any health checks for their employees. Things are not getting any better. This is proved by the fact that there has been a 20% increase in industrial accidents in West Bengal in just four years, from 55,618 in 1974 to 66,895 in 1978. The highest incidence of accidents, not surprisingly, is in jute followed by cotton and engineering. The picture is not very different in Maharashtra and Tamil Nadu.

While the casual attitude of managements and workmen has a lot to do with the high incidence of accidents, what can one say about a Government that does not insist on adequate safety precautions in its own organisations? That there was only one fire hydrant at the Santa Cruz airport when a disastrous fire broke out in the terminal building and that water pumps of requisite power were not available to cope with a precarious flood situation in the Chasnala mines four years ago shows how a casual approach to industrial safety is a sure road to disaster.

Based on their past industrial experience, the American Conference of Governmental Industrial Hygienists had laid down safe limits (Threshold Limit Values, TLV) for 400 industrial chemicals and dusts. It had been accepted that if the concentration in the working environment was kept within these limits the workers' health would not be impaired.

Managements whose responsibility it is to ensure the health and welfare of the workers, the Hygienists said, could make sure of safe working environment by: i) getting the different work room environments in their plants monitored for concentration of toxic substances; ii) implementing control measures suggested by experts on the basis of their studies; and iii) checking the improvement in the environmental conditions attained by a second monitoring survey.

The Bombay Port Trust has a safety training programme for their shed superintendents, labour supervisors and inspectors. There is also need to train crane drivers, winchmen, fork-lift operators, riggers and tindals. It has been estimated that 85% of accidents in the docks are caused by wrong handling of cargo, falling objects and persons falling from a height. In factories, mishaps are due to lack of guards for machines and faulty maintenance, failure to wear protective equipment, lack of fencing to prevent heavy objects from falling on workers and storing dangerous materials without a licence.

The Central Labour Institute in Bombay is well equipped and has undertaken several surveys. Industrialists who care for the lives of their workmen would do well to seek their advice.

LACK OF MOTIVATION CRIPPLES WORKERS

BRIG. G.R. CHAINANI

S.P. GODREJ

RASHMI MAYUR

OUR industrialists have yet to accept that they have a social responsibility—besides making profits for themselves. More man-days are lost due to industrial mishaps than through strikes and lock-outs. There are nearly 300,000 such accidents every year.

Brig. G.R. Chainani (Central Labour Institute) participating in a seminar on *Humanisation of Industry* said: "Experience in India fully corroborates that investment in safety leads to reduction in accidents and increase in productivity. Our research has revealed numerous such cases."

Mr R.S. Pande, Managing Director, TISCO, gave the following example: "In my own city of Jamshedpur, I have seen long queues of workers and their family members standing for 11 hours for drawing a ration of 500 gms for a fortnight. At the end of this long waiting, they are not sure whether they would get their ration. Ration or no ration, they have to reach their workplace in time. In such a situation, what do you think will be the worker's mood when he comes to the factory? It is easy to talk about productivity and prevention of accidents, but difficult to take positive measures in the prevailing situation. Workers' behaviour on the shop floor is influenced by the situation on the home front."

Housing — Low Priority?

He gave another instance: "What is the state of housing provided by the industry? Even today, industries which claim to be highly developed, with good profit, give a relatively low priority to housing. The modern management concept considers investment in housing unproductive, and therefore it is not given the priority that it deserves.

"All of us who are involved in industry—manager, supervisor and worker—have to understand that management is not one man's job. It is not the workers alone who are responsible for the illness of the industry. The managers are equally responsible. Whatever we say, the fact remains that it is the managers who formulate and implement the policies."

Stressing the need for Workers' Leadership and Productivity, Dr Rashmi Mayur, Chief of Urban Systems Centre, NITIE, explained: "There is further need to share leadership between the management and workers. They cannot be pitted against each other. An experience of such a joint project in New York City in 1969 proved not only reduction by 50 per cent of unemployment but also 3 per cent increase in production. It is easy for the management to become complacent and isolated while the workers can think that the only recourse to their grievances is to go on strike.

"A great deal has been said about the illiteracy of workers. Many implications of illiteracy are exaggerated and used against workers."

The President of All India Port and Dock Workers' Federation, Mr S.R. Kulkarni, pointed out that the middle management employees had become the worst sufferers.

"Middle management cadre acts as the agent in the process of production but their conditions are worse than the people over whom they supervise." he said. "Now, this particular cadre which really gets the work done on the production line is totally ignored in terms of wages and fringe benefits. This cadre deserves our sympathy and needs consideration."

