ANUMUKTI

A Journal Devoted to Non—Nuclear India

Volume 8 Number 1 August / September 1994

Action Alert Kakrapar

The floods were bad enough but the Incompetence of authoritios knows no bounds

Following the heavy rains of June 15 and 16, floods devastated the Kakrapar Atomic Power Station (KAPS) as was reported in our last issue. The fury of the floods was such that it not only drowned 80 motors and pumps in the turbine room, but broke the waste management facility and lifted canisters of solid radioactive waste and carried them out into the open. However the flood was not strong enough to shake the complacency and arrogance of nuclear and civic authorities. They have continued their policy of deception and bland 'trust us' reassurances. No effort has been made to inform and educate the public especially those living in the vicinity of the station. The incompetence and callousness of the nuclear authorities and the ignorance coupled with the high-handed attitude of the civic authorities together is in itself a serious hazard to public safety.

Ducts and storm drains connect the turbine building of KAPS to the Moticher Lake situated just behind. The lake is not a natural lake but a man-made lake and has gates situated near the village of Ratania to control the flow of water. Following heavy rains on June 15, the level of the Moticher Lake began to rise. The outlet ducts became inlet pipes and water began entering the turbine building on the night of June 15th itself. By the morning of June 16th, there was water not only in the turbine building but in other parts of the reactor complex. The morning shift had to swim in chest high water to get to work and the control room according to one rumour was "inaccessible for some time".

The floodwaters breached the solid waste management facility and lifted canisters of waste and carried them out into the open. Since the authorities have not been forthcoming with detailed information (See page 3 and 4), it is not known exactly how many canisters were swept away. The original news-report spoke of four but the KAPS superintendent said only one had been lifted and whose lid had become "loose".

What Did The Authorities Do?

First of all they slept; then they bickered among themselves; after that they issued misleading and erroneous statements to the press;(See Collector D.P.Trivedi's statement on page 4) blamed and cursed "troublemakers" and "vested interests"; and finally they slept again.

All these years, the gates of Moticher Lake at Ratania were never operated so much so that according to the authorities' own admission (page 4) "A lot of grass has grown very tall near the gates." Even as the

flood waters were entering the turbine building on the night of June 15th and causing havoc, the KAPS authorities slept. No action was taking till the "gentlemanly' hour of 11 O'clock on 16th morning when a site emergency was declared and workere evacuated. (My guess is this action was taken due to the 'automatic' radiation monitoring unit detecting radioactivity in the environment.)

After the situation had become desperate and there was water, water everywhere, the KAPS authorities woke up and started frantically asking the district and the state authorities to use their influence to get the gates of the Moticher Lake opened. However, the gates after years of neglect could not be opened. Nearby villagers, worried about the security of their own homes, caused a breach in the embankment of the lake which allowed the waters to drain out. It was only on 18th of June that a large pump was brought to Kakrapar from Tarapur, that the work of removing the water from the turbine building could begin.

The KAPS authorities did not think it their duty to inform the public or even the Atomic Energy Regulatory Board (See Editor's commentary on page 5) of the events that had taken place. Whatever information that did come out was not because of but despite their doing. Reporters from *Abhiyan* and *Gujarat Samachar* along with yours truly happened to visit Kakrapar in connection with a different article on nuclear power. The KAPS authorities refused to talk; but workers showing a greater sense of responsibility did. It was only after the report was published that the KAPS authorities and the collector of Surat issued their statements.

The statements that they did issue display an economy with truth that would be commendable if applied to public funds. For instance, the district collector says in his statement (See page 4) "Before starting the reactor, it had been subjected to all the stringent tests and conditions." This statement might be true but it is equally true that the reactor did not pass all the tests. The Emergency Core Cooling System for one did not work as expected during the test and needed "fixing". As admitted by the present chair of the Atomic Energy Regulatory Board in an interview with. *The Telegraph,* the system was not again subjected to the same test to see if the fix worked. Similarly the contention in Mr. Trivedi's statement that had the reactor been in operation, there could not have been any accident is more hype and hope than fact. The authorities had no control over the amount of water that was entering the building and not only the regular electricity supply but also the diesel emergency power supply could have been disrupted reminiscent of the situation during the Narora fire of last year.

Had there been an off-site emergency needing evacuation of people, there was no way that it could have been accomplished in a reasonable time-frame. The floods had caused havoc to roads and bridges. Even now, three months after the event, it takes more than an hour to traverse just 15 kms on the highway with a motorcycle. Less manoeuvrable vehicles like trucks and buses take longer and there are large number of trucks turned turtle dotting the highway. The condition of side-roads in some cases is much worse.

What Can You Do?

Show and express your solidarity with the people living around Kakrapar who in their hundreds are writing letters to their elected representatives and the Chief Minister of Gujarat demanding an all-party commission of inquiry. You can send your letters to the Prime Minister, the Minister for Environment, your local MP, chairman DAE and of course the Chief Minister of Gujarat. Please send a copy also to us. In this letter, please ask for:

Constituting an all-party enquiry committee which would investigate and report to the public in a reasonable time. The committee should look into the following:

- What were the reasons for the delay of at least 12 hours between the flooding of the turbine room and the declaration of site emergency?
- What were the reasons for declaring the site emergency?
- Why were the people living in the vicinity (within 30 kms) of the plant, not informed of the situation?
- What was the extent of the damage to the waste management area? How many waste filled drums are kept at different locations within the KAPS premises? What are the contents of these drums?
- What amount and kinds of radionuclides were released to the environment? What are their long term implications for public health?
- How do the authorities propose to evacuate the public in case of emergency during monsoons when the condition of the roads makes the task impossible?

Neither the stalled unit-1 nor the completed but yet to be started unit-2 should be allowed to start functioning before the committee satisfies itself that public safety would be maintained in case of emergency. The report of the committee should be made public and published in newspapers.

Surendra Gadekar

The Official Response fo Kakrapar Flooding

The chief superintendent of Kakrapar Atomic Power Project Mr. J. B. Kalaiya, along with other high officials of the project visited the Surat office *of 'Gujarat Samachar'* subsequent to the publication of the report regarding the flooding of the Kakrapar plant following the rain of June 15th and 16th. While he had himself refused to meet journalists only the day before, Mr Kalaiya eagerly and on his own initiative sought an interview after the publication of the report. The following is a translation of the interview. We are reproducing it because this is the sum-total of the official response. In the following Q. stands for the interviewer of Gujarat Samachar and A. for Mr. Kalaiya.

Q. What has been the total damage to the plant?

A. There has been no damage to the pumps and motors as such. No machinery has been destroyed. However, some repairs would be needed whose labour costs could run up to Rs 10 lakhs.

Q. How much water had entered the plant on June 15th?

A. Water had not entered into all the installations in the plant.

Q. Is it true that there is 56 tonnes of uranium stored in the plant?

A. I am not at liberty to answer this question and confirm or deny whether there is uranium stored in the plant.

Q. Was the plant shut down?

A. Yes.

Q. If the plant had been operating and these pumps had drowned what would have happened?

A. We have three separate and independent systems which can shut down the plant within seconds in case it had been operating.

