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What does the father say then to his little girl when he hikes her up a certain hill ?
He says "Don't he afraid little dove.
Under this hill is buried an old atomic power plant, but it's perfectly safe."
And then, when the frightened little girl still doesn't want to climb it, what does he tell her ?
He says "But, really, it's quite all right.
Here, if you're frightened, give me your hand. Now give me your other hand. Now give the your other hand..."

Chernobyl: A Novel ***Frederik Pohl***

Two years ago this month a 'temple' of modern Russia blew its top. The radioactive poisons contained in it were spread far and wide. The air we breathe, the waters we drink, the land on which grows the food we eat all were affected. How many people died *i* How many more shall die in the future ? Experts have come up with numbers which differ from each other all the way from a few thousand to hundreds of thousands. The fall-out from Chernobyl was measured by a large number of independent observers and is not significantly disputed among experts. Then why are their estimates of the resulting malignancies so significantly different ?

Effects of large doses of radiation—like those suffered by people of Hiroshima and Nagasaki arc immediately apparent. Besides an early death, they include skin burns, cataracts, loss of hair, loss of apctite, nausea, vomiting and sterility. But what *of* those who live far from Chernobyl or live near normally running nuclear plants ? It is the unapparent and distant damage caused by low doses of radiation, which is a nutter of dispute.

The main cause of the dispute is the systematic campaign of disinformation carried out by promoters of nuclear power. People have been consistently told that cancer hazard from radiation exposure is smaller than it truly is. For decades the myth of a 'safe threshold dose'—below which radiation was harmless or even beneficial - was propagated. Today even that citadel of 'expertise', the International. Commission for Radiological Protection (ICRP) accepts that there is no safe dose of radiation. In fact al) the latest data have confirmed that the critics of nuclear industry have been right all along : radiation damage is cumulative and irreversible. Radiation is low doses is more harmful than previously believed. (Sec article "Radiating Complacency" in Anumukti vol. 1 number 3, Dec- '87)

Radiation like political rhetoric pays special attention to the weaker sections of the society. Sensitivity to radiation induced cancer is highest at youngest ages of exposure. "When a population of normally mixed ages is irradiated, about 73% Oi the cadiation induced cancers develop in people who were aged 20 years or younger at the time of exposure." (Goffman : Radiation and Human Health) The sick, the hungry and the very old are more prone to radiation harm than healthy adults. Women are twice as susceptible to radiation induced cancers as men.

Cheer-leaders for the nuclear industry have repeatedly claimed that many more people die from spontaneous cancers than shall die of Chernobyl cancer; in fact, that Chernobyl cancers will be undetectable. That is true. But undetectable is not the same as imaginary. Even a million real malignancies do not alter cancer statistics because a million is within the 'error bars'.

Information can be a deadly weapon. It is not only an 'act of Go a government made famine or an atomic bomb that can kill a million people. Disinformation which understates hazards does the task equally well. "In the USA alone 1½ million people per generation will get unnecessary cancer just from the unnecessary nigh doses used in medical diagnostic X-rays." (Goffman &: O' Conner : X-Rays : Health Effects of Common Exams)

It is a strange morality which finds it acceptable to kill other human beings so long is the victims remain faceless undetectables. The only antidote is a well informed citizenry which is not shy of resistance. Edmund Burke put it well long ago : "All that is necessary for the triumph *of* evil is that good men do nothing."

Radiation Effects in Tahiti

'Throughout the Pacific we're now seeing the same diseases and conditions that occured at Hiroshima and Nagasaki. - stillbirths an*d* growth retardation," says Or. Tony Atkinson of the International Physicians for the Prevention of Nuclear War (IPPNW). Atkinson was speaking in relation to the over 225 Tahitiaus who had paid thousands of dollars to fly to New Zealand for cancer treatment rather than attend free hospitals with sophisticated equipment for cancer treatment run by the French military in Tahiti.

The Tahitiaus distrust the French military because they believe that their cancers are a result of the French nuclear testing at Mururoa. Until now there has been no way of conclusiv-ely proving this. Dr.Atkinson soon hopes to be able to begin a study in Tahiti aimed at analysing residents' teeth for Strontium-90- u known radionuclide.

In Tahiti's military run hospitals, patients with cancers suspected of being radiation induced have their files declared security documents This particularly applies to those who have serviced ships and planes on Mururoa. There's almost a total security blackout on the health of Tahitians. The health statistics are falsified and don't list everyone who dies, he says. Until 1980, when the World Health Organization intervened, French authorities in Tahiti did not even keep a cancer registry. There are still not statistics for thyroid cancer in Tahitian men - known result of radiation exposure after a bomb explosion.

French Polynesia has the highest number of cancer deaths in the Pacific. Cancers caused by radiation such as leukemia, for example, arc double what they arc in American Samoa on the other side of the Pacific.

Source : WISE News Communique : 286.2901

How Many Chernobyls ?

The Nuclear Power Industry Could Produce Three More Chernobyl-Sized Accidents by the Year 2000

Through April 25, 1986, the Chernobyl 4 nuclear reactor was one of the world's most reliable. It had the best operating record of any power reaction in the Soviet Union, producing at 83 percent of capacity in 1985. But on April 26th it exploded, hurling the contents *of i*ts radioactive core across Europe.

That such a seemingly reliable reactor should be the site of the world's worst nuclear power accident raises fundamental questions about the safety of nuclear power everywhere. Like Three Mile Island before it, Chernobyl reminded us that capturing the energy of the atom is, by its nature, a risky proposition. But how risky is it? How many Chernobyls might nudear power have in store for us ?

Long before Chernobyl, nuclear experts had agreed about the possibility of accidents killing people and irradiating large areas. Indeed, despite major design differences between the Chernobyl plant and those used in the West, che risk of a serious accident is one characteristic that all large nuclear reactors share.

The real argument is over the frequency of serious accidents. Defenders of the industry claim catastrophic accidents are extremely rare events. At the United States Atomic Energy Commission, precursor to the Nuclear Regulatory Commission (NRC), Dixie Lee Ray often argued that nuclear power was safer than eatng because more people had choked to death than had died from nuclear power.

