Dumping Ground

U.S. Stores Radioactive Waste From Foreign Nations

By LEE DYE
Part-Time Service

Deadly radioactive waste products from nuclear reactors in foreign countries are being imported into the United States in spite of the fact that the United States has serious problems in storing its own radioactive wastes.

At this point, it appears that the U.S. is well on its way to becoming the radioactive dumping ground for much of the world.

At the same time, U.S. Atomic Energy Commission officials conceded that the United States has not solved its own problems of waste disposal. And the brief 30-year history of the nuclear age is replete with serious shortcomings in the management of radioactive waste products in this country, as the Los Angeles Times has reported several times in recent weeks.

However, radioactive waste products are already in storage here from Japan, Canada and Italy, and many other countries will join that list soon.

American-made Nuclear power plants are going into service in many countries around the world. The American firms which build the reactors also hold contracts for reprocessing the fuel, the source for nearly all of the lethal radioactive waste products generated by nuclear reactors.

The fuel rods must be returned to this country for reprocessing, and the waste remain here.

This predicament evolved from the Atoms for Peace program which the late President Dwight D. Eisenhower laid before the United Nations on Dec. 8, 1953. In a dramatic speech, Mr. Eisenhower pledged this nation to the peaceful exploitation of the atom on a worldwide basis.

He followed up on that theme two years later in a message to scientists from all over the world who had gathered in Geneva for the U.N. Conference on Peaceful Uses of Atomic Energy. Referring to his earlier speech, the President said:

"I stated then, and I reaffirm now, that the United States pledges its determination to help find ways by which the miraculous inventiveness of man shall not be dedicated to his death but consecrated to his life.

"THIS PLEDGE WHICH we gave 20 months ago has become the law of our land, written to our statutes by the American Congress and the new Atomic Energy Act of 1954. The new act states in forthright language that we recognize our responsibilities to share with others, in a spirit of cooperation, what we know of the peaceful atomic art."

That pledge led the United States into a worldwide program aimed at developing atomic energy. U.S. scientists were dispatched to foreign capitals to encourage the use of nuclear power, and foreign scientists and technicians were imported by the planeload so that they might learn from our experiences.

Over the years American industry moved to the forefront in the promotion of nuclear power. Today, companies like General Electric and Westinghouse build nuclear reactors for foreign countries around the world.

But as Dr. Frank Pittman, director of waste management for the Atomic Energy Commission, noted in an interview with the Times, more money is to be made in the fuel than in the reactors themselves.

"General Electric produces fuel for reactors they have sold around the world," Pittman said.

The sales contracts require the buyer to purchase fuel from G.E., Pittman said.

That means that the fuel rods from the reactors must be removed from time to time and shipped back to the GE reprocessing center in Morris, Ill. Reusable uranium and other saleable radioisotopes will be extracted from the fuel rods, leaving considerable amounts of extremely deadly radioactive waste.

Those waste products will remain in this country under [illegible] the AEC calls "perpetual care."

THIS SITUATION CAME to light in a letter from Pittman to Oregon's Sen. Mark Hatfield. The senator had written the AEC at the request of Nancy Cutler of Portland, Ore., a member of Another Mother for Peace, the antiwar organization that has turned much of its attention to nuclear power.

In his letter to Hatfield, dated Sept. 27, 1972, Pittman referred to agreements with 35 countries under the Atoms for Peace program:

"Consistent with these agreements, small quantities of spent fuel from Japan and Canada have recently been processed at AEC and commercial facilities within the United States. The high-level radioactive waste derived from these processing activities remain in this country."

In an interview with the Times, Pittman said he does not consider the problem of foreign waste significant because it will not add appreciably to the waste generated by the United States.

He added that economics will force some countries to build their own reprocessing facilities rather than transport the material all the way back to the United States.

However, AEC documents indicate that the amount of fuel for foreign reactors that will be processed in the United States may be very substantial in the years ahead.

In its annual reports on the nuclear industry in recent years, the AEC has projected that "foreign free world requirements" for fuel will nearly equal domestic requirements by 1985. The reports indicate that more than 60 per cent of that requirement probably will be met by U.S. processing plants in 1985.

The reports also show that in dollar values the export of nuclear fuel material and isotopes exceeded the value of exported reactors and instruments as early as 1969.

As Pittman told the Times:

"The money in the long term is [illegible] the fuel."

Consider for a moment one of the prime activities that results in environmental deterioration: the generation and use of electric power. Europeans live a pleasant, reasonably affluent life on somewhat less than one-half the per capita electric power consumption of Americans, and with careful planning their level of consumption could also be greatly reduced. Actually, though, the American power industry wants to *increase* our per capita consumption at a rate that will double our national use of power every decade. At this rate, every square inch of the United States would be covered with conventional power plants in two hundred years or so.

This projected increase is the reason that the industry is vigorously promoting the construction of more heavily-subsidized nuclear powerplants, perhaps the most dangerous single trend in the environment-technology area today.

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Perhaps the most dangerous single agency outside of the Department of Defense (DOD) is the Atomic Energy Commission (AEC) which has, among other duties, the impossible task of both promoting and regulating the peaceful uses of atomic energy. Under pressure from the power industry and at the urging of a group of guilt-laden physicists, the AEC emphasizes promotion, and has a dismal record at regulation. The result has been the AEC's promotion of a long series of schemes, virtually all premature or completely unworkable, which would lead to irreversible radioactive poisoning of our planet.

Fundamentally, an agency of repeatedly proven incompetence is all that stands between a safe and the virtually permanent poisoning of the entire environment of our spaceship by the widespread and premature use of fission reactor technology. Whether power generation by fission can eventually be both safe and economical is problematical, but *there is no question that it cannot be either today.* There is one point on which all competent scientists agree: the AEC must be dismembered so that the promotion and regulation of the uses of atomic energy no longer rest in the same hands.

NEWS AND COMMENT

Radiation Spill at Hanford: The Anatomy of an Accident

For most of the 7000 workers at the Atomic Energy Commission's vast Hanford Reservation—and for most of the 26,000 citizens of Richland, Washington, Hanford's residential appendage—nuclear energy long ago lost its aura of mystery. They grew up with the atom in a way most Americans did not; they learned to live near, if not exactly to love, potentially hazardous sources of radiation, and they learned to take for granted the strange jargon and paraphernalia of the business—"radwaste," the film badges, the head-to-toe coveralls, the scintillation counters. If nuclear energy meant a mushroom cloud to most Americans, it meant a way of life to those at Hanford.

Nestled in a crook of the Columbia River in a dry, almost empty corner of south-central Washington, the 570-square-mile reservation was the site of one of the three "atomic cities" that the Army built for the Manhattan project. During the war and for 25 years thereafter, great complexes of production reactors and chemical plants (there are nine reactors, all but one of which has been mothballed) turned out tens of thousands of kilograms of plutonium for the nation's swollen stockpiles of nuclear weapons. In the process, the chemical plants also turned out more than 70 million gallons of intensely radioactive liquid waste. The AEC has been slowly evaporating the waste down into solid cakes of salt and storing the cakes in steel tanks; 42 million gallons of the waste are still in liquid form, however. Either way, it remains an exotic legacy of the postwar arms buildup that will have to be guarded for centuries until radioactive decay renders it harmless.

The waste is also an aspect of nuclear energy that Hanfordians have learned to live with quite well. Perhaps because of this necessary accommodation with the atom, and perhaps because spills of radioactive waste are not all that unusual at Hanford, officials of the Atlantic Richfield Hanford Company—the AEC contractor in day-to-day charge of all this nuclear garbage—evinced no signs of urgency in June as hints appeared of yet another spill.

In fact, they kept the bad news to themselves for an entire working day. Having confirmed at a 9 a.m. meeting on Friday 8 June that some of the waste was missing, ARHCO officials waited until 4:25 that afternoon before telephoning the AEC's Richland office and relaying the news: One of the oldest and largest of 151 underground tanks of "high-level" waste was leaking.

No one knew how long tank 106-T had been leaking, or how much of its caustic, boiling contents had seeped into the sandy soil near the center of the reservation. As a matter of fact, no one was certain how much liquid had been in the tank in the first place. Nevertheless, the AEC was advised that emergency pumping operations would begin late that night to salvage what remained in the 533,000-gallon tank.

It was only around noon on Saturday 9 June that federal authorities and ARHCO technicians began to grasp the magnitude of the problem. Picking through what recent records they could find of the leaking tank's contents (a month later, some records were still missing), technicians calculated that the seepage had begun "on or about" 26 April. For 51 days thereafter, roughly 2500 gallons of liquid waste had dribbled out of the steel-and-concrete tank each day; the total loss is estimated at 115,000 gallons, containing 40,000 curies of cesium-137; 16,000 curies of strontium-90, 4 curies of plutonium, and smaller amounts of assorted fission by-products.

The AEC has methodically and deliberately disposed of far larger amounts of radioactivity in Hanford's soil over the past 25 years, and quite safely, it insists. Other high-level waste tanks have also leaked. Between August 1958, and this June, an eyeball 422,000 gallons containing more than half a million curies seeped out of 15 other tanks, all of which have since been "retired." But the leak in 106-T was something different. It was the largest single accidental release of radioactive waste in the commission's history, and easily its most embarrassing incident since Project Rainier, a weapons test that went awry in Nevada in 1970, sending a puff of fallout all the way to the Canadian border.

Not surprisingly, Hanford's big leak has blossomed into one of the AEC's worst public relations disasters in years. Environmental groups have filed a flurry of lawsuits seeking to stop the flow of wastes from Hanford's two chemical reprocessing plants, and the spill has brought out a rash of frightening headlines up and down the West Coast. On the morning of 5 July, for instance, 22 days after the AEC at Richland issued a press release describing the accident, readers of the Los Angeles *Times* awoke to a six-

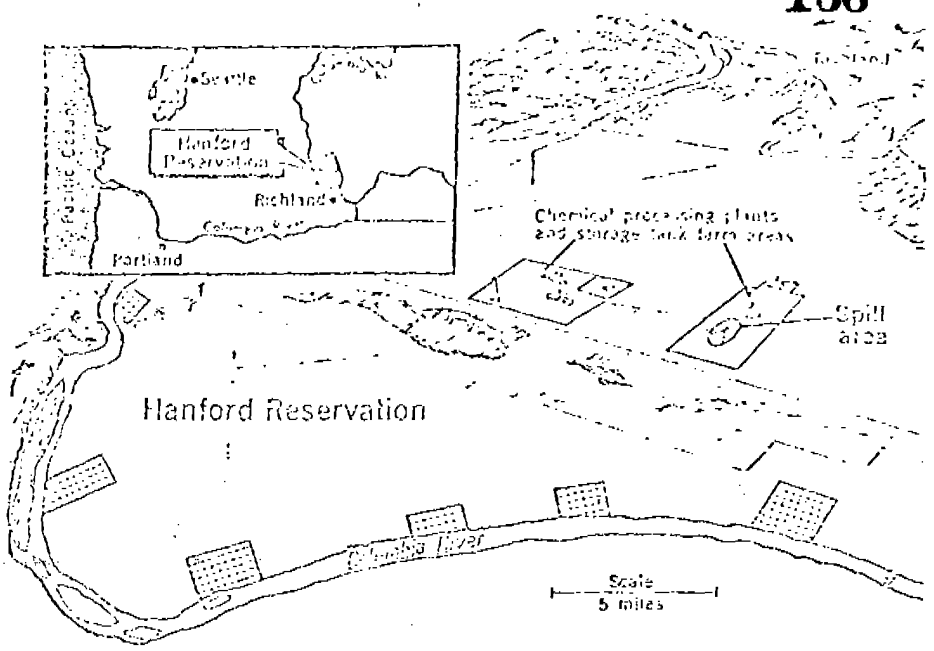
column banner across the front page declaring, "Nuclear Wastes Peril Thousands." Thomas A. Nemzek, the AEC's general manager at Hanford, has even been getting worried letters from his relatives. "They're wondering what's going on," he says. "Are we dropping into a hole, slipping into the sea?"

Whether anyone is actually imperiled is a matter of dispute. AEC commissioner Clarence E. Larson says that he's "distressed at implications that large masses of people are endangered"; as evidence to the contrary, he notes that radioactivity in the Columbia River, downstream from Hanford, is less than half that present naturally in the Potomac River. Nemzek, for his part, contends that no high-level waste has ever reached groundwater at Hanford, and he adds that, even if all the waste stored at Hanford did somehow escape and reach groundwater, radioactivity in the Columbia River would still remain within drinking water standards. In any case, the site's 7000 workers are going about their normal routines, and Richland, at last report, was calm.

More to the point is what the incident reveals about the keenness of the AEC's vigilance over the nation's vast and expanding store of nuclear processing wastes, 75 percent of which are stored at Hanford. Is the AEC really prepared to manage thousands of pounds of wastes that civilian nuclear power plants will be generating in the years ahead? And how, exactly, could it lose the equivalent of a railroad tank car full of radioactive liquid hot enough to boil itself for years on end and knock a Geiger counter off scale at a hundred paces?

The AEC has been asking itself such questions lately, and, with notable candor, is letting the public have a look at the answers. In response to lawsuits filed by the Natural Resources Defense Council and other environmental groups, the AEC has promised to write an environmental impact statement assessing the full range of its waste management programs; it is opening up nuclear waste information centers in five cities; and it is publishing a 1093-entry bibliography of research papers covering storage and disposal of wastes at Hanford from 1951 to the present.

The first real product of this open-window policy is a 129-page report on the causes of June's record leak. The report, written by a four-man committee appointed by Nemzek, attributes the accident partly to aging tanks and primitive monitoring technology, but mostly to managerial laxity and human error on the part of Atlantic Richfield. The report also contains a brief admission that the AEC's Richland operations office, which is supposed to supervise Hanford contractors, failed to detect flagrant deficiencies in management of Hanford's 13 waste storage tank "farms."



Map depicts site of nuclear waste spill found in June at the AEC's Hanford Reservation near Richland, Washington. Hatchured areas denote plutonium production reactor sites. [Kenneth D. Smith]

The bungling attributed to Atlantic Richfield (which has declined to comment on the report) would be unbecoming for a municipal sewage plant, to say nothing of the nation's main repository for nuclear waste. In practice, there are two ways of detecting a leaking tank. While neither method has changed much since the Manhattan Project, they both work passably well if everyone pays attention to his job. For one, tank farm operators were supposed to take weekly readings of fluid levels. Second, they were supposed to take weekly or monthly radiation readings at dry wells spotted around the tanks. If fluid levels sank and radiation in the wells rose, that meant a tank was leaking. Simple, but not fail-safe.

The problem, according to the report, was that the operators who took the readings did not know how to interpret them; and a day shift supervisor in charge of half of Hanford's tanks, who *did* know how to read the data, let 6 weeks worth of charts and graphs pile up on his desk because of "the press of other duties," he said later, and never got around to reviewing them; and consequently a "process control" technician elsewhere at Hanford, who was supposed to be reviewing the tank readings for "long-term trends," received no data for more than a month. The technician, who was not identified, waited until 30 May to complain about the delays, but he nevertheless emerges as the hero in this dismal story. Fragmentary readings of fluid levels in 106-T arrived in his hands on Thursday 7 June, but it was enough to show that something was amiss. The technician put out the alarm; the supervisor confirmed the leak the next morning after checking his records and promptly resigned.

All of this, the report says, led to the discovery of more far-reaching deficiencies that AEC officials had previously failed to notice or fully appreciate. Communications within the tank farm management were chronically poor; there was no "well-defined, formalized training program" for operators and no systematic checking of their qualifications; written and oral instructions to tank operators were neither "consistently applied nor completely understood"; nor was there evidence that supervisors were checking "the operator's knowledge of what he has learned"; no formal preventative maintenance program for monitoring equipment existed; and no evidence

ARCO officials were paying much attention to the leaky tank farms, in spite of pressure from the AEC to tighten up monitoring procedures and in spite of a "growing number of radioactive leaks," as an ARCO memorandum from September 1972 puts it.

For all its shortcomings, though, Atlantic Richfield did no more than make the worst of bad circumstances. Monitoring systems were so primitive that, even if everyone had performed up to expectations, between 27,000 and 38,000 gallons of waste would still have been lost. Moreover, the tanks were wearing out (106-T was built in 1943–44, and 168 others still in use are more than 20 years old) and the AEC knew it.

Multiple Warning

Indeed, as if periodic leaks were not sufficient warning, from 1953 to 1971 private consultants, the U.S. Geological Survey, and the Government Accounting Office (an investigative arm of Congress) all had warned the AEC that it was courting trouble by its continuing reliance on the technology of the 1940's to store the nuclear wastes of the '60's and '70's. In the face of this advice, the AEC stepped up its solidification program but turned down requests from Hanford contractors in 1959 and 1961 to build new tanks. (Since then the AEC has built six new tanks and has two more under construction, but has been forced to decommission 25 as confirmed or suspected "leakers.")

One of the first cautionary notes is found in a classified study of Hanford groundwater characteristics, prepared by the U.S.G.S. in 1953. Observing that tank-stored wastes and interconnecting pipelines had occasionally leaked, this report called the tanks a "potential hazard" and concluded that their "true structural life . . . [is] not entirely known." The U.S.G.S. report was declassified in 1960, but was not published in the open literature until this year (as Professional Paper 717).

Nevertheless, on 29 January 1959, the then manager of Hanford chemical plants, Herbert M. Parker, told a congressional hearing on nuclear waste disposal that he confidently expected the storage tanks to remain serviceable for "decades" and possibly for as long as 500 years. Asked whether any had ever leaked, Parker replied that fluid levels in some had undergone "suspersuaded that none has ever leaked."

A GAO report dated 29 May 1968 tells a rather different story, however. By then, ten tanks at Hanford had leaked 227,000 gallons of waste, all of which was said to be held in the soil beneath the tanks. The first major leak, of 35,000 gallons, occurred in August 1958, 6 months before Parker had testified. Later, the service life of remaining tanks had been reliably estimated at 10 to 20 years. The GAO said structural weaknesses and corrosion were "almost certainly present" in 14 tanks, 4 of which had previously leaked but were still in use. The AEC had apparently ignored the advice of consultants from the Illinois Institute of Technology, who said that some tanks were being stressed "well beyond accepted design limits" and that the wisdom of reusing such tanks was "debatable."

Waste managers at Hanford had little choice in the matter, however. Liquid wastes continued to pour from the reprocessing plants, but the only spare tanks on hand were those with known weaknesses. Between 1963 and 1965, the GAO said, the AEC had found itself in an even less tenable position, with no empty spares on hand. Thus, in November 1963, tank farm operators had watched helplessly from afar as tank 105-A—9 years old, with a capacity of 1 million gallons of high-level waste—sprang a small leak that was later traced to a cracked seam. In full knowledge of this weakness, Hanford continued to use 105-A for the simple reason that there was no other place to put its contents. Indeed, after the initial leak seemed to seal itself, Hanford's waste managers filled it even fuller than before, exceeding the tank's design capacity by 10 percent.

In January 1965 tank 105-A sustained further damage from a powerful internal steam explosion that shook the ground and battered tank instruments. But the tank held, and it remained in use until 1968.

The upshot of the GAO's investigation was an exhortation to the AEC to "devote more vigorous attention" to its waste management problems. The GAO report was classified, stamped "secret" on every page, and remained under wraps until December 1970.* One follow-up report that cited some progress toward solidifying liquid wastes and phasing out the aging tanks. Taking note of several new leaks, however, the GAO cited an "increased possibility" of still more spills and urged an "increased . . . level of effort" in waste management programs.

AEC officials insist that these criticisms were taken to heart, not ignored. Partly in response, they say, waste solidification programs were stepped up, to immobilize the waste and eliminate the need for tank storage. Technological and funding problems, however, have impeded this effort. In 1968, the AEC expected to have caught up to current waste flows by 1974; now the target date is 1976, although the AEC is thinking about asking Congress for a supplemental appropriation to speed things along.

Civilian Wastes are Different

What does all this have to say about the AEC's ability to handle wastes from civilian power plants? Not much, the AEC says.

"It's an entirely different problem," commissioner Larson said in an interview. "The precautions we take to keep [civilian power plant wastes] from getting into the ground will be much greater than with the defense wastes at Hanford, and our margins of safety will be much greater."

The main difference is that commercial reprocessing plants will solidify reactor fuel wastes almost immediately, before sending them to the AEC for long-term storage.

In the meantime, the incident at Hanford has suggested to the AEC that its allowances for human error may be less than adequate. The commission is looking into waste management practices at its other storage sites, and Hanford claims a heightened vigilance over its troublesome tanks. Liquid levels are now read three times a day instead of weekly; a computerized, automated leak-detection system is being rushed to completion; and there is said to have been a "realignment" of sleepy watchdogs in the local AEC office.

In spite of all precautions, though, more spills from Hanford's 149 tanks are inevitable. Thomas Nemzek said so late in June, and sure enough, on 6 July, yet another one struck: a leak of high-level waste. It is true, tank farm crews were alert: They held the loss to 1500 gallons.

—ROBERT GILLETTE

* AEC officials say the report was classified not to avoid embarrassment but to protect information that could be used to calculate rates of U.S. plutonium production. The classification was lifted, officials say, after it was determined to have been "overly cautious."

Nuclear paradox: If it's foolproof, why insure it?

NEW YORK—Insurance coverage on nuclear power plants is an issue employed by both sides in the nuclear power safety debate to establish their separate causes.

Defenders of nuclear power like to note the various nuclear insurance pools have never received a claim stemming from the operation of a reactor. They highlight the fact the pools annually, almost as a matter of course, refund premiums to insureds because of good experience.

In July, for example, the Nuclear Energy Liability Insurance Assn. (NELIA) and the Mutual Atomic Energy Liability Underwriters (MAELU) refunded $1,-035,153 to some 300 insureds. Over the past seven years, the two pools have refunded more than $5 million.

Critics, on the other hand, contend the $560 million limit on recovery in case of a nuclear accident set by the Price-Anderson Act is not only ridiculously low but is tantamount to admitting manufacturers, utilities, insurers and the government are simply protecting themselves against an inevitable catastrophe.

AS ARCH-CRITIC Ralph Nader phrased it at hearings on nuclear safety conducted by the Pennsylvania insurance department (*Business Insurance*, Aug. 27): "If nuclear power plants were safe they would be insurable. The utilities and the insurance companies won't take the financial risk of nuclear power . . . The lack of full insurance coverage against nuclear power plant accidents is the clearest warning the public can have about the unresolved nuclear power plant safety problems."

At those same hearings, NELIA's general manager, Joseph Marrone, and F.J. Goodfellow, general manager of the Nuclear Energy Property Insurance Assn. (NEPIA), testified as to their pools' activities.

Mr. Marrone pointed out NELIA or MAELU had received claims arising from 24 incidents over the last 16 years, none of them stemming from the operation of a reactor. Nine of the incidents occurred during the transportation of nuclear material. The other 15 he characterized as "nontransportation" incidents.

"Five of the nine transportation incidents involved claims for property damage caused by contamination," he said. Two of the remaining claims, he added, involved alleged bodily injury to transportation workers and another involved contamination of a warehouse and truck weigh-in station.

THE OTHER transportation incident "involved alleged bodily injury from a shipment of a small quantity of depleted uranium delivered to the wrong address." This, he said, was covered by conventional insurance, not the nuclear pools.

After testifying that five of the non-transportation incidents involved leaks of encapsulated radioactive isotope sources, Mr. Marrone said, "One reported incident involved possible radiation exposure to children who had stolen a radium source." Jaws dropped in the hearing room.

The other incidents, he reported, involved bodily injury claims from persons who had come in contact with radioactive material, in one way or another, in the course of their employment. One of these was a fatality after an accident at a facility processing enriched uranium.

"The total of incurred losses since the inception of the nuclear liability pools (1956) is $1,600,-000," Mr. Marrone said. The pool has cancelled two risks over the years and refused to write one, he added.

Mr. Goodfellow testified that NEPIA had received some 200 property claims but none of them arising from the operation of a nuclear reactor. Most of them, he added, were "small stuff."

NEPIA covers the construction phase of the nuclear plant and its most expensive claim stemmed from a fire at a plant under construction. This fire, an arson-caused blaze at Consolidated Edison's Indian Point Two plant in New York, produced a $4.5 million loss for the property pool. ■

Safe Nuclear Power?

On Nov. 2, the Atomic Energy Commission confirmed that a spill of radioactive material occurred at its Shippingport, Pa., nuclear power plant—which the AEC brushed off by calling it "a minor accident which was quickly contained."

The spill occurred inside a safety shell covering the plant's reactor and involved a resin and water mix which, the AEC said, "contained some radioactivity." Two employees of the Duquesne Light Co. were overcome by heat prostration while attempting to clean up the spill, the AEC said, but were not injured by the material.

The AEC did not report the accident to the press until a week after its occurrence because it "considered it minor and no outside contamination had resulted from the spill," according to the Associated Press.

In Pennsylvania, two environmental groups have had to drop their fight against a mammoth nuclear power project in the Delaware Valley due to lack of money. In exchange for withdrawal of the objections, three power companies agreed to install a device to screen out low-level radiation. An attorney for the intervenors, the Harrisburg Citizens for a Safe Environment and the Coalition on Nuclear Power, said it would have cost $30,000 to continue the fight.

Pennsylvania's insurance commissioner Herbert Denenberg, an implacable foe of nuclear power development, termed the settlement "blackmail."

"This shows that, once again, the nuclear establishment has ransomed the public interest for its own benefit. In order to get a safety device which should be mandatory to protect the health of the public, the nuclear establishment forced the intervenors to drop their objections by financial coercion," Denenberg said.

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A Citizen's Bill of Rights on Nuclear Power

1. The public is entitled to full and candid information about the dangers and benefits of nuclear power in language they can understand, not just obscure technical jargon and Madison Avenue propaganda.

2. The nuclear establishment, including the AEC, utility companies, nuclear manufacturers and the insurance industry, has the obligation to disclose all information about the dangers of nuclear power.

3. The nuclear establishment has the obligation to make all relevant information readily available nationwide and not simply to store it in document rooms in Washington. Because of the unprecedented danger, failure to make readily available all information should be subject to severe criminal penalties.

4. The public is entitled to participate fully in all nuclear power decisions at all levels and at the earliest possible time. The public should not have these decisions rammed down their throats.

5. The public is entitled to have nuclear power plant decisions made on the local as well as the state and federal levels of government with meaningful input by citizens who will be directly affected. All decisions should not be made by federal officials.

6. The public is entitled to government regulation of the atomic energy industry designed to protect the citizen rather than to promote and protect the interests of the nuclear establishment. The health and safety of the public should come ahead of the corporate health and safety of the nuclear establishment.

7. The public is entitled to full protection for all damages caused by nuclear accidents. The financial risk of any accident should fall on the nuclear establishment, not on the public.

8. The public is entitled to a legal system that will guarantee compensation for the special types of injuries caused by nuclear radiation, such as genetic damage and delayed diseases, that may not be compensable under present law.

9. The public is entitled to an insurance industry that actively promotes safety and the public interest rather than one that serves as a mere adjunct to the nuclear establishment.

10. The public is entitled to full legislative monitoring of the risks and benefits of nuclear power. Responsibility should not be abdicated to a Congressional Joint Committee on Atomic Energy that has a vested interest in nuclear power and has traditionally been part of the nuclear establishment.

11. The public is entitled to a nuclear policy that protects present and future generations against unreasonable dangers. Future generations should not be given the oppressive burden of the storage of the present generation's nuclear waste.

12. The public is entitled to an energy policy that in no way compromises national security. The public should not be subjected to nuclear Trojan Horses susceptible to sabotage and attack by conventional weapons.

13. The public is entitled to a comprehensive national energy policy with full environmental protection to assure a safe and sufficient supply of power rather than the present circus of hazards and inadequacies.

14. Until the previously mentioned rights are assured, the public is entitled to a moratorium on the further expansion and operation of the nuclear establishment.

"MC" Disaster?

Citizen's Bill of Rights and Consumer's Guide to NUCLEAR POWER

A summary of what you're entitled to - but aren't getting now.

Prepared by Pennsylvania Insurance Department

HERBERT S. DENENBERG
Insurance Commissioner

MILTON J. SHAPP
Governor

September 1973

FOREWARD

During August, 1973, the Pennsylvania Insurance Department held three days of public hearings on the risk and insurability of nuclear electric power plants. The hearings brought to light serious doubts in the scientific community about the safety of these plants. They also confirmed that there is a lack of insurance coverage to protect the public against the consequences of catastrophic accidents that could occur.

Responding to these facts, the Insurance Department issued "A Consumer's Guide to Nuclear Non-Insurance" which informs consumers about the lack of adequate insurance protection against nuclear accidents. The Department also issued "A Citizen's Bill of Rights on Nuclear Power," which affirms that the public has basic rights to be informed about the hazards of nuclear power, to be consulted about their willingness to accept such risks, and to make the final decision on whether such risks should be accepted.

The text of these two documents is reprinted herein. We invite everyone to let us know their views on the subject of nuclear power. We also urge you to write your congressman, state legislators, and other government officials.

Herbert S. Denenberg
Insurance Commissioner

Business Insurance, October 8, 1973

Nuclear paradox: If it's foolproof, why insure it?

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"The total of incurred losses since the inception of the nuclear liability pools (1956) is $1,008,-269," Mr. Marrone said. The pool has cancelled two risks over the years and refused to write one, he added.

Mr. Goodfellow testified that NEPIA had received some 200 property claims but none of them arising from the operation of a nuclear reactor. Most of them, he added, were "small stuff."

NEPIA covers the construction phase of the nuclear plant and its most expensive claim stemmed from a fire at a plant under construction. This fire, an arson-caused blaze at Consolidated Edison's Indian Point Two plant in New York, produced a $4.5 million loss for the property pool. ■

Safe Nuclear Power?

On Nov. 2, the Atomic Energy Commission confirmed that a spill of radioactive material occurred at its Shippingport, Pa., nuclear power plant—which the AEC brushed off by calling it "a minor accident which was quickly contained."

The spill occurred inside a safety shell covering the plant's reactor and involved a resin and water mix which, the AEC said, "contained some radioactivity." Two employees of the Duquesne Light Co. were overcome by heat prostration while attempting to clean up the spill, the AEC said, but were not injured by the material.

The AEC did not report the accident to the press until a week after its occurrence because it "considered it minor and no outside contamination had resulted from the spill," according to the Associated Press.

In Pennsylvania, two environmental groups have had to drop their fight against a mammoth nuclear power project in the Delaware Valley due to lack of money. In exchange for withdrawal of the objections, three power companies agreed to install a device to screen out low-level radiation. An attorney for the intervenors, the Harrisburg Citizens for a Safe Environment and the Coalition on Nuclear Power, said it would have cost $30,000 to continue the fight.

Pennsylvania's insurance commissioner Herbert Denenberg, an implacable foe of nuclear power development, termed the settlement "blackmail."

Environment Action Bulletin—November 17, 1973

"This shows that, once again, the nuclear establishment has ransomed the public interest for its own benefit. In order to get a safety device which should be mandatory to protect the health of the public, the nuclear establishment forced the intervenors to drop their objections by financial coercion," Denenberg said.

NUCLEAR DISARMAMENT WITHOUT SECRECY

An Address By

Dr. Fred C. Ikle
Director, U.S. Arms Control and Disarmament Agency
at
The Council on Foreign Relations
Chicago, September 5, 1974

How, in the nuclear era, can we ensure the survival of our country with its freedoms? We need courage and candor to cope with this most painful question of our time.

We all sense the uncertain danger of nuclear war; but we have imposed on ourselves an inner secrecy. We have ceased asking the questions that would stir up our quiet anxiety: What are the human implications of nuclear weapons? What can they do to people, to a country? The potential for grief and suffering that lies hidden in the nuclear arsenals has long grown so immense that it has outstripped our capacity for fear.

Those of us who are old enough to remember 1945 still carry a vivid picture in our minds. We recall from Hiroshima and Nagasaki the acres of cities turned into a desolation of twisted steel and shattered concrete. We recall the eyewitness reports, the photographs, the detailed medical studies, and scientific evaluations. We thought we would never forget the flesh burns, the mangled children, the fearsome radiation sickness.

To provide a measure for the destructiveness of the atom bomb, we referred to the explosives used in World War II in the strategic bombing of cities. With those ruined cities still painfully visible, tons of TNT had some meaning. The "blockbuster," the largest pre-nuclear bomb of the war that could destroy a whole city block, contained ten tons. The atom bomb of Hiroshima had the explosive power of 15 thousand tons of TNT.

Thus we strove to give a human scale to the threat of a Third World War in which kiloton bombs would be used in dozens of places. I say "dozens," for such were the numbers of atom bombs available in the late 1940's.

Then in the early 1950's a qualitative leap in technology brought the megaton. Now, reality could no longer be encompassed by our imagination. We could not comprehend in human terms a blockbuster multiplied by a hundred thousand. But we thought we could still comprehend scientifically. A "megaton" is scientific language without appropriate emotive content, like the distance of the stars expressed in light years.

Yet the fundamental truth about megatons is that they are not out there in a distant galaxy; megatons are aimed today at people, you and me, the people in the United States and in Russia, men, women, and children in many cities of many countries. It is the human meaning therefore, that is the essence of nuclear weapons -- the very meaning that our scientific jargon cannot convey.

Thus, over twenty years ago we lost comprehension -- in emotive and human terms -- of the reality of nuclear weapons. And yet, reality receded even further beyond the horizon of our understanding. For after this qualitative leap from kilotons to megatons, in the following decades the quantity of weapons also increased a thousand fold. Instead of the dozens of atomic bombs that frightened us so much in the late 1940's, we are now confronted with many thousands of nuclear weapons.

This story, I am sure, you were all aware of. But for those of you who have not followed this macabre branch of science closely, I have important news: We are not only unable to express the human meaning of nuclear war -- the only meaning that matters -- we are also unable to express the full range of physical effects of nuclear warfare, let alone to calculate these effects.

Why is this so? Because the damage from nuclear explosions to the fabric of nature and the sphere of living things cascades from one effect to another in ways too complex for our scientists to predict. Indeed, the more we know, the more we know how little we know. Several accidents and chance discoveries permitted us to catch a new glimpse of this nether world over the past twenty years. At least half a dozen such discoveries seem worth recalling.

The first reminds us of the unpredictability of nuclear fallout.

In 1954, the United States exploded an "experimental thermonuclear device" on a coral reef in the Marshall Islands. It was expected to have the power of about 8 million tons of TNT. But actually it exploded with about double the yield predicted -- 15 million tons of TNT. And it produced much more fallout than expected. An area of more than 7,000 square miles was seriously contaminated. Radioactive debris showered down on a Japanese fishing boat 40 miles from outside the pre-announced test area.

About 100 miles downwind from the explosion, Rongelap atoll unexpectedly received serious fallout, so that inhabitants there had to be evacuated. One section of the atoll received about 6 times the lethal dose. And the U.S. Government promptly issued a notice expanding the danger area to about 400,000 square miles or roughly eight times the area previously designated as the danger zone. This experience furnished a dramatic lesson in the difficulty of predicting fallout.

Second. The same thermonuclear test unexpectedly drove home to us some of the human meaning of fallout, largely an abstraction to most of the world at the time.

Soon after the explosion, a sandy ash showered down on crew members of the Japanese fishing boat I mentioned, settled in their hair, and on their skin. The crew, having no idea about the nature of this strange substance from the sky, kept working. But before long, the awful symptoms of radiation sickness began to be felt.

At Rongelap atoll it was two days before people on the island were evacuated. By that time they had received about one fourth the lethal dose of radiation. Fortunately, they had not been at the northern end of the island, where the fallout would have brought quick death. But children were later found to have serious permanent thyroid injury, which would retard their growth. Just recently, a young man who was exposed in that test while still in his mother's womb, underwent surgery at Cleveland Metropolitan General Hospital. Growths were removed from his thyroid gland.

This brought to 28 the number of residents of Rongelap who have had such surgery.

The third unexpected discovery made us aware how nuclear explosions can bring about massive disruptions in worldwide communications. This type of disruption could have seriously impaired the ability of governments and military commanders to receive attack warning and maintain control. In 1958, the United States exploded two nuclear devices high above Johnson Island in the Pacific. High frequency radio communications which crossed the sky 600 miles from the detonation point were unexpectedly lost. Some interruptions lasted minutes; others many hours. The disruption resulted from complex interactions among effects produced by the explosion: the shock wave's disruption of the ionosphere which normally reflects radio signals back to earth, radiations from debris, and ionization of the atmosphere. The reasons for the unexpected disruption were explained -- but only well after the event.

The fourth chance discovery made our experts focus on the distant damage to electronic equipment and computers that nuclear detonations can cause. Given that our engineers, happily, had never seen a nuclear war, they were used to worrying primarily about heat and blast damage, familiar to them from Hiroshima and Nagasaki and from subsequent weapons tests. But meanwhile, the British had discovered that the electromagnetic pulse produced by nuclear explosion could destroy critical command and control links and computer memories beyond the range of blast damage. The British, having a much smaller test program than our own, assumed we must be aware of this vulnerability. We weren't. Only through coincidence was knowledge of this effect relayed to our own experts.

The fifth discovery alters our assessment of the vulnerability of missile forces that are protected in underground silos such as our Minuteman. As you know, there is continuing concern that our Minuteman missile force might become vulnerable to a sudden attack, hence lose its deterrent value. For years, simplistic calculations have been used -- the kind of calculations that a teacher can put on half a blackboard -- to show that accurately aimed multiple warheads, so-called MIRVs, would inevitably increase this vulnerability. Then, the complexity of the real world was rediscovered. It was found that through a phenomenon dubbed "fratricide" some of these warheads might destroy or divert each other before they could destroy the intended target. In this case, the discovery suggests something reassuring: our simple calculations may have exaggerated the vulnerability of our missiles.

The sixth and last example concerns a new uncertainty about what nuclear war might do to people and to the very environment on which life depends -- an uncertainty that has gone unnoticed for 25 years. This is the possibility that a large number of nuclear explosions might bring about the destruction, or partial destruction, of the ozone layer in the stratosphere that helps protect all living things from ultraviolet radiation.