Q. How much water entered the turbine building?

A. There was 25 feet of water in the turbine building.

Q. WAS site emergency declared in the plant?

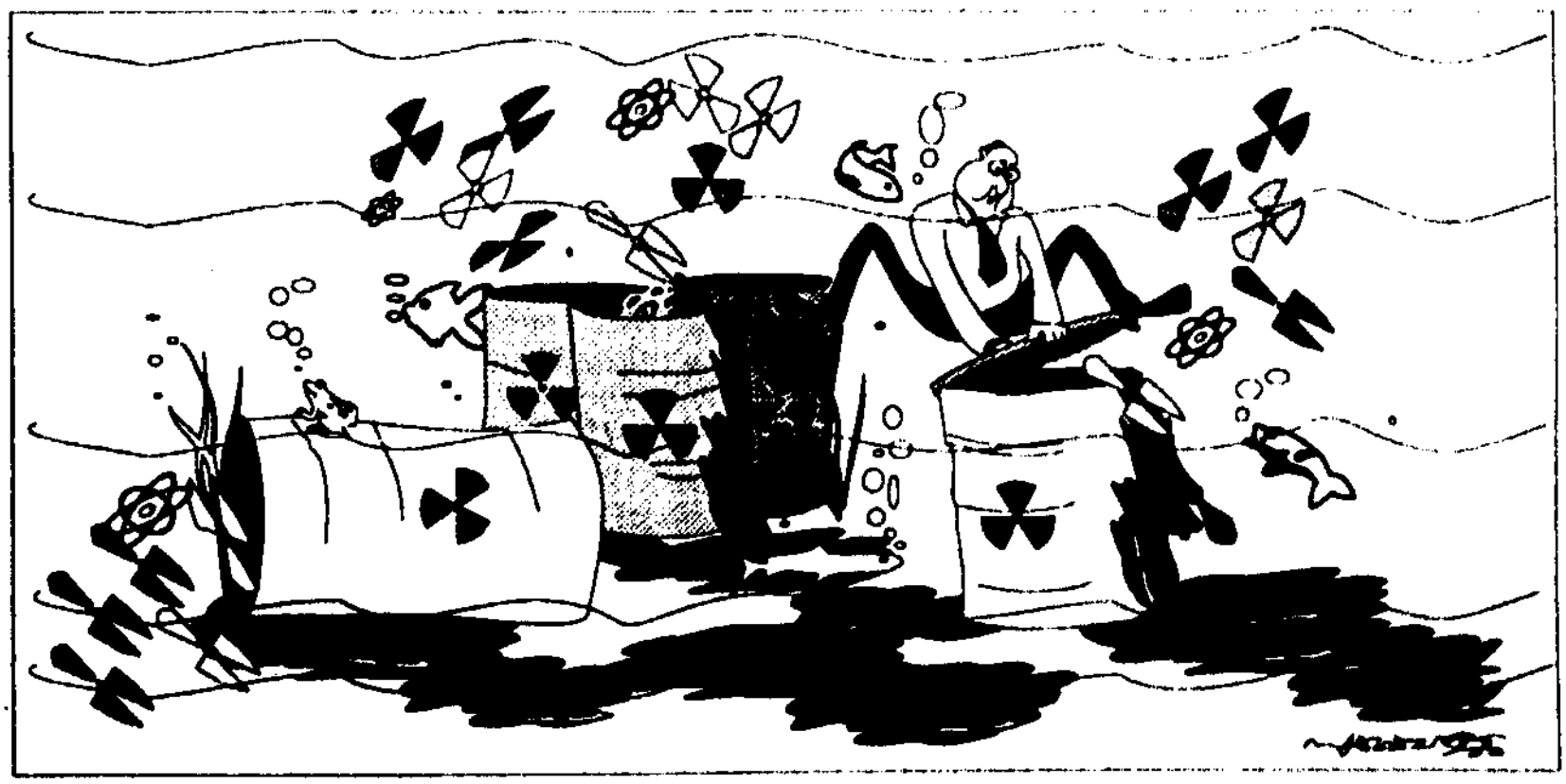
A. Yes, we declared site emergency at 11 A.M. on 16th June.

Q. When will the plant start again?

A. We expect it to start in the second week of July.

Q. Is there a 'monsoon committee'and who are its members?

A. Yes. There is Mr Sinha who is an administrator and there are some seven to eight engineers.



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Notice of Shri D.P.Trivedi Collector, Surat

The Kakrapar Atomic Power Station is this country's fifth and most modern atomic power station. This atomic power station has been built within schedule despite adverse circumstances at a cost of around Rs. 1350 crores. It adheres to the highest internationally accepted safety standards. Before starting the reactor, it had been subjected to all the stringent tests and conditions imposed by the government appointed Atomic Energy Regulatory Board. The design of the atomic power plant takes into consideration site specific factors such as geographical conditions, the rainfall and flood patterns of the last 40 years, and the arguments of seismic experts. On 15th and 16th of June, due to inconceivably heavy rainfall in the whole area and the extremely fast rise in the level of the Moticher Lake and the Kakrapar dam catchment area, affected the whole area and also the plant. There was more than 9 feet of water flowing above the Kakrapar weir. In circumstances beyond human and plant management control, this water had entered the turbine room of unit-1 and unit-2 and the pump house through storm drains and the inlet pipes from the Moticher Lake. In these circumstances, the plant engineers had closed the gates on inlet pipes of the pump house and a site emergency was declared at 11 O'clock as per prescribed procedures and all efforts were made by the workers to remove the water from the plant. The reactor was in a shutdown state at the time, but had it been operating it could have been shutdown within a few seconds. This plant uses natural uranium only 0.7% of which is fissionable. Had these circumstances arisen when the plant was operating, the resultant steam would have gone into the reactor building, it would have gone into the suppression pool of the reactor building and would have condensed into water. These safety features are part of the reactor's safety system and there is no fear whatsoever that had the reactor been in operation when the flooding took place than half of Gujarat would have been affected by the explosion. Today (June 22nd, 1994) after having made an inspection, I am making this statement as the off-site emergency director of the plant to bring these facts for the attention of the public.

Q. Why did it not take measures to prevent the flooding of the plant?

A. The committee's work is to deal with ordinary rain.

Mr. Dipak (Technical Services Superintendent):

What happened was beyond anybody's imagination.

Q. What is the condition at present of unit-1 and unit-2?

A. All together about 40 motors in unit-1 and the same number in unit-2 have water in them.

Q, Was the Ratania gate of the Moticher Lake opened?

A. Mud has collected around the Ratania gates of the lake. Actually, there is an island in the lake and the gates are on this island. A lot of grass has grown very tail near the gates. The gates are manually operated. Despite lot of effort the gates of the lake could not be opened.

Q. Had the gates been opened would it have made any difference?

A. Certainly it would have made some difference.

Q. I hear that valuable records have also got destroyed in the flood.

A. Well, records... A little bit... some account books, correspondence regarding plant construction, some drawings, and other stationary has been destroyed.

Q. What is the condition of the computers?

A. Some computers bought in 1985 and 1986 have suffered some damage.

Q. So, really there has only been damage worth Rs 10 lakhs?

A. Yes. There is of course the production loss. The plant was to have started on the 16th of June. That did not happen. If the plant operates at full capacity, then there is a loss of Rs One crore for every day that the plant gets delayed.

The next 'event' took place on 29th June with the publication of a report in *Gujarat Mitra* which claimed that during the floods on 15th June, the water had breached the waste management facility and four drums of solid radioactive waste had been swept away. The containers, according to the paper had spilled some of the contents outside, which had been collected later by the authorities. The paper talked about the threat posed to Surat city which is downstream of Kakrapar on river Tapti.

Since this was a 'sensational' disclosure, all the inhabitants in villages around Kakrapar including the Anumukti team were waiting with baited breath for an official response. However, there was no response at all till the 8th of July; when the district collector Mr. D.P.Trivedi was invited along with a large posse of pressmen from Surat to Kakrapar for a briefing. In the briefing, Mr. Kalaiya repeated most of the things he said in his previous interview with *Gujarat Samachar*. Regarding the waste, the statement of Mr. Kalaiya were reported differently by different newspapers.

The *Indian Express* said:
"Mr. Kalaiya described as misleading a report in a local daily that four drums containing nuclear waste had been swept away by swirling waters resulting in a leak of radio-active material from the drums. He agreed that water had seeped into the two-metre trench meant for keeping these drums but no drum had been swept away. One of the drums had been lifted a little by the water and from it a container with the waste inside had come out. But he said, the container had not opened ruling out the possibility of leakage of material. "But despite this, we took samples of the water in the trench, tested it and sent the report to the Gujarat Pollution Control Board," he said. The test had not found any contamination, according to him.

"Besides, Mr. Kalaiya explained that the waste stored here was that which was left during clean ing-up and maintenance of the plant. This waste was very low active and had radioactivity of less than 0.03 MR, he added. The more radioactive wastes were being reprocessed at Tarapur and was not released into the atmosphere, according to him.

On the other hand, *Gujarat Mitra* had this to say regarding Mr. Kalaiya's remarks regarding the waste.