Since the accident at Chernobyl, however, t seems inevitable that many people will die from nuclear power, and for the most part, the risk they have taken is an involuntary one.

The Calculus of Catastrophe

To calculate the odds of nuclear disaster, engineers developed a modeling tool in the early 1960s known as probabilistic risk asscssnaeut. Using this method, analysts study accident scenarios and failure probabilities of critical components, estimate safety margins, and develop overall estimates of risk.

Government-sponsored studies in the United States and West Germany have estimated that severe nuclear core-damaging accidents should occur once every 10,000 "reactor years." (A reactor year is a unit used in discussing experience in operating nuclear reactors. The world's current total of 366 operating nuclear power reactors chalked up 36ft reactor years in 1986, for example, regardless of how many days they were actually on line.)

Even if the one-in 10,000 figure, is correct, assuming that 500 nuclear plants are in operation by the late 1990s, there would he one core-damaging accident every 20 years. However, a post-Three Mile Island study by the Oak Ridge National laboratory in 1982 raised the risk to once in 4,000 reactor years or once every eight years.

Experience so far indicates that these o-tinntes are based on uncertain assumptions that often do not reflect actual plant conditions. For example, circuit breakers connected to crucial safety systems at the Salem nuclear plant in New Jersey were estimated to have a one in 33,000 chance of failing. Yet, two circuit breakers malfunctioned in one week. Only prompt action by an alert operator prevented a serious accident.

Redundant safety systems have also been simultaneously destroyed, supposedly a highly improbable event, leaving no margin for safety. The 1975 Browns Ferry fire in Alabama destroyed several redundant electrical systems, shutting down the control room and threatening catastrophe.

The limitations of probabilistic risk assessment as an accurate forecasting tool were detailed in a 1986 report by the Paris-based Nuclear Energy Agency, which concluded that they arc useful in evaluating the reliability of particular plant components but of uncertain validity when assessing overall safety.

So far nuclear power has been more accident-prone than predicted by the experts. Three Mile Island occurred after 1,500 reactor years, and Chernobyl after another 1,900 Core-damaging accidents arc occurring at over twice the rate predicted by the Oak Ridge study, casting doubt on the accuracy of these major probabilistic assessments.

Of course, not all core-damaging accidents result in major releases of radioactive material, at Three Mile Island the secondary containment vessel held virtually all the core material inside. On the other hand, much of the Chernobyl core was deposited on forests and farmland thousands of kilometers away.

With more nuclear power plants coming on line, especially in Europe, the chances and likely frequency of a serious accident arc increasing .is well. Assuming a continuation of the accident rate of one core-damaging accident every 1,900 reactor years, there would be three additional accidents by the year 2000.

At that point, with 500 reactors in operation, core-damaging accidents would occur every four years. Scientists *in* Sweden and West Germany have used this data to estimate a 70 percent probability that another such accident will occur in the next 5.4 years.

These figures are not a prediction of what will happen in the future, but rather an indication that the worldwide nuclear accident rate has already become unacceptable. The nuclear industry cannot, and perhaps should not, survive the public opposition that would be the unavoidable consequence of a continuation of this dismal history.

Blind Faith in Technology

When Pennsylvania's Governor Richard Thornburgh toured nuclear facilities in the Soviet Union in 1979, he was informed that nuclear safety was "a solved problem" and that it would soon be possible to safely operate a reactor in Red Square. Three Mile Island, he was told, had little relevance to the Soviet nuclear program.

Complacency and arrogance clearly helped sow the seeds of disaster in the Ukraine. The Chernobyl plant exploded when operators overrode multiple safety systems during a test. These actions, along with statements by Soviet officials, demonstrate that the Soviets had an almost blind faith in technology.

Ironically, the excellent performance of the Chernobyl plant may have bolstered this overconfidence, encouraging the operators' blatant violations of safety procedures.

The accidents at Chernobyl and Three Mile Island can be traced to human mistakes and, more specifically, to the "man-machine interface" at the center of complex technology.

The President's Confuession on the Accident at Three Mile Island stated in its 1979 report : "Equipment can and should be improved to add further safaty. to nuclear power plants-But as the evidence accumulated, it became clear that the fundamental problems are people-related problems and not equipment problems."

The conclusions of the official Soviet report on the Chernobyl disaster were similar : 'The prime cause of the accident was an extremely improtable combination of violations of instructions *in* operating rules committed by the staff of the unit.-The accident assumed catastrophic proportions ...... because all the negative aspects of the reactor design...were brought out by the operators."

The fact that operators helped cause both accidents means that plant control systems and operator-training programs need to be upgraded. It does not mean, however, that the solution is to replace human operators with robots. Computer systems can malfunction or be misprogranuned, and some aspects of plant operation require human judgment. As long as people run nuclear power plants, human error can never be entirely avoided.

Incidents in the United States demonstrate that carelessness and willful violation of operating procedures arc not confined to Soviet nuclear plants. Less than a year after Chernobyl, an engineer at the U.S. Nuclear Regulatory Commission detailed a longstanding pattern of operators turning off important safety systems unknowingly or through carelessness. Were problems to develop while these safety systems were turned off, then an otherwise manageable situation could have gone dangerously out of control.

Irresponsible operators are another problem. In April 1987, fourteen of twenty-six nuclear workers of the Tennessee Valley Authority, America's largest nuclear utility, tested positive for drug use. At other nuclear facilities, cheating on operator licensing exams has become "common.

Operators at the Peach Bottom plant in Pennsylvania were found sleeping in the control room with the reactor at full power in 1987. The NRC shut down the plant, and the owners promised to rectify the situation through a Volt*ery* of measures, including replacing comfortable high-back chairs with low-back models.

A Dismal Record'

Despite post-Three Mile Island improvements, American nuclear plants arc still plagued by problems. There were almost 3,000 plant mishaps and 764 emergency shutdowns in 1985, up 28 percent from 1984.

The average nuclear plant in the U.S. was shut down six times in 1985, and the industry as a whole averaged two shutdowns for day. More than just a sign of trouble, emergency shutdowns are sudden, violent procedures that stress a nuclear plant's intricate and crucial plumbing, and can impair safety.