I want to stress the accidental nature of this discovery. Not studies about thermonuclear war, but totally unrelated investigations of the supersonic transport aircraft surfaced the ozone problem. A few years ago, the public controversy surrounding supersonic aircraft led to inquiries into their possible effect on the stratosphere. This in turn led to a reexamination of measurements taken after a series of atmospheric nuclear weapons tests in the early 1960's. Based on this evidence, a few articles have started to appear in scientific journals, beginning to unfold the story.

We do know that nuclear explosions in the earth's atmosphere would generate vast quantities of nitrogen oxides and other pollutants which might deplete the ozone that surrounds the earth. But we do not know how much ozone depletion would occur from a large number of

nuclear explosions -- it might be imperceptible, but it also might be almost total. We do not know how long such depletion would last – less than one year, or over ten years. And above all, we do not know what this depletion would do to plants, animals, and people. Perhaps it would merely increase the hazard of sunburn. Or perhaps it would destroy critical links of the intricate food chain of plants and animals, and thus shatter the ecological structure that permits man to remain alive on this planet. All we know is that we do not know.

To find out more about this new potential danger from nuclear war, my Agency, the Arms Control and Disarmament Agency, has enlisted the help of the National Academy of Science as part of the Agency's statutory obligation to provide the scientific information upon which arms control policy must be based.

The six examples I mentioned show how the accidents of scientific discovery continue to add fragments to our knowledge of nuclear warfare. Each of these discoveries tore a hole in the facile assumptions that screened the reality of nuclear war. Each brought a new glimpse into the cauldron of horrors. What unexpected discovery will be next? What will surprise number seven be? Number eight?

Unfortunately, when man can no longer confront his fears, and can no longer comprehend reality, he takes refuge in superstitions. As substitutes for the incomprehensible reality, we create an imaginary order. We count megatons, missiles, and MIRVs; we classify weapons as "tactical" or "strategic"; we use computers to calculate "unacceptable damage", we elaborate theories of "first strike," "second strike," and "mutual deterrence." All these concerns are important. But we must not mistake uncertain notions for knowledge based on solid experience.

This lack of real knowledge applies not only to the effects of nuclear weapons, but to the armaments themselves. Their steel and aluminum and concrete seem solid enough. However, lest we place too much confidence in these so-called "weapons systems" we should remember this: These complex "systems" had to be designed and developed in a world of theory. They could never be tested in that cataclysmic world where they would have to function if they ever had to function at all. Modern nuclear armaments are the product of a long succession of research and engineering projects, fortunately without full-scale tests – a development process unique in the history of technology.

It is as if we had been building airplanes of more and more advanced design ever since the Wright Brothers without ever flying a single one, testing only components while basing the design of the plane as a whole entirely on theory. Would you trust your family to fly in the latest model of an aircraft thus developed?

The fact is, since World War II, layers and layers of nuclear weaponry have accumulated, based on paper studies, laboratory experiments and partial tests. We do not know -- and, of course, never want to find out -- the full implications if ever those entire weapon systems were to be used. Yet, we, as well as other nations, keep adding new layers of such armaments, in the hope that they will ward off an enemy attack.

Fortunately, in our country the tradition of openness and the adversary system practiced by the Congress and the press maintain a healthy sense of concern and skepticism. New weapons systems are subjected to scrutiny. But in closed societies, where the practice of secrecy is so deeply rooted, the military and their technicians can tunnel along in complete seclusion with their untested "systems" and their unverified hypotheses about how they would fight a nuclear war, none aware of the disaster that is being prepared. In an open society, foolishness and falsity, in the long run, come up against wise and honest men.

I reminded you of the accident 20 years ago that forced our technicians to recognize the implications of nuclear fallout. For a short while, the bureaucratic instinct among some of our officials was to conceal. A few days after the Marshall Island explosion the information made available seemed to imply that the Japanese vessel may have trespassed, that the fishermen were not seriously injured, that the fishing area was not contaiminated, and that nature was somehow to blame: "The wind failed to follow the predictions . . . ." was given as an excuse. But our free press and Congress demanded the facts.

As you know, the temper of the American people, the energies of our free press, and the constitutional structure of our government are not a hospitable environment for secrecy. In this lies a real strength – and a real hope. We have access to the facts that are known, and equally important, to the larger truth: that a great deal remains unknown. Of course, it is not enough for the facts to be open to the citizens; the citizens must be responsive to the facts.

The world seems to have become habituated to nuclear weapons. We were warned that this might happen by Bernard Baruch almost thirty years ago, when he represented the United States on nuclear arms control issues in the United Nations. In December 1946, six months after making the famous proposal which bears his name, Baruch said: "Time is two-edged. It not only forces us nearer to our doom if we do not save ourselves, but, even more horrendous, it habituates us to existing conditions which, by familiarity, seem less and less threatening."

What can be done to combat this habituation, this fatalistic lethargy? Part of the answer lies in our ability as Americans to communicate with other governments and people. I do not

offer this as the[illegible]terally. It would be the gre[illegible]timate the intellectual [illegible] we can have on world affa[illegible].

Since the b[illegible]ya, the intellectual found[illegible]and dis-armament efforts [illegible] from American contri[illegible] of our scholars and diplo[illegible]and our scientists. The [illegible] States Government was [illegible]agency devoted to arms [illegible]t is in itself a reflection [illegible]erican quality – a practi[illegible]e man-ageability of hum[illegible].

Because the [illegible]n open society and also the [illegible], we alone can comm[illegible] to the world at large. It [illegible] country to remain ins[illegible]e small and terribly fragile [illegible]ents of destruction. If we [illegible]ess the implications of the[illegible]ements of disarmament, we [illegible]e to speak

to the citizens of all nations.

We are likely to be greatly tested. We must not show weakness of character by choosing to rely only on the strength of our armaments, rather than endure the frustrations of negotiating for mutual reductions of armaments. And we must not show weakness by departing from our standards for sound arms control measures. I am confident we shall pass these tests. As President Ford has said: "Just as America will maintain its nuclear deterrent strength, we will never fall behind in negotiations to control – and hopefully reduce – this threat to mankind."

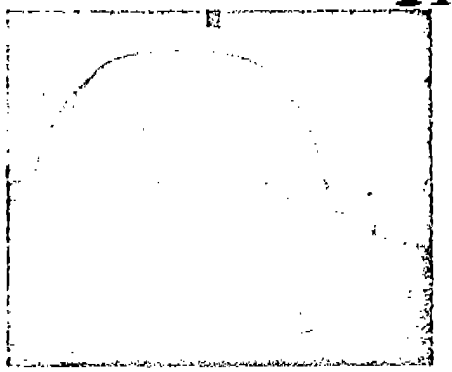
For the United States, as for every nation, self-interest and the human interest are one: to protect the earth, our only source of life. Halting the increase and spread of nuclear armaments thus can become the common cause of the international community. We must mount a great effort to insure that America's candor and confidence and energy in seeking to control nuclear weapons will find the necessary response among leaders and citizens throughout the world.

A joint project of Environmental Alert Group and Environmental Education Group.

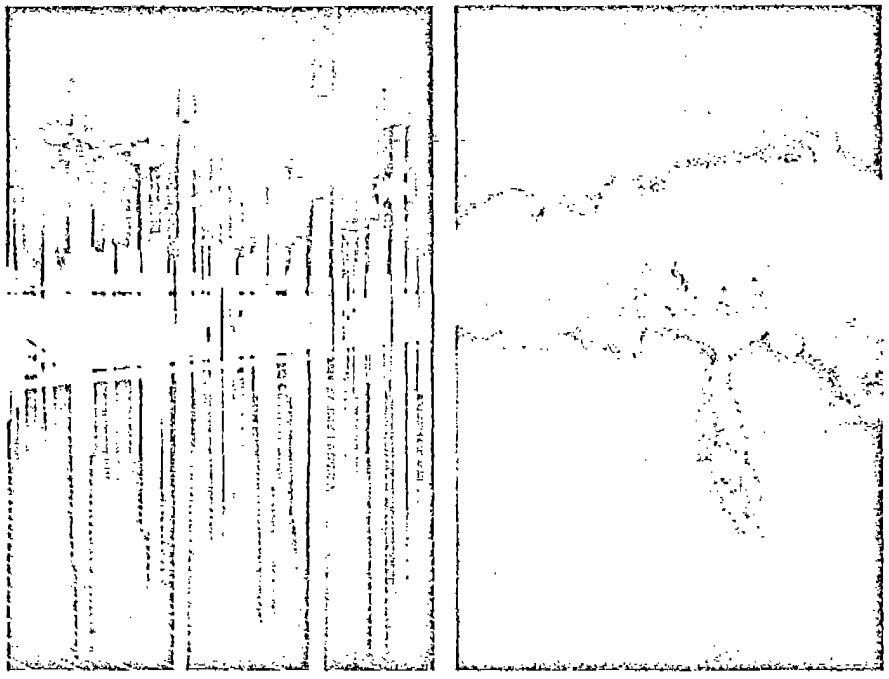
PUBLIC INTEREST REPORT

NUCLEAR TERRORISM

Atomic Energy Commission



One essential step in diverting civilian power plant fuel to military use is the fuel reprocessing plant. Shown here are hangers from which spent nuclear fuel assemblies hang below the grating at the Idaho Chemical Processing Plant. The fuel is awaiting processing which will remove plutonium, potential bomb material.



National Reactor Testing Station

"... the adaptability of nuclear fuels for use as weapons poses a growing danger to all peoples in these times of increasing reliance on nuclear energy to meet the power demands of industrial societies that are increasingly vulnerable to the disruptive acts of desperate individuals and organizations. The nuclear trigger which threatens the lives of millions, if not the peace of the world, is no longer within the grasp of just a very few. The failure of governments to face this ugly fact constitutes another measure of the increasing danger in which we all live."

—Samuel H. Day, Jr., "We Re-Set the Clock," Bulletin of the Atomic Scientists, Sept. 1974

"Fission energy is safe only if a number of critical devices work as they should, if a number of people in key positions follow all their instructions, if there is no sabotage, no hijacking of the transports, if no reactor fuel processing plant or reprocessing plant or repository anywhere in the world is situated in a region of riots or guerrilla activity, and no revolution or war — even a 'conventional one' — takes place in these regions. The enormous quantities of extremely dangerous material must not get into the hands of ignorant people or desperados. No acts of God can be permitted."

—from Dr. Hannes Alfven, Nobel Laureat in Physics, writing in May, 1972 BULLETIN OF THE ATOMIC SCIENTISTS

Unprecedented tragedy looms in the form of terrorism and blackmail involving *privately built atomic bombs* and *the deliberate dispersion of radioactivity*. These mounting threats stem from the worldwide proliferation of nuclear power plants. As India showed recently, "peaceful" reactors can be used to manufacture atomic explosive materials such as plutonium. Moreover, staggering concentrations of lethal radioactive wastes accumulate in nuclear power plants. The cost of crimes involving these substances could sum to billions of dollars annually, which would make atomic fission the most expensive possible way to generate electricity. The key facts are these:

—Each large nuclear power reactor contains enough radioactive wastes to force evacuation of over 10,000 square miles should they be dispersed by sabotage.[1] Also, embedded in the spent fuel which a single plant discharges each year is enough plutonium to make 30 "crude" atomic bombs. Each bomb would be at least powerful enough to demolish a skyscraper, the U.S. Capitol Building, or — a nuclear power plant. These deadly materials must therefore *never* be permitted to come under the control of outlaws. Yet there are no plans to guard shipments of high-level waste or spent fuel. As for plutonium and other fissionable A-bomb ingredients, a group of Atomic Energy Commission consultants recently urged that immediate steps be taken to greatly strengthen their protection from theft.[2]

—Atomic bombs and radiation-dispersal weapons are fairly easy to build. Two eminent nuclear scholars, Mason Willrich and Theodore Taylor, believe that a small group of persons could do so within several weeks, utilizing only open unclassified information available to anyone.[3] Such persons would then be in a position to blackmail whole cities, or even entire governments through threats against national capitals. Via smuggling, nuclear materials stolen anywhere in the world could be used against the United States.

—Already in the U.S., several thefts of highly radioactive gamma-ray sources have occurred, and several nuclear blackmail threats have been received. Incidents of intrusion, arson, and small-scale sabotage have occurred during the construction of nuclear plants in Vermont, New York, and Colorado respectively. Atomic secrets may be obtained by the underworld by bribery or extortion directed against vulnerable employees.[4]

American nuclear power capacity is expected to triple by 1980. Foreign capacity will go up *eightfold* by then, involving 30 nations. Despite these ominous trends, only feeble attempts are being made to develop safeguards adequate to protect the anticipated massive flows of ultra-dangerous materials through commercial channels. Many who have studied the outlook say that no imaginable safeguards could work well enough. The awesome consequences which could follow from even a single breach of the safeguards demand nothing less than perfection in the system.[5] An international black market in the means of mass destruction appears inevitable unless nuclear fission power industries are shut down everywhere.

Hijacking of plutonium. Purified plutonium is stored near nuclear fuel reprocessing plants. When it is later shipped for fuel fabrication or military weapons production, it is accompanied by no more than three armed guards. Sealed in strong containers, its low-penetration alpha ray emission would present no danger to thieves. Yet finely powdered plutonium in the environment represents an appalling lung-cancer hazard. One 140,000,000th of a pound of inhaled plutonium has caused lung cancer in animals. Its dispersal by wind from a high building could evacuate one to three square miles per pound released.

A privately built fission bomb would require no more than 18 pounds of plutonium metal, or 22 pounds of the oxide, PuO_2.

ILLEGAL ACTS BEARING ON POSSIBLE RADIOACTIVE THREATS TO THE PUBLIC — AN INFORMAL COMPILATION 8-15-74

SCOPE: Actual illegal acts having the potential for damage to the public from nuclear materials

April, 1964 through June, 1972. During this interval William T. Riley, top national security officer for the Atomic Energy Commission, borrowed $239,300 from fellow AEC employees and failed to repay over $170,000. A substantial portion of the money was used in racetrack gambling. During this interval Riley had access to the nation's highest atomic secrets, and his gambling activity was unknown to his superiors. Thus he was a possible target for blackmail. He was sentenced to three years' probation in February, 1973. Michael Satchell, "The Riley Affair" (2-4-73) and "Ex-AEC Aide Put On Probation" (2-21-73), *Washington Star-News*.

Oct. 1970. A fourteen-year-old extortionist demanded $1 million from authorities of Orlando, Florida lest he destroy the city with a hydrogen bomb. The teenager's drawing of his nonexistent hydrogen device was sufficiently convincing that an armaments officer at McCoy Air Force Base said "it would probably work." Ralph E. Lapp, "The Ultimate Blackmail," *New York Times Magazine*, February 4, 1973.

August, 1971. An intruder penetrated post guard towers and fences to enter the grounds of the Vermont Yankee nuclear power plant under construction at Vernon, Vermont. He escaped after wounding a night watchman. "Man Penetrates N-Plant Security," *Gloucester* (Mass.) *Daily Times*, September 1, 1971.

November, 1972. Aircraft hijackers circled over Tennessee and threatened to crash their plane into the nuclear installation at Oak Ridge, Tenn. unless a $10 million ransom was paid. In view of the threat, Oak Ridge closed down all of its nuclear reactors and evacuated all but emergency personnel from the compound. "Hijacked Jet Skids to Landing in Cuba," *Los Angeles Times*, 11-12-72.

March, 1973. A guerilla band took temporary possession of a nuclear station nearing completion in Argentina. The guerillas decorated the plant with political slogans and left without doing any damage. *Environment*, June 1973 (Spectrum section), citing *Nuclear Industry*, April 1973.

April, 1974. Parts of two trains in Austria were found contaminated with a radioactive liquid used in medical diagnosis. A man calling himself a "justice guerilla" telephoned a warning that passengers' lives were in danger. Slight traces of radiation were found in (sic, not "on") eight passengers and in a box in the baggage car. "Mystery Radiation Hits Another Train," *Los Angeles Times*, April 20, 1974.

NOTES OF INTEREST:

3,600 Lost Nuclear Jobs in Year, Many to Alcohol, Drugs

WASHINGTON—More than 3,000 persons with access to nuclear weapons were removed from their jobs within a single year because of drug abuse, mental illness, alcoholism or discipline problems, Congress has been told.

The information was provided to Congress last May and June by Carl Walske, former assistant defense secretary for atomic energy matters, in testimony before a subcommittee. It was released Saturday.

—*Los Angeles Times*, January 27, 1974

The recent rash of airport and airline in-flight bombings heightens the dangers inherent in the transportation and storage of radioactive materials used in numerous industries. If the "alphabet bomber" of L.A. International Airport had bombed a freight area where nuclear materials were sequestered for shipment by air, he would have succeeded in dispersing radioactive materials not only throughout the huge facility but, with proper weather conditions, throughout the immediate environs and beyond.

Even if such a bomb 'fizzled' (gave negligible nuclear yield) when detonated, its high-explosive implosion triggering device would still make it a very effective dispersal weapon. Thus the blackmail leverage inherent in plutonium is enormous.

Theft of high-yield atomic weapons from the military presents even more fearsome dangers. Retired Admiral G.R. La Rocque recently testified to Congress that American nuclear bombs stored overseas are poorly guarded, and could easily be captured by terrorist groups. U.S. atomic warheads are kept in many countries including Greece, Turkey, South Korea.

Demolition of spent fuel. Used fuel elements are dispatched from nuclear power plants in thick steel-and-lead casks. Once their carrier truck had been stopped, or a train shipment derailed, such casks could be ruptured with bazookas or shaped explosive charges. The resulting dispersion of a million or more curies of penetrating gamma radiation would be extremely difficult, dangerous, and expensive to clean up. If spent fuel were blown up in a city, decontamination and abandonment costs could exceed a billion dollars. What would a local government not bargain away in order to ransom such a cargo?

Sabotage of nuclear power reactors. The AEC calculates that a maximum accident at a contemporary nuclear power plant could release radiation offsite sufficient to kill 45,000, injure 100,000, and damage property worth $17 billion in 1965 dollars. Maleficence could yield the same effect, assuming the right wind and weather conditions prevailed. The attackers would be aided in their planning by the schematic diagrams which the operators of nuclear plants distribute for public-relations purposes. Having overcome the few armed guards at a plant, a squad of saboteurs could cripple its regular and emergency cooling systems. The reactor core would then begin to melt down, within hours releasing great quantities of airborne radioactivity. Alternatively, the malefactors could blast their way into the domed containment area, and then explode the core directly with delayed explosives. They could also choose to destroy the storage pool used to age large quantities of spent fuel following refueling. Ominously, recent terrorist assaults have employed a variety of sophisticated weapons, including helicopters and heat seeking missiles. It is far from certain whether a nuclear plant could resist an attack involving such means.[6]

What shall we conclude from these stark possibilities? *The proliferation of nuclear materials opens wide the door to anarchy and chaos.* Large regions, or any specific target within them, will be placed at the mercy of anonymous enemy spies, fanatic terrorists, criminal blackmailers, and deranged persons. Thus the ambitions of the nuclear power industry clash with the basic requirements for public safety: law enforcement and national defense.

Perhaps the criminal abuse of radioactive materials could be adequately controlled by widespread regimentation of society. However, nuclear power is unnecessary to meet our present or future energy needs, and thus there is little point in sacrificing our freedoms in exchange for it. A fission-free energy economy can be built on sound and sustainable alternative power sources now being developed.[7] Only in such a society will humankind be spared from the scourge of atomic banditry.

This report was drafted by Dr. L. Douglas DeNike, a contributor to the Bulletin of the Atomic Scientists, and author of a forthcoming book on radioactive crime and banditry.

1 The AEC's director of regulation L. Manning Muntzing concedes that a band of highly trained sophisticated terrorists could conceivably take over a nuclear power plant near a major city and destroy it in such a way as to kill thousands — perhaps even millions — of people. —*Los Angeles Times*, Dec. 17, 1973.

2 "The Threat of Nuclear Theft and Sabotage," *Congressional Record*, Apr. 30, 1974, p. S6621-6630.

3 *Nuclear Theft: Risks and Safeguards*, Ballinger, 1974. See also John McPhee's very readable book *The Curve of Binding Energy*, Farrar, Straus & Giroux, 1974.

4 An example of vulnerability to blackmail: The AEC's former chief of security William T. Riley was dismissed and sentenced to three years probation in February, 1973. An investigation revealed that for the previous eight years, he had been a high stakes racetrack gambler. He had borrowed $239,300 from fellow AEC employees, and had failed to repay over $170,000. All this was unknown to his superiors during the years when he had access to America's top nuclear secrets.

5 "The widespread use of nuclear energy, requires the rapid development of near perfect social and political institutions. This is the unprecedented challenge before us." —*Nuclear Theft: Risks and Safeguards*, p. 173.

6 Perhaps no very exotic means are necessary. "As one trained in special warfare and demolitions I feel certain that I could pick three to five ex-Underwater Demolition, Marine Reconnaissance or Green Beret men at random and sabotage virtually any nuclear reactor in the country." Dr. Bruce L. Welch who served for four years as an officer in the U.S. Navy Underwater Demolition Teams.

7 See the wide range of safe and promising energy options described in our Public Interest Report "Solutions to the Energy Crisis", also the book *Energy and the Future*, American Association for the Advancement of Science, 1973.

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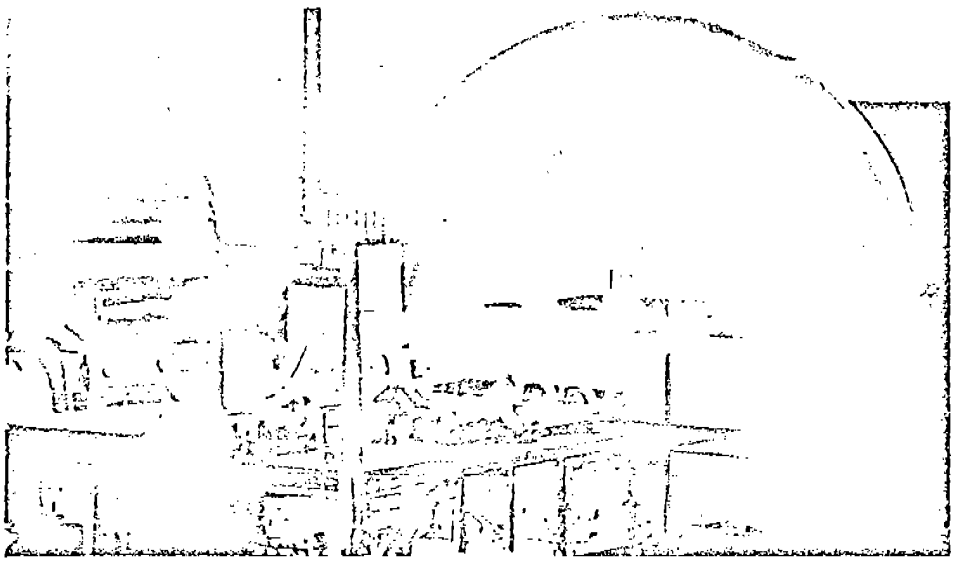


PUBLIC INTEREST REPORT

NUCLEAR POWER PLANTS

"Fission energy is safe only if a number of critical devices work as they should, if a number of people in key positions follow all their instructions, if there is no sabotage, no hijacking of the transports, if no reactor fuel processing plant or reprocessing plant or repository anywhere in the world is situated in a region of riots or guerrilla activity, and no revolution or war — even a 'conventional one' — takes place in these regions. The enormous quantities of extremely dangerous material must not get into the hands of ignorant people or desperados. No acts of God can be permitted."

—from Dr. Hannes Alfven, Nobel Laureat in Physics, writing in May, 1972 BULLETIN OF THE ATOMIC SCIENTISTS

This public interest report is adapted from "The Clear and Present Danger: A Public Report on Nuclear Power Plants," a 47-page document, presented to the U.S. Congress and international agencies in May 1973.

The Atomic Energy Commission (AEC) and the nuclear energy industry have led the public to believe that nuclear energy is safe, clean, and inexpensive, but scientists, environmentalists, and concerned citizens have proven that nuclear energy functions with the following severe and distinct handicaps: the possibility of catastrophic radiation disasters due to *accident;* the fear of *sabotage* and *diversion of nuclear materials* for the construction of nuclear weapons; the continuous *thermal pollution* of waterways; the routine *releases of radioactive substances* into the environment; the hazards of *transporting nuclear materials;* and the long-term handling and storage of *radioactive waste.* Furthermore, nuclear power plants have proven to be *inefficient, expensive,* and *virtually uninsurable.*

PRESENT AND FUTURE

A recent Federal Power Commission report predicts that the nation's power requirements will quadruple between 1970 and 1990. The report also predicts that nuclear power plants will meet more than 50% of the nation's electrical power needs within the next two or three decades, as compared with less than 2% at the present time. As of January, 1974, there were 39 operating civilian nuclear electrical plants in the U.S. But according to the latest statistics, nearly *one third* of them are closed for repairs and at least 6 of those still open are running *far below their production capacity, due to mechanical failure* or for *safety reasons.* Of the 12 that are closed, three were shut down for overhaul. The other nine were closed because of *accidents, safety-related problems,* or *AEC orders.*

SAFETY AND ACCIDENTS

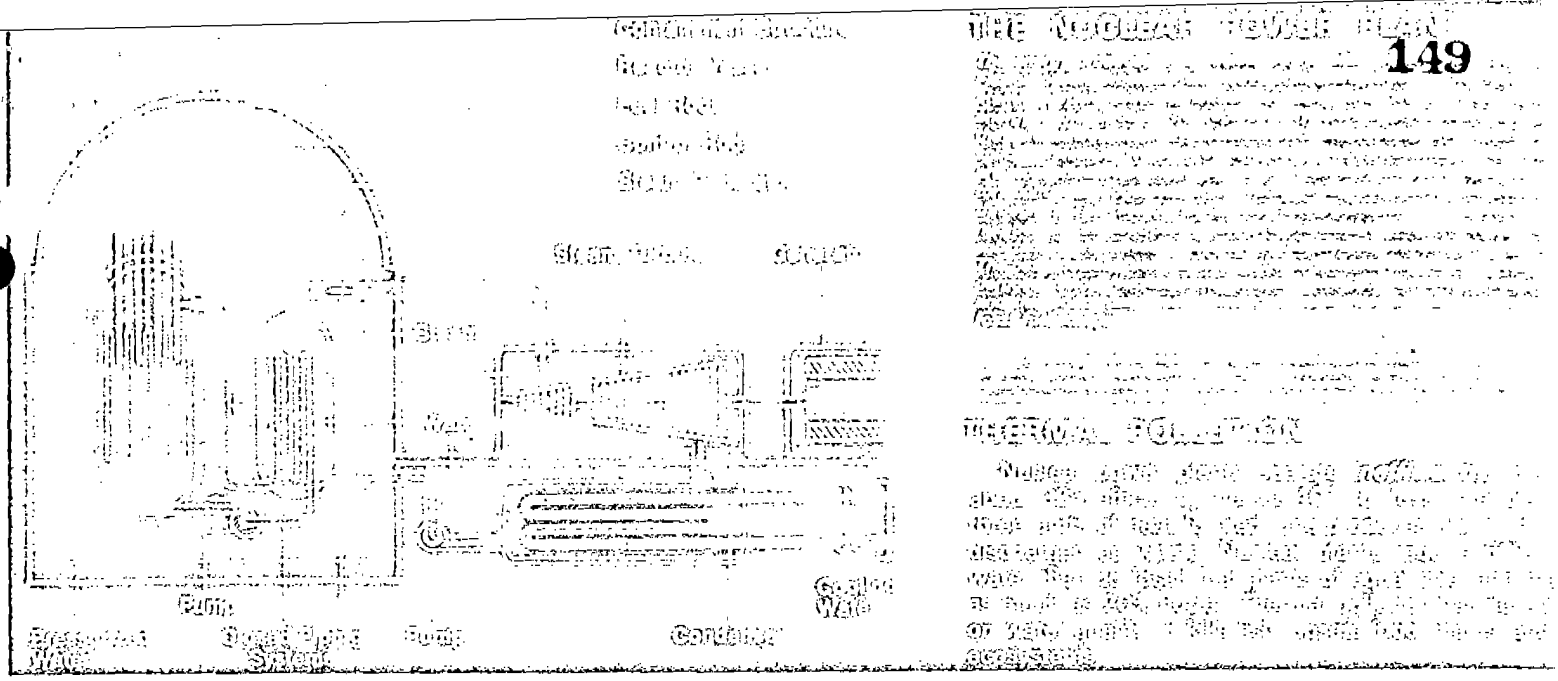
Great reliance is placed on engineered safety systems to prevent or mitigate the consequences of a *nuclear power plant accident,* an accident which might release enormous quantities of *radioactive materials,* creating a nuclear catastrophe. And, yet, according to a report released by the AEC, nuclear power reactors in the nation experienced *850 "safety related abnormal occurrences"* during a 17-month period beginning January, 1972. Such accidents bring into sharp focus that man is not *infallible;* that the materials are not *always dependable;* that structural designs are not always *flawless;* and that equipment can be *defective* — that the *unexpected* can happen.

Foremost among safety systems are the *emergency core cooling systems* (ECCS) which, should normal cooling systems accidentally fail, are designed to prevent an overheating and melting of the reactor fuel and subsequent release of lethal radioactivity. If the ECCS did not function at all, the *core would melt* and the molten mass of radioactive material would collapse and melt through the pressure vessel, and then would proceed to melt into the earth, *discharging large amounts of radioactivity* and endangering large numbers of people.

The ECCS in all reactors is *experimental;* it has never been tested under actual operating conditions. When initial tests were run by Aerojet Nuclear Company at the National Reactor Testing Station in Idaho, mechanical failures occurred. In the winter of 1970-71, Aerojet ran a significant series of tests using model reactors. *All six tests of the model systems failed.* The reactor community was stunned. The lives of thousands are in jeopardy because of theories, and mechanical systems that *have not proven their ability to perform the job for which they were designed.*

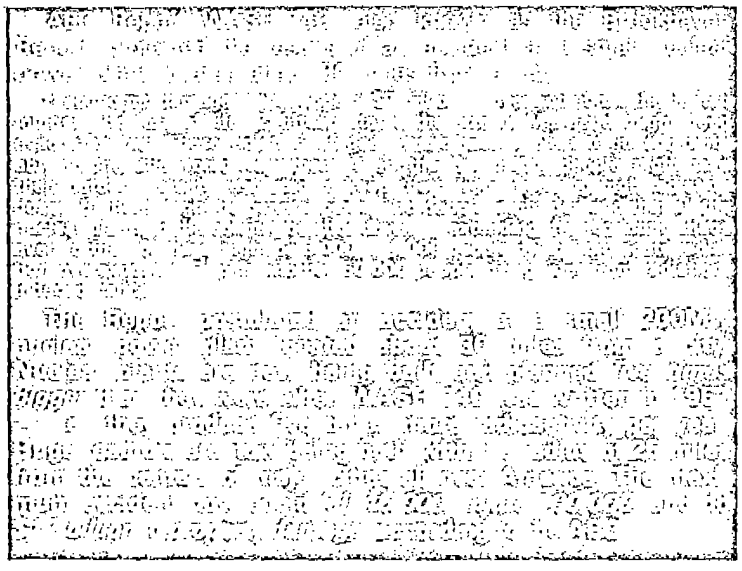
When an AEC member was asked whether a full-scale test could be conducted, his answer was: "It could be done, but it would be terribly expensive to *wipe out* all of that equipment." It should be noted that the system is supposed to save the equipment, not wipe it out.

Another important safety question involves *natural disasters.* Nobel Prize-winning physicist Dr. Hannes Alfven observed that the nuclear industry relies on a level of perfection in which *"no acts of God can be permitted."* An *earthquake* could wipe out in a single stroke all of the safety features built into nuclear facilities. Even geologic surveys may fail. The San Fernando, California, Earthquake occurred along an "unknown fault", and had it been much closer to a nuclear power plant, the results could have been catastrophic. The AEC has demonstrated its incompetence in this area in its siting of plants, such as the one in Diablo Canyon, California, near active faults. A large reactor complex in Virginia has been sited *directly* over a geologic fault.



The nuclear safety question is in reality a political one. A recently exposed AEC Task Force report states this most clearly: "The ultimate determination of the acceptable level of *public risk* is actually a matter which should be debated and established in the *public arena*. It is a political question which cannot be solely resolved by a regulatory or technical decision. It is recognized that technical issues are difficult for the layman to understand, especially as related to the occurrence of low probability events. In the case of nuclear reactors, the *level of risk* is presently difficult for even the engineer to quantify, and in fact, it has *not yet* been firmly established."

THE CATASTROPHIC ACCIDENT — INVENTORY OF A NUCLEAR DISASTER



RADIATION

Radioactive substances are incredibly dangerous. The dangers of prolonged, *low-level exposures* to radiation are insidious because there are no obvious or sudden results. Like pesticides, the absence of immediate and overt symptoms does not imply the exposure is harmless. Radioactive substances remain dangerous for extended lengths of times and many are *concentrated in biological systems*. Because of the potency of radioactive substances, a nominal initial amount remains hazardous for centuries. In fact, because of its uniquely destructive effect on tissue, *radiation is 100 million times as deadly as cyanide.*

"... available evidence indicates that *no amount of ionizing radiation* ... is completely safe — some *mutations* are always induced, and if the exposed population is large enough and the data complete, a statistical increase in *deformities, still births,* and *cancers* will always appear ... There will be some environmental and human cost associated with *any increase in radiation dosage* ... The peculiar problem with radiation is that the penalties are so far removed in time from the activity and its benefits. By the time the price is clear, the damage is done ... if present trends (notably, increased numbers of nuclear power plants) and procedures continue, it (radiation release) will unquestionably increase."

—Dr. John Gofman, Dr. Arthur Tamplin, "Radiation, Cancer, and Environmental Health"

RADIOACTIVE WASTES

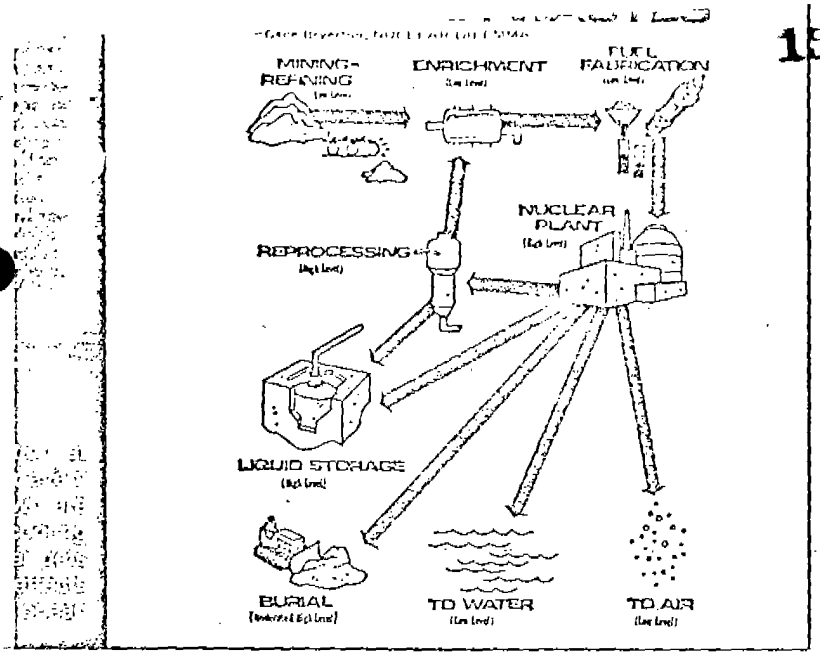
During the year 2000, the forecast 1200 atomic power plants would create as much strontium-90 and other long-lived radioactive poisons as the fissioning of about *1,200,000 Hiroshima bombs*, plus at least 600,000 pounds of radioactive plutonium* (more, if there are breeder reactors in operation). During the following year (2001), the same plants would add the same amount of poison to the legacy again, and so on year after year. It is difficult to imagine a process more filthy than nuclear fission. It is the only process for producing power which creates pollutants so toxic that they must be kept contained continuously for *half a million years!*

According to the AEC forecast, other non-Communist countries will produce substantial quantities of wastes by the year 2000, and by agreements, the U.S. will be the respository for those *imported wastes;* the combined production of long-lived radioactivity in the year 2000 would be equal to exploding about three million Hiroshima bombs. We cannot predict future growth of the nuclear industry without considering the drawbacks of handling the wastes.

Radioactive wastes are created wherever radioactive materials are used. By far, the greatest source is the nuclear fuel cycle: the *milling, mining,* and *preparation of fuel* for reactors and weapons produce wastes containing natural radioisotopes, and *fuel irradiation* and subsequent *processing* produces wastes rich in fission products. Additional wastes are produced by irradiation of nonfuel material in and around reactors.

Disposal and storage of these wastes is hazardous. *Solid wastes,* such as clothing and tools, are customarily buried in cement drums either in trenches on land or at sea. *Low-level liquid wastes* resulting from impurities in the coolant water are dis-

*Plutonium is the most toxic substance known to man. Radioactive potency remains for more than 500,000 years. One ounce of this poison released into the environment could cause 300 million lung cancers. Plutonium will be created in the reactors used to fuel the new "breeder" reactors ... and used because they may create more fuel ... which are currently being promoted to solve predicted uranium shortages. These breeders present even more serious hazards than conventional nuclear plants.



charged into the environment. The *high-level fission wastes,* millions of gallons of which are already in storage, remain highly radioactive for hundreds of years while the storage tanks, which boil like teakettles from the intense heat, will suffice but for decades. A *single gallon* of this waste released into the environment would be sufficient to threaten the health of several million people. Disposal is a euphemism for perpetual guardianship.

Radioactive wastes involve more than the reactor and its byproducts. *Waste ore,* called mine tailings, is piled up outside uranium mills from Texas to Oregon, and these deposits emit radioactivity. The dust from these mounds blows into the atmosphere and watersystems, raising in certain areas radioactivity readings well above the maximum permissible levels suggested for human consumption, and furthermore, *tailing sand* has been incorporated into *children's sand boxes* and into the *construction of homes* — the radon gas given off by tailings is the prime cause of lung cancer in uranium mine workers.