Prof Nitish De (Indian Institute of Management, Calcutta) dealing with the problem of "how to overcome the alienation of the working class" added: "I do not think that one union for one industry is the answer. I do not think that a highly conformist union leader is the answer. Then you will have to buy a union and make them members of the company on the pay roll. That is not possible. There is no point in attacking and criticising the environment unless you try to carry out a revolution in the country and change the entire democratic structure. There is no point in arguing that there is too much of politics and too many trade unions. Too much of politics in trade unions cannot be a cause of criticism."

"For a very long time workers have been treated merely as a source of labour or output," Mr S.P. Godrej, a noted industrialist countered. "It is not at all surprising that the workers were called 'hands'. Many of us are familiar with what we have read and seen in photographs: the long tiring hours that men, women and children spend in badly ventilated and cramped work places trying to make out a living. Many of them probably feel that they are not getting the just share of the national output and I do not think that there is any dispute in the fact that they are not much better off."

Can Trade Unions Help?

How can trade unions help in prevention of accidents? Mr H.N. Trivedi (INTUC), gave the following facts: "Regarding the use of personal protective equipment, it has been seen that employers purchase and bring these in a lot and often are found to be defective, bad smelling or not properly fitting to the body of the workers. Hence they do not find them really useful. It is therefore, necessary that the personal protective equipment should be of a high standard and be freely supplied.

"It is often found that accidents are due to mental or physical conditions of the workers. It may be difficult to counteract the mental state of the person. The physical condition can only be observed and, if not corrected, the worker may think it to be the correct one, continue to work in an unsafe manner and in the process get injured."

Industrialists must realise that higher pay in itself does not yield best results. What is required is motivation through involvement in work. This unfortunately is sadly lacking.

X. Alvares

Int. J. Epidemiol. Advance Access published November 22, 2005

OH-2

Published by Oxford University Press on behalf of the International Epidemiological Association

International Journal of Epidemiology
doi:10.1093/ije/dyi235

POINT–COUNTERPOINT

Is modern Western culture a health hazard?

Richard Eckersley

Epidemiology, health, and culture

The cultures of societies are underestimated determinants of their population health and well-being. This is as true of modern Western culture, including its defining qualities of materialism and individualism, as it is of other cultures. This paper draws on evidence from a range of disciplines to argue that materialism and individualism are detrimental to health and well-being through their impacts on psychosocial factors such as personal control and social support.

The focus of the resurgent scientific and political interest in the effects of the social environment on health has been on socioeconomic inequalities in health—especially those associated with income inequality. Two developments strengthen the case for paying more attention to the role of culture in health. The first is that, at the population level, the role of income inequality has become less clear, with recent research challenging the view that it is a major determinant of population health differences.[1–3] Instead it suggests that population health is the product of a complex interaction of history, culture, politics, economics, and the status of women and ethnic groups[4]; and that we need, in particular, a better appreciation of how broad indicators of social and economic conditions are related to the levels and social distribution of major risk factors for particular health outcomes.[3]

The second development is a general acceptance that psychosocial factors are a significant pathway by which inequality and other social determinants affect health and that perceptions and emotions are important to health outcomes.[2,4] This position is now common ground between those who believe that sources of health inequalities are primarily, or fundamentally, material—resulting from differences in material exposures and experiences—and those who argue that their sources are psychosocial—stemming from people's position in the social hierarchy and their perceptions of relative disadvantage.[2]

Psychosocial processes involve interactions between social conditions and individual psychology and behaviour,[5] and are associated with (in their negative forms) stress, depression, anxiety, isolation, insecurity, hostility, and lack of control over one's life.[6,7] Whether psychosocial factors affect health only (or principally) through health-related behaviours or also act via direct effects on the neuroendocrine and immune systems remains contested, but this does not affect the case for taking culture into account. Once we allow a role in health for psychosocial factors and for perceptions, expectations and emotions, then cultural factors have to be considered because culture influences these things.[8]

Epidemiology understands 'culture' mainly in terms of 'subcultures' or 'difference', especially ethnic and racial, and so, usually, as one dimension of socioeconomic status.[9–11] Culture in the broader sense of the dominant or defining culture of a society has been given scant attention in the recent social determinants literature.[12] Of the many books and reports on the subject published over the past two decades, only a few give cultural determinants more than a passing mention. (The exceptions include the works of Corin on culture in general,[10,11] and my own work on modern Western culture in particular.[12,13])

Generally speaking, the influence of culture (in this broad sense) on health and well-being has been seen as distal and diffuse, pervasive but unspecified.[12] Yet it seems plausible, if not self-evident, that cultural characteristics such as materialism or individualism can have as important an impact on psychosocial factors such as social support and personal control as socioeconomic inequality—perhaps even more important.