Although most of these shutdowns were due to minor problems, at least 18 were serious accidents that could have led to core damage.

One of nuclear power's fundamental problems is that even the most trivial incident could one day lead to catastrophe, a fact made possible by the enormous complexity of these systems. Significant nuclear incidents have already been initiated by hungry field mice, a worker's loose shirttail and an improperly used candle.

Intensified Congressional and regulatory scrutiny of the American nuclear power industry since the Chernobyl accident has apparently done little to improve the safety record. Indeed, a string *of incidents in* the year since the disaster show just how far from foolproof reactor safety systems are. The most consistent element in these incidents is human error combined with design flaws.

The nuclear power industry's flawed record since Chernobyl is not just a superpower problem. France, largely quiescent about the risks of nuclear power since the election of President Francois Mitterand in 1981, and now reliant on nuclear power for 70 percent of its electricity, was reawakened in April 1987 by two accidents.

At least 25 tons of potentially combustible sodium coolant leaked from the experimental Superphenix breeder reactor on the Rhone River for two weeks before the source could be identified. Next, the Tricastin uranium enrichment plant, also on the Rhone, suffered a leak of highly corrosive uranium hexaafluoride that injured seven workers.

Reports of incidents and controversies since Chernobyl have trickled in from other parts of the world as well, including Brazil, Mexico, South Africa, *Spain* and the United Kingdom. Because many countries do not report accidents at nuclear installations, and consider all nuclear issues to be state secrets, it is quite possible that the list of reported incidents remains incomplete.

Aging Nucear Plants

There are other problems on the safety horizon. The world now has a growing number of aging nuclear plants, many beginning to show signs of deterioration. In 1990 there will be 35 plants that are at least 25 years old; by 1995 there will be 66, and in 2000 there will be 150.

The nuclear industry has little experience with aging nuclear plants, but is about to get a crash course as many plants have already developed unanticipated problems. Among the most serious are corrosion of steam generators and embrittlement of steel pressure vessels due to neutron bombardment. Both of these problems are rampant in some types of plants; they involve critical components and arc difficult to remedy.

The problems of aging plants were highlighted in late 1986 when Virginia's 13-year-old Surry nuclear plant suffered a "guillotine break" in a hot water pipe. Four workers were killed by steam burns and the plant was closed for several months while the plumbing system was thoroughly inspected.

After the accident, inspectors found extensive corrosion of pipes in areas where decay had never been anticipated. A back-up valve that should have stopped the surge of scalding water had not been properly installed. In some places half-inch pipes had been eaten away to less than the thickness of a credit card.

This incident and others like it indicate that nuclear plants are aging in unexplained and dangerous ways, and that nuclear technology continues to present engineers with unwelcome surprises.

Aging U.S. military reactors may present more immediate hazards than their commercial counterparts, a point reinforced by their similarity in design to the Chernobyl reactor. After Chernobyl, the U.S. Department of Energy (DOE), which runs the military's nuclear programs, was forced to temporarily shut down all of the reactors and processing plants that produce plutonium for nuclear warheads.

Independent reviews showed that the plants were antiquated, poorly managed, largely unregulated and a danger to workers and the general public. Ironically, a Soviet nuclear accident may have saved the U.S. nuclear weapons industry from an embarrassing and lethal mishap.

The first facilities to be closed were two processing plants on the Hanford nuclear reservation, a vast expanse of desert bordering the Columbia River in eastern Washington state. On September 29, 1986, workers began a routine procedure of pumping plutonium, suspended in a liquid solution, from a separation facility to a storage tank in the plutonium finishing plant. Because a transfer line was not sealed, the plutonium was diverted to an already full storage tank.

Had enough of the new plutonium mixed into the full tank, plutonium concentrations could have approached "criticality", risking a nuclear chain reaction and releases of radiation. The Department of Energy ranked the incident as a four on a danger scale of five.

During the same month, the Government Accounting Office (GAO)of the U.S. Congress revealed that several of DOE's nuclear weapons production sites, including the Hanford reservation, were severely contaminated with both radioactive and toxic chemicals. In some places concentrations of the materials in soil and groundwater were hundreds or even thousands of times higher than safety guidelines.

Later, a scries of critical reviews led to the shutdown of the N-reactor at Han ford, the oldest of the nation's plutonium production reactors. The N-reactor *is* the U.S. reactor most similar to the Chernobyl design—it employs a graphite moderator and lacks a full secondary containment vessel.

According to official reports, the plant suffers from aging equipment, poor maintenance and staff complacency. A late 1987 report by the National Academy of Sciences concluded that the Hanford plant and others like it are at risk of a Chernobyl-like catastrophe.

The next wave of shutdowns came in March 1987 when the GAO told a Site committee that four plutonium-producing reactors at Savannah River in South Carolina had operated for most of *seven* years at power levels far beyond what the emergency core-cooling system could have handled in an accident.

GAO investigators went on to detail a pattern of poor management, inadequate external review, and disregard for safety and environmental protection. They characterized the Savannah complex as "costly, diverse, potentially dangerous and aging."

Pending Judgment

How many more Chernobyls ? It is impossible to answer this crucial question. Looking at the experience of the world's operating plants, though, suggests that additional accidents are likely in the next decade.

On the positive side, Chernobyl has increased many countries' stated commitment to nuclear safety, and led to some safety-specific action, such as the long overdue shutdown of plutonium reactors in the United States, and the creation of a cabinet-level position for nuclear safety in West Germany.

Whatever improvements in safety standards Chernobyl may have precipitated, they cannot stop the ultimate, double-fisted enemy of nuclear safety—time. Even if accidents occurred only once every 10,000 reactor years, and if the world's inventory of reactors did not grow beyond 500, core-damaging accidents would occur about five times per century.

Time also slowly wears away at the precise machinery that is central to nuclear technology. The inevitable aging and physical deterioration of the world's nuclear equipment could swamp efforts to make nuclear power safer

Technology, training, strict regulation and vigilant oversight can lower the chance of catastrophe But in the end, the chance remains.

Computer models can help us to understand the risks, but they cannot pass judegnment-they cannot tell us how safe is safe enough. The answer to that question will always fall to human beings.

