

special issue

Peace NOW!



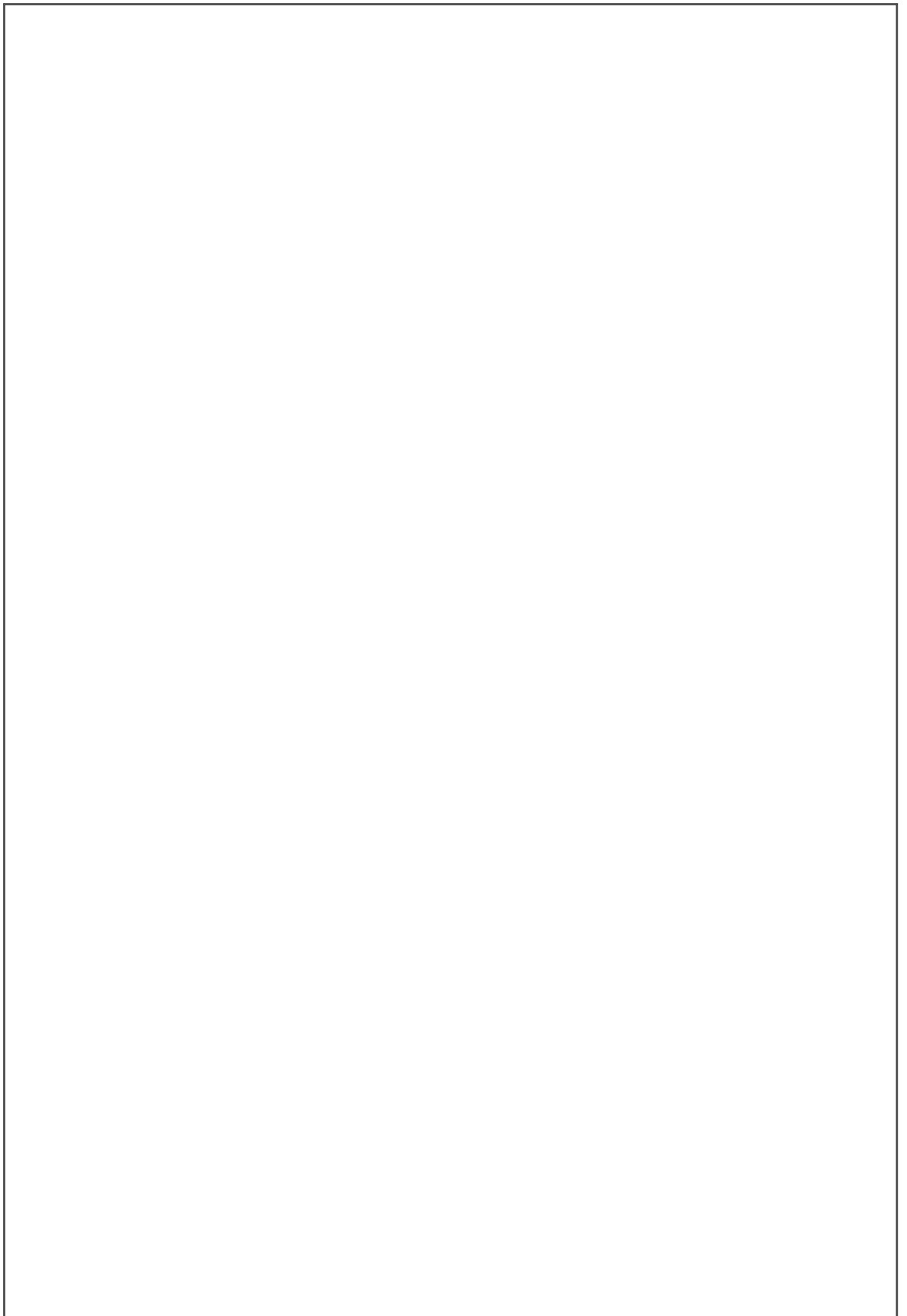
The Bulletin of the Coalition for Nuclear Disarmament & Peace

Fifty three years' back, by the
end of the Second World War,
the cities of Hiroshima and
Nagasaki were made to suffer the
irreversible trauma of being
incinerated by atomic bombs
dropped from the sky by the U.S.
Air Force. Never before in the
history of humanity so many
people were made to die in
one moment. And those who
survived their fate was pre-
determined. The consequences
of the atomic bombing were
irreversible. The only way
to prevent such a tragedy
from happening again
was to abolish nuclear
weapons. This is the
only way to ensure
the survival of
humanity.

Just moments ago, the world
was still at peace. And now
it is in a state of chaos. The
only way to prevent such a
tragedy from happening
again was to abolish nuclear
weapons. This is the only
way to ensure the survival
of humanity.

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Editorial

It is just over four years since the Coalition for Nuclear Disarmament and Peace (CNDP) was brought into being through the collective efforts of the anti-nuke peace activists from all over India. The manner in which India went nuclear on 11th May 1998 amidst vulgar and intoxicating chest-thumping all around had utterly shocked the peace activists in every nook and corner of India. But the numbing effect of the sudden blow, and a terrific blow at that, did not, however, last too long. On the following 16th itself, the day which was to be celebrated as the 'Shaurya Divas' (Glory Day) by the architects of the Pokhran blasts, protesters came out on the streets, braving the seemingly tidal waves of popular sentiments, in many corners of the country - most prominently in Delhi and Calcutta, under the banners of various organizations. But that was only the start. The following days saw the protests spread and multiply. In a rather paradoxical way, the anti-nuke movement in India, as elsewhere in the world, which was born in the traumatic aftermath of Hiroshima and Nagasaki in 1945, came into its own under the impact of Pokhran II. It, however, took about two and a half years of intense efforts to give the movement an institutional form. The CNDP was born out of the 'National Convention for Nuclear Disarmament and Peace' held in Delhi from November 11-13, 2000.

It is of course a matter of some pride and satisfaction that the organization has just not only survived this long but also lived a useful life by actively intervening in and impacting the unfolding events on national, regional and global scale. This special enlarged issue of the one and a half year old bulletin, one of the major instruments of intervention, coincides with the second

national convention of the CNDP being held in Jaipur, the capital of the state to which Pokhran belongs, from 26-28 November.

During the intervening four years the situation worldwide has, however, taken an unambiguous turn for the worse. This downturn was virtually inaugurated by the ascendance of George W Bush, Jr. to the presidency of the USA. His policies as regards the CTBT, BMD, mini-nukes and, most of all, the 'preemptive' war on Iraq, as the crucial element of the neo-con project for unfettered and unilateral world domination, undertaken under the cover of the tragedy of 9/11, have proved disastrous for world peace and the prospects of nuclear disarmament. Hence, his reelection cannot but be regarded as a profoundly negative development. But this has also opened up the possibility of the world's second super-power, the global peoples' movement, galvanizing itself in the face of the dire threat and coming into its own. At the national level, the recent change in regime has, by and large, been welcomed by the peace activists in so far as the dreaded "Hindu" Nationalists have been unseated from the Delhi throne. But there is hardly any escape from the harsh reality that in many of the fields, and in the areas of nuclear and 'defence' policy in particular, the new regime considers itself nothing more and nothing less than the successor of the old one. The days ahead are admittedly difficult. But there is no other go but to take up the challenge with full vigour and cool courage.

In the coming days, the peace movement in India will have to actively engage itself with three major issues/events. Firstly, Iraq, which is absolutely crucial to the

making or unmaking of the neo-con project for world domination. Intimately associated with it is the broader question of peace in West Asia, with the unresolved issue of an independent Palestinian homeland at its heart. Then, there is the question of Indo-Pak peace and resolution of the Kashmir problem in a manner that takes due note of the authentic aspirations of all sections of the Kashmiri people. The prospect of denuclearising South Asia and thereby very substantively bringing down the threat of a nuclear holocaust is inextricably dependent on it. And, finally, the global campaign for nuclear disarmament spearheaded by the Mayors for Peace, led by the Mayors of Hiroshima and Nagasaki, for complete abolition of all nuclear weapons, in a well defined step by step manner by the year 2020, with the forthcoming NPT Review Conference in New York in May 2005 as its immediate focus. The fact that the year 2005 is the 60th year of the bombing of Hiroshima and Nagasaki has its own profound moral and practical significance. The other major

issues which will engage our attention are Northeast Asia and the threat of unchecked proliferation of nuclear technology and unguarded fissile materials. The issue of nuclear power generation, various hazards associated with it and its correlation with nuclear weapons will of course continue to torment the peace movements all over the world.

The second national convention of the CNDP will vigorously deliberate on all these issues, and more, to work out an effective strategy for the coming days in tandem with the global currents. This issue, in terms of its contents, it is hoped, will help to deepen and broaden our understanding of the various issues and contribute in a meaningful way to the success of the convention.



OBITUARY

Yasser Arafat (1929-2004)

We profoundly mourn and deeply grieve the passing of the President of Palestine Authority, Yasser Arafat. We send our most sincere condolences to the brave Palestinian people for the death of their national leader. President Arafat's life expressed and symbolized the steadfast resistance of the Palestinian people to Zionist dispossession and occupation of Palestine. His consistent and concerted efforts contributed to bringing the issue of Palestine to international consciousness. President Arafat played a significant role in unifying the exiled and occupied Palestinian society, gaining support from all shades of political opinion, and creating a strong and proud national identity for the Palestinian people. President Arafat coupled his steadfast resistance to the Israeli occupation with moves to create a just peace for Palestinians and Israelis.

The CNDP calls on the Palestinian people to intensify their unified legitimate resistance for the achievement of the Palestinian national goals, all in accordance with international conventions and declarations. We hope President Arafat's legacy continues to be a factor in providing inspiration and hope for the Palestinian people, and for an end to the Israeli occupation. CNDP reaffirms its commitment to the Palestinian national cause. We will continue to stand by the struggles of the people of Palestine.

Six Checkpoints on Nuclear Power Generation in Japan

*Ikuro Anzai**

In 1964, I graduated from Department of Nuclear Engineering, Faculty of Technology, University of Tokyo which was the first university department in Japan for training specialists in the field of nuclear power technology. I studied radiation protection in the graduate school of the same university, and obtained doctorate in technology in 1969. I became an assistant lecturer working for the Department of Radiological Health, Faculty of Medicine, University of Tokyo in 1969, when Japanese industrial circles, which were backed up by the Japanese government, were planning to construct a number of nuclear power stations throughout the nation. One of the symbolic events was to light up the opening ceremony of the 1970 Osaka International Exposition by the electric power transmitted from Tsuruga Nuclear Power Plant in Fukui Prefecture.

I was a member of the Japan Scientists Association (JSA) which was established in 1965 as one of the non-governmental organizations of Japanese scientists consisting both of natural and social scientists for the independent, democratic and harmonious development of science. JSA was already taking active part in the national movements to stop Vietnam War and port call of U.S. nuclear submarines to Japanese harbours. It started a new and long-lasting movement in the late sixties to criticize governmental policies regarding nuclear power generation. I became JSA's permanent steering committee member in charge of nuclear issues, and came to be involved in very serious and long-lasting nationwide anti-nuclear power movement. Since then, JSA has been organizing a great number of

symposia on nuclear power generation in close cooperation with the inhabitants of local communities where the construction of nuclear power plant was planned by the electric power companies.

In 1971, the Science Council of Japan (SCJ) which is the official organ of Japanese scientists, for the first time, organized a symposium on nuclear power generation. SCJ was often called "scientists' national congress", because its 210 members in seven different disciplines were elected by the direct vote of scientists from the national and regional constituencies. SCJ had sometimes made recommendations to the Japanese government about important scientific issues. SCJ invited me to the 1971 symposium on nuclear power generation, and, on behalf of JSA, I proposed six points to check the wholesomeness of Japan's nuclear programs. The checkpoints I proposed are :

- A. Independence of Japan's energy policy (*dependence on U.S. policy or independent?*),
- B. Firm brake on military use,
- C. Priority of policies (*cheaper or safer?*),
- D. Democracy in decision-making (*top-down or democratic?*),
- E. Transparency of decision making (*behind closed doors, or with doors open?*),
- F. Safety of nuclear power generation.

I would like to present the background and status of these six checkpoints, in brief, which, I hope, will be useful for the people of India.

A. Independence of Japan's energy policy

Immediately after the termination of World War II, most of the electric power in Japan was supplied from hydroelectric power plants. There was only one electric power company at that time, i.e., the Japan Electric Power Generation and Transmission Company. The General Headquarters of Allied Powers, led by the U.S. government, decided to break up this monopolistic company into 9 regional companies, each covering different district(s) from north to south, i.e. Hokkaido, Tohoku, Tokyo, Chubu, Hokuriku, Kansai, Chugoku, Shikoku and Kyushu. Official explanation for this partition policy was to dissolve the so-called "zaibatsu" (financial clique or plutocrats) for the democratization of Japanese economic system. In the prewar Japanese society, there were strong "zaibatus" such as Mitsui, Mitsubishi, Yasuda etc. who were exclusively controlling Japanese economy with strong back-up of political leaders who were pursuing invasive war oriented policies. The Japan Electric Power Generation and Transmission Company was a monopolistic industrial house that could have accumulated a vast amount of capital by exclusively supplying electric power to the postwar society, thereby in all likelihood growing into a gigantic economic monster. If such a monster is to combine with militarism again in the future, it may be a serious risk to the Japanese people. Therefore, the official explanation for the partition of monopolistic electric power company seemed to be fairly rational.

But the real purpose of the regional partition policy was to make Japan's electric power production dependent upon the U.S.

Why is it so? If, for example, Tokyo Electric Power Company is restricted to the Kanto district around Tokyo, then there is no abundant water source to produce enough electric power to be able to support vigorous postwar reconstruction activities in that densely populated metropolitan area, because the water sources are mainly concentrated in the central mountainous region of mainland Japan. So the electric power companies had to change their technology from hydraulic power generation to thermal power generation, because thermal power generation plants can be built near the power consumption areas.

Japan, however, is extremely poor in petroleum, and the switchover to thermal power generation inevitably required a drastic change in Japan's independent power generation system. By the year 1960, thermal power came up to the level of hydraulic power, thereby enhancing Japan's dependence on imported oil - mainly from the U.S.

Until early 1950s, the U.S. industrial circles were not so eager for peaceful use of nuclear energy. On the other hand, the USSR started to operate a 5000 kW nuclear power plant for practical use in 1954, and the U.K. as well developed a Calder Hall type nuclear power plant (natural uranium fuelled, carbon dioxide cooled, and graphite moderated) around the same period. U.S. immediately tried to develop a prototype of light water reactors (enriched uranium fuelled, light water cooled, and light water moderated), i.e. the Boiling Water Reactor (BWR) by General Electric and the Pressurized Water Reactor (PWR) by Westinghouse. The year 1954 became unforgettable for the Japanese people because a hydrogen bomb test nicknamed "Bravo" conducted by the U.S. on March 1 at Bikini Atolls released vast amounts of radioactive fallout over the Pacific Ocean which seriously contaminated a Japanese tuna-fishing boat "Lucky Dragon No.5", killing Mr. Aikichi

Kuboyama, a radio-operator, half a year later. In this very year, however, Japan started a nuclear program for peaceful use, and soon decided to import a Calder Hall type nuclear power reactor from the U.K. Then the U.S. decided to supply enriched uranium for research activities to Japan in a hurry and tried to consolidate the foundation for future control over the Japanese energy policy. At that time, a number of important questions were raised in connection with the safety and economy of nuclear power generation because the nuclear power industry was still young and immature and the U.S. took measures to turn off such criticisms. The Price-Anderson Act was enforced, on the one hand, to financially cover the enormous damages in case of critical accidents, and, on the other, a series of measures were taken in the fields of technology and publicity to show that the safety of light water reactor technology was proven. Reliability of emergency core cooling system (ECCS) was one of the most serious safety issues in 1960-1970's.

Japan concluded a new Japan-U.S. Security Treaty in 1960, and gradually fell into a deeper subordinate position to the U.S. militarily, politically, economically and technologically. Except the first Calder Hall type nuclear power plant imported from the U.K., all the nuclear power plants used light water reactors originally developed in the U.S. (*The solitary exception was the Advanced Thermal Reactor developed by Japan, but its operation had already been discontinued on account of economic and technological reasons. A prototype Fast Breeder Reactor was in operation, but it caused a serious accident of sodium coolant leakage.*)

In order to control other nations, controlling food and energy it is said, is an effective way. Japan's self-supply rate of food is below 30%. Self-supply rate of essential cereals has fallen down to the low level of less than 60%. As has already been mentioned, Japan is very poor in petroleum.

Nevertheless Japan is increasing its dependence on petroleum by adopting "miraculous" economic growth. This leads to an enhanced level of electric power consumption dependent more and more upon thermal and nuclear power generation which can not be sustained without depending upon other countries. Japanese nuclear power generation depends on enriched uranium preferentially imported from the U.S. The Japan Scientists Association (JSA) has been consistently pointing out that the energy policy of Japanese government is damaging genuine independence of the nation and is undermining the will to develop other natural energy sources including solar energy, terrestrial heat, wind force etc.

B. Firm brake on military use

Japan has important principles stipulated in the fundamental law for the peaceful use of nuclear energy i.e. independence, democracy and transparency, which were enacted in the fifties based on a recommendation made by the Science Council of Japan. There is also another important principle called the "Three Non-nuclear Principles" i.e. "not to possess, not to produce, not to allow introduction of nuclear weapons onto Japanese soil", which was declared by the Japanese Diet based on the citizens' strong demand broadly expressed prior to the restoration of the Okinawa Islands from the U.S. administration in 1974. The city of Kobe issued a municipal regulation in 1975 which requires every ship coming into the Kobe port to submit a certificate to prove that the vessel is free from nuclear weapons. Such severe attitude of Japanese people against nuclear weapons is rooted in the national tragedies experienced in Hiroshima, Nagasaki and Bikini Atolls. Two classic nuclear weapons used on Hiroshima and Nagasaki killed some 200,000 people by the end of that year 1945 and drove more than 100,000 A-bomb survivors to death after the end of the World War II. A hydrogen bomb used in "Bravo" test on March 1, 1954 had an

explosive yield of 15, which was 5 times as great as the total explosive yield of the bombs used in the World War II, which began in 1939 with the German invasion into Poland and ended in 1945 with Japan's unconditional surrender. The total yield of the bombs used in World War II was 3 Mt, even including the two atomic bombs dropped on two Japanese cities. As was pointed out earlier, a nationwide anti-nuclear movement in Japan started in 1954, provoked by the death of a fisherman who was heavily exposed to ionizing radiations produced by the "Bravo" explosion, and people came to have a very strong antipathy against ionizing radiations, even against radiations emitted by nuclear power stations.

Japanese people are very much alert and sensitive to the use of nuclear energy for military purpose and demand a strict ban on military use of nuclear energy, giving birth to the Three Non-nuclear Principles. But, in the recent years, Japanese political leaders sometimes speak out their real intentions by advocating that the Three Non-nuclear Principles should be reviewed. It was reported that more than 80 Diet members favour pro-nuclear policy which means that Japan should make further investigations into the possible possession of nuclear weapons in the future.

Nuclear reactors for "peaceful use" inevitably accumulate plutonium that can be converted into nuclear weapons, as was already proved by India. Japan has very high-level of technologies capable of developing nuclear weapons in a short period of time. But whether or not Japan develops Nuclear weapons is a question not of technology but political decision. Three Non-nuclear Principles is only a declaration of the Diet confirmed by the cabinet, and the third principle to prohibit introduction of nuclear weapons onto Japanese soil has frequently been violated by the US forces and deliberately overlooked by the Japanese government. I request the

Japanese government to legislate the Three Non-nuclear Principles, and demand Japanese Diet to resolve afresh that Japan is a nuclear-free nation, which should also be recognized by the United Nations, just as is the case with Mongolia, to honour the political determination of the Japanese people.

C. Priority of policies - cheaper or safer?

It is obvious that priority must be given to safety assurance of workers, residents and environment. But, throughout the whole process of the development of nuclear power generation in Japan, priority has often been given to economic efficiency.

Reliability of emergency core cooling system was at times arbitrarily trumped up to produce a pro-nuclear atmosphere without enough technological evidence to assure tangible safety of the system needed to mitigate serious situations endangering core melt-down.

Evacuation areas in the case of serious nuclear accidents were also minimized by introducing a number of "safety factors" that could not be considered proven. Some nuclear power reactors were constructed on the possible earthquake affected zones where large-scale dislocation of strata has been anticipated by the seismologists.

Nuclear power plants were made compact to economize materials, making impossible to secure enough space for reducing radiations due to short-lived radioactive substances produced in the circulating cooling water, thereby enhancing radiation dose received by the workers in the turbine room.

A great number of ruptures were found in the piping systems, especially in the case of pressurized water reactors, but, instead of taking essential measures, including the development of materials resistant to stress induced corrosion, inlet and outlet

of broken pipes were sealed with stoppers. In the case of critical accident experienced in 1999 in a nuclear fuel company named JCO located at Tokaimura Village, Ibaraki Prefecture, even buckets and dippers had been used for dealing with high level of enriched uranium!

Electric power companies have almost continuously been trying to expand consumption of electric power except during the oil crisis periods. There are more than 5 million automatic vending machines throughout the nation, which consume approximately 0.8% of the total electric power, almost equivalent to the power generated by several nuclear power plants. Electric power plants have been constructed to cope with the peak consumption levels in summer and winter, although electric power is oversupplied in spring and fall. It is necessary to cut the peaks and to flatten the consumption levels throughout a year, but such measures have not been actively promoted. It is also essentially meaningful to develop technologies which enable to store electric power when in excess. But such efforts have not been adequate. Safer methods of electric power generation, including windmill and solar battery technologies, have been lukewarmly promoted compared with well-off nuclear power generation, because they are not considered to be profitable for the U.S. and Japanese electric power industries.

I demand Japanese government not to leave profit-oriented electric power companies with this crucially important enterprise and request the government to promote appropriate policies to save on electric power consumption and vigorous development of safer power technologies.

D. Democracy in decision-making

Construction plan of a nuclear power plant is quite often brought by the electric power company and/or the Ministry of International Trade and Industry to a local

community just like a thunderbolt. In 1974, the first public hearing was held in Fukushima Prefecture about the permission of a nuclear power plant in that area, in which I made a speech to criticize governmental nuclear policy, but this public hearing was reluctantly organized by the government long after the political decision and vigorous criticism by the people. In addition, the public hearing was almost hijacked by the electric power company. Tokyo Electric Power Company schemed to send an overwhelming number of pro-nuclear residents to the hearing, at times arbitrarily posting application cards without consent of the residents themselves. The company manoeuvred to change the hearing to a place where an overwhelmingly large number of pro-nuclear residents welcomed the construction of nuclear power plant, and overpowered a handful of critical people. Japan Scientists Association cooperated with the conscientious inhabitants, and organized study meetings in the local community almost every day and night, thus publishing an urgent report entitled "Testimonies of 60 People" which was a kind of comprehensive book of criticism against nuclear power generation.

In another case in Fukui Prefecture, Japan Scientists Association planned to hold a nationwide gathering at a public regional centre in which we were planning to study a number of important problems, regarding nuclear power generation, including safety issues. The town authorities once gave us permission to use the public hall for the gathering, but later they suddenly cancelled the permission without any convincing reason. It was obvious that they secretly communicated with the Kansai Electric Power Company which was bringing a large sum of money to the local government. In 1974, Prime Minister Kakuei Tanaka, who wrote a book, 'Remodelling Archipelago of Japan', took the initiative in legislating a set of laws for the promotion of electric power generation. One of these was to enable the local

government to accept several million U.S. dollars if the local government formally accepts the plan to construct a nuclear power plant within its jurisdiction. The law is damaging democracy within local communities by depriving people of their free will to dispassionately discuss the problems accompanying such a nuclear power plant. People of the local community were often split into pro and anti-nuclear groups, souring age-old relationships, sometimes endangering cooperation for traditional festivals that had long been an important element of community spirit. In some regions, such collisions even caused a crack in a group of people who had long been engaged in struggles for a discrimination-free society. Money politics in connection with nuclear power generation sometimes severely hurt unity and solidarity among the people, thereby spoiling democracy in the local community.

Hence it is imperative that the central and local governments strictly abide by the principle of democracy in the decision-making processes.

E. Transparency of decision making

Transparency is indispensable for the people to be able to believe in what is said by the policy makers and nuclear power plant authorities. But, in Japan, many bits of information necessary for evaluating the safety of nuclear power generation were kept secret, and the information often came from the U.S. In the U.S., people can call for necessary information based on the "Freedom of Information Act", unless the information is classified. The Act is also available for the Japanese people, and we Japanese can request the U.S. government to provide information about the accidents pertaining to light water nuclear power reactors operating in Japan. It is quite queer that the Japanese people can sometimes get such information from the U.S. more easily than from the government/electric power companies in Japan.

It has been disclosed that electric power companies often intentionally concealed or sometimes falsified very important information about safety for fear of losing the confidence of the people. But, in reality, such deceptions themselves are the very causes of criticism against nuclear power development. Dishonest information handling was often seen in the process of treatment of accidents. Electric power companies usually publish information giving the impression that the accident is minor or even negligible. But they gradually change the content of information as the actual truth as regards the accident becomes clearer through the joint efforts of scientists, journalists and residents. Eventually they confess their deceptions.

Now in Japan, more than 50 nuclear power plants are in operation, and a vast amount of plutonium has been accumulated, which is mounting an economic pressure, because plutonium cannot still be used for power generation. Japanese government and electric power companies had an idea to consume plutonium as the fuel for the present light water reactors by developing MOX fuels, i.e. plutonium-uranium mixed fuel. Tokyo Electric Power Company, for example, requested Niigata Prefecture and Fukushima Prefecture to tentatively use the MOX fuel in the light water reactors, but both the prefectures recently disapproved of such request, because it was made clear that the data regarding fuel processing were fabricated.

I request the Japanese government to offer information more openly by legislating a law corresponding to the "Freedom of Information Act" in the U.S. and demand electric power companies not to conceal information regarding accidents, major or minor.