Marmot and Wilkinson,[7] in noting the relationship between income inequality and social affiliation, suggest there is a 'culture of inequality' that is more aggressive, less connected, more violent and less trusting. Singh-Manoux and Marmot[14] take this cultural perspective further in suggesting that socialization provides a mechanism for integrating the cultural, behavioural, structural, and material explanations of social inequalities. Socialization is the process of transferring attitudes, beliefs, and behaviours between and within generations, the means by which societies shape patterns of behaviour and being that then affect health. Drawing on Bourdieu's concept of 'habitus', they argue that social structures become embodied as schemes of perception that provide individuals with class-dependent and predisposed ways of thinking, feeling, and acting, which are then reproduced.

However, we can also think of such processes as going beyond matters of class; socialization reproduces lifestyles and identities, not just social differences in them. A culture of individualism and materialism could also produce those attributes of a culture of inequality. In other words, these developments in thinking about inequality in essentially cultural terms invite a broader consideration of cultural factors as determinants of health.

The neglect of culture is surprising in some respects, but not others. It is surprising given that some of the earlier social epidemiological research—for example, the work by Marmot and Syme[15,16] in the 1970s on the effects of exposure to Western influence on heart disease in ethnic Japanese—pointed to its significance. It is unsurprising in that cultures tend to be 'transparent' or 'invisible' to those living within them because

National Centre for Epidemiology and Population Health, The Australian National University, ACT 0200, Australia.
E-mail: richard.eckersley@anu.edu.au

they comprise deeply internalized assumptions and beliefs, making their effects hard to discern. As Corin says, cultural influences are always easier to identify in unfamiliar societies.[10] Our own cultures appear to constitute a natural order that is not itself an object of study. This impression, she says, is an 'unsupported ethnocentric illusion'.

Another reason for underestimating the role of culture is the extent to which its impacts are 'refracted' through a host of other, more specific influences, including a person's personal circumstances and temperament (this is also true of other distal determinants of health). In other words, changes that affect everyone can, nevertheless, affect people differently and contribute to specific problems that only some experience.

A third explanation is that culture is a much debated and contested subject, defined and used in many different ways in different disciplines and even within the same discipline. Culture, as I use the term here, refers to the language and accumulated knowledge, beliefs, assumptions, and values that are passed between individuals, groups, and generations[17]; a system of meanings and symbols that shape how people see the world and their place in it and give meaning to personal and collective experience[11]; or, more simply, as the knowledge we must possess to function adequately in society.[18]

In discussing the effects of modern Western culture on health, I do not mean to suggest that culture exerts a uniform effect on everyone, regardless of gender, class, and ethnicity; or that individuals passively absorb cultural influences, rather than interacting actively with them; or that there is not a variety of subcultures marked by sometimes very different values, meanings, and beliefs. To rephrase Ehrlich's comments about genes: cultures do not shout commands to us about our behaviour, they whisper suggestions (although, as I will show, the whispers are loud and persistent).[19]

My arguments about culture and health draw mainly on the sociological, psychological, and epidemiological literatures. While this analysis differs in its scope and focus from anthropological perspectives, it is, I believe, conceptually consistent with those perspectives. For example, Dressler *et al.*[18] argue that individuals possess cultural models that derive both from their own biographies and from the collective or shared understandings that form the traditions of their society. These models reflect a 'cultural consensus' about the way the world works, but this consensus is not complete and can be contested, even bitterly so. 'Cultural consonance' is the extent to which individuals reveal in their own beliefs and behaviour the cultural consensus (with one focus of research being the association between cultural consonance and disease risk).

It follows that, just as inequality can be studied at both population and individual levels so too can culture. It can be measured as differences between societies (reflecting differences in cultural consensus), or as differences between individuals and groups within a society (reflecting degrees of cultural consonance). Some societies are more materialistic or individualistic than others (even among Western nations), and some individuals and groups within any one society will reveal these qualities more than others. Thus the evidence I draw on relates to both individual-level and population-level effects of culture.

Culture may help to explain health differences within societies in several ways. As already noted, they could arise from variations in cultural characteristics between individuals and groups. Culture could also influence levels of inequality—for example, through the part individualism plays in market-oriented, or neo-liberal, political doctrines that are associated with greater inequality. It might also interact with socioeconomic status to moderate or amplify its health effects—for example, materialism and individualism might accentuate the costs of being poor or of low social status by making money more important to social position and weakening social bonds and group identity. However, culture's role is perhaps more important in explaining health differences among societies, or changes in a population's health (or, more accurately, health potential) over time. (As the novelist L. P. Hartley famously said in *The Go-Between*: 'The past is a foreign country: they do things differently there'.)