In the immediate future, tighter regulation, improved management and the willingness to shut down dangerous plants are clearly in order. Over the long run, the merits of the atom must be weighed much more carefully against the alternatives. Ultimately it is the world's people, through their national political systems, who must decide how safe is safe enough.

Christopher Flavin, a senior researced at World-watch Institute in Washington, D.C.. *is author of Reassessing Nuclear Power: The Fallout from Chernobyl and coauthor of State of the World* 1987. *Courtsey : World. Watch Jan. Feb. 19*88.

GUJARAT PROTEST

The messing of the Gujarat Anu Urja Jagruti at Vadodara on 14th February, 1988' was significant in as much as it provided an opportunity for evaluation of the present position of the anti-nuclear movement in Gujarat and also a chance to chalk out some long range and short term programmes for the future.

Shri Chinu Shreenivasan's paper entitled "Where do we go ?" provided the basis for critical review and assessment, It was felt that lack of continuity in the movement was a major weakness. It was also felt that not many people give much time to it in spite of their deep interest in the issue. Stress was laid on strengthening the movement both at the grassroots and the state levels. Giving his ideas about the future course of the movement Shri Babubhai J.Patel, ex-Chief Minister, suggested that the information that we have at present should be widely diffused in the public. He also emphasised the need for a dialogue with the state and central ministries. Dr. B.G. Desai, a consultant on energy, pointed out that nuclear policy was after all only a small part of our over all energy policy, which was going astray.

It was decided that educational and organisational activities should be continuously going on in the Kakrapar and Surat areas. The ideas of organising local committees and training camps for local leaders were mooted. It was also decided that some of the larger towns of the area should be covered intensively in the programme of Anu Urja Jagruti.

The following programmes were chalked out for the state level ;

1. To prepare a small pamphlet on the issue and to send it to all the representatives of the State Legislative Assembly and members of the Parliament from the state.
2. To discuss the issue with members of the Assembly.
3. To try to prepare some members to raise the issue in the Assembly.
4. To organise a march on wheels from Kakrapar to Gandhinagar ending on the Chernobyl Day (26th April).
5. To seek an interview with the Chief Minister after the march, and to convey the message of Anu Urja Jagruti to the Prime Minister through him.

Committees were appointed to :

a. Draw a detailed programme for the suggested march on wheels,
b. To collect the money needed for such a march,
c. To find out the possibilities of asking for a legal stay on the construction of the plants.

Editor Bhoomiputra promised to give the nuclear issue much more space in the future numbers.

Editor Anumukti announced that those interested in selling retail copies of Anumukti will be given special commission ou bulk orders.

A small exhibition of charts and paintings was also displayed at the meeting. It was decided to display that exhibition along with film and slide shows during the Kakrapar Gandhinagar march too.

One Deadly Summer

Something strange happened to America in. the summer of 1986 : around 35000-40000 more people than usual dropped dead. A statistical fluke ? Dr.Jay Gould, a fellow of the Institute of policy Studies in Washington and a distinguished statistician, thinks not.

The seasonal pattern of mortality in America is pretty stable. Over the 80 years before 1986, 31.7% of each years deaths occured on average during the four summer months *of* May to August. In 1986 that percentage rose to 33.1% the highest this century and 1.1 percentage points above the 1983-1985 average of 32%. Dr. Gould calculates that the odds of such an increase happening by chance are more than one million to one. So what happened ?

The explosion of a nuclear reactor at Chernobyl in Russia on April 26th, 1986 and, in particular, the ensuing radioactive plume that reached America eleven days later, may offer a clue. When the radioactivity arrived, rainwater samples in northwestern regions of America recorded 46 picocuries (pC) of radioactivity per litre. By May 12th,' in the northwestern state of Washington, the level had risen to 6620 pC per litre. In milk samples—a routine indicator of radioactivity—the concentration of radioactive Iodinc-131 peaked at around 130 pC per litre, compared with che 1985 average of below 7pC per litre. Because the 130 pC per litre peak was less than 1% of the American government's coaling of 15000 pC per litre for milk radioactivity, no action was taken. The levels were after all, between 100 and 1000 times lower than those recorded across Europe after the disaster.

Dr. Goulds analysis picks up a worrying correlation between regional American levels of radioactivity in milk and regional mortality in the summer of 1986. For several reasons - such as rainfall patterns and the precise path of the radioactive cloud - levels of radioactivity varied sharply across America. Dr. Gould calculated averages of peak concentration of Iodinc-131 in milk for each of the census bureau's nine regions during the four month period. The highest concentrations were seen in Pacific northwestern states such as Washington and California. In those states the total number of deaths in four months was 5% higher than it had been in May-August 1985. In areas recording the lowest concentrations - such as the central southern states of Texas and Arizona - the number of deaths was unchanged from the previous summer. That relationship between radioactivity and death held true throughout the country. Statisticians have tests to determine how likely it is that such correlations are blue to mere chance. The tests showed that for these correlations, sheer coincidence was hardly possible.

A Radical Theory

According to received wisdom, exposure to such low levels of fall-out is harmless. Some people even claim that a little radiation is good for you. Most of the debate *on* the medical consequences of Chernobyl has centred on the long term dangers of cancers and genetic defects in future, generations that can be caused by higher doses. Any suggestion that the disaster had immediate adverse effect on mortality rates is heresy. Recently the OECD's Nuclear Energy Agency reaffirmed its belief that the risk of "radiation related harm" to the public in western countries had "not been changed to any noticeable extent" by Chernobyl.

Such claims ignore research into indirect effects of low level radiation according to Dr. Earnest Sternglass, emeritous professor of radiological physics at the University of Pittsburgh. Instantaneous bursts of high level radiation - such as medical X-rays - are relatively harmless to normal adults. That is mainly because such "external" radiation does not concentrate itself in crucial organs. Ingested or inhaled fission products behave rather differently. Once inside the body, they seek out various organs according to their chemical characteristics. Iodinc-131 heads for the thyroid, Strontium-90 and Barium-140 (which chemically resemble Calcium) head for the bone marrow. Then they sit there emitting radiation.

Such low level radiation promotes the slow release of molecules known as free radicals. The most common - Oxygen free radical - arc also a by-product of normal oxygen using reactions. But their production is increased by protracted exposure to radioactivity of ingested fission products.