F. Safety of nuclear power generation

There are two important problems

regarding the safety of nuclear power generation : I. Safety of the nuclear power plant itself, and II. Safety issues concerning the nuclear power generation system as a whole - from uranium mining to disposal of radioactive wastes.

Before entering into the discussions about these issues, some basic explanations have to be provided as to the effects of ionizing radiations. As is well-known, there are two different types of radiation effects : I. Deterministic effects, and II. Stochastic effects.

Deterministic effects are the radiation injuries that would occur to one who receives radiation dose greater than the threshold dose level. Examples are alopecia, diarrhoea, cataract, etc. On the other hand, stochastic effects are the radiation injuries without threshold dose that could occur to anybody who receives radiation exposure with the probability corresponding to the level of radiation dosage. Examples are cancers, including leukaemia, and adverse genetic effects. The higher the radiation dose, the greater is the probability of stochastic effects.

Stochastic effects are sometimes compared to a lottery. For example, a person who has bought only one lottery ticket has a very small probability to win the first prize, but a person who has bought 1000 lottery tickets has a 1000 times greater probability to do so. The more the tickets, the higher is the probability. But, it is important to understand that the winner may get the same prize irrespective of the number of tickets bought. If two persons have received radiation doses 0.1Gy and 10Gy respectively and both have got leukaemia, there exists no difference in terms of severity. Leukaemia caused by 0.1Gy and that caused by 10Gy are of same severity, but chances of getting afflicted are different.

Another remarkable characteristic of radiation effects is "non-specificity", which

means that it is impossible to distinguish the leukaemia caused by radiation and that caused by any other factors. Many A-bomb survivors in Japan are suffering cancers even today, but they often encounter the difficulty in proving that the cancer has been caused by atomic radiations. The situations are pretty similar in case of the nuclear power plant workers.

Safety of nuclear power plant

The most serious safety problem of nuclear power generation is the concern about the occurrence of grave accidents which release vast amount of radioactive materials into the environment. In this respect, it is absolutely crucial to recognize that the serious accidents usually occur on account of the causes that had not been anticipated, because it is possible, and hence likely, to take preventive measures against the causes which were anticipated.

In the accident of SL1, a nuclear reactor for military use, in the U.S. in 1961, a person went up to the reactor and pulled out a control rod. Violent nuclear fission reactions naturally occurred and a steam explosion broke out, resulting in the death of 3 persons on the reactor. What was the cause of the accident? It is quite obvious that the accident was triggered off by the pull-out of a control rod, but it is important to identify the reason why the personnel pulled out a control rod. The cause was beyond anticipation. The cause was the decision to commit suicide by the broken-hearted person!

In the accident of Brownsferry Nuclear Power Plant in 1975 in the U.S., a fierce fire was triggered off by a candle flame which was also beyond anticipation. Why was there a candle flame in such a nuclear facility? The reactor building and the control building were connected with some 2000 cables for many purposes. Cables were bunched up together, and laid through the common wall separating the two buildings. If there is any leakage of air

through a gap between the wall and the cable casing, radioactive substances may come out from the reactor building into the control building in an accident. Therefore, air leakage test was being carried out by using a candle flame which would detect the existence of gaps by wavering. The flame caught one of the cables and spread out over the other cables. The scenario of accident starting from a candle flame was beyond anticipation in the process of prior safety assessment.

In the accident of the Three Mile Islands Nuclear Power Plant in 1979 in the U.S., all the 3 auxiliary water supply systems failed to work when the main feeder pump stopped functioning, which was also beyond anticipation.

In the case of Chernobyl Nuclear Power Plant accident in 1986 in the USSR, an intentional violation of operation rules was one of the essential causes of this unprecedented serious accident, which was also beyond anticipation.

Therefore, it is extremely important to recognize that the serious accidents can be set off by causes beyond anticipation. It may be arrogant to insist that all the causes of accidents have been anticipated with regard to the Japanese or Indian nuclear power plants. We have to take the risk of operating nuclear power reactors on the assumption that there may occur serious accidents on account of the causes beyond anticipation.

Safety issues of nuclear power generation system as a whole

Nuclear power generation requires a comprehensive system consisting of uranium mining, uranium enrichment, fuel processing, nuclear power plant operation, reprocessing of used fuels, and disposal of radioactive wastes. Therefore, it is completely inadequate to take care of the nuclear power plant only. A number of safety issues concerning the total system as

a whole - including, for example, terrorism against nuclear power plants, extortion of nuclear materials in the process of transportation, countermeasures against accumulation of plutonium (so-called "plutonium pressure"), etc., must be taken care of.

Japan promoted nuclear power generation without taking adequate technological care of radioactive waste disposal. Such an unprepared exploitation posture has often been jokingly termed as "a mansion without toilet".

Finally, I would like to add a few words about the relationship between "the anti-nuclear power movement" and "the anti-nuclear weapons movement". There are so many in Japan who think that nuclear weapons must be abolished but nuclear power generation is necessary because of the paucity of natural energy resources. I think it is very important to create as many opportunities as possible to inform people of the essential problems about nuclear power generation, including safety issues, of which I have discussed in this paper, but it is also important not to press a specific view of nuclear power on the citizens who otherwise can cooperate together for the movement against nuclear weapons. Many peace activists in Japan are, however, apprehensive about so-called "peaceful use" of nuclear energy and are collaborating with the concerned scientific workers to disclose the truths hidden beneath the shrouds of undemocratic politics and rank commercialism.

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The Hazardous Mix A Peculiar Act and the Perilous Energy

S. P. Udayakumar*

Q: What is it that is benign in appearance but malignant in nature?

A: If cells, it is cancer. If law, it is Jim Crow legislation. Both can hurt, harm and even kill if left unchallenged.

The Atomic Energy Act 1962 (33 of 1962) is supposed to serve a few specific purposes: enhancing the safety of the "ordinary citizens" of India; safeguarding India's natural resources and talents for the country's development; controlling and using atomic energy for the welfare of Indians and for other peaceful uses.

In reality, this law has failed miserably on all counts. Instead, it is used for a few other purposes: to threaten the critics who disagree with the authoritarian Department of Atomic Energy (DAE); to undermine the democratic fabric of the Indian society, and now to help the private profiteers reap rich dividends at the cost of public safety and costs.

Enhancing Safety?

Providing the basic regulatory framework for all activities related to atomic energy program and the use of ionizing radiation in India, Sections 3 (e) (i), (ii) and (iii), 16, 17 and 23 of the Atomic Energy Act, 1962 address the safety concerns. The regulatory body designated by the Central Government is the competent authority for granting, renewing, withdrawing and revoking consents for nuclear facilities. It also exercises control over nuclear installations and the use of radioactive substances

and radiation generating plants outside such installations. Sections 16 and 17 of the Act refer to control over radioactive substance and special provisions for safety. Section 23 empowers the regulatory body with administration of Factories Act 1948, including enforcement of its provisions, appointment of inspection staff and making of rules in the nuclear installations.

The Central Government had appointed the Chairman, Atomic Energy Regulatory Board (AERB) as the 'Competent Authority' to exercise the powers conferred on it in the rules such as *Radiation Protection Rules, 1971; Atomic Energy (Working of the Mines, Minerals and Handling of Prescribed Substances) Rules, 1984; Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987; Atomic Energy (Factories) Rules, 1996; and Atomic Energy (Control of Irradiation of Food) Rules, 1996*. As far as radioactive substances are concerned, AERB is empowered to enter any installation and take samples under the Environmental Protection Act, 1986 and to receive information on excess discharge of pollutants under the Environmental Protection (Amendment) Rules, 1987. Similarly, when it comes to radioactive air pollution and radioactive wastes, the provisions of Atomic Energy Act, 1962 and rules made there under cover these issues rather than the relevant rules and AERB becomes the authority to enforce directions and procedures as per the Atomic Energy Act, 1962 with respect to radioactive substances

under Rules 2(b) and 3 of Manufacture, Storage and Import of Hazardous Chemical Rules (1989) under the Environmental Protection Act, 1986.

This all-powerful AERB with a wide range of functions to lay down safety standards and frame rules and regulations to carry out its mandate was set up in November 1983. When A. Gopalakrishnan, the AERB Chairman from 1993 to 1996, submitted the Safety Issues Report that ordered several procedures and corrective actions in Indian nuclear installations, "the BARC management refused outright to comply with [them]" (Frontline, June 24, 2000). In fact, in April 2000, Dr. R. Chidambaram, the then secretary of DAE, simply took away the authority of the AERB to oversee the safety of a large number of critical nuclear installations meant for the weapons program in the Bhabha Atomic Research Centre (BARC). An Internal Safety Committee set up by the BARC director became responsible for ensuring the safety of the public and the workers from dangers that could emanate from these facilities. Thus the safety norms and provisions of the Atomic Energy Act 1962 stood seriously compromised.

Safeguarding Natural Resources?

The Atomic Energy Bill 1948, which Pandit Nehru moved in the Constituent Assembly of India (Legislative) on April 6, 1948, ensured the state control of atomic minerals. The Parliament repealed the Atomic Energy Act 1948 when it passed the Atomic Energy Act 1962 and the new Act was quite comprehensive about the discovery of uranium or thorium (section 4), control over mining or concentration of substances containing uranium (section 5), disposal of uranium (section 6), power to obtain information regarding materials, plant or processes (section 7), power of entry and inspection (section 8), power to do work for discovering minerals (section 9), compulsory acquisition of rights to

work minerals (section 10), compulsory acquisition of prescribed substances, minerals and plants (section 11), compulsory acquisition not sale (section 11-A), compensation in case of compulsory acquisition of a mine (section 12), and novation of certain contracts (section 13). Despite this painstaking coverage of all aspects of uranium and thorium discovery inside India, several private operators are mining the coastal sand in southern Kerala and southern Tamil Nadu indiscriminately. They extract thousands of metric tons of ilmenite, sillimanite, zircon, garnet, and most importantly, monosite that contains thorium, uranium and cerium. The people of Kanyakumari and Tirunelveli districts in Tamil Nadu have been agitating against these sand barons whose unscrupulous activities have triggered massive sea-erosion, increased the amount of natural radiation, undermined fishing, and caused havoc in the overall environment. But the Atomic Energy Act 1962 has simply been a paper tiger crouching in front of the big-money business and big-time corruption.

Using Atomic Energy for Indians' Welfare?

The Atomic Energy Act 1962 is expected "to provide for the development, control and use of atomic energy for the welfare of the people of India and for other peaceful purposes and for matters connected therewith." The atomic adventurism of May 1998 and the subsequent weaponization hoopla that resulted in the 2002 Kargil war and the near nuclear annihilation in the subcontinent speak amply about the contribution of atomic energy "for the welfare of the people of India." The use of atomic energy "for other peaceful purposes" would become clear if one were to look into the track record of the DAE and the humongous amount of money it has swallowed over the past fifty years to spit out a meagre two percent electricity of India's total power generation.

Threatening the Critics!

One of the chief dangers of Jim Crow legislations is that they can be implemented in a manner that was violative of the Constitution and international treaty obligations of the concerned country. The Atomic Energy Act 1962 has indeed become a potent weapon for the DAE officials to threaten and silence the opponents and critics and shun any public dissension to their plans and projects. As a matter of fact, Dr. R. Chidambaram did warn openly and blatantly the anti-nuclear power activists in and around Koodankulam in southern India that the Atomic Energy Act 1962 would be used against those who spread "canards" against the upcoming nuclear power project there. All local Tamil dailies reported this public warning to the advantage of the DAE and there was no opposition to this highhandedness from any quarter.

Undermining India's Democracy!

Section 3 of the Atomic Energy Act 1962 enables the Central Government "to declare as 'restricted information' any information" not so far published or otherwise made public" and "to declare as 'prohibited area' any area or premises" where "production, treatment, use, application or disposal of atomic energy or of any prescribed substance" is carried out. Leaping much further, section 18 (restriction on disclosure of information) restrains nuclear information sharing even more stringently. Without any transparency, accountability, parliamentary oversight or popular scrutiny and with unlimited funding, 'sacred cow' status, innocuous 'science and technology' label, and the 'national security' jingoism, the Atomic Energy Act 1962 easily becomes an undemocratic piece of legislation. This inhuman Act has made it possible for the DAE parivar (family) to keep several 'incidents' and 'accidents' under wraps.

To make matters worse, the Supreme Court

ruled in January 2004 that the central government had every right to maintain secrecy about nuclear installations and deny public information about these in the interest of national security, which was paramount. Although our Constitution guarantees us the right to information vide Article 19(1)(A), these are, according to the court, subject to reasonable restrictions in the interest of national security. Rejecting a petition by the People's Union of Civil Liberties (PUCL) and the Bombay Sarvodaya Mandal for making public a government report on safety of nuclear installations, submitted by the Atomic Energy Regulatory Board (AERB) to the Delhi government in November 1995, the Court ruled that the petitioners were "not entitled" to get the document declared as "secret" by the Union Government under Section 18 of the Atomic Energy Act 1962.

It is important to note that the petitioners did not ask for any information about India's nuclear arsenal or its storage site or anything like that but expressed a genuine concern that there was not enough safety precautions in nuclear power stations in the country and any accident could have a disastrous affect on human beings, animals, environment and ecology. The petitioners had moved the Supreme Court after the Bombay High Court had rejected their petition in January 1997. The petitioners had also raised doubt about the safety aspect with regard to disposal of nuclear waste.

The Atomic Energy Act 1962 allows arbitrary suppression of all information -- patently unconstitutional, according to V.K. Krishna Iyer, a widely respected legal luminary in India. The DAE is easily one of our most secretive departments and has much to hide: uranium mining hazards in Jadugoda, excessive irradiation of power-plant workers, waste mismanagement, and numbers regarding explosive yields. When a former Captain B.K. Subba Rao questioned the DAE's nuclear sub (Advanced Technology

Vessel) project, a spectacular Rs. 2,000 crore failure, he was charged in 1988 with spying with the ludicrous evidence of "espionage" (his IIT-Bombay Ph.D. thesis) and jailed for 20 months--until fully exonerated by three different courts.

Helping Profiteers!

There is an added danger now that the DAE is looking into ways of making amendments in the Atomic Energy Act 1962 in order to have private participation in the future nuclear power programs. Talking to reporters after inaugurating the Reverse Osmosis Plant and participating in the 'Bhoomipooja' for the construction of turbine building and other civil structure at Koodankulam on August 1, 2002, the chairman and managing director (CMD) of Nuclear Power Corporation of India Ltd (NPCIL) V. K. Chaturvedi said that NPCIL's proposal in this regard was under the consideration of the Central Government. The latest word is that

amendment to the act is under consideration at various levels. Once the amendment is passed in the Parliament, the states, public and private sectors could invest in the nuclear power program. The Atomic Energy Act 1962 would thus facilitate the fusion of secretive state, careerist DAE and greedy power barons and the fission of India's future and Indians' well-being.

As is the department, so is the law. Instead of getting its act together, it all together gets into wrong acts.

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No More Jadugoda : People of Nalgonda, A.P. Oppose Uranium Mining

*M. Channa Basavaiah**

First discovered in the eighteenth century, uranium is a dense, heavy metal found in tiny amounts almost everywhere. However, concentrated deposits of uranium (called ores) are found in just a few places, usually in hard rock or sandstone. These deposits are necessarily covered over with earth and vegetation. Before 1939, there was no significant use for uranium. German potters used it to make a reddish glaze. It was during World War - II period that scientists realised "splitting" uranium atoms using nuclear fission could make extremely powerful bombs. Since then it is being used to manufacture nuclear weapons and from 1960s, nuclear fission began to be used to produce electricity through nuclear reactors. However, now there are various alternatives for power generation and worldwide trends in nuclear power generation in the developed countries are on the decline.

The process of mining involves bringing the uranium and its decay products buried deep in the earth to the surface, and rock containing them is crushed into fine sand. After uranium is partially removed through a chemical process, the residual effluents are stored in huge reservoirs. These leftover radioactive wastes are called "uranium tailings". Uranium tailings contain over a dozen radioactive materials, which are all extremely harmful to living things. Inside the mines, the workers are principally exposed to ionising radiation from radioactive uranium and the accompanying radium and radon gases emitted from the ore. Ionising radiation is the part of the electromagnetic spectrum that

extends from ultraviolet radiation to cosmic rays. This type of radiation releases high-energy particles that damage cells and DNA. Damage to DNA has many harmful effects. It can weaken a person's defences against disease, decrease ability to heal, and undermine one's ability to adapt to environmental changes. This process can also cause abnormal cell division (being tumours or various kinds of cancer, particularly, lung cancer) and genetic/hereditary deformities. Radiation exposure has entirely different implications on reproductive organs and the unborn. A mutated reproductive cell has the potential of passing on the "defect" to one's offspring. An additional harmful effect of radiation on progeny may take years to surface. Genetic defects that can be passed on to one's offspring include children with deformed or underdeveloped physical characteristics, children born mentally handicapped, children born with weakened immune systems, and children born with congenital diseases. Radiation exposure has also been known to cause sterility in men as well as making women unable to conceive or carry a child. According to the International Physicians for the Prevention of Nuclear War (IPPNW), uranium mining has been responsible for the largest collective exposure of workers to radiation.

The problems of uranium mining do not end here. In fact, the problems associated with uranium tailings are considered as permanent and spread to other areas as they are left on the surface of earth and allowed to dry out. In the tailings,

soil will only absorb the radioactivity for the short term; the high salinity of the water would reach the ground water table below relatively quickly. This would lead to an unacceptable impact on the ground water systems of the region. After 100 years, the radioactivity will begin to migrate and become mobile. If this kind of ground water is used in irrigation, radioactivity spreads to the other parts. Besides this, the accumulated radioactivity in the topsoil will lead to high contamination, which is susceptible to wind erosion and sediment runoff, by which it can enter other parts/region. In other words it can be blown in the wind and the radioactive material be deposited on vegetations far away. They can be washed by the rain into the water system, and spread inevitably. In this way all the radioactive materials found in tailings enters the larger food chain.

Owing to these long lasting adverse impacts, the uranium mining has become controversial wherever it was undertaken, whether in Australia or Canada or India. In India, uranium mining and processing is carried out at Jadugoda, in the Jharkhand State since mid 1960s. So far these mines are the lone source of uranium ore for the country's 14 nuclear reactors. Decades of uranium mining, processing and waste disposal adversely affected these villages and made the local peoples' life miserable. Hitherto free, healthy, innocent tribal people of these areas are today haunted by dangerous deceases, abnormalities and thus deaths. Though these health hazards have been reported in the local press, the authorities of the Uranium Corporation of India Limited (UCIL) and the Department of Atomic Energy (DAE) vehemently deny them. However, an independent medical survey conducted and published by the medical professionals of Sampurna Kranti Vidyalaya, Vedchhi (Gujarat), confirmed increasing cases of congenital deformities, mental retardation, Polydactyl (extra fingers or toes) and

Syndactyl (fused or missing fingers and toes), Lung Cancer and Silicosis, etc. in the villages where the uranium mining and processing is carried out.

In the light of adverse experiences of uranium mining world-over in general and specific experiences of uranium mining at Jadugoda, the proposal of uranium mining at Peddagattu - Lambapur at the Nalgonda District of Andhra Pradesh by the UCIL met with stringent opposition from the civil society groups. The Movement Against Uranium Mining (MAUP) - a collective of individuals and groups against uranium mining, the Jana Vignana Vedika (JVV), the Human Rights Forum (HRF) and the Coalition for Nuclear Disarmament and Peace (CNDP) were the organisations actively involved in the public education campaign on uranium mining and exposed the claims made by the UCIL. A number of issues as detailed below were debated in the process of public awareness campaign and at the Public Hearing conducted on the Project by the A.P. Pollution Control Board (APPCB) in the last August.

The proposed mining sites of Peddagattu and Lambapur are right above the Nagarjunasagar reservoir and are in the vicinities of Akkampally Reservoir (pumping station of drinking water to the twin cities of Hyderabad and Secundrabad) and Rajiv Gandhi Sanctuary, which is part of Project Tiger rich in fauna with about 150 species of birds. The UCIL estimated 11.02 million tonnes of uranium reserves spread over 1301.35-acres land (of this 1104.64 acres are under Yellapur Reserve Forest and remaining 196.71 acres are under private patta land) in these areas. The UCIL estimated to undertake production of 1,250 tpd (tonnes per day) for a period about 20 years. The Environment Impact Assessment and Environment Management Plan (EIA&EMP) of the proposed uranium mining and processing

prepared by Mecon Limited, a Ranchi based company, as against the International Committee for Radiological Protection (ICRP) suggested radius of 15 kilometres, conducted its survey only in 7.5 kilometre radius. However, even within this area, as per the survey 96,000 people live in seven to eight villages. If the proper 15-kilometre radius is taken into account, the populations affected by radiation due to uranium mining and processing operations would be more than double the figure of Jadugoda. The aspects debated in this regard were the issues related to the resettlement and rehabilitation, on which no claims were made by the UCIL. Given the experience of Jadugoda, perhaps the question of resettlement and rehabilitation does not arise! At Jadugoda, before the mining was undertaken, Homi Bhaba, one of India's pioneering nuclear scientists, and the Swedish engineers who were building the plant, advised that four villages should be moved as they lay within 500 metres of the tailings dam. But, even today this has not been undertaken.

The problems in the case of proposed mining area of Nalgonda would be more intensive due to the specific ecological and demographical conditions. Referring to the claims made by the UCIL that there would be no impact on Nagarjunasagar, "due to almost impervious granite rock formation and meagre rainfall", the MAUP critiqued that the general drainage of the uranium mining area at an elevation of more than 300 metres is towards Nagarjunasagar with maximum water level at 180 metres and a number of ephemeral streams flow down to Nagarjunasagar from the plateau region where the mine is planned to be located. The general direction of the sub surface water flow in the processing plant region is also towards Nagarjunasagar. This being the case, Nagarjunasagar is bound to be adversely affected owing to flow of storm water

contaminated with uranium particulate matter spread over the vast mining area and from the contaminated underground water from the processing plant.

Due to the inadequate designs of tailings, there is a real threat from contaminated rainwater run off. Thus, the claim of the UCIL carrying out mining operation with zero discharge is "misleading", said the MAUP. The Nagarjunasagar is an important source of irrigation for the districts of Nalgonda, Guntur, Krishna and Prakasham and also drinking water source of certain towns, and the Akkampally Reservoir is the pumping station of Krishna River water to the twin cities of Hyderabad and Secundrabad. As a result of these, there are definite chances of radioactive material entering the larger food chain of the larger region of the state. The suggestion made by the UCIL that these ponds would be lined with impervious sheets is "fiction" as it is practically impossible to cover the entire 80-hectares land.

The MAUP questioned the claim of the UCIL that the concentration of radon gas coming out of the mine and tailings ponds will be weak and subjected to further atmospheric dilution and pointed out that this has to be taken with a pinch of salt as the gas is capable of remaining stable for a long time. In this respect the MAUP pointed out, "If this is true, the US Congress would not have chosen to enact the Uranium Mill Act of 1978 and amended it from time to time. Section 2 (a) of the Act stated that the Congress found that the uranium mill tailings located at active and inactive mill operations may pose a potential and significant radiation health hazard to the public."

The proposed uranium mining and processing operations in Nalgonda District are against the Wild Life (Protection) Act of 1972, as the mining area falls under the Yellapur Reserve Forest and is in the vicinity of Rajiv Gandhi Sanctuary, which is part of Project Tiger.

The undertaking of uranium mining also goes against the Water (*Prevention and Control of Pollution*) Act of 1974 due to the existence of major water bodies of Nagarjunasagar (Krishna River) and the Akkampally Reservoir and their likelihood of being affected by radiation. Besides these, undertaking mining and processing activities also violates the G.O. No. 111 of the Government of A.P. prohibiting industries, major hotels, residential colonies or other establishments, that generate pollution in the catchments areas of drinking water sources.

The other important issues addressed were the promises made by the UCIL regarding the region's development. Though the proposed project claims to generate employment for 422 persons, the actual benefits it promises to the locals are: engaging them for transportation of ore and material on contract; in case of direct manpower required, provides employment especially in the category of unskilled and semi skilled workers (subject to rules and procedures in vogue in UCIL); proposals to undertake training for a section of local youth in a phased manner to take up jobs (mining contracts, building contracts, supply of mining/lignite handling plant materials and also 'small scale rural business developments') of their own (self employment) or in mines (on contract basis) or elsewhere; proposals to undertake training from time to time for 'improved agro techniques, water conservation, first aid and safety, adult literacy programmes etc. to the villages'; and proposals to provide regular grant to neighbouring schools and 'constant encouragement for cultural activities in local villages.' Just a casual thought about these proposals would easily reveal that there is nothing substantial promised to the region and its people. There is nothing new about these promises. The politicians of the region and state have made these from time to time. Hence, the locals were just not carried away by these.

The attempts by the various civil society

organisations like MAUP, JVV, HRF, CNDP etc. and other individuals, along with the media, against the proposed uranium-mining project at Nalgonda district of A.P. have not gone waste. Thanks to the multi-pronged strategies of these groups, a majority public opinion was mounted against the project on the day of public hearing and later periods within the Nalgonda and surrounding districts, including the capital city of Hyderabad. Despite this, the APPCB has taken an ambiguous decision. The APPCB rejected the proposed processing plant at Mallapuram and Dugyal, owing to its proximity to the Akkampally Reservoir, the drinking water source (in accordance with above mentioned G.O. No. 111), but the same was not applied to the mining, despite its proximity of the Nagarjunasagar Reservoir. The APPCB maintained that since mining is "site specific" (in fact all mining activities are site specific) it called for certain conditionalities (which are yet to be specified) to be fulfilled by the UCIL, rather than rejecting it in totis. However, the APPCB left the final decision to the State. Thus the ball now is in the court of state government. The local Lambada tribal women, actively participating at the public hearing in opposition to the uranium mining, said that "Katti Bangaramdani Medagosukuntama!" (We cannot slit our necks just because the knife is made up of Gold), "Deepam Manchigagupadutundani Muddu Pettukuntama!" (We cannot kiss the flame just because it looks bright). If this local tribal wisdom prevails on the state government, it cannot but reject the proposal for uranium mining at Nalgonda.