This paper is an exercise in multidisciplinary synthesis.[13] Rather than improving our understanding of the world by creating new knowledge, as empirical research does, synthesis seeks to improve understanding by bringing together existing knowledge from different disciplines. I acknowledge that: there is a lack of research in many areas I discuss; much of the research remains in its infancy (many of the associations are correlational and do not prove causation); the interplay between social factors and individual behaviours is both subtle and complex; and cultural influences, with their intangible, subjective qualities, are difficult to measure. Given these limitations, the evidence is often indirect and circumstantial, and the arguments are to some extent theoretical and speculative, intended to stimulate greater research interest in the topic.

Materialism and individualism

The psychological and sociological literatures suggest powerful effects of culture on psychological well-being. Take materialism, by which I mean attaching importance or priority to money and possessions (and so broadly equate here with consumerism), and which underpins consumption-based economies. Many psychological studies have shown that materialism is associated, not with happiness, but with dissatisfaction, depression, anxiety, anger, isolation, and alienation.[13,20] Human needs for security and safety, competence and self-worth, connectedness to others, and autonomy and authenticity are relatively unsatisfied when materialistic values predominate.

People for whom 'extrinsic goals' such as fame, fortune, and glamour are a priority in life experience more anxiety and depression and lower overall well-being than people oriented towards 'intrinsic goals' of close relationships, self-knowledge and personal growth, and contributing to the community.[13,20] People with extrinsic goals tend to have shorter relationships with friends and lovers, and relationships characterized more by jealousy and less by trust and caring.

As materialism reaches increasingly beyond the acquisition of things to the enhancement of the person, the goal of marketing becomes not only to make us dissatisfied with what we have, but also with who we are. As it seeks evermore ways to colonize our consciousness, the market both fosters and exploits the restless, insatiable expectation that there must be more to life. In short, the more materialistic we are, the poorer our quality of life.

Individualism, by which I mean placing the individual at the centre of a framework of values, norms, and beliefs and celebrating personal freedom and choice, is another cultural quality with profound significance for well-being, but here the evidence is contradictory. Well-being is associated with several qualities that individualistic societies should encourage, notably personal control and self-esteem[12,13]; individualism is, after all, supposed to be about freeing us to live the lives we want. Historically, individualization has been a progressive force, loosening the chains of religious dogma, class oppression, and gender and ethnic discrimination, and so associated with a liberation of human potential.

However, just as the reality of commitment differs from the ideal, so the reality of freedom differs from its ideal, especially when it is taken too far or is misinterpreted. Sociologists note that individualization has transformed identity from a 'given' into 'task'; it has replaced determination of social standing with, in Bauman's[21] words, 'compulsive and obligatory self-determination'. The individualized life is a fate, not a choice; we cannot choose not to play the game.

This process has had a range of consequences: a heightened sense of risk, uncertainty, and insecurity; a lack of clear frames of reference; a rise in personal expectations, coupled with a perception that the onus of success lies with the individual, despite the continuing importance of social disadvantage and privilege; and a surfeit or excess of freedom and choice, which is experienced as a threat or tyranny.[22–25] To cite Bauman[21] again, there is 'a nasty fly of impotence in the ointment of freedom', an impotence that is all the more upsetting in view of the empowerment that freedom was expected to deliver.

Psychology offers at least two mechanisms by which individualism not only reduces social connectedness and support, but also diminishes personal control. First, Twenge[26] has argued that a lack of control over one's life can be part of a defensive strategy to maintain self-esteem. The modern individual needs high self-esteem and one way to maintain that high self-esteem is to believe that the things that threaten it are beyond one's control.

Second, building on the work of Ryan and co-workers,[27] I have suggested that Western individualism confuses autonomy (the ability to act according to our internalized values and beliefs) with independence (not being reliant on or influenced by others).[13] Someone who holds collectivist values is behaving autonomously, but not independently, when acting in the interests of the group. (Or, to put it somewhat differently, 'thinking *for* ourselves' has been redefined as 'thinking *of* ourselves'.)

The confusion of autonomy with independence encourages a perception by individuals that they are separate from others and the environment in which they live, and so from the very things that affect their lives. The more narrowly and separately the self is defined, the greater the likelihood that the personal influences and social forces acting on us are experienced as external and alien. The creation of a 'separate self' could be a major dynamic in modern life, impacting on everything from citizenship and social trust, cohesion and engagement, to the intimacy of friendships and the quality of family life. So the issue here is not just a matter of the changed relationship between the individual (as an entity) and society, but of the way in which the individual self is construed. In other words, the result is not only increased objective isolation, but also more subjective loneliness (even in company or within relationships); out of regard for privacy—our own and others'—we may fail to seek support when we need it, or hesitate to offer it to others when we should.

An important means by which individualism and materialism affect well-being is through their influence on values.[12,13] Values are a core component of culture, a property of societies and their people and institutions, as well as of individuals. Like culture more broadly, values have been underestimated in health research because their effects are hard to measure: they are abstract, generic, pervasive, flexible, and internalized (just the sort of 'rules' complex adaptive systems like human societies need). Values provide the framework for deciding what is important, true, right, and good, and have a central role in defining relationships and meanings, and so in determining well-being.