The rainwater which entered the plant in flood force had breached the spot where radioactive waste is stored in special cans. The lid of one of the cans had become loose due to which the radiation monitoring unit had automatically started. Experts had immediately begun to study whether radiation had spread to various neighbouring zones. Wind direction, water, soil and cattle samples were examined and so also different samples were collected. Nothing has come out which can be a cause of any worry. There is regular sampling of radiation in the zones adjacent to the reactor."

Gujarat Mitra also reports that Mr Kalaiya had also appealed to the neighbouring public not to give way to panic and informed that he the chief superintendent of KAPS, the district collector, the police commissioner, the chairman of Atomic Energy Regulatory Board, were in contact 24 hours through telephone, telex, satellite channel, wireless etc. So that even in case of an accident these worthies would have been informed immediately.

There has been no further word from either the district collector or Mr. Kalaiya the station superintendent of Kakrapar since the 8th of July, and it seems as if they have decided that the matter is closed.

Editor's Commentary

Since the *Indian Express* and the *Gujarat Mitra* reports regarding Mr Kalaiya's explanation about the waste and swirling waters are so radically different, one claiming that no waste was spilled at all, while the other saying that it did and talking about the automatic radiation monitoring unit getting started, I will leave it to the reader to come to his or her own conclusions as to what actually took place that fateful day.

I would only like to make a small comment regarding Mr. Kalaiya's use of numbers and units. I find this 'scientific' rigmarole a regular feature of nucleocrats' efforts at 'educating' the public. Units for radioactivity are becquerrels (one disintegration per second) and curies (3.7×10^{10} disintegration per second). There is no unit of activity called MR. Presumably what is meant by this MR is milli-rem. Rem is a unit of dose. If one knows the activity of the waste cannister and what kind of waste there is and what kind of radiation it emits and the energy of that radiation then one can calculate the dose per unit of time that the can emanates. Capital M is usually used to denote mega (million) rather than milli (thousandth) which is denoted by small m. In any case, the 0.03 MR still does not make any sense since no time interval has been specified.

On July 18, 1994 I wrote Dr. A. Gopalakrishnan, the chair of Atomic Energy Regulatory Board, a letter informing him of what Mr. Kalaiya had said to newspapers and requesting information regarding when the AERB was officially informed.

As luck would have it I met Dr. Gopalakrishnan himself in Delhi on the 8th of August at a meeting called by INTACH—a voluntary organisation which wants to organise a national workshop on 'Nuclear Safety and the Public' on February 3rd and 4th, 1995. The first thing Dr. Gopalakrishnan said to me was, "I have received your letter and you will be getting a reply soon.'" I have still (31st of August, 1994) not received any reply to this letter

But I did ask Dr. Gopalakrishnan the same questions and his oral replies are the following:

Regarding waste, he said that the canisters were not totally filled and hence they had buoyancy and as a result they floated in the water and had to be searched and fished out. But they had not opened. On my asking him if that were the case then how come the radiation monitoring unit had automatically kicked-off, he had no answer. He said that he would be visiting Kakrapar on August 24th and would make it a point to meet us. However, he hasn't come as yet.

Regarding when he was informed by the KAPS authorities about the flooding he said that he came to learn of it on June 23rd, when *Gujarat Samachar* carried the story. So much for the 24 hours contact with telephone, telex, satellite chanel, wireless, etc.

A National Treasure Or A Global Security Risk

What To Do With Hugo Stocks of Surplus Plutonium?

Ite makers had hoped that plutonium would lead the world to a utopia created by a boundless source of energy. Glen Seaborg, who led the team that first isolated it, felt that plutonium would provide the energy to make deserts bloom and enable "planetary engineering"; there would be earth to moon shuttles; sea water would be made potable. "My only fear is that I may be underestimating the possibilities," he said in 1968.

"The plutonium we no longer need for weapons is a global security risk and an economic liability."

Hazel O'Leary,
US Energy Secretary

"Plutonium has essentially a negative economic value,"

John Gibbons, Scientific Advisor to President Clinton

The Indian establishment as also the Russian, has a similar view. They both see plutonium as the currency of power—the gold of the nuclear age. The direction of nuclear energy policy in India is towards establishing a plutonium based programme.

Right now, India is a long way off from this goal. Although, our reactors produce a good deal of plutonium in the spent fuel, it comes mixed with all kinds of highly radioactive fission products that need to be separated out before one can obtain the plutonium in a usable form. This process is known as reprocessing. India has a small reprocessing facility at Trombay and a slightly bigger one at Tarapur. Another reprocessing plant is undergoing construction at Kalpakkam in Tamil Nadu. However, obtaining enough plutonium for a full reactor load from these reprocessing plants would still take years. Having enough plutonium for making a bomb is another matter and we have already demonstrated our ability to do that twenty years ago.

The Scale of the Problem

The Americans and the Russians are in a different position altogether. During the Cold War, each had produced huge quantities of plutonium and highly enriched uranium (HEU) at enormous cost in money, health and environmental damage.

With the arms race winding down, these large stocks of plutonium and HEU are coming out of weapons. Over the next decade at least 50 tons in the United States and probably a little more in Russia. In addition, there is some 33 tons or more of 'other plutonium" found around nuclear weapon's complex in the US alone, much of it scrap and other forms not easily made into fuel.

It is crucial that this surplus weapons plutonium be managed in a way that minimises the danger that it will be re-used for weapons by the initial possessor nation, another nation, or a sub-national group; strengthens national and international institutions and incentives for control and reduction of nuclear weapons; does not lead to increased accessibility of civilian plutonium for weapons use; and meets reasonable standards for safety, health, the environment and cost.

Highly enriched uranium does not constitute a proliferation risk. It can be easily diluted with natural uranium so that the resultant is no longer so highly enriched and cannot be used for making bombs. Recovering bomb-usable material from diluted HEU requires technologically demanding and costly isotopic separation. In contrast, plutonium offers no such possibility of "denaturing".

The Russians, even after fifty years of experience with plutonium still regard it as an asset not a liability It is, as one official put it, "a national treasure", to be husbanded now in order to produce boundless energy for future generations. Besides the plutonium in weapons, there are large plutonium stocks accumulated for use in power plants. Russia is also planning a new generation of nuclear power plants called breeders that create more plutonium than the nuclear fuel they consume. And that plutonium, while not as pure as that from weapons, would still be readily usable by weapons makers.

What is more, senior Russian officials say they plan to pay for these costly plants in part with dollars from the US government money that the Russians will earn from a contract to sell America highly enriched uranium.

The United States has contracted to buy Russian HEU to use it in civilian reactors for energy, but the real American purpose was to reduce the chances of theft or sales on the world market, a goal that could be undercut by the Russians use of the revenues to build breeder reactors.

Thus, the gap in attitudes about the nuclear legacy looms large.

Russia wants to keep its surplus plutonium in a pure form, the form in which it is used in weapons. This would make it attractive to terrorists or nations that want such a weapon; as little as four kilograms, would be enough. Even without thefts, the more plutonium that remains in an easily accessible form in either country, the easier it would be for a future Russian or American government to rebuild a giant nuclear arsenal quickly.

While American officials believe their own stockpiles are safely guarded for now, they argue that disposal of plutonium now could help protect future generations. The United States, which first synthesized plutonium and has spent billions of dollars and done substantial damage to the environment and human health in the process, is ready to dispose of it. The question is how!

Plutonium is a Ilability

The US National Academy of Sciences (NAS) issued a report in January 1994, entitled *Management and Disposition of Excess Weapons' Plutonium.* The report examines the problem of the management and disposition (long-term management) of plutonium from unwanted nuclear weapons at the end of the Cold War.

The report warns that excess military plutonium poses high security risks and at the same time affords no economic advantage for the foreseeable future. It states that "exploiting the energy value of plutonium should not be a central criterion for decision-making, both because the cost of fabricating and safeguarding plutonium fuels makes them currently not competitive with cheap and widely available low-enriched uranium fuels, and because whatever economic value this plutonium might represent now or in the future is small by comparison to the security stakes."

The NAS analysis shows that even when the plutonium itself is assumed to be "free", it costs more as an energy source than uranium because plutonium processing and the fabrication of fuel containing plutonium is so expensive. (In most cases, plutonium is used in a reactor fuel known as MOX a mixture of oxides of plutonium and uranium).