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India Goes Nuclear : Tracing the Trajectory

*Sukla Sen**

The Major Drivers

The propulsion for 'nuclearism' is often derived from a quest for raw power and potency, 'power' shorn of any 'moral' or 'ethical' principles, 'power' to dominate and subjugate, and 'potency' coupled with grossest exhibitionism. While the 'elite', or a section of it, functions as the main driving force; in order to gain legitimacy and momentum the 'quest' must also infect and intoxicate the 'masses', who would then join the 'quest', even if in a vicarious manner. So, in the process, 'nuclearism' has to and does actually set off a whole chain of motions transforming the individual and collective mindset. Peace and non-violence is projected, and eventually comes to be regarded, as 'effeminate', and 'machismo' as the 'ultimate' virtue.

In the specific Indian context, the leading support for the drive towards nuclear weaponisation comes mainly from three distinct and yet somewhat overlapping segments. These are :

1. The scientific and technical establishments associated with the development of nuclear weapons. Their prestige and power are directly at stake. The scientists and technocrats connected with the BARC, AEC and the DRDO fall in this category.

The top echelons of the 'defence' forces and the current breed of defence analysts played supportive roles, even if, as late entrants and junior collaborators.

These are the people who have most consistently and with single-minded fiendish determination pushed India towards nuclearisation.

2. The new Indian elite, a product of the post-Independence economic development, who gradually sidelined the 'old' middle and lower middle classes - whose ideals and value systems were by and large rooted in the experiences of the epic anti-colonial liberation struggles of the past decades, and emerged as the most vocal section of the society.

Particularly since the mid-seventies the mainstream political parties more and more transformed themselves into the vehicle and mouthpiece of their hopes and aspirations. Fiercely narrow-minded and self-centred, they started viewing acquisition of nuclear weapons as the shortest path to enduring glory.

3. The triggering force behind the Pokhran-II blasts was, however, unarguably the forces and politics of 'Hindutva'.

For these sickeningly evil forces the nuclear explosion was to provide a grand opportunity to stir up bestial passions and trigger off an avalanche of murderous mass-hysteria, which would, at one go, radically consolidate and crystallise the exclusionist and majoritarian 'national' identity sought to be built by them. And that is precisely why the explosions were engineered, in less than two months of their coming to power, as part of a predetermined agenda, without the least pretence of carrying out any systematic and comprehensive review of India's current security concerns and strategic needs. Even the Defence Minister and the three Service Chiefs, it came to light subsequently, had been informed, so to say, only at the last moment; even though the

publisher of the RSS organ *Organiser* had been made privy to this schedule so that they could advance and coincide the publication of their special issue to commemorate the first nuclear blast (ostensibly for peaceful purpose) eighteen years back on 18th May 1974. This 'leak' alone is sufficient to blow the lid off the claim that the concern for 'National Security' was the motivating force for undertaking these explosions, even if 'security' is interpreted in the most narrow-minded right wing fashion - completely disconnected from the issues of food, shelter, health, education and such other basic necessities for sustaining human life.

The ideological tight fit between "Hindu" nationalism and the upsurge of nuclear nationalism that it caused, also the radical rupture from the past, comes out in graphic vividness if the apparent diffidence of Indira Gandhi, widely regarded and reviled for her deadly decisiveness, in acknowledging the military implications of the 1974 "implosion" is juxtaposed with the screaming proclamation of wobbly Vajpayee, and accompanying chest thumping of his colleagues, regarding India's attainment of nuclear weapon power status without the slightest hint of any regret, remorse or even self-doubt.

The Background

Nuclearisation of a state has essentially two dimensions : technological and doctrinal/ideological. It requires a certain level of scientific/technological development in a certain specific direction. More so, as unlike other armaments nuclear weapons and related technologies are not freely tradable commodities in the international markets. But then, that by itself is not enough. It also calls for a conscious and deliberate political decision making based on an ideology/doctrine favouring a decisive move in the required direction. These are two distinctly different aspects, but not wholly unconnected and autonomous. The 'technological develop-

ment' while by itself is not 'sufficient', even if 'necessary', tends to generate its own momentum/pressure to reorient the ideological sphere. However, the ideological orientation may very well precede the 'technological development' and in fact guide and steer it along a route, at least broadly, charted out in advance. Then again, quite significantly, there is no clear fault line demarcating the 'technology' required for 'peaceful' use of nuclear energy, or to be more precise nuclear power generation, and that for production of nuclear explosive devices meant for mass destruction. So, while the shift from peaceful use of nuclear energy to nuclear weaponisation involves a big leap in the realm of political decision making, in the domain of technology the transition is virtually seamless.

In order to make sense of the emergence of India as a declared Nuclear Weapons State (NWS) from the status of a founding and leading member of the Non Alignment Movement championing the cause of decolonisation, pacifism and nuclear disarmament over a period of about half a century it is imperative to keep the broad clues offered above in close focus.

In the Indian case, the distinction between 'technology' and 'ideology' becomes all the more relevant and important if one is not to lose sight of the fact that Independent India started off its journey with no blueprint whatsoever for its eventual nuclear weaponisation even as the endeavour for building up the requisite scientific/technological base had commenced even before the actual independence. With independence attained, the drive for technology in general, and nuclear in particular, gained further momentum. But that was more reflective of Independent India's supreme leader Jawaharlal Nehru's telling faith in science and technology, in stark contrast with his mentor Gandhi, not just as a great devel-



opmental tool but also as a liberating force of immense proportions. (Only with the benefit of actual historical experience and the hindsight of more than half a century one can now proceed to pronounce such visionary faith and optimism on his part somewhat naïve and misplaced). The other important aspect of India's drive for nuclearisation, which would start off much later, is that quite contrary to the claims of its apologists this had only a tenuous correlation with any external threat perception. This has been rather brilliantly captured by a perceptive Indian observer in the following words : "Speaking after the nuclear tests that he had ordered [in May 1998], with a clear sense of being vindicated, Prime Minister Vajpayee declared 'I have been advocating the cause of India going nuclear for well over four decades.' In triumph were forgotten the careful, laboured explanations of the need for the bomb; there was no problem with the fact that four decades earlier China was seen as a special ally not threat, that China then had no nuclear weapons, that Pakistan was struggling to find its feet as

a state". A foreign observer, of great diligence and distinction, has also arrived at a broadly similar, even if rather prosaic and more detailed, conclusion : "Domestic factors, including moral and political norms, have been more significant in determining India's nuclear policy... Often, tensions between domestic interests have made this policy appear ambivalent and ambiguous. India has been torn between a moral antagonism toward the production of weapons of mass destruction, on one hand, and on the other hand, an ambition to be regarded as a major power".

The Trajectory

India's journey towards eventual nuclearisation in May 1998 (and further development onwards) since Independence has passed through a couple of distinct phases.

1947 to 1964 : Technology Sans Weapons
 The Tata Institute of Fundamental Research, with funding from the Tata Trust, had been launched in 1945 in the then Bombay. It was the brainchild of Dr

Homi Bhabha, an extremely gifted world class physicist. Bhabha was its first Director and would often refer to this institute as the cradle of Indian atomic energy programme. In 1946 the Atomic Energy Research Committee was instituted, again Bhabha as its Chairman, to promote studies in nuclear physics in Indian colleges and universities. Within a year of attainment of independence, at the initiative of Nehru, the Atomic Energy Commission (AEC) came into being, under an appropriate act passed by the parliament, led by Dr Bhabha reporting directly to the Prime Minister. Through the establishment of the AEC India's atomic/nuclear energy programme was formally launched. The programme from the very beginning received highest indulgence from the PM and its progenitor the highest degree of autonomy and institutionalised protection from parliamentary and other forms of enquiry/intervention. While the large overlap between the programmes for peaceful use of nuclear energy and weapon producing capability was clearly recognised, the Indian state at the doctrinal and policy level remained firmly wedded to the ideal of abjuring nuclear weapons. And this was very much in keeping with the overall foreign policy and its status as a pioneering and leading member of the Non Aligned Movement.

India's foreign policy for the first time, however, came under serious assault in the wake of October 1962 - as a consequence of terrible humiliation of the Indian Army at the hands of its Chinese counterpart. The Jana Sangh (JS), the earlier incarnation of the BJP, took the opportunity to repeatedly put forward its decade old demand that India at least now must go nuclear. But Nehru, however, was able to weather the storms in spite of losing much of his moral/political stature.

On 16th October 1964 China carried out an overground nuclear explosion pursuant to the state policy adopted as far

back as in 1958. On November 27, as the culmination of an ongoing outcry for an Indian Bomb - encouraged and reinforced by none other than Homi Bhabha's public pronouncement promising cheap and quick nuclear deterrence capability if backed up by the Indian state, the Jana Sangh introduced a motion in the Lok Sabha calling for the manufacture of nuclear weapons. While Lal Bahadur Shastri, the successor of Nehru, could manage to save the day, in the teeth of dissenting voices from influential quarters even within his own party, and even reiterated his earlier position of renouncing the Bomb, he nevertheless had to make two important concessions. From "No Bomb Ever", the position shifted to "No Bomb Now". And then, along with energy, the goal of developing technological capability for Peaceful Nuclear Explosion (PNE) was adopted. At that time it went by and large unnoticed, given the rather meagre presence of the JS in the parliament, that the politics of Hindutva had scored a significant victory with far-reaching consequences, with backing from the Samyukta Socialist Party and a section of the Congress itself. As would happen about thirty three and a half years later there was a complete convergence of interests between the scientocrats/technocrats representing India's nuclear establishment and the rabidly chauvinist/jingoist "Hindu" nationalist party.

1965 to 1974 : Downslide Along Strategic Ambiguity

During this period India fought an intense ten day war with Pakistan in August-September 1965, and faced economic/military sanctions from the US on that account. Both Shastri and Bhabha died premature deaths in January 1966. Indira Gandhi was installed as Shastri's successor. And Mrs Gandhi chose Dr. Vikram Sarabhai as Bhabha's successor. Sarabhai was unique in that he was the only head of India's nuclear establishment

who did not exhibit any marked enthusiasm to develop technological capability for manufacturing nuclear weapons or even (peaceful?) explosion. India in 1968 reiterated its resolve not to go in for nuclear weapons on practical considerations and refused to sign the [Nuclear] Non Proliferation Treaty (NPT) on the ground of it being discriminatory. In 1971, facilitated by India's direct military intervention, Pakistan was dismembered and the new state of Bangladesh came into being in place of the erstwhile East Pakistan. Dr Sarabhai died prematurely on 30th December 1971. On May 18, 1974 India carried out its first (underground) nuclear explosion, dubbed as 'implosion' for peaceful purpose, in Pokhran in the bordering state of Rajasthan. As per available accounts, which are at any rate rather scanty, the explosion was carried out at the initiative of India's nuclear establishment and was endorsed by Mrs Gandhi to counteract the raging mass discontent against her rule. Nevertheless she took special care to emphasise the 'peaceful' nature and intent of the blast and even wrote a letter singing the same tune to Pakistani Prime Minister to dispel his misgivings four days after the blast. The blast was perceived as a great feat for Indian science and technology and India's de facto entry into the big league. With few exceptions, the media and the political parties, the "nationalist" Jana Sangh in particular, welcomed the development with rapturous applause. But in so far as the official position was concerned, the attainment of nuclear weapon capability, which the 'implosion' demonstrated, however, remained only a powerful subtext - carefully and emphatically denied in all formal enunciation. While the nuclear establishment scored a landmark victory, Indira gained a political dividend which appeared quite impressive for a while but would soon prove to be rather transient and dubious. As regards the external consequences,

"[i]t increased US and international pressure on India to conform to the nonproliferation regime. It appeared to have no effect on China, and it had the negative impact of hardening Pakistan's resolve to develop nuclear weapons." As regards the process, "[t]here was no systematic analysis of costs and benefits. India's foreign affairs establishment was not asked to assess likely international reactions and repercussions. The military services were not consulted..." The 'process', more than the 'consequences', clearly points out that the motivation underlying the blast flowed essentially from domestic compulsions - and definitely not from any external threat perceptions.

1974 to 1984 : The Years Of Lull

The ten years from '74 to '84' proved to be rather uneventful in terms of development on the nuclear front. Of the two Prime Ministers, who ruled for significant periods, Morarji Desai was implacably set against any nuclear programme. Even Indira seemed to have regained, at least partly, the strong moral aversion of her father, Independent India's first Prime Minister. Despite persistent efforts the nuclear establishment failed to obtain any authorisation for any further test, peaceful or otherwise. General Sundarji, an advocate of nuclear weaponisation, later bitterly lamented, "Between the mid-Seventies and mid-Eighties, India's [nuclear] decision-making ... appears to have enjoyed something between a drugged sleep and a deep postprandial siesta."

1985 to 1995 : Back To Life

After the assassination of Indira Gandhi, Rajiv Gandhi took over the reins. In March 1985 an American documentary on Pakistan's clandestine nuclear programme drew the attention of the Indian press. In 1986 border tension between the two neighbours rose to a new pitch. Nevertheless commitment to restrict India's nuclear programme to peaceful

use only was repeatedly reiterated. India also took some initiative in the direction of global nuclear disarmament but steadfastly rejected any overture for regional disarmament. Concurrently the programme for developing nuclear weapon capability and also ballistic missiles went apace without resorting to any further test explosion.

1995 to May 1998 : The Final Push

In 1995 May the NPT was indefinitely extended without any commitment from the NWSs for a time-bound programme for denuclearisation. This in India was perceived as a perpetuation of the 'nuclear apartheid' regime and consequently a setback. At the same time the negotiation to finalise the CTBT draft had already been under way since January 1994. This added to the nervousness of the nuclear lobby in India, comprising top functionaries of the DAE, BARC and DRDO, the so-called 'strategic enclave' on the one hand, backed up by a loose group of 'strategic analysts', and a section of the political milieu - the BJP in particular, on the other. They foresaw in the forthcoming CTBT a permanent closure of India's nuclear weapon development programme in absence of the facility to carry out explosive testing, as the Treaty was meant to ban all explosive testing save the sub-critical ones. The objection, to be sure, was not because these developments would allow the P5 countries to maintain their nuclear arsenal indefinitely, as had been publicly claimed, but because it would stop India from joining this big league as a new member. At any rate, pressure was built up for authorising test explosions before the CTBT coming into force. Narasimha Rao-led Congress government grappling with serious corruption charges and due to face election in the next year apparently gave green signal to the scientists to carry out test explosion in the month of December. However, the US intelligence

got wind of it and under pressure the attempt was abandoned. At that time, however, for evident reasons such report was vehemently denied. The Rao government somewhat compensated for the abandonment by flight-testing a 250 kilometre range Prithvi missile on January 27 next.

The Congress lost its majority in the election for the eleventh Lok Sabha. Vajpayee was sworn in as the PM on May 16 and on May 28 he lost the vote of confidence. Even within this short span the nuclear establishment and the BJP toyed with the idea of going ahead with nuclear explosion. For whatever reasons, the attempt did not fructify.

H D Deve Gowda, the chosen leader of the United Front, with Congress support from outside took over. Inder Kumar Gujral became the External Affairs Minister. While the UF government reportedly turned down the nuclear lobby's ardent plea to carry out further tests, it nevertheless came under tremendous pressure of BJP's hawkish posture on the issue of CTBT to which it had to succumb. Rather ironically the position of the Left, an important prop for the UF government, on this issue remarkably converged with that of the BJP.

It was only since October 1995 that the Indian government started making a clear linkage between the CTBT and a time-bound programme for disarmament by the P5 as a precondition for its accession. But as the negotiation inched towards the final phase Indian objection became more and more shrill and high-pitched reflecting the general mood amongst the debating 'experts' within the country.

On June 20, India's representative at the Geneva talks, Arundhati Ghosh rejected the CTBT draft not only on the ground of discrimination between the NWSs and non-NWSs (rather unjustifiably, as

the CTBT draft did not recognise different classes of state parties as regards its implementation) but also on the ground of "national security considerations". This was a crucial departure from India's traditional position on nuclear weapons. Even as recently as in March 1996, India's then Foreign Secretary, Salman Haider, had submitted to the same august body, Conference on Disarmament (CD) : "We do not believe that the acquisition of nuclear weapons is essential for national security, and we have followed a conscious decision in this regard. We are also convinced that the existence of nuclear weapons diminishes international security. We, therefore, seek their complete elimination. These are fundamental precepts that have been an integral basis of India's foreign and national security policy." On July 15, Gujral, the External Affairs Minister, reiterated in the parliament India's resolve to scuttle the treaty by blocking the required consensus. On August 14, India carried out its threat in Geneva. The Treaty, however, was eventually taken to the UN General Assembly and, on September 10, was voted for by a margin of 158 to 3. India was in the august company of only Bhutan and Libya.

The next day the Times of India noted : "India has hardly ever been so united internally, or so isolated internationally, as on the issue of the Comprehensive Test Ban Treaty". In fact, it is the CTBT 'debate' - a virtually one-sided misleading campaign replete with deliberate disinformation, that had gone on furiously for the last one year or so in the domestic circles subsequently proved to be a major facilitator for India, under the "Hindu" Nationalist rule, to come out openly as a Nuclear Weapons State throwing all moral inhibitions of the yesteryears, so to say, to the dustbin of History. And the whole political class, without any significant exception, became willing partici-

pants in this grand extravaganza of political/moral degeneration.

The United Front government which became instrumental in rejecting the CTBT died a premature, and yet not wholly unexpected, death by the end of '97. In between, I K Gujral, who had by then become the Prime Minister, made a public declaration on May 31, 1997 that India would not sign a prospective treaty banning fissile material production - in keeping with the hardened and belligerent posture adopted at the time of CTBT negotiations. This, however, went hand in hand with intermittent reassertion of India's resolve not to go in for nuclear weapons.

Loud Goes The Bang!

On March 19, 1998, Atal Bihari Vajpayee, the leader of the BJP parliamentary party, was, for the second time, sworn in as the Indian Prime Minister. This time he could survive the confidence vote, even if rather narrowly, held on March 28. And on 11th May - just about six weeks after, the Government of India claimed before the stunned nation and the international community, to have carried out three underground nuclear explosions in Pokhran, to be followed by another two - two days later. Amidst rapturous chest thumping within, and massive censures without, India declared itself to be a Nuclear Weapons State. Ecstatic Vajpayee claimed to have fulfilled his life's dream. The anti-climax, however, lagged not too far behind. Pakistan followed suit a fortnight later.

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Indo-Pak Defence Spending

*C. Rammanohar Reddy**

Introduction

India and Pakistan are two of the largest spenders on defence in the world. In spite of the ongoing (2003) attempts to give a new thrust to normalisation of bilateral relations, the two countries continue with their major drive at militarisation. The current phase of military expansion is, in part, linked to the decision by both countries to become nuclear powers. It is also a continuation of the trend established in the 1990s when India began a modernisation programme and Pakistan, in response, hoped to keep pace with its neighbour. Both programmes have imposed huge financial and opportunity costs on the two economies. With India and Pakistan deciding to continue on the nuclear path, the cost of nuclear weaponisation is only going to increase in the years ahead. In short, militarisation in the two South Asian neighbours, which has always imposed costs on their development efforts, will continue to do so in the future.

Both countries figure among the biggest spenders in the world. According to the most recent data compiled by the Stockholm International Peace Research Institute (SIPRI), India's military defence expenditure, when measured on market exchange rate, amounted to US\$. 12.9 billion in 2002, making it the country with the 11th highest military expenditure in the world. Pakistan does not figure in SIPRI's list of the 15 largest spenders in the world. However, when national military expenditure is compared on a pur-

chasing power parity (PPP) basis, the picture is quite different. According to SIPRI, India with an expenditure of US\$. 66.2 billion in 2002 ranks third in the world. Only the U.S. and China made a larger outlay than India on defence last year. Pakistan with a military outlay in 2002 of US\$. 14.2 billion (PPP terms) ranked 15th in the world.

An attempt at assessing the impact of military expenditure on the economies of India and Pakistan has to begin with an estimation of the true size of the burden of defence. Unfortunately, in India and Pakistan, the budgetary figures on defence do not give a complete picture of total outlays. The data for India is far more transparent than for Pakistan (where there is only a single line figure on defence in the official documents) but the problem in both countries is that budgetary figures under-estimate the true burden of militarisation.

SIPRI estimates cover a reasonably broad definition of what constitutes defence expenditure, but in as much as these estimates too rely on published documents, the assumption must be that the SIPRI data is also not complete. Presented below are SIPRI estimates since 1990 of the defence expenditure as a percentage of the gross domestic product (GDP) for both India and Pakistan as reproduced in World Bank data.

Pakistan has consistently shown a higher level of military expenditure-GDP ratio

Table 1: Defence Expenditure as % of GDP

Year	India	Pakistan
1991	2.5	5.8
1992	2.3	6.1
1993	2.4	5.7
1994	2.3	5.3
1995	2.2	5.3
1996	2.1	5.1
1997	2.2	4.9
1998	2.2	4.8
1999	2.3	4.6
2000	2.3	4.4
2001	2.5	4.5

Source: World Bank Indicators
(World Bank Data Base: 2003)

than India. However, before analysing the data in Table 1, a comparison of defence outlay-GDP proportion of a few countries is given below:

Table 2: Defence Expenditure as % of GDP

China	2.1
India	2.3
U.S.	3
Russia	3.8
Pakistan	4.6
Turkey	5
Israel	8.1
S. Arabia	13.2

Source: World Bank Indicators
(World Bank Data Base: 2003)

It appears that in larger countries, defence expenditure as a proportion of GDP is generally lower than in the smaller countries. Thus, China, India, the U.S. and even Russia have lower defence-GDP levels than Pakistan, Israel, Turkey and Saudi Arabia, although it is difficult to assert that the first group of countries shows a significantly lower level of militarisation than the second group. One can speculate that there is always a 'minimum' level of military infrastructure that all countries have to establish, which is reflected in smaller countries showing a higher defence-GDP ratio. However, even if this is true, one cannot deny that a high degree of militarisation is responsible for the

astronomically high defence-GDP estimates for Israel and Saudi Arabia.

To return to Table 1, India's defence expenditure in relative terms was high at the beginning of the 1990s (it reached a peak of 2.8-2.9 percent of GDP in 1989), before gradually declining and picking up from the mid-1990s onwards. For Pakistan, a somewhat similar pattern holds, except that defence expenditure does not pick up in the mid-late 1990s as it does for India. This does not mean India and Pakistan have been giving increasingly less importance to military spending. Reasonable explanations can be offered for each case. However, one must first reiterate that Pakistan has always had a higher level of defence-GDP ratio than India, though Pakistan's higher level of defence-GDP outlay could be explained partly in terms of 'minimum outlay' hypothesis.

Defence Spending During the 1990s

The defence spending-GDP ratio is the standard yardstick of measurement of the burden of defence. As will be argued later, this is not the best indicator of spending. But what of spending in absolute terms? SIPRI estimates of military outlays in the two South Asian countries during the 1990s provide a basis for comparison. This is presented in Table 3

Table 3: Military Expenditure (in US\$ million, at 2000 prices)

Year	India	Pakistan
1990	8051	2636
1991	7532	2823
1992	7209	2997
1993	8137	2993
1994	8109	2917
1995	8340	2965
1996	8565	2961
1997	9307	2837
1998	9387	2833
1999	10482	2858
2000	10900	2867
2001	11837	3071
2002	12882	3176

Source: SIPRI estimates (2003)

The facts show that in India expenditure in real terms initially declined during the 1990s only to pick up gradually from the mid-1990s. From the late 1990s onwards there has been a sharp acceleration. Indeed, between 1998 and 2002 an interval of just four years -- there was a 37 per cent increase in outlays. This is a huge increase in real terms. The rise would have been even larger but for the fact that in recent years capital spending has turned out to be less than budgeted for.

The trend is different for Pakistan. After an initial spurt, military outlays were more or less stagnant in the first half of the 1990s, before falling slightly and showing a moderate increase in the initial years of the first decade of the 21st century. Although Pakistan shows a smaller increase than India, the country remains, as argued below, more militarised than India.

Defence Spending: (1961-2003)

Graph I** presents the trend in the long-term movement of the defence spending-GDP ratio in India and Pakistan from the 1960s onwards. The chart is based on a compilation of estimates from different sources and must, therefore, be seen as presenting only a broad picture of the trend over the last 40 years.

The graph shows some interesting and at the same time well-known trends. First, Pakistan's spending has always been higher than that of India. Two, there have been spikes during periods of wars between the two countries as well as times of tension with other countries. For India, the spikes have been during the early 1960s (after the war with China), mid-1960s and early 1970s (wars with Pakistan) and during the late 1980s (modernisation and large arms imports). For Pakistan, the spikes have been other than during wars with India during the 1980s when Pakistan was involved in the Afghanistan war.

The decline during the 1990s has taken place in a specific context. In India, the conditions of a structural adjustment programme with the IMF in the early 1990s meant that defence expenditure was capped, before it could gradually be increased from the late 1990s onwards. In Pakistan, the defence-GDP ratio continued to remain steady until the late 1990s, when the country went in for an IMF loan which came with similar conditions on defence spending.

The Indian Case

An attempt has been made here to estimate the full extent of defence expenditure for India in recent years. Where data presented earlier have been either of official nature or of SIPRI estimates, the exercise here takes a larger sweep of all defence, para-military and related expenditure an aspect which is of particular importance to the nuclearisation of the two countries.

Indian official estimates of defence spending, as reported in the budget, cover current and capital expenditure in the three forces and also research and development. They do not cover (i) pensions, (ii) para-military expenditure (iii) defence-related atomic energy outlays and (iv) defence-related space outlays. SIPRI estimates include the first and second items of outlays.