Oxygen free radicals are unstable oxygen molecules with an extra electron. They arc attracted to the membranes of the cells, which then they damage, disabling the cell. This process is efficient only when there is a low concentration of free radicals. At high concentrations (that is at high radiation doses) the free radicals deactivate each other. That is why America despite its lower close of radiation, the have suffered more from this problem than* parts of Europe.

How could Americas increased mortality rate in the summer of *1986* be related to the damage colsed by free radicals ? Among the celt functions impaired or destroyed by prolonged exposure to free radicals is the production of hormones and various types white cell which provide the body's immune defences. Such an erosion of the immune system might be expected to hit two groups of people first : the old or weak, and those suffering from life threatening diseases.

Of all those Americans aged over. 65 who died in 1986, 32.7% did so in the four summer months. During the same months in .1985, the proportion was only 30.6% This suggests that in 1986 something was hastening their demise. Compared with the summer average *of* 1983-1985, an estimated 7.4% more people died iu summer of 1986 - around 30000 people.

The number of people dying from nncum-onia in all age groups was 18.1% higher in May-August 1986 than in the same months of 1985. Deaths from infectious deseases rose by 22.5%, over the same period. And deaths caused by AIDS and its related infections increased by 60.3%. As the table below shows, the year on year changes were much smaller in the first four months (January to April) *of* 1986. And they fell back during the final four months of the year.

American Mortality 1986

No. of deaths from :	Jan-Apr	May-Aug	Sep-Dec
	% change on a year ago		
Pneumonia	-5.7	+18.1	-34
All infectious diseases	+2.3	+22.5	+15.7
AIDS related infections	+ 11.6		+ 19.8

Leaving out deaths caused by accidents, suicides, drug abuse and violence. Dr. Gould found that the natural death rate of all people aged between 25 an*d* 34 was 5.3% higher in 1986 than in 1985. That age group was born in the 1950's, a decade when atmospheric nuclear bomb testing was at its peak. As the}' have aged the mortality rate of the age group has increased much faster than the mortality rate of those born between 1935 and 1944 - before bomb testing started. Doctors believe that fall out from testing may have weakened the immune systems of the very young. In later life that might make them more susceptible to the biological effects of additional fall-out.

Americas seasonally adjusted fertility rate - measured by number of live births per 1000 women aged between 15 and 44 - fell to a record low during July and August 1986. In contrast, live births rose in the first four months of 1986. The fall is due, Dr.Sternglass believes to an increase in miscarriages, foctal deaths and still-births. During the summer infant mortality rates reflected the regional pattern of milk radioactivity.

Both Dr.Gould and Dr.Sternglass emphasize that their work is still in its infancy. But their analysis already suggests that the change in the American way of death in 1986 was not a nutter of chance. If Chernobyl was the cause, a complete review of "safe" radiation levels is needed. And if Chernobyl was not to blame, what was ?

Courtesy : Economist : *Jan* 30-Feb 6 1988.

Editors Note : India suffered similar low level fall out as USA The numbers of the very young, the sick and the malnourished are much larger in India. Unfortunately our mortality statistics arc not good enough to detect this effect.

Utterly Gutterly Butter

The Supreme Court of India by an order of March 8th, 1988 dismissed the special leave petition brought by Dr. S. S. Wagle and others against the Union of India. The petition challenged the marketing of 3000 tons of butter imported from Ireland by the National Dairy Development Board. (NDDB)

For the last two decades we have been in the throes of a flood. Described sclf-promotionally as the "White Revolution" it was designed to nuke India awash with milk. Today rivers of milk do flow through most parts of urban India. Unfortunately, the design envisaged the rivers to originate in the butter mountains of the European Economic Community. (EEC).

The explosion at Chernobyl cast a shadow on this scheme. Large parts of Europe were contaminated by the fall-out. The EEC governments themselves were quick to ban import of food items from eastern Europe even from places a thousand kilometres distant from Chernobyl. Radioactivity respects no frontiers. Significant radioactive fall-out was deposited also on western Europe. The long lasting radionuclides like cesium-137 (half life 30 years) have got incorporated into the soil. From there to grass, cows, milk, humans and back to soil is a simple cycle. The process will go on and on.

The accident initiated an acrimonious debate within the EEC with regard to 'acceptable' limits for radioactive food contamination. The nuclear lobby wanted to raise the existing limits. They demonstrated their clout when the EEC council of ministers on December 14th, 1987 did raise the limits by a substancial amount. This was despite an earlier vote in the European parliament which had recommended ten times lower doses. The major point to note is that 'acceptable' is not the same as safe. There is no safe limit for radiation. This has been accepted by some W.German courts and they have upheld the appeal of a woman who wanted to return milk powder less contaminated than the government approved 'safe' limits.

In the meantime, the food multinationals were busy exporting contaminated produce to the third world. Singapore, which probably has the most efficient system of testing and control, rejected 240 separate consignments of contaminated food just upto October '86. A large number of other third world nations including Sri Lanka, Bangladesh, Malaysia, Philipines and Guyana have rejected milk products from EEC. Some W. German activists last year resorted to direct action by breaking into a train filled with contaminated milk powder and destroying a large-number of sacks meant for the third wo;

India being the largest dump-ground of EEC milk products one would have expected the Indian government to have taken vigourous action to protect the population from this additional menace. Instead, the reality has been very far from this. The burden of protecting public health has been taken up by public spirited individuals like Dr. Wagle *and* others.

Between April T986 and September 1987, commodities imported from the EEC were released on the basis of "certificates of fitness" provided by the suppliers and the Union agricultural ministry. BARC turned a blind eye to alarming reports coming from various third world countries. That these commodities were used throughout the country in milk and also in infant foods appears to be pretty certain.

Wagle's battle began in late 86. Beginning first by cautioning the government not to release the butter, the Maharashtra State Government Employees Confederation spearheaded by Wagle got a recalcitrant NDDB and the Greater Bombay Milk Scheme (GBMS) to undergo tests to determine radionuclide contamination by BARC. But the widely different results of the test, coupled with enormous flaws in collecting samples for the tests and the determination of the state government to go ahead with marketing the butter forced Wagle to move the Bombay High Court. After granting a stay order initially, the petition was dismissed and the matter brought before the Supreme Court.