The report also discusses the issue of "civilian plutonium", or plutonium recovered from reprocessing spent

Plutonium Storage:

In the nuclear weapons complex, plutonium is primarily found in three forms: plutonium metal, plutonium oxide and plutonium nitrate solutions. Each form poses its own set of potential problems that may result in the release of plutonium from storage containers or create difficulty in handling. Plutonium metal reacts with oxygen in air (or corrodes) to form plutonium oxides. Of these oxides plutonium dioxide (PuO_2) is the most prevalent. The formation of plutonium dioxide from plutonium metal is accompanied by release of heat and a large expansion in volume, which may breach the primary storage container according to the US Department of Energy's own assessment.

Plutonium oxide normally consists of small particles. If not properly contained, such particles can easily be dispersed and inhaled. Plutonium oxide has the ability to adsorb (to stick: see box on jargon) water and organic molecules on its surface. If the container (and thus the plutonium inside it) is heated, or if chemical reactions within the container raise the temperature, any adsorbed water on the plutonium may be released as steam, building up the pressure in the container. Pressurisation can also occur when the adsorbed materials are slowly released over time. In addition, the adsorbed molecules are subject to radiation from the plutonium, which can chemically break them up. The process of chemical breaking of molecules under the action of radiation is called radiolysis. Radiolysis can also cause problems in the packaging of materials; any plastic in the packaging, for example, may disintegrate. Unfortunately, the DOE wrapped and sealed many containers in plastic bags in an effort to minimise the spread of contamination. A breach of the primary containment would therefore put plutonium in contact with the plastic. Radiolysis of some types of plastic bags releases hydrogen and gaseous hydrochloric acid, both of which react with the container material and the plutonium metal. There reactions increase the risk of fires; some of them also release heat within the container. Such reactions in turn increase the risk that the plutonium will not be contained.

Other kinds of hazards can result from other material properties of plutonium. In some case, plutonium is pyrophoric (spontaneously igniting in air). Clean plutonium metal does not burn at room ternperature, but the higher temperatures associated with machining plutonium metal have caused numerous fires in the finely-divided plutonium metal machine scraps. Secondly, the decay of short-lived plutonium-241 yields americium-241, which emits penetrating gamma radiation and can thus cause worker exposure. Spills and criticality are important concerns for plutonium nitrate solutions.

It Pays To Increase Your Jargon Power

1. *pits*

a. a sassy cologne for the manly man; let her know how base you can be

b. what John McEnroe thinks of referees and linesmen

c. a hollow sphere of plutonium-239 or uranium-235 metal. It is the trigger of nuclear weapons — the first part of a nuclear explosion in the primary stage of a nuclear weapon.

2. *pyrophoric*

a. having a phobia of spontaneously catching on fire

b. an obscure eighteenth century term that referred to pirates who had successfully found treasure. It eventually was used by royalty to express a feeling of euphoria (as in "totally pyrophoric, Duke")

c. the ability to ignite spontaneously in air. Several metals used in the nuclear fuel cycle, such as liquid sodium, plutonium and uranium, are pyrophoric to varying degrees. The latter two metals have an increasing likelihood to spontaneously ignite with rising temperatures or decreasing particle size. However, they are not pyrophoric at room temperature.

3. *vitrification*

a. an especially cruel form of medieval torture involving the force feeding of vitamin supplements

b. the transformation of a sincere and sweet child into a vitriolic teenager

c. to convert into glass. In the nuclear arena, vitrification refers to the glassification of radioactive waste, mixed waste or materials such as plutonium

4. adsorption

a. the manner in which humans have long-term memory of television commercials

b. the rate at which various billboard materials succumb to the ravages of birds

c. the sticking of molecules to the surface of a liquid or solid. Adsorption is different from absorption, which involves taking molecules in through pores or soaking up

5. ro*diolysis*

a. the process by which listening to the radio turns you into a couch potato

b. a special hair treatment for bald people

c. the change in the chemical form of a substance caused by the action of radiation

6.MOX

a. a state of utter and complete thoughtlessness. From Sanskrit Moksha. Indian nucleocrats are said to attain this state of mind as they contemplate replacing enriched uranium fuel for the Tarapur reactors

b. a very virulent form of small-pox which left the afflicted mentally retarded

c. from mixed oxide fuel; a way to utilising plutonium by mixing it with uranium for use in light water reactors

fuel from civilian power plants. Recognizing the security risks from all separated plutonium, including that in civilian nuclear power programs, it recommends that the US and Russia "pursue a reciprocal regime of secure, internationally monitored storage of fissile material, with the aim of ensuring that the inventory in storage can be withdrawn only for non-weapons purposes." As Russia continues to experience severe economic problems and political uncertainty, this is a crucial and very urgent recommendation.

The report also implies that civilian plutonium is a liability, comparing it with producing oil from shale rock, which will remain uneconomic for decades, but which poses no comparable security risk.

Recommandations

The NAS report recommended the possible use of MOX as one long-term plutonium disposition option. If MOX were used in existing nuclear reactors, the plutonium remaining in the waste would be sufficiently mixed with radioactive fission products that it could not be used in weapons without costly and dangerous processing. Alternatively, the report suggested mixing excess plutonium with radioactive wastes and molten glass a process known as vitrification.

Both of these options would make it difficult, costly, and dangerous to re-extract the plutonium for use in weapons. The criterion by which these options were adjudged suitable was the "spent fuel standard" that is, it should be at least as difficult to make weapons from unreprocessed spent fuel from civilian nuclear power plants.

The report also recommended considering deep boreholes (two to four kilometers deep) for evaluation as a disposal option, but recognized that retrievability from such boreholes could cause problems because, in that case, the plutonium could be re-used to make nuclear warheads. On the other hand, the report notes that retrievability might be an advantage in negotiations with the Russian government, which views plutonium as an economic resource.

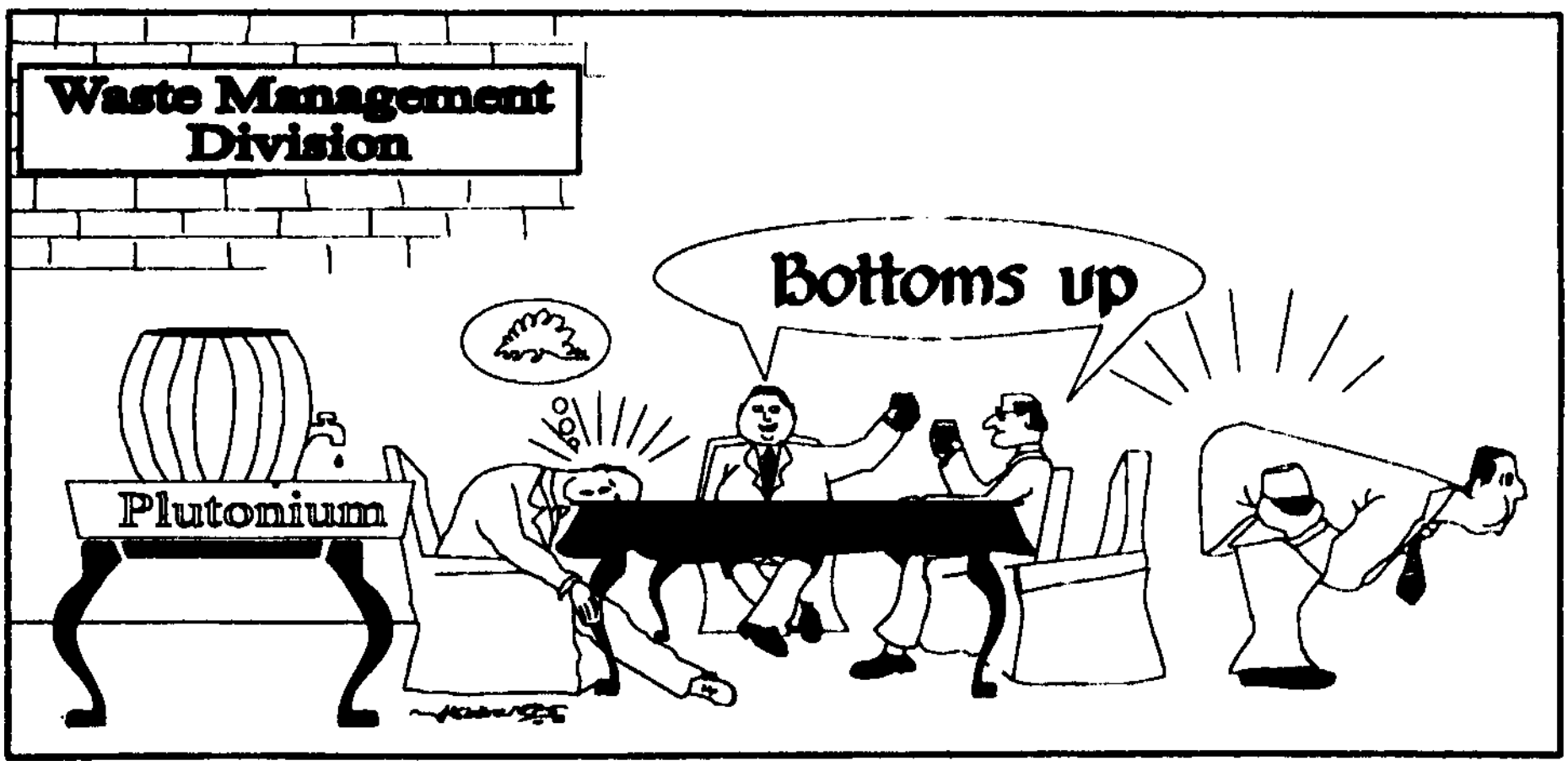
But plutonium would continue to pose a threat even in these hard-to-handle radioactive forms. The report notes that most fission products, which make spent fuel or radioactive glass logs difficult and expensive to handle, decay well before plutonium does. It therefore recommended research into a variety of transmutation options using critical and subcritical reactors that, in the very long-term, could fission essentially all existing plutonium. The NAS panel recommended this approach a supplement to, and not a substitute for, the two main options.