In this paper, a broad coverage of defence expenditure in India has been covered. This coverage is necessarily approximate and is based on a number of assumptions. The source, however, remains the budget documents of the Government of India. Para-military expenditure is as reported in the Home Ministry outlays. The biggest assumption is regarding defence-related space and atomic energy expenditure. It is assumed that 25 per cent of all outlays on space and atomic energy (other than for nuclear power generation) have a defence orientation. This is a reasonable assumption to make, given that much of India's ongoing nuclear programme will be based

on work done at the nuclear and space research establishments.

Table 4: 'Official' versus 'Alternate' Estimates for India (Rs crores, at current prices)

Year	Official	Alternate
1995-96	26879	33940
1996-97	29498	37336
1997-98	36099	46120
1998-99	41200	54255
1999-2000	48504	66232
2000-01	54461	72308
2001-02	57000	75170
2002-03	56000	73777
2003-04	65000	83955

Source: Computed from Government of India Budget documents

In 2003-04 (budget estimates), the budgeted outlay, according to the alternative estimate of defence expenditure is 29 per cent more than the official figure. The gap between the official and alternate estimate widens in the late 1990s, exactly when Indian defence expenditure begins to accelerate. The higher outlays, according to the alternative estimate, take the defence spending-GDP ratio to much higher levels. Thus, while the official figures suggest a defence spending-GDP level of 2.5 percent in 2001-02, the alternate estimate leads to a ratio of as much as 3.3 percent. Clearly, when all aspects of defence spending are taken into account, outlays are much higher than the figures that form the basis for the official data. It is more than a reasonable speculation that a similar exercise conducted for Pakistan will show a similar (perhaps even larger) gap between the official and true levels of defence spending. Unfortunately, the same exercise cannot be done for Pakistan because of the much greater opaqueness of official statistics in Pakistan.

Real Burden

The analysis has so far focussed on defence expenditure as reflected in the spending-GDP ratio. This, however, is

not the best measure by which to assess the burden of the defence sector on the economy. Since military expenditure is incurred entirely by the government and as governments in developing countries also have to carry out important functions in the social sector and infrastructure, what does matter ultimately is the demands the defence sector places on the resources of governments.

Military spending also has an impact on the private and non-government sectors. However, the first charge is on government, specifically central government spending. Here the data are revealing. First, the size of military expenditure at the central/federal government level is huge. According to comparable World Bank data, military spending as a percentage of total central government expenditure was 14 percent in India in 2001. The figure for Pakistan for the same year was much higher at 23 percent. In both India and Pakistan, defence is the second largest item in central/federal government spending. Indeed, if one were to exclude interest payments then defence (capital and revenue) expenditure is the largest item of expenditure. Moreover, historically the burden of the military on central government expenditure in Pakistan has been much higher than in India. Such a high proportion of government resources being consumed by the military sector does inevitably have an impact on government outlays in the social sector.

The second and related point is that military spending dwarfs government spending on the two main social sectors of education and health. This is reflected in the following World Bank data for 1999 the latest year for which information is available. The comparable data are for public spending as a proportion of GDP, not of total government expenditure, but the data still tell the same story.

Defence expenditure dwarfs public spending on health in both India and Pakistan

and it is far above public spending on education in Pakistan. In India, public spending on education in 1999 was considerably more than on defence. The misplaced priorities are most evident in Pakistan, which in relative terms spends far more on defence than India but also spends less on the social sectors than India. The comparison with respect to central government expenditure is actually worse than presented in Table 5. 'Public spending' refers to intervention by both central/federal and state/provincial governments and in the case of education refers to outlays at all levels. If one were to compare only central government spending on defence with that on the social sectors, then the situation is far more stark.

Table 5: Defence vs Education and Health (% of GDP, 1999)

Country	Public Spending on Health	Public Spending on Education	Defence Spending
India	0.91	4.1	2.3
pakistan	0.9	1.8	4.6

Source: World Development Indicators Database (World Bank, 2003)

The picture is most graphically presented in the case of India in Graph II** which plots the movement of military spending against central government spending on elementary education, education and health. Central government spending on defence in India is manifold that on education and health. As the well-known economists Amartya Sen

and Jean Dreze have pointed out, India's defence spending is more than three times the combined central and state government expenditure on health.

South Asia has some of the worst indicators in health and education, yet the governments of India and Pakistan clearly prefer to spend more on defence.

Comparison with the World

Both India and Pakistan are allocating a considerable amount of resources to the defence sector. Arms imports as a proportion of total imports are higher in Pakistan than in India. According to World Bank data, Pakistan's arms imports constituted 9.7 percent of total imports in 1999 (the latest year for which data is available), compared to 1.6 percent for India in the same year. This ratio varies in both countries from year to year, but in general the ratio for Pakistan is around 6 percent while that for India it is 2 percent. Clearly, the imports of arms place a bigger strain on Pakistan's balance of payments than on India.

Another indicator of the greater role of defence in Pakistan's economy is in the size of the military force. India of course has the larger army, with 1.3 million personnel in uniform, while Pakistan has less than half this number, 590,000 (1999, World Bank data). However, in relative terms, the Pakistani army is proportionately bigger. The Indian defence personnel population constitutes just 0.30 percent of the labour force. The Pakistani

Table 6: India, Pakistan and the rest of the World

Category	year	India	Pakistan	Low-income countries	World average
Defence Spending-GDP (%)	2001	2.5	4.5	2.3	2.3
Defence Spending-Central Govt. Expenditure (%)	2001	14	23	13.1	9.8
Military Personnel-Labour Force (%)	1999	0.3	1.18	0.56	0.7
Arms Imports-Total Imports (%)	1999	1.6	9.7	2.1	0.9

Source: World Development Indicators Database (World Bank, 2003)

military strength, on the other hand, is as much as 1.2 percent of the labour force - four times as large as in India.

With respect to averages of low-income countries and of the world as a whole, India and Pakistan allocate considerably more resources to defence. Table 6 presents statistics for India, Pakistan, averages for all low-income countries and for the world.

It is clear that India and Pakistan are showing higher levels of defence spending than other low-income countries or the world as a whole. Where the size of the military population is considered, the Indian figure is lower than the global average while for Pakistan it is larger. In arms imports, Pakistan spends relatively much more than what the low-income countries do. On the whole, the message that comes through from these figures is that India and Pakistan give considerably more importance to defence than other countries that are at roughly the same level of development.

Guns versus Butter?

The argument presented here suggests that money allocated to defence is a diversion of scarce resources from other sectors; and that for countries like India and Pakistan, which still belong to the group of low-income countries, this is a diversion they can scarcely afford. This is what economists refer to as the 'Guns versus Butter' argument the choice is between more arms and more butter. More of one means less for the other.

In theory, this argument is valid only when a country is at a stage of what is called the 'production possibility frontier'--resources are fully deployed, and only a re-allocation between competing sectors is possible. One criticism of the application of the guns versus butter argument to developing countries is that these countries are not at the production possibility frontier, therefore it is not a question of

guns versus butter in allocation of resources. It is possible, the counter-argument would imply, to increase resource allocation to defence without cutting down on investment in important economic and social sectors. Another criticism of the guns versus butter argument is that if India or Pakistan do reduce defence spending, government spending on primary education, health care or any of the other important areas, in the countries will not necessarily follow.

Both counter arguments are valid, but neither can be offered in defence of the high level of military spending the two countries have been incurring and the future levels they have committed themselves to. The most powerful critique of an expansionary military spending that has been made in recent times is the one offered in 2002 by the economists, Jean Dreze and Amartya Sen. The critique is of India's policy since the late 1990s and covers India's nuclear weapons policy as well. But the argument is equally valid for Pakistan. The argument made by the two economists is that there are many 'social costs of militarism' of the kind pursued by India. One, rising military expenditure imposes substantial opportunity costs on government priorities like health care and primary education, even if every rupee saved in defence does not lead to a corresponding hike in social sector spending.

Two, nuclear weaponisation leads to increased insecurity in South Asia. Three, nuclear weaponisation will lead to an arms escalation in South Asia, which will end up in further diversion of scarce resources to the defence sector. Four, there is not merely a diversion of economic resources when countries like India and Pakistan embark on an arms race. There are also the demands made on 'the time and energy' of political leaders, government officials and the public at large. Fifth, military expansionism leads to a diversion of scientific and technological resources to the defence sector. The research

and development expenditure in defence, space and nuclear field in India constitutes over 60 percent of total government research outlay in the country.

All told, there is indeed a trade-off between guns and butter, '...there is much evidence that military expenditure adversely affects economic performance by 'crowding out' other uses of scarce resources, such as private investment and social spending. In the case of India, recent increases in military expenditure are bound to affect prospects for a much-needed expansion of public expenditure on health, education, social security and related matters. Indeed, given that the bulk of money is pre-committed in the form of public sector salaries and interest payments, mobilising additional resources for the social sectors is a major challenge. Restraining military expenditure is among the few available options (others include wasteful subsidies and expanding the tax base), and in that sense the trade-off between military and social expenditure is quite sharp. (add the emphasis)

Schools for Children or Nuclear Weapons?

The discussion above has made no reference to the decision by India and Pakistan to go nuclear. Nuclear weapons introduce a qualitatively new dimension to defence spending in the subcontinent.

If the rising burden of military expenditure in the late 1990s in India is not cause enough for concern, we now have the decision to go in for open nuclear weaponisation to contend with. Nuclear weaponisation will not just be costly, it also threatens to change the nature of the state and engage India and Pakistan in a dangerous race of nuclear proliferation. As far as expenditure is concerned, there is very little evidence to suggest that nuclear weaponisation will lead to savings in conventional arms outlays.

There is very little information on the like-

ly costs of a nuclear weapons programme in Pakistan, but there is enough data available in the public domain in India to make an informed estimate about what an Indian weapons programme could cost. This could serve as a benchmark for the Pakistani programme.

It is often argued that a nuclear weapons programme for India will not be expensive. The reasoning is that India already has a nuclear infrastructure in place and that the additional expenditure required will not be much. Another reason given is that India will not duplicate the gigantic nuclear weapon models of the U.S. and the former Soviet Union and instead develop a small nuclear arsenal. This, however, is not correct reasoning.

First, as events since 1998 have shown, nuclear arms have not reduced spending on conventional arms in India. If anything, the increased insecurity that nuclear weapons have brought to the region has led to higher conventional arms spending. Second, while in theory one can make the case for a small nuclear weapons arsenal, in practice the demands for an expanding arsenal will keep growing. This has already been taking place with signs of an inter-service rivalry in India, major import/joint development programmes for supporting infrastructure (command and control) and expanded/new programmes like the anti-missile defence systems etc. Much of this is reflected in the numerous deals and proposals India has been exploring with Israel, Russia and even the U.S. All this suggests that the elements of a new arms race are in the making in the subcontinent.

A very conservative estimate of the cost of an Indian nuclear weapons programme suggests that at a minimum this would cost Rs. 800 billion over a decade at 1998-99 prices, or Rs. 700-800 billion a year. This is equivalent to an incremental cost of 0.5 percent of India's GDP every year. The dollar costs over a decade on an Indian nuclear weaponisation programme

will be around US\$. 16-19 billion (at the average 1998-99 market exchange rates) or US\$. 81-93 billion (at the 1999 purchasing power parity, PPP, exchange rate). The larger component in these costs would be the outlays on delivery systems (missiles and nuclear submarines) and on a command and control system.

To give an idea of the financial implications of a Rs. 700-800 billion Indian nuclear weaponisation programme spread over a decade:

- India's defence expenditure (revenue and capital) in 1998-99 was Rs. 398.97 billion, which was equivalent to 2.23 percent of GDP. (If India had begun a 10-year programme in 1998-99 to complete development of its nuclear arsenal then this would have raised this outlay by about 20 percent.)
- The Government of India's own tax revenues in 1998-99 were Rs. 1046.52 billion. This means that every year 7-8 paise of every rupee collected as taxes would have to be used for creation of the nuclear arsenal.
- In 1998-99, the Government of India's total investment expenditure on creation of economic and social assets, on loans for state governments for capital expenditure and for defence was Rs. 61,947 crores. A nuclear weaponisation programme that would have added Rs. 7,000-8,000 crores to the capital budget that year would have implied an 11-13 percent increment to total government investment expenditure or a corresponding reduction in other areas of expenditure.
- A comparison of the financial demands of nuclear weaponisation with the government allocations for specific social and economic sectors makes the comparison even starker:

The annual outlay of Rs. 7,000-8,000 crores on nuclear weaponisation in 1998-99 prices was almost exactly the same as the Government of India's total budget for education (Rs. 7,046 crores) that year. So what the government would have to spend annually on weaponisation is equivalent to its yearly expenditure on all forms of education school and university, technical and medical education, teaching and research.

An Indian nuclear weaponisation programme that would cost 0.5 percent of GDP a year is equivalent to the annual cost of introducing universal elementary education in India.. This 'high' cost was for years cited as one of the reasons for not universalising elementary education in India. The question then is of choosing between sending every Indian child to school and acquiring nuclear weapons, both of which are going to make similar financial demands on the Government of India. Although India's Parliament in 2001 enacted an amendment to the Constitution guaranteeing elementary education to every Indian child, the initial financial allocations suggest that the government is giving a greater importance to nuclear weapons than to universal elementary education.

In recent years, India has entered into a number of arms import agreements and is planning to purchase more from the U.S., Russia, Israel, the U.K. and France. These deals are not for nuclear weapons per se, but they are for a number of weapons and defence systems that will become an integral part of a command and control infrastructure that India is building for its nuclear arsenal. They include anti-missile systems, intelligence radar, delivery aircraft and leasing of nuclear submarines. In addition there has been a new thrust to domestic research and development directed towards missiles. If even some of these

costs are allocated to the Indian nuclear weapons programme as they must be then the annual cost of the Indian weapons programme will end up as much more than 0.5 percent of GDP.

In all this, Pakistan has not been found wanting. Pakistan too has announced it is developing its command and control infrastructure, it has tested new missile systems and announced its plans to enter into arms deals so as to neutralise the Indian arms purchase spree. The net result is that Pakistan has embarked on an expensive nuclear weapons programme which will only add to its already high defence expenditure.

Conclusion

In the 1990s, India and Pakistan continued to spend on defence. There were some differences between the two countries. In Pakistan, expenditure came down from the high levels of the 1980s, during the Soviet occupation of Afghanistan and was then held in check (in real terms) by economic difficulties and the conditions of structural adjustment programme. In spite of these trends, there is no denying that militarisation in Pakistan continues to be high. In India as well commitment to international institutions held down expenditure during the first half of the 1990s. The situation changed dramatically in India in the late 1990s with a new spurt in military outlays, especially during the last few years.

The most significant development in recent years, which is going to have a profoundly negative impact on military spending, leading to an arms race and increased insecurity, is the decision of India and then Pakistan to go nuclear. This has given a new dimension to militarisation in the region. The nuclear arms race, which has just begun, will add to the burden of costs. In addition, it will contribute significantly to insecurity in the region.

All this has had and will have major economic and social costs. The major economic costs are that with defence making the first charge (after interest costs) on both governments, there will be limited resources available to meet the many economic and social challenges in the two countries. One argument is that the acceleration in growth in the 1990s in India demonstrates that military expenditure does not come in the way of economic development. It is even argued that increased security facilitates faster growth and this security requires substantial spending on defence. A similar argument is made in Pakistan as well, though the 1990s were poor in economic terms for the country.

There are many things wrong with such an argument on military spending. First, military spending cannot buy a country peace and security. That will come first and foremost with constructive diplomacy and better internal relations. Second, both India and Pakistan continue to suffer from fiscal stress. This means there is only a small pool of financial resources available for investment. And in spite of the recent acceleration in growth (in India), the two countries remain home to the largest population in the world which lives in poverty, the largest number of illiterates and against the backdrop of very high levels of morbidity. All this requires strong government intervention. This is constrained by the demands of the militarisation. Nuclearisation will add to military costs, which means that public services, which are already in disarray in the two countries, will continue to deteriorate further for want of financial resources.

Third, the kind of spending on defence that the two countries are now incurring also comes with social costs. Militarisation empowers certain political and economic groups which have a stake only in making themselves more powerful. Such groups have no interest in broad-based social and

economic development. Fourth, even if we accept the argument that India's economic growth during the 1990s indicates that militarisation does not affect the economy, a counter-view could be that growth could have been even higher. That the 5-6 per cent growth India now records is insufficient is evident from the continued high levels of under-nutrition, under-employment and low incomes experienced by the majority of the Indian population.

In sum, the current levels of military spending in India and Pakistan slated to grow with nuclearisation are going to continue to hold back development in one of the poorest regions in the world. Militarisation is one important factor, not the only one but an important reason nevertheless, for the low levels of human development in both countries. This is not going to change dramatically as long as India and Pakistan persist with their present policy of building a nuclear arsenal and giving considerable importance to expanding their military infrastructure.

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Note This article has been downloaded from

http://www.southasianmedia.net/Magazine/Journal/in_dopak_defence.htm (** Graphs are not available)

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SOUTH ASIAN HOT SPOT

The Effects of Nuclear War

Russell D. Hoffman

A year ago, India surprised the CIA -- and nearly everyone else except, perhaps, Pakistan, who seems to have been nearly ready -- by setting off several underground nuclear explosions. Then Pakistan, claiming self-defense, followed suit. But what would actually happen if India and Pakistan had a nuclear exchange?

Most people in India and in Pakistan (and in the U.S.) probably do not know that as many as 9 out of 10 people -- or more -- who die from a nuclear blast, do not die in the explosion itself. Most people probably think that if they die from a nuclear blast, they will simply see a flash and get quickly cooked.

Those within approximately a six square mile area (for a 1 megaton blast) will indeed be close enough to "ground zero" to be killed by the gamma rays emitting from the blast itself. Ghostly shadows of these people will be formed on any concrete or stone that lies behind them, and they will be no more. They literally won't know what hit them, since they will be vaporized before the electrical signals from their sense organs can reach their brains.

Of the many victims of a nuclear war, these are the luckiest ones, of course.

Outside the circle where people will be instantly vaporized from the initial gamma radiation blast, the light from the explosion (which is many times hotter than the sun) is so bright that it will immediately and permanently blind every living thing, including farm animals (including cows, sacred or otherwise), pets, birds while in flight and not to mention peasants, Maharajah's, and Government officials -- and soldiers, of course. Whether their eyes are opened or closed. This will happen for

perhaps 10 miles around in every direction (for a 1 megaton bomb) -- further for those who happen to be looking towards the blast at the moment of detonation. Even from fifty miles away, a 1 megaton blast will be many times brighter than the noonday sun. Those looking directly at the blast will have a large spot permanently burned into their retinas, where the light receptor cells will have been destroyed. The huge bright cloud being nearly instantly formed in front of them (made in part from those closer to the blast, who have already "become death"), will be the last clear image these people will see.

Most people who will die from the nuclear explosion will not die in the initial gamma ray burst, nor in the multi-spectral heat blast (mostly X-ray and ultraviolet wavelengths) which will come about a tenth of a second after the gamma burst. Nor will the pressure wave which follows over the next few seconds do most of them in, though it will cause bleeding from every orifice. Nor even will most people be killed by the momentary high winds which accompany the pressure wave. These winds will reach velocities of hundreds of miles an hour near the epicenter of the blast, and will reach velocities of 70 miles per hour as far as 6 miles from the blast (for a 1 megaton bomb). The high winds and flying debris will cause shrapnel-type wounds and blunt-trauma injuries.

Together, the pressure wave and the accompanying winds will do in quite a few, and damage most of the rest of the people (and animals, and structures) in a huge circle -- perhaps hundreds of square miles in area.

Later, these people will begin to suffer from vomiting, skin rashes, and an



intense unquenchable thirst as their hair falls out in clumps. Their skin will begin to peel off. This is because the internal molecular structure of the living cells within their bodies is breaking down, a result of the disruptive effects of the high radiation dose they received. All the animals will be similarly suffering. Since they have already received the dose, these effects will show up even if the people are immediately evacuated from the area -- hardly likely, since everything around will be destroyed and the country would be at war.

But this will not concern them at this time: Their immediate threat after the gamma blast, heat blast, pressure wave and sudden fierce wind (first going in the direction of the pressure wave -- outwardly from the blast -- then a moment later, a somewhat weaker wind in the opposite direction), will be the firestorm which will quickly follow, with its intense heat and hurricane-force winds, all driving towards the center where the radioactive mushroom-shaped cloud

will be rising, feeding it, enlarging it, and pushing it miles up into the sky.

The cloud from a 1 megaton blast will reach nearly 10 miles across and equally high. Soon after forming, it will turn white because of water condensation around it and within it. In an hour or so, it will have largely dissipated, which means that its cargo of death can no longer be tracked visually. People will need to be evacuated from under the fallout, but they will have a hard time knowing where to go. Only for the first day or so will visible pieces of fallout appear on the ground, such as marble-sized chunks of radioactive debris and flea-sized dots of blackened particles. After that the descending debris from the radioactive cloud will become invisible and harder to track; the fallout will only be detectible with geiger counters carried by people in "moon suits". But all the moon suits will already be in use in the known affected area. Probably, no one will be tracking the cloud. One U.S. test in the South Pacific resulted in a cigar-shaped

contamination area 340 miles long and up to 60 miles wide. It spread 20 miles *upwind* from the test site, and 320 miles downwind. Where exactly it goes all depends on the winds and the rains at the time. It is difficult to predict where the cloud will travel before it happens, and it is likewise difficult to track the cloud as it moves and dissipates around the globe. While underground testing is bad enough for the environment, a single large above-ground explosion is likely to result in measurable global increases of a whole spectrum of health effects. India or Pakistan will deny culpability for these deaths, of course. The responsible nations, including my own, always do.

But the people who were affected by the blast itself will not be worrying about the fallout just yet.

A 1 megaton nuclear bomb creates a firestorm that can cover 100 square miles. A 20 megaton blast's firestorm can cover nearly 2500 square miles. Hiroshima and Nagasaki were small cities, and by today's standards the bombs dropped on them were small bombs.

The Allied firebombing of nearly 150 cities during World War Two in Germany and Japan seldom destroyed more than 25 square miles at a time, and each of those raids required upwards of 400 planes, and thousands of crewmembers going into harm's way. It was not done lightly. And, they did not leave a lingering legacy of lethal radioactive contamination.

In the span of a lunch hour, one multi-warhead nuclear missile can destroy more cities than all the incendiary raids in history, and the only thing the combatant needs to do to carry off such a horror is to sit in air-conditioned comfort hundreds or even thousands of miles away, and push a button. He would barely have to interrupt his lunch. With automation, he wouldn't even have to do that! The perpetrator of this

crime against humanity may never have seen his adversary. He only needs to be good at following the simplest of orders. A robot could do it. One would think, that ONLY a robot WOULD do it.

Nuclear war is never anything less than genocide.

The developing firestorm is what the survivors of the initial blast will be worrying about -- if they can think straight at all. Many will have become instantly "shell-shocked" -- incapacitated and unable to proceed. Many will simply go mad. Perhaps they are among the "lucky" ones, as well.

The firestorm produces hurricane-force winds in a matter of minutes. The fire burns so hot that the asphalt in the streets begins to melt and then burn, even as people are trying to run across it, literally melting into the pavement themselves as they run. Victims, on fire, jump into rivers, only to catch fire again when they surface for air. Yet it is hard to see even these pitiable souls as the least lucky ones in a nuclear attack.

For the survivors of the initial blast who do not then die in the firestorm that follows, many will die painfully over the next few weeks, often after a brief, hopeful period where they appear to be getting better. It might begin as a tingling sensation on the skin, or an itching, which starts shortly after the blast. These symptoms are signs that the body is starting to break down internally, at the molecular level. The insides of those who get a severe dose of gamma radiation, but manage to survive the other traumas, whose organs had once been well defined as lungs, liver, heart, intestines, etc., begin to resemble an undefined mass of bloody pulp. Within days, or perhaps weeks, the victim, usually bleeding painfully from every hole and pore in their body, at last dies and receives their final mercy.

But this too will probably not be how most

victims of a nuclear attack will die. A significant percentage, probably most, of the people who die from a nuclear attack will die much later, from the widespread release of radioactive material into the environment. These deaths will occur all over the world, for centuries to come. Scattered deaths, and pockets of higher mortality rates, will continue from cancer, leukemia, and other health effects, especially genetic damage to succeeding generations.

Nuclear weapons do not recognize the end of a war, or signed peace treaties, or even the deaths of all the combatants. They simply keep on killing a percentage of whoever happens to inhale or ingest their deadly byproducts.

Some deaths will occur hundreds and even thousands of miles away, because low levels of ionizing radiation are capable of causing the full spectrum of health effects, albeit at a lower rate within the population. Not to mention the radioactive runoff from the rivers and streams that flow through the blast area and the area under the radioactive mushroom cloud's drift. It may carry its deadly cargo for thousands of miles, raining a fallout of death only on some cities, and not on others. It will land upon nations which had not been involved in any way in India's dispute with Pakistan. These nations will be mightily hurt and mightily upset.

Nuclear weapons do not recognize international borders.

Finally, an atmospheric blast of a nuclear "device" creates an EMP (Electro-Magnetic Pulse) which can be as large as Pakistan or even India -- perhaps even larger than India and Pakistan together. The higher the altitude of the blast, the bigger the circle of damage will be from the EMP. This is a very serious concern for those of us in the high-tech industries, such as myself.

The Electro-Magnetic Pulse will electrify all sorts of metallic structures that are not normally electrified except by the occasional short circuit or lightning strike. This will be a lot like the whole country getting struck by lightning all at the same time.

As computer chips make better and better use of "real estate", using more and more delicate electronic circuits, the more tightly-packed transistors, capacitors, diodes and resistors become more and more vulnerable to the EMP which will be carried into the chips via the connecting wires. The Electro-Magnetic Pulse is one of the reasons above-ground testing was stopped. (The other reason was that it became impossible to deny that the radiation dispersed by the tests was killing people.)

Pacemakers, for example, may stop working because of the "hit" from the EMP. It will be quite something to see people in a thousand mile radius of the epicentre of the blast (or further) who are using pacemakers, suddenly drop dead, and all the computers permanently go down and all the lights go out, all at the same time. And commercial and private aircraft will drop out of the sky, since their sensitive electronics and fly-by-wire systems are not very well shielded from the EMP. These planes will then not be available for evacuation purposes, nor will they be available to air-drop food, water, morphine and cyanide, all of which will be in great demand throughout the area.