Most societies have tended to reinforce values that emphasize social obligations and self-restraint and discourage those that promote self-indulgence and anti-social behaviour. Virtues are concerned with building and maintaining strong, harmonious personal relationships and social attachments, and the strength to endure adversity. Vices, on the other hand, are about the unrestrained satisfaction of individual wants and desires, or the capitulation to human weaknesses. 'We define virtue almost exclusively as pro-social behaviour, and vice as anti-social behaviour', Ridley[28] observes in his analysis of human nature and society.

Christianity's seven deadly sins are: pride (vanity, self-centredness), envy, avarice (greed), wrath (anger, violence), gluttony, sloth (laziness, apathy), and lust. Its seven cardinal virtues are faith, hope, charity (compassion), prudence (good sense), temperance (moderation), fortitude (courage, perseverance), and religion (spirituality). Extending this list, Comte-Sponville[29] gives these as 'the great virtues': politeness, fidelity, prudence, temperance, courage, justice, generosity, compassion, mercy, gratitude, humility, simplicity, tolerance, purity, gentleness, good faith, humour, and, finally, love (which transcends virtue). He says that a virtuous life is not masochistic or puritanical, but a way of living well and finding love and peace.

Modern Western culture undermines, even reverses, universal values and time-tested wisdom.[12,13] The result is not so much a collapse of personal morality, but a loss of moral clarity: a heightened moral ambivalence and ambiguity, a tension or dissonance between our professed values and lifestyles, and a deepening cynicism about social institutions. Without appropriate cultural reinforcement, we find it harder to do what we believe to be 'good'; it takes more effort. And, conversely, it becomes easier to justify or rationalize bad behaviour. There are positive (reinforcing) feedbacks in the process: anti-social values weaken personal and social ties, which, in turn, reduce the 'hold' of a moral code on individuals because these ties give the code its 'leverage'; they are a source of 'moral fibre'.

Social perspectives on population health must also take personality into account because new research shows that our personalities are changing in ways that may impact on the psychosocial pathways between social conditions and health. For example, in a series of studies drawing on psychological tests conducted with American children and college students over periods of up to 60 years, Twenge *et al.*[26,30–34] have found large shifts (up to 1 SD) in scores on a range of personality traits and other psychological qualities. Twenge[30] says her findings show that broad social trends—not just genes and the family environment, as psychologists have assumed—are important influences on personality development. She quotes an Arab proverb: 'Men resemble their times more than they resemble their fathers'.[34]

Twenge and her colleagues found increases in trait anxiety (or neuroticism), self-esteem, extraversion, and, in women, assertiveness, while sense of control over life had declined (that is, locus of control had become more external). To give two examples of the extent of these shifts, the average American child in the 1980s reported more anxiety than child psychiatric patients in the 1950s,[30] and the average college student in 2002 felt less control over their lives than 80–90% of college students in 1962.[26] Using a range of indicators (for the anxiety study these included divorce rate, birth rate, women's age at first marriage, proportion of people living alone, crime rate, and youth suicide rate), Twenge links most of these trends to rising individualism and freedom through declining social connectedness and increasing environmental threat. Economic factors such as unemployment and poverty seem not to be involved.

With respect to the negatives, trait anxiety has been associated with depression, suicide attempts, alcohol and drug abuse, and poorer physical health;[30] an external locus of control is associated with lower well-being, depression, anxiety, poor school achievement, helplessness, ineffective stress management, and decreased self-control.[26] The associations of anxiety and lack of control with depression, for example, can be stronger than those between depression and experiences such as parental divorce, domestic violence, relationship break-ups, unemployment, and financial hardship.[35]

Turning to the positives, the benefits of high self-esteem to well-being are now being questioned and it might itself have costs, including aggression and risk-taking.[13] It may also work against personal control, as already mentioned. And while extraversion is associated with higher well-being, its combination with the other personality changes could lead to a more narcissistic or 'contingent' self-esteem, which requires constant external validation or affirmation to be sustained.[13,20] This development is consistent with an extrinsic goal orientation that is associated with diminished well-being, as noted above.

Most of the associations between culture and well-being are correlational, as I have said; they do not prove that materialism, for example, causes a deterioration in well-being; it could also work the other way, with unhappier people drawn to materialistic pursuits as a distraction or antidote—as 'retail therapy'. However, the associations do suggest that the cultural promotion of materialism and individualism is not conducive to well-being. The causal relationships are likely to be complex and reciprocal, and to involve interactions with other, more specific influences, including genetic and socioeconomic factors.