Currently, there is *no known safe storage for the high-level nuclear wastes.* Storage in geologic formations such as salt deposits has proven unsatisfactory. Thus, we continue to produce millions of gallons of highly toxic wastes; we continue to commit these poisons to interim storage under costly and unreliable surveillance, with no future home in sight — the Hanford nuclear waste storage facility has gained justified notoriety for its several leaks of thousands of gallons of highly radioactive wastes into the ground and for its possible contamination of the Columbia River.

TRANSPORTATION OF RADIOACTIVE MATERIALS

The route taken by uranium and its fission products before reaching final disposal (or dispersal) is a long one: from the mine to the refining mill to the fuel fabrication assembly plants to the reactor vessel to the reprocessing facility (where unused fuel and economically recoverable radioisotopes are extracted) and finally to disposal points.

David Lilienthal, former chairman of the AEC, is among those who have expressed doubts on the subject:

[redacted]

And accidents in transportation have occurred. Trucks bearing radioactive materials have been involved in accidents, and in one instance a train carrying radioactive materials derailed.

A 63-page report by the Public Interest Research Group of Michigan gives harrowing descriptions of hauling operations. Roll-

nuclear waste casks are superheated, turning the contain "huge pressure cooker", ready to spew out gases and pressures up to 300 pounds per square inch if its insta cracked. The report warns that *within a half mile of majo "deaths of infants, young children and susceptible pe likely' and land would remain contaminated for over 1* Based on population density the report estimated that th of people would experience gradual deaths from one tra near a large city. The investigation found that drivers have *training* to handle nuclear ware and are *not equipped wit tion leak detectors;* that police aren't notified of the nucle routes and that casks of atomic wastes are not adequately If by the year 2000 we have nuclear power projected by t including the power from breeder reactors, there will be *12,000 annual shipments* of spent fuel from reactors to c plants, with an average *60 to 100 loaded casks in trans times.* These casks will offer opportunities for *sabota terrorism.*

SABOTAGE, DIVERSION, AND BOMBS

The recent plague of aircraft hijackings, terrorism, and bings has made it clear that *society is highly vulnerable to mined efforts at sabotage* and that these are extraordinar ficult to prevent. It is clearly not beyond possibility that a n power plant could be held hostage for financial gain or for p purposes.

With the increasing social tensions that are bound to a pany the growth of populations, the depletion of natural reso and the present widening economic gap between the rich a poor nations, it would seem prudent to assume that suc heavals may be even more intense in the coming years. *Nu fission plants will be enormously attractive objects sabotage and blackmail.* A well-placed charge of explosiv the midst of one of these huge concentrations of radio material, could blow into the air enough radioactivity to be c by the winds over thousands of square miles, and perhaps r large areas uninhabitable for decades.

And then there is an even more startling revelation. As nu power plants come into increasing use, *large stockpile atomic fuel* and *spent nuclear fuel elements* will be creat from which people with a certain amount of scientific know could make crude *nuclear bombs.** Given the catastr nature of a single malicious incident, it is by no means that satisfactory protection measures are possible.

*Professor Mason Willrich, director of the Center for the Study of Science, Technology, and Public Policy, of the Uni Virginia:

Most experts consider the design and manufacture of a crude nuclear explosive device without previous access to class to be no longer an extremely difficult task . . . a very small amount of nuclear material — for example, a few k pounds of plutonium — is enough for a nuclear explosive capable of mass destruction, and the manufacture of such a within the capability of many groups."

In August 1971, an intruder penetrated boat guard towers and fences to enter the grounds of the Vermont Yankee nuc plant at Vernon, Vermont. He escaped after wounding a night watchman.

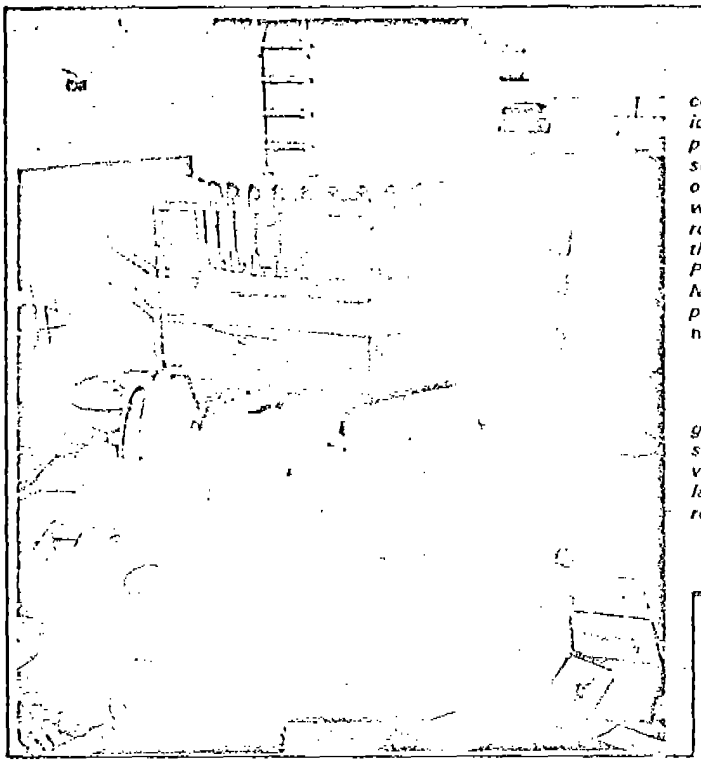
In November 1971 arson caused $5 to $10 million damage at the Indian Point No. 2 plant at Buchanan, N.Y., just prior to pletion. A maintenance employee was accused of the crime.

INSURANCE

On August 16, 1973, Herbert S. Denenberg, Pennsylvania' surance Commissioner, issued the following statement:

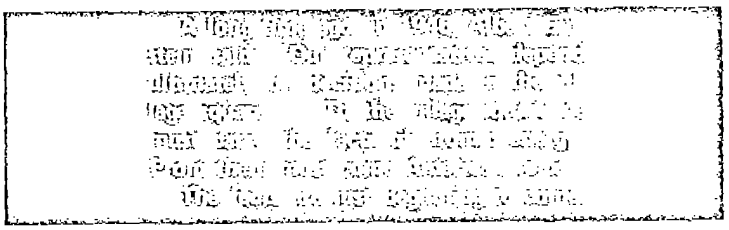
[redacted]

If you look at your Homeowner's Insurance Policy, you will that there is *specific exclusion for damages caused by radia contamination.* No one is protected for an accident in which le radiation contaminates the property. The Price-Anderson A basically an insurance policy in which a limited amoun coverage is provided in the event of an accident in which l amounts of radioactivity are released from a nuclear power p The Act limits the amount of money which can be recovere the public to $560 million. S. A. Szalewic, chief of the At Energy Commission's Research and Development Branch, Div of Reactor Development, reports that estimates indicate tha *total damage from an accident could reach $480 billion — times the amount previously estimated by the AEC.* Thus public could recover virtually nothing on this policy, while nuclear industry would continue to survive.



Some years ago the AEC built the Enrico Fermi breeder reactor. The plant cost more than twice original estimates ($124-million), operated only periodically and was plagued with a number of accidents, including a serious and potentially dangerous "meltdown" of nuclear fuel which halted its doubtful services for nearly four years. The reactor is now dead. But it will cost well over $4 million to decommission it. Furthermore, there are problems with what to do with the highly radioactive liquid sodium, what to do with the 3000 rods of highly dangerous uranium fuel, and what to do with the hot "heart" of the plant — the actual chamber in which the nuclear reactions took place. Plans are now to virtually entomb the vessel, creating the Enrico Fermi Nuclear Mausoleum, which will have to be continuously monitored and protected. The major obstacle now is that no one has ever attempted to dismantle a breeder reactor *such as Fermi.*

The Soviet Union's fast-breeder nuclear power station BN 350, still undergoing commissioning trials on the shore of the Caspian Sea, has experienced a serious accident, according to Washington sources. Based on satellite observation, there has occurred a major failure of the cooling system and a fire of large proportions. It is not known whether radioactive material has been released.



CONCLUSION

"We nuclear people have made a Faustian bargain with society. On the one hand, we offer — in the catalytic burner — an inexhaustible source of energy ....

But the price that we demand of society for this magical energy source is both a vigilance and a longevity of our social institutions that we are quite unaccustomed to."

Dr. Weinberg, of the Oak Ridge Laboratory, continues: "We make two demands. The first, which I think is easier to manage, is that we exercise in nuclear technology the very best techniques and that we use people of high expertise and purpose ...."

The second demand is less clear, and I hope it may prove unnecessary. This is a demand for longevity in human institutions. We have relatively little problem dealing with wastes if we can assume always that there will be intelligent people around to cope with eventualities we have not thought of.

Since the social requirements for acceptability of nuclear power are dominant and cannot be met, it follows that *no group of humans has the moral right to support the construction or operation of nuclear power plants. Minimum* morality, as many have stated, requires that we do not compromise the chance of life for generations to come. No one seriously denies that nuclear power generation can thus compromise the life of generations to come and no one is seriously prepared to guarantee the future social stability required to prevent this.

Therefore, the only conservative, rational and moral position is to opt for an immediate cessation of all nuclear fission power generation. It is not a question of making nuclear power generation safe for people. The insurmountable obstacle is that we cannot envision any way to make people safe fornuclear power generation, short of total robotization.

The manufactured and fraudulent quality of the so-called "energy crisis" is well known. Nuclear power is not now providing any significant net increment to U.S. energy supply. There is no reason to believe that nuclear power ever need provide any of our energy, even if our total energy consumption rises appreciably.

—Dr. John Gofman, M.D., Ph.D., Professor of Medical Physics at the University of California, former Associate Director of the Lawrence Radiation Laboratory

Let me make a prediction here. I don't think that there will be another nuclear plant built in this country in nuclear fission after five years. I think there is going to be the biggest, environmental, legal, legislative, executive branch, citizen, consumer battle in the history of the country. And what happened to the SST will be a spring picnic compared to the struggles that are going to come forward on nuclear fission power.

It is utter folly for utilities and the energy industry in general to replace a significant portion of our electricity resources and supply from nuclear fission plants... There are too many generational hazards, and there are *too many alternatives* which we could take advantage of if we simply started to reallocate the research budget at the federal level into non-nuclear-fission regions.

Indeed, to put all our energy eggs in one fragile nuclear basket may well go down in history as the most prominent act of *technological suicide* that a country has ever advocated. And to engage in the promotion of these nuclear fission plants overseas, to try to sell them to countries like India and Brazil and African nations whose technical infrastructure of care is orders of magnitude below ours, is also an act of folly.

All of this would not have occurred, I submit, if we had open disclosure of information. If we had standing of citizens to challenge, if we had technical representatives at the state level, if we had a state jurisdictional input, if we had an R&D budget working on alternatives such as solar, geothermal, liquefaction, and so forth.

Nader asked the governors, *"Can we, as a society, rely on a technology ... that has to be perfect forever, or face massive social disaster?* I think the answer to that is no," concluded Nader.

—Ralph Nader, Western Governors Conference

A moratorium bill on nuclear power plants has been introduced in the Senate by Senator Mike Gravel of Alaska, in the House, by Congressman Jerome Waldie. The Swedish Parliament is considering an indefinite moratorium and so are the Germans. A number of State legislatures are considering similar moves. An initiative is being circulated in California. In a wide-based consensus of opinions for safe nuclear power, a recent Pugwash Conference of 100 top world scientists has expressed, in a resolution, serious misgivings over the wisdom of fission power.

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The Los Angeles Times

MONDAY MORNING, DECEMBER 17, 1973

AN ASSESSMENT

Nuclear Energy: Great Hopes, Great Problems

BY LEE DYE
Times Staff Writer

The nuclear industry may well have the best safety record of any major industry in the history of the United States.

It has been subjected to examination and scrutiny on a level that is without parallel.

Some of the most brilliant minds in the world are working to see that the industry does not destroy us while trying to save us.

The tools of its trade are equipped with automatic and redundant safety features that make such things as automotive airbags seem terribly crude.

Yet in spite of all of that, the industry is haunted by critics who refuse to go away. It seems at times that some people never will be satisfied.

Why?

Perhaps UC San Diego's Nobel Prize-winning physicist Dr. Hannes Alfven pinpointed the reason when he observed that the nuclear industry relies on a level of perfection in which "no acts of God can be permitted."

In short, although the nuclear industry has the capacity for doing great things for mankind, it also has the capacity for unleashing catastrophies of such magnitude that all other problems seem pale by comparison.

Some of the problems have been the subject of much shouting and yelling in the past. But others are just now being discussed in whispers.

And as if all this were not enough, the beleaguered industry has problems of its own. Its power plants have not proved reliable, and today, at the height of the energy crisis when the industry had expected to move into prime time, many of its plants are shut down or operating on a limited level.

Southern California has only one nuclear power plant, and it has been closed for six weeks and will be closed until sometime after the first of the year.

New England has five nuclear power plants—only one of which is operating now at full capacity. One has been inoperable for 10 of the past 12 months.

The most pressing questions today, however, strike directly at the issue of public safety rather than plant reliability.

Adding punch to the issue are the conclusions of some of the top nuclear physicists in the world, experts within the Atomic Energy Commission (AEC) itself, a prestigious international scientific organization, and U.S. governmental agencies. Briefly, the questions center on:

—Reactor safety. The most important safety feature in any nuclear power plant is the emergency core cooling system, but no full-scale test ever has been conducted to see if the system will work.

—Breeders. Because of the shortage of uranium, this country already has committed itself to the fast breeder reactor, which makes more fuel than it uses. However, the breeder is an unproven technology, and many experts contend that breeders will be many times more hazardous than the present generation of reactors.

—Sabotage. This subject is so disturbing that it never has been discussed fully and openly. But there is mounting concern over nuclear facilities as targets for terrorists.

—Homemade bombs. As nuclear facilities proliferate, the opportunities increase for diversion of bomb-grade nuclear materials that would permit terrorists to build their own atomic bombs. In addition, such countries as Cuba probably will soon have nuclear weapons, possibly built with materials diverted from the peaceful use of the atom.

—Radioactive waste. Although the nation is moving fully into the nuclear age, no method has been developed for disposing of deadly radioactive waste products that must be isolated from man's environment for thousands of years.

—Acts of God. Although, as Alfven observed, they are not permitted, acts of God could wipe out in a single stroke all of the safety features built into nuclear facilities. The San Fernando earthquake occurred along an "unknown" fault, and had it been much closer to a nuclear power plant the results could have been catastrophic.

As a top AEC executive observed in a Carmel conference in September, 1971:

"When an earthquake occurs near a nuclear power plant, every feature of the plant will be affected to some degree by the earthquake. Complex multiple failures may occur. If the nuclear power plant is not adequately designed and constructed to withstand the earthquake effects, the potential exists for the concurrent loss of fuel integrity and loss of function of the redundant systems and barriers which prevent radioactivity release."

In view of that, it is a little difficult for the critics to understand why the government is just now getting around to conducting extensive seismic surveys of the area immediately offshore from a major new nuclear power complex that is more than half completed near San Luis Obispo.

But so much for earthquakes. What about the built-in safety systems? Will they work, God permitting?

The most controversial part of any reactor today is the emergency core cooling system. This system would deliver borated water to the reactor core in the event that the primary cooling water was lost. The emergency coolant would keep the reactor from overheating to the point of melting, which could result in the release of radioactivity.

The critics say it won't—or at least may not—work.

The AEC and the nuclear industry insist that it will, and some have even pointed to the recent problems at Southern California's San Onofre power plant as proof that the emergency system works.

Mechanical problems there last October resulted in minor damage to the emergency cooling system, but the system did pump borated water to the reactor in response to automatic warning devices.

The water did not enter the reactor core because there really was no emergency—the core was still full of the primary coolant.

Officials with Southern California Edison Co., which owns 80% of San Onofre, have contended that the incident demonstrated the reliability of the equipment.

But the debate over the emergency core cooling system has had nothing to do with whether the pumps would work. In fact, just about everybody has assumed that the pumps would work.

Dr. Henry Kendall, professor of physics at Massachusetts Institute of Technology, contends that if the primary cooling water were lost (through extensive pipe ruptures, for instance) pressures in the reactor core would build up so fast that the emergency cooling water would not be able to enter.

As a result, the reactor would melt. Some critics contend that the heat and pressures would be so great that the reinforced concrete dome over the reactor would be damaged, permitting the release of massive, deadly radiation.

Who is right?

That question could be answered by simply denying the primary coolant to an operating reactor.

If the AEC is right, the reactor would shut itself down automatically and the emergency cooling system would do its thing.

But if the AEC is wrong . . .

A special reactor could be built to test the system underground in the nuclear weapons testing area of Nevada, for instance. A complete, full-scale test could then be conducted safely.

Recently such a plan was suggested to the aide of one of the members of the Atomic Energy Commission.

"It could be done," he said, "but it would be terribly expensive to wipe out all of that equipment."

He was reminded that the system is supposed to save the equipment, not wipe it out.

If everything worked according to plan, the plant could be used to generate electricity, and nothing would have been lost while much would have been gained.

At this stage, however, the AEC has not seen fit to plan such a test.

In the long run, the questions of sabotage and diversion of bomb-grade nuclear materials may be of even greater significance than plant safety.

During an interview in his Washington office, L. Manning Muntzing, director of regulation for the AEC, conceded that a band of highly trained, sophisticated terrorists could conceivably take over a nuclear power plant near a major city and destroy it in such a way as to kill thousands — perhaps even millions—of people.

In order to be successful, the terrorists would have to know a great deal about nuclear power plants, but as time passes and nuclear reactors proliferate around the world that knowledge will become more common.

Some of the world's leading scientists expressed grave concern over this problem during the Pugwash Conference held in Finland last September.

The conference, with head offices in London, brings together about 100 scientists each year, many of whom are nuclear physicists who have been instrumental in the advancement of the nuclear age. UCSD's Alfven is president of the conference.

In a report issued following the 23rd Pugwash Conference on Science and World Affairs, the scientists warned:

"The question of sabotage of nuclear reactors, waste shipments, or reprocessing plants generates especially grave concerns because this possibility renders all the theoretical failure probabilities meaningless.

"This may be an additional reason to place reactors and reprocessing plants deep underground, if research confirms any real accident-containment advantages for this approach.

"Other measures against sabotage discussed by the (conference) included very careful guarding of the installations themselves, perhaps facilitated by clustering the various facilities at one location."

"Unfortunately, it is difficult to believe that even these measures can be 100% effective."

The question of theft of bomb-grade material also brought expressions of grave concern from the delegates. The Pugwash report stated:

"The problem of theft of nuclear material by internal groups or individuals intent on sabotage, terrorism or blackmail was agreed to be a very serious one."

The report points out that the breeder reactors will produce far greater amounts of dangerous by-products than the present generation of reactors, but it concludes:

"The problem cannot be avoided simply by abandoning the breeder reactor, because, as noted above, all other reactor types also involve the use of materials available for weapons manufacture.

"It is difficult to see how the theft of such material can be made impossible in a world characterized by human failings, but measures to make such theft more difficult should be carefully studied and the best ones implemented as soon as possible."

In an effort to deal with this problem, the AEC recently tightened security requirements for nuclear facilities. However, a report to Congress by the comptroller general of the United States, dated Nov. 7, 1973, contains some rather startling observations.

The report (Improvements Needed in the Program for the Protection of Special Nuclear Material) noted that "persons with the requisite technical expertise and the necessary resources can make a crude nuclear weapon from 17 kilograms (37½ pounds) of uranium or 6 kilograms of plutonium." You could almost carry that much in your pocket.

To aid in preparing their report, GAO investigators visited three of the 600 organizations authorized to possess what the AEC calls "special nuclear material." The investigators "noted several conditions at two of the three plants which significantly limited the (plant's) capability for preventing, detecting, and effectively responding to a possible diversion or diversion attempt."

Examples included fences that had holes large enough for people to get through. In some cases the holes were in areas where the guard could not see them.

Inspectors also found nuclear material stored in "a prefabricated steel structure which could be breached easily."

They also found ineffective guard patrols, ineffective alarm systems, a lack of automatic detection devices, and a lack of an action plan in the event of theft of material.

As the report notes, the opportunities for diversion will multiply as more and more nuclear plants and related facilities are built around the country. That obviously means more and more hazardous material will move along the streets and highways from one facility to the next.

Another GAO report, dated July 31, 1973 (Opportunity for AEC to Improve Its Procedures for Making Sure That Containers Used for Transporting Radioactive Materials Are Safe), notes:

"Annual shipments of the more hazardous types of radioactive materials in the United States are expected to increase nearly eighteenfold between 1972 and 1985—from 1,800 to 32,100 tons."

Debate broke out last year in Oregon when local citizens discovered that highly radioactive materials had been shipped through their state in unmarked trucks, and local officials were not even notified.

Local people figured they had a right to know about such things, but federal officials were concerned over the fact that informing the natives would also mean that potential hijackers would be alerted to the shipment.

So what do you do? Do you paint "radioactive" across the truck so the citizens know of the danger? Or do you disguise the shipment so that the hijackers won't know?

As it stands now, the government has decided that it is more important to keep the hijackers in the dark, but at least it tells local authorities about the shipments.

Some of these problems could be minimized by clustering nuclear power plants and related facilities together, far from population centers. Large areas of land could be set aside, thus permitting greater security for the entire operation.

Many executives within the AEC favor such "nuclear parks," but there is little evidence so far that the nation is moving in that direction. Nuclear power plant sites are still being approved across the country, and existing facilities are still being permitted to expand.

So it appears that the course for the future will follow about the same path as in the past. There will be more and more nuclear facilities in widely scattered areas of the country.

In addition, facilities will multiply not only in number, but in complexity as well—and quite possibly in hazards.

Earlier this year the AEC awarded contracts to Westinghouse for the nation's full-scale demonstration breeder reactor.

During extensive interviews with AEC executives in Washington, it became clear that the AEC believes the breeder is essential to the nuclear industry in order to guarantee an adequate supply of fuel. It also became clear that the country is already committed to the breeder, come what may.

The breeder is not merely another evolution in the nuclear cycle. It is a new breed of cat, and many pro-nuclear scientists are deeply concerned about the safety of the breeder.

The breeder will operate at such high temperatures that it will not be possible to cool it with water. As a result, liquid sodium will be used. Writing in the Bulletin of the Atomic Scientists, physicist Amory B. Lovins noted that a single breeder will contain roughly a ton of plutonium 239 — a radiological poison so toxic that if properly reduced and dispersed, a ton of it would far more than suffice to give lung cancer to everyone on earth."

In describing breeder operations, Lovins said "The sodium, which is violently reactive with air or water, is to emerge (from the reactor core) intensely radioactive and heated to about 1,000 degrees F."

If such a system can even be made to work, can there be a guarantee that it will not deteriorate faster than it can be maintained?

Perhaps time will tell.

Meanwhile, the nation will continue stockpiling deadly radioactive waste products for which it has no permanent repository.

The issue was summarized in the Pugwash Conference report:

"The as yet unsolved problem of radioactive waste management, and the possibly unsolvable problems of catastrophic releases of radioactivity or diversion of bomb-grade material, combine to create grave misgivings in the (conference) about the vast increase in the use of nuclear power that has been widely forecast."

Maybe that's why the questions won't go away.

A.E.C. Files Show Effort To Conceal Safety Perils

By DAVID BURNHAM
Special to The New York Times

WASHINGTON, Nov. 9 — Atomic Energy Commission documents show that for at least the last 10 years the commission has repeatedly sought to suppress studies by its own scientists that found nuclear reactors were more dangerous than officially acknowledged or that raised questions about reactor safety devices.

One key study, which the commission kept from the public for more than seven years, found that a major reactor accident —should one occur — could have effects equivalent to a "good-sized weapon," killing up to 45,000 persons, and that "the possible size of such a disaster might be equal to that of the state of Pennsylvania."

In addition, the documents show that the commission ignored recommendations from its own scientists for further research on key safety questions. And they show that on at least two important matters the commission consulted with the industry it was supposed to be regulating before deciding not to publish a study critical of its safety procedures.

Memos Back to 1964

Details of the commission's efforts to avoid publishing reports on the potential reactor hazards have emerged from an examination by The New York Times of hundreds of memos and letters written by commission and industry officials since 1964. Additional material was found in the record of an obscure commission hearing in 1972.

Some of the documents were originally leaked by A.E.C. officials to the Union of Concerned Scientists, a Boston-based research group that has questioned many commission policies. Others became available as a result of suits and threats of suits under the freedom of information law by such critics of the commission as David Dinsmore Comey of the Chicago-based group, Business and Professional People for the Public Interest.

In response to an inquiry about the commission's information policies, L. Manning Muntzing, director of regulation, said that "there is no agency as dedicated to opening up as the A.E.C." He conceded that there had been "bad examples" of secrecy in the past, but he said that beginning "three years ago we created a revolutionary openness —we may not be perfect, but we're a lot better."

Increasing concern about the inherent conflicts in the A.E.C.'s twin roles of regulating atomic power and promoting its use played a role this year in the Congressional decision to split the commission into two agencies —one to sponsor energy research and one to monitor the safety industry.

Questions Are Posed

But the documents, some of which the staff of the Congressional Joint Committee on Atomic Energy has begun to study, raise a number of continuing questions. Some of them are these:

Given how safe are the millions of persons who live close to the approximately 50 reactors now operating in the United States?

Given its effort to deal with the charge that it would put private interests ahead of those of the public, should the United States Government continue to push for the construction of about 200 more reactors in the next 25 years?

Given that the Government agency responsible for protecting the public from the hazards of radiation has sought to suppress studies dealing with the potential dangers of these reactors?

The extent of the alleged failure of the A.E.C. to do required safety research was commented on five years ago by D. B. Imhoff, a [illegible] field of development engineering [illegible] in a letter to a [illegible] official.

"We [illegible] plans should give [illegible] effort to possible failures and that some funds [illegible] be available to resolve important safety issues [illegible] rather than after-the-fact," Mr. Imhoff wrote.

In other words, Mr. Imhoff, then a top official in one of the two major reactor manufacturers in the world, was complaining that the commission should do safety research before rather than after building reactors.

Over and over again, the internal memos of the A.E.C. officials indicate that they were apparently more concerned about the possible public relations impact of safety studies than the actual safety of reactors.

In September, 1971, for example, Steven H. Hanauer, a top commission official, wrote to colleagues that a paper by A.E.C. experts questioning the commission's method of estimating the effectiveness of reactor safety systems had been "temporarily forestalled" but that further action dealing with the paper was required.

"The point at issue should be a paper that can be published without harming the A.E.C. and without in fact making a cause celebre [illegible] a paper because of technical dissent," Dr. Hanauer wrote.

In January, 1972, the commission was forced by critics to hold a public hearing on the standards it had adopted for nuclear power plant cooling systems. These systems are supposed to prevent a massive release of radioactive material should the reactor's nuclear core overheat. One of the witnesses during the protracted hearings was Milton Shaw, the head of the agency's reactor development and technology division.

Mr. Shaw was asked if it was not a fact that his division had been "censoring" the monthly reports of the commission's safety laboratory in Idaho.

"Censoring?" Mr. Shaw replied. "If you want to use that terminology in the sense I think you are using it, yes."

On the next day of the hearings, J. Curtis Haire, the general manager of the Idaho laboratory's safety program, was asked why the Washington officials were "censoring, in your judgment, free an open discussions of Aerojet's viewson nuclear safety."

"Well, I believe that R.D.T. is trying to avoid the problems or burden, if you will, of having to spend a lot of time answering public inquiries that are addressed to Congress and referred to them."

"On nuclear safety?"

"On general questions of nuclear safety," Mr. Haire replied. Within a few months of his public testimony, Mr. Haire was relieved of his duties in the A.E.C.'s safety research program—as a result of his candor, many believe in one commission.

Even more recently, on April 17, 1973, a group of A.E.C. staff members met with representatives from six major power companies to discuss a policy paper the commission was considering on the proper location of reactors in relation to population centers.

"The consensus of the meeting," a report by the A.E.C. said, "was that the principal impact of the policy would be the potentially adverse reaction to any action which indicated that the safety of reactors was in question."

Study not Published

Despite the urging of some senior A.E.C. officials, the commission apparently agreed with the concerns of the utility officials and the so-called reactor siting study was not published.

One year ago, an internal A.E.C. task force on the reactor licensing process completed a critical study of the commission's effort to provide safe reactors.

"The large number of reactor incidents, coupled with the fact that many of them had real safety significance, were generic in nature, and were not identified during the normal design, fabrication, erection and preoperational testing phases, raises a serious question regarding the current review and inspection practices both on the part of the nuclear industry and the A.E.C.," the task force report concluded.

A copy of this report, completed in October of 1973, was given last January to the Union of Concerned Scientists, which in turn made the documents

A.E.C. Documents Show a 10-Year Effort by Agency to Conceal Studies on Safety Peril Posed by Reactors

THE NEW YORK TIMES SUNDAY, NOVEMBER 10, 1974

available to the press. Following publication of the document, the A.E.C. put out an official version that modified or deleted many of the key conclusions of the original.

A finding that safety problems were "besieging reactors under construction and in operation" was entirely removed. Also missing was a task force statement that it "does not believe" that there is "the required confidence level" that accidents are as unlikely as the commission tells the public.

An extensively documented case in which the commission suppressed one of its own scientific studies concerns a $120,000 research project undertaken by the A.E.C.'s Brookhaven National Laboratory in 1964, updating a previous study done by the same group on the estimated damages of a major reactor accident.

The findings of the 1964 update, which Government officials came to refer to as the Wash-740 revision, were grim. In one memo written on Nov. 13, 1964, an A.E.C. official, Stanley A. Szawlewicz said: "The results of the hypothetical Brookhaven National Laboratory accident are more severe than those equivalent to a good-sized weapon and the correlation can readily be made by experts if the Brookhaven National Laboratory results are published. . . .

Area For a 'Big Accident'

Several months later, the advisory committee reviewing the Wash-740 revision received a Jan. 6, 1965, memo from an A.E.C. official that said that "Mr. Smith has prepared isotope curves for given releases and meteorological conditions that show the areas involved: For a big accident the area would be the size of the State of Pennsylvania."

Mr. Szawlewicz, who is still an atomic energy official, was aware of the possible impact the Brookhaven study might have on reactor construction. "The impact of publishing the revised Wash-740 report should be weighed before publication," he wrote to U. M. Staebler, another commission official, on Nov. 27, 1964.

A week later, on Dec. 4, Howard G. Hembree, now retired from the A.E.C., wrote a memo about Mr. Szawlewicz's view to those working on a rewrite of the Wash-740 revision.

"One concern that Szawlewicz expressed was that the reactor chosen by Brookhaven could generate an accident whose consequences could be projected downward to planned reactors, such as Nine-Mile Point and Oyster Creek, and that such projections could affect their building and site locations."

The Nine Mile Point reaction, which is situated 36 miles south of Oswego, N.Y., began generating commercial power in 1969. Oyster Creek, nine miles north of Toms River, N.J., also went commercial in 1969.

Just before Christmas 1964, Mr. Szawlewicz wrote another memo to Mr. Staebler saying that the review committee had agreed to submit copies of the draft report to the Atomic Industrial Forum after its next meeting. The forum is the major industrial lobbying organization of companies manufacturing reactors or otherwise involved in nuclear matters.

In the same memo, Mr. Szawlewicz said "the results of the study must be revealed to the commission and the Joint Atomic Energy Committee without subterfuge, although the method of presentation to the public has not been resolved at this time."

Recently, in response to questions Mr. Szawlewicz said he did not feel the commission had attempted to suppress the Wash-740 revision. "We just held up the report because we wanted to get more data," he said.

On March 17, 1965, C. K. Beck, the former assistant director of regulation, wrote a summary memo to the full commission, then headed by Dr. Glenn Seaborg.

Mr. Beck told the commission that it was an "inescapable calculation" that, given the hypothetical reactor accidents considered in the original Brookhaven National Laboratory study and the subsequent growth of reactors, "damages would result possibly 10 times as large as those calculated in the previous study."

"The problem facing the commission, therefore, at this time, is the choice among the few alternate methods which might be selected for presenting the results of this newer Brookhaven study in 'proper perspective,'" Mr. Beck continued.

The official then told the commission that a special committee of the Atomic Industrial Forum—the industry's lobbying group—had met with the commission's staff and "urged" that "the revised Brookhaven report not be published in any form at the present time" but that the study be extended for "another year or two."

The forum, Mr. Beck continued, recommended that the commission "at the present time simply report in a very brief letter to the Joint Atomic Energy Committee that if major accidents are assumed to occur without regard to the improbability of such events, very large damages, of course, would be calculated to happen. . . .

Findings Not Announced

The official added that a draft of the letter "along the lines discussed between the forum and the steering committee members has been prepared for discussion" of the commission.

On June 13, 1965, Dr Seaborg sent such a letter to the joint committee and no public announcement was made about the Brookhaven findings. Eight years later, June 25, 1973, the commission responded to a threat of a freedom of information suit by Mr. Comey, the nuclear critic in Chicago, and released selected parts of what it called "the final draft" of its report on nuclear reactor safety.

Despite all the statements to the countrary in the A.E.C. files, the commission press release said the Wash-740 revision done by Brookhaenven "was never completed."

The press release summarized the Brookhaven study as finding that the possible damages of a reactor accident "would not be less and under some circumstances would be substantially more than the consequences reported in the early study."

On the third page of the press release, the commission said that in one extreme case examined by Brookhaven using "grossly unrealistic assumptions" it had been found that "45,000 fatalities could result from such an accident."

TKhere is a sharp contrast between the conclusions of the original Wash-740 revision—made public seven years later—and even the press release and many of the public statements by top commission officials.

ON July 21, 1971, for example, Mr. Seaborg told a Washington audience that though there will be some failures, "I believe that just as has been the case in the past, these problems will only cause a temporary shutdown of the plant for the necessary repairs and corrective action and will not harm the public."

During a recent telephone interview, Dr. Seaborg denied that his 1971 statement conflicted with the Wash-740 revision but "in retrospect, I wish we had published it sooner."

The long-time head of the commission, now a professor at the University of California at Berkeley, explained that "we didn't want to publish it because we thought it would be misunderstood by the . . . Even when the laboratories operated by the commission developed important reports raising questions about safety, the commission staff in Washington sometimes ignored it.

On April 2, 1971, for example, the A.E.C.'s Idaho laboratory submitted a complex analysis of the computer methods then being used to estimate what would happen to a reactor if it lost its coolant.

"The analysis of a loss of coolant accident in a nuclear reactor is an extremely complex problem," a summary of the April report said. "The complete and correct analysis is beyond the scope of currently used techniques and in some areas beyond present scientific knowledge. Because of the complexity of the problem, simplifications are often made in the analyses and defended on the grounds that the simplifications make the predicted results 'conservative.' However, it is difficult to ascertain what is 'conservative' if the correct and complete answer is not available."

In A.E.C. Jargon, a "conservative" judgment is one that leans toward overwhelming safety.

During the hearings on emergency core cooling standards almost a year later, Mr. Hanauer, the A.E.C. official who had been concerned to avoid a cause celebre, was asked whether he had ead th rehd the report in question.

"I leafed through it. I did not read it," Dr. Hanauer replied.

"And you dismissed it as not helpful?"

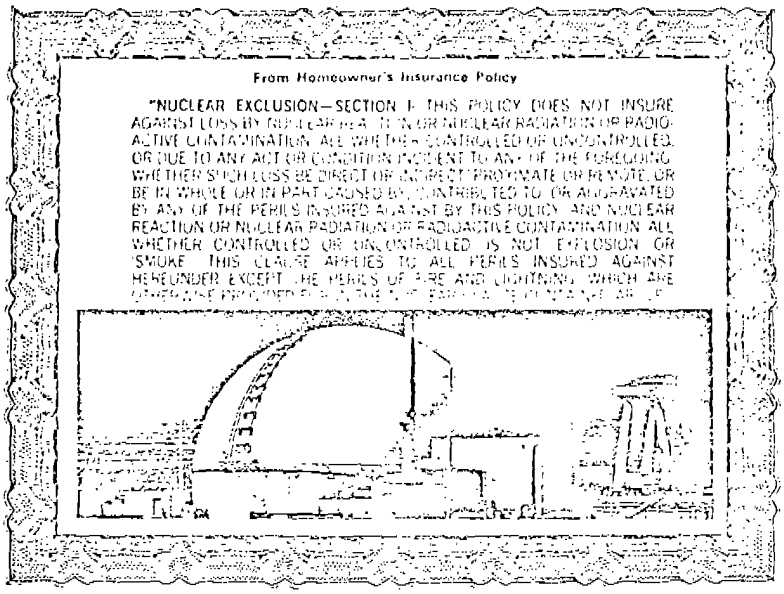
"It did not seem to help me any," he said.

According to A.E.C. internal documents, the report from the Idaho laboratory was intended to provide the technical support for an important statement on safety policy that the commission wanted to issue.

A joint project of Environmental Alert Group and Environmental Education Group

PUBLIC INTEREST REPORT

THE PRICE-ANDERSON ACT AND THE NUCLEAR INDUSTRY: THE ATTEMPT TO INSURE THE UNINSURABLE



"Is the present state of nuclear power technology safe? One way to answer this basic question is to analyze the scientific dispute about possible nuclear accidents and their consequences. But there is an easier way, and that is to examine the willingness of the nuclear establishment itself to assume financial responsibility for accidents and their consequences. This is a good measure of the safety and reliability of the technology. If there is inadequate evidence and experience on which to base a firm judgment on the insurance and economic risk of nuclear accidents, is there enough evidence and experience to justify putting human life at risk?"

—Herbert S. Denenberg, "Nuclear Power: Uninsurable, Progressive Magazine, Nov. 1974; Congressional Record, Nov. 1974

The Price-Anderson Act was enacted in 1957, and extended and amended in 1965 and 1966. The Act was designed to create at least a modicum of protection for the public and the emerging nuclear industry by assuring the availability of funds for the payment of claims in the event of a catastrophic nuclear incident. As the legislative history of the Act demonstrates, while the Joint Congressional Committee on Atomic Energy was asserting publicly that nuclear power was safe, the insurance industry claimed the potential risks were too great.