The main arguments put forth in the petition were the following :

1. "Permbsible levels" implied an accep-

table level *of* risk including the risk of death.

2. Maximum limits are normally expressed in the terms of annual intake for a statistically "standard" man: they are not adjusted for specially vulnerable sections like pregnant women, children and malnourished infants.
3. The "permissible levels were based on an extrapolation from the Hiroshima and Nagasaki data to low doses on ? linear basis. This procedure was seriously flawed asecepted even by the ICRP.
4. NDDB by not labeling the origin of it's products was denying people the right to decide for themselves whether or not to or contaminated food.

Amongst other testimony the petitioners also produced a letter from George Wald, Nobel Laurate and Professor of Biology at Harvard University, parts of which are reproduced below :

"In reality no threshold exists for damaging effects of ionizing radiation or radioactive material ingested or respired. Any level may result in some damage, more does more damage. From that viewpoint, every dose is an overdose.

So-called "permissible levels" of exposure are compromises with convenience, economic pressures, business interests and political expediency, superimposed on a consideration for health. Ideally all such exposure should be avoided. The presence of unavoidable background radiation, perhaps even larger than is offered by some new source, is no excuse for accepting the added threat of the new source.

For persons suffering from hunger it makes a gruesome choice to offer to relieve the hunger at the expense of the threat of eventual malignancies. I can imagine situations in which that ghastly choice might need to be made; but then in full awareness of the risks, and keeping the radioactive exposure to the absolute minimum. The threat is greatest to infants and the young, falling off with age."

The Supreme Court's position is best expressed in its own words : "Having regard to the magnitude, complexity and technical nature of the enquiry involved in the matter and keeping in view the far -reaching implications, we must at the outset clearly indicate that a judicial proceeding of the nature initiated is not an appropriate one for determination of such nutters."

Therefore the court appointed a committee of three experts and decided to follow their advice. The experts were : Dr.M.G.K.Menon-member Planning Commissi, Dr.P.K. Iyengar, chairman of BARC and Mr.G.V. K.Kao, vice chairman, Karnataka Economic Planning Council. Of the three, the first two are representatives of the atomic energy establishment and the third a long term supporter of NDDB. The experts commence reached it's predictable conclusion :

1. "The permissible levels *of* radioactivity in milk, dairy and other f*ood* products fixed by the Atomic Energy Regulatory Board as per it's communication of August 27, 1987 have been arrived ar after due consideration of ICRP dose limits for the general population.
2. The AERB has allowed more safety margin than other countries, and international organisations like EAO and WHO, in arriving at the levels fixed for milk, dairy and other food products. The levels adopted by AERB are one of the lowest in the world.
3. The consumption of milk, dairy and other food products, having levels of man-made radionuclides below the permissible levels fixed by AERB, by all sections of population, and throughout the year, are safe and harmless."

Having taken the attitude that the issue was too technical and complex and hence having decided to rely on expert judgement, the court had left itself with no other alternative but to dismiss the petition. The judgement raises an important issue. It is an individuals right to decide what risk he or she wants to take. The exercise of the right cannot be denied under the pretext that in our daily lives we take similar or greater other risks. By not forcing the NDDB to properly label the origin of its products, the court judgement denies this right.

There is a court higher than the Supreme Court-that is the court of public opinion. It is there that the issue will be fatally decided.

Surendra Gadekar

This is based on articles in WISE and Sunday Mail.

LETTER BOX

Congratulations for publishing a very lucid article 'Another Pyrrhic Victory' in your journal, vol. 1 No. 4, February 1988. While agreeing with some of the observations such as "...... the group that suffers the hazards could be totally different", I would like to point out:i) that the anomalies of the earlier terms such as maximum permissible exposure or dose are removed in the presently accepted international terminology, dose equivalent, effective dose equivalent etc.2) It is preposterous to suggest that nuclear power is incompatible with indefinite sustenance and perpetuation of life on earth in time.3) The author has given us a succinct summary of the concentration process existing in the marine food chain webb, but fails to add that the concentration occurs with the diluted concentration of the pollutants due to mechanical convection.4)Citing D.D.T. alongside radionuclides just because both are considered *to* be toxic is not appropriate as radionuclides do not behave like DDT in the environmcnt.5) I welcome the authors suggestion that all the geophysical aspects have to be taken into account in studying the problem of nuclear waste disposal in deep geological formations.

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Authors's Reply :

To begin with, let me thank Shri Sastry for reading my article with interest and, more so, for commenting upon it. Let me come to points of our disagreement.

We are residents not only of the external-physical world but also of the world of out languages. Every language has its own point of view and prejudices against other viewpoints. Therefore, certain ideas just cannot be thought of in a particular language. This is Whorf's linguistic relativity principle. That was exploited *in* George Orwell's "1984" to develop a language in which revolt against the totalitarian set-up could just not be imagined. That is precisely the game played by the nuclear establishment. Phrases such as maximum permissible exposure or dose, dose equivalent or effective dose equivalent are devised so that the physical reality of cumulative and irreversible damage done by nuclear radiation can be linguistically kept out. Earlier terms were "anomalous" because they did not serve this purpose, effectively. Hence the new terms. But this "progress by renomenclature" is deceptive and does not change the objective reality.

Unless otherwise proved, Gofman's view, that nuclear power is incompatible with indefinite sustenance and perpetuation of life on earth in time, may so depressing, frightening, horrifying, but certainly not preposterous. There is no way in which radioactivity can be prevented from doing the damage, nor is there any way in which increasing quantities of radioactive waste can be isolated for long periods. The only good news I am aware of is the work of Donald Cram, Charles Pederson and Jean-Marie Pierre Lehn in supermolecular chemistry. Their work raises hope of separating radioactive tissues *from* normal tissues in individuals exposed to radiation. But firstly, it is philosophically wrong to escape through hope and secondly, whereas ill effects of nuclear radiation will be freely available to all in the neighbourhood of a nuclear plant, the supermolecular chemical treatment could be afforded only by some, who would not be residing near the nuclear plant, in the first place. That is a general law of the distribution of "goods" and "bads" in the society. "Medicines are proprietary, but germs are free", Schelling had said. Therefore, to rely on distant hopes of supermolecular chemistry as an antidote to the malady freely dispensed by the nuclear radiation amounts to sacrificing some individuals for the benefit of others, or in other words, regarding some men as means. This is not in consonance with the modern (or even ancient) theories of justice such as Rawls's. I have an impression that here Shri Sastry agrees with me.