None of these disposal options can be accomplished quickly it will be well into the next century before they are completed. As Wolfgang Panofsky, Chair of the NAS plutonium panel, told the *Washington Post,* "the world is condemned to having to baby-sit this material for at least another decade," (January 25, 1994). As part of that atomic baby-sitting exercise, the NAS report recommends, all inventories of fissile materials must be declared, and put into international or bilateral verified storage.

One possibility for relatively quick processing of plutonium (within the next decade) is to vitrify it alone, without mixing it with radioactive waste. Because plutonium emits mainly alpha radiation, which is dangerous only when inside the body, it can be vitrified without massive shielding. A far more complex plant would be needed if radioactive wastes emitting far more penetrating radiation were mixed in.

The NAS report considered such an option, but did not recommend it, since the plutonium could be recovered after processing at far lower levels of effort than with spent fuel from reactors, a disadvantage from the point of view of potential re-use in weapons.

However, the report does note that "experience with separating materials from glass is far less widely disseminated than experience with spent fuel reprocessing." For this reason, this measure would provide a considerable barrier to re-use. Moreover, as with deep boreholes, a potential for re-extraction could be an advantage in the near future.



Who Says Plutonium Disposal Is a Problem!

Given the collapse of the economy in the former Soviet Union and the accompanying political and military instability, time is the most important factor in coping with excess plutonium. Added to the problem is the Russian government's attachment to plutonium as a resource. The NAS report should have put the vitrification of plutonium alone at least on a par with disposal in deep boreholes* We recommend that DOE build a pilot plant to test the process with plutonium metal and with various chemical residues present in the DOE complex. This would provide much of the environmental, health, and safety data needed for a sound decision on the vitrification of plutonium.

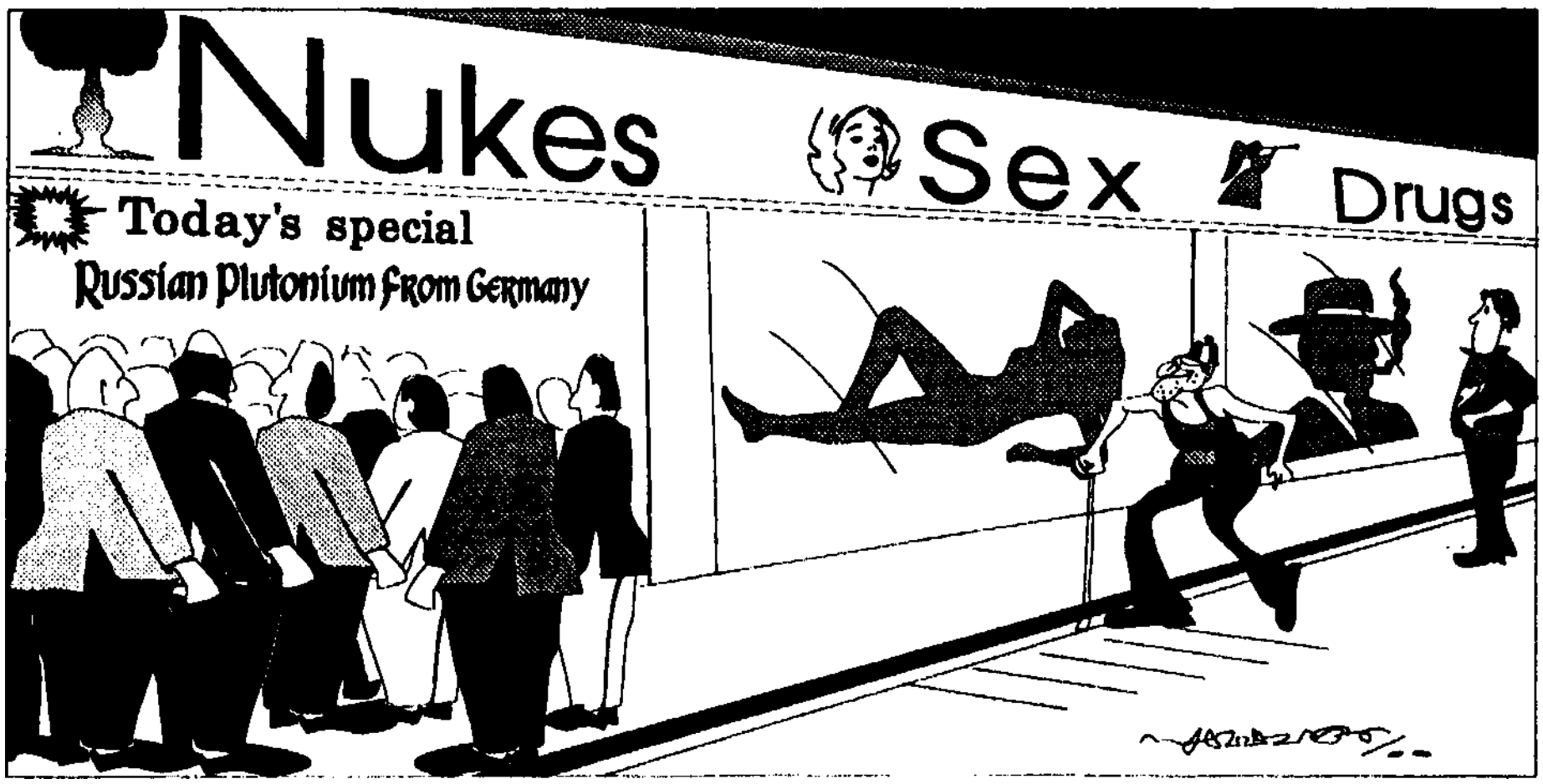
The high cost of deriving energy from plutonium has to do with the enormous precautions that must be taken in processing it (it is highly carcinogenic), with the large capital investment needed for building nuclear reactors, and with the difficulty and expense of decommissioning reactors and disposing of their radioactive wastes. Other burdens stem from safeguarding it, since all grades of plutonium are usable for making nuclear weapons, another important fact that the NAS report highlights.