Because private insurance refused to insure the fledgling nuclear industry, doubting that commercialization could maintain a fail-safe record in the peaceful use of the atom, the government had to step in to provide adequate coverage — without this federal subsidy, the nuclear industry could not have developed as it has. The Price-Anderson agreement limits liability for any one nuclear accident to $60 million dollars regardless of the number of victims or the dollar value of the loss. The liability is paid by private industry to the extent of its availability, and the balance of the burden belongs to the Federal government. The government is mandated to make payments in an indemnity agreement with each nuclear power plant owner for a premium far lower than that which would be demanded by commercial insurance. Private insurance made $60 million available in liability insurance in 1957 — leaving $500 million for the government. The amount of insurance has been gradually increased to $110 million — the taxpayers, through the government, are responsible for $450 million.

Consequently, since 1957, the nuclear establishment has been sheltered from any meaningful liability to the public in accordance with the Price-Anderson Act. Once it purchases the available insurance, and pays the premium for the indemnity agreement, the industry has no further financial responsibility for losses suffered by the public. *In the event of a nuclear catastrophe where damages may rise astronomically beyond the limit, there would be no legal responsibility on the part of anyone for payment to those who have suffered death, injury, or property loss.*

"The Price-Anderson Act, according to its proponents, is designed to protect the public as well as the nuclear industry. This claim is based more on public relations rhetoric than on factual financial analysis. It would have been possible to protect the public without limiting the responsibility for nuclear losses inflicted on the public. In fact, this must be considered a strange method of protecting the public, since its main thrust is to limit the amount of money available to the public and to shield the nuclear industry from legal responsibility."

—"Nuclear Power: Uninsurable," Herbert S. Denenberg, Congressional Record, Nov. 25, 1974

The $560 million limit of Price-Anderson protection may appear to some a large amount of money, but in the face of a nuclear accident of catastrophic proportions, it would be a paltry sum. In 1957, an Atomic Energy Commission (AEC) study known as WASH-740 estimated the consequence of a major nuclear disaster to be 3,400 deaths, 43,000 injuries, and 7 billion dollars in property damage over and above the human injuries and loss of life. An update of that study conducted in 1965 *raised the estimate to 45,000 deaths, 100,000 injuries, long term contamination of an area the size of Pennsylvania and property damage of 17 to 280 billion dollars.* The AEC withheld the study of 1965 for eight years, until it was forced to expose it to public scrutiny as a result of a lawsuit filed under the Federal Freedom of Information Act. Then, the Commission attempted to repudiate both WASH-740 and the update through its WASH-1400, which focused not on damage potential but on the probability of damage.

According to the report, "the chances of an accident causing 10 or more fatalities is 1 in 2,500 per year, or, on the average, one accident every 25 centuries." The report studies the chances of future accident by a probability analysis of accident-engendering events, but as Dr. Beck of the AEC points out in the 1965 study: *"There is no objective, quantitative means of assuring that all possible paths leading to catastrophe have been recognized and safeguarded or that the safeguards will in every case function as intended when needed."*

The AEC based its conclusion on probability from new techniques borrowed from advances in space technology. Challenging this foundation, William Bryan, now with the National Institute for Applied Research, who had eleven years' experience in the aerospace industry and was involved in reliability and safety analyses for the Apollo and Nerva programs, testified that the Commission is "pushing phony reliability and safety numbers" to establish the safety status of nuclear power plants.

Viewed by many critics as a form of science fiction, the Commission's analysis does not present the *de facto* probability of danger to the public but offers a highly subjective, judgmental and unreliable conclusion. We would be more anxious to accept the AEC's probability results if the insurance industry commenced to exploit the figures to set insurance rates. *If the 1974 study is correct, then liability insurance premiums on reactors should be slashed by about 90 percent.*

The people who build and run nuclear power plants are telling the American public that they do not trust their own creation when they clammer for limits in their liability. How can the public have confidence in nuclear reactors if the experts share no such confidence. The insurance industry shares the fear of the nuclear establishment when it limits its underwritings to $110 million for each incident although they will take the responsibility for far greater amount for other types of risks. Even the Federal Government, with its vast financial resources, is intimidated and has been historically lessening its liability rather than assuming more. Under the 1974 Amendments to the Act, the government's indebtedness will be further decreased and will eventuary be phased out entirely. It appears that *no one has the financial capacity and willingness to compensate for the catastrophes of nuclear technology, disasters that could demand remunerations of hundreds of billions of dollars.*

And even if the Federal establishment were to eliminate limits on liability, it would still be inadequate in assuming full responsibility for nuclear disasters, for there are potential losses resulting from nuclear radiation that defy adequate compensation. It is difficult to establish a causal link between a nuclear incident and delayed radiation injury. There remains the unresolved legal dilemma of compensating for radiation-induced genetic deformation and the shortening of lifespans. Furthermore, the statute of limitations may preclude claims for radiation injuries far removed in time from the nuclear incident.

Finally, and perhaps most ominously, is that even if there were adequate limits for all responsibility, covering all nuclear-related occurrences, there could not be full protection for the public since *no one yet knows what damage has already been wrought by the past and current operation of nuclear power plants and related facilities.*

"By recruiting the nuclear industry to bear the burden of proof for the reliability of its own technology, there would be strong economic incentives for insuring nuclear power safety. If, indeed, as some critics have charged, nuclear power is unduly hazardous, normal market forces would delay any dangerous nuclear operation until solutions are found."

—Senator William Proxmire

The nuclear industry has been conspicuously derelict in monitoring low-level radiation releases, and neither the nuclear industry nor the nuclear scientists have adequate information concerning the harmful effects of such radiation.[1] Affirming this obvious lack, a select committee reported to the governor of Pennsylvania on the Shippingport Nuclear Power Station: "During the course of the investigation it became apparent that current, as well as past, environmental radiation monitoring programs are inadequately designed and carried out for determining the impact of radioactive releases on the environment. Environmental monitoring programs conducted in the vicinity of the reactor have not been properly reviewed by a qualified health physicist on a timely basis. Apparently, no qualified health physicist was in the employ of the Duquesne Light Company."

Despite claims that no member of the public has been injured in a nuclear incident, the fact remains that the nuclear establishment does not know what effect its operations have had on the public. After more than twenty years in nuclear effort, the atomic circle has not even begun to properly tackle the problem. To this date, there has been no *full-scale public health review* of the impact of various kinds of nuclear facilities, even though noted nuclear experts such as Drs. Arthur Tamplin and John Gofman have concluded, through intensive research, there is evidence that there is ***no safe level of ionizing radiation to which one may be exposed.***[2]

This failure to adequately safeguard facilities and the public typifies the behavior of nuclear operations. On August 15, 1974, the Wall Street Journal reported that Consumers Power Co., of Michigan, was fined $19,000 for its violations, which included, among other things, failure to control radioactive releases and to perform requisite safety review functions. A front page report in the New York Times of August 25, 1974 revealed that AEC inspections of nuclear facilities unearthed deficiencies in more than one of three cases. During the year concluding on June 30, 1974, the Commission inspected 3,047 facilities and uncovered 3,333 violations in 1,288 of them. Ninety-eight of these incidents occurred in the most serious of three categories of violation. AEC-imposed punishment was levied only eight times. Such recorded performance by the nuclear establishment belies the aura of safety and does little to inspire confidence in nuclear operations.

A brief and chilling warning to mankind about the hazards of nuclear power plants has been issued by the recent Pugwash Conference of one hundred top scientists, including about twenty each from the U.S. and U.S.S.R. Many of the conference participants were nuclear physicists who had been hopeful of finding a peaceful use for splitting the atom. For that reason, their unanimous conclusion was all the more significant: *"The as yet unresolved problems of waste management and the possibly unsolvable (in an absolute sense) problems of catastrophic releases of radioactivity and diversion of bombgrade material, combine to create grave and justified misgivings about the vast increase in the use of nuclear power that has been widely predicted. The wisdom of such an increase must at the present time be seriously questioned."*

The experts feared there were grave dangers in all aspects of the nuclear fuel cycle. All the risks cannot be adequately covered by an insurance policy, for the public must be protected fully from radioactive releases during the mining, fabrication of nuclear fuels, and processing of waste — the nuclear reprocessing plant handles materials at their most critical states, in the transportation of nuclear materials; and in the maintenance of radioactive wastes in interim and long-term storage — several leaks have already occurred. Furthermore, there is no way to predict what may occur in the event of various acts of God such as earthquakes, floods, tornados, and so on. And, most seriously, in a world plagued by unrest and dissatisfaction, how will we insure against the ***diversion of nuclear materials for the clandestine fabrication of atomic weapons;*** the possibilities for *terrorism* are endless. Society could be brought to its knees by a handful of fanatics or revolutionaries.

Moreover, the proposed breeder reactor program raises even more safety questions. The breeder uses and produces ton-quantities of plutonium, the most toxic substance known to man, and, in addition, beyond the many risks of current nuclear plants, there is the possibility of an uncontrollable fission reaction that could explode the reactor core.

On August 16, 1973, Herbert S. Denenberg, Pennsylvania's Insurance Commissioner, issued the following statement:

"It may be that nobody but God could write the insurance policy we need on nuclear power plants ... the only adequate insurance against catastrophic loss from nuclear accidents is to stop building more nuclear power plants and to begin closing down the ones we have now. It's that simple."

Murphy's law states that "if anything can go wrong, it will." Nuclear engineers apparently ignore this tenet in their enthusiasm for the peaceful use of the atom. They envision the year 2000 harboring nearly a thousand reactors with a technology perfectly handling the numerous processes of manufacturing, transporting, and storing thousands of tons of highly toxic nuclear materials and wastes. In their fantasy, all this harmony will occur *devoid of human error, free from sabotage and terrorist activities, untouched by mechanical failure and structural abnormalities.*

Such a fail-safe society has never existed, and it is more than difficult to believe the near future will supply us with the wholly altered world this would require. Within the nuclear arena — for that matter, within all human endeavors — serious mishaps and accidents have occurred. The unique difficulty with nuclear technology is that *no* error can be tolerated owing to the extraordinarily toxic nature of radioactivity. The unfortunate consequence of the commercial use of atomic power is that we evolved a technology without first understanding how to deal with all aspects of that technology. And, as reactors multiply and enormously deadly nuclear wastes pile up, with nuclear materials coursing our highways and railways, it is only a question of time until a nuclear mishap ripens into disaster. In a short period between 1972 and 1974, more than 800 safety-related accidents occurred in commercial power plants, according to a study suppressed by the AEC and finally exposed by Ralph Nader. The margin between accident and disaster has been pure chance.

As Herbert Denenberg points out: "Nuclear power safety is too important to be left to the experts. It is an issue that should be resolved from the point of view of the public interest, which requires a broader perspective than that of tunnel-visioned technicians. In the final analysis, nuclear safety is not a scientific question. It is a humanitarian, moral, and philosophical decision, one uniquely susceptible to resolution by the public."

> At the time of this publication, the President has vetoed the bill extending the Price Anderson Act because of a provision that apparently erodes his authority. A time shortage in Congress has forced postponement of further action. The delay has been termed a setback for the nuclear power industry. With the veto, there is another opportunity for reconsideration of whether the subsidy is *apropos*. In the early stages of consideration, some opponents of the bill had objected that it was being pushed through three years in advance of expiration because five members of the Joint Committee on Atomic Energy who favored the nuclear industry were retiring. The opponents maintained the nuclear industry depended so much on the Act that they could not wait for full debate and consideration. Furthermore, some opponents maintained the Act did not protect the public against incidents in plutonium processing plants or in transportation.
>
> Senator Gravel of Alaska and others believe that the most acceptable solution to the problem of nuclear insurance is to repeal the Act. A corporation which allows a nuclear incident to occur should accept full financial liability for damage its activities may inflict upon the public. It is socially unacceptable that the nuclear power industry be allowed to expand under a law which openly acknowledges that nuclear disasters can happen, and then proceeds to withdraw the prime restraints which generally operate to check reckless action, namely, the acceptance of full liability. In replacing the Act, opponents require that nuclear utilities put their assets on the line if they are unable to acquire private insurance, and such new legislation should retain "no fault" provisions since negligence could very well be impossible for claimants to establish if the radioactive debris is unapproachable. Additionally, a new act must deal cogently with the question of radiation-induced cancers which may take decades to appear.
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> * * * * *

"In the past, Congressional consideration of the Price Anderson Act and its amendments has proceeded on the tacit agreement that Price Anderson is a technical measure necessary for adequate protection of the public interest with respect to a technology that exists and will inevitably grow substantially. The fact is that the technology exists and grows only because Price Anderson has been artfully concealed from public view so that consideration of the indemnity legislation would not trigger debate as to whether nuclear power was needed and whether its risks were acceptable."

Nuclear Power: Risk, Liability, and Indemnity, Harold P. Green, Michigan Law Review, January 1973.

"If it is possible for catastrophic nuclear accident to happen, then it is surely time for Congress to correct the unfairness of putting risk on the victims instead of the investors. More important, we must examine the morality of encouraging such a technology at all, especially in view of the safe alternatives like direct and indirect solar energy."

Senator Mike Gravel, Congressional Record, March 20, 1974

1. There is vigorous opposition to conclusions found in the WASH 1400 Rasmussen study. See "Preliminary Review of the AEC Reactor Safety Study" [illegible] Joint Review Committee, Sierra Club and Union of Concerned Scientists [illegible] and Henry W. Kendall, November 1974.

2. [illegible]

3. [illegible]

4. In 1974 the [illegible]

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The Los Angeles Times

WEDNESDAY MORNING, AUGUST 1, 1973

Nuclear Wastes From Foreign Reactors Being Stored in U.S.

BY LEE DYE
Times Staff Writer

Deadly radioactive waste products from American-built nuclear reactors in foreign countries are being imported into the United States in spite of the fact that this country has serious problems in storing its own radioactive wastes.

While an Atomic Energy Commission official said the quantity of imported nuclear waste is relatively small, it is growing.

And it appears that the United States is well on its way to becoming the radioactive dumping ground for much of the world.

At the same time, U.S. Atomic Energy Commission officials concede that the United States has not solved its own problems of waste disposal. The 30-year history of the Nuclear Age is replete with serous shortcomings in the management of radioactive waste products in this country.

However, radioactive waste products already are in storage here from Japan, Canada and Italy, and many other countries will soon join that list.

American-made nuclear power plants are going into service in many countries. The American firms which build the reactors also hold contracts for reprocessing the fuel, the source for nearly all of the lethal radioactive waste products generated by nuclear reactors.

The fuel rods must be returned to the United States for reprocessing and the waste remains here.

This predicament evolved from the Atoms for Peace program which President Dwight D. Eisenhower laid before the United Nations on Dec. 8, 1953. In a dramatic speech, Mr. Eisenhower pledged this nation to the peaceful exploitation of the action on a worldwide basis.

He followed up on that theme two years later in a message to scientists from all over the world who had gathered in Geneva for a U.N. conference on peaceful uses of atomic energy. Referring to his earlier speech, the President said:

"I stated then, and I reaffirm now, that the United States pledges its determination to help find ways by which the miraculous inventiveness of man shall not be dedicated to his death but consecrated to his life.

Worldwide Program

"This pledge which we gave 20 months ago has become the law of our land, written into our statutes by the American Congress and the new Atomic Energy Act of 1954. The new act state in forthright language that we recognize our responsibilities to share with others, in a spirit of cooperation, what we know of the peaceful atomic art."

That pledge led the United States into a worldwide program aimed at developing atomic energy. American scientists were dispatched to foreign capitals to encourage the use of nuclear power and foreign scientists and technicians were imported to learn from the AEC.

Over the years American industry moved to the forefront in the promotion of nuclear power. Today, companies like General Electric and Westinghouse build nuclear reactors for foreign countries around the world.

But as Dr. Frank Pittman, AEC director of waste management, has said, more money is to be made in the fuel than in the reactors themselves.

"General Electric produces fuel for reactors they have sold around the world," Pittman said.

The sales contracts require the buyer to purchase fuel from GE, Pittman said.

That means that the fuel rods from the reactors must be removed from time to time and shipped back to the GE reprocessing center in Morris, Ill. Reusable uranium and other saleable radioisotopes are extracted from the fuel rods, leaving considerable amounts of deadly radioactive waste.

Those waste products will remain in this country under what the AEC calls "perpetual care."

This situation came to light in a letter from Pittman to Sen. Mark Hatfield (R-Ore.). The senator had written the AEC at the request of Nancy Cutter of Portland, Ore., a member of Another Mother For Peace. The antiwar organization has turned much of its attention to nuclear power and recently made its files available to The Times.

Facts Mentioned

In his letter to Hatfield, dated Sept. 27, 1972, Pittman referred to agreements with 35 countries under the Atoms for Peace Program:

"Consistent with these agreements, small quantities of spent fuel from Japan and Canada have recently been processed at AEC and commercial facilities within the United States. The high-level radioactive wastes deriving from these processing activities remain in this country."

Pittman said he does not consider the problem of foreign waste significant because it will not add appreciably to the waste generated by this country.

Amount of Fuel

He added that economics will force some countries to build their own reprocessing facilities rather than transport the material all the way back to the United States.

However, AEC documents indicate that the amount of fuel for foreign reactors that will be processed in this country may be very substantial in the years ahead.

In its annual reports on the nuclear industry in recent years, the AEC has projected that "foreign free world requirements" for fuel will nearly equal domestic requirements by 1985. The reports indicate that more than 60% of that requirement will probably be met by U.S. processing plants in 1985.

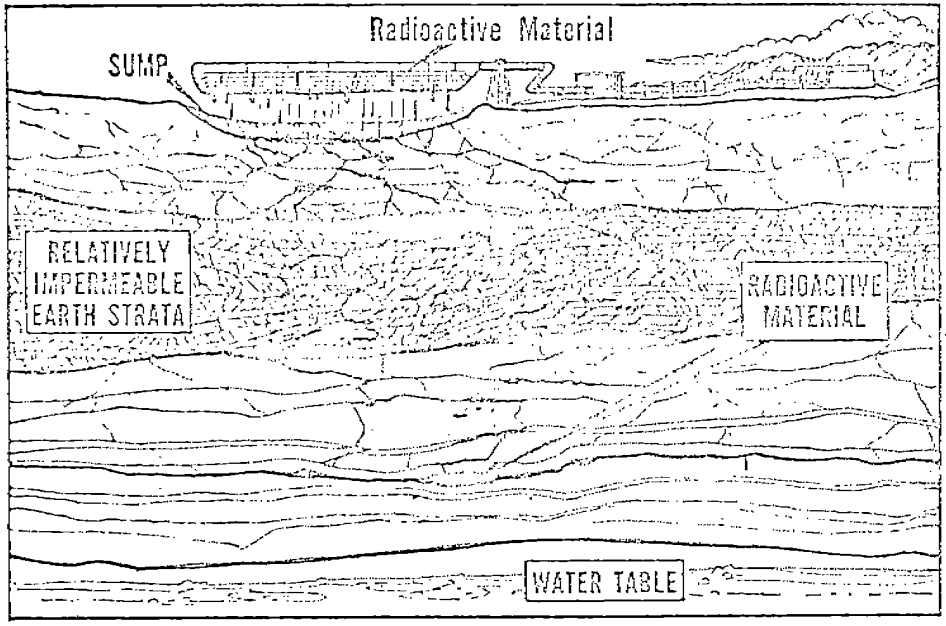
The reports also show that in dollar values the export of nuclear fuel material and isotopes exceeded the value of exported reactors and instruments as early as 1969.

As Pittman said: "The money in the long term is in the fuel."

Another Mother for Peace
407 North Maple Drive
Beverly Hills, California 90210

The Los Angeles Times

MONDAY MORNING, JULY 23, 1973



HAZARD OF WASTES — Radioactive wastes, disposed of by dumping into sump, approach water table.
Times drawing by Russell Arasmith

Nuclear Wastes Contaminate River

AEC Liquid Discharge Seeping Into Columbia in Hanford Area

BY LEE DYE
Times Staff Writer

Practices by the Atomic Energy Commission have led to the deliberate contamination of the ground water beneath the AEC's Hanford Reservation in southeastern Washington and the National Reactor Testing Station near Idaho Falls, Ida.

The operations have placed the AEC on a collision course with other government agencies and will lead to at least one lawsuit in the weeks ahead.

The Times disclosed July 5 that half a million gallons of highly radioactive liquid waste have leaked accidentally into the soil at Hanford. AEC officials contend the spilled materials will never reach the nearby Columbia River and their views were reported in the July 5 story.

But in addition, the AEC has been deliberately discharging low-level radioactive liquids into the soil at Hanford and in Idaho. As a result, some radionuclides have already entered the Columbia, and the ground water at both sites has been contaminated.

Federal Officials Startled

That practice came under fire three years ago by officials with the federal Water Quality Administration who were startled by the AEC's definition of pollution during an investigation of the Idaho Falls facility.

The investigators found that contamination of the ground water below some areas of the facility exceeded federal standards. However the AEC argued that no one was using the ground water beneath the reservation and said by the time the water reached the area where it would be used most of the contaminants would have been leeched out by the soil.

In a 1970 report on Waste Treatment and Disposal Operations at NRTS, the federal Water Quality Administration noted:

"[NRTS] defines pollution as 'the presence in the environment of substances in quantities which are injurious to human, plant, or animal life or to property,' and operates under the policy that chemical waste can be discharged to the regional ground water supply to the extent that the receiving water quality, at the point of first use, does not exceed the recommended upper limit of the drinking water standards of the Public Health Service.

"Under this policy, a severe deterioration in ground water quality beneath the NRTS and a deterioration in water quality outside the NRTS could occur without being interpreted as water pollution."

Quote Concerns Scientists

The report noted that chemical contaminants in ground water below one area of the NRTS already exceeded Public Health Service standards for drinking water, but the AEC did not regard it as water pollution because "there is no injury to human, plant, or animal life or to property at this time."

The last three words of that quote —"at this time"—focus on the reason some scientists are concerned.

The movement of water beneath the surface is subject to subtle changes, sometimes prompted by events some distance away, such as nautral flooding, irrigation projects or the construction of dams. In addition, changing population patterns may place greater drains on the water supply and could result in tapping the water at a different place, such as closer to the NRTS.

The AEC's practices in this area will result in a lawsuit which will be filed soon by the Natural Resources Defense Council, Inc., of Palo Alto. John E. Bryson, an attorney with NRDC, said the suit will deal mainly with the AEC's activities at Hanford, the sprawling reservation near Richland, Wash., where plutonium has been produced for three decades for use in construction of nuclear weapons.

Reactors used to produce the plutonium also produced hundreds of millions of gallons of radioactive and chemical waste products. Some of the materials are so hot from their own radioactivity that they boil for years and must be cooled to keep from melting the steel and concrete tanks in which they are stored.

Many of the tanks have leaked in recent years, releasing half a million gallons of radioactive liquids into the soil.

In addition, the reactors produced millions of gallons of waste products of considerably lower radioactivity, called "low level" or "intermediate level" waste.

This material has been disposed of by dumping it into sumps, trenches or dugouts called "cribs."

Most of the radioactive materials in this category are relatively short-lived radioisotopes that decay before reaching the ground water. Isotopes that would remain dangerous for many years pose a greater threat, but they are held—mostly—within the soil.

Limits Exceeded

However, according to papers presented in international symposiums in Vienna in 1967 and in 1970, some long-lived radionuclides have been found in the ground water beneath Hanford. The papers, presented by scientists directly associated with the operation, confirmed that in some cases the concentration exceeded public drinking water limits. One report stated:

"Eight long-lived radionuclides have been detected in the ground water underlying these disposal sites. They are strontium 90, cesium 137, cobalt 60, iodine 129, carbon 14, ruthenium 106, tritium, and technetium 99.

"Of the eight nuclides just listed, only ruthenium and tritium are routinely detectable in the ground water in concentrations exceeding the public drinking water limits. Concentrations of strontium 90 are occasionally detected above these limits beneath some of the cribs which have been removed from service."

The papers confirmed also that some of the radionuclides had reached the nearby Columbia River, but not in concentrations above drinking water standards.

International Concern

The revelations caused some concern, even on an international level. In the transcript of the symposium, a noted Russian scientist, V. I. Spitsyn, observed:

"I was interested in the results presented in this paper because the problem of the release of radionuclides at this site came up at the Second Geneva Conference in 1958. At that time Soviet scientists expressed the view that radionuclides were bound to reach the ground water.

"Later on, at the 1959 Monaco Conference on the Disposal of Radioactive Wastes, it was reported that radionuclides had actually reached the ground water but that they were still a long way from the Columbia River.

"We have now heard that individual radionuclides have moved many kilometers away from the original site. While I don't suppose that this phenomenon represents any real hazard at the present time, there is no doubt that the radionuclides are moving and that this movement is not under control."

Spitsyn served for years as director of the Institute of Physical Chemistry, Academy of Sciences, USSR. He has specialized in radioactive elements in the soil and is a three-time winner of the Order of Lenin.

The American scientist presenting the paper, D. J. Brown, argued that details on radionuclides in the ground water were given at the earlier conferences, and that concentrations of nuclides entering the Columbia were "well below the drinking water limits."

The question of control, cited by Spitsyn, also troubles many American scientists.

Robert C. Scott of the federal Environmental Protection Agency's San Francisco office was on a team of experts who examined the AEC's waste management program for the National Academy of Science. The team issued a report in 1966 which sharply criticized the AEC on many aspects of waste management.

Scott, who maintains that the AEC's safety procedures are better than most other governmental agencies, is concerned over dumping low and intermediate level wastes directly into the ground.

"The thing that troubles me is that they no longer have control over it," Scott told The Times.

Trapped by Rocks

As the liquid passes through the soil, some of the nuclides are trapped by relatively impermeable layers of rock at different levels between the surface and the water table. The phenomenon, called "perching," is beneficial in that it delays the material's travel toward the ground water, thus allowing more time for radioactive decay.

But what troubles Scott is the fact that springs are formed in a similar way. Water enters the ground at one level, travels along a relatively impermeable layer of rock underground, and eventually resurfaces somewhere else or feeds into another stream or river.

It is not inconceivable, Scott contends, that springs in the future could leech out the material which has been concentrated on the rocks beneath the cribs and carry it to the Columbia or into subterranean aquifers which supply drinking water to communities in the Pacific Northwest.

The results could be significant, particularly in the case of some selected materials. When radionuclides reach the river they are extremely diluted, but in some cases they are reconcentrated later at various levels of the food chain.

Because of its chemical properties, cesium, for example, tends to concentrate in freshwater fish. Some authorities have said that the concentration may be as great as 1,000 times the level of contamination in the water itself.

The Columbia River is the home of one of the greatest salmon runs in the entire world, and the river's salmon turn up on dinner tables all around the globe.

In contrast to the accidental leakage of Hanford's high level storage tanks, the use of cribs, trenches and sumps for disposal of lower level waste has been deliberate.

And there have been instances when the cribs and sumps have been used for disposal of higher level wastes on an emergency basis.

One of the papers presented in the 1967 Vienna conference notes that in 1951 a substantial amount of radioactive liquid was dumped into a limited "swamp" during an emergency. The liquid caused the water level in the swamp to fluctuate.

The paper stated: "At the edge of the swamp, fluctuation in water level periodically exposed contaminated mud which dried out and became airborne."

In other words, the wind blew it away.

The AEC has maintained that these problems are not serious.

The Natural Resources Defense Council disagrees and has asked the AEC to furnish an environmental impact statement on waste disposal at Hanford and elsewhere.

The AEC has declined, and the council expects to file suit soon in an effort to force the AEC to stop dumping the waste until the statement is filed.

Adapted from a major 3-part public energy study, "Energy Options for Man," produced at the request of Mr. Ralph Nader, and under a grant from Environmental Alert Group.

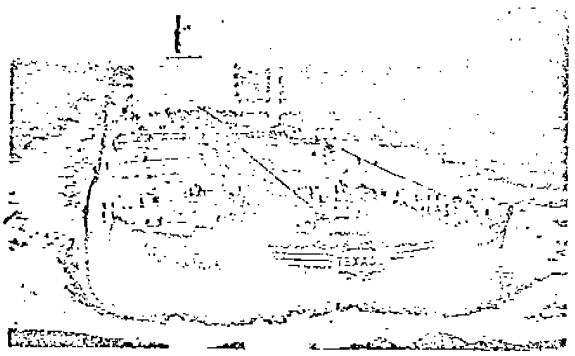
PUBLIC INTEREST REPORT

SOLUTIONS TO THE "ENERGY CRISIS"

Between now and 2001, just 30 years away, the United States will consume more energy than it has in its entire history. By 2001 the annual U.S. demand for energy in all forms is expected to double, and the annual worldwide demand will probably triple. These projected increases will tax man's ability to discover, extract and refine fuels in the huge volumes necessary, to ship them safely, to find suitable locations for several hundred new electric-power stations in the United States (thousands worldwide) and to dispose of effluents and waste products with minimum harm to himself and his environment. When one considers how difficult it is at present to extract coal without jeopardizing lives or scarring the surface of the Earth, to ship oil without spillage, to find acceptable sites for power plants and to control the effluents of our present fuel-burning machines, the energy projections for 2001 indicate the need for thorough assessment of the available options and careful planning of our future course. We shall have to examine with both objectivity and humanity the necessity for the projected increase in energy demand, its relation to our quality of life, the practical options technology provides for meeting our needs and the environmental and social consequences of these options. "Energy and Power," Scientific American.

COAL:

Coal is a *fossil fuel.* It is the result of tremendous pressures that have transformed organic materials, after millions of years, into a concentrated carbon/hydrocarbon form. We combust coal to release its stored chemical energy. Coal represents 20% of the U.S. total energy uses. Coal is certainly the most abundant of the fossil fuels, with estimated reserves in the U.S. of from 300 to over 600 years. But coal utilization brings with it many negative environmental impacts. The combustion of coal releases tremendous quantities of sulfur dioxide, an enormous health hazard. Furthermore, this burning produces particulate pollution and carbon dioxide (which may in the future bring about serious alterations in climate). There are many devices to control pollution from stacks after combustion and there are methods for the gasification of coal to produce a cleaner fuel. But these are currently very expensive. Also, the mining of coal in deep mines is dangerous and creates health hazards, and the surface stripping of coal damages the land, creating tremendous soil-waste problems, acid drainage, unproductive land, and visibly ugly terrain. Reclamation techniques could restore this land, but proper restoration is expensive. We will have to solve many environmental hazards with coal utilization before we continue to use it as a main source of energy for the future.



PETROLEUM:

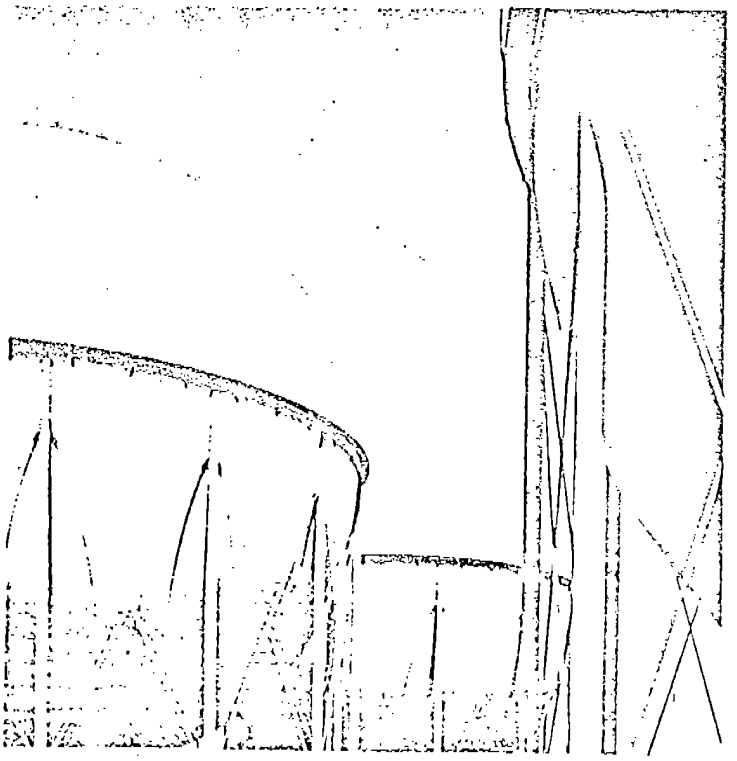
Petroleum is a *fossil fuel*, emanating from the conversion of organic materials after millions of years of heat and pressure. We combust petroleum to release its stored chemical energy. With the projected high demand for oil, experts believe that by the year 2000, 90% of the world's oil may be exhausted. Particularly in the last few years, domestic production of this fuel has not kept pace with the rapidly expanding demand. Even the tremendous North Slope oil from Alaska (the Alaskan pipeline) will only sustain the U.S. demand for about 3 years. Furthermore, in order to meet demands we will have to import more and more oil from the very rich Middle East locations. This dependence will have serious political implications, and substantial increases in the cost of this foreign oil will seriously divert international funds and cause balance-of-payments worries. Moreover, in order to ship enough oil, supertankers will be needed and these tankers will need offshore marine terminals. This will involve enormous investments, and with the unpredictability of Middle East politics, there could be great monitary losses.

In order to bypass such problems, we will have to bypass importing such great quantities. One way to achieve this is to locate more oil on this continent in the many commercially exploitable areas still available onshore, and the locations offshore.

Of course, the use of oil also has environmental dangers. The atmospheric pollution from the use of petroleum in automobiles is noticeably adverse. The U.S. Office of Science and Technology reports that motor vehicles accounted for 44% of nationwide atmospheric emissions. Stationery fuel combustion of oil accounted for 16%. On a pollutant-by-pollutant basis, the report states that vehicles give off 65% of the carbonmonoxide46% of the hydrocarbons and 37% of the nitrogen oxides. And there is the hazard of ocean oil spills and petroleum-related pollution of lakes and streams.

Oil shale could also help increase oil supplies. Oil shale is a limestone-like rock that can be processed to produce oil. But there are still problems to be faced with surface mining, waste, and water use.

The serious impact of oil environmentally can be minimized through such techniques as hydrogenation to yield sulfur-free fuel gas. And there are emission control devices for autos and industry — but these involve cost and fuel problems, which must be considered seriously.

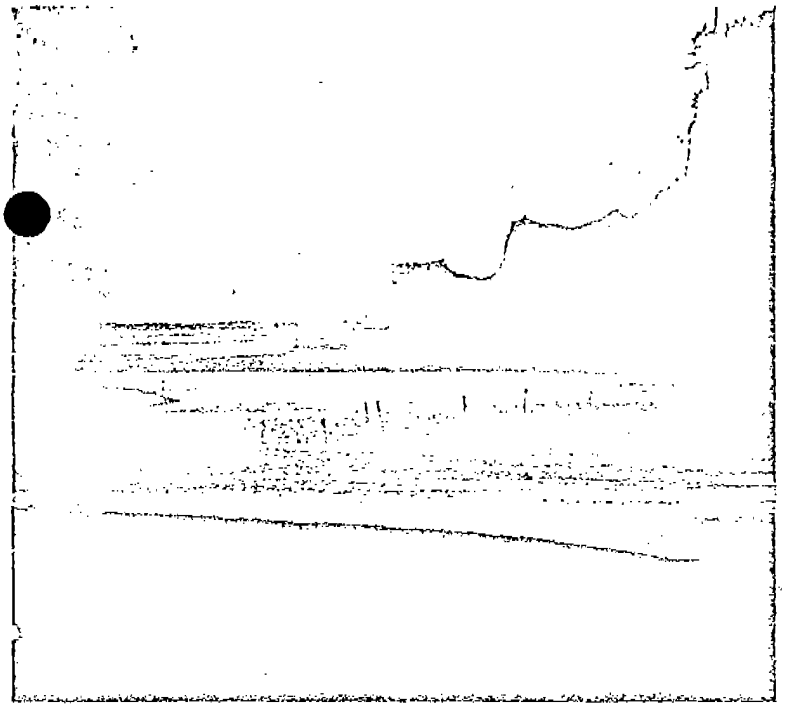


NATURAL GAS:

This gas is a fossil fuel — natural gas is a mixture of gaseous hydrocarbons predominantly methane. Barely thirty years ago, natural gas was flared at the wellhead as an unwanted byproduct of the search for oil. Currently it supplies one third of the total energy used by the U.S. — as much as is supplied by petroleum. Spurred by the relative cheapness and the clean aspects of the fuel, the market has outstripped projections. In 1968, for the first time, proved reserves of gas in the U.S. declined while production outran new discoveries. Experts say that the reason for the shortage of gas is that the Federal Power Commission has regulated the price of natural gas so low that it discouraged investment.

With the known and available deposits of gas, there appears to be only about 11 years of gas left in the U.S. at current output. There is predicted to be, though, a large quantity of natural gas undiscovered on the continental shelf (this is currently irretrievable by modern techniques). And unless prices or some such encouragement can bring about dramatic discoveries of gas, the future is dim. In order to increase supplies, a frantic scramble is underway.

One way to get more gas is to import it as liquefied natural gas from foreign sources. This requires expensive tankers and expensive gas. Gasifying coal may produce a great deal of gas. Also, methods to extract methane from organic refuse and waste is promising. As for its environmental impact, natural gas is relatively clean. It is virtually sulfur free and when combusted burns with a clean flame. There are problems with natural gas as it is burned in large power plants. In the high temperatures produced for power generation, high quantities of nitrogen oxides are produced. As for natural gas in the form of liquefied natural gas, there are very definite risks in handling in the form of vapor clouds, fire, and flameless booms. We may have to augment natural gas supplies in the many different methods available to us in order to meet the demand for this clean fuel.