A year ago people were dancing in the streets over this in both India and Pakistan. Why?

Home plumbing systems and most other plumbing systems are good examples of large metallic structures that will suddenly become electrified, destroying the motors, gauges, electronics, etc. which are attached to the plumbing systems. More and more pumping equipment is computer controlled

nowadays for efficiency. Imbedded controllers are becoming prevalent but as they do, the potential damage from the Electro-Magnetic Pulse increases dramatically.

Train tracks will also carry the charge, as well as telephone wiring. All these things will have a nearly simultaneous surge of energy sent through them, igniting gas containers such as fuel storage tanks, propane tanks, and so on. Whatever doesn't blow up will at least stop working.

My country has lived under the Russian and Chinese threat of nuclear war for many decades now, and it is not a pleasant thought. This is nothing to dance about. There is no benefit to having, or using, nuclear weapons.

I think the world would be a better place if we all stopped and said, "I will not be a part of this. I do not need these weapons, for I would never commit this sin against my own children, nor against my neighbour's children, nor against my enemy's children, nor even against my enemy. I choose not to be a part of this madness."

There is a greater battle mankind must fight than against each other. Humanity's fight right now, is for humanity's general survival despite depleted and poorly used resources, environmental degradation (there is none greater than that from a nuclear explosion), dwindling effectiveness of antibiotics and other wonder drugs, an uneven distribution of available food, knowledge and wealth, and against weapons of mass destruction.

America had three excuses for her previous use of nuclear weapons in war, which we plead every time it is mentioned. First, we claim that we did not understand back then (over 50 years ago) all the ways nuclear weapons damage the Earth and her living inhabitants. Second,

we claim that there was a war going on, and that had we not used these weapons, perhaps a million soldiers would have died invading Japan instead. But this second excuse is weakened by the knowledge that Japan was at that time very near collapse anyway. She was without an air defence, a sea defence, she did not have advanced radar, she had lost all her good pilots, millions of soldiers were either dead, wounded, captured, or uselessly stuck on nameless islands in the middle of the Pacific, and towns in her homeland was being firebombed on almost a nightly basis.

Our third excuse was that both Japan (and definitely Germany) were building their own nuclear weapons, and DEFINITELY would have used them against us had they succeeded in developing "the bomb" before the war ended. The war could not go on forever. We were, indeed, running out of time.

Perhaps these excuses are insufficient, but India and Pakistan hasn't even got them. India can, and therefore should, along with Pakistan, renounce nuclear weapons and the nuclear option. Perhaps her populace does not understand the full nature of the threat of nuclear weapons, and thus they are dancing in the streets, but I hope that her leaders do. However, I strongly suspect most of them are unaware of the things I have written about in this newsletter. Perhaps you, dear reader, will help me to educate them in this matter.

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Nuclear Risk Reduction Measures Between India and Pakistan

MIND, New Delhi

Executive Summary

1. *There is a special danger of nuclear conflict breaking out in South Asia. This is not simply Western propaganda but common sense. Nuclear weapons are most likely to be used in wartime or near-wartime conditions when mutual suspicion and tensions are greatest. It is the continuous hot-cold war that has been going on between India and Pakistan for 55 years, and which shows no signs of diminishing, that makes the face-off between these two nuclear equipped rivals so serious.*

2. *There is an acute need, therefore to prevent through design, miscalculation or accident, nuclear conflict between these two countries. We need therefore to put in place nuclear risk reduction measures (NRRMs). However, we must be clear about the limitations of NRRMs. We can try and make South Asia less unsafe, nuclearly speaking, but we cannot make it nuclear-safe except by making it nuclear-free, i.e., eliminating nuclear weapons from the region and from the world. NRRMs must be seen as transitional measures we adopt while constantly pursuing disarmament. They are not a substitute for nuclear disarmament.*

3. *As a form of confidence building measures or CBMs they suffer from the basic problem facing CBMs, namely that it is the political context in which they operate that establishes how effectively they will work. It is not the effective verifiability of CBMs that creates trust but the pre-disposition to trust that is the best guarantee that CBMs will work effectively and promote even greater trust. Thus throughout the Cold War, NRRMs between the US and USSR*

were few and feeble. It was only after the end of the Cold War that most effective NRRMs were put in place. Similarly, the whole history of CBMs between India and Pakistan has been dismal. Nevertheless, insofar as NRRMs can raise the threshold of nuclear safety even if only by some degree, they are valuable and necessary.

4. *Apart from the deliberate use of nuclear weapons by one side or the other, there are four potential risks that NRRMs must address. This is a) use through miscalculation because of faulty information processing or faulty technologies; b) unauthorized use of nuclear weapons; c) accidents, fires and explosions in the vicinity of nuclear weapons; d) rumours of imminent use and as result of this, panic behaviour in crowded urban centers.*

5. *The best and strongest form of NRRMs is to separate the nuclear warheads from the delivery systems (missiles, planes, boats) and store them and monitor them elsewhere. This means, in effect, their non-deployment and would be the best precaution to ensure the needed safety.*

6. *However, since improving safety from inadvertent use or accidents requires reducing the state of readiness of the nuclear weapons system there is always a trade-off between the demands of safety and the demands of having an active nuclear deterrent system. This is why there can never be complete or assured safety as long as one also wants to have a serviceable nuclear deterrent system. Actually, security through nuclear deterrence is an illusion and this*

doctrine as well as nuclear weapons should be discarded. But if one believes in this doctrine then it is still best to sacrifice a considerable measure of readiness in the interests of securing a greater measure of safety.

7. India and Pakistan should strive to secure an agreement to reciprocate such safety measures and establish procedures to confirm that each side is doing what it is supposed to do. It is India that must take the initiative since Pakistan has already declared officially that it will not be the first to openly deploy nuclear weapons, nor the first to undertake further nuclear tests.

8. Since India says it only wants a minimum nuclear deterrent and that it does not need to have further tests to establish this minimum, it should immediately and permanently close down the Pokharan Test site. This would make it much more likely that Pakistan would do the same. Both governments could also negotiate to bring this about.

9. Transparency and accountability to the Indian public demands that India do two things. a) It should replace the inordinately secretive 1962 Atomic Energy Act with new legislation separating the military and civilian dimensions, making the civilian sector accountable to Parliament and the public on the lines of procedures and laws governing civilian atomic energy establishments elsewhere such as in the US and Britain. b) If India is genuine about its commitment to No First Use (NFU) of nuclear weapons to any nuclear weapons state and No Use towards any non-nuclear state then the government must repudiate the Draft Nuclear Doctrine which aims to develop a whole range of weaponry, tactical nuclear weapons, battlefield nuclear weapons, etc. Instead it should together with Pakistan initiate steps for fulfilling the objectives outlined in the preamble to the resolution on Reducing Nuclear Danger - A/56/24C - adopted on 29 November 2001 in the UN General Assembly.

Nuclear Risk Reduction Measures

The Special Danger in South Asia

Nuclear conflict is most likely to break out between two nuclear weapons states at political loggerheads with each other. For the Cold War period, it was the face-off between the former Soviet Union and the USA that was correctly considered the most dangerous confrontation. Though the systemic rivalry between these two giants meant involvement on opposing sides in Third World wars and conflicts, the two countries shared no common border, their troops were not deployed directly against each other's, and the 'war' between them remained a 'cold' (essentially ideological) one. Even so, it was still a close run matter with the October Cuban missile crisis of 1962 leaving them and the world a hair's breadth away from a nuclear holocaust.

In South Asia there is every reason for alarm. India and Pakistan are territorially contiguous countries, sharing a long common border. Moreover, from their very inception as independent countries there has been a bitter, ongoing and unresolved dispute over Kashmir. Already four wars (1948, 1965, 1971, 1999) have taken place between them with Kashmir at the heart of three of these wars. The last one took place after both had become declared nuclear powers. From December 2001, the two countries have placed their armies on high alert and have deployed them all along the border. Never before in peacetime have their respective troops been placed on such high alert and at such levels of preparedness and mobilization for so long and so continuously. The India-China dispute is by contrast far less dangerous. Since it is in wartime or near-wartime conditions that mutual tensions and hostilities are greatest and therefore the temptation to use nuclear weapons greatest, the most dangerous nuclear flashpoint in the world

today is South Asia precisely because of this face-off between India and Pakistan. This is after all the only part of the world that has had a continuous hot-cold war (which shows no signs of diminishing) between the same two rivals, each of which is now nuclearly equipped.

In such a situation when the possibility of use of nuclear weapons whether by design, miscalculation or accident is so real, there is a vital need for establishing, to whatever extent possible, nuclear risk reduction measures (NRRMs). Even the pro-nuclear bomb lobbies in both countries can accept and endorse this. However, in contrast to nuclear disarmers they believe that this is enough to make the region 'nuclear safe' and that one can then go on comfortably 'living with nuclear weapons'. This is dangerous thinking. Real safety comes only from total elimination of nuclear weapons. Talk of institutionalizing NRRMs can, in the wrong circles, serve to legitimize having them in the first place. All the more reason, therefore, why the nuclear disarmament and peace movement, when talking about NRRMs must properly contextualise the whole issue.

The Political Context of NRRMs

We must never allow NRRMs to become a substitute or diversion from the necessity of constantly focusing on the effort to bring about total regional (and global) disarmament. That is to say, NRRMs are to be seen as, at best, transitional measures to lower dangers while the pursuit of full disarmament and elimination of nuclear weapons in South Asia and the world at large continues. Moreover, we must constantly remind people that it is an illusion to think NRRMs provide adequate assurances of safety. They can, properly instituted, make the situation less bad than one without NRRMs in place. But they do not reduce risk to the point of making living with nuclear weapons acceptable. And of course, they cannot guarantee safety because they cannot guarantee non-use of

nuclear weapons. Furthermore, the extent to which NRRMs can be instituted are themselves limited by the very nature of the political context which calls for their establishment!

This point needs to be clearly understood. NRRMs are also supposed to act as crucial confidence-building measures (CBMs). They are supposed to operate in such a way that each side believes the other will not 'cheat' and will comply by their respective obligations. That is to say, NRRMs to work properly must promote trust through assurances of compliance. Technical verification of NRRMs is thus meant to show that there is such proper compliance. Unfortunately, this is putting the cart before the horse! In order to put a full array of comprehensive and desirable NRRMs in place you first need to have a considerable measure of political trust existing between rivals. And in order for both sides to believe that there is proper compliance and no cheating, there has to be some considerable measure of political trust and respect of the other side, since no amount of technical verification can guarantee the complete absence of cheating, or the impossibility of doing so without detection. Verification techniques can at most provide very reasonable assurances of compliance or of detection if there is non-compliance, not absolute certainty.

This is the key point, which bedevils all forms of confidence-building measures between hostile opponents: it is not CBMs that effectively create political trust, but the pre-disposition to trust that makes CBMs, including NRRMs, effective and ever more acceptable. The whole history of both the Cold War and India-Pakistan relations confirms this crucial point. Despite constant talk and some limited practice of CBMs between these two countries over the decades, these have never gone far; they have not significantly or crucially promoted trust but have themselves repeatedly been hostages to the lack of trust between the two sides. Similarly, it

is vital to remember that throughout the Cold War both sides had their nuclear missiles on high alert (indeed, launch on warning); that whatever NRRMs existed during the Cold War era were very feeble; and that the real breakthrough in the establishment of a serious and comprehensive set of necessary NRRMs between Russia and the USA only took place after the Cold War began to be dismantled. It was not the establishment of greater nuclear safety through the installment of NRRMs that led to greater trust between the two countries, but the prior breakthrough in politics (the ending of the Cold War) and the establishment of greater trust between the two countries that led to the establishment of more and better NRRMs and therefore greater nuclear safety. Even so, both countries still retain their weapons on high alert.

So even as we try to put forth and establish NRRMs between India and Pakistan, we should be under no illusion that we can go very far along this course or that they will work as well as we would want them to, in the absence of sufficient political trust between the two countries. In short, NRRMs are not a substitute for disarmament which itself promotes, and comes from, better political relations. Even with the best will in the world or with some NRRMs in place, the risks of a nuclear outbreak between politically hostile rivals remains real and therefore there is vital need to continue focussing on nuclear disarmament as the only real method of reliable and assured nuclear safety.

Potential Risks Needing To Be Tackled

1) *The danger of miscalculation through faulty information processing and thereby the launching of a nuclear weapons delivery system.*

During the Cold War, just for the period between 1977 and 1984, there were 20,000 false alarms of which 1000 were serious enough in the US to have to go to

the next higher level of command for evaluation. For Russia the time between warning and possible attack by the US was shorter since American submarines were much closer to the USSR than vice versa. Here the warning time instead of the 25 minutes taken for a Soviet missile to reach the US was only 10 minutes. But regardless of whether the time was 25 minutes or only 10, there is a disturbing problem here that greatly weakens the claim of the pro-nuclear lobby everywhere. The usual argument between pro-bomb and anti-bomb exponents revolves around the issue of whether or not nuclear deterrence works? But the very practice of the nuclear systems of the USSR and the USA raised another question: did nuclear deterrence even exist when there was simply not enough time to properly decide whether or not one's enemy had launched a nuclear attack and therefore whether or not one was retaliating or, in fact, mistakenly initiating an attack?

Assume that there existed 25 minutes before the time a Soviet missile was launched and landed on a possible US target. 10-12 minutes would need to elapse in order for the missile to be identified, its path tracked and this necessary information to be relayed to top command. Another 2-3 minutes would elapse before this could be communicated to the President. Any decision by the President in order to be communicated and then properly conveyed to all necessary stations (whether or not to retaliate or whether this was to be treated as a false alarm) required another 8-10 minutes. This means that even if the President had the communications apparatus to be able to immediately consult with his top political staff by phone, he had literally 1 or 2 minutes at the most to take a decision before a possible landing of a Soviet missile or missiles which could be directed at the country's main nuclear command, control and communications posts. In short, there is no way that any President within 25 min-

utes could properly judge and decide on whether deterrence was working and this was a false alarm, or not. For Russia, even the couple of minutes to decide did not exist. Both the USSR and the USA established throughout the Cold War era, 'launch-on-warning' systems which meant that even before the short time taken for an opponent's missile to land, their own systems of launching would take place. Thus the space and time to allow for human decision was immensely shortened. So what is all this business about deterrence operating when there was never throughout the Cold War period any real check on accidental launch by an opponent or false alarm by one's own system?

In the face of this stark reality, a desperate counter argument would be the claim that deterrence is essentially a political-psychological phenomenon. So as long as one side had 'enough' nuclear weapons of sufficient sophistication and readiness, then this would ensure that no political decision to attack would be taken by the opponent. However, on closer inspection this argument also breaks down. Since 'enough' and 'sufficient' are not absolute measures but are relative to what the opposition has, then one's own side in order to feel 'secure' must feel confident of 'riding out' a first-strike by the opponent and still being able to inflict 'unacceptable' damage on it in a second-strike. But if the opponent's arsenal is constantly improving, quantitatively and qualitatively, then one has to improve/expand one's own arsenal. This becomes yet another dimension making the arms race inevitable.

But, just as we clarified earlier that trust is a pre-requisite for NRRMs to properly work rather than their consequence, here too the issue of trust becomes central. Neither side can 'trust' what it 'sees' of the weapons-preparedness of the other side nor trust its opponent's bona fides regarding its willingness to use its weapons in a first strike, even if there exists a NFU

commitment. So both sides will not only invest constantly in improving/expanding their arsenals but also in enhancing the 'use-readiness' of these arsenals. This is the other level of practical behaviour that is imposed by the 'logic' of deterrence thinking. In this constant pressure for foreshortening the time taken for initiation or retaliation 'deterrence' itself becomes irrelevant since the steadily growing danger now comes from the ever-decreasing margins of errors of many kinds. The less sophisticated the nuclear weapons systems of a country the more easily will a catastrophically dangerous level of error-proneness be reached. This is obviously the case in South Asia.

In the case of India and Pakistan, not only does neither country have the sophisticated early warning systems that the USSR and the USA had, but the flight times of missiles between the two countries is as little as 5 to 8 minutes. Correction for launch by miscalculation through false alarm is hardly possible if here too both countries establish nuclear missile systems based on the principle of 'launch on warning'. India's declaration of NFU is not an assurance that Pakistan will trust India not to make a first strike. Nor will India trust Pakistan not to use its missiles first. Both countries will thus be pushed to make preparations like 'launch on warning'. In 1982, Russia declared a No First Use policy (which was rescinded only in the early nineties) but that did not stop either Russia or the US from resorting to 'launch on warning' postures throughout the eighties.

This problem of inadvertent launch through failure of technology is particularly serious for countries like India and Pakistan. Nuclear weapons systems require a vast array of very sensitive high-tech components for all phases of command, control, communications, intelligence gathering, information processing or C3I2. Any survey of the past record of

performance of India and Pakistan shows how routine are their technology failures. Though India's record is good in certain high-tech areas, there is a big difference between space launches and nuclear weapons systems. Failure in the former domain merely leads to 'doing it again'. Not so if missiles/bombs are launched. Also, unlike space launches in which launches are made periodically, with nuclear weapons systems, launches are never supposed to be made. But once decided upon are supposed to work with full efficiency. That is to say, these are not 'active' but 'dormant' systems that are expected to be fully efficient and operational if and when required. But by virtue of their dormant character, alertness in respect to safety erodes over time. This is the problem of almost inevitable fatigue in respect of maintaining effective watchfulness over systems that are dormant and in fact not ever supposed to be used.

2) *The danger of nuclear weapons being used without authorization.*

In this time of heightened alarm over terrorism and of terrorist groups/individuals getting hold of nuclear weapons, the more likely danger of unauthorized use tends to become obscured. Every country that has a nuclear weapons system has to be worried about a pre-emptive strike of massive or significant proportions from its opponent aimed at decapitating its command structure as well as its deployed military and missile installations. This possibility is sought to be countered by establishing some balance between centralization and de-centralisation of command, communications and control systems, e.g., through the existence of a hierarchy of alternative chains of command. But the basic dilemma remains. There has to be a considerable degree of dispersion of not just deployed nuclear weapons and their delivery systems but also of their command and control systems. This always raises the spectre of both unauthorized use of such weapons in certain tension-ridden circumstances

(especially during what is called the 'fog' of wartime conditions) by someone lower down the chain of command, as well as the spectre of such dispersed components of the nuclear weapons system falling into other unofficial hands. Whatever the precautions taken there is simply no guarantee that either or both of these eventualities will never occur. They can occur.

3) *Accidents, fires and fuel explosions in the vicinity of nuclear weapons.*

The nuclear warhead is a shell of powerful chemical high explosive (HE) surrounding a core of plutonium or enriched uranium. This HE is meant to trigger the nuclear chain reaction. Though separated from the core, this HE can be ignited by fires/explosions in the vicinity of the bomb or warhead. This vulnerability is greater when the nuclear weapons are kept on high alert and especially when rockets are liquid-fuelled. Both the Prithvi short-range missiles of India and the Ghaury short-range missiles of Pakistan are as yet liquid-fuelled rockets. There is a long history of HE detonations for both the US and the USSR despite their efforts to hush this up.

If the HE is ignited it can result in any of the following: a) the HE burns but does not detonate. Limited amounts of plutonium or enriched uranium are released into the environment causing local radioactive pollution. b) There is detonation of the HE with resulting vaporization of plutonium and its release into the atmosphere. This leads by ordinary standards into massive damage with inhalation and ingestion into the body and increased risk of cancers. c) There is the kind of detonation that actually brings about a nuclear chain reaction and explosion of the nuclear bomb. This is the least likely of the three scenarios detailed but, of course, it cannot be ruled out from taking place.

4) *Rumours and panic behaviour, e.g., stampedes ('rush to get out') in crowded urban centres.*

This is the kind of scenario that can develop in wartime or near-wartime conditions when such rumours are likely to become most believable. The bigger and more crowded the metropolises the more damaging the consequences of such panic. And of course, it is the bigger metropolises that are the routine and natural targets of the nuclear weapons systems of the rival country or countries.

What Nuclear Risk Reduction Measures (NRRMs) Can Be taken?

1) The best form of risk reduction is to carry out a strong form of de-alerting of nuclear weapons systems. De-alerting means that the weapons should not ever be put in a state of instant readiness to use. This can take three forms, ranging from the mildest to the strongest. The weakest measure is simply to de-target, i.e. not have the missiles already targeted on the enemy sites. However, re-targeting involves adjustments that take only minutes, so this doesn't amount to much. Better is to extend the time between deployment and launching so that preparing the final launch can be a matter of hours, days or more. Best and safest of all, is de-mating or separating the warheads from the delivery systems so that a much longer time, not just days or hours but weeks, are required to get things ready. Storing the warheads well away from the delivery systems and carefully monitoring their storage means in effect, non-deployment of nuclear weapons and is, from the safety point of view, far and away the most sensible approach. Incidentally, both India and Pakistan have themselves endorsed resolutions at the UN (A/c.1/55/L.32/Rev.1, 23 October 2000) calling for de-alerting measures even if the specific forms of de-alerting have not been spelled out.

2) The greater safety provided by this separation of warheads from delivery systems can be further reinforced by keeping the warhead in a disassembled state with the

HE separated from the nuclear core. This would increase the time that it would take for a country to launch a nuclear attack, and thus lower the probability of an accidental initiation of nuclear war. This, of course, is the central point. There is an inevitable trade-off between the claims of nuclear weapons safety and nuclear weapons readiness as required by doctrines of security based on the principle of nuclear deterrence! You can only go so far in trying to make nuclear weapons systems 'safe' and still try to retain a deterrent system. So don't fool yourself or others into thinking a nuclear weapons system can be completely or even reliably safe. But you can try and make things less unsafe and in doing so you have to sacrifice speed of readiness. This is a sacrifice that is worth making in the interests of greater safety and sanity.

3) There should also be some form of transparency and verifiability between India and Pakistan in regard to the de-alerting measures each adopts. It is not enough to have a governmental agreement in principle but to institutionalize ways for both countries to reassure themselves to at least some extent that the other side is doing what they are supposed to be doing. Moreover, transparency is not an issue between governments only. There must also be transparency in respect of one's own population. In respect of political democracies like India there can be no excuse from the responsibility of being transparent with the Indian public. This means that there has to be a new Atomic Energy Act replacing the 1962 one, separating the civilian and military dimensions. The civilian sector must now be open to the kind of public and parliamentary scrutiny that the secrecy surrounding the existing Act does not allow. Now that a military nuclear arsenal has been declared, this can no longer be even remotely justified.

4) While China is the only other nuclear

power to have declared a NFU policy, India is the only democracy to have declared this. If India is really serious about its NFU claim then there are two basic ways to go about ensuring this. The first is that technical measures should be established which provide a warning that an unwarranted launch is being prepared, and at the same time provide enough time for this to be checked so that a possible launch can be detected and prevented. Warning sensors on launch systems e.g. missile silos or on systems preparing to arm delivery systems with warheads, well ahead of the launching or arming process would be one form that such technical transparency measures could take. These warning sensors could then enable the watchdog body to check on what is happening. If the Indian government is truly sincere about NFU and genuinely believes in democratic accountability then these are the kind of measures it should accept and establish.

5) Moreover, there are also non-intrusive, non-technical assurances that the Indian government can give to show that it is sincere about its NFU commitment. To uphold a policy of NFU is to declare that your nuclear weapons system is meant only for retaliation and not for first strike or first use. Therefore, a NFU commitment is logically connected to upholding a posture of minimum nuclear deterrent and arsenal. However, India's Draft Nuclear Doctrine which talks precisely of building a full triadic range of nuclear weaponry, of going in, if necessary, for tactical and battlefield nuclear weapons, of keeping up with all kinds of possible nuclear weapons advancement, etc. is simply an outright, flagrant and inexcusable refutation of the claims to moderation and to being sincere about its NFU commitment that the Indian government has made. These extravagant ambitions in the DND are partly justified in the name of assuring the 'survivability' of the Indian arsenal so that it can carry out an effective second-strike. But this won't do.

The ambitions go well beyond the requirements of 'survivability' needs. Instead the DND rules nothing out and leaves all frontiers of exploration and expansion open. In the DND, there is even an explicit dilution of the commitment not to ever use nuclear weapons against non-nuclear states-the exception being where non-nuclear states are allied to nuclear ones.

6) Finally, if the Indian government is sincere in its claim that it only wants to have a minimal nuclear deterrent and that it does not need to conduct anymore nuclear tests to build such a minimum deterrent, and that it wishes to lower the nuclear temperature in the region, then it should immediately and permanently close the Pokharan nuclear test site. The French have permanently closed their nuclear test site in the South Pacific. This would also put great pressure on Pakistan to reciprocate by closing down its Chagai site, especially since officially it has said it will neither test further nor openly deploy its nuclear weapons if India does not first do so. There should at least be a serious Indian initiative to discuss with Pakistan the joint closing down, on a permanent basis, of both their respective test sites.



POETRY CORNER

Hands Which Spread Light

Satish Chaube

*It's celebration today,
As the evening of the East
Slips into the night,
And the night of the West
Rolls into darkness*

*The hands that are
Placing the lamp
On a tomb,
(Which may be of a spirit)
STOP!*

*The hands that are
Floating the lamp
In the rivers,
(Which may be of a bride)
STOP!*

*The hands that are
Lighting the lantern
In unlit streets,
(Which may be of an old man)
STOP!*

*The hands that are
Taking the safety lamp
Inside the pit,
(Which may be of a miner)
STOP!*

*All the hands,
Which spread light, let
Come closer today, and
Hold each other tightly,
And let this be the
Beginning of
Thumping at the doors of
The dark world
By the hands-
Glowing in togetherness.*

The original poem in Hindi was titled 'Raushan Hathon Kee Dastaken'. It was penned by the departed poet from Raipur in 1955-56. English translation by Lalit Surjan.