I have adequately mentioned that the density of pollutants gets diluted by convection and the biological concentration does act on these diluted pollutants. But it nevertheless docs ample harm. Aquatic life and through multiply linked trophic chains **all** other life forms do suffer the damage. **That** most countries have, at least officially, given up discharging nuclear waste in the large water bodies, is proof enough that dilution due to convection currents is not an adequate safeguard.

I must apologize for citing DDT am! radionuclides side by side. That is unfair to DDT. It is a chemical and could be chemically decomposed in to nontoxic substances and therefore the problem posed by DDT can have a technical solution. Radionuclides cannot be neutralized thus. I had agested geophysical studies of the proposed nuclear waste disposal sites because I believe that such studies would prove that these proposals are untenable, as happened in the U.S. I am glad that Shri Sastry welcomes such exhaustive geophysical studies.

I must thank Shri Sastry for giving im this opportunity of offering amplification of my views.

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FUDGING THE ISSUE

The Truth About "Safe" Background Radiation

AMONG the most important dogmas held by the nuclear establishment worldwide is that "background radiation"—i.e. radiation from the earth and space (in the form of cosmic-rays), as well as from food, airplanes and machines, to which people everywhere are subjected—is safe. At least, it has not been known to cause any health damage, say the nuclear pundits.

This proposition is of critical importance in setting the "safe" or "maximum permissible" limits for radiation exposure of human subjects from mail-made sources, such as nuclear power stations and other atomic installations. The argument is that if background radiation (usually of the order of 100 to 150 millirem per annum) cannot cause any harm, then a little additional dose of ionising radiation from nuclear installations cannot damage the health of the normal population either.

That is how, in practice, the exposure limits (currently of the order of 500 millirem a year) are set for the ordinary people (as distinct from specialised radiation workers) who may live close to nuclear installations and face the potential risk of becoming their victims. That is how people who ought not to be exposed to any additional radiation at all arc asked to bear an extra dose of it , which they are told will not harm them in any way. Indeed, some scientists of BARC have even gone to the preposterous length of claiming that low doses of radiation may actually be beneficial !

There is growing evidence that the original dogma on which this self-serving inference is based is as false and pernicious as the conclusion itself. Studies from Australia and southern Africa suggest that "natural" Kick-ground radiation—like all ionising radiation in any form or dose -is harmful.

Of particular significance is a 1976 Indian study, remarkable at least partly because it was conducted by researchers of the prestigious All India Institute *of* Medical Sciences, New Delhi, which has devastating results as far as the nuclear industry's pet predilection about background radiation goes.

Published in *Nature*, the study was conducted by N. Kochupillai, I.C. Veima, M. S. Grewal and V. Ramalingaswamy in the coastal villages of Chevara-Noendakara in Kerala and Manavalankurichi in Tamil Nadu, which have high background radiation levels thanks to the presence of thorium-bearing monazite in the beech sands. It concludes that the prevalence of Down's Syndrome (or Mongolism, caused by a genetic abnormality) in the study population was significantly higher than in a comparable ("control") population which, however, lives under normal background radiation.

The Kochupillai study jolted the nuclear establishment throughout the world : while the prevalence of Down's Syndrome and severe mental retardation with physical abnormalities was only 0.17 per 1,000 in the control group, it was more than five times higher or 0.93 in the study groups. Hence background radiation at Chevara-Neendakara, variously estimated at between 342 millirems a year (BARC) and 1,500 millirems a year (WHO) must be considered definitely harmful. The nuclear industry's dogma thus falls to pieces.

The industry retaliated in the form of a reply by K. Sundaram (of none other than BARG), which contested some assumptions in the study pertaining to thortality and fertility age structure of the population. Sundaram estimated the frequency of Down's Syndrome in the "normal" population on the basis of certain western models and showed that the high frequency found in the study was not (statistically speaking) significantly higher.

The AI1MS group published a rejoinder to Sundaram, questioning some of his assumptions and conclusions on the ground that he had failed to consider the likelihood that if the infant and childhood mortality in India is about six times higher than in the West, the mortality of Down's Syndrome would also be substantially higher than *in* the West. If the higher mortality of Down's Syndrome is taken into account, then their original conclusion stands.

The debate thus ended with the substance of the Kochupillai study hypothesis remaining uncontested. But now, V.T. Padmanabhan, the author of two remarkable studies on the Indian Rare Earths plant in Kerala, has published a superb analysis of the entire debate. ("Radiation-Caused Genetic Diseases at Chavara-Neendakara in Kerala India : the Anatomy of a Non-Debate": in *International Perspectives in Public Health,* Vol-3, Issue 1, Spring 1987, pp. 20-25).

He shows that neither of the two contestants had taken into account the peculiarities of the area they had studied, viz. the low mortality rates in Kerala in relation to the country as a whole, the significant differences *within* Kerala between the lowlands (where the monazite sand belt is located) and the mid and highlands.

Padmanabhan brings to bear ou this analysis his knowledge of the state and his rich insights into its distinctive socio-economic features such as the fishing economy of Neendakara, the site of an Indo-Norwegian project for mechanised trawler-based fishing, the relatively advanced status of the health-care facilities in the village, and so on.

After a masterly analysis of the mortality, fertility and genetic abnormality rates in the study and control groups, he concludes that the Kochupillai team had *underestimated* the damage caused by exposure to radiation from the monazite sands. The frequency of Down's Syndrome at Chavara-Neendakara, he shows, is five times higher than in Trivandrumand in the country as a whole (excluding Madras) and as many as 16 tunes higher than iu Madras.

Padmanabhan's work has thus demolished the bogus assumptions and dogmas o£ the nuclear industry once and for all.