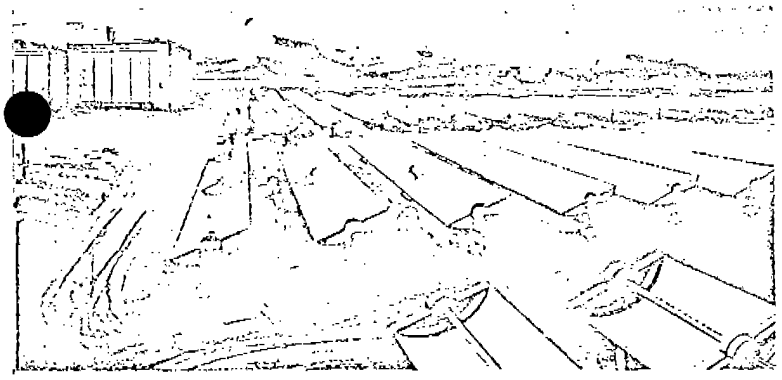


SOLAR:

If 1% of the solar energy falling on the Sahara Desert were converted to electrical power, it would supply all of the world's needs for electrical power for the year 2000 . . . technological breakthroughs are not needed to solve this problem the means to convert solar energy to electrical power is here today

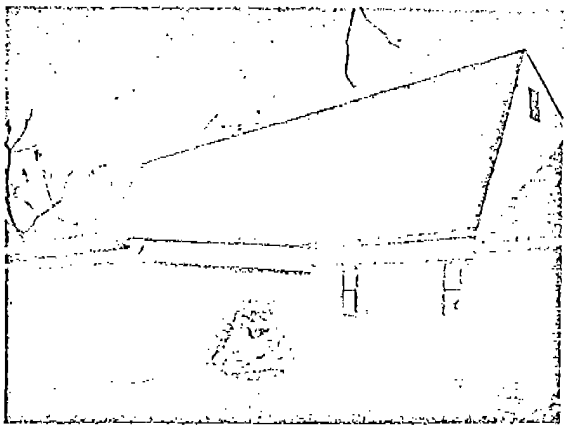
The problem is an economic one. (V. Beaninger) Solar energy offers an endless and clean source of electrical power There are many ways to convert solar energy to non-polluting fuels like methane and hydrogen, and there are also ways to use sunlight directly through the use of solar cells, also called photovoltaics These devices, which power 90% of our unmanned space vehicles, convert sunlight directly to electricity. Since solar cells have no moving parts, their reliability is high and their maintenance is low. With mass production, these devices could be the roofing for our homes in the form of solar shingles. Solar cells, together with other solar-power technologies, could have the capability to meet all of our energy needs with clean, safe systems.

Russia is already experimenting with large-scale solar-cell energy farms — a solar-cell power plant. A totally solar home, including solar electricity, could be built with today's technology (this includes heating and air conditioning). And there are many current projects in which homes are already functioning on solar energy. Thousands of solar water heaters have been installed in buildings and homes in Florida, for example There are also proposals for orbiting solar power stations in synchronous orbit above the earth that would beam down energy in the form of microwaves to earth. Furthermore, there are proposals for large scale solar farms in the Southwest and massive solar furnaces that would focus sun energy to heat water and dissociate it into pure hydrogen and oxygen (see hydrogen). All solar energy needs to become a commercial reality is more backing in the form of funding by the government — there are no technical barriers to wide application.



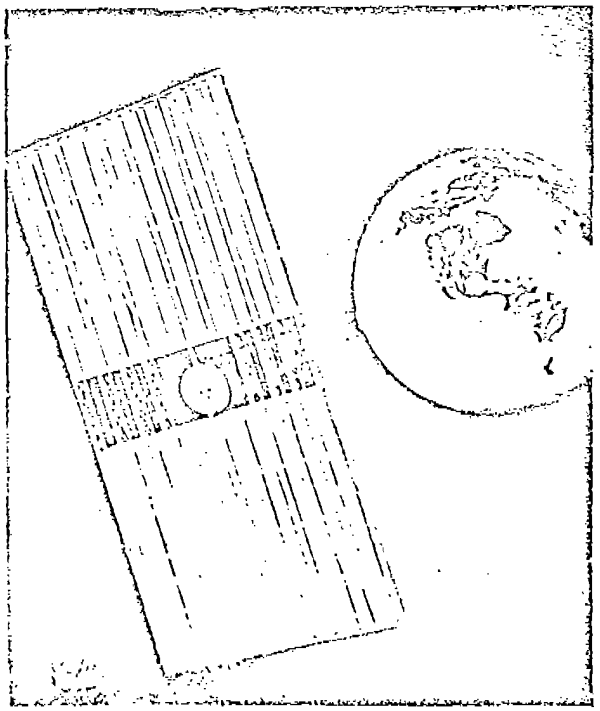
—Illustration by NASA

This is one design for a "solar farm." The flat ton panels are lenses that concentrate the sun's rays on the heat-collecting tubes inside. Hopes are to build a vast array of these farms across the southwestern deserts that will collect heat to generate steam to run power generating turbines. A long range plan to create a million megawatt generating facility would take care of the country's entire electrical power needs through the year 2000, and the leftover heat could desalinate 50 billion gallons of water a day. The farms would also improve desert grazing lands, since runoff from solar panels would concentrate rain into bands, promoting growth of grass.

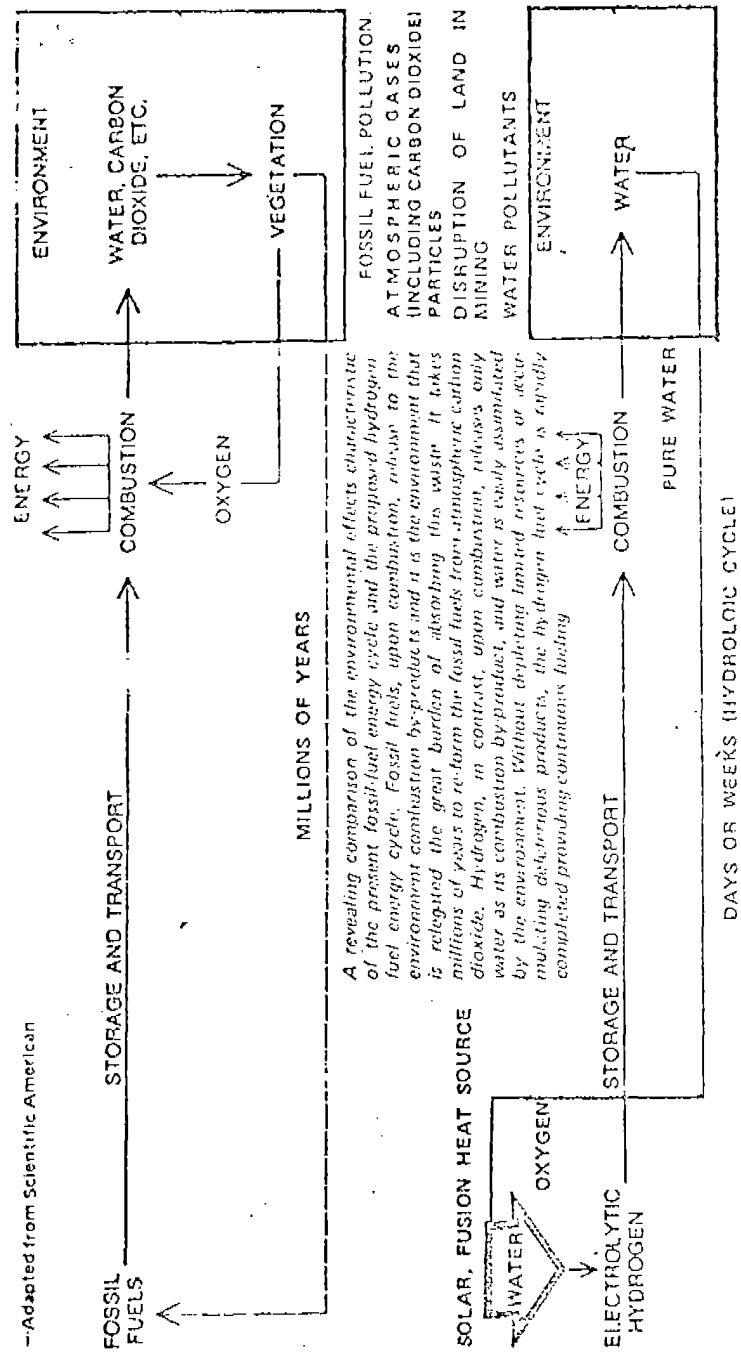


An aluminum roof traps sun's rays to provide heat for a "solar house" in suburb of Washington, D.C.

—U.S. News and World Report



RESORT: This is an illustration of how solar power from space can be monitored to earth with electronic and space technology that already exists. The concept, developed by Dr. Peter Glaser, head of engineering sciences at Arthur D. Little, Inc., utilizes a collector, 5 miles wide on each side, which is an array of solar cells in stationary synchronous orbit. The cells convert sunlight to electricity, which a superconductive cable transmits to a microwave converter. An antenna beams the microwave energy to an earth receiving grid, where it is converted to usable power — enough for a New York sized city.



—Adapted from Scientific American

A revealing comparison of the environmental effects characteristic of the present fossil-fuel energy cycle and the proposed hydrogen fuel energy cycle. Fossil fuels, upon combustion, release to the environment combustion by-products and it is the environment that is relegated the great burden of absorbing the waste. It takes millions of years to re-form the fossil fuels from atmospheric carbon dioxide. Hydrogen, in contrast, upon combustion, releases only water as its combustion by-product, and water is easily assimilated by the environment. Without depleting limited resources or accumulating deleterious products, the hydrogen fuel cycle is rapidly completed providing continuous fueling.

HYDROGEN:

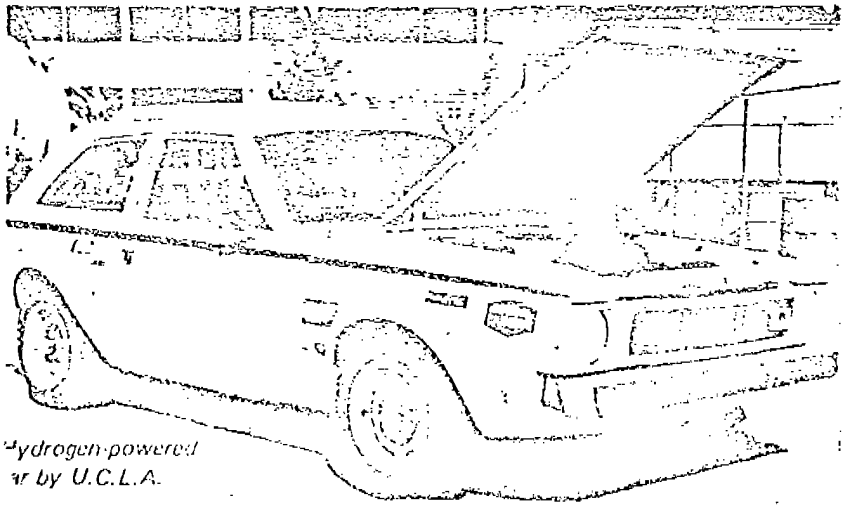
Hydrogen, by far the most abundant, energetic, and clean of all the elemental fuels in the universe, may well be the decisive technology of this century. From the inexhaustible seas, hydrogen would flow continuously. Hydrogen can be produced by central plants by many of several methods, most prominently by electrolysis, and transmitted in underground cables in the form of a gas. Then, this hydrogen gas may be used almost in the identical manner as natural gas. When distributed, this gas can be burned as a gas in home heating and cooling appliances with but slight adjustments or redesigning. It can be used in a wide range of industrial processes. It can be used to generate electricity in local power plants. It can generate power most efficiently of all if it is used in large fuel cells.

With a range of large and small fuel cells, homes and industries would have the option of generating their own power on the premises. When compressed and cooled to liquid form, hydrogen has about two and a half times the energy by unit weight of gasoline, and with some mechanical modifications, all types of internal combustion engines can burn it cleanly.

Converting to liquid hydrogen would make it possible to nearly double the operating range of jet aircraft on the same weight of fuel. Buses, trucks, ships, and trains can all run on hydrogen with their present engines — using fuel cells would be greatly more efficient. Private automobiles can run on liquid hydrogen.

Whatever form the combustion of hydrogen takes, its only major waste is water vapor, which returns in a short time to the sea to become again the source of hydrogen. Thus a hydrogen economy would revolve on a completely renewable, nonpolluting fuel cycle. And hydrogen is relatively safe. In open air or well ventilated places, leaks or spills diffuse so rapidly, hydrogen being the lightest of all elements, that the risks of ignition or spreading flames are actually less than those for gasoline. In general, it's hardly more hazardous than gasoline or even natural gas, though, having different characteristics it requires different treatment.

Hydrogen, because it burns without noxious exhaust products, can be used in an unvented appliance without hazard, hence it is possible to conceive of a home furnace operating without a flue. The list of remarkable innovations possible with this gas is long. The prospects promise to revolutionize domestic heating and cooking techniques. Furthermore, in power production, hydrogen can be stored and used to even out the daily and seasonal variations in load. And hydrogen can be produced by clean sources of energy such as windpower, solar power and fusion. Hydrogen serves as an excellent and efficient means of transmission and storage for these energy producers. Hydrogen is available, effective, economical, safe, and doesn't pollute — and will fit into present technological structures without any profound changes in our present patterns of industrial and economic organization.



ydrogen-powered
r by U.C.L.A.

Minor carburetor modification for hydrogen powered I.C. engine.

Hydrogen fuel represents a simple and practical solution to vehicular emissions -- it is a fuel which can be recycled and which has no toxic sub-cycle components. Hydrogen is a fuel generated from atmospheric compounds, which, when burned in a combustion engine, releases no toxic compounds and yields the very chemicals used to generate the fuel. Hydrogen offers the following advantages: 1) ease of extraction (from the atmosphere by condensation), 2) ease and efficiency of conversion (to the fuel form by electrolysis), 3) excellent operational characteristics as an engine fuel, and 4) non-toxic engine exhaust.

Two units of a geothermal steam power plant in Northern California.

This power is literally "earth heat." And some of the sources of this heat to be tapped for power are steam, hot water, and hot rock. The earth's heat has a potential to be a valuable source of energy, and is currently in use in some areas, producing a substantial contribution to local energy sources. If but 1% of the total heat from geothermal sources could be converted to electric power, we could produce ten times the world's present average power output. The heat energy stored in 500 square miles of the Imperial Valley equals 27% to 65% of the heating capacity of the entire world's oil reserves.

Current studies show that the geothermal sources are large and can be readily exploited. At the Geysers in northern California, generating plants that are powered by geothermal steam already produce 180 megawatts of electricity at costs lower than those for comparable plants utilizing fossil or nuclear fuel sources.

As for hot water sources, plans are now being seriously investigated for using sources of hot water, a much more abundant resource than steam, to generate electricity and to ease the chronic water shortage in the southwestern portion of the U.S. (The brackish waters reaching the surface could be desalinated in the process of generating electricity.)

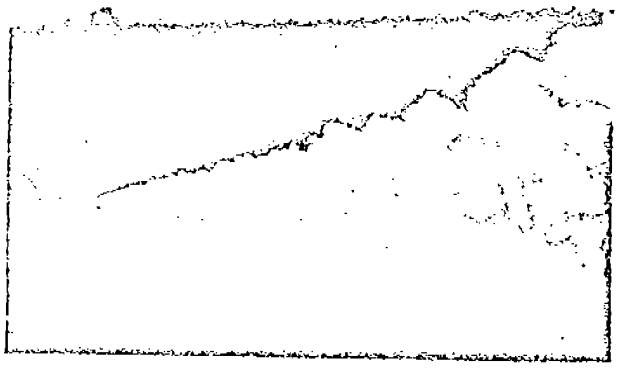
Geothermal sources are found generally where there is a large intrusion of magma, slightly cooled from past volcanic action, lies relatively near the surface, heating a deep underground reservoir of water trapped in permeable rock. With respect to power, water is critical, for it is the medium that carries the heat to the surface. In the process, the water turns to steam which drives the turbines.

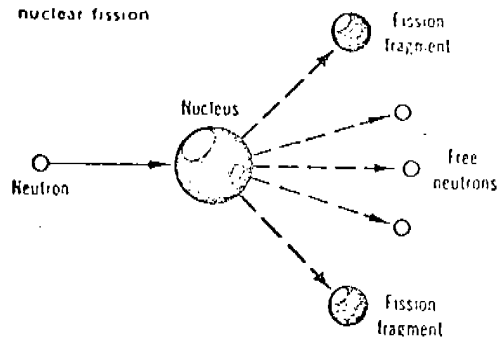
There are two broad classes of geothermal fields. One is the fumerole (natural steam vent) in which heat, pressure and reservoir flow are so balanced that the vent of wells at the surface produce mainly "dry," slightly superheated steam. The second class, much more common, is the hot-spring or geyser system, in which a super-abundant reservoir of high-pressure hot water produces mainly boiling water at the surface, only a portion of which flashes to steam. Another source is hot rock, which does not come in contact with underground water systems. Techniques are being devised to circulate water down through cracks to liberate this heat.

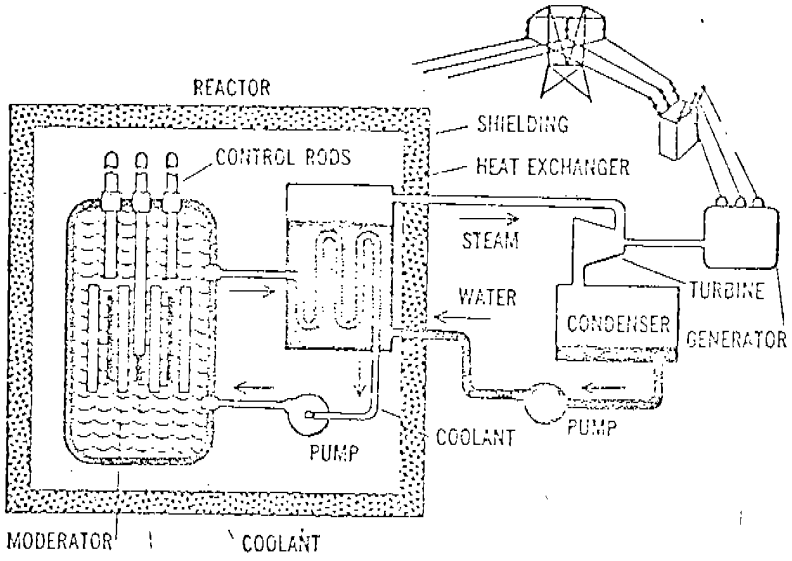
There are environmental problems with geothermal power. Disposal of waste waters from steam or hot water wells could pose a substantial problem, particularly where the water is highly mineralized (minerals in high concentrations can poison fish and other aquatic life). Air pollution is also a problem, since noxious gases often accompany geothermal wells. Martin Goldsmith of the California Institute of Technology estimates that the amount of sulfur released at the Geysers is equivalent to that emitted by a fossil-fueled plant of the same size burning low-sulfur oil, and that at the hot water plant under construction at Cerro Prieto, the sulfur release might exceed that of comparable fossil-fueled plants burning high-sulfur fuel.

There is also pollution from the release of ammonia and boron. Also, injection and withdrawal of geothermal fluids may trigger seismic effects whose nature is not well known. And there are problems of odor and noise.

But there are ways to bypass many of these problems by using different methods of converting the heat energy to electricity. One method uses a secondary fluid to carry the energy (isobutane). And another proposes using thermoelectric devices that would obtain electricity directly from the heat source with very slight environmental danger (proposed by the Environmental Education Group). It should be noted that there is tremendous potential for this resource, and with further research it could be of great significance in supplying energy in the near future on a highly competitive basis.







REACTOR CORE (URANIUM FUEL) —Atomic Energy Commission

FISSION POWER:

Nuclear fission — certain heavy atoms, on being struck in the right way by a subatomic particle called a neutron — split into two or more fragments and release energy in the process. The basic nuclear fuel is uranium, another is thorium. A nuclear reactor is a device for the controlled fission of a nuclear fuel. At one time the world was led to believe that the peaceful use of the atom was indeed a safe and practical answer to solving the energy problems of the developed nations and that the commercial use of nuclear energy was the humanistic harnassing of the incredible power locked in the atom.

Recently, a great deal of information, much of which was formerly suppressed from public view, has brought startling awareness of inherent difficulties, and the real and potential hazards that have accompanied the proliferation of nuclear engendered power. And what is even more frightening is the fact that the further development of nuclear plants is dependent upon the proliferation of an even more hazardous nuclear facility — the *breeder* (a plant where more fuel is produced than is consumed — but these plants have serious safety problems).

When we first got into the nuclear fission program it was believed that this form of energy would provide inexpensive power and would be safe, clean, and efficient. Nuclear energy in execution has manifested none of these attributes. With regard to heat waste, nuclear plants are less efficient in conversion than are conventional fossil-fueled plants. Furthermore, there is no substantial evidence that shows that nuclear energy has competed economically with other forms of energy. In operation, these nuclear plants are far from clean, producing some of the most toxic substances known to man and releasing them in the form of nuclear wastes. Some of these wastes are discharged directly into the environment in the form of gaseous waste, radioactive gases. Radioactivity is extremely hazardous to health and causes genetic mutation, cancer, and other serious disorders.

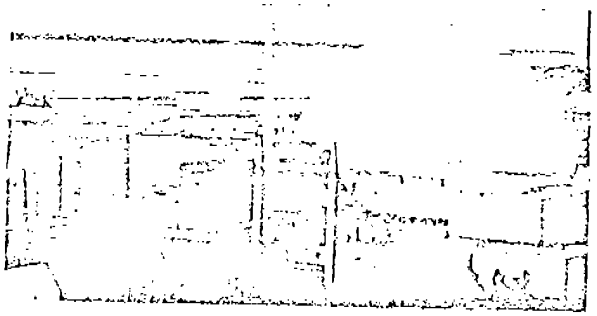
Great volumes of liquid wastes are produced which must be stored in tanks, some underground, above ground, and in the water. These millions of gallons of wastes are enormously toxic and are so hot that many times they make their containers boil like teakettles. Radioactive substances must be stored for centuries until they degrade enough to be harmless, while the storage units last but decades. Already there have been serious leaks of these materials into water and land, threatening all of us with disaster. Also, these nuclear plants produce tremendous quantities of thermal waste in the form of heated water that must be dumped into air or water. This waste in the water creates many complications, affecting aquatic life and nearly every physical property of concern in water quality management — creating lethal and sublethal results in water life.

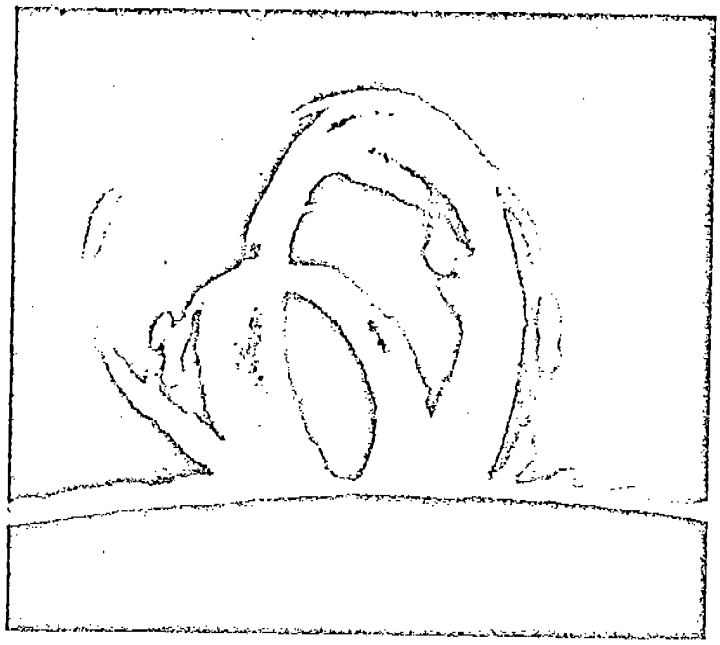
There are, moreover, dangers in the transportation of nuclear wastes and in the possibility of sabotage and diversion of nuclear materials for use in nuclear weapons. And one of the greatest hazards associated with this form of energy is the possibility of a catastrophic accident in which large amounts of radioactive material will be released to the environment, killing thousands and hundreds of thousands of people.

The emergency core cooling system is the last line of defense in an accident and if it fails, such a disaster is possible — and in numerous tests in laboratories, these systems have failed. And no system in current plants has ever been tested. So they don't know for sure if these systems will work at all in the individual plant.

Suffice it to say there are numerous serious dangers involved in the production of nuclear energy, and that, with all the far more promising alternatives at our disposal, this form of energy should be bypassed for cleaner and safer means of electrical power. An economy based on nuclear power is an economy chained to the perpetual surveillance of nuclear waste and to constant fear.

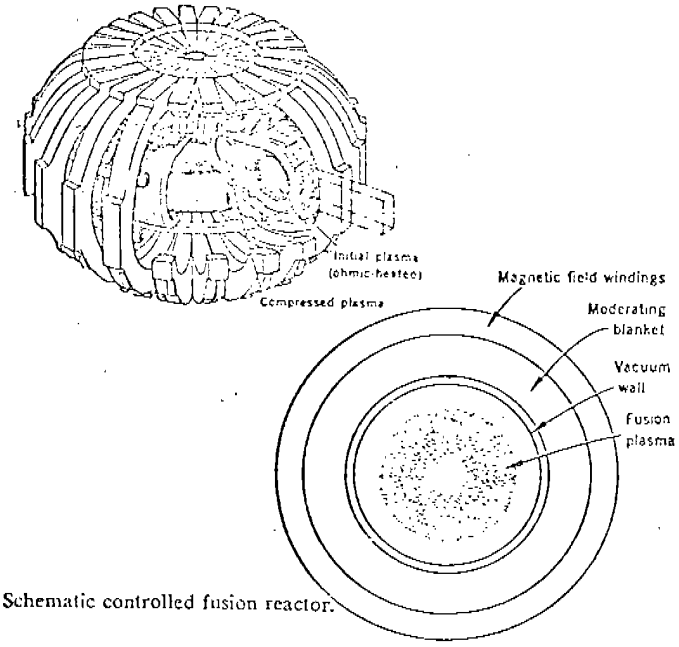
Browns Ferry nuclear fission power plant under construction. With three boiling-water reactors, and generating over 3 million kilowatts, it will be the largest atomic generating project in the world



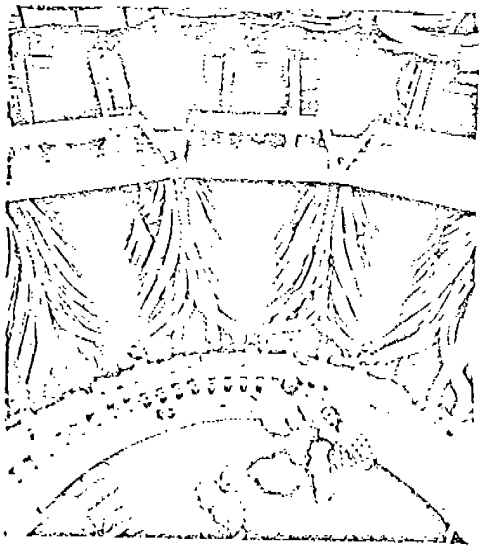


Large loop prominences on the sun, caused by a locally intense magnetic field. The ultimate source of energy on earth, the sun derives its energy from fusion reactions. Current energy research hopes to harness this fusion power for terrestrial use.

—A.F.C., Courtesy Sacramento Peak Observatory, AFCRL



Schematic controlled fusion reactor.



More than 200 planned or operating fusion machines in 14 countries are now trying to achieve a sustained fusion reaction.

NUCLEAR FUSION:

Fusion power is the ultimate source of energy in the universe and if successfully tapped, could provide for mankind a virtually inexhaustible supply of energy that is virtually pollution-free. It is the promise of limitless energy and low pollution that makes the quest for controlled fusion power one of the most important technological searches in man's history.

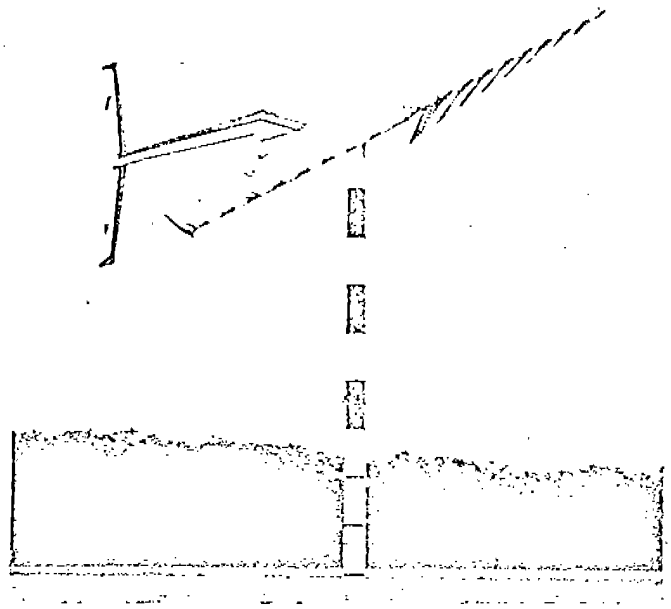
One important aspect of nuclear fusion technology is *plasma physics. Plasma* is the fourth state of matter, different from solid, liquids, and gases. Plasma is an ionized gas. Some of the atoms have had one or more electrons ripped away. A plasma is a mixture of ordinary neutral atoms, ions (atoms that have lost electrons), and free electrons. Those lost electrons are free to carry electrical currents; plasma rather easily conducts electricity. The sun is plasma, and so are all the stars. In fact, almost all the universe is plasma. Plasma can be manipulated by electromagnetic forces, and, under certain conditions, the vast energies locked inside them can be utilized to produce electricity.

One method of releasing this energy is through thermonuclear fusion, or the controlled thermonuclear reactor. Fusion energy is the power of the stars. Scientists throughout the world, through various processes, are trembling close to producing fusion reactions in their laboratories. Although fusion energy comes from the heart of the atomic nucleus, it is very different from the fission-type of nuclear energy that is used to produce electricity. In fission, heavy atoms such as uranium are split apart, releasing energy. In fusion, light atoms such as the various isotopes of hydrogen are forced together — fused — to create energy. Deuterium, an isotope of hydrogen, is found in seawater and can be separated from ordinary hydrogen rather simply. There is enough deuterium in the oceans to supply hundreds of times the amount of energy the world now uses for millions of years into the future — if a practical controlled thermonuclear fusion reactor can be built. To achieve this state scientists must achieve a minimum temperature of 46 million degrees K.; the density must be at least 10^{15} ions per cubic centimeter (roughly 10,000 times more dense than sea level air); the plasma must be kept at this temperature and density for about a tenth of a second. This is called confinement.

The key to controlled fusion is the task of plasma confinement, and there are many experiments underway to accomplish this. A few are coming very close. The use of laser-pulsed energy to achieve this controlled fusion is one of the most promising.

The environmental advantages of fusion are numerous and remarkable. Here are some: fusion fuel requires no combusting of the world's oxygen or hydrocarbon resources and hence no carbon dioxide or other combustion products; there are no radioactive wastes in the cycles most seriously contemplated; there is never enough fuel present to a support a nuclear excursion; there is safety in the event of sabotage or natural disaster; the potential exists for fusion systems to essentially eliminate the problem of thermal pollution by going to charged-particle fuel cycles that result in direct energy conversion; neutrons from the reaction can be used to transmute radioactive wastes so as to render them nonradioactive; the ultra-high density plasma directly from the exhaust of a fusion reactor can be used to dissociate and ionize any solid or liquid material — an operational fusion torch could be used to reduce all kinds of waste to their constituent atoms for separation, thereby creating a closed system of resources where everything is recycled and reused, and the list goes on.

If we can harness this energy in the near future, by intense interest and funding, there is great hope to supply an energy source for the world that all nations could develop regardless of their native resources, thereby raising the standard of living of all nations without draining the resources of the world or polluting the environment.



WIND:

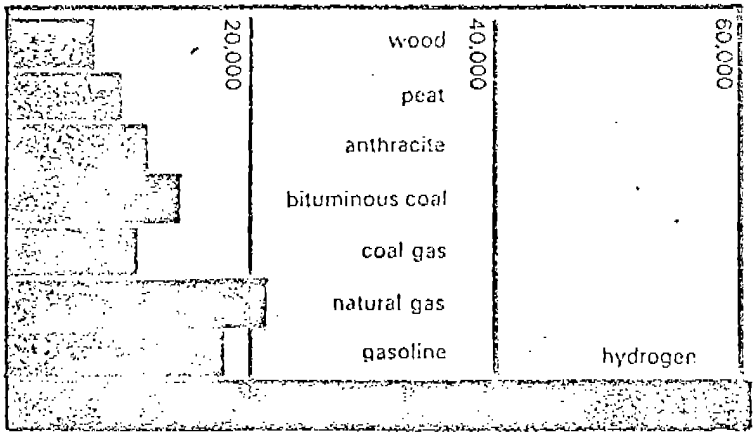
Wind is continuously regenerated in the atmosphere under the influence of radiant energy from the sun. Like solar power itself, wind is a self-renewing source of energy capable of producing harnassable power. Windmills have had a long history. Thousands of streamlined windmills have lighted farms or charged batteries in rural America for decades. Yet, the use of windmills on a greater scale has been neglected. The potential for wind power is major. One scientist envisions windmills spread across the Great Plains that could supply half the electrical power of the entire United States.

The basic project now is to design windmills that are efficient and operate at low cost. With better design, wind generators could very possibly become competitive sources of energy. Furthermore, to solve the obvious unpredictability and storage problems of wind-generated power, windmills could be used to electrolyze water in order to produce hydrogen for power. This approach would, in essence, convert wind energy into chemical energy. The hydrogen could then be stored or transported in conventional pipelines.

There is much recent concern about wind power and there are many promising proposals. There are current designs for windmills that are based on aircraft technology and may hold the answer to harnassing wind energy more efficiently. With more research, wind energy could very possibly contribute significantly to our future energy needs.

LOW ENERGY OPTIONS

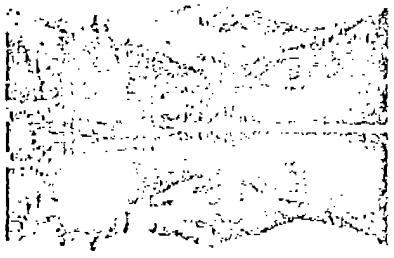
BTU (British Thermal Unit): The quantity of heat required to raise the temperature of 1 lb of water through 1 degree F; equal to about 252 calories.



Caloric values of various fuels in BTUs per pound

Wood – A statement here should be made for the use of wood for conversion to energy for man's use. Wood, of course, has been used for thousands of years as a source of heat for domestic comfort and for cooking. In some places it is still used for providing heat for conversion into power. Wood and charcoal have greatly declined as producers of energy while the fossil fuels have increased in importance. But, generally speaking, wood is unsatisfactory as a fuel and should not be considered an alternative source of energy to supplant current forms. Wood provides less heat per unit of weight than other fuels such as coal and oil. Furthermore, the remaining great forests of the world are far from the industrial centers of population where power is in greatest demand. Until about two centuries ago, wood was man's most important fuel. But it is not suitable for current or projected energy needs, and the impact, environmentally, of decimating forests and then combusting them for dirty fueling would be enormously degrading.

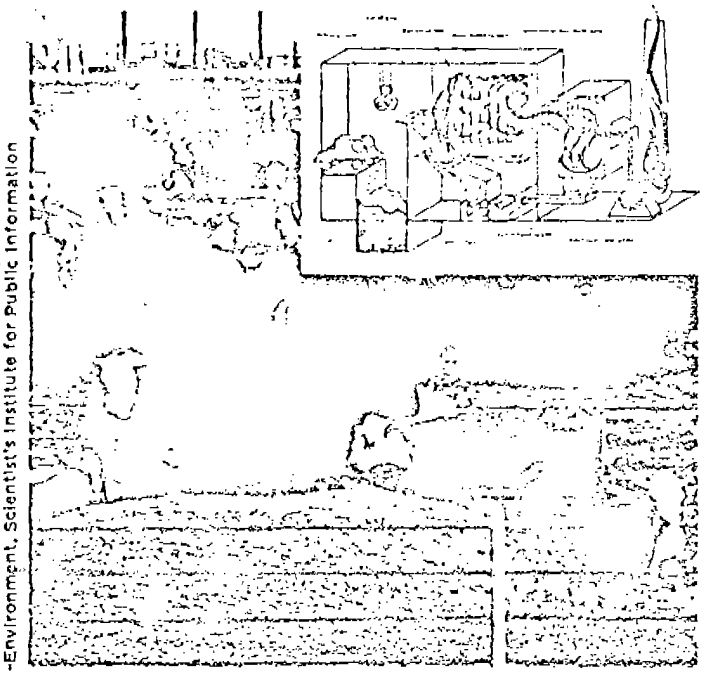
A statement here also for other solid fuels, derived from compressed vegetation, (other than coal) such as peat or lignite. Although these have been used for fuel, their reserves are small in comparison with coal and could not extend these limits by more than a small per cent.



"Solar energy can be utilized through photosynthesis and bacterial fermentation processes to produce fuel gases, such as methane or hydrogen, to augment the nation's dwindling supplies of natural gas. Fuel gases can be produced from organic materials in municipal, industrial, and agricultural wastes, or from plants grown and harvested on land, in fresh water ponds, or in ocean areas."

ALGAE:

Fuel can be obtained from the solar energy fixated in algae. When fast growing algae are digested by bacteria, the major product is methane. These plants could be grown and harvested on land, in fresh water ponds, or in ocean areas. It has been suggested that all of the world's energy requirements in the year 2000 could be met by combustion of high-energy plants cultivated on only about 4% of the world's land surface. Note, the algae grown on only about one-fifth of 1% of the land in Minnesota could probably produce power equal to all Minnesota's 1971 electrical power requirements at peak consumption (and this state is very north, where the sunlight is less intense than in the South). The power we could produce by cultivating algae would be additional to the methane which could be produced from the digestion of animal and urban waste by anaerobic organisms. That same waste could be converted to oil instead of methane and could satisfy nearly half of this country's present oil demand. Thus, these two – algae and waste -- could work together to solve our energy dilemma. These processes are clean, simple, certain and safe.