The Twist In The Tall

All statements from high US officials need to be carefully considered for their Tiidden' agenda. Lest we forget, these are the guys who gave us "Atoms for Peace" in the first place. The continued funding for research on the Advanced Liquid Metal Reactor which is a breeder reactor with a new name and a so-called 'inherently' safe garb does little to generate confidence that the Americans are really serious about getting rid of their own plutonium stocks.

Plutonium was regarded in most of the post-World-War-11 era as the gold of a glorious nuclear age to come. It was not to be. Rather, it has become a terrible liability. Today, knowledge of nuclear weapons technology is so widespread that getting access to it is not a substantial barrier to proliferation, rather, as the NAS report notes, "access to fissile material is the principal technical barrier to proliferation in today's world..." That is why complete elimination of nuclear weapons usable materials is a necessary condition for achieving both nuclear non-proliferation and nuclear disarmament goals.

Based on articles by Matthew L. Wald & Michael R. Gordon in Times of India, Arjun Makhijani Science for Democratic Action Vol. 3 No.2 Special Thanks to Dr Egghead Science for Democratic Action Vol. 3 No.2 for the feature It Pays to Increase Your Jargon Power



The Global Supermarket

lethal Privatisation Off Nuclear Trade

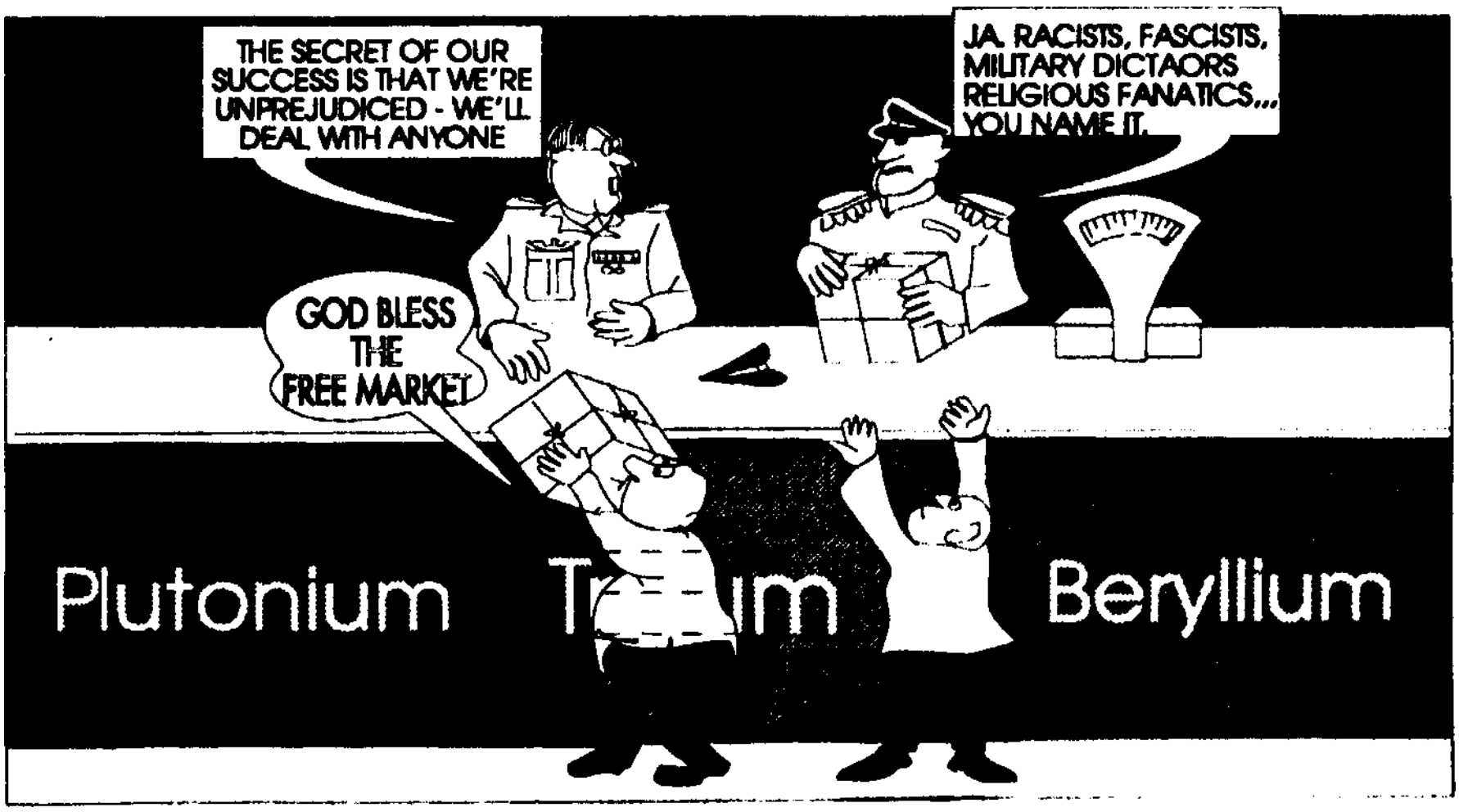
A Pakistani national is suspected by the German authorities to be involved in the smuggling of plutonium out of Russia. Indian newspapers and parliamentarians think this proves that the Pakistan government is building up a clandestine nuclear arsenal, and have expressed outrage. Long articles have been written about Pakistan's record of nuclear smuggling or theft.

I fear this loud condemnation of Islamabad may be misplaced, and that we may be ignoring an indefinitely bigger danger. We do not have the full picture yet, but for all we know the smuggled plutonium may have been paid for not by the Pakistan government but by terrorist groups in Pakistan. For all we know, the plutonium may have been destined for Dawood Ibrahim, or for Islamic groups wanting to overthrow the Rabbani government in Afghanistan, or wanting India to give up Kashmir.

For many reasons, I find it infinitely more frightening to contemplate plutonium with terrorists than with the Pakistan government. First, the Pakistan government already has nuclear weapons, and adding a few kilos to its arsenal makes little difference. Second, Pakistan can be deterred from using its arsenal by India's own nuclear power.

But if plutonium ends up with terrorist groups, they will constitute a new source of danger, over and above anything we face from Pakistan. More serious, it is impossible to deter a terrorist group with our own nuclear weapons. We can target our nuclear weapons at Pakistani military bases, but have no way of targeting individuals or groups. Finally, terrorist are far more fanatical and impervious to persuasion or international pressure than governments, and so will be far more reckless in their use of nuclear materials than Islamabad.

So I hope and pray that the plutonium being smuggled out of Russia is indeed going to the Pakistan government, and not to terrorist or underworld groups. I find it quite comic that supposed intellectuals are indignant at the prospect of the Pakistan government adding a few irrelevant kilos to its arsenal. Smuggling fissile material out of the ex-soviet Union is rife, and I would be extremely happy if the entire amount is purchase by the Pakistan government, for that will ensure that the material does not end up in the



Come One Come All

hands of terrorists. Indeed, I would almost be willing to offer Pakistan a subsidy for the purpose.

Some people argue that the Pakistan government may pass on nuclear materials to terrorists. No nuclear government has ever done so, and I doubt if Pakistan will, since it is vulnerable to economic and diplomatic sanctions by western powers. (Editor's Note: I agree with the author's conclusion that it is doubtful that Pakistan will pass on nuclear material to terrorists, though not with his reasons for coming to this conclusion. It is not the vulnerability to western economic sanctions that makes governments take the straight and narrow path but sheer self-interest: terrorism is a two edged sword and can very easily bite the hand that feeds it. India has enough first hand experience of this with LTTE in Sri Lanka.)

It is not difficult for any skilled group to assemble a bomb once it acquires bomb-grade uranium or plutonium. A crude terrorist bomb weighs no more than one tonne, and be detonated by remote control. It will be small enough to be concealed and carried in a small truck or jeep to any site.

The thought is frightening, the Bombay blasts of March 1993 used RDX as explosives. If plutonium leaks to terrorists, the next blasts may be nuclear. Every time there is a communal riot, we could see nuclear blasts as the culmination of the frenzy, a new horror to add to other horrors. In a worst-case scenario, the acquisition of nuclear material by Muslim terrorists could be followed by a similar acquisition by Hindu fundamentalist groups, and that would be the end of the Indian state as we know it. This is, of course, an extreme scenario, but looking at the worst possible outcome is an important way of analysing the dangers of a situation.