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RADIATION FACTS

Many Friends have said that Anumukti is getting too technical and is not for the uninitiated. From now on we will have a page for just that.

The type of radiation emitted from nuclear power facilities is called ionizing radiation ; it has the energy needed to remove one or more electrons from an atom. The ionization of an atom creates an ion which is chemically reactive and can damage living tissue. Ionizing radiation includes X rays, gamma rays and alpha, beta, and neutron radiation. Cosmic radiation and naturally occurring radionuclides (radioactive elements) such as uranium, radium and thorium all emit ionizing radiation referred to as natural background radiation. Ionizing radiation is also the type used in medical X-rays, and the type found in atomic weapons fallout and all phases of the nuclear fuel cycle from mining and milling to waste storage. The radionuclides are unstable and eventually decay through a decay chain to a stable element. Radiation is emitted during this process. The half life of a radionuclide refers to che tunc necessary for one-half of a given amount of it to decay.

When radiation strikes a person, one of four events may occur :

i) it may pass through the cell without causing any damage;
2) it may damage the cell, but the damage may be repaired;
3) it may damage the cell, but the cell may divide before being repaired;
4) it may kill the cell.

The last, two events are of concern to human health. Ce Killing is often harmless unless enough cells in a particular tissue are killed, rendering it incapable of functioning. Medical radiation therapy uses the cell-killing effect *of* radtation to kill cancerous cells. The third effect, incompletely or incorrectly repaired cell damage, may eventually result in delayed health effects such as cancer or be passed on to future generations as a genetic defect.

Total body radiation involves the exposure of all organs. Gamma radiation is the most highly penetrating form and creates, the most damage as it passes through the body. This is also true of X rays and neutron radiation. Alpha and beta radiation, which have low energies arc not serious external threats, but if ingested or inhaled they are extremely harmful to the organs or tissues in which they lodge.

The most common measurements of human radiation exposures are rads and reins. Both refer to the actual amount of radiation absorbed by the body. The rem is a more precise measurement of the actual biological damage done. Because the rem is an inconveniently large unit for radiation protection purposes, doses arc often expressed in millircm (mrcm). One rem equals one thousand millircm. When referring to the collective dose received by a certain population the dose is generally expressed in man-rems. This is calculated by multiplying the total number of people exposed times their average individual dose. For example, 10,000 man-rems is the dose received by 5,000 persons each exposed to 2 rems, or by 10,000 persons each exposed to one rem, or by 20,000 persons each exposed to 500 mrem. Current guidelines recommend the general public receive no more than 500 mrem per year.

Inside the human body, many radioisotopes are concentrated in a specific organ, meaning that most effects of the radiation arc concentrated into a small area.

Radiation emitted from nuclear power plants occurs in the form of several radioi-sotopes. Routine operation of a nuclear reactor includes occasional releases of radionu-clides that have built up within the reactor system. Some of the isotopes routinely released are tritium (radioactive hydrogen), iodinc-131 which has a half-life of eight days, noble gasses (argon, xenon, and krypton), cobalt-60 which has a half-life of five years, strontium 90 which has a half-life of 28.5 years, and cesium-137 with a half-life of 30 years.

Noble gases are inert, meaning they do not chemically interact with the body. but they arc capable of decaying to elements which are not inert and are concentrated in the body. For example, xenon can decay to isotopes of barium, cerium, and cesium; and krypton can decay to strontium and yutrium.

Once radiation has been released it is dispersed by the wind and is brought down by gravity, rain, snow and fog. If winds are calm the radiation will just deposit near the base of the stack. If the radiation drifts over a city where it is raining most of the radiation would be deposited there.

After radionuclides reach the ground they can be absorbed by plants and people. It is possible to receive direct radiation from the nuclides at ground level and to receive a radia-tion dose through the inhalation or ingestion of contaminated materials. Many plants and animals which arc important human food sources are known to concentrate several radionuclides. Tor example, iodine is concent-rated in milk; strontium is concentrated in milk, root vegetables and animals.

Many types of cancer are known to result from radiation. The most common type is leukemia, but recent studies have shown that bone marrow and soft tissues like the pancreas, brain, kidney, lung, and large intestine also develop radiation induced cancers.

Protest in Russia

In respvise to pressure from local residents, Soviet authorities have halted the construction of a nuclear power plant in Krasnodar, north of the Caucasius mountains, near the Black Sea. This news was reported in the paper Komosomolskaja Pravda on 27th .January 1988, which also stated that there is bitter, opposition to most of the nuclear plants under construction, as well as to those alredy in operation. These announcements arc the strongest acknowledgement yet that there is strong public opposition to nuclear energy in the USSR.

Before the Chernobyl accident, when it was considered prestigious and profitable to have a nuke in your neighbourhood, the local authorities in Krasnodar requested a nuclear plant in their area to make up an anticipated shortfall of energy in the northern Caucasius. However, after Chernobyl attitudes changed rapidly. Twenty-five million Roubles had already been spent on construction of the Krasnodar plant when the local officials gave in to public pressure and cancelled it.

This is the first time that opposition has actually halted construction of a nuclear plant in Russia. Public concern has lead to the suspension of work at another power station near the town of Clugrin in the central Ukraine.

The development of open opposition to nuclear energy also points to the growing power of public opinion in Soviet politics. In the past intellectuals had been known to express their opinions to the leadership on important issues. Until recently, however newspapers would rarely give such opoinions space if they contradicted the official viewpoint.

A backlash against nuclear energy would create a serious dilemma for the Soviet leadership, which is basing much of its development plans on the assumption that nuclear energy will play an increasing role in supplying power. At present, there are plans to build six new 1000 Mw reactors in the Ukraine, each of which would be based at one of the seven existing power stations in the republic. In some cases the result would be a group of reactors at a single site producing up to 6ooo MW of electricity. A recent review carried out by various institutes of the USSR snd the Ukrainian Academics of Science had reached the conclusion that no nuclear power stations execding a total output of 4000 MW should be built. The option of opening new sites is slowly being foreclosed by growing public opposition. The authorities would be better advised in giving up their fascination for nuclear power, rather than in digging the foundations of a deeper tragedy in the future by making the existing power stations too large and unwieldly.

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