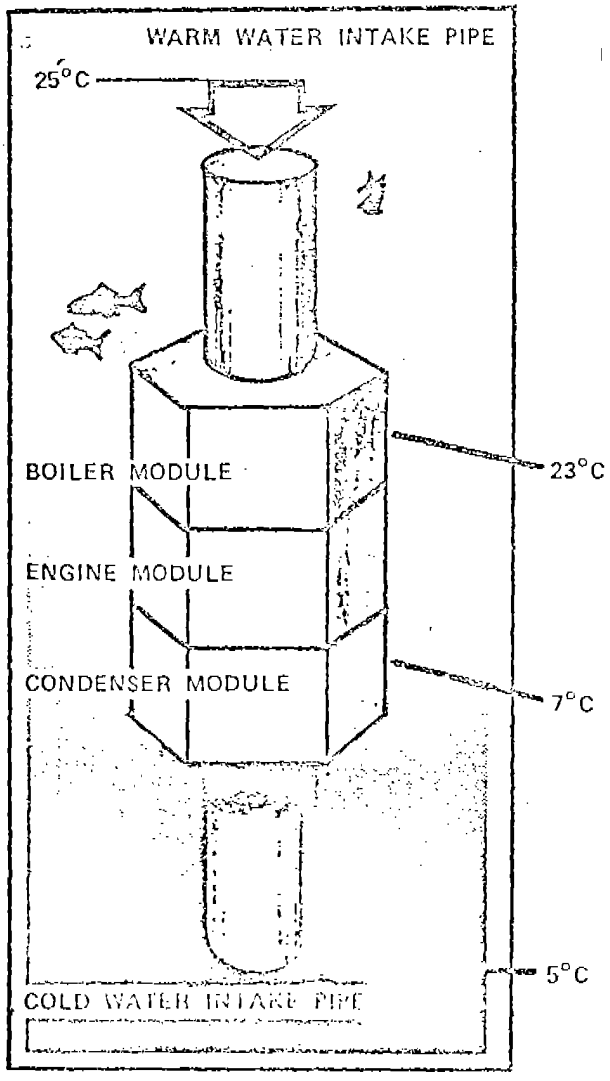


ORGANIC WASTE AND REFUSE:

Urban and agricultural wastes commonly considered pollution and health hazards could be converted to *methane*. This conversion could reduce by half or more the tremendous mass of organic wastes and conserve dwindling fossil deposits of methane (natural gas). It is predicted that efforts to convert waste to gas would not outweigh the current costs of disposing of waste and of searching for gas in submarine deposits. Methane is produced in nature by the bacterial decay of vegetation and animal wastes in the absence of air -- a process known as anaerobic decomposition. The technology of this digestion is reasonably well worked out.

The potential methane production is more than considerable — the combined urban and agricultural waste production in the U.S. is about 1.5 billion tons annually. Each pound of organic waste yields about 10 cubic feet of methane during anaerobic digestion — the combined solid waste could yield 30 trillion cubic feet annually. This amount is half again as much as the current natural gas consumption in the U.S. and would be worth $6 to $9 billion at current prices. It is possible to have methane plants in every municipal sanitation facility to produce this gas. Also, a world-famous authority on the use of waste to produce power sites that it is possible to manufacture small, family-sized methane generators that can make any house or apartment at least semi-independent of external power sources. If these projects can be instituted, we will help to solve both an energy and a waste problem in a very clean fashion.

A solar sea power plant, operating between ocean levels at 25°C and 5°C. The entire plant is neutrally buoyant at a depth of about 200 feet.
—Adapted from Physics Today, Jan. 73



SEA GRADIENT (SEA THERMAL):

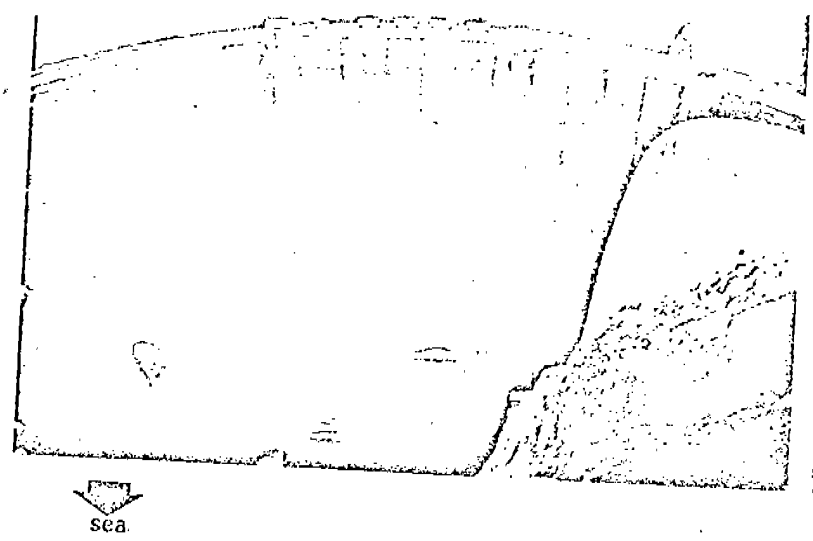
Insolation at the surface of the seas, plus seasonal meltdown of the polar ice caps by solar energy, creates astronomically huge volumes of warm surface water and near-freezing deep ocean water. The thermal gradient that exists between water at the surface and water 1000 feet beneath that surface can be as large as 45 degrees F. A heat engine could operate across such a temperature differential. And the Gulf Stream could be an enormous source for such power generation. These engines could produce electricity that would possibly meet many times the projected demand in the year 1980.

There are at least two systems that have been proposed to harness this power. In one, the ocean thermal gradients are used to generate water vapor (steam) or the vapor of some intermediate working fluid such as freon. This vapor is then expanded through turbines to drive generators, synchronized at an A.C. net. The A.C. electrical power is transported along tether lines to anchor points in the sea bed, collected in larger sea bed cables, carried ashore, and transported as high voltage A.C. power.

Another system uses thermal gradients in a vapor cycle to generate direct current. The direct current is fed to electrolyzers which are also fed distilled water, then released hydrogen is transported through a hollow tether to an anchor point in the sea bed, collected in larger in-seabed pipelines and transported then as electrolytically pure hydrogen. The hydrogen is converted to electricity in 10 to 20 megawatt fuel-cell central stations dotted throughout the country along the branching inground pipelines. These systems are economically feasible and the ecological impact is too small to measure.

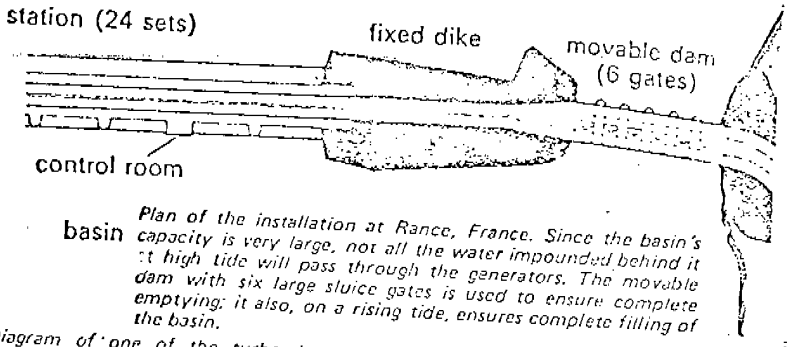
CURRENTS:

Three scientists, two of them with the Commerce Dept.'s National Oceanic and Atmospheric Administration, suggest that man may one day use the energy of the northward flowing Gulf Stream to spin electric generators in systems the scientists liken to "underwater windmills." The Florida Current, a major component of the Gulf Stream, carries more than 50 times the total flow of all the fresh water rivers of the world. Near the surface, the speed sometimes exceeds 5.5 miles per hour. The total energy of motion of the current could produce about 25,000 megawatts -- the output of the largest power plants built by man — if all the energy could be harnessed.



HYDROELECTRIC:

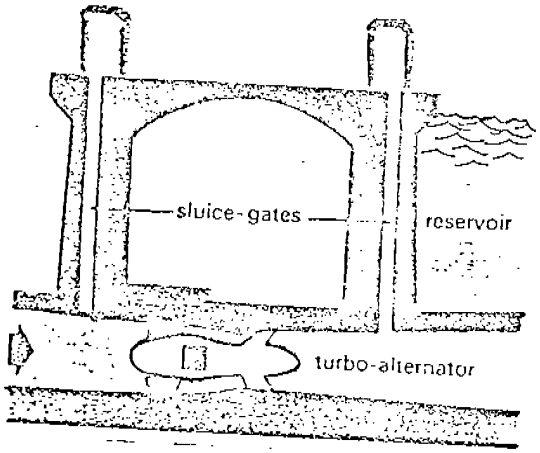
Today, only a small portion of the power needs of ma
tries is met from hydroelectric sources. Although these sou
clean means of generating power, there are many enviro
and societal damages associated with them. Damming in
vast areas of some of the best lands in an era when we ca
ford to lose such acreage; this form of power ge
precipitates a process of backwater sedimentation which, i
cases, spreads indefinitely upstream and into tributarie
damage to good farmland; it is not needed for power h
steam-generated power in low-gradient areas is now cheap
hydroelectric power; it provides an expensive, temporary
ture — in an average prairie plowland the large dam has a
pectancy of only about 50 years due to rapid siltation. It is
pitable to wildlife because of rapid siltation which choke
spawning beds and destroys aquatic vegetation. Probab
most important obstacle in the development of this form of
power is the limitation of use. The growing shortage of n
sites and the high cost of construction rule out dependence o
form of energy in the future.



basin

Plan of the installation at Rance, France. Since the basin's capacity is very large, not all the water impounded behind it at high tide will pass through the generators. The movable dam with six large sluice gates is used to ensure complete emptying; it also, on a rising tide, ensures complete filling of the basin.

Diagram of one of the turbo-alternators installed in the Rance barrage. Since the turbine is mounted horizontally, it can be driven by water flowing either way — from the sea into the reservoir during rising tide, and from the reservoir to the sea during falling tide. The alternator can also be fed with electricity, from outside sources, to drive the turbine and so pump water into the basin at times when demand for electricity is small.



TIDAL:

Tidal power is a promising source of power from water. All
is required is a place on the coast where there is a high rise in t
Then you dam off a natural bay or an artificial basin, so that at h
tides the water must run through turbines to flow into the bas
and at low tide it runs through them to flow out. The problems
harnessing tidal energy are formidable, however, because of
very nature of this form of energy. The incoming flood tides flo
for about six and a half hours, followed by the same duration of
outgoing tide. Conversion of this energy to useful energy can
obtained only part of the time. And there are other variables i
volved that limit the use of this energy form.

There are only a few places in the world where the availab
difference in water level is high enough to generate energy. Th
world's first tidal-powered electric plant is on the estuary of th
River Rance in Britanny in northern France. It ranks as one of th
world's great power stations but such areas are very limited. Th
tidal energy is more likely to be a valuable resource only to selec
areas.

WAVES:

It has been proposed to obtain electric power from waves and
tides. Since waves exhibit tremendous power, schemes have been
put forth to harness it. One plan is to have each incoming wave
force water, by means of valves and a pressure chamber, into a
tank above sea level; this water would run a turbine on its way
back to the sea. Or a battery of floats would be mounted along the
shore, each float connected with the shore by a long boom, and
the up-and-down motion of these booms would turn a generator.
At present the machinery for such ventures is expensive, but these
and other schemes are worth investigating, because there is great
potential to produce continuous and clean energy.

DEVICES AND METHODS FOR MORE EFFICIENT ENERGY CONVERSION

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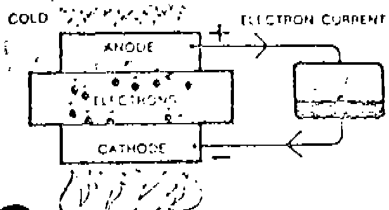
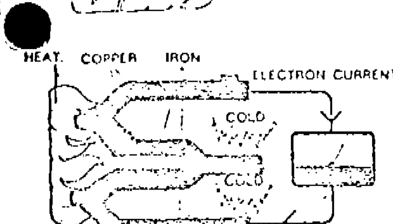
In our technologically oriented society, there is an increasing need for an array of compact, convenient, pollution free electrical power sources and energy storage devices that will help to conserve energy and produce it in a more efficient manner. A large number of power-source needs, both civilian and military, have remained unfulfilled because of limited capabilities of presently available batteries and engine generators. The following devices and methods of energy production represent some of the work that is being done. And many of these devices will be used in conjunction with new energy sources as better means of energy production or combustion.

In efforts to increase energy production and reduce pollution concurrently, efficiency is the key factor with respect to conversion devices. "The higher the efficiency of an energy system, the more usable power is produced per unit of fuel, and the less pollution and waste. Conventional steam power plants, after nearly a century of refinement, barely reach an efficiency of 40%, the rest of the energy from burning coal, gas, or oil goes off in waste heat, smoke, and such partial-combustion products, or pollutants, as oxides of nitrogen and sulphur. The steam-generating process, which currently accounts for over three-fourths of the nation's power, is essentially a ponderous three-stage mechanical system. Water is heated to high-pressure steam in a furnace boiler; the steam then spins a huge turb[illegible] which in turn drives a big rotary motor generator, whirling a copper-wire armature through a magnetic field to produce electric current. Energy is lost at each stage, and more is lost in transmission lines. The whole system still reflects nineteenth-century attitudes that the earth's resources are so limitless that we can afford, as the shortest route to the greatest profit, to waste most of them." —*Fortune*, 1970

And even nuclear-generating plants are linked to the same inefficient system.

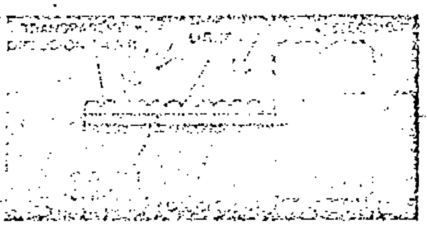


Direct Conversion [illegible] and in many cases higher efficiencies and less pollution.



Thermionic. Thermionic generation is a high efficiency method of heating metals to boil off electrons, thus creating electricity. A thermionic converter is a vacuum or gas filled device with a hot electron emitter (cathode) and a cold collector (anode). The cathode discharges electrons to the anode. This electron exchange with a closed circuit is electricity. Thermionic converters may be made into concentric cylindrical shells and wrapped around the uranium fuel element in nuclear reactors. The waste heat in this case would be carried out of the reactor to a separate radiator by a stream of liquid metal.

Thermoelectric. When two dissimilar metals are joined and heated at one junction, electrons begin to flow in the connected circuit. This is electricity. The materials which work the best are poor conductors of heat but good conductors of electricity. One very important application of this principle involves geothermal power. The heat within the earth can be converted directly by thermoelectric devices. Thus it is possible to produce electricity directly from a heat source like a volcano rather than using the heat source to convert water into the geothermal steam traditionally used to drive generating turbines. Non-polluting, efficient, and long-lived, this system could overcome the seismic and pollutive problems of geothermal steam.



Photoelectric. A photoelectric cell is constructed of two dissimilar materials treated so that one has an excess of electrons and the other has a deficiency of them. When light strikes the surface having an electron excess, the free electrons are dislodged and attracted by the second material which lacks the electrons. The resulting electron movement in a closed circuit is electricity. The research into this cell is vital in harnessing the sun's energy directly for electrical production. The potential of solar cells is discussed in the solar energy section.

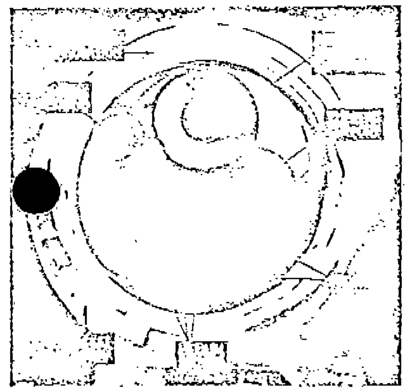
Superconductivity. It has been discovered by Dutch Nobel Prize physicist Heike Onnes that at temperatures near absolute zero (minus 460 degrees F) certain metals suddenly lose all resistance to an electric current and become perfect conductors. They carry current without any heat or other energy losses. Ordinary copper conductors operating at normal temperatures in a power system may run up cumulative losses of 20% or more. Since conductors are the heart and arterial system of all electric equipment, this discovery of a means to transmit power without energy loss easily raises the vision of lightweight, highly efficient electromagnets, generators, motors, transformers, circuits, and transmission lines.

"The first use of superconductivity was in electromagnets. An electromagnet with superconductive coils needs only one large injection of current, rather than the enormous and constant amount necessary before, which then circulates in the coils almost endlessly without loss as long as the coils remain superconductive. And this capability provides savings in cooling costs. These magnets can markedly raise the efficiency of generators, transformers, and motors while greatly reducing their bulk and cost. In addition, they are indispensable for developing new and cleaner forms of power generation, more efficient nuclear systems, and ultimately thermonuclear power.

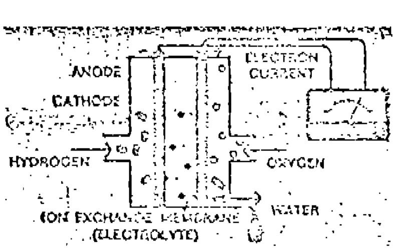
Another great role for superconductivity lies in power transmission. Great losses of current are sustained in the distribution of power from central stations. Superconductive lines could cut these losses, making power more available without added generating capacity and its accompanying pollution. Potentially, one full scale 345 kilovolt superconducting line, twenty inches in diameter, could carry more power than is now used in all of New York — it would take twenty-two conventional cables, ten inches in diameter, to carry the same amount of power (*Fortune*, Nov. 1970).

Superconductors entail the added expense of refrigeration and must run underground for the most efficient operation. At the onset, the cables for superconductivity would be more expensive than overhead bare copper transmission. But underground, the cables (niobium) could show immediate advantages over conventional underground cable, which costs about ten times more per mile than overhead lines, and is limited to lower voltages with much higher current loss.

Research into improvement of transmission systems is vitally important. If U.S. power consumption multiplies at the alarming rates so often predicted, it will be intolerable to install 6 or 7 more lines for every one that exists, or to replace each with a higher [illegible] counterpart. More than 7 million acres of land are now set aside for overhead transmission. In large cities there simply is not enough available land in many cases for an enlargement of power corridors. New technologies are also reviewing such cables as those insulated with compressed gas, cables cooled to the temperatures of nitrogen (cryoresistive transmission).



FUEL CELL:

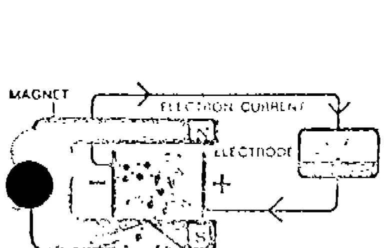


The fuel cell power plant produces electrical power directly from natural gas or hydrogen or many other clean fuels by an electrochemical reaction. Its operation is fundamentally different from conventional methods now in current use to generate electricity. The fuel cell utilizes a clean fuel and air to produce power directly at the site without the intermediate steps of conversion and transmission. The fuel cell's main components are a fuel electrode (anode) and an electrolyte. In a typical application hydrogen is fed to the anode, where it is catalytically converted to hydrogen ions, releasing electrons to an external circuit. At the cathode, these electrons reduce oxygen to ions which then migrate through the electrolyte and combine with hydrogen ions to form water.

This process — effectively the reverse of electrolysis — continues as long as the fuel and air are supplied to the cell and its structural integrity is maintained. By connecting a number of cells, it is possible to create a useful potential of [illegible] to 1000 volts and power levels of 1 kilowatt to nearly 100 megawatts.

Some of the advantages of fuel cells over conventional power sources: emissions of air pollutants are negligible because fuel cell operation is not based on combustion; thermal pollution is not a handicap because excess heat is released directly to the atmosphere; noise pollution is also minimal; electrical efficiency is much higher; fuel cells maintain high efficiency even when operated under a partial load.

MAGNETOHYDRODYNAMICS

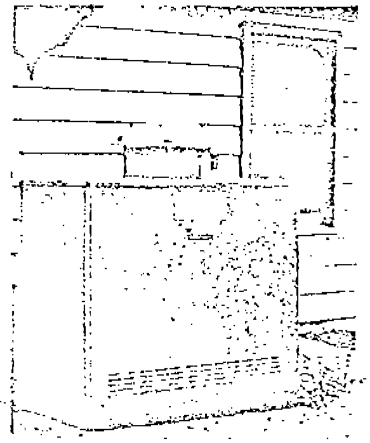


Referred to as MHD for short. When a moving conductor cuts through a magnetic field, current is induced in the conductor. In MHD the moving conductor is a heated gas or liquid metal moving at a high rate of speed. A powerful electromagnet provides the magnetic field, and the resulting flow of electricity travels through the circuit connected to a collection plate electrode at opposite sides of the moving gas or liquid metal.

MHD reduces the three stages of the steam generating cycle to a single continuous process, requiring no turbines or other moving parts. It has a potential of over fifty per cent conversion. MHD promotes more complete combustion of its fuel, producing one third less effluent from its stack than a conventional power plant of the same capacity. It has a built in recovery system that can be designed to remove nearly all particulate matter, as well as nitrogen and sulfur pollutants. Furthermore, the system needs no cooling water to condense steam. MHD discharges no thermal pollution into bodies of water but dissipates its waste heat into the air. And since MHD produces more power per pound of fuel, it could show a substantial saving in fuel.

MHD is a conversion device and thus can be applied to many different fuels such as coal and nuclear to create higher efficiencies in conversions from one form into electricity.

This is the Powercel 11, a backyard fuel cell developed by a team set up by 32 gas companies. The cell, using natural gas and producing no pollution, can generate 12.5 kilowatts of power.



ROCKET ENGINE

Rocketdyne and Commonwealth Edison Company of Chicago are currently working on a joint plan to install an experimental [illegible] power machine or [illegible] engine to produce electricity at a plant near Joliet, Illinois. This program will mark the first Earth adaptation of power units developed for Apollo Saturn V moon flights. It stems from studies indicating that such a system shows promise of providing a clean source of peaking power — the type of capacity needed to supplement base load generation during periods of heavy electrical demand.

The new power unit [illegible] similar to that of the rocket engine that helped to power many of the nation's most important space launches [illegible] will have a combustion system for [illegible] instead of [illegible] thrust, the engine [illegible] from the combustion process will turn water into steam to drive a turbine generator [illegible] produce power. This process is effected in a manner that will virtually eliminate emissions of [illegible] and other pollutants without the noise normally associated with rocket engines.

The combustor is designed to fit in a [illegible] boiler [illegible] times its size. The engine is compact and efficient. And the engine [illegible] that would otherwise be scrapped. It appears the total operating cost would be no more than those of [illegible] gas turbines.

Power Gas and Combined Cycles. In the search for new ways to produce clean electric power from fossil fuels, generating systems that combine gas and steam turbines are playing an important role. Combined cycles offer the promise of greater efficiency than conventional stations and the system can be designed to burn most gasified fuels. Also, when supplies of natural gas and low-sulphur fuel oil becomes increasingly short supply, combined-cycle systems may be the key to clean production of electricity from coal, a far more plentiful resource. Coal gasification to make power gas appears to be one of the least expensive methods of eliminating the sulphur from coal combustion, and combined cycles are symbiotic with systems for coal gasification. The combined cycle system can be tied with the products of the coal gasification process, and the gasifiers can draw compressed air from the combined cycle system.

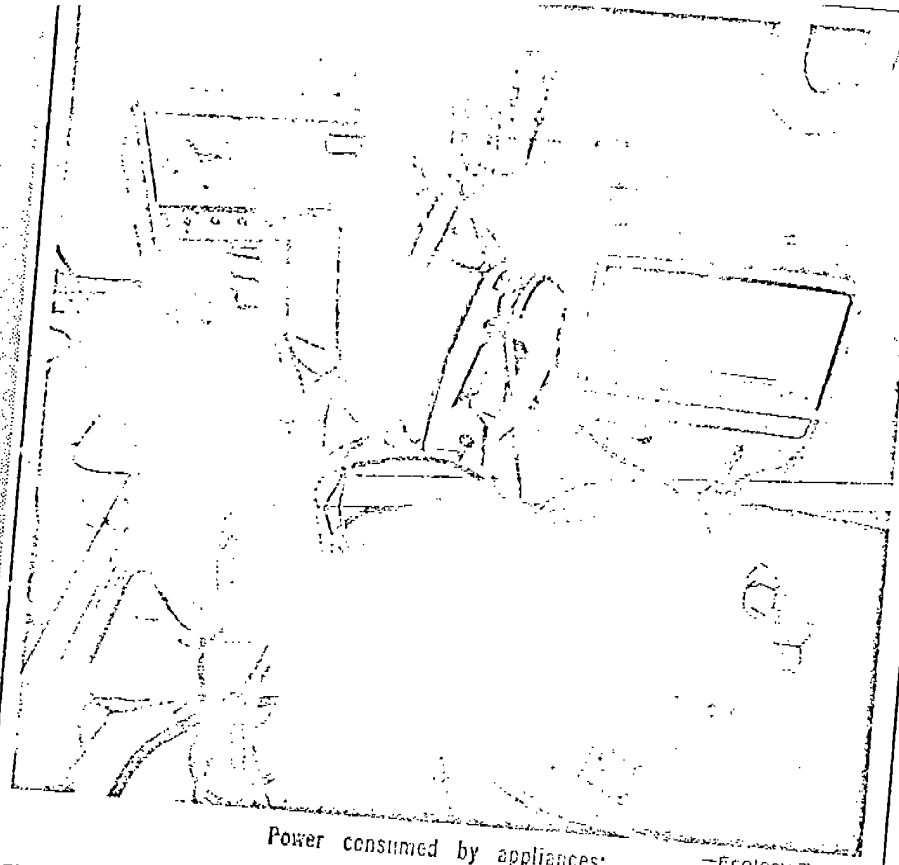
The advantage of a combined cycle system is that it has the potential of greater efficiency than either a gas turbine or steam turbine alone. Much of the heat entering gas turbine is wasted when the exhaust gases escape at relatively high temperatures. If the exhaust gas of the gas turbine is channeled into a boiler rather than allowed to escape, the waste heat can be used to produce steam that would also produce electricity. The efficiency of combined gas and steam turbine systems is now comparable with the efficiency of the best existing steam power stations — about 39%. It may be possible to extend the efficiency of a turbine system even further by adding another cycle.

And the list of innovations in power generation goes on. There are even studies in direct conversion of chemical energy to mechanical energy as is routinely effected in muscle. Furthermore, there are studies in the properties of magnetic liquids [illegible] hydrodynamics. In one experiment, a liquid ferrofluid within a pipe is attracted to a magnet where its pressure rises. Heating the fluid within the field reduces its magnetic strength [illegible] the field with more pressure. The difference in pressure generates a flow that can be used to turn a turbine or generator. Much work is being done in the field of high temperature electrochemical storage cells that may help to create higher efficiencies, high enough to power an urban vehicle.

ENERGY STORAGE.

There are many battery and other storage facility units that are currently being investigated that would serve the causes of electrical storage. Studies of lithium and [illegible] batteries brings more hope to the concept of battery powered vehicles. There is also pumped storage, which has the property of water during the [illegible] hours into reservoirs that can be tapped for energy use at other times — thus creating a kind of water battery. There are also proposals for storage of energy in [illegible] hydrogen which can be produced by many energy sources as a form of storage that may be the storage battery for western and [illegible] thermal energy sources. Research in solar battery storage has also brought up increased capacity in the form of advanced photovoltaics.

"We have examined the effects that future growth alternatives are likely to have on our economy, society, government, resources, and environment, and we have found no convincing argument for continued national population growth. On the contrary, the plusses seem to be on the side of slowing growth and eventually stopping it altogether. Indeed there might be no reason to fear a decline in population once we are past the period of growth that is in store."
Final Report, President's Commission on Population Growth and the American Future

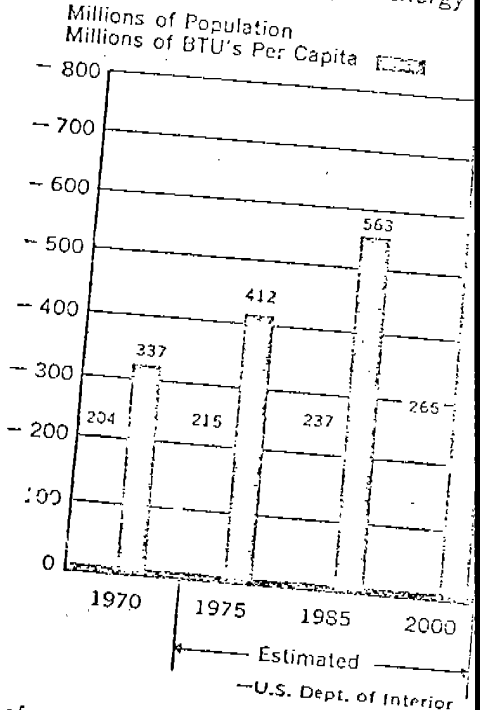


Power consumed by appliances: —Ecology Today

	watts		watts
Electric range	12,200	Refrigerator/freezer	325
Laundry dryer	4,856	Laundry washer	285/510
Air conditioner (window)	1,566	Television set	235
Dishwasher	1,200	Fan (window)	225
Electric fry pan	1,196	Ventilator	150/200
Toaster	1,145	Mixer	125
Iron	1,090	Can Opener	90
Coffee Maker	895	Sewing Machine	75
Blender	385	Tuner/amplifier	50
Hair dryer	380	Electric toothbrush	7

As the United States Grows . . . More Consumers Will Demand More Energy Per Capita . .

Trends in U.S. Per Capita Energy



—U.S. Dept. of Interior

CONSERVATION OF ENERGY:

Amidst the current concern with ways of producing enough energy to meet the staggering projected demands, relatively little attention has been accorded research on methods of making existing supplies stretch further and drastically lowering the necessity for large power plants in great numbers in the near future. Yet by one widely accepted estimate, five-sixths of the energy used in transportation, two-thirds of the fuel consumed to generate electricity and nearly one-third of the remaining energy — amounting in all to more than 50% of the energy consumed in the United States — is discarded as waste heat.

More efficient uses of energy in various sectors may be achieved in numerous effective and relatively simple ways: electric heat pumps for heating and cooling, solar heating and cooling, proper shielding from sun in residences, architectural and engineering practices that build conservation in, vacuum furnaces, magnetohydrodynamics and the various devices discussed previously, the use of smaller cars that require less fuel and the use of rapid transit, and recycling. Conservation now could prevent blackouts and local shortages now and provide more time to find the correct solutions to our energy dilemma.

"Public Interest Report" is a continuing series of projects dealing with the major environmental issues of our time. Produced for free public dissemination by the Environmental Education Group from profits (tax exempt scientific educational public foundation) under grants derived from citizen contributions to the Environmental Action Foundation (tax exempt charitable membership organization). Project by Alan A. Tratner, Director of Environmental Education; Tony Shultz, Ph.D., Director of Investigative Research; Mrs. Karen Lee Trattner, Projects Editor. Additional copies may be obtained by writing to E.A., 1543 North Martel, L.A., Calif. 90046, U.S.A.

It was once made only in secret government installations in remote areas. Now it is made by electric utility companies in towns all around the U.S. Plutonium is produced as waste in commercial nuclear power plants.

The world was created out of oxygen, hydrogen, carbon, iron and other elements; there are 103 altogether. Man, however, has made a few new elements. "plutonium" is one of them.

American scientists during World War II developed a method, now no longer a secret, of using plutonium. They learned how to take a small amount of plutonium, about the size of a grapefruit, and to compress it rapidly. The result was an enormous explosion: an atomic explosion.

Plutonium was used in the atomic bomb that was dropped over Nagasaki, Japan, on August 9, 1945. Nagasaki was destroyed.

There is a growing concern that terrorists might steal some of the plutonium produced by nuclear power plants, and use this plutonium to make nuclear explosives. Also unsettling is the thought that countries to which the U.S. is selling nuclear power plants may use the by-product plutonium to build an arsenal of atomic weapons.

result of the atomic explosions it can be used to produce. A very small particle of plutonium – the size of a grain of pollen – causes lung cancer, if inhaled. A typical nuclear power plant annually produces several hundred pounds of plutonium. A pound of plutonium, if it were efficiently spread around the country, would be more than enough to give lung cancer to everyone. It was Glenn Seaborg, the discoverer of plutonium, once the head of the Atomic Energy Commission, who called plutonium a "fiendishly toxic" material.

The various owners of nuclear power plants assure their neighbors that they will be careful. Plutonium and other hazardous radioactive materials are present inside nuclear power plants and are transported in vehicles that carry radioactive waste away from these plants.

All nuclear power plant owners concerned do say that they are careful and, yet, this year plutonium was discovered in the Erie Canal, outside an AEC facility in Ohio that uses plutonium. An AEC spokesman said, "We have no idea how the plutonium leaked out of the factory into the mud. This comes as a complete surprise."

The fact that plutonium was found in the mud of the Erie Canal means that it was released in solid or liquid form, not as particles in the air that people might breathe. There was not so much danger, therefore, that people living in the vicinity of the plant would get lung cancer from the leak. However, if plutonium gets into drinking water, plutonium can cause bone cancer.

All radioactive materials, over time, lose their capability to harm human beings. They run out of steam, so to speak, as they continuously give off their hazardous energy. Some radioactive materials disappear within seconds after their creation. For plutonium, however, tens of thousands of years are required before it loses its ability to harm human beings. Plutonium (and other long-lived radioactive wastes from nuclear power plants) will have to be stored – somewhere, somehow – for hundreds of generations. The present generation will get whatever convenience there is from nuclear power plants and bequeath radioactive wastes from these plants to future generations. Some people call this the moral problem of nuclear power.

A leading cancer researcher – Harvard's Nobel Prize winner, Professor James D. Watson – said what he thought about plutonium and this country's nuclear power program:

"I am increasingly worried that the current blossoming of the nuclear power industry will be an irreversible calamity for the human race. Particularly scary is the thought that we, shall senselessly march into wide-scale employment of breeder produced plutonium, the most dangerous atom man has yet tried to assimilate into his industrial life. Only the tiniest

PLUTONIUM

PRELIMINARY RELEASE

For: Saturday, November 16, 1974 CRITICAL MASS '74

At: Discussion/Debate, Accidents, Worker Safety, Radiation Hazards

Topic: CUMULATIVE GENETIC DEGRADATION

Speaker: Dr. Irwin D.J. Bross

Low levels of radiation that were considered "safe" a few years ago produce cumulative genetic degradation leading to leukemia and other diseases in subsequent generations. According to Dr. Irwin Bross, a leading cancer epidemiologist and biostatistician, "The insidious danger of low level radiation is that there is no visible effect from any single exposure and the cumulative effect is less likely to appear in the person exposed to the radiation than in his or her children and grandchil" The complicated scientific detective work required to track down these subtle effects has just been reported by Bross and Natarajan in PREVENTIVE MEDICINE for September 1974 (Vol. 3, No. 3, pp 361-369). From the standpoint of the cumulative genetic degradation hypothesis, AEC policies have sometimes served to maximize the genetic damage. Thus at a reprocessing plant in the Western New York area young persons were brought in to work in "hot" areas until they were exposed to the maximum permissible radiation levels set by the AEC. They were then replaced by fresh bodies. This spread the genetic damage much more widely through the population of the Buffalo area.

A-bombs, H-bombs, and other nuclear weapons have fixed public attention on the dramatic, immediate dangers of nuclear technology. Much of the discussion of the hazards of the proposed expansion of the network of nuclear power plants, for instance, has focused on the chances of a big blow-up due to reactor failure or terrorist attacks. But while these spectacular short-term dangers may get the headlines, it is probably the quiet, invisible damage done to human genetic material during routine, normal operations of breeder technology that is a much more serious risk in the long run. Instead of sudden death for a few hundred victims, cumulative genetic degradation promises slow and painful deaths for tens of thousands of children, many yet unborn.

The insidious danger of the low level radiation to which all of us in a technological society are exposed is that there is no immediate visible effect of the damage that has been done by any single exposure. Indeed, the damage is unlikely to have an effect for about seven years and probably will not show up during the lifetime of the person who was directly exposed. In our recent studies of leukemia in adult men, Dr. Rosalie Bertell has developed mathematical tools to estimate the additional risk produced by a single diagnostic X-ray plate. The relative risk is so small (a 4% increase) that the exposed individual is not likely to develop leukemia. Nevertheless there has been invisible damage to the genetic material of the cells and this damage can show up in the children or grandchildren of the individual.

The hazards are subtle and we are only gradually developing the techniques that are needed to study them in human population. We began our study of the effects of low level radiation about 6 years ago with the hypothesis that there was a subgroup of susceptible children who were highly vulnerable to low doses of radiation that would have little effect on normal, insusceptible children. We analyzed data on 301 children with leukemia and 838 normal children from a random sample of the same three-state area. Considering diagnostic radiation delivered at time of pregnancy, we were able to show strikingly increased risks in children with a report of allergies and certain other diseases--500% increase in risk. These findings attracted world-wide attention from health scientists but at this point it was not clear whether the radiation had an effect on the genetic material or some direct destabilizing effect on the blood-making organs of the fetus.

In a later study, which was also carried out with N. Natarajan, we considered the effects of radiation delivered to women prior to conception. Once again we found striking increases in the risks for the susceptible sub-group of children but not in the insusceptibles. This time the machinery had to be genetic. Apparently the supposedly "safe" dosages of radiation resulted in children that were not only vulnerable to leukemia but to many other diseases. It now looks as if genetic deficiency in these children is such that they have to be rather "lucky" to live long enough to get leukemia. We have just completed a further analysis, which has just appeared in Preventive Medicine, (Vol. 3, No. 3, September 1974, pp. 361-369). This also includes the effects of radiation delivered directly to the child. Here the effects only show in the

children who get leukemia after age 10, suggesting a long latent period. This would also seem to involve a genetic machinery.

Putting together all of our findings, together with the work of Dr. Alice Stewart and the more recent reports of Dr. Abraham Lilienfeld, a hypothesis of cumulative genetic degradation emerges as the most probable explanation of these effects of low level radiation. A genetic "ladder" analogy may help to explain what is going on. Imagine a very long ladder with hundreds of rungs but with the lower rungs missing or broken. All of us start life at some step on this genetic ladder. When we are exposed to radiation or mutagenic chemicals, we are moved a step down the ladder. Natural repair processes may sometimes move us up a step. In the past, natural radiation from cosmic rays and other sources and the repair process were about in balance so that on the average a person ended up in about the same position on the genetic ladder as where he started.

With the advent of modern technology, there has been a tremendous increase in the amount of radiation to which we are exposed. There is a cumulative effect from medical x-rays, nuclear weapons testing, reactors and reactor products and many other sources. Although the natural repair process could handle the natural radiation, it cannot cope with modern technology. So all of us are being moved down the genetic ladder. Our children will start life closer to the broken or missing rungs toward the bottom of the ladder. The children who are very close are the susceptibles. They will be vulnerable to allergies, infections, and other diseases. In our polluted environment, they will probably suffer enough additional genetic damage to move them onto a broken rung or knock them off the ladder entirely.