SPEAKING UP FOR PEACE

Peace is in Our Hands

*Aya Takeuchi**

"I've never thought that refugees smile because I've only seen their tears and the faces of anger on TV." An elementary school girl wrote this in her remarks about my lecture on Palestinian refugees. She also said, "I realize that they are not different, they are just like us." At the elementary school Peace Rally in Aki city, Kochi, I gave a lecture to the school children from grades one to six about the Palestinian-Israeli conflict from my experiences of volunteer activities in Palestine and at the Rashidieh refugee camps in Lebanon. It was then that I noticed how our images are different from the truth. In fact, my preconceptions were completely turned upside down while staying in the region and meeting a lot of people. They were by all means peace loving and did not at all conform to the terrorist image so often portrayed by the media.

When I went to Lebanon, I was surprised by the number of women deeply involved in NPO activities. For example, at an active NPO group at a refugee camp in Lebanon, there was a female leader who worked on pre-school children's education. She had not married and had dedicated herself & her time to this calling. There were also many young female volunteers at the NPO participating in activities together with other male workers. Their activities was aimed at the young children in refugee camps was to offer them places to play and to take care of them. Besides, all the young volunteers receive leadership training and workshops with foreign volunteers for cultural exchange to broaden their perspective.

Because of my lack of knowledge about Islam, I believed that women couldn't be deeply involved in their society. It is said that women are oppressed in the Islamic world and we easily apply this idea to all situations or countries. Usually, we lose

sight that there are differences depending on the governments, regions, and customs. Prejudices have prevailed and we tend to judge people based on their background. Therefore, we tend to separate people into groups based on the abstract rather than reality so that many of us forget that we are one and the same. Some people really cannot identify themselves with those who are different from them such as people who live in conflict areas or who live in terrible poverty. Especially in places like affluent Japan it is possible for us to live without caring about the other side of the world, and some of us are really insensitive and devoid of sympathy.

As it is important to get rid of this bad situation, the peace movement is growing in Japan, just as it is doing so around the world, especially since 9/11. I would like to introduce some of the peace activities held in Kochi, a small city in rural Japan: "Peace Action", "Peace Live" and "FOP ~Flowers Of Peace~". In each case, it is the dedicated women who are taking leadership roles in these projects.

The citizens of Kochi started the "Peace Action" around the time of the U.S-led Afghan invasion. Standing along the street with the photos of Afghan children, we asked people walking by to write messages for peace on a big blank paper, while at the same time calling on peace and handing out flyers. Then, we took pictures of the colourful messages written on the paper and sent them to the government. Some wrote regarding the concrete facts about what is happening around the world in a very humorous way, and some wrote about their wishes and their love for peace. While doing this activity, I realize that, of course, everybody wants to keep peace within their daily lives.

It is important to note that the organizers of this attempt are two female university lecturers. Despite their busy work and home-making, they organized everything. Their passion about peace was so incredible that they encouraged us in so many ways. They said that imagination is very important for achieving peace. Like the popular song "Imagine", written by John Lennon, we must try to imagine the feelings of people, rather than only trying to know the situation and the incidents. Imagination joins people's hearts in spite of the distances.

"Peace Live" is one of the activities of the private peace museum "Grass Roots House" in Kochi. Some local musicians are invited to play live music and express their passion for peace. It is not the ready-made action but it's a very new approach to encourage people to reconsider what we already have. Unfortunately, peace activities are not yet in the mainstream in Japan but more people are beginning to understand the importance of giving a cry for peace. In fact, so many people still think that we have peace in our hands and that it will remain forever without ever really cherishing it.

At last, it is the time for us to notice that peace doesn't stay in our hands unless we hold it tight. "Peace Live" is an amazing opportunity to make people aware how nice it is to be able to do what they like. Please think about this: If you don't know soccer, how do you get to like soccer? If you have never experienced the peaceful time, how do you know peace is necessary and worth sacrifice? You fight for peace because you know that it is worthwhile to do so. Because when you enjoy what you have and realize that you are happy, you are able to think about others.

More and more young people in Japan, especially students, are now interested in knowing what is happening in the world. At the same time, they have slowly started to realize that each of us must cover our own small

share in the construction of peace. However, university students in Japan, who should be society's most liberal members, are not really ready for this. Therefore, "FOP ~Flowers Of Peace~", the Kochi University peace circle, was established in January 2002. The purpose of this club is to give the students some opportunities to discuss about peace. It is organized by the students and offers some activities: free seminars and special projects like sending aid or holding documentary movies.

As with imagination, sympathy is very significant when we think about peace. When I was in Palestine, people asked me about Hiroshima and Nagasaki. I was really surprised how the tragic history of those two tragic cities is known all around the world. Of course, there are no Japanese who don't know about the experiences of atomic bombs but I wonder how many people are really concerned about it? Nuclear power is no longer just a nightmare but a substantial threat because of the lack of sympathy for the Hibakusha, those people and their offspring who were injured in the atomic attack. Even though they are still living in Japan and suffering every day, it is just one of the innumerable incidents constituting history. That is the reason why many people are not as passionate as the Japanese are about fulfilling their responsibilities to push for nuclear abolition. While only a few people are working on this, all of us must consider peace as one of our most vital rights.

If peace is our right, we must obligate ourselves to keep and cherish peace. Peace is in our hands only if we hold it tightly and treat it gently. It is not only a possibility but it is a necessity. Each one of us has to take a part in keeping peace so that we can deserve it. Again, peace is in our hands.

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Women against War

*Ilina Sen**

Women have been and continue to be war sufferers in many ways. Some of the specific ways in which women have been victims of nuclear and other wars are documented and some are not. What stands out across all debate and discourse is women's enormous suffering and enormous courage to cope, to protest, and to seek change. It is this that gives us the hope in which we enter into this discussion.

When the atomic bombs were dropped on the cities of Hiroshima and Nagasaki, they unleashed a hitherto unknown force full of horrors. As the dust and debris settled, and as people struggled to cope with the horror, there was not much scope for exact documentation and accounting of the dimensions of the tragedy. A defeated Japan was not in a position to understand, acknowledge, or seek retribution for the full effects on women, children and other identifiable sections of the population. A victorious United States of America was totally callous to possibilities of reparation or atonement for its crimes against humanity. Through the efforts of peace loving people and particularly through the struggles of the Hibakusha, the horrific effects on all people and particularly on women came gradually to be known. The psychological damage, the increase in cancers, in leukaemia, in destruction and damage to unborn life in utero, in genetic distortion lasting generations and affecting life yet to come- all this gradually came to be known. Even today, because of the social and psychological barriers to coming out in the open with the truth of nuclear suffering, the full extent of the suffering of the women of Hiroshima and Nagasaki are unknown.

The post war history of nuclear testing and

nuclear disasters confirmed much of what we already were getting to know about the effect of nukes on women, and built up a strong body of evidence that was impossible to wish away. Cancers, birth deformities and wasted pregnancies affecting the women of the Marshall islands, the US test site in the Pacific, went on to strengthen the rising protest voices that were growing globally, but because of the interests of US national security were never fully documented or publicized.

In contrast, we have much better information about the after effects of the Chernobyl disaster. A major conference on the 'Health consequences of the Chernobyl disaster' (Basel, 2003) brought together much data that showed that the less specialized the cells, the more vulnerable they are to radiation damage. Exposure of the mother to radiation led to severe organ and brain damage to infants, apart from increasing the risk of cancer to the mother herself. For the 1986-90 period, the Ministry of Health in Ukraine noted an increased number of miscarriages, premature births and stillbirths as well as three times the normal rate of deformities and developmental abnormalities in newborns. The period after 1989 saw a previously unsuspected rise in early infant mortality in Belarus and Ukraine, caused by the strontium effect.

Coming closer to our own times, the use of DU (depleted uranium) weapons by the United States of America on the Iraqi people in the earlier Gulf war and in the present phase of the conflict in the region is affecting the women, the born and unborn children of the region in much the same way. Let us not be misled by the word 'depleted'! Like spent fuel from civilian reactors, DU is

highly toxic and carcinogenic and has a half life of some 4.4 billion years. From this perspective, we must remember the effects of radiation on the women of the indigenous area where uranium has been and continues to be mined, be it in the U.S. or in India. In the U.S., the raw material for the Los Alamos Lab was mined in the lands of the Apache and Navajo native people. In India, the Jaduguda mines with documented evidence of increasing cancers in women, and increasing masculinity of the new born population in the surrounding villages supplies much of our current uranium requirements. Uranium deposits as yet unmined lie over large tracts of Jharkhand and Chhattisgarh.

What is true of nuclear war is equally true of chemical and biological war. In Vietnam the effects of the notorious Agent Orange on the people of the land were known and suffered though again not. Its effects were fully researched by a nation struggling to rebuild itself. In America, the connection between Agent Orange and breast cancers reproductive disorders in women first became known through the pioneering work of Linda Schwrtz and the Registered Nurses Association (RNA) that first exposed the effect of Agent Orange on military nurses who had nursed soldiers with Agent Orange toxicity. Previously, US studies on the effects of Agent Orange had only studied possible effects on men from the point of view of fixing compensation and insurance payments to the veterans. The RNA has fought a valiant battle for fixing US government culpability towards nurses and other women victims, and has established links with women's organizations in Vietnam in this regard. Similar findings are cited by studies on the Bhopal Gas tragedy. A study by the Medico Friends Circle finds a five time increase in menstrual and birth disorders in the gas affected women as compared to the general population - a frightening preview of what can happen in a full scale biological war.

Apart from the physical and emotional scars

caused by the tools of modern war, women in war are affected in many other ways. From ancient times, rape, physical assault and enslavement of women has been used as a tool of war and all conquering armies and their agents have resorted to these ways of demeaning women, and through them, an entire vanquished population. We see this happening today in wars between nations, as well as in conflict situations within countries in which an oppressed people are fighting for their basic human rights. The example of Manorama, our sister, who was brutalized by the Indian army in Manipur, comes immediately to mind even as we know that there are many more Manoramas, in many more situations. Many such conflicts also lead to situations in which oppressed people aggressively assert their cultural identities, and often the way to do this is to enforce behaviour norms on women that are patriarchal even as they are proclaimed to be patriotic. We see examples of this in Palestine and parts of West Asia today, where sections of the resistance movement insist on dress and behaviour codes for women. This has made the struggle of women so much the harder as they have had to cope with the destruction of life and livelihood and the disruption of family all around them at the same time as they have had to yield hard won personal spaces.

Today, women's voices have acquired a particular sensitivity as well as authority in the peace movement internationally. This has been the result of women's specific experiences and specific sufferings. Palestinian Women's Peace Organizations, The Naga Mothers' Association with their powerful logo proclaiming "No more Tears!", the Meira Peibis of Manipur - these and many other organizations of women lend their weight to this new trend.

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SPEAKING UP FOR PEACE

From Gandhi to the Grassroots

*J. Sri Raman**

This is just to share a modest experience of the peace activists of Chennai in mass interaction.

Every October 2, an otherwise deserted Gandhi Mandapam, a compounded space with a Mahatma statue, in the heart of the metropolis comes alive. For several years now, the Tamil Nadu Government has been conducting a Gandhi Jayanti programme here, ending on October 4. It has been doing so by enlisting the participation of several organizations. The participants put up stalls and exhibitions. The visiting public are treated to music by different groups in the open-air auditorium at the venue. Vendors of eatables and beverages do brisk business.

The three-day 'mela' is a big draw. Families on an outing, schoolchildren on guided tours, sightseers from districts, and others stream in and out endlessly. In a meeting of the Movement Against Nuclear Weapons (MANW), three years ago, someone asked why we couldn't participate in the program. It seemed a good idea. We got a stall on request. And the MANW exhibition has become a regular fixture in the program.

The first thing that struck us on October 2, 2001, was that we stuck out like a sore thumb. The MANW and its stall appeared a misfit among the other organizations and their exhibitions. Most of them were into what might be called Gandhi cuisine. A Martian visitor, if only he skipped our stall, would have gained no idea about the Mahatma as, above all, an apostle of peace, who had no soft word to speak about the atom bomb that made its advent three years before his martyrdom. The only other stall to mention the P-word was our neighbour, a

spiritual organization that portrayed peace in mysteriously geometric patterns.

Strange but true, a section of the officials looked with askance at our exhibits and us and even some visitors made us feel that peace activists were intruders at a Gandhi Jayanti venue. We stayed on, however, and we were soon accepted as a not entirely incongruous feature of the landscape. We have participated in the program every year since then, and the organizers and at least a small section of the visitors have come to see peace - in India, South Asia and the world - as one of the messages of the Mahatma.

To us, the most interesting and illuminating part of the program has been our interaction with visitors of varied descriptions. We have enjoyed answering questions - of scientific curiosity about nuclear weapons from school kids and slum-dwellers, of sympathetic interest about Hiroshima and Nagasaki, of concern about the spiralling costs of sub-continental militarism and, of course, of 'patriotic' indignation about our activities.

We have found it easy enough to convince people from the lower middle class downwards. They saw immediately the criminality of spending billions on bombs while much of the country (including Chennai, of course!) went without the minimum of drinking water, for example. Not so the elite of the establishment, who just couldn't see how any Indian could not want India to be a military superpower. They didn't like to be reminded that this was an occasion to remember an Indian who nursed no such ambition for his country.

The interaction has provided many instruc-



tive moments. The one I remember best was the reaction of an otherwise pro-peace visitor to the part of our exhibition dealing with and denouncing the Bush war on Afghanistan. Said he: "I agree that it is a bad war. But, if it helps to solve our Kashmir problem, is it not all right?" This showed us not only the effect of the semi-official propaganda that the war on Afghanistan was also one on the terrorists who were giving us so much trouble in Kashmir. Even more significantly, it illustrated the public impression created by long years of propaganda that Kashmir was a life-and-death issue for India, that no price was too high to pay for its 'solution' as India saw it.

The programme this year, too, has been purposeful. An additional feature this time was the participation in the musical part of the program by a choir of the Movement for People's Unity (MPU), closely associated with the MANW. It was gratifying to hear from members of the floating audience that the choir's songs of peace and social awareness were a refreshing addition to the earlier repertoire of exclusively religious hymns.

I must end with an inland letter I received a

day after the end of the program. It came from an unidentified but obviously devout Saivite, who was so self-effacing as to sign 'Siva Siva'. The same invocation took the place of his address. The handwritten letter, in beautiful Tamil, lauded and chided us at the same time. "War is evil. Let us have no war", it said. But it added: "If darkness must go, light should come. If you curse darkness or describe it, darkness won't go or become light." Alluding to one of our slogans, perhaps, the letter went on to say: "We cannot stop wars by declaring a war on warmongers...Do we need fire to extinguish fire?" It concluded: "It is enough if we convince them (warmongers) that they have come to wrong conclusions from wrong information. Wars will then cease."

We must admit that the Mahatma may have agreed. But we cannot help wondering whether the method suggested would have worked with George Bush and his cronies!

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POETRY CORNER

The Bridge On The Ocean

*Lalit Surjan**

The chess board is
Slowly folded back
By a restless Mandodari and
In Ashok Vaatika,
Like the drooping branch of Ashok
Still sits the sorrowful Bhumisuta.

The war
Can breakout
Any moment, but
On the shores of emotion, alone
Stands Arjun,
Overcame by indecision.

The soldiers stand face to face, and
The warriors are ready for sacrifice
Ram is looking at the ways to
Build bridge on the ocean, and
While Krishna is bridging the gap
With his words,
Sits a sobbing Uttara
in the solitude of the camp.

The bridge is in process and
Soldiers are screaming with excitement
Bheem and Sugreev are not able
To control their frenzy
The very thought of victory
Makes Vibheeshan shiver and
Dharmaraj is preparing himself
To utter an untruth.

Recollecting the struggles of life,
Krishna, the Poorna Purush, is writing
His role for the history,
And in the oceanic waves
Purushottam Ram is trying to find
Meaning of Maryada.

Tired of himself
Waits Bheeshma
To return to the laps of Ganga,
Vaidehi, tired of the tests is
Counting the days to
Return to the earth's bosom.

Madhav has returned from Hastinapur
And is all alone in Dwarika
Raghnath has returned from Lanka
And is all alone in Ayodhya

In this lonesomeness of the victory
Nowhere is the rice of Sudama
Nor Shabri's berries, and
Neither is the dinghy of Kevat.

An endless stillness
Hovers over Kurukshetra and
In Rameshvaram lays
A deserted bridge,
And trapped in memory of Ram
An old squirrel
Thinks, again and again
For whom the war was fought
For whom the bridge was built
Who has won
And to what end.

The original poem is in Hindi
Translation by Vani Xaxa

* Lalit Surjan, an eminent figure in the realm of Hindi literature, is a leading peace activist and the owner-editor of the Hindi daily 'Deshbandhu' from Raipur. He is an NCC member of the CNDP. He can be contacted at <lalitsurjan@dailydeshbandhu.com>

BOOK REVIEW

US, India, Pakistan : The Nuclear Triangle in South Asia

How the U.S., India, and Pakistan Brought the World to the Brink of Nuclear War by J. Sri Raman; Common Courage Press, Monroe, Maine; pages xxii + 306; \$18.95.

J Sri Raman is a veteran and eminent journalist based in Chennai, (formerly Madras), contributing regularly to a number of national, foreign and international newspapers, journals and web-based publications. While his chequered and distinguished career spans over the last three decades, he has emerged as a front ranking anti-nuke peace activist ever since India went nuclear in May '98. Soon after the Big Bang he founded the Journalists Against Nuclear Weapons (JANW). Currently he is the Convenor of the Movement Against Nuclear Weapons (MANW). He is also on the advisory board of the Global Networks Against Weapons and Nuclear Power in Space. He is a founder NCC member of the CNDP, India.

The volume under review is a unique product of thoroughgoing journalistic scholarship, conscientious activism and a pen relentlessly weaving magic. The main thesis is, as claims the author, that South Asia turned into a nuclear flashpoint in the wake of the 9/11. Both the main (nuclear) protagonists from the region, viz. India and Pakistan - the two traditional rivals, joined the 'War on Terror' unleashed by the US under the George Bush led administration. Having succeeded in becoming the 'allies' of the hyper-

power (notwithstanding the strong censures both had to suffer only three and a half years back), they turned even more reckless. This is how the world came to be faced with the ten month long spine chilling spectacle of the 'Operation Parakram' (or Show of Might) when India went in for its largest ever peacetime mobilisation of troops along the Indo-Pak border as an act of 'coercive diplomacy' as a measure of instant and massive retaliation against the - presumably Pak inspired even if not actually executed, armed attack on the Indian parliament on the 13th December, 2001 - just about two months after 9/11. Since the days of nightmarish Caribbean Crisis in the October of 1962, the world has never seen such an eyeball to eyeball confrontation between two nuclear powers. But like a superior piece of creative literature the volume goes well beyond the territories charted to be covered.

The book is divided into nine chapters. The structure defies linear logic. If the first chapter brings the reader face to face with the chilling scenario of a not-too-unlikely nuclear exchange between the two neighbours, the second one transports her back to the gory blood-soaked chapter in the life of the subcontinent - the presumed 'dawn' of Independence inextricably intertwined with the blood-dripping 'darkness' of Partition. The Partition still defines the life of the subcontinent in its post-colonial phase perhaps much more than any other event except, of course, the Independence itself. The third chapter recounts the story of the four wars fought - two declared and

two undeclared, and the last one, from May 5 to July 26, 1999, in the post-nuclear phase. It has been claimed that during the (undeclared) Kargil War no less than thirteen times nuclear threats were exchanged between the two sides. The fourth chapter deals with the Kashmir issue and its criticality in defining the prospects of peace between India and Pakistan. Quite significantly, it also grapples with the possible contours of a likely solution.

The fifth chapter takes us to the tumultuous days of May '98 and traces the trajectory of India's eventual nuclearisation. Even if one is a big sceptical about the author's grave doubts regarding 'the mystery of the dog not barking', i.e., in this case, non-detection by the supposedly omniscient American spy satellites of the preparations for Pokhran II or the dark hints that Pokhran II was only a clever ploy to make India join the CTBT regime - an imperialist trap by all means, the compelling merits of this narrative engraved in lyrical prose can hardly be lost sight of.

The sixth chapter explores, by travelling back to the hoary thirties, the historical linkages between "Hindu" communalism in India and Italian fascism. The ugly face of the former, in terms of Gujarat 2002 and much older texts penned by its earliest authors, is revealed and equated with fascism. Its impact on Indian Muslims and Pakistan, and American complicity in the rise of radical Islam in the subcontinent, is etched out. However, hardly any attempt is made to flesh out the contention that this Indian variant of 'fascism' lies at the root of India's nuclearisation. It is the seventh chapter, which encapsulates the author's central thesis. It is here that the author comes out with his categorical claim that by becoming "allies" in the U.S.-led war on terrorism - unleashed in the wake of 9/11, India and Pakistan have

actually become more implacable adversaries than ever before, with each hoping to turn the situation to its own decisive and deadly advantage. Consequently "9/11 and the subsequent war on terrorism [turned out to be] the trigger that brought us closer to nuclear war than anything [else] since the Cuban missile crisis". The whole chapter is devoted to the development of this theme. And the US, in this narrative, emerges as the villain of the piece, albeit operating from behind the curtains. The abiding merits of the arguments put forward notwithstanding, the doubts, however, persist whether the case has been a wee bit overstated, particularly given the fact that the Kargil War, again fraught with the very real threats of nuclear exchange, preceded 9/11 by two and a half years, (*and the war was actually brought to a halt through the personal intervention of Bill Clinton, the then President of the USA.*)

The next chapter deals with the incipient anti-nuke peace movements in the subcontinent and the various issues confronting the peace activists. For very understandable reasons, the founding convention of the CNDP figures prominently.

The ninth, and the last, chapter in a way revisits the main theme. It paints a bleak future for the peace process under way, presumably dictated by the US, and, in fact, characterises it as a sham. Even here, while by and large agreeing with the main thrust, one cannot but suspect that the conclusion drawn is perhaps a bit too sweeping, and too pessimistic. The author, at the end, has urged the people of South Asia to rise to protect themselves and has located the glimmer of hope in the tidal waves of global protests against the neo-con project of world domination, which also recognise the dire necessity to avert a nuclear holocaust, witnessed in the recent past.

It appears that his overriding concern to paint the US as the main villain has somewhat inhibited the author from adequately exploring the (autonomous) role of the radical "Hindu" Right as the triggering force behind the Pokhran II blasts and consequently there is not much mention of what, other than the mere force of habit, had motivated them to make, so to say, such an earthshaking move, that too in a tearing hurry, fraught with grave risks. But the import of this brilliant volume goes well beyond the 'main thesis'. It is just not only a treasure house of relevant information, the most remarkable

feature is its profound success in bringing out the stark danger staring at our face in the most graphical manner, narrated in lyrical prose. All in all, this is undoubtedly a very significant addition to the growing volume of literature on the nuclearisation of South Asia from the viewpoint of a leading peace activist.



Iraq : Nuclear Atrocities **DU: Washington's Secret Nuclear War**

Shaheen Chughtai / Al-jazeera (Doha)

The US has dropped tonnes of depleted uranium on Iraq

Illegal weapons of mass destruction have not been found in Iraq but it have been used against Iraqis and have even killed US troops.

But Washington and its allies have tried to cover up this outrage because the chief culprit is the US itself, argue American and other experts trying to expose what they say is a war crime.

The WMD in question is depleted uranium (DU). A radioactive by-product of uranium enrichment, DU is used to coat ammunition such as tank shells and "bunker busting" missiles because its density makes it ideal for piercing armour.

Thousands of DU shells and bombs have been used in Yugoslavia, Afghanistan and - both during the 1990-91 Gulf war and the ongoing conflict - in Iraq.

"They're using it now, they're using it in Falluja, Baghdad is chock-a-block with DU - it's all over the place," says Major Doug Rokke, director of the US army's DU project in 1994-95.

Scientists say even a tiny particle can have disastrous results once ingested, including various cancers and degenerative diseases, paralysis, birth deformities and death.

And as tiny DU particles are blown across the Middle East and beyond like a radioac-

tive poison gas, the long-term implications for the world - DU has a shelf-life of 4.5 billion years - are deeply disturbing.

Sick Soldiers

Only 467 US soldiers were officially wounded during the 1990-91 Gulf war. But according to Terry Jemison at the US Department of Veterans Affairs (VA), of more than 592,560 discharged personnel who served there, at least 179,310 - one third - are receiving disability compensation and over 24,760 cases were pending by in September 2004.

This does not include personnel still active and receiving care from the military, or those who have died. And among 168,528 veterans of the current conflict in Iraq who have left active duty, 16% (27,571) had already sought treatment from the VA by July 2004.

"That's astronomical," says Rokke, whose team studied how to provide medical care for victims, clean contaminated sites, and train those using DU weapons.

Rokke admits the exact cause for these casualties cannot be confirmed. But he insists the evidence pointing to DU is compelling.

"There were no chemical or biological weapons there, no big oil well fires," he says. "So what's left?"

Cradle to grave

Dr Jenan Ali, a senior Iraqi doctor at Basra hospital's College of Medicine, says her

studies show a 100% rise in child leukaemia and 242% increase in all types of malignancies in the region in the decade after the first Gulf war.

The director of the Afghan DU and Recovery Fund, Dr Daud Miraki, says his field researchers found evidence of DU's effect on civilians in eastern and southeastern Afghanistan in 2003 although local conditions make rigorous statistical analysis difficult.

"Many children are born with no eyes, no limbs, or tumours protruding from their mouths and eyes," Miraki told Aljazeera.net. Some newborns are barely recognisable as human, he says. Many do not survive.

Afghan and Iraqi children continue to play amid radioactive debris. But the US army will not even label contaminated equipment or sites because doing so would be an admission that DU is hazardous.

This "deceitful failure", says Rokke, contradicts the US army's own rules, such as regulation AR 700-48, which stipulates its responsibilities to isolate, label and decontaminate radioactive equipment and sites as well as to render prompt and effective medical care for all exposed individuals.

"This is a war crime," Rokke says. "The president is obliged to ensure the army complies with these regulations but they're deliberately violating the law. It's that simple."