Fissile materials need not be exploded to cause damage. Plutonium is extremely toxic, and even microscopic quantities can maim and kill people. A few kilos of plutonium would not be enough to make a bomb, but would be enough to poison the water supply of Bombay or Delhi, and maim or kill lakhs.

Why are leakages from Russia so widespread ? Because, as a nuclear weapons' power, it is not subject to international inspection. There is an urgent need to expand such inspection to cover all nuclear powers, including the USA. Leaks from US facilities are not entirely unknown. Even with universal inspection, some leakages will still take place. But the greater the vigilance, the smaller will be the leakages and the less the danger.

Left-wing comrades in India are terrified at the possible privatisation of government monopolies in industry. I am terrified by the possible de facto privatisation of nukes and violence. A civil society bestows a monopoly of force and weapons on its elected government, which alone can use weapons or force against individuals, in accordance with the laws of the land. This monopoly of force is sometimes misused. But it must not be replaced by free trade in violence and weapons, that way lies anarchy and oppression.

by Swaminathan S. Anklesaria Aiyar. The Sunday Times of India, August 21,1994.

The 40-year lie

On March 1,1954, at Bikini Atoll—a curving string of several dozen tiny islands looping gracefully around a 24 mile long lagoon—the United States tested its first deliverable hydrogen bomb. That test—Bravo—was the most destructive nuclear test in U.S. history. With an explosive force equal to nearly 1,000 Hiroshima-type bombs, it vaporised the test island and parts of two others and left a mile-wide crater in the lagoon floor.

In 1954, Bikini was one of the 29 atolls and five islands comprising the Marshall Islands, a United Nations trusteeship administered by the U.S. Department of the Interior. Although the total land area of the Marshalls is only about 70 square miles, they are scattered over 357,000 square miles of the Pacific. Two of the atolls—Bikini and Enewetak—were used for 66 nuclear tests, from 1946 to 1958.

The greatest irony of the Bravo shot was the decision not to evacuate any Marshallese. For Operation Crossroads, (a series of nuclear tests conducted on the same islands eight years earlier), the navy had evacuated the Marshallese living on Bikini as well as the three inhabited atolls closest to Bikini—Rongelap, Wotho and Enewetak. The tests during Operation Crossroads had not imperilled the other atolls, although they had seriously contaminated Bikini's lagoon.

Thus, in 1953, when the navy suggested an even more expansive danger zone for the Bravo shot and removing people from Rongelap, Interior Department officials balked. The 167 men, women and

children removed from Bikini had never been permitted to return. Now High Commissioner Elbert D. Thomas, the highest ranking U.S. official in Micronesia, was reluctant to displace more Marshallese.

Their reaction to an enlargement of the area of activity will be apprehension, and fear that future extern sions may place any of them in the same homeless position as the Bikini people now occupy," Thomas wrote his superiors at Interior. Evacuation would result in a "lowering of morale."

The Atomic Energy Commission agreed with Interior, and the results were tragic. For an atomic bomb the size of those dropped on Hiroshima and Nagasaki, the U.S. Navy had evacuated Marshallese for hundreds of miles to the east, west and south of Bikini. For a hydrogen bomb in 1954 that the government knew would be at least 400-500 times more powerful, no one was evacuated from these atolls. As a result, some 236 inhabitants of Rongelap and Utrik atolls, as well as 28 American servicemen on Rongerik Atoll and 23 crewmen on a Japanese fishing vessel, the Lucky Dragon, were sprinkled with fallout from Bravo.

Ever since March 1,1954, the U.S. government has explained that there was an unexpected "shift of the winds occurring after the detonation" that carried radioactive fallout from Bravo eastward over Bikini as well as over Rongelap, Utrik and other atolls in the Marshall Islands.

We now know that this was not true. The shot was deliberately set off despite the fact that government officiate knew exactly which way the winds were headed. According to a series of now-declassified for-the-record memos, the weather briefing at 7 a.m. February 28, the day before the shot, predicted "no significant fallout ... for populated Marshall Islands." But later in the day, "the **trend was toward an unfavourable or marginal condition." By 6 p.m., "conditions were getting less favourable."**

"It should be noted that no test is done without a specific purpose in mind, and at no time was the testing out of control."

Admiral Lewis Strauss at 'Bravo' press conference 30th March, 1954

The midnight briefing, less than seven hours before the shot, showed "less favourable winds at 10,000- to 25,000-feet levels." Winds at 20,000 feet "were headed for Rongelap to the east" and "it was recognised that both Bikini and Eneman Islands (east of the shot island) would probably be contaminated."

Following the midnight briefing, Bikinis weather outlook was downgraded to unfavourable, and Joint Task Force Seven ordered several of its ships to move 20 miles farther out to sea and to the south, to get out of the path of the fallout.

This evidence puts Bravo in a different category from an "unexpected wind shift." Some of the Americans were moved out of harm's way. But the "native" were left in place downwind. If the weather forecast created enough risk to move the ships, either the Marshallese in danger should have been also moved or the shot should have been postponed.

Following the shot, Atomic Energy Commission chairman, Lewis Strauss immediately opted for total secrecy, saying that "no public release will be made in regard to Call-out or evacuation in Trust Territory unless forced by leak or other circumstances."

Los Alamos test division leader Alvin Graves strongly objected to this policy. In an "Eyes Only" cable to the task force director of military application, Graves said he was "very concerned" about Strauses order. "I should regret very much the impression that we are being furtive in our actions with regard to these people." To no one's surprise Strauss prevailed.

Graves was right. The secrecy about the fallout exposure—and the later lies about a "wind shift"—were unconscionable acts, it is time for the U.S. government to apologise.

Jonathan M. Weisgall
Bulletin of Atomic Scientists
May/June 1994

The inhabited atolls of Rongelap and Utrik, some 100 and 300 miles east of Bikini were bathed in radioactive fallout. A pale powder coated Rongelap to the depth of one and half inches and Utrik was wrapped in radioactive mist. It was three days before U.S. Navy ships arrived to evacuate the residents. By then they were experiencing a range of symptoms: nausea, burnt skin, diarrhoea, headaches, eye pains, numbness and general fatigue. They also suffered a lowering of the blood cell levels, especially the white and T-cells, which form a major part of the body's immune system. Their fingernails came off, their fingers were bleeding and their hair was falling out. The exact dose of radiation that the 236 islanders received was never measured, but it is estimated at 11 rem per person on Utrik and 190 rem on Rongelap. (For comparison, the average dose per person received after the Chernobyl accident to residents living nearby was estimated to be 12 rems.)

"Greater knowledge of radiation effects on human beings is badly needed ... Even though the radioactive contamination of Rongelap Island is considered perfectly safe for human habitation, the levels of activity are higher than those found in other inhabited locations in the world. The habitation of these people on the island will afford most valuable ecological radiation data on human beingss."

The Rongelapese now suffer from high rates of malignancies and reproductive problems, all directly associated with radioactive fallout. The Marshall Islanders have one of the highest rates of diabetes in the world. They are also suffering from psychological phobias as the result of uncertainties about their future.

The Brookhaven scientists allowed the Rongelapese, including some who had not been exposed to the effects of Bravo originally, back to their islands in July 1957, declaring the atoll to be safe, despite 'slight lingering radiation'. There had been no radiological clean-up.

From Greenpeace Book of the Nuclear Age

The Economy off Nuclear Security

Stuck in a relationship of conflict, that has led in the past to three wars, security issues loom large for the governments of India and Pakistan. Being poor countries they want "cheap security", and now many of their policy makers seem to think that nuclear weapons can provide just that. But nuclear weapons have never provided cheap security and cannot do so for India or Pakistan. Nuclear weapons systems are neither cheap to develop, nor do they allow large reductions in conventional military forces.

Since both governments already claim to have some kind of "nuclear capability", it could be argued that the huge sums involved in developing such weapons have been spent already, so what is the point of crying over it now? Nuclear weapons are more than just "things" , like one buys from a shop. They are part of the search for "nuclear security". The setting up of a nuclear weapon's programme marks the beginning of this process, not its end.