In sum, then, we now have solid evidence that low levels of radiation which were considered "safe" a few years ago are able to produce cumulative genetic degradation which can lead to leukemia and other disease in future generations. The details of the mechanism are still somewhat speculative. We don't know how many rungs there are in the ladder, how far one must go down the ladder before coming to the broken rungs, or how fast the American population is moving down this ladder. The Tri-State data shows that we are moving down the ladder and we cannot wait until we have filled in all the details before we take vigorous action to cut down on the radiation expesure in our environment. Nor can we rely on the AEC or other government agencies to protect us even though they are supposed to do so.

The policies at the processing plant for nuclear wastes in Springville, New York, which are in line with AEC directives, are a horrible example of this. The policy was to bring young men in to work in the "hotter" parts of the installation until they had been loaded up with all the radiation exposure that the AEC would permit. They were then replaced by fresh bodies. In terms of the cumulative genetic degradation hypothesis what this policy did was to maximize the amount of defective genetic material that these young men will pass on to their children and children's children. the policy insures that the genetic damage will not be confined to the regular employees of the installation or the people living in the vicinity but rather the damage will be spread out through the whole Buffalo area when these hundreds of "temporary" workers marry and have families. From the standpoint of cumulative genetic degradation, this is about the worse possible policy but it is a policy which the AEC approved and encouraged.

& ASSOCIATES
ECONOMIC CONSULTANTS

P.O. DRAWER E, SILVER CITY, NEVAD

TELEPHONE: AREA CO
VIRGINIA CIT

MARCH 6, 1975

AJR 15

In speaking against the passage of Resolution _____ I will restrict myself to testimony forthcoming from the Nevada Radioactive Materials Storage Advisory Committee. This committee was appointed by ~~the~~ Governor O'Callaghan last September to advise him on the then A.E.C.'s proposal for a nuclear waste storage site in Nevada. Although the Committee was composed of notable and respected Nevadans in education, public service and private enterprise, none of the members appear to have a background in nuclear physics, nuclear engineering or nuclear waste disposal. However, two of the members of the committee are scientists; one a seismologist and the other a biologist. Both of these people expressed critical concern about the safety of the A.E.C. proposal.

Dr. James Deacon, the biologist, recommended that the State of Nevada "request that AEC suspend consideration of using the Nevada Test Site for a Retrievable Surface Storage Facility " until it can be shown that alternative energy systems are not less damaging and further, that transportation, storage and disposal problems would not increase radioactivity hazards.

Dr. Deacon opposes nuclear power generation basically for the reason that "a power industry based on geothermal, solar, wind, tidal and fossil fuel sources would produce less severe and less dangerous environmental impact..." "The DES (Draft Environmental Statement) does not consider alternatives to nuclear energy development."... The Test Site could be admirably located for the production of SOLAR energy. This is a competitive land use to a RSSF site, and we should

view these alternatives. Might it not be more advantageous to Nevada to be a producer of a relatively non-polluting energy resour rather than be the repository of radioactive waste from what will surely be a short-lived nuclear industry?"

(pg 54) "While participation in the development of solar, geothermal and wind power sources would likely bring much favorable public attention to Nevada, participation in encouraging the development of the nuclear power industry by accepting a RSSF (Retrievable Surface Storage Facility) would almost certainly carry the appelatio of Nevada as the site of the National Nuclear Dump. Such a designa-tion could not help the tourist image of the state and might cause extensive damage if a leak of radioactive material were to occur in Las Vegas while in transit to the RSSF."

Further quotes from Dr. Deacons report critical of the AEC plan include the following:

(pg. 5)"Transportation risks appear considerably more significant than is admitted in the DES, therefore we oppose the proposed action." Dr. Deacon then quotes the DES (pg 9.1-23) that " a decision on whether to build an RSSF may be made without regard to the potential risks of transportation."...(pg 5) "Page 3.3-8 of the Des shows that of the 4000 casks of irradiated fuel shipped during the past 25 years, 300 incidents have occurred with release of contents or increased radiation levels accompanying 30% of these incidents. That is there has been release of radioactive material or increased radioactivity on about 90 occasions during the past 25 years instead of the none Dr. Pittman suggested."

GRAHAME A. ROSS
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(pg 6) "AEC credibility is suspect in regards to their ability to manage radioactive wastes safely,..." "We are told in this DES that "transport safety is dependent, not on the elimination of accidents, but rather on the integrity of the transport packaging, and slight increases in the probability of an accident occuring does not increase the probability of release." (2.8-3)" Dr. Deacon states that: "I don't believe this statement, and would like to see the documentation to prove it since they admit (3.3-1) that 'no shipping cask specifically designed for high-level waste has yet been built.' "

Dr. Deacon then goes into an analysis of natural background radiation and safety standards for induced radiation levels. He concludes by saying that: (pg 8) "The question of radiation exposure to the people of Las Vegas (i.e. is not adequately considered in the DES."

These and other points raised by Dr. Deacon lead me to believe that there is an unacceptable possibility of serious radioactive accident occuring which could adversely affect the health of Nevada citizens as well as the health of our tourist oriented economy. I feel that far more public discussion and professional research should be undertaken before Nevada accepts the location of a nuclear waste dump within her boundaries.

Gentlemen,

I have come here today to ask that you take into consideration this petition that many people have had the desire and opertunity to sign . It asks for the presentation of detailed information in regards to the storage and transportation of nuclear waste from power plants to the disposal area(Nevada), and that the people be allowed to have a voice in their future.

I feel that the people of the state may have been missled by the A.E.C. in recent years, and that many facts should be open to the public for consideration. I will here refer to an article in the New York Times, Nov. 10th 74, in wich it states that A.E.C. for a period of at least ten years (64 to 74) had engaged in activities that kept information from the public, and that they were keeping their own scientists from investigating possible hazards of nuclear energy.

I lived in Las Vegas for over 18 years and have been a resident for 23 years, I never seemed to hear anything bad about the atomic test site wile I lived in Vegas, but when I was in the service I was in the East and there is wher the people seam to have more worry than here. In other words it is like you have to leave home to see what is really happening there.

It seams reasonable to me that we should allow this issue to be decided by the people, 1) it does not seam that the legislature has time to devote to a complete examination 2) that there would be time to educate the people, and have plublicity both pro and con 3) so that in the end the people will have responsibility for such a decision.

Just because we have always before been Americas playground for nuclear toys does not mean that we can not educate the rest of the country as to a new image.

As for a possible solution, if the people reject an atomic waste disposal site here. The prossesing of the waste and the wait period after the prossesing is at least five to ten years, so that hopefully there can be some way found to deal with the problem, but until that time the waste is safe were it is stored as much so as if it were in an interm waste disposal site here or anywere. This time lag may provide for a permenant disposal plan to be arranged.

Thank You

John Miller

MINUTES

ASSEMBLY
COMMERCE COMMITTEE - NEVADA STATE LEGISLATURE - 58TH SESSION

MARCH 14, 1975

The meeting was called to order by Chairman Robinson at 1:40 P.M.

MEMBERS PRESENT: Mr. Benkovich
Mr. Demers
Mr. Getto
Mr. Harmon
Mr. Hickey
Mr. Moody
Mr. Schofield
Mr. Wittenberg
Mr. Chairman

MEMBERS ABSENT: None

SPEAKING GUESTS: Assemblyman Bremner

The meeting began with discussion on AJR 15 which was a concurrent referral to the Environment and Public Resources Committee and the Commerce Committee of the Assembly. Extensive testimony has previously been heard in the Environment and Public Resources Committee of which Assemblyman Bremner is Chairman. He spoke on behalf of this bill. He explained that the majority of people in Southern Nevada are in favor of passage of this measure because of the economic impact it would have on that area. Four amendments to this bill were proposed by the Governor and are attached hereto. The purpose of these amendments is to give the Governor the power to enforce some will over this matter and to give the State of Nevada some control over the storage of this waste.

Dr. Robinson asked if adequate testimony was given as to the safety of this. Mr. Bremner said there had been controversy in this area. Mr. Mahlon Gates from ERDA outlined what the safety factors would be and perhaps it might not be completely safe anywhere but the way it is presently being stored is not safe at all. The waste will be solidified and placed in stainless steel containers and shipped on special railroad cars and will not be transported through any metropolitan areas. Other sites were considered but Nevada does not have the hydrology problems that other sites do which would be safer with regard to possible water pollution. There is, however, an earthquake potential.

Mr. Harmon moved that the proposed amendments to AJR 15 be adopted. This was seconded by Mr. Demers and carried the committee unanimously with the exception of Mr. Benkovich who was not voting.

Mr. Harmon moved that AJR 15 be "do passed as amended". This was seconded by Mr. Demers and passed unanimously with the exception of Mr. Getto who was not voting.

AB 96 was discussed and there are amendments to this bill forthcoming. Action was deferred on AB 96 awaiting these amendments.

AB 28 was discussed and Mr. Demers moved a "do pass" of AB 28. This was seconded by Mr. Harmon and passed the committee. (See attached Legislative Action Form)

Senate Bill No. 126.
Bill read second time, and ordered to third reading.

Senate Bill No. 129.
Bill read second time, and ordered to third reading.

Senate Bill No. 141.
Bill read second time, and ordered to third reading.

Senate Bill No. 143.
Bill read second time, and ordered to third reading.

Senate Joint Resolution No. 10 of the 57th Session.
Resolution read second time, and ordered to third reading.

Assembly Joint Resolution No. 15.
Resolution read second time.
The following amendment was proposed by Assemblyman Mann:
Amendment No. 4594.

Amend the resolution, page 1, by deleting lines 12 and 13 and inserting: "as sites for the storage and processing of nuclear material have serious anxieties and doubts about providing storage and processing sites; and".

Amend the resolution, page 2, by deleting line 7 and inserting:

"WHEREAS, The storage and processing of nuclear material, and solar energy research can both".

Amend the resolution, page 2, by deleting line 13 and inserting: "Test Site for the storage and processing of nuclear material provided that there is an acceptance by the Energy Research and Development Administration of the following conditions:

1. Air cooling is used at the storage facility;
2. Rail transportation avoiding the Las Vegas metropolitan area is established to the site;
3. Appropriate state agencies and local governments can cooperate in, and contribute to, the development of the Energy Research and Development Administration's site-specific environmental impact statement;
4. It is satisfactorily demonstrated that adequate radiation safeguards for storage and transportation can be developed and will be implemented; and be it further".

Amend the title of the resolution by deleting line 2 and line 3 and inserting: "ment Administration to choose the Nevada Test Site for the storage and processing of nuclear material and for solar energy research under the Solar Energy Research, Devel-".

Assemblyman Mann moved the adoption of the amendment.
Remarks by Assemblymen Mann and Coulter.
Amendment adopted.
Resolution ordered reprinted, engrossed, and to third reading.

REMARKS FROM THE FLOOR

Assemblyman Jeffrey requested that Assemblyman Hickey's remarks be entered in the Journal:

185 A

(REPRINTED WITH ADOPTED AMENDMENTS)

FIRST REPRINT

A. J. R. 15

ASSEMBLY JOINT RESOLUTION NO. 15—ASSEMBLYMEN MANN, ROBINSON, PRICE, HICKEY, MAY, GETTO, JACOBSEN, HAYES, MOODY, CHANEY, SCHOFIELD, BENKOVICH, DREYER, HOWARD, HEANEY, BENNETT, CHRISTENSEN, JEFFREY, VERGIELS, SENA AND BROOKMAN

FEBRUARY 26, 1975

Referred to Concurrent Committees on Environment and Public Resources and Commerce

SUMMARY—Urges the Energy Research and Development Administration to choose the Nevada Test Site for disposal of nuclear wastes and for solar energy research under the Solar Energy Research, Development and Demonstration Act of 1974. (BDR 1030)

EXPLANATION—Matter in *italics* is new; matter in brackets [ ] is material to be omitted.

ASSEMBLY JOINT RESOLUTION—Urging the Energy Research and Development Administration to choose the Nevada Test Site for the storage and processing of nuclear material and for solar energy research under the Solar Energy Research, Development and Demonstration Act of 1974.

WHEREAS, The now supplanted Atomic Energy Commission has, over the years, demonstrated an outstanding concern for nuclear safety and has compiled, at the Nevada Test Site, an equally outstanding safety record; and

WHEREAS, The people of Southern Nevada have confidence in the safety record of the Nevada Test Site and in the ability of the staff of the site to maintain safety in the handling of nuclear materials; and

WHEREAS, The unemployment rate in Clark County, Nevada, is 20.7 percent higher than the disturbingly high national unemployment rate; and

WHEREAS, The people and the leaders in many states being considered as sites for the storage and processing of nuclear material have serious anxieties and doubts about providing storage and processing sites; and

WHEREAS, The existing facilities and the years of expertise in nuclear material handling at the Nevada Test Site are a tremendous existing resource; and

WHEREAS, Southern Nevada also offers an excellent environment in which to explore the potential of solar energy; and

WHEREAS, National energy independence and a clean environment are dependent upon tapping nonfossil fuel sources of energy for heating, cooling and electricity; and

WHEREAS, The existing facilities of the Nevada Test Site and its support infrastructure are available and well suited to scientific research in addition to nuclear projects; and

WHEREAS, The storage and processing of nuclear material, and solar energy research can both be carried out at the Nevada Test Site with minimal capital investment relative to other locations; now, therefore, be it

Resolved by the Assembly and the Senate of the State of Nevada, jointly, That the legislature of the State of Nevada strongly urges the Energy Research and Development Administration to choose the Nevada Test Site for the storage and processing of nuclear material provided that there is an acceptance by the Energy Research and Development Administration of the following conditions:

1. Air cooling is used at the storage facility;

2. Rail transportation avoiding the Las Vegas metropolitan area is established to the site;

3. Appropriate state agencies and local governments can cooperate in, and contribute to, the development of the Energy Research and Development Administration's site-specific environmental impact statement;

4. It is satisfactorily demonstrated that adequate radiation safeguards for storage and transportation can be developed and will be implemented; and be it further

Resolved, That under the provisions of the Solar Energy Research, Development and Demonstration Act of 1974 the Energy Research and Development Administration utilize the extensive resources and facilities of the Nevada Test Site to explore the potential uses of solar energy; and be it further

Resolved, That copies of this resolution be prepared and transmitted by the legislative counsel to the administrator of the Energy Research and Development Administration, to the assistant administrators for nuclear energy and for solar, geothermal and advanced energy systems and to all members of Nevada's congressional delegation; and be it further

Resolved, That this act shall become effective upon passage and approval.

(30)

Assemblyman Chaney moved that the bill be referred to the Committee on Health and Welfare.

Motion carried.

By the Committee on Ways and Means:

Assembly Bill No. 423—An Act appropriating funds to the Commission on Crimes, Delinquency, and Corrections federal grants account for the support of the federal grant program to units of local government.

Assemblyman Mello moved that the bill be referred to the Committee on Ways and Means.

Motion carried.

By Assemblymen Wagner, Lowman, Wittenberg, Chaney, Weise, Coulter, Vergiels, and Polish:

Assembly Bill No. 424—An Act relating to preschools; requiring licensing and regulation of preschools by the State Board of Education; and providing other matters properly relating thereto.

Assemblyman Wagner moved that the bill be referred to the Committee on Education.

Motion carried.

UNFINISHED BUSINESS

CONSIDERATION OF SENATE AMENDMENTS

Assembly Bill No. 233.

The following Senate amendment was read:

Amendment No. 5475.

Amend section 1, page 1, line 20, by deleting "*September 1*" and inserting: "*October 1*".

Assemblyman Glover moved that the Assembly do not concur in the Senate amendment to Assembly Bill No. 233.

Remarks by Assemblymen Glover and Heaney.

Motion carried.

Bill ordered transmitted to the Senate.

GENERAL FILE AND THIRD READING

Assembly Joint Resolution No. 15.

Resolution read third time.

Remarks by Assemblymen Mann, Weise, Murphy, Robinson, Benkovich, Wagner, Demers, Jacobsen, Barengo, Price, Wittenberg, and Lowman.

Assemblymen Getto, Schofield, and Sena moved the previous question.

Motion carried.

The question being on the passage of Assembly Joint Resolution No. 15.

Roll call on Assembly Joint Resolution No. 15:

YEAS—32.

NAYS—Barengo, Coulter, Ford, Heaney, Murphy, Wagner, Weise, Wittenberg—8.

Assembly Joint Resolution No. 15 having received a constitutional majority, Mr. Speaker declared it passed, as amended.

Resolution ordered transmitted to the Senate.

SENATE
GOVERNMENT AFFAIRS COMMITTEE

Minutes of Meeting - April 24, 1975

Present:
Chairman Gibson
Senator Walker
Senator Dodge
Senator Gojack
Senator Hilbrecht
Senator Schofield

Also Present:
See the attached Guest Register

The thrity sixth meeting of the Government Affairs Committee was called to order at 4:15 P.M. by Chairman Gibson with a quorum present.

AB-491 Liberalizes provision for greyhound racing and pari-mutuel wagering. (BDR 41-1387)

Assemblyman Jeffrey went over the changes their committee made on AB-491 and urged its support. Mr. Jeffrey had a copy of a petition from the Henderson Chamber of Commerce in support of AB-491. He also had a copy of a letter from the City Council in Henderson giving full support to AB-491. (See the attached)

David J. Funk, Las Vegas Downs, had a copy for the committee on the Economic Impact for the first 100 days of the first year in operation. (See the attached). Mr. Funk feels that greyhound racing is a very profitable business.

Harry J. Frost, Racing Commission, stated that the Nevada State Racing Commission supports AB-491, in the reprinted form. He also felt that the bill should be passed without any further amendments. (See the attached statement signed by the Racing Commission)

Mayor Stewart, Henderson, stated that he was in full support of AB-491 in the amended form.

Jack Statton, Gaming Control Board, stated they had no objection to the reprinted version of AB-491.

Motion for "Do Pass" by Senator Hilbrecht, seconded by Senator Dodge, motion carried unanimously.

AJR-15 Urges the Energy Research and Development Administration to choose the Nevada Test Site for disposal of nuclear wastes and for solar energy research under the Solar Energy Research, Development and Demonstration Act of 1974. (BDR 1030)

Assemblyman Mann, stated that the Chamber of Commerce in Clark County is in favor of AJR-15. Mr. Mann suggested that the Governor's

veto be put back into the bill.

Mr. Malon Gates, representing R.S.S.F., Manager of the Nevada Operations Office, passed out copies of the latest edition of the E.R.D.A. News regarding radioactive wastes. Mr. Gates thought if the committee could see the whole process on this matter they would have a better understanding of the project to store radioactive wastes in Nevada.

Mr. Gates slide presentation included the following topics, (1) Nuclear fuel cycle process. (2) Retrievable surface storage facilities. (3) Types of canisters used for storage; a canister will hold 6.3 cubic feet of radioactive waste, canisters go through various tests to assure safety. (4) water basin storage facilities, showing their removal system, (5) maps indicating the various places throughout the United States for the proposed storage facilities. At the conclusion Mr. Gates indicated that the first canisters will be stored in 1983.

Mr. Bill Flanegas, Field Operations Manager at the Mercury test site. Mr. Flangus felt that in Nevada they had a good record for safety in the work they have been doing over the years. Mr. Flangus read his prepared testimony to the committee and passed out copies for each member. (see the attached) His concluding remarks indicated that Nevada was a very logical choice for this storage facility and the people in Nevada would be acceptable to the idea.

Senator Dodge stated that he would like something in the bill that insured enviornmental safety and wondered if this could be added to the bill.

George Hawes, representing the A.F.L.C.I.O. stated that they were in favor of AJR-15 as it will be a great economic boost to the Nevada people.

Elmo DeRicco, Conservation Department, passed out a copy of his testimony that was given before the Assembly Committee on Government Affairs. Mr. DeRicco is in favor of this bill.

Ted Lawson, representing the Nevada Labor Counsel, stated that they were in favor of AJR-15.

Professor Sill, representing himself as an interested resident of Nevada and authority on nuclear wastes. Professor Sill had written testimony and passed out copies to each committee member. (See the attached). Professor Sill is against AJR-15, and recommended that the committee form a subcommittee to study all the facts concerning nuclear wastes and what Nevada would be committing itself to regarding a stoage facility.

Katherine Hale, spoke in opposition to AJR-15. She had her written testimony and a map indicating certain areas of Nevada that could be adversely affected by this storage facility. (See the attached)

Assemblywoman Wagner spoke in opposition to AJR-15. Mrs. Wagner stated that this bill was "railroaded" through the Assembly and she feels that there should be much more study done in this area before considering such a measure.

Assemblywoman Dean Ford spoke in opposition to AJR-15 and reiterated Mrs. Wagner's testimony. Mrs. Ford went to a seminar on nuclear wastes and felt that there is much we don't know about the far reaching effects and possible harm to Nevada if this bill is enacted. Mrs. Ford suggested references to nuclear waste be removed and put more emphasis on research for solar energy.

Susan Orr, Foresta Institute, spoke in opposition to AJR-15, passed out copies of her testimony and supporting documents. (See the attached)

The committee discussed the possible values that scientists could discover in nuclear wastes and why the storage facilities should be of the nature that these canisters could be used some day. It was decided to study the materials that were presented during the meeting as well as materials obtained from the Assembly Government Affairs committee during their hearing on AJR-15. (see the attached)

The following people did not have the opportunity to speak in opposition of AJR-15 but wanted to be reflected in the minutes:

Jane McCarty, Roza Meadieros, Bruce Bunker, Kristy Klosterman
Bob Gamber, Kathleen H. Winnington, Greg Knisley, John Taylor,
Jeff Micer, Rex Jacobian, Christopher Brown - interested Nevadans.

As there was no further business the meeting was adjourned at 6:30 p.m.

Respectfully submitted,

Janice M. Peck
Committee Secretary

Approved:

James J. Gibson
Chairman

SENATE HEARING ON ASSEMBLY JOINT RESOLUTION 15

April 24, 1975

My name is Richard C. Sill. I live at 720 Brookfield Dr., Reno. I am a fifteen year resident of Nevada.

I am a Professor of Physics at the University of Nevada, Reno. My testimony will be relatively brief but I must identify my qualifications for this testimony.

I hold three college degrees AB - double majors in Physics and Mathematics, MA - in Physics and a PhD (University of Nebraska, 1954) with major in Physics and related minors in astrophysics and mathematics.

I have been a professional astronomer (Lick Observatory, University of California); a research engineer (Liquid Propellant Section, Jet Propulsion Laboratory, Calif. Inst. of Technology); a research physicist (Stanford Research Institute); and have done postdoctoral studies in several institutions including the Massachusetts Institute of Technology and the University of London (England). I have taught at the University of California, Berkeley; University of Nebraska; New Mexico Institute of Mining and Technology, Socorro New Mexico; and at the University of Nevada.

I have worked on weapons at the Jet Propulsion Laboratory and at the Stanford Research Institute and have held high security clearance at both institutions.

In addition to the above I was a several year member of the Nevada State Radiological Safety Board; the Assistant Director, Production Committee, Nevada State Office of Emergency Planning (under Governor's Sawyer and Laxalt; Deputy Chief of the Interim Radiological Defense Center, Office of Civil Defense, Menlo Park, California with one third of California under our jurisdiction.

I have been for three years Chairman of the University of Nevada Environmental Studies Board, and last year was Chairman of the Energy Advisory Committee of the UNR President.

My research field is systems, atomic physics, and condensed states of matter. I am a member of a number of honorary and professional societies including Phi Beta Kappa and the American Physical Society.

In addition to the short testimony I will submit to this committee, I will attach three attachments:

1. A recent editorial from the Nev. State Journal which discusses some aspects of a several year study of energy and resources conducted in cooperation with the Environmental Studies Board of UNR.

2. Correspondence to and from Governor O'Callaghan regarding the radioactive waste disposal problem before you today.

3. An excerpt from a letter to my wife from Dr. L. Douglas DeNike a clinical psychologist whose practice includes violence prone elements. In this letter Dr. DeNike remarks in part (paragraph 2)

"I was most impressed with Professor Sill's letter to the Governor, which was included in the set of statements on the Salt Lake City hearings distributed by Susan Orr of Foresta Institute. Your husband shows an extraordinary depth of appreciation for the social factors which must constitute outer limits for the utilization of dangerous technologies."

My testimony is as follows:

TESTIMONY

Assembly Joint Resolution 15 addresses three items which must be treated separately.

1. It seeks action that will improve the economic situation in Southern Nevada. It is apparent real need exists for appropriate action that will help remedy the unemployment rate there.

2. It seeks to encourage solar energy research and demonstration projects in Nevada. This is quite desirable and appropriate.

3. It seeks to encourage utilization of Nevada as a, if not the, major storage site for radioactive waste from the entire country. With this I must take categorical issue.

What this resolution will do if adopted will endanger Nevada beyond any reasonable degree. In addition, it will encourage the United States to try to meet the projected energy needs of the country by massive reliance on successive forms of nuclear energy.

Studies I have participated in make me certain we can maintain a high standard of living, a tolerable unemployment level, a society with opportunity and progress by utilizing the traditional characteristics of our system and do so without meeting the commonly accepted exponential growth in use of energy and resources. It will require diversification of energy sources including some nuclear energy.

This is more likely to be the path the country will follow if no state does as AJR 15 would do, namely invite its land be used for all radioactive waste storage.

But negative aspects are just as important as positive ones. And both locally and nationally, excessive reliance on nuclear energy will force us to go to breeder reactors which make weapons grade plutonium a socially common commodity. This absolutely guarantees that we shall have to become accustomed to terrorist activities using nuclear weapons that will result in both the loss of several major American cities per year due to detonation of clandestine atomic bombs and the imposition on America of a police surveillance and security system, that will constitute the virtually total loss of personal freedom. In addition, the detonation of nuclear weapons and terrorist breaching of radioactive processing, transportation and waste storage facilities will render extensive areas of the United States uninhabitable for thousands of years.

Do not play with this sort of fire on the mistaken idea that what Nevada does is unimportant. AJR15 carries within it the seeds of destruction of Nevada, much of the United States, and of democracy and freedom in this country and probably the rest of the world.

Richard C. Sill

Richard C. Sill, PhD
Professor of Physics

Nevada State Journal

A Speidel Newspaper

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Sunday, April 20, 1975

Editorials

The System as a Tool

Discussion of world energy problems has died dramatically since last year's "energy crisis" which forced America to wait in lines at gas pumps and endure underheated homes.

The problem of energy and resource depletion is still real, however. And if discussion is not as loud as it was a year ago, it's the subject of grave speculation in the academic community.

Reviewing the options that appear open, many serious thinkerss distressingly arrive at one conclusion: Only a dictatorship in America can discipline the American populace to endure the massive change in its way of life needed to prevent economic chaos.

It's a grim forecast.

Viewing current trends, and recalling incidents of lawbreaking that occurred during last winter's gasoline shortage, it's not as impossible a prospect as some might believe.

Enormous increases in the price of oil have caused America's balance of paymets deficit to surge dramatically. Some believe that at this rate, the nation will be bankrupt within a decade.

Americans are slow to change their habits, however. And Congress is moving slowly in providing leadership.

Beyond the danger of consuming too much expensive energy, there is also the danger of depleting the earth's nonrenewable resources which, as the world becomes more industrialized, are running out faster than research can provide substitutes.

Clearly, matters cannot continue at this rate.

Is a dictatorship, that would forcibly allot resources and control growth the only answer?

Perhaps not.

A group of scholars at the University of Nevada, in cooperation with the Environmental Studies Board, believe they have gone one step beyond this grim forecast. They predict that industrial-economic growth and democracy can continue only if the American system is altered to encourage the saving of energy.

According to one spokesman, "Our considerations at the University of Nevada indicate to me it is possible to separate industrial-economic growth and the rate of energy and resource use."

In short, it does not necessarily require an increase in energy use to allow economic and industrial growth.

A classic example is the enormous growth in the use of computers, which, because of advances in the use of transistors, integrated circuits and crystals, consume far less energy than they did a decade ago.

"Quick computations," according to the studies group spokesman, "indicate known and extant technology (if miraculously substituted for that being used today in American society) could permit us to live equivalent life styles with something like one-half the energy we are using today."

American industry and society developed wasteful habits in a time when it appeared natural resources were limitless and when energy was cheap.

During the time of growth, the government encouraged certain industries and certain practices by means of subsidies.

Timber franchises, land grants, mineral subsidies, oil depletion allowances, river basin and hydroelectric developments all stimulated economic growth.

There is no reason why the system, that so successfully encouraged industry to expand, could not also write laws that would make it in the interest of industry to conserve energy and natural resources.

The studies group at the university sees self interest as the most positive and dynamic force for change. Now, however, self interest guides Americans toward wasteful consumption.

"Dictatorship is at best not a happy form of government under which to live. Self interest, on the other hand, does not need policing and hence is a stability producing social factor.

"If the federal government wishes to do so, it can write regulations and prepare tax and other laws . . . that will define a different path of positive self interest, and in a way fully compatible with American traditions. The vast industrial economic machinery will begin finally to do desirable new things and old things differently."

Solar power, for instance, is considered uneconomic by industry and builders. If the government would make tax free loans available to homeowners wishing to install solar heating plants; if it would write tax laws to encourage industry to produce these plants; if it would offer other tax incentives to make development of solar power profitable, the production of solar power would naturally begin to seem highly attractive.

Other energy saving devices and methods that might be encouraged by proper tax legislation and incentives are sailing vessels, increased use of insulation, increased mass transit and railroad trains.

One member of the environment committee estimates that if some energy saving incentives were put into effect, it would take not longer than two years for industry to respond.

The spokesman has an interesting rebuttal to sincere advocates of totalitarianism who argue dictatorship is the only way to efficiently and equitably distribute goods and services: "They claim the system is immoral when in fact it is actually amoral. It is a tool to be used and it can be used as a tool of liberation rather than one of

University of Nevada
RENO, NEVADA 89507

1225

DEPARTMENT OF PHYSICS
(702) 784-6702

October 19, 1974

The Honorable Mike O'Callahan
Governor, State of Nevada
Carson City, Nevada 89701

Dear Governor O'Callahan:

There are two overriding factors which cannot be ignored in any large scale radioactive material use, transport, or storage, and these two factors virtually define what is allowable, irrespective of where the materials are being produced, used, transported, processed, or held. First is the absolute certainty that commando type operations will be staged against the United States, using the potentiality these materials have or will have shortly to compel our compliance with ransom demands of the participants. Suicidal groups might stage the operations to destroy the United States or achieve revenge for some real or imagined reason. This certainty demands the assurance that at no stage in the history of the materials can they be allowed to be vulnerable to such tactics. If this safety cannot be guaranteed, any vulnerable stages must be short in duration and receive maximum military protection while in process. Such groups as the Symbionese Liberation Army would be hard to respond to if they were able to install several technically competent members with plastic explosives inside an operating fast breeder reactor facility, for example, or were able to interrupt in a significant degree a processing or storage phase so conceived that such interruption could produce dispersal of the materials. The SLA is but one of many groups whose members would endanger innocent bystanders without thought, or perhaps would do so deliberately to achieve some form of ransom. Danger to themselves would in no way inhibit their actions.

As famine deepens in the world over the next several decades, one can expect nationals of the stricken countries or their American sympathizers to utilize similar tactics to force us to ship food to their homeland, although there is no way America can feed ourselves and the whole world. There are other groups who would not bother with ransom, but would be content to destroy or disrupt for revenge or other purposes.

It is therefore startling to read in the pertinent Draft Environmental Statement (WASH-1539), page 3.1-38, that "retrievable surface storage facilities will not be designed for continued waste confinement following the direct impact of massive or explosive missiles such as large meteorites or aircraft. Such events are of such low probability of occurrence that they are considered to be incredible." This statement means that equivalent internal sabotage could be successful and that the contemplated processes are not secure, thereby guaranteeing such attempted sabotage will occur somewhere.

Little solace is to be found in the immediately preceding section, Pages 3.1-32 and 33, dealing with sabotage. This section concludes, "Results of these studies (now underway to evaluate both the probability and consequences of various acts of sabotage) will be discussed in the final environmental statement to the extent that this can be done without jeopardizing the security of the project" (emphasis added)--an admission the hazard exists and that those outside the AEC will not be consulted or informed. Several of the existing technologies referred to in the impact statement are so potentially susceptible to disruption (water basin and aircooled vault storage concepts in particular) they should never have been seriously considered. None of these Environmental Statement references is at all reassuring.

The second of the two important factors is the provision that use, processing, transport, or storage must be so conceived and executed that, at any stage, social or power disruption cannot result in the dispersal of the materials. The distinction between storage and disposal (WASH 1539, page 1, 2-7) is therefore not admissable except in the sense of retrievable and irretrievable, respectively, of materials sufficiently immobilized so as to be not dispersable by overt action.

If our society disintegrates, everything will stop where it is, and the radioactive waste processing must be safe as it is and where it is. If not, a dependable process must exist that will be set in motion automatically in the event, so that the materials will move immediately into safe and irretrievable disposal. Any disruption that causes ordinary processes--physical, technological, industrial, social, or even hierarchical--to falter or fail must be covered. A massive depression, for example, might have this effect, as could a system wide power failure (such as that occurring some years ago in New York and New England) or revolution, war, insurrection, or even a progressive failure of the educational system to train adequate personnel for the proper maintenance or management of the advanced systems involved.

There are many subsidiary questions and factors to be considered, but the two major problems I have discussed argue strongly for a different approach to hazard assessment than is being employed. If everyone cooperates, we can achieve remarkable things technolgically, but that cooperation is certain not to occur where so powerful an instrument is created for the use of malefactors, dissidents, enemies, or victims of circumstance. At the very least, compliance with the safety requirements would be easier if the entire history of the radioactive materials from fuel enrichment to disposal occurs in a circumscribed region, although power distribution would be much more difficult and expensive under such a plan. If this cannot be accomplished, we may have no choice but to be highly restrictive in our use of such materials. This means significant conservation in the use of energy, as is being recommended by the Ford Foundation energy study. While such a

The Honorable Mike O'Callahan
10/13/74. Page 3.

policy decision is beyond the scope of the current Environmental Statement. it represents another scenario that must also be considered (See WASH-1539. Pages 1.2-3 and 4).

In the meantime I urge a serious re-casting of thought away from the current pattern, which seems thoroughly irresponsible to me because it is unrealistic. A new environmental statement still in draft form is needed and new hearings staged, this time with extensive publicity and advanced warning and with copies of the environmental statement made readily available (unlike what has occurred this time). In no way can we allow the National Security to be so flagrantly jeopardized as is done in the proposed procedures for handling radioactive waste. Nevada should not be a party to reckless behavior on this scale.

Respectfully yours,

Richard C. Sill

Richard C. Sill, Professor of Physics
Chairman, Environmental Studies Board
and
former Assistant Director, Production
Committee, State Office of Emergency
Planning (under Governors Sawyer
and Laxalt)
Former member, State Radiological
Safety Board

cc Mr. Norman Hall, Member
Nevada Radiological Materials Storage
Advisors Committee
Chairman of Subcommittee for Storage
and Management of Commercial High
Level Nuclear Waste Materials
Department of Conservation and
Natural Resources
Carson City, Nevada

Also other copies for distribution

UNIVERSITY OF NEVADA
RENO, NEVADA 89507

DEPARTMENT OF PHYSICS
(702)-784-6792

November 5, 1974

Ref. my letter dated Oct. 19, 1974.

Honorable Mike O'Callaghan
Governor, State of Nevada
Executive Chamber
Carson City, Nevada 89701

Dear Governor O'Callaghan:

Thank you for your letter dated October 25, 1974 which discusses your position about high level radioactive waste storage in Nevada. Your letter included a copy of your letter dated October 28, 1974 to the AEC. Both letters lead me to worry that I did not make my points clear. Let me try again with just one aspect of the situation.

I am afraid the entire governmental apparatus is making decisions that basically assume everyone in the world is as law abiding as are Americans. I repeat---when the famine in the world deepens, we can expect the most extreme forms of pressure (including terrorist commando tactics) which will hit us where it will hurt most; and the nuclear power, radioactive waste storage complex must not be accessible to such disruption. You as Governor of one of the states most immediately likely to be endangered can do much to bring some patriotic rationality into this picture. I urge you to reconsider your position, and take the lead among governors in getting a realistic rather than the current idealistic review of the radioactive waste problem, a review that can pin point what we really can or must do in regard to nuclear power and its waste.

Respectfully yours,

Richard C. Sill

Richard C. Sill, Professor of Physics
Chairman, Environmental Studies Board
Chairman, Energy Advisory Committee
UNR 1973-74
Former Assistant Director, Production
Committee State Office of Emergency
Planning (under Governors Sawyer and
Laxalt)
Former Member State Radiological Safety
Board

cc: President Max Milam
Other copies for distribution

THE STATE OF NEVADA
EXECUTIVE CHAMBER
CARSON CITY, NEVADA 89701

MIKE O'CALLAGHAN
GOVERNOR

November 21, 1974

Professor Richard C. Sill
University of Nevada
Department of Physics
Reno, Nevada 89507

Dear Professor Sill:

Thank you for your follow-up letter of November 5, on the subject of high level radiation waste material storage.

I recognize the military question which you pose with regard to the safety of stored material. I believe safeguards must be maintained in order to secure such a facility to the maximum possible against terrorist action.

In my letter of October 28, to the Atomic Energy Commission, I stated: "The committee did not address itself to some of the broader questions which the AEC must itself decide in cooperation with the American people. These include the question of nuclear generation of electric power in the first place..."

I feel this broad national question is one which my office cannot alone answer; but rather one which individuals such as yourself must pursue with national government officials. I will, in the meantime, attempt to maintain for Nevada the position of seeking honest and realistic answers to questions regarding radiation waste disposal until residents of the state can reach a concensus on the subject.

Sincerely,

Mike O'Callaghan
Governor of Nevada

ZERO POPULATION GROWTH

March 10, 1975

Mrs. Marjorie Sill
720 Brookfield Drive
Reno, Nevada 89503

Dear Mrs. Sill:

Enclosed are some items of interest pertaining to the dumpsite issue and the broader question of antisocial exploitation of radioactive materials.