No remedy

But these blatant violations are practically irrelevant because Rokke's Iraq mission found that DU cannot be cleaned up and there is no known medical remedy.

US President George Bush and UK Prime Minister Tony Blair used Saddam Hussein's alleged possession of illegal weapons to justify invading Iraq. But several prominent jurists hold Bush and Blair guilty of war

crimes for waging DU warfare.

The vice-president of the Indian Lawyers Association, Niloufer Bhagwat, sat on an international panel of judges for the unofficial International Criminal Tribunal for Afghanistan.

Bhagwat and her fellow judges ruled that the US had used "weapons of extermination of present and future generations, genocidal in properties".

Friendly Fire

And not just against defenceless Afghan civilians. "Bush was guilty of knowingly using DU weaponry against his own troops," Bhagwat told Aljazeera.net, "because the president knew the effects of DU could not be controlled".

A prominent US international human-rights lawyer, Karen Parker, says there are four rules derived from humanitarian laws and conventions regarding weapons: weapons may only be used against legal enemy military targets and must not have an adverse effect elsewhere (the territorial rule) weapons can only be used for the duration of an armed conflict and must not be used or continue to act afterwards (the temporal rule) weapons may not be unduly inhumane (the "humaneness" rule). The Hague Conventions of 1899 and 1907 speak of "unnecessary suffering" and "superfluous injury" in this regard weapons may not have an unduly negative effect on the natural environment (the "environmental" rule).

Illegal weapons

"DU weaponry fails all four tests," Parker told Aljazeera.net. First, DU cannot be limited to legal military targets. Second, it cannot be "turned off" when the war is over but keeps killing.

Third, DU can kill through painful conditions such as cancers and organ damage and can also cause birth defects such as facial deformities and missing limbs.

Lastly, DU cannot be used without unduly damaging the natural environment.

"In my view, use of DU weaponry violates the grave breach provisions of the Geneva Conventions," says Parker, "and so its use constitutes a war crime, or crime against humanity."

Parker and others took the DU issue before the UN in 1995, and in 1996, the UN Human Rights Commission described DU munitions as weapons of mass destruction that should be banned.

Deceit

Despite the evidence, Rokke says Pentagon and Energy Department officials have campaigned against him and others trying to expose the horrors of DU. That charge is echoed by Leuren Moret, a geoscientist who has worked at the Lawrence Berkeley and Lawrence Livermore nuclear weapons research laboratories in California.

President Bush insists warnings about DU are merely propaganda

White House denials are part of a long-standing cover-up policy that has been exposed before, she says.

"For example, the US denied using DU bombs and missiles against Yugoslavia in 1999," she told Aljazeera.net, but scientists in Yugoslavia, Greece and Bulgaria measured elevated levels of gamma radiation in the first three days of grid and carpet bombing by the US."

Moret said: "A missile landed in Bulgaria that didn't explode and scientists identified a DU warhead. Then, Lord [George] Robertson, the head of NATO, admitted in public that DU had been used." Even the US army expressed concern about the use of DU in July 1990, some six months before the outbreak of the first Gulf war. Those concerns were later

echoed by Iraqi officials.

Denial

But brushing his own army's report aside - now said to be "outdated" - US President George Bush dismissed such warnings as "propaganda".

"In recent years, the Iraqi regime made false claim that the depleted uranium rounds fired by coalition forces have caused cancer and birth defects in Iraq," says Bush on his White House website.

"But scientists working for the World Health Organisation, the UN Environmental Programme and the European Union could find no health effects linked to exposure to depleted uranium," he said.

Bush can point to a World Health Organisation (WHO) report in 2001 that said there was no significant risk of inhaling radioactive particles where DU weapons had been used.

It said the level of radiation associated with DU debris was not particularly hazardous, but it accepted that high exposure could pose a health risk.

Scientific studies

WHO also commissioned a scientific study shortly before the 2003 invasion of Iraq that warned of the dangers of US and British use of DU - but refused to publish its findings.

The study's main author, Dr Keith Baverstock, told Aljazeera.net that "the report was deliberately suppressed" because WHO was pressed by a more powerful, pro-nuclear UN body - the International Atomic Energy Agency. WHO has rejected his claims as "totally unfounded".

The study found DU particles were likely to be blown around and inhaled by

Iraqi civilians for years to come. Once inside a human body, the radioactive particles can trigger the growth of malignant tumours.

Bush's claim that the UN Environmental Programme (UNEP) gives DU pollution a clean bill of health is also disingenuous.

UNEP experts have yet to be allowed into Iraq, its spokesman in Geneva Michael Williams told Aljazeera.net, citing security concerns.

And a scientific body set up in 1997 by Green EU parliamentarians - the European Committee on Radiation Risk (ECRR) - found that DU posed serious health risks.

An eminent Canadian scientist involved with the ECRR, Dr Rosalie Bertell, says that the deadliness of DU derived not just from its radioactivity but from the durability of particles formed in the 3000-6000 heat produced when a DU weapon is fired.

"The particles produced are like ceramic: not soluble in body fluid, non-biodegradable and highly toxic," she told Aljazeera.net. "They tend to concentrate in the lymph nodes, which is the source of lymphomas and leukaemia".

Known Killer

The US military and political establishment cannot plead ignorance. As early as October 1943, Manhattan Project scientists Arthur Compton, James Connant and Harold Urey sent a memo to their director, General Leslie Groves, saying DU could be used to create a "radioactive gas". DU targets human DNA and may thus affect future generations. In 1961, two nuclear experts, Briton HE Huxley and American Geoffrey Zubay, informed the scientific community that DU targeted human DNA. Moret said that it effected the "Master Code, which con-

trols the expression of DNA". In September 2000, Dr Asaf Durakovic, professor of Nuclear Medicine at Washington's Georgetown University, told a Paris conference of prominent scientists that "tens of thousands" of US and UK troops were dying of DU.

Death sentence

"There has to be a moratorium on the manufacture, sales, use and storage of DU," geoscientist Moret says, warning that this will not happen unless more Americans realise what is happening. The Middle East has been severely contaminated, warns Moret. "That region is radioactive forever," she says, but worse is yet to come. Moret says the air carrying DU particles takes about a year to mix with the rest of the earth's atmosphere. The radiation released by DU nuclear warfare is believed to be more than 10 times the amount dispersed by atmospheric testing. As a result, DU particles have engulfed the world in a radioactive poison gas that promises illness and death for millions. Rokke went to Iraq a fit and healthy soldier, but the Major is now beset with a variety of illnesses and each day is a struggle. He suffers from respiratory problems and cataracts while his teeth - weakened by DU radiation - are crumbling. At least 20 of the 100 primary personnel he worked with on the US army's DU project have died. Most of the rest are ill. Meanwhile, WHO says cancer rates worldwide are set to rise by 50% by 2020, although it does not link this publicly to DU. "They would never say that - they offered various strange explanations," said Moret, "but DU is the key factor. People will slowly die."

Note : This article is downloaded from
<<http://www.mindfully.org/Nucs/2004/DU-Secret-Nuclear-War14sep04.htm>>



Tragedy of Palestine **The Question of Palestine**

*N.D. Jayaprakash**

The genesis of the problems facing the Palestinian people today can be traced to the early twentieth century when contradictions between the imperialist powers sharpened and culminated in World War-I. On 09 December 1917, Britain occupied Palestine, thereby ending Turkish rule over the territory since 1517. The occupation came about as a result of the Sykes-Picot agreement between Britain and France in 1916, which was part of a policy of the imperialist powers to divide and rule the Arab world.

Even before gaining control of the territory, Britain promised a national home for Jews in Palestine through its infamous Balfour Declaration issued on 02 November 1917, which planted the seeds of an endless conflict in that land. The Declaration was in the form of a letter written by Arthur James Balfour, the then Foreign Secretary of Britain, to Lord Lionel Walter Rothschild, one of the leaders of British Jewry.

Zionism

The political movement for a separate homeland in Palestine for the Jews, or Zionism, began during the 1870s when victims of anti-Semitism in various cities across Europe set up societies for propagating the idea.

The bizarre idea of Zionism was staunchly opposed by many well-known intellectuals of Jewish origin of that time and since then. However, it cannot be denied that anti-Semitism was a serious problem then as it was one of the tactics adopted for diverting people's anger and for disrupting their

unity in the struggle against those forces that were instrumental in causing economic, social and political upheavals in Europe from that time until the end of World War-II.

Modern Zionism effectively began with the holding of the First Zionist Congress on 29 August 1897 AD at the initiative of Theodor Herzl, an Austrian Jew, in Basle, Switzerland. The Zionist Organization emerged out of this Congress. Central to Zionist thought is the concept of the Land of Israel (Palestine) as the birthplace of the Jewish people (a mythical claim invoking the Old Testament) and the belief that Jewish life elsewhere is a life of exile. It is true that the Jews as a community were formally expelled from Palestine in 135 AD - a process that began from as early as 70 AD. However, by no stretch of imagination can the Palestinians be blamed for the forced exodus; the decision to expel the Jews was that of the Romans. It was a form of reprisal for revolts by the Jews against the Romans, who had conquered Palestine in 63 BC and made it a province of the Roman Empire. The Maccabees, a Jewish family, had ruled Palestine from 142 BC to 63 BC, until the Romans took over power. It may be pointed out that the Hebrew patriarch Abraham, the founder of Judaism - the religion of the Jews, was not an original inhabitant of Palestine. According to legend, he is said to have emigrated from Ur in Babylonia (what is now Iraq) some 3700 years ago.

Unjustified Demand

The right of return to Palestine after a long gap may have had some semblance of just-

ness if all the Jews of today were the direct descendants of those who were forced to emigrate from there over 1900 years ago. That is surely not the case. Of the total Jewish population the world over, direct descendants of the expelled Jews would constitute but a tiny fraction. A slightly larger fraction would be of mixed decent, while the overwhelming majority would consist of those who are Jews by religion but having anthropologically no connection whatsoever with the Jews expelled from Palestine. This is because there have been conversions to Judaism of large numbers whose earliest ancestors were nowhere near Palestine. After their dispersal from Palestine, the thing common to all Jews was only their religion. If religion should be the yardstick for deciding nationality, all Christians across the globe should also have the right to make Palestine their home as Christianity too originated there! Mahatma Gandhi saw through the fallacy of this tenuous claim of the Zionists and was of the opinion that : "The nobler course would be to insist on a just treatment of the Jews wherever they are born and bred. The Jews born in France are French in precisely the same sense that Christians born in France are French. If Jews have no home but Palestine, will they relish the idea of being forced to leave the other parts of the world in which they are settled?"(The Collected Works of Mahatma Gandhi, vol. 68, p. 138)

By no stretch of imagination could a separate homeland in Palestine for Jews have been a solution for anti-Semitism. Nevertheless, the Zionists went about seeking that goal in a much-organised manner. The first large-scale immigration of Jews into Palestine (mainly from Russia and Romania, all of whom were converts and not descendents of the expelled Jews) took place during 1882 -1903. Still in the early 1880s, there were only about 24,000 Jews in Palestine, consisting less than 4% of the total population there and a mere 0.3 % of the world's total population of Jews at

that time. (Source : Prakash C Jain [School of International Studies, Jawaharlal Nehru University], 'Population and Society in Israel', *Encounter* (New Delhi), Vol. 2, No. 3, May/June 1999, pp. 57-58)

Meticulous Planning

After the First Zionist Congress, the Zionist movement organised itself as a world wide organisation with permanent institutions. The primary tasks of the Zionist Organisation were to purchase land in Palestine, reclaim unproductive land and to settle immigrating Jews in newly created rural settlements and townships. For these purposes, it established two central agencies. The first was the Jewish National Fund (JNF) founded in 1901, whose charter specified land purchase in Palestine as the organisation's sole pursuit. The second agency that was founded was the Palestine Land Development Company (PLDC) established in 1908. Subsequently an overseas fundraising mechanism known as Keren Hayesod was founded in London in 1920 (its headquarters were moved to Jerusalem in 1926).

The Zionists were able to impose their will over the Palestinians only because of their military superiority. Such superiority was achieved through long-term planning. To advance their interests, the Zionists methodically went about arming and training their members in large numbers soon after they started immigrating to Palestine in an organized manner. They began by setting up so-called "security organizations", the first of which was founded in 1909 and was called Hashomer. Subsequently, in 1920 an underground organization called Haganah was formed as a "grassroots" armed force (which gradually became the full-fledged military wing of the Zionists) to unleash terror on the Palestinians and to remove all obstacles in their path including those placed by the British. It is suspected that the Zionists managed to procure vast quantities of arms

from the residue of the US and British military campaigns in the Middle East after World War II. The steady flow of military hardware from Czechoslovakia after World War II was what finally helped them a great deal in consolidating their military might. Thus, at the time of forcibly establishing the State of Israel in 1948, the Zionist had well-trained and well-armed forces, which were at least 65,000 strong. There was little doubt that the number of well-armed Zionists in 1948 was far greater than the combined strength of the ill-trained, in-disciplined and poorly armed Arab armies from the neighbouring countries, which came to the defense of the Palestinian people who were at the mercy of the marauding Zionist gangs.

Usurpation of Power

In the latest phase of its history most of Palestine has been under the occupation of the Zionists since their unilateral proclamation of the "State of Israel" on 14th May 1948, which coincided with the decision of Britain to terminate its mandate over the territory. This precipitate action on the part of the Zionists needlessly aborted the move for a peaceful transition of power as envisaged in the UN Partition Plan for Palestine, which the UN General Assembly had adopted on 29 November 1947. The partition plan had allocated approximately 43 % of the territory of Palestine to the Arab State, while about 56 % of the area (including the most fertile land) to the Jewish State, and less than 1 % of area to the City of Jerusalem. (Source : UN Document No. A/364, Add.1, 9 September 1947, Map No. 82.) This ignored the fact that the Jews then constituted only about one-third of the population and the land under their possession, which in 1918 amounted to less than 2% of the total land area of Palestine, had by 1946 just increased to about 6 % of the total land area there. The population composition in the UN Partition Plan would further reveal the patently discriminatory nature of the Plan. In the designated Jewish

State nearly half the population consisted of Arabs: 498,000 Jews against 407,000 Arabs, totaling 905,000 in all. On the other hand, in the designated Arab State there were 725,000 Arabs against a mere 10,000 Jews, totaling 735,000 in all, while in the City of Jerusalem there were 100,000 Jews to 105,000 Arabs, totaling 205,000 residents in all. (Source: UN Document No. A/364, 3 September 1947, p.54) After proposing the creation of two separate states, was it not mischievous on the part of those who prepared the Partition Plan to enlarge the boundaries of the Jewish State to include within it such a large number of Arabs, most of whom were driven out as soon as the Zionists seized power?

A UN report later recounted the developments as follows: "One of the two States envisaged in the partition plan proclaimed its independence as Israel and in the 1948 war expanded to occupy 77 per cent of the territory of Palestine. Israel also occupied the larger part of Jerusalem. Over half the indigenous Palestinian population fled or were expelled. Jordan and Egypt occupied the other parts of the territory assigned by the partition resolution to the Palestinian Arab State which did not come into being. In the 1967 war, Israel occupied the remaining territory of Palestine, until then which was under Jordanian and Egyptian control (the West Bank and Gaza Strip).

This included the remaining part of Jerusalem, which was subsequently annexed by Israel. The war brought about a second exodus of Palestinians, estimated at half a million". (*Overview, UN Information System on the Question of Palestine (UNIS-PAL)* at <http://www.un.org/Depts/dpa/ngo/history.html>)

Meaning of Occupation

The Zionists are intent on depriving the Palestinians of all their land through force and subterfuge. The Jewish population in Israel has already risen to about 5,000,000 and the free flow of Jewish immigrants

meant occupation of more and more Palestinian lands! Jewish settlers were occupying West Bank and Gaza Strip (i.e., whatever is left of the land ostensibly allocated to the Palestinians under the UN Partition Plan of 1947) at an alarming rate. This issue is adding fuel to the fire. By 1998, 62 % of the land in West Bank and 35 % in Gaza were confiscated to serve only 155,000 Israeli settlers, while nearly 3,000,000 Palestinians were cramped into rest of the area. (Source: Khalid El-Sheikh, *The Palestinian Catastrophe*, Embassy of the State of Palestine, New Delhi, 1998, p.65) The situation has aggravated since then. Thus, nearly 90 % of the original Palestine homeland has been taken over by the Zionists. If this trend continues, the entire Palestinian people would - in the not too distant future - be deprived of all their land and become a stateless people (already more than 50% of the Palestinians are forced to live outside Palestine, while in 1948 nearly all of them lived inside it). The Palestinian population has also gone up to over 8,000,000 today. While nearly 2,000,000 live in West Bank, over one million in Gaza Strip and about one million in Israel (and in the areas it had occupied before 1967), over 4 million of them live in Diaspora in the four corners of the world. (Source : Ministry of Information, Palestine National Authority at <http://www.minfo.gov.ps/general/basicinf.htm>)

International Community and Palestine

The world at large is blissfully unaware of the enormity of the tragic situation confronting the Palestinians. The Palestinians in West Bank and Gaza Strip are literally confined to about 190 pockets with severe restrictions placed on their movements even from one pocket to another for the security considerations of the residents of the over 200 illegal Israeli settlements in the area. Thousands of Palestinians are regularly placed under detention on one pretext or another. Periodic destruction of

standing crop of the Palestinians is a game indulged in by the Zionists to harass the Palestinian population. Israeli authorities exercise control over Palestinian water sources and are therefore at their mercy for access to this precious resource. Most of the Israeli Defence Force (IDF) incursions into Palestinian-controlled areas are accompanied by the indiscriminate and often massive bulldozing of Palestinian property, both public and private, under various security-related justifications. Apart from carrying out periodic massacres, the IDF indulges in selective assassinations of Palestinian activists and political leaders through means of special undercover units and snipers or through helicopter-gunship fired air-to-surface missiles and other high-tech means. The living conditions of the Palestinians are such that during 2000-2001, the United Nations Relief and Works Agency (UNRWA) had to provide some 3.8 million refugees with social services, schooling and health care. Moreover, unemployment is a major problem confronting the Palestinians.

It is time that the world lends its ears to the anguished cries of the Palestinian people against occupation and fascistic repression by the Zionists. All efforts should be made to convene an international conference under the aegis of the UN - and the UN alone - to resolve peacefully this long-standing dispute at the earliest. In the light of the colossal indifference towards their just cause and the almost total inability on the part of the international community to ensure that justice is done, is it at all surprising that the beleaguered Palestinians are seething with rage?

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NPT PARADOX

Proliferation Treaty

George Monbiot

Poor Mr Baradei,

His mission is a parody:

He tells the states (with some aplomb)

They can and cannot have the bomb.

Here is the world's most nonsensical job description. Your duty is to work tirelessly to prevent the proliferation of nuclear weapons. And to work tirelessly to encourage the proliferation of the means of building them. This is the task of the head of the International Atomic Energy Agency (IAEA), Mohamed El Baradei. He's an able diplomat, and as bold as his predecessor, Hans Blix, in standing up to the global powers. But what he is obliged to take away with one hand, he is obliged to give with the other. His message to the non-nuclear powers is this: you are not allowed to develop the bomb, but we will give you the materials and expertise with which you can build one. It is this mortal contradiction which permitted the government of Iran this weekend to tell him to bog off.

His agency's motto - "Atoms for Peace" - wasn't always a lie. In 1953, when Eisenhower founded it with his famous speech to the United Nations,¹ people really seemed to believe that nuclear fission could solve the world's problems. An article in the Herald Tribune, for example, promised that atomic power would create "an earthly paradise. ... Our automobiles eventually will have atomic energy units built into them at the factory so that we will never have to refuel them.... In a rela-

tively short time we will cease to mine coal."² Eisenhower seemed convinced that the nuclear sword could be beaten into the nuclear ploughshare. "It is not enough to take this weapon out of the hands of the soldiers. It must be put into the hands of those who will know how to strip its military casing and adapt it to the arts of peace." The nuclear powers, he said, "should ... make joint contributions from their stockpiles of normal uranium and fissionable materials" which should then be given to "the power-starved areas of the world", "to provide abundant electrical energy".³ This would give them, he argued, the necessary incentive to forswear the use of nuclear weapons. The IAEA, its statute says, should assist "the supplying of materials, equipment, or facilities" to non-nuclear states. It should train nuclear scientists and "foster the exchange of scientific and technical information".⁴ Its mission, in other words, is to prevent the development of nuclear weapons, while spreading nuclear technology to as many countries as possible. It is also responsible for enforcing the Nuclear Non-Proliferation Treaty (NPT), which has the same dual purpose.

There might have been a case, while Eisenhower's dream could still be dreamt. But to persist with this programme long after it became clear that it caused proliferation, not containment, suggests that the global powers are living in a world of make-believe. The IAEA has put nuclear technology "into the hands of those who will know how to strip its civilian casing and adapt

it to the arts of war." It's not difficult. Every state which has sought to develop a nuclear weapons programme over the past 30 years - Israel, South Africa, India, Pakistan, North Korea and Iraq - has done so by diverting resources from its nuclear power programme.⁵ In some cases they built their weapons with the direct assistance of Atoms for Peace. India developed its bomb with the help of fissionable material and expertise from Canada, the United States, Germany, France, Norway and the United Kingdom. Pakistan was able to answer the threat with the help of Canada, the United States, Germany, France, Belgium, China and the United Kingdom. In the name of peace, we equipped these nations for total war.⁶ Now there are about 20 countries which, as a result of foreign help for their civilian nuclear programmes, could, if they choose, become nuclear weapons states within months.⁷ When Russia shipped uranium and the technologies required to build a bomb to Iran, it not only had a right to do so: under the NPT it had a duty to do so.⁸ It's not yet clear whether Iran has stepped over the brink. It is plainly enriching uranium and producing heavy water, which could enable it to build both uranium and plutonium-based bombs. But both processes are also legitimate means of developing materials for nuclear power generation. To enrich uranium from power-grade to bomb-grade you need only pass it through the centrifuges a few more times.⁹ The NPT gives Iran both the right to own the materials and the government requires to use them for a weapons programme. If you want to build a bomb, you simply sign the treaties, join the IAEA, then use your entitlements to do what they were designed to prevent.

Iran certainly has plenty of motives for seeking to become a nuclear power. Israel has enough nuclear weapons to

wipe it off the map. Sheltered by the US, it has no incentive to dismantle them and sign the NPT. Both the United States and the United Kingdom have abandoned their own obligations to disarm, and appear to be contemplating a new generation of nuclear weapons.¹⁰ Both governments have also suggested that they would be prepared to use them pre-emptively.¹¹ Iran is surrounded by US military bases, and is one of the two surviving members of the axis of evil. The other one, North Korea, has been threatening its neighbours with impunity. Why? Because it has the bomb. If Iran is not developing a nuclear weapons programme, it hasn't understood the drift of global politics.

But what can El Baradei do? He can beg Iran to stop developing enriched uranium, but the treaty he is supposed to be enforcing gives him no authority to do so: the government has pointed out that it's legally entitled to pursue all the processes he fears. This is why he's seeking to persuade it to stick to "voluntary agreements". I hope I don't need to explain how dangerous all this is. The official nuclear powers have junked the NPT, while the non-nuclear powers are using it to develop their own programmes. If Hizbullah clobbers Israel, Israel might turn on Iran, and the Middle East could go up in nuclear dust, rapidly followed by everyone else who has decided to join the second nuclear arms race. And the man charged with preventing this from happening is still facilitating it.

The obvious conclusion is that you can't phase out nuclear weapons without phasing out nuclear power. Now that the old treaty has become worse than useless, now that the promise of an earthly paradise of free power and electricity too cheap to meter has been shown to be false, isn't it time for a new nuclear treaty, based not on

Eisenhower's chiliastic fantasy but on grim global realities? Isn't it time for Mr Baradei to stop destroying the world in order to save it?

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CALL FOR ACTION : Voices from Abroad

Toward Next NPT Review Conference and 60th Year of Atomic Bombings

*Yayoi Tsuchida**

The 2004 World Conference against A and H Bombs took place on Aug. 2-9 in Hiroshima and Nagasaki with "Abolition of nuclear weapons, now! Let there be no more Hiroshima and no more Nagasaki!" as its theme. The Conference generated a strong momentum for wider cooperation and even more forceful actions on the common goal of "Abolition of nuclear weapons, now" with the forthcoming NPT Review Conference in coming May and the 60th year of the atomic bombings in August next year as the immediate focus. Sixty six overseas delegates from twenty four countries participated. And more than 10,000 Japanese took part; 260 in the International Meeting (Aug. 2-4), 7,800 in Hiroshima (Aug. 5-6) and 2,500 in Nagasaki (Aug. 8-9).

The Conference had the participation of the government representatives from Mexico, Egypt, Malaysia and Cuba. These are the countries playing leading roles at the international level in the abolition of nuclear weapons campaign as members of the New Agenda Coalition and the Non-Aligned Movement. The Conference enjoyed a high representation of grassroots movements of A-bombed Japan and anti-nuclear movements and radiation victims from all over the world. The governments and grassroots movements together discussed and explored the ways to a world free of nuclear weapons.

In the midst of ongoing attempts of the

US Bush administration to block the way to the abolition of nuclear weapons on the pretext of "counter-terrorism" and "prevention of proliferation", the government representatives categorically asserted that only the abolition of all nuclear weapons provide the guarantee for the resolution of these problems and the only way humanity should go forward. The implementation of the "unequivocal undertaking" to accomplish the elimination of all nuclear weapons, given by the nuclear weapons states at the 2000 NPT Review Conference, was stressed to be crucial. The government representatives put forward their initiatives such as the holding of a nuclear-free zones conference in Mexico prior to the NPT Review Conference and the promotion of a treaty totally banning and eliminating nuclear weapons. And it was emphasized that the role of the movements was increasing in putting more pressure on nuclear weapons states.

Many initiatives were proposed by the anti-nuclear movements. Alice Slater, a representative from the Abolition 2000, announced that the Abolition 2000 had started an "Abolition now!" campaign in May this year, and linked their campaign with the "Abolition of nuclear weapons, now!" signature campaign, launched by the 2003 World Conference against A and H Bombs.