The pursuit of "nuclear security" creates a sense of "insecurity" in others, which they try to overcome. A simple example of this is the rationale offered for Pakistan's nuclear weapons programme. It is supposed to be a response to India's nuclear programme, which was claimed, in turn, to be a response to the Chinese programme. The competitive dimension is common to all attempts to create security by military means, nuclear and non-nuclear. It follows from the strategic notion of "deterrence" which is not peculiar to nuclear strategies, but has been associated with weapons throughout history; in fact from the time the first caveman with his stone-axe decided if his neighbour also had a stone-axe, he needed a spear and in time a bow and arrow, guns, tanks nuclear bombs. This process is driven by pressures that are brought into being as soon as the first step is taken.

The logic of deterrence says a nation always has to be prepared to fight. There is, therefore, a great deal of importance attached to being ready to fight a war, at any moment. Deterrence theorists argue this "readiness" defers the outbreak of war. But they fail to understand this "readiness" not only undermines any effort to prevent crises from developing in the first place, it also becomes increasingly costly.

A former chairman of Pakistan's Atomic Energy Commission has already observed "all weapons systems, including nuclear devices, lose their effectiveness over time. New technological advances render them obsolete." This implied, to him, that "defence preparedness has to be renewed and upgraded year after year." However, the open-ended and unlimited renewal and improvement of "defence preparedness" is certain to claim scarce resources "year after year". An apt analogy is heroin addiction; the victim spends more and more time, effort, and of course money "chasing the dragon".

How severe nuclear addiction can be is evident from the experience of nuclear junkies that have already travelled this road. The US started with two atomic bombs, which destroyed the two Japanese cities of Hiroshima and Nagasaki in 1946. In 1947 they wanted three bombs to use on Soviet cities, by 1949 they wanted 220, and by 1960 they had 18,000 nuclear weapons in their arsenal.

The types of nuclear weapons also increased, ranging from bombs that weighed less than 50 kg to those weighing several tonnes. The destructive power available increased enormously when, following the Soviet nuclear test-explosion in 1949, the US detonated the first hydrogen bomb in 1952- a feat which the Soviets duplicated within a few years.

The delivery systems for nuclear weapons increased not only in number but in their range and in sophistication. There are long-range bomber aircraft, nuclear artillery shells, short range intermediate range and intercontinental ballistic missiles, that can be launched from silos on land or from submarines, and now cruise missiles that can be launched from aircraft, shops and even from a truck. What has increased throughout is the speed, complexity and lethality of the weapons system taken as a whole.

Should anyone want to argue that this is a specifically superpower experience, they will firstly have to explain why Britain, France and China did not stop their weapons programmes when they had built atomic bombs. All these nuclear weapon states went on to build hydrogen bombs, missiles, submarines, and so on. There are signs that the next stage of competitive escalation has already begun in South Asia; it is widely believed that Indian bomb-designers have been working on a hydrogen bomb, and there is probably a similar team somewhere in Pakistan, desperately trying to catch up. If Pakistan's military planners were ever foolish enough to explode an atomic bomb as a test (and as a demonstration) then India's would almost certainly respond with a nuclear-test aimed at developing their hydrogen bomb.

Given that India and Pakistan are developing missiles and trying to buy submarines, clearly they are not immune to the escalation that comes from the logic of "deterrence". Even the prime minister (Benazir Bhutto) has recognised this when she referred to "fears" of an "arms race" and "huge defence establishments". Why she thinks these are still "fears", something that may happen rather than something that is already happening, is a question someone should ask her when it comes to preparing the defence budget. In her address to the National Defence College (March 17, 1994) she seems to return to the pattern of deterrence: "This is my promise to you: come what may we shall get the weapons of tomorrow. It shall not be our fate to live in perpetual fear of predatory neighbours brandishing hi-tech weapons."

All nuclear weapons, irrespective of who they belong to, once designed and assembled, have to be tested, inspected and maintained. For Pakistan or India to think about deploying their nuclear weapons, rather than just talking about them, or sitting on them without knowing if they are safe and reliable, makes such procedures absolutely indispensable. A nuclear test is more than setting off a bomb in a hole in the ground. It is actually a very complex scientific experiment, and doing an experiment just once is bad science. A typical series of nuclear weapons tests in the early days of the US nuclear programme consisted of 20 test explosions for each weapon design. These tests are not cheap; the current cost for one simple underground test explosion is $ 30 million. The US Department of Energy has requested $ 428 million for 1994, just to maintain the infrastructure and capability required for nuclear testing. But these are the least of the costs associated with nuclear weapons testing.

The real consequences of nuclear weapons testing are to be found in large areas of Nevada and Kazakhstan. These areas, described as "National Sacrifice Zones" by US officials have become unfit for human habitation as a result of these test-explosions. In both areas there is radiation in the soil, in the food and in the water. Farmers commonly find that their livestock give birth to "monstrous offspring", others just die "mysteriously". In Kazakhstan, milk in the area has 500 times the officially acceptable amount of radioactivity in it.

It is the local people who are the worst suffers. Around the Nevada test site, people now suffer from "cumulative cancers, neurological disorders, and genetic defects". Cancer is common that almost everyone living there can recall "long lists of tumours or deceased friends and relatives". Eyewitnesses have described people whose "hair was falling out and their skins seemed to be peeling off. And then there are the "jellyfish babies", born to women living in these areas; women who after six months of pregnancy, give birth to what "looked like a bunch of peeled grapes".

It does little good to detonate the test explosions underground. One

Nuclear weapons have never provided cheap security and cannot do so for India or Pakistan. The social costs of pursuing such "security" are evident in the schools, hospitals, roads, water and sewage systems that could have been built, but were not built. The money has obviously been there to be spent, but has, instead, been wasted on chasing the nuclear dragon, whose fire may consume both nations.

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out of every three underground Soviet tests threw radioactive dust and gas into the atmosphere. In about 30 tests these clouds were blown by the wind outside the test area into populated regions. The incidence of leukaemia has more than doubled in this area where more than 95 % of the children suffer from anaemia. The Soviet obsession with secrecy meant that "people living in this area died slow and horrible deaths from unknown illnesses—diagnosing radiation related illnesses was forbidden." As many as 500,000 people are believed to have been affected by radiation from the Soviet nuclear blasts in Kazakhstan.

The situation is little better in the US. An unpublished government report prepared during the 1970s estimated that 175,000 people had been poisoned with radioactivity, nearly everyone living within 250 miles of the Nevada test site. A further 250,000 US soldiers may have been exposed to radioactivity by US nuclear bomb tests, while as many as a million people have actually worked in the nuclear weapons plants. Ill-health among these workers is increasingly being linked to their jobs.

The intensely radioactive materials that form the core of nuclear weapons make the bomb-factories so contaminated that, in time, they become unusable. As a result of safety and environmental problems in such plants in the US does not have the capacity to make nuclear bombs. The cost of clean-up are staggering. It is estimated that to clean up just the Hanford nuclear facility in the US, described as the "dirtiest place on earth", will cost at least US $ 150 billion, the real costs may be much higher. What is already clear is that $ 8 Billion have already been spent on this with "little to show".

How badly do the people of Pakistan need "nuclear security"? How much are they willing or able to pay? The social costs of pursuing such "security" are evident to everyone, especially in the lost opportunities, the schools, hospitals roads, water and sewage systems that could have been built, the lives immeasurably improved, by deploying the same capital investment. This money has obviously been there to be spent, but has, instead, been wasted on chasing the nuclear dragon, whose fire may consume the nation. But it has to be said that nuclear weapons are only part of a larger story. There are the hundreds of thousands of men, hundreds of tanks, dozens of F-16s, submarines and frigates, as well as nuclear weapons and missiles. The larger story is about a society that is obsessed with war, that does not believe it can ever know peace.

Dr. Zia Mian
Sustainable Develop. Policy Inst. Islamabad.
The News March 19, 1994

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Sumesh Chandran, Sanghamitra and Surendra Gadekar

Published by Gadekar For Sampoorna Kranti Vidyalaya and printed at the Parijat Printry,Ahmedabad.

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