Culture's impacts on health

Culture's impacts are most clearly observed in the study of psychological well-being, as the above discussion shows. Given this, and epidemiology's traditional focus on physical disease, it is worth noting the personal and social costs of mental illness. Depression is the leading cause of disability in the world.[36] In the global ranking of the burden of disease, measured in terms of both disability and death, major depression is projected to rise from fourth in 1990 to second in 2020.[36] In high-income countries, depression and other neuropsychiatric conditions account for more of the disease burden than heart disease or cancer.[37] Suicide, which has been called the mortality of depression, ranks in the 10 leading causes of death in these countries.[36]

The extent to which we are falling short of maximizing human well-being, despite falling mortality and rising life expectancy and material wealth, has been demonstrated in a large study of Americans aged 25–74, which examined mental health not just as the absence of mental illness but as 'a syndrome of symptoms of positive feelings and positive functioning in life'.[38] The study and found that 26% of people were either 'languishing', depressed, or both—that is, mentally unhealthy; 57% were moderately mentally healthy—neither mentally ill nor fully mentally healthy; and only 17% of people were 'flourishing'—that is, they enjoyed good mental health. (Consistent with other research, older, well-educated, or married people were more likely to be flourishing and less likely to be languishing or depressed.)

When it comes to physical ill-health such as heart disease and cancer, cultural influences are likely to be hard to disentangle from the many other social and personal factors involved, as we have already learned with other distal determinants such as income inequality.[3] These factors include health care: in attempting to measure the health effects of social and cultural determinants, we must take into account the growing role of biomedical advances, which are extending life but, in doing so, may be masking the health effects of the changes in the social conditions in which we live.

Nevertheless, the combined evidence linking culture, via psychosocial pathways, to psychological well-being, and well-being, through behavioural and physiological pathways, to physical health is, I believe, persuasive. Health authorities now accept that there is strong and consistent evidence for a causal association between depression, social isolation and lack of social support, and heart disease; and that the increased risk posed by these factors is of a similar order to that of more conventional risk factors such smoking, high blood pressure, and high cholesterol.[39] Mortality among people who are socially isolated is two to five times higher than for those with strong ties to family, friends, and community.[40] Cultural factors, especially materialism or consumerism, are also implicated in adverse social trends such as growing obesity and inactivity, which, in turn, are linked to a wide range of physical health problems including heart disease, diabetes, and cancer.[41]

The strength of the subjective—of perceptions, expectations, and emotions—in influencing health more broadly is highlighted in an American study (reported in the psychological, not health, literature) that found that older people who had more positive self-perceptions of ageing lived an average 7.5 years longer than those with less positive attitudes.[42] The advantage remained even after age, gender, socioeconomic status, loneliness, and functional health were taken into account. The study says this effect on longevity is greater than the survival advantages associated in other studies with low blood pressure and cholesterol, not being overweight, not smoking, and exercising. The study notes one likely cause of poor self-perceptions of ageing: 'socially sanctioned denigration of the aged'. This is a cultural characteristic of modern Western societies with their adulation of youthfulness (if not youth), a trait promoted by materialism and individualism.

Most of the evidence cited above concerns individual-level health effects of psychosocial and attitudinal factors that culture influences (so making these effects a valid means of assessing the health impacts of culture). Several recent studies have also found population or ecological effects that are attributable to culture. A cross-country study of crime found that tolerance for a set of 'materially self-interested' attitudes—such as keeping something you have found, lying in your own interest, or cheating at tax—was higher in men, younger people, larger cities, and had increased over time, mirroring patterns of criminal offending.[43] These values were also associated with national crime victimization rates, more strongly so than were social trust and inequality. The relationships of inequality and social trust with crime were conditional on the prevalent values of society; thus inequality per se was only modestly associated with higher crime, but when it occurred in societies that were characterized by high levels of self-interested values its effects became more pronounced.

In another cross-country analysis, a colleague and I found strong and positive correlations between national youth suicide rates, especially among men, and several different national indicators of individualism, including a measure of young people's perceived freedom of choice and control over their lives (but which is probably measuring independence, as argued above), but not between suicide and social and economic factors including per capita income, poverty, youth unemployment, inequality, and divorce.[44] A study of the association between suicide and deprivation and social fragmentation in British parliamentary constituencies found suicide was more strongly associated with fragmentation than with poverty (other causes of death were also related to fragmentation, but more strongly to deprivation).[45] Fragmentation was measured with indicators of renting, single-person households, unmarried people, and mobility, so suggesting at least some influence of individualism.

These findings are consistent with the conclusions of a major international review in 1995 of the evidence on trends in psychosocial problems such as depression, drug abuse, suicidal behaviour, and crime among young people in Western nations.[25] It concluded that social disadvantage and inequality were unlikely explanations for the increases in psychosocial disorders. Amongst its recommendations, the review called for further investigation of the theory that shifts in moral concepts and values were among the causes—in particular, 'the shift towards individualistic values, the increasing emphasis on self-realization and fulfilment, and the consequent rise in expectations'. The review noted that far more effective use could be made of cross-national differences in testing possible explanations.