The International Meeting of the World Conference by consensus adopted a

Declaration entitled "Abolition of Nuclear Weapons, Now - Call for Worldwide Action and Solidarity". Based on this, the World Conference - Nagasaki adopted a "Letter to All Governments of the World".

The Declaration puts forward building up of momentum in both the peace movement and public opinion with the common slogan "Abolition of Nuclear Weapons, Now!" and supporting and taking initiatives and global actions aimed at abolition, including the one of the Mayors for Peace proposing a May 1 action in New York. It demands that the nuclear weapons states, both declared and undeclared, make plans for the abolition of their nuclear arsenals and set about implementing them without delay, doing away with the use or threat or development of nuclear weapons. It also calls on all governments to put forth every effort to start and complete negotiations for an international agreement for the abolition of nuclear weapons. It further urges that they vote in support of the resolutions that call for the elimination of nuclear weapons in the coming session of the UN General Assembly. On the governments that base their "security" on the "nuclear deterrence" provided by a nuclear weapons state, it urges them to abandon the current policy and take actions, such as ridding their territories of nuclear weapons. Lastly, the Declaration calls for developing the "Abolition of nuclear weapons, now" signature campaign and building many creative actions all around the world, including joint presentation of the signatures and peace marches.

Actions toward the next year have already begun. The signature campaign is spreading to all corners of the world. In India, too, signature collection has started. In the USA, preparations and discussion on the May 1 action have

begun. In Japan, we are observing the UN Disarmament Week. This includes petitioning the nuclear weapons states in Tokyo and New York.

More than 50% of the participants in the World Conference are youth and students. French Peace Movement is going to send 100-200 young people to the 2005 World Conference. In response to the French initiative, movements of UK, USA and the Philippines are also planning to send young people to Hiroshima next year. Let's develop joint actions and build up a momentum to make the next year a decisive turning point on the way ahead towards the abolition of nuclear weapons.

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CALL FOR ACTION : Voices from Abroad

Abolition Now! Dare to Plan! **Organizing for a Nuclear Weapons Free World**

Alice Slater

This May, the nations of the world will gather at the United Nations in New York City for the 2005 Non-Proliferation Treaty Review Conference, 35 years after five nuclear powers, the US, USSR, UK, France and China, promised to give up their nuclear weapons in return for a promise from all the nations in the world, except three-- India, Pakistan, Israel--never to acquire nuclear weapons. The Treaty is in tatters. The 2004 Preparatory Meeting ended in total disarray. With more than 30,000 nuclear weapons on the planet, the US arrogantly insisted that the NPT should address only problems of nuclear proliferation by "rogue" countries such as North Korea and Iran while maintaining that it wasn't obligated to eliminate its own massive nuclear arsenal. It hypocritically dismissed any relationship between its aggressive \$7 billion program to build new nuclear weapons-bunker busters and more "usable" mini-nukes--and the desire of states to acquire their own nuclear deterrents to avert the onslaught of the Empire.

Here in the belly of the beast, peace activists worked overtime to defeat the Bush imperium. But we are all subjects of the Empire, while so many of our governments shamelessly collude on space militarization, military bases, and weapons research. The very existence of nuclear weapons on our planet is evidence of a failure of democracy. People all over the world, in innumerable polls, have said we should eliminate them, by large majorities, including in India and the US. And now we have a plan! Abolition 2000, a global network of over 2,000 organizations in more than 90 countries is supporting the Mayors for Peace Emergency Campaign to Ban Nuclear

Weapons, spearheaded by the Mayors of Hiroshima and Nagasaki. The Mayors are proposing a timetable for achieving a nuclear-weapon free world, with negotiations to begin in 2005 and conclude by 2010, with global nuclear disarmament implemented no later than 2020. At the 2004 NPT Preparatory Committee Meeting, they brought 15 Mayors to the UN. Next year, through the rising power of support for this Campaign, we hope to have 100 Mayors at the UN. We're organizing with the US anti-war movement, which mobilized millions of people to demonstrate against the Iraq war and the Republican National Convention in New York, for a massive turn-out for nuclear disarmament on May 1st, the day before the NPT opens. We're calling on Heads of States to show up at the UN with the power to authorize negotiations.

And if the US refuses to negotiate, we will work to get talks started as in the Ottawa process when Canada hosted treaty negotiations with governments and NGOs to ban landmines, despite US refusal to participate. Which will be the first country to host negotiations for nuclear disarmament? There are hopeful developments in India and Pakistan. The Congress Party is revising Rajiv Gandhi's plan for nuclear disarmament. Members of CNDP and others are urging India to take the lead in a "Delhi Process." Pakistan would surely follow. Indeed, following the encouraging talks between India and Pakistan, Musharraf said he wants India and Pakistan to rid themselves of their nuclear weapons during his lifetime. When questioned, in the *The Hindu* (news daily), whether India and



Pakistan would set an example before the world by jointly announcing that they were going to bring down their nuclear arsenal or dispose of it altogether he replied, "That is a possibility... But let me tell you, this has to be initiated by India". And China has repeatedly supported General Assembly resolutions calling for nuclear disarmament

over a number of years as well as resolutions to prevent the weaponization of space, supported by Russia. Perhaps Asia can be persuaded to take the lead and host the negotiations.

But the first step for nuclear disarmament is to know where all the deadly materials are

before we put them under lock and key-"under strict and effective international control" as the International Court of Justice ruled in its landmark 1996 decision which found that "all states are under a legal obligation to pursue in good faith and bring to a conclusion negotiations leading to nuclear disarmament in all its aspects." Citizens can help by locating their nuclear mines, processing facilities, test sites, research reactors, civilian power reactors, bomb storage sites and reporting it for a compilation prepared by Reaching Critical Will, NGO Shadow Report on Nuclear Disarmament: Accountability is Democracy, Transparency is Security. NGOs can provide a head start by doing an inventory of the wherewithal to make nuclear bombs.

(See www.reachingcriticalwill.org)

Even the Washington-based Carnegie Endowment for International Peace, while continuing to support US hegemony as a means of keeping a lid on the spread of nuclear weapons and terror-by advising the US to threaten military "sticks" against recalcitrant "rogue" proliferators if "carrots" won't work-even they, in their recent report, Universal Compliance: A Strategy for Nuclear Security, alarmed at the disintegration of the NPT, call for a minimal PLAN for the dismantlement of nuclear arsenals, to show that nuclear disarmament obligations are taken seriously. Let us take them up on their call for a plan. What would disarmament look like in the United States? In Russia? In France? In England? In China? In India? In Pakistan? In Israel? What conditions would have to be met in order for them to start seriously dismantling-in an irreversible manner-their nuclear stockpiles? Such a plan would manifest a State's leadership ability, around which the non-nuclear weapons states and NGOs could rally. Non-nuclear weapons states should also begin drafting their own plans for disarmament incorporating verifiable non-proliferation initiatives including existing nuclear power and research reactor facilities. Don't forget, every nuclear power plant is a poten-

tial bomb factory! Abolition 2000 has already produced a plan. Working with lawyers, scientists and policy makers we drafted a Model Nuclear Weapons Convention which is available to willing nations as a starting point for making their plans!!

This year, growing numbers of activists' energies and resources are focused on our new Campaign, Abolition Now! Dare to Plan!, to mobilize civil society to support the Mayors' plan for a nuclear weapons free world by 2020. In the lead-up to the NPT Review Conference at the UN in New York this May, individuals, citizen groups, and community and civic leaders are taking action-enrolling their mayors, signing petitions, holding community meetings, contacting parliamentarians and Heads of States-- to support the call for concrete plans for a nuclear free world during the 60th Anniversary Year of Remembrance and Action for a Nuclear Weapons Free World. Sign your organization up for the Campaign and join the rising movement for Abolition Now! See www.abolitionnow.org to learn how you can join up with this promising new initiative.

* Alice Slater from the US is a leading member of the Abolition 2000. She also heads the Global Resource Action Center for the Environment, 215 Lexington Ave., New York, NY 10016. 212-726-9161 (tel), 212-726-9160 (fax) www.gracelinks.org, www.abolitionnow.org



FACT SHEET

How Nuclear Power Works

Marshall Brain

Nuclear power plants provide about 17 percent of the world's electricity. Some countries depend more on nuclear power for electricity than others. In France, for instance, about 75 percent of the electricity is generated from nuclear power, according to the International Atomic Energy Agency. In the United States, nuclear power supplies about 15 percent of the electricity overall, but some states get more power from nuclear plants than others. There are more than 400 nuclear power plants around the world, with more than 100 in the United States.

Have you ever wondered how a nuclear power plant works or how safe nuclear power is? In this article, we will examine how a nuclear reactor and a power plant work. We'll explain nuclear fission and give you a view inside a nuclear reactor.

Uranium

Uranium is a fairly common element on Earth, incorporated into the planet during the planet's formation. Uranium is originally formed in stars. Old stars exploded, and the dust from these shattered stars aggregated together to form our planet. Uranium-238 (U-238) has an extremely long half-life (>4.5 billion years), and therefore is still present in fairly large quantities. U-238 makes up 99 percent of the uranium on the planet. U-235 makes up about 0.7 percent of the remaining uranium found naturally, while U-234 is even more rare and is formed by the decay of U-238. (Uranium-238 goes through many stages or alpha and beta decay to form a stable isotope of lead, and U-234 is one link in

that chain.)

Uranium-235 has an interesting property that makes it useful for both nuclear power production and for nuclear bomb production. U-235 decays naturally, just as U-238 does, by alpha radiation. U-235 also undergoes spontaneous fission a small percentage of the time. However, U-235 is one of the few materials that can undergo induced fission. If a free neutron runs into a U-235 nucleus, the nucleus will absorb the neutron without hesitation, become unstable and split immediately. See the note How Nuclear Radiation Works for complete details.

Nuclear Fission

The animation below [not included here] shows a uranium-235 nucleus with a neutron approaching from the top. As soon as the nucleus captures the neutron, it splits into two lighter atoms and throws off two or three new neutrons (the number of ejected neutrons depends on how the U-235 atom happens to split). The two new atoms then emit gamma radiation as they settle into their new states. There are three things about this induced fission process that make it especially interesting:

The probability of a U-235 atom capturing a neutron as it passes by is fairly high. In a reactor working properly (known as the critical state), one neutron ejected from each fission causes another fission to occur.

- The process of capturing the neutron and splitting happens very

quickly, on the order of picoseconds (1×10^{-12} seconds).

- An incredible amount of energy is released, in the form of heat and gamma radiation, when a single atom splits. The two atoms that result from the fission later release beta radiation and gamma radiation of their own as well. The energy released by a single fission comes from the fact that the fission products and the neutrons, together, weigh less than the original U-235 atom. The difference in weight is converted directly to energy at a rate governed by the equation $E = mc^2$.

Something on the order of 200 MeV (million electron volts) is released by the decay of one U-235 atom (if you would like to convert that into something useful, consider that 1 eV is equal to 1.602×10^{-12} ergs, 1×10^7 ergs is equal to 1 joule, 1 joule equals 1 watt-second, and 1 BTU equals 1,055 joules). That may not seem like much, but there are a lot of uranium atoms in a pound of uranium. So many, in fact, that a pound of highly enriched uranium as used to power a nuclear submarine or nuclear aircraft carrier is equal to something on the order of a million gallons of gasoline. When you consider that a pound of uranium is smaller than a baseball, and a million gallons of gasoline would fill a cube 50 feet per side (50 feet is as tall as a five-story building), you can get an idea of the amount of energy available in just a little bit of U-235.

In order for these properties of U-235 to work, a sample of uranium must be enriched so that it contains 2 percent to 3 percent or more of uranium-235. Three-percent enrichment is sufficient for use in a civilian nuclear reactor used for power generation. Weapons-grade uranium is composed of 90-percent or more U-235.

Inside a Nuclear Power Plant

To build a nuclear reactor, what you need is some mildly enriched uranium. Typically, the uranium is formed into pellets with approximately the same diameter as a dime and a length of an inch or so. The pellets are arranged into long rods, and the rods are collected together into bundles. The bundles are then typically submerged in water inside a pressure vessel. The water acts as a coolant. In order for the reactor to work, the bundle, submerged in water, must be slightly supercritical. That means that, left to its own devices, the uranium would eventually overheat and melt.

To prevent this, control rods made of a material that absorbs neutrons are inserted into the bundle using a mechanism that can raise or lower the control rods. Raising and lowering the control rods allow operators to control the rate of the nuclear reaction. When an operator wants the uranium core to produce more heat, the rods are raised out of the uranium bundle. To create less heat, the rods are lowered into the uranium bundle. The rods can also be lowered completely into the uranium bundle to shut the reactor down in the case of an accident or to change the fuel.

The uranium bundle acts as an extremely high-energy source of heat. It heats the water and turns it to steam. The steam drives a steam turbine, which spins a generator to produce power. In some reactors, the steam from the reactor goes through a secondary, intermediate heat exchanger to convert another loop of water to steam, which drives the turbine. The advantage to this design is that the radioactive water/steam never contacts the turbine. Also, in some reactors, the coolant fluid in contact with the reactor core is gas (carbon dioxide) or liquid metal (sodium, potassium); these types of reactors allow the core to be operated at higher temperatures.

Outside a Nuclear Power Plant

Once you get past the reactor itself, there is very little difference between a nuclear power plant and a coal-fired or oil-fired power plant except for the source of the heat used to create steam. Electricity for homes and businesses comes from this generator at the Shearon Harris plant. It produces 870 megawatts.

Pipes carry steam to power the generator at the power plant. The reactor's pressure vessel is typically housed inside a concrete liner that acts as a radiation shield. That liner is housed within a much larger steel containment vessel. This vessel contains the reactor core as well the hardware (cranes, etc.) that allows workers at the plant to refuel and maintain the reactor. The steel containment vessel is intended to prevent leakage of any radioactive gases or fluids from the plant.

Finally, the containment vessel is protected by an outer concrete building that is strong enough to survive such things as crashing jet airliners. These secondary containment structures are necessary to prevent the escape of radiation/radioactive steam in the event of an accident like the one at Three Mile Island. The absence of secondary containment structures in Russian nuclear power plants allowed radioactive material to escape in an accident at Chernobyl.

Workers in the control room at the nuclear power plant can keep an eye on the nuclear reactor and take action if something goes wrong.

Uranium-235 is not the only possible fuel for a power plant. Another fissionable material is plutonium-239. Plutonium-239 can be created easily by bombarding U-238 with neutrons -- something that happens all the time in a nuclear reactor.

Subcriticality, Criticality and

Supercriticality When a U-235 atom splits, it gives off two or three neutrons (depending on the way the atom splits). If there are no other U-235 atoms in the area, then those free neutrons fly off into space as neutron rays. If the U-235 atom is part of a mass of uranium -- so there are other U-235 atoms nearby -- then one of three things happens:

- If, on average, exactly one of the free neutrons from each fission hits another U-235 nucleus and causes it to split, then the mass of uranium is said to be critical. The mass will exist at a stable temperature. A nuclear reactor must be maintained in a critical state.
- If, on average, less than one of the free neutrons hits another U-235 atom, then the mass is subcritical. Eventually, induced fission will end in the mass.
- If, on average, more than one of the free neutrons hits another U-235 atom, then the mass is supercritical. It will heat up.

For a nuclear bomb, the bomb's designer wants the mass of uranium to be very supercritical so that all of the U-235 atoms in the mass split in a microsecond. In a nuclear reactor, the reactor core needs to be slightly supercritical so that plant operators can raise and lower the temperature of the reactor. The control rods give the operators a way to absorb free neutrons so the reactor can be maintained at a critical level.

The amount of uranium-235 in the mass (the level of enrichment) and the shape of the mass control the criticality of the sample. You can imagine that if the shape of the mass is a very thin sheet, most of the free neutrons will fly off into space rather than hitting other U-235 atoms. A sphere is the optimal shape. The amount of urani-

um-235 that you must collect together in a sphere to get a critical reaction is about 2 pounds (0.9 kg). This amount is therefore referred to as the critical mass. For plutonium-239, the critical mass is about 10 ounces (283 grams).

What Can Go Wrong

Well-constructed nuclear power plants have an important advantage when it comes to electrical power generation, they are extremely clean. Compared with a coal-fired power plant, nuclear power plants are a dream come true from an environmental standpoint. A coal-fired power plant actually releases more radioactivity into the atmosphere than a properly functioning nuclear power plant. Coal-fired plants also release tons of carbon, sulfur and other elements into the atmosphere (see this page for details).

Unfortunately, there are significant problems with nuclear power plants:

- Mining and purifying uranium has not, historically, been a very clean process.
- Improperly functioning nuclear power plants can create big problems.

The Chernobyl disaster is a good recent example. Chernobyl was poorly designed and improperly operated, but it dramatically shows the worst-case scenario. Chernobyl scattered tons of radioactive dust into the atmosphere.

- Spent fuel from nuclear power plants is toxic for centuries, and, as yet, there is no safe, permanent storage facility for it.
- Transporting nuclear fuel to and from plants poses some risk, although to date, the safety record in the United States has been good.

These problems have largely derailed the creation of new nuclear power plants in the United States. Society seems to have decided that the risks outweigh the rewards.

Note : This article is downloaded from
<<http://people.howstuffworks.com/nuclear-power.htm>>



How Does Radiation Affect Humans?

Radiation may come from either an external source, such as an x-ray machine, or an internal source, such as an injected radioisotope. The impact of radiation on living tissue is complicated by the type of radiation and the variety of tissues. In addition, the effects of radiation are not always easy to separate from other factors, making it a challenge at times for scientists to isolate them. An overview may help explain not only the effects of radiation but also the motivation for studying them, which led to much of the research examined by the Advisory Committee.

What effect can ionizing radiation have on chemical bonds?

The functions of living tissue are carried out by molecules, that is, combinations of different types of atoms united by chemical bonds. Some of these molecules can be quite large. The proper functioning of these molecules depends upon their composition and also their structure (shape). Altering chemical bonds may change composition or structure. Ionizing radiation is powerful enough to do this. For example, a typical ionization releases six to seven times the energy needed to break the chemical bond between two carbon atoms. This ability to disrupt chemical bonds means that ionizing radiation focuses its impact in a very small but crucial area, a bit like a karate master focusing energy to break a brick. The same amount of raw energy, distributed more broadly in nonionizing form, would have much less effect. For example, the amount of ener-

gy in a lethal dose of ionizing radiation is roughly equal to the amount of thermal energy in a single sip of hot coffee. Only a small part of this DNA needs to be read at any one time to build a specific molecule. Each cell is continually reading various parts of its own DNA as it constructs fresh molecules to perform a variety of tasks. It is worth remembering that the structure of DNA was not solved until 1953, nine years after the beginning of the period studied by the Advisory Committee. We now have a much clearer picture of what happens within a cell than did the scientists of 1944.

What effect can ionizing radiation have on DNA?

Ionizing radiation, by definition, "ionizes," that is, it pushes an electron out of its orbit around an atomic nucleus, causing the formation of electrical charges on atoms or molecules. If this electron comes from the DNA itself or from a neighbouring molecule and directly strikes and disrupts the DNA molecule, the effect is called direct action. This initial ionization takes place very quickly, in about 0.000000000000001 of a second. However, today it is estimated that about two-thirds of the damage caused by x rays is due to indirect action. This occurs when the liberated electron does not directly strike the DNA, but instead strikes an ordinary water molecule. This ionizes the water molecule, eventually producing what is known as a free radical. A free radical reacts very strongly with other molecules as it seeks to

restore a stable configuration of electrons. A free radical may drift about up to 10,000,000,000 times longer than the time needed for the initial ionization (this is still a very short time, about 0.00001 of a second), increasing the chance of it disrupting the crucial DNA molecule. This also increases the possibility that other substances could be introduced that would neutralize free radicals before they do damage.

Neutrons act quite differently. A fast neutron will bypass orbiting electrons and occasionally crash directly into an atomic nucleus, knocking out large particles such as alpha particles, protons, or larger fragments of the nucleus. The most common collisions are with carbon or oxygen nuclei. The particles created will themselves then set about ionizing nearby electrons. A slow neutron will not have the energy to knock out large particles when it strikes a nucleus. Instead, the neutron and the nucleus will bounce off each other, like billiard balls. In so doing, the neutron will slow down, and the nucleus will gain speed. The most common collision is with a hydrogen nucleus, a proton that can excite or ionize electrons in nearby atoms.

What immediate effects can ionizing radiation have on living cells?

All of these collisions and ionizations take place very quickly, in less than a second. It takes much longer for the biological effects to become apparent. If the damage is sufficient to kill the cell, the effect may become noticeable in hours or days. Cell "death" can be of two types. First, the cell may no longer perform its function due to internal ionization; this requires a dose to the cell of about 100 gray (10,000 rad). (For a definition of gray and rad, see the section below titled "How Do We Measure the Biological Effects of Radiation?") Second, "reproductive death" (mitotic inhibition) may occur when a cell can no longer reproduce, but still performs its other functions.

This requires a dose of 2 gray (200 rad), which will cause reproductive death in half the cells irradiated (hence such a quantity is called a "mean lethal dose.") Today we still lack enough information to choose among the various models proposed to explain cell death in terms of what happens at the level of atoms and molecules inside a cell. If enough crucial cells within the body totally cease to function, the effect is fatal. Death may also result if cell reproduction ceases in parts of the body where cells are continuously being replaced at a high rate (such as the blood cell-forming tissues and the lining of the intestinal tract). A very high dose of 100 gray (10,000 rad) to the entire body causes death within twenty-four to forty-eight hours; a whole-body dose of 2.5 to 5 gray (250 to 500 rad) may produce death within several weeks. At lower or more localized doses, the effect will not be death, but specific symptoms due to the loss of a large number of cells. These effects were once called nonstochastic; they are now called deterministic. A beta burn is an example of a deterministic effect.

What long-term effects can radiation have?

The effect of the radiation may not be to kill the cell, but to alter its DNA code in a way that leaves the cell alive but with an error in the DNA blueprint. The effect of this mutation will depend on the nature of the error and when it is read. Since this is a random process, such effects are now called stochastic. Two important stochastic effects of radiation are cancer, which results from mutations in nongerm cells (termed somatic cells), and heritable changes, which result from mutations in germ cells (eggs and sperm).

How can ionizing radiation cause cancer?

Cancer is produced if radiation does not kill the cell but creates an error in the DNA blueprint that contributes to

eventual loss of control of cell division, and the cell begins dividing uncontrollably. This effect might not appear for many years. Cancers induced by radiation do not differ from cancers due to other causes, so there is no simple way to measure the rate of cancer due to radiation. During the period studied by the Advisory Committee, great effort was devoted to studies of irradiated animals and exposed groups of people to develop better estimates of the risk of cancer due to radiation. This type of research is complicated by the variety of cancers, which vary in radiosensitivity. For example, bone marrow is more sensitive than skin cells to radiation-induced cancer.

Large doses of radiation to large numbers of people are needed in order to cause measurable increases in the number of cancers and thus determine the differences in the sensitivity of different organs to radiation. Because the cancers can occur anytime in the exposed person's lifetime, these studies can take seventy years or more to complete. For example, the largest and scientifically most valuable epidemiologic study of radiation effects has been the ongoing study of the Japanese atomic bomb survivors. Other important studies include studies of large groups exposed to radiation as a consequence of their occupation (such as uranium miners) or as a consequence of medical treatment. These types of studies are discussed in greater detail in the section titled "How Do Scientists Determine the Long-Term Risks from Radiation?"

How can ionizing radiation produce genetic mutations?

Radiation may alter the DNA within any cell. Cell damage and death that result from mutations in somatic cells occur only in the organism in which the mutation occurred and are therefore termed somatic or nonheritable effects.

Cancer is the most notable long-term somatic effect. In contrast, mutations that occur in germ cells (sperm and ova) can be transmitted to future generations and are therefore called genetic or heritable effects. Genetic effects may not appear until many generations later. The genetic effects of radiation were first demonstrated in fruit flies in the 1920s. Genetic mutation due to radiation does not produce the visible monstrosities of science fiction; it simply produces a greater frequency of the same mutations that occur continuously and spontaneously in nature.

Like cancers, the genetic effects of radiation are impossible to distinguish from mutations due to other causes. Today at least 1,300 diseases are known to be caused by a mutation. Some mutations may be beneficial; random mutation is the driving force in evolution. During the period studied by the Advisory Committee, there was considerable debate among the scientific community over both the extent and the consequences of radiation-induced mutations. In contrast to estimates of cancer risk, which are based in part on studies of human populations, estimates of heritable risk are based for the most part upon animal studies plus studies of Japanese survivors of the atomic bombs.

The risk of genetic mutation is expressed in terms of the doubling dose: the amount of radiation that would cause additional mutations equal in number to those that already occur naturally from all causes, thereby doubling the naturally occurring rate of mutation.

It is generally believed that mutation rates depend linearly on dose and that there is no threshold below which mutation rates would not be increased. Spontaneous mutation (unrelated to radiation) occurs naturally at a rate of

approximately 1/10,000 to 1/1,000,000 cell divisions per gene, with wide variation from one gene to another.

Attempts have been made to estimate the contribution of ionizing radiation to human mutation rates by studying offspring of both exposed and nonexposed Japanese atomic bomb survivors. These estimates are based on comparisons of the rate of various congenital defects and cancer between exposed and nonexposed survivors, as well as on direct counting of mutations at a small number of genes. For all these endpoints, no excess has been observed among descendants of the exposed survivors.

Given this lack of direct evidence of any increase in human heritable (genetic) effects resulting from radiation exposure, the estimates of genetic risks in humans have been compared with experimental data obtained with laboratory animals. However, estimates of human genetic risks vary greatly from

animal data. For example, fruit flies have very large chromosomes that appear to be uniquely susceptible to radiation. Humans may be less vulnerable than previously thought. Statistical lower limits on the doubling dose have been calculated that are compatible with the observed human data. Based on our inability to demonstrate an effect in humans, the lower limit for the genetic doubling dose is thought to be less than 100 rem.

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