Cultural fraud

The apparent harm caused by materialism and individualism raises the question of why these qualities persist and even intensify. Both have conferred benefits to health and well-being in the past, but appear now to have passed a threshold where rising costs exceed diminishing benefits.[13] Various forms of institutional practice encourage this cultural 'overshoot'. Government policy gives priority to sustained economic growth but leaves the content of growth largely to individuals, whose personal consumption makes the largest contribution to economic growth.

This ever-increasing consumption is not natural or inevitable, but culturally 'manufactured' by a massive and growing media-marketing complex. For example, big business in the United States spends over US$1000 billion a year on marketing—about twice what Americans spend annually on education, private and public, from kindergarten through graduate school.[46] This spending includes 'macromarketing', the management of the social environment, particularly public policy, to suit the interests of business.

Psychologists who have studied cults and mind control warn that even the brightest and best of us can be recruited or seduced by social situations and conditions to behave in ways that are contrary to our values and dispositions, to engage in actions that are immoral, illegal, irrational, and self-destructive.[47] As Zimbardo has said, many agents of mind control 'ply their trade daily on all of us behind many faces and fronts'; we need to learn how to resist them and to weaken their dominance.[48]

There is evidence that resistance is growing, that increasing numbers of people in Western nations are rejecting this dominant ethic of individual and material self-interest, and are making a comprehensive shift in their worldview, values and way of life as they seek to closed the gap between what they believe and how they live.[13] Sociologists are writing of the emergence of a new moral autonomy and the opportunity to be truly moral beings, perhaps for the first time in history,[49] and the creation of new forms of social affiliation through a 'cooperative or altruistic individualism'.[50] We may, then, be witnessing parallel processes of cultural decay and renewal, a titanic contest as old ways of thinking about ourselves fail, and new ways of being human struggle for definition and acceptance.

Cultures bring order and meaning to our lives. Of all species, we alone require a culture to make life worth living, to give us a sense of purpose, identity, and belonging—personally, socially, and spiritually—and a framework of values to guide our actions. There may be many cultural paths we can follow in meeting human needs. This is the source of our extraordinary diversity and versatility, but it is also a source of danger: we can lose the path altogether, run off the rails.

One of the most important and growing costs of our modern way of life is 'cultural fraud': the promotion of images and ideals of 'the good life' that serve the economy but do not meet psychological needs or reflect social realities. To the extent that these images and ideals hold sway over us, they encourage goals and aspirations that are in themselves unhealthy. To the extent that we resist them because they are contrary to our own ethical and social ideals, they are a powerful source of dissonance that is also harmful to health and well-being.

KEY MESSAGES

- Cultural factors such as materialism and individualism are underestimated determinants of population health and well-being in Western societies.
- Evidence links cultural factors, via psychosocial pathways, to psychological well-being, and well-being, through behavioural and physiological pathways, to physical health.
- An important and growing cost of our modern way of life is 'cultural fraud': the promotion of images and ideals of 'the good life' that serve the economy but do not meet psychological needs or reflect social realities.

References

[1] Subramanian SV, Kawachi I. Income inequality and health: what have we learned so far? *Epidemiol Rev* 2004;**26**:78–91.

[2] Lynch J, Davey Smith G, Harper S *et al.* Is income inequality a determinant of population health? A systematic review. *Milbank Q* 2004;**82**:5–99.

[3] Lynch J, Davey Smith G, Harper S, Hillemeier M. Is income inequality a determinant of population health? Part 2. US national and regional trends in income inequality and age- and cause-specific mortality. *Milbank Q* 2004;**82**:355–400.

[4] Lynch J, Davey Smith G, Hillemeier M, Shaw M, Raghunathan T, Kaplan GA. Income inequality, the psychosocial environment, and health: comparisons of wealthy nations. *Lancet* 2001;**358**:194–200.

[5] Martikainen P, Bartley M, Lahelma E. Psychosocial determinants of health in social epidemiology. *Int J Epidemiol* 2002;**31**:1091–93.

[6] Lynch J, Davey Smith G, Kaplan GA, House JS. Income inequality and mortality: importance to health of individual income, psychosocial environment, or material conditions. *BMJ* 2000;**320**:1200–04.

[7] Marmot M, Wilkinson RG. Psychosocial and material pathways in the relation between income and health: a response to Lynch *et al. BMJ* 2001;**322**:1233–36.

[8] Lazarus RS. *Emotion and Adaptation*. New York: Oxford University Press, 1991.

[9] DiGiacomo SM. Can there be a 'cultural epidemiology'? *Med Anthropol Q* 1999;**13**:436–57.

[10] Corin E. The social and cultural matrix of health and disease. In: Evans RG, Barer M, Marmor TR (eds). *Why are Some People Healthy and Others Not? The Determinants of Health of Populations*. New York: Aldine de Gruyter, 1994, pp. 93–132.

[11] Corin E. The cultural frame: context and meaning in the construction of health. In: Amick BC, Levine S, Tarlov AR, Chapman Walsh D (eds). *Society and Health*. New York: Oxford University Press, 1995, pp. 272–304.

[12] Eckersley R. Culture, health and well-being. In: Eckersley R, Dixon J, Douglas B (eds). *The Social Origins of Health and Well-being*. Cambridge: Cambridge University Press, 2001, pp. 51–70.

[13] Eckersley R. *Well and Good: Morality, Meaning and Happiness*. 2nd edn. Melbourne: Text Publishing, 2005.

[14] Singh-Manoux A, Marmot M. Role of socialisation in explaining social inequalities in health. *Soc Sci Med* 2005;**60**:2129–33.

[15] Marmot MG, Syme SL, Kagan A *et al.* Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii and California: prevalence of coronary and hypertensive heart disease and associated risk factors. *Am J Epidemiol* 1975;**102**:514–25.

[16] Marmot MG, Syme SL. Acculturation and coronary heart disease in Japanese Americans. *Am J Epidemiol* 1976;**104**:225–47.

[17] Boyden S. *The Biology of Civilisation: Understanding Human Culture as a Force in Nature*. Sydney: UNSW Press, 2004.

[18] Dressler WW. Culture and the risk of disease. *Brit Med Bull* 2004;**69**:21–31.

[19] Ehrlich PR. *Human Natures: Genes, Cultures, and the Human Prospect*. Washington DC: Island Press, 2000.

[20] Kasser T. *The High Price of Materialism*. Cambridge, MA: MIT Press, 2002.

[21] Bauman Z. Individually, together. Foreword. In Beck, U, Beck-Gernsheim E, Individualization. London: Sage, 2002.

[22] Furlong A, Cartmel F. Risk and uncertainty in the youth transition. *Young* 1997;**5**:3–20.

[23] Furlong A, Cartmel F. *Young People and Social Change: Individualisation and Risk in Late Modernity*. Buckingham: Open University Press, 1997.

[24] Schwartz B. Self-determination: the tyranny of freedom. *Am Psychol* 2000;**55**:79–88.

[25] Rutter M, Smith, DJ (eds). *Psychosocial Disorders in Young People: Time Trends and Their Causes*. Chichester: John Wiley and Sons for Academia Europaea, 1995.

[26] Twenge JM, Zhang L, Im C. It's beyond my control: a cross-temporal meta-analysis of increasing externality in locus of control, 1960–2002. *Pers Soc Psychol Rev* 2004;**8**:308–19.

[27] Chirkov V, Ryan RM, Kim Y, Kaplan U. Differentiating autonomy from individualism and independence: a self-determination theory perspective on internalization of cultural orientations and wellbeing. *J Pers Soc Psychol* 2003;**84**:97–110.

[28] Ridley M. *The Origins of Virtue*. Viking, 1996.

[29] Comte-Sponville A. *A Short Treatise on the Great Virtues*. London: Vintage, 2003.

[30] Twenge JM. The age of anxiety? Birth cohort change in anxiety and neuroticism, 1952–1993. *J Pers Soc Psychol* 2000;**79**:1007–21.

[31] Twenge JM. Birth cohort changes in extraversion: a cross-temporal meta-analysis, 1966–1993. *Pers Indiv Differ* 2001;**30**:735–48.

[32] Twenge JM. Changes in women's assertiveness in response to status and roles: a cross-temporal meta-analysis, 1931–1993. *J Pers Soc Psychol* 2001;**81**:133–45.

[33] Twenge JM, Campbell WK. Age and birth cohort differences in self-esteem: a cross-temporal meta-analysis. *Pers Soc Psychol Rev* 2001;**5**:321–44.

[34] Twenge JM. Birth cohort, social change, and personality: the interplay of dysphoria and individualism in the 20th century. In: Cervone D, Mischel W (eds). *Advances in Personality Science*. New York: Guilford, 2002.

[35] Donald M, Dower J, Lucke, J Raphael B. *The Queensland Young People's Mental Health Survey Report*. Centre for Primary Health Care, School of Population Health and Department of Psychiatry, University of Queensland, 2000.

[36] Murray CJL, Lopez AD (eds). *The Global Burden of Disease—Summary*. The Harvard School of Public Health on behalf of the World Health Organization and the World Bank, distributed by Harvard University Press, 1996.