I was most impressed with Professor Sill's letter to the Governor, which was included in the set of statements on the Salt Lake City hearings distributed by Susan Orr of Foresta Institute. Your husband shows an extraordinary depth of appreciation for the social factors which must constitute outer limits for the utilization of dangerous technologies. I think Susan can benefit from your mature counsel, and you from her strong investment in the dumpsite issue, and I wish you well for joint success in this most vital of all environmental battles.

I assume you will take the appropriate steps to bring the resources of the Sierra Club national office to bear on this truly national threat. I will drop a note to Mike McCloskey urging that the Club take this on with the same priority given Mineral King or the Alaska pipeline.

With very best wishes,

L. Douglas DeNike

Enclosures

L. Douglas DeNike, Ph.D.
Vice-President

Los Angeles Chapter: 2315 Westwood Boulevard / Suite Z / Los Angeles, California 90064
Telephone 213 / 474-2154

Katharine Gardiner Hale
1101 Keystone Avenue
Reno, Nevada 89503

Transcript of Statement of
Katharine Gardiner Hale
given at
Nevada State Legislature
Carson City, Nevada
on
April 24, 1975

Gentlemen and Gentlewomen,

My name is Katharine Gardiner Hale; I have lived in Reno for 14 years. During that time, I have developed a deep regard for Nevada and I submit that we must forego immediate economic benefits in favor of long-term consideration of the state's potential productivity. I was reproved at the Assembly hearings for calling A.J.R. 15 an economic bill, yet Lloyd Mann, its sponser, was quoted by the Gazette Journal as saying "Somebody is going to pick up that $1.5 billion and I want it to be Nevada." To my mind, the bill is a bit of a bribe. We are promised money and solar energy research (unfunded), if we prostitute our state for 250,000 years.

I have testified at the A.E.C. (now E.R.D.A.) hearings in Salt Lake City, and before our local Assembly. One of the major contributors to both hearings was Mr. Flangas, a mining engineer. I have discussed his testimony with Mr. G. Martin Booth, III. who has a Masters degree in geology from Mackay School of Mines, has spent eight years, worldwide, as a petroleum geologist; and the past seven years as an independent consultant in geothermal energy, petroleum and hard mineral resources. My testimony is not intended to be in vituperation of Mr. Flangas' remarks. It is intended to show that much of what he said was generalized or speculative. With all due respect to his background, the fact that Mr. Flangas is primarily a spokesman for the Las Vegas Chamber of Commerce does not make him a spokesman for the larger interests of humanity.

It would be foolish to ignore or minimize the grave need for jobs and money. Our economy has been based on an exchange of money for money, rather than for culture or research or any of a thousand other economic devices. I have great faith in the

"Sage" State. This state has strength and beauty that deserves more than a "fast-buck" approach. It has always been called "dry and barren" because it was originally passed over by an essentially agricultural western movement requiring lush valleys and temperate climates. But we are no longer an agricultural nation, and it's time we re-evaluate Nevada's resources.

Mr. Flangas stated that there was no inter-valley ground water flow; and that, if by some unforseen accident, radioisotopes did find some underground water, that the tuff would filter them out. Mr. Robert Horton, who did the AEC study at Fallon, says there is substantial evidence that ground H_2O travels from valley to valley. I have given each of you a map taken from the Nevada Bureau of Mines and Geology report: Interbasin Ground-Water Flow in Southern Nevada. It was co-authored by Richard L. Naff, George B. Maxey, and Robert F. Kaufmann, for March 1974. It distinctly shows water flow, going through N.T.S. land.

Concerning the filter aspects of tuff, Mr. Horton states that certain clays might retain the radioactive wastes but water-soluable wastes would migrate through any soil or rock. Mr. G. Martin Booth stated that "tuff itself might trap some wastes but that Mr. Flangas did not account for fissures and faults. Such flaws might reduce hundreds of years of water passage to as little as ten years."

What is tuff? It is often referred to as volcanic tuff and consists of the smaller kinds of volcanic detritus. Detritus is anything broken away from the mass. At this time, I request permission to stand, and explain this beautifully detailed map.

It shows young ~~terit~~ tertiary and quaternary volcanic formations in Nevada. "The western U.S. is geologically far more unstable than that part of the country East of Denver. Of the eleven (11) western states, Nevada is one of the most seismologically and geologically active." (G.M.B.)

"The Nevada Test Site is wholly within a main volcanic center. Many of the strata are just a few million years old, to probably a few thousand years old. Specifically, there are areas mapped by the U.S. Geological Survey, within the N.T.S., and on its periphery, which are probable quaternary age. Quaternary age may be defined as the age we are living in today to as old as approximately 1.5 million years. It is likely that exceptionally strong seismic activity may develop within and on the periphery of N.T.S. during the interval" (a geologist calls thousands of years an interval!) "when dangerous radioactive wastes are stored there." (G.M.B.)

The caldera are pink circles, outlined in black. A caldera occurs when "many cubic miles of volcanic rock are

brought to the surface and come out in such quantities that they spread out over 100's of square miles, leaving a void which becomes a cavity within the near surface of the earth." Their presence is an indication of more seismic activity in the future, which could be quite severe.

"Some of the most recent and well known and largest calderas in the whole state of Nevada are over the Nevada Test Site" (G.M.B.)

We have heard much of the technology and well-trained staff at N.T.S. In fact, the number of personnel is at rock-bottom and the technology required is entirely different from that needed for underground testing. The underground testing produces radiation that dissipates. As we all know, Nagasaki and Hiroshima are currently inhabited by a million people (800,000 1964 census) who could not live, if those land parcels had been polluted by the wastes which we intend to invite to our state.

In response to the argument: "N.T.S. is already polluted, a little more won't hurt;" (Flangas) I say: "We must define what kinds of radiation are involved and outline their different lifespans and levels of toxicity.

I respectfully ask that my senators find an expert to disseminate facts for us all concerning the radioisotopes with which we will deal. We've been told they'll be solid. We've been told they'll be liquid. What are they?

Nuclear power plants routinely release these radioisotopes: Barium Lanthanium 140, Strontium 89 and 90, Iodine 131, 133, and 135, Cesium 134, 137 and 144, Cobalt 58 and 60, Manganese 54, Zinc 65, Xenon 133, 135, 137 and 138, and Krypton 83, 85, 87, 88 and 89. All of these are accumulative in the environment and in humans, and potentially fatal. I want to know what controls are being used in the power plants and which radioisotopes we will be "caring for."

Before we give a green light to E.R.D.A., concerning waste storage, we should consider that one conceivable outcome would be our eventual acceptance of an instate nuclear power plant. Even if we never did the latter, the storing of wastes gives E.R.D.A. the chance to create more as soon as possible. The plants and their wastes are inextricably entwined. An average plant produces 200,000 grams of Plutonium 239 per year. That doesn't sound disastrous until one realizes that <u>one</u> gram could cause thousands of lung cancers; and that it will remain deadly <u>forever</u> (in non-geological jargon).

Scientists have yet to discover ways to store, neutralize, or dispose of it. <u>Nothing</u> is perfect; but the emergency

core-cooling system which is supposed to prevent disaster, if the main cooling system fails, has been tested in a smaller scale breeder reactor six times . . . . six times it has failed. The AEC admitted in 1974 that it's safeguards were inadequate and asked for more money to improve security. Congress appropriated the funds but Ford vetoed it for lack of money.

We cannot afford to not afford the precautions.

We are all in a terrific bind. We want to do the right thing with the energy crisis. The people who have spent their lives trying to create clean energy, (scientists, environmentalists, et al) have developed an understandable blind spot. They want to save us, so badly. It reminds me of a patient I cared for; he was psychologically affected by cortisone. He could only see the future and grandiose goals and was incapable of working out the detailed means to his ends. He and E.R.D.A. are in a similar position; that of eagerly striding forward in the name of progress and dismissing anyone who asks, "How will you do this?" by labeling the question conservative and counter-productive. To my mind, progress is necessarily destructive. But there comes a time when it is so destructive that it becomes recessive in terms of it's benefit to humanity.

What I hope I have shared with you today is a sense of the time it took for us to get here and the relative haste with which we make our decisions. This state of ours is OLD. So OLD that we cannot readily grasp the statistics that tell us how old it is. Let me share an ounce of perspective. Richard Carrington said: "If the earth's history could be compressed into a single year, the first 8 months would be without life, the next two would see the most primitive creatures, mammals wouldn't appear until the second week in December, and no Homo Sapiens until 11:45 p.m. on December 31st. The entire period of man's written history would occupy the final 60 seconds before midnight."

When we consider how difficult it has been to grasp this subject, it helps to remember how very young and inexperienced we are, compared to other natural forms. We do not know what goes on under the earth yet. We do not even know what really goes on under our skins. When we do, we may be able to preserve them both with a minimum of wrinkles.

If we don't aggravate the contamination at N.T.S. "we could be sitting on the greatest geothermal opportunity in the country. The state could conceivably be self-sufficient in terms of energy and even provide power for surrounding states ($$$$!)." (GMB)

The Powers That Be designed our universe so that the oldest nuclear reactor, the sun, is about the right distance

from its users: 93,000,000 miles. Why, if the wastes are not all that dangerous to store, do we not have regional depositories in the Eastern and Midwestern sectors of the country? The U.S. Geological Survey is a competant, respected and scientific organization. Nonetheless, it is within the domain of Federal Bureaucracy. Our senators might consult the technologists in the state of Nevada who have considerable expertise in science and engineering within the state. Some of these are Desert Research Institute, the Nevada Bureau of Mines and Geology, the Department of Water Resources and the private sector of objective scientists.

Thank you.

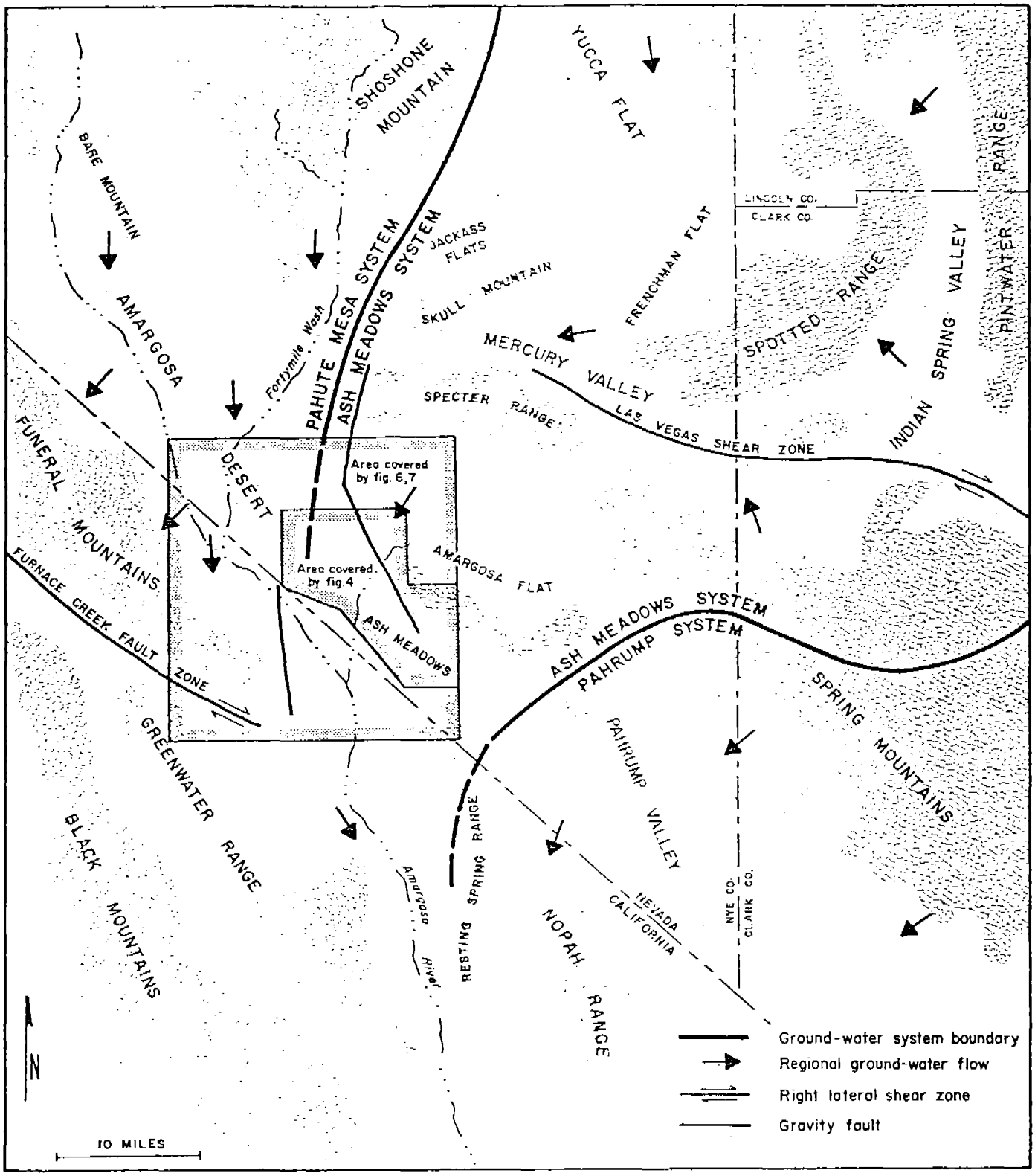

FIGURE 3. Index map of regional structural controls and directions of interbasin ground-water flow in the vicinity of the Amargosa Desert.

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1257

Senator Gibson
Nevada State Committee on Government Affairs
State Legislature Building
Carson City, Nevada 89701

April 1, 1975

Dear Senator Gibson,

I understand that your committee will be considering AJR15 which contains a proposal urging the Energy Research and Development Administration to locate a radioactive waste "disposal" facility at the Nevada Test Site. (In ERDA's terminology, "disposal" refers to permanent disposition rather than "storage" which is seen to be temporary and retrievable management of the commerically generated atomic wastes the government is currently concerned about.)

I would like to be advised of the date of your committee's hearings on the Resolution as soon as it has been set.

I would also like to urge you to recognize the ominous and controversial nature of the proposal and the consequent need to invite learned testimony from both proponents and opponents of the measure. It is very important to always be clear about the character of radioactive waste storage/disposal that is being referred to in discussion: interim or permanent, surface or buried, form (solid, liquid or contaminated "artifacts"), high-level or trans-uranium contaminated. These qualifying factors were not made clear during the Environment and Public Resource Committee hearings in the Assembly, which resulted in serious misunderstanding about the nature of the project.

The idea for commercially generated radioactive wastes to be stored in Washington, Idaho or Nevada is most fully developed in WASH 1539, the AEC-now-ERDA Draft Environmental Impact Statement on "Management of Commerical High Level and Trans-uranium Contaminated Radioactive Waste". It is a government proposal. The final impact statement has now been postponed for at least a year because 1.) the first was found to be inadequate in its presentation of alternatives and detailed technical information, and 2.) the idea for interim storage may be scrapped by the government altogether so that they can put all their money and effort into developing permanent disposal pilot projects. At any rate, the final impact statement should provide more detailed information about the plans for managing the highly toxic and volatile radioactive wastes and the criteria for site selection. Any waste storage/disposal discussion should be kept in the context of what we know and don't know from ERDA...they make the proposals and the decisions.

Foresta has been gathering information on nuclear waste storage since the governor first held hearings. We would be more than glad to share what we know with the Government Affairs Committee, to suggest people who can give knowledgable testimony, and to let committee members have access to our library and files, should they so desire.

We feel that the potential threat nuclear power poses to the environment and its inhabitants -- for 250,000 years if industry develops the fast-breeder -- demands that every aspect of the process receive careful and rational consideration. A Resolution may not carry the weight of law, but it does indicate a public sentiment...whether or not it represents an informed public view will be a matter of conscience for the Nevada legislators.

I look forward to hearing from you.

Most sincerely,

Susan Orr

Susan Orr
Program Coordinator

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1989

"In the recent past, there have been a number of occurrences at reactors where human error resulted in undesirable situations. None of these situations represented a threat to the health and safety of the public. The absence of more serious effects is largely the result of good luck."
-AEC Division of Reactor Licensi
Reactor Operating Experiences
No. 69-9

"We cannot rely on good luck and good intentions to achieve safe plant operation."
-L. Manning Muntzing, Director o
Regulation, USAEC, Nov. 26, 1973

"In my opinion, there are no measures we can take that will eliminate the possibility of a major nuclear accident."
-Walter H. Jordan, formerly
assistant director, Oak Ridge
National Laboratory,
Nuclear News, October 17, 1971

"...(W)ithin the AEC it has been the policy that designs should not be required to provide protection against pressure vessel failure. So the question of whether or not such an event was credible did not arise. The reason is very simple - no design was available for a building which could withstand the consequences of pressure vessel failure, so it was decided to accept the risk."
-Peter Morris, Directorate of AE
Regulatory Operations, at Julich
Meeting International Atomic
Energy Agency, Feb. 5-9, 1973

"In all of this (growing interest in nuclear safety) there has developed a serious credibility gap. It seems apparent that the AEC isn't nearly as certain about nuclear safety as it ought to be. It has suppressed unwelcome evidence of possible hazards that have been discovered by its own researchers. When the researchers have pressed their doubts on higher officials, the AEC suppressed their reports and terminated their experimental programs, and sometimes researchers have been fired."
-Dr. W.N. Peach, Univ. of
Oklahoma, in "The Energy Outlook
for the 1980's," prepared for the
Joint Economic Committee of the
Congress (Dec. 1973)

Nuclear technology is a "fail-safe" technology. Once a critical error is made, there can be no turning back; consequently no errors can be made.
-Wilson Clark, 1974

Since all levels of radiation are hazardous, setting radiation protection standards is essentially a matter of applying moral judgments to cost/benefit analyses. It involves an evaluation of how much life and good health we, as a nation, are willing to sacrifice in the interest of having nuclear power. There is reason to conclude that present radiation standards are too high. While the issue of proper protection standards is beyond the scope of this booklet, it is important to understand that existing standards-even if met-will result in serious injury to health and life in a not insignificant percentage of the population.

After two years' study a National Academy of Sciences-National Research Council committee found that the current radiation protection standard of the AEC would, if the entire population were exposed to the maximum permissible exposure, "eventually lead to an increase of 5% in the ill'health of the population."*** The committee also estimated that this level of radiation exposure "would cause from roughly 3,000 to 15,000 cancer deaths annually."****

While there is a considerable body of information about the deleterious effects of radiation on man, there is a serious lack of precise knowledge about the possible environmental and health impacts of radioactive chemicals that may be released into the environment through the handling of vast amounts of radioactive wastes. Of particular concern is the uncertainty in assessments of the long-run environmental and health effects which may result from the biological concentration and transport of long-lived radionuclides.

Citizens' Guide: The National Debate on the Handling of Radioactive Wastes from Nuclear Power Plants

***National Academy of Sciences-National Research Council, The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, Nov. 1972

****Based upon these estimates, the committee concluded as follows:

"The present guides of 170 mrem/year grew out of an effort to balance societal needs against genetic risks. It appears that these needs can be met with far lower average exposures and lower genetic and somatic risk than permitted by the current Radiation Protection Guide. To this extent, the current Guide is unnecessarily high."

<u>There is no evidence at all</u> for any safe threshold of radiation exposure.

The 150 nuclear plants already planned or operating will produce more long-lived radioactivity in this country every year than about 130,000 Hiroshima bombs.

Nuclear energy is "clean" only the way coal is "clean." They are <u>both</u> clean, provided you keep their deadly pollutants out of the environment.

-D.F. Ford and H.W. Kendall

It is within the capability of sub-national groups (e.g. "Black September") to construct a nuclear weapon from such materials that are available in the commercial nuclear power program. Moreover, given the hazards of plutonium, it would not be necessary to turn this material into a weapon in order to undertake a terrorist campaign. The threat simply to disperse this immensely toxic material, among the most potent of cancer-causing agents, would be adequate for terrorist purposes. (A quanity of plutonium the size of a grain of pollen is sufficient to cause lung cancer in mammals.)

-D.F. Ford and H.W. Kendall

The radioactive wastes created in nuclear power plants are extremely toxic and persistent poisons...Nuclear power plants are expected to have a service life of 40 years. Yet the wastes each one creates will become a lagacy from this transient existence to future generations for nearly geological periods of time.

-D.F. Ford and H.W. Kendall

AEC's Director of Regulation, L. Manning Muntzing, admitted to a Congressional Committee (JCAE): "I'm really concerned about some of the surprises we see."

SOME NUCLEAR 'SURPRISES'

Discovery in 1972 that nuclear engineering firms have built the Prairie Island and Kewaunee plants with steam lines running underneath the control rooms, where a rupture of a line could destroy the controls and kill the nuclear plant operators; extensive modifications will be required in about six plants.

Failure of the vital emergency core cooling system to provide AEC experts with assurance of effective performance; the system, which has never had a large-scale test, failed six out of six miniscale tests in late 1970.

As of Spring 1974, the emergency cooling system has never had a successful large-scale test.

Discovery in 1971 that the allegedly watertight salt mine chosen for radioactive waste storage in Kansas was full of holes; the AEC has been forced to improvise "surface storage" plans.

Confirmation by the National Academy of Sciences in November 1972 that low-level radiation exposure is at least 500 percent more harmful than the experts had previously admitted; this surprise had already forced the AEC to suggest drastically reduced "permissible emissions" from nuclear power plants.

Discovery by the North Anna Environmental Coalition in August 1973 that two nuclear power plants in Virginia had been built on an earthquake fault in undeniable violation of AEC policy.

Apparently nuclear experts did not foresee, either, that on Nov. 11, 1972, three skyjackers would threaten to bomb the nuclear reactor at Oak Ridge, Tenn.; helpless, the AEC shut down its reactor and evacuated. The skyjackers did not carry out their threat.

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Resource People: Nuclear Energy and Radioactive Waste Storage

Natural Resources Defense Council, Inc.
664 Hamilton Avenue
Palo Alto, California 94301
--Terry R. Lash, Ph.D.
--John E. Bryson, Esq.

Office of Energy Research and Planning
Office of the Governor, State Capital
Salem, Oregon 97310
--Joel Schatz, Director
--Robert Murray

Environmental Policy Center
324 C Street SE
Washington D.C.
--Wilson Clark, energy consultant
wrote Energy for Survival

John Goffman, M.D., Ph.D.
Professor of Medical Physics at UC
--former Assoc. Director of Lawrence Radiation Lab
--outspoken critic of promotion of nuclear power
--Dr. Arthur Tamplin and Goffman wrote Poisoned Power
(Rodale Press, 1971)

Robert F. Mueller, Ph.D.
Planetary Branch of NASA's
Goddard Space Flight Center

Union of Concerned Scientists
--Daniel Ford, Director of UCS
--Henry Kendall, prof. at MIT

Harold Urey, Nobel scientist
Prof. Emeritus, Chemistry
UCAL San Diego

Hannes Alfven, Nobel Laureate (Physics)
Royal Institute of Tech.
Stockholm & UCSD

Alvin Weinberg, Ph.D.
former director of ORNL
Oak Ridge National Laboratory

Glen Seaborg, Nobel Laureate (Chemistry)
Associate Director of Lawrence Lab
(U.C., Berkeley)

Milton Shaw, former Director
AEC Div. Reactor Development & Tech.

Robert Gilette, Science

Dr. Ralph Lapp, Energy Consultant
Alexandria, Va.

Hans A. Bethe, Nobel Physicist
Cornell University
Laboratory of Nuclear Studies

Carl J. Hocevar, ex employee at AEC's
Idaho Safety Research Center

Donald Geesaman, biophysicist formerly of AEC
now at School of Public Affairs
University of Minn.

John T. Edsall
Prof. of Biochemistry,
Harvard University

Paul R. Ehrlich
Prof. of Biology
Stanford University

David R. Inglis
Prof. of Physics,
University of Massachusetts

Linus Pauling
Nobel Laureate
Prof. of Chemistry,
Stanford University

Harold Urey
Nobel Laureate
University Prof.
Emeritus, Chemistry
Dept. University of California
San Diego

George Wald
Nobel Laureate
Higgins Prof. of Biology
Harvard University

James D. Watson, Novel Laureate
Prof. of Biology
Harvard University

For A Habitable World, Inc.
ROUTE 1, BOX 540 - PAYETTE, IDAHO 83661

April 17, 1975

Committee on Government Affairs
NEVADA STATE SENATE
Carson City, Nevada

Assemblymen: Re: ASSEMBLY JOINT RESOLUTION NO. 15 - Nuclear Wastes

Numerous thoughtful citizens of Idaho have expressed admiration for the sponsors of this Resolution, in that its proposal to ERDA that the Nevada Test Site be used for disposal of nuclear wastes, if accepted, would relieve the NRTS/INEL Site near Idaho Falls from the liklihood of being so used.

Although NRTS/INEL already has been named a nuclear waste repository, under circumstances set forth at page S-3142 of the Congressional Record of March 6, 1970, it seems evident now that the Idaho state administration which requested such designation (July 23, 1969) did not fully take into consideration the problems associated with permanent disposal there of radioactive materials as long-lived as plutonium-239. The NRTS/INEL ground, as you doubtless are aware, lies above an important acquifer of the Snake-Columbia river system. Obviously it would not be wise to commit to this earth materials certain to remain a threat to human life for possibly a million years. As recently as three weeks ago, a severe, earth-cracking temblor (scale 7.5) shocked the area from an epicenter only 100 miles away.

While your Nevada site has none of these disadvantages, we cannot help remarking that even one-tenth of a million years considerably exceeds man's competence to predict geological changes. So wherever the present store of plutonium wastes come to rest, decision as to even relative safety for future generations for so long a period will amount to little more than guesswork. Such being the case, your Committee ought not to assent lightly to Nevada's becoming part of the plutonium syndrome.

The old Pu-239 wastes must somehow be taken care of, but new wastes of this sort need not be created. Power reactors based upon a thorium cycle, rather than uranium, wind up with wastes much shorter lived.

Why not, therefore, make the offer of your Resolution a contingent one? Why not propose the Nevada Test Site as a disposal site for present commercial reactor wastes, provided the reactor program producing plutonium wastes authorizes the building of no further such reactors, and provided further, that all present U.S. light-water reactors producing plutonium wastes be phased out in accordance with a specific timetable?

Respectfully submitted,

FOR A HABITABLE WORLD, INC.

Paul Kiepe, President

2551 Westfield Ave.
972-1721

April 2, 1975

Editor,

Nevada voters should decide if we want our state to be a radioactive dump for nuclear wastes.

This matter is too big, too crucial to be decided by the legislature, the governor or even the Las Vegas Chamber of Commerce.

The world's best scientists cannot even agree on where we go from here with nuclear power. As Dr. Hannes Alfven, Nobel laureate in physics said, "In the nuclear industry...no acts of God can be permitted."

Those Nevada officials asking to have the wastes stored here must tell us why they are so willing to gamble with our lives and our lands. Is Nevada that desperate for a couple hundred new jobs and additional "economic benefits?"

The AEC (now Energy Research & Development Administration) does not have a comforting safety record. Nevadans should be aware, for example, that some 500,000 gallons of hot nuclear waste have been spilled on the ground at the nuclear disposal site in Washington over the last three decades.

If the AEC is soft on safety, it is little better on candor. The agency is noted for dealing with critics within its ranks by firing them or otherwise making their lives difficult, e.g. harassment, blacklists and dossiers.

In a recent bizarre case, Karen Silkwood, an employee of Kerr-McGee, the nation's largest uranium producer, was killed en route to a meeting with a New York Times reporter. Her car ran off the road and investigations indicated the vehicle may have been rammed from behind. She was carrying information alledging that

Kerr-McGee was falsifying quality control records on plutonium fuel rods. The critical material disappeared following the accident. The Justice Department is now reportedly investigating the incident.

The Times reporter planning to meet Silkwood was David Burnham, the man who broke open the Serpico story of police corruption in New York City. Prior to the scheduled meeting, Burnham had combed through hundreds of memos and letters, according to a story in Rolling Stone, March 27, 1975, and had "learned the AEC had a ten-year record of blue-penciling alarming data, soft-soaping test failures and glad-handing an industry that increasingly appeared not to know what it was doing."

There are many more horror stories and the AEC has a library of encouraging words to counter them. A lot to sift through.

I urge Gov. O'Callaghan and other supporters of this waste disposal plan to study this matter as if the lives of all Nevadans depended on it--they just might. Then let the people decide.

James A. Nelson

Reno

CONSUMERS LEAGUE OF NEVADA

1408 EAST OWENS AVENUE
NORTH LAS VEGAS, NEVADA 89030
TEL. (702) 642-0395

March 10, 1975

Assemblyman Paul May
State Legislative Building
Carson City, Nevada 89701

Dear Mr. May,

This letter deals with Assembly Joint Resolution (AJR) 15 which: "urges the Energy Research and Development Administration to choose the Nevada Test Site for disposal of nuclear wastes and for solar energy research under the Solar Energy Research, Development and Demonstration Act of 1974.

As the Resolution is written, it constitutes a mandate from the people of Nevada and this, in fact, does not exist. Enclosed you will find a copy of "A Citizen's Bill of Rights on Nuclear Power". This document has been voted on and established as policy for the Consumer League of Nevada in the field of nuclear establishments.

When we speak of storing nuclear wastes, it is imperative that we understand what this "waste" is. Waste products accumulate from nearly all stages of the nuclear fuel cycle. High level wastes, those that may be stored in Nevada, are generated at reprocessing plants where plutonium and uranium are separated from fission waste products. These wastes emerge in liquid form and are initially stored in tanks. These wastes are extremely hazardous.

Extremely low amounts of radiation can cause cancer and genetic mutations. Many radioactive elements can concentrate in plants and animals at hazardous levels. This danger grows more acute as time passes. Less than 5% of the nation's energy (electricity) is presently generated by nuclear power plants, but that amount is expected to be in excess of 50% by the year 2000. Because of the rapidly growing nuclear establishment there should be wide spread consideration of the fundamental aspects of radioactive waste generation and storage.

Although radioactive wastes are generation at each stage of the nuclear fuel cycle, including mining, milling, enriching and fabricating fuels, the principal wastes are created from nuclear power plant operations. Accumulated fission products and fission by-products are separated from reusable isotopes in the reprocessing of spent fuels. These wastes are high-level radioactive substances. High-level wastes have high heat generation rates. The two principal radionuclides of concern are strontium-90 and cesium-137, which emit very intense beta radiation that in the absence of considerable external cooling causes high-level liquid wastes to boil for decades. In the management of wastes, this heat must be dissipated in order to prevent it from breaking down the structural materials encasing the wastes.

The fission by-product, such as plutonium-239, has a half-life of over 24,000 years. This means that radioactive wastes that are contaminated with plutonium have to be contained for a period approaching 500,000 years.

Although the two broad types of waste, fission products and by-products, are distinguishable, current and proposed commercial spent fuel reprocessing does not physically separate them. Thus, all the high-level wastes must be contained for a period of nearly half a million years, under conditions of perfect stability.

The Resolution states that the AEC has, over the years, demonstrated an outstanding concern for nuclear safety. The past experiences of the AEC are not encouraging. I have enumerated their safety record to clarify my concerns. At the AEC facility at Hanford, Washington, liquid radioactive wastes have been stored in underground tanks. A number of these containers have leaked, with the result that over 400,000 gallons of highly radioactive materials have seeped into the ground, permanently contaminating it.

One leak that occurred in the spring of 1973 went undiscovered for 55 days, allowing 115,000 gallons to seep into the ground. Although readings on the tanks were taken each day, personnel did not recall the previous day's readings, and their supervisors were said to be over-burdened with other work and did not make the comparisons.

If we have not been able to control the wastes that have been generated, can we expect to achieve perfect control required for long-term isolation? The answer is NO.

Is the transportation of radioactive wastes safe? Recently, a steel cask with highly radioactive cesium and cobalt, taken from the Pilgrim Station reactor in Massachusetts, fell off a truck in Middleboro and rolled down a 200 foot slope. It did not burst, however, this is only one example of the enormous risks posed by transporting nuclear materials.

Sabotage and theft enter into the picture of nuclear waste storage. Diverted materials might be made into atom bombs or other devices for blackmail and terror. The adequacy of ACE safeguards measures has received recent attention from the General Accounting Office, the AEC, critics of nuclear energy, and the Congress.

Limited insurance liability is another inherent problem when we deal with the nuclear establishment. Without its federal subsidies, nuclear power would not be economically feasible. One of the key subsidies is the limitation on liability of nuclear power companies in the event of an accident and the government indemnity for payment of some damages.

To eliminate this roadblock to the development of the nuclear industry, the Congress in 1957 enacted the Price Anderson Act which sets a statutory ceiling of $560 million on insurance coverage for one nuclear power plant catastrophe regardless of the scope

of the actual damage. A recent 1974 report prepared for the AEC by Dr. Norman Rasmusson of MIT found that a reactor accident could cause 5500 deaths, 90,000 injuries, and 6.2 billion dollars in property damage. The report admitted these figures could be in error by a factor of three. Moreover, this accident was only the worst considered by the Rasmussen report, it is not the worst possible accident. The corperations which construct and operate nuclear power plants with their deddly potential destruction are liable for only the cost of their premiums on the maximum amount of insurance available from private sources; as of 1972, this was $95 million dollars. Realizing that we will not be building a nuclear power plant, these facts are relevant, because the AEC wishes to store the highly radioactive wastes that are generated by these nuclear powor plants in Nevada.

If there were to be a zone leakage from the storage of radioactive wastes, are the people in Nevada aware of the insurance coverage? I think not. If your home is destroyed, you can't count on your homeowner's coverage...it has a total exclusion against damage from a nuclear accident. If your auto is dettroyed or contaminated, you auto policy has the same type of exclusion as does your homeowner's policy. If youre injured, your health insurer may be bankrupt as claims mount up. Those concerns do exist and should be examined with the closest scrutiny possible.

In conclusion is wish to say that the Nevada State Legislature and it Legislaters do not have the expertise in the field of nuclear radioactive waste storage, they must be required to read appropriate materials that would enable them to understand and ask questions; and they should not take the right away from every Nevada citizen to become a part of that decision making process. I would recommend that the bill be separated into twoparts: one dealing with the AEC's choice of the Nevada Test Site for disposal of nuclear wastes and the AEC's solar energy research under the Solar Energy Research, Development and Demonstration Act of 1974.

Respectfully submitted,

Yvonne McClain

Yvonne McClain,
1st Vice President

cc: Governor Mike O'Callaghan

People for an Informed Choice ✓

Legislater Robert Robinson

Legislater Douglas Brennor

Legislator Robert Price

Legislator Tom Hickey

Legislator Eugene Echols

The following is a bibliography of some of the material and information that is available for your consideration:

F. Gerra dn D.G. Jacobs, Considerations in the Long-Term Management Of High-Level Radioactive Wastes, ORNL-4762, February 1972.

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Citizen's Guide: The National Debate on the Handling of Radioactive Wastes from Nuclear Power Plants, National Resources Defense Council, Inc. Palo Alto, California.

Dreschoff, Saunders, Joller, "International High-Level Waste Management," Bulletin of the Atomic Scientist, Vol. 30, January 1974.

Dye, Lee, "Thousand Periled by Nuclear Waste; AEC Continues Calculated Risks Despite Numerous Near-Disasters, "Los Angeles Times, " July 5, 1973

Kubo, Arthur S. and Rose, David J., "Disposal of Nuclear Wastes," Science, Vol. 182, December 21, 1973.

CONSUMERS LEAGUE OF NEVADA

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TESTIMONY BEFORE THE NEVADA STATE
SENATE
COMMITTEE ON GOVERNMENT AFFAIRS
APRIL 24, 1975

My name is Yvonne L. McClain and I am representing the Consumers League of Nevada (CLN) before this Committee. I am currently serving as the 1st Vice President of CLN, which is an all volunteer organizations to protect and promote consumer interests in Nevada.

The Consumers League of Nevada is against the establishment of a high-level radioactive waste storage facility that is proposed for the Nevada Test Site. The following remarks will clarify our position.

Responding to the Governer and the initial environmental impact study (WASH 1526), CLN, stated that "The study also fails to present the detailed basis for its conclusion that a solution will be found before a disastrous management mistake occurs." CLN has also asked for full disclosure of all memoranda, reports, studies, and decision papers to allow the public to decide and make a determination as to the pro's and con's of this project. This Resolution, A.J.R. 15, that is before you today, takes all rights and privileges away from those who live in Nevada and call it home.

We are discussing the storage of radioactive by-products and dangerous elements such as iodine, strontium, cesium and worst of all, plutonium. Plutonium is the most toxic substance known to man. It has a half-life of 24,000 years, which means that after that period of time, half of it is as lethal as it is today. After an additional 24,000 years, one-quarter of it is still lethal, and so forth. So plutonium must be stored for hundreds of thousands of years, away from contact with man, in containers and loca-

tions that must be 100% immune to fires, earthquakes, bombs, sabotage, mechanical or technical failure, corrosion, and human error.

I am sure that you are aware of the 115,000 gallons of radioactive waste that leaked out of some steel containers in Hanford, Washington, contaminating not only the soil but the Columbia River watertable. So much plutonium was found in trenches in the area that some scientiest believe a fission chain reaction could occur. Such leaks in varying degrees are occuring all across the country. And more and more wastes continue to accumulate. The AEC (or the newly established ERDA) tries to minimize the waste problem by pointing out how small it is in volume. They overlook the fact that it is radioactivity, not the volume, that counts. Radioactivity is measured in microcuries, since one curie is considered a very large dose. By the year 2000, this country will have accumulated billions of curies of radioactive wastes, stored in a manner similar to those that leaked out at Hanford.

One can find in an AEC fact sheet entitled Commercial High-Level Radioactive Waste the following explanation of how much waste we are talking about. "All the high-level waste generated at commercial spent fuel processing plants by the year 2000 would fill no more than 80,000 canisters when solidified and shipped to a federal repository ten years later. All 80,000 canisters could be placed in storage basins taking up to 5 to 15 acres of land. A canister will probably be about one foot in diameter and ten feet long, made of steel, welded shut and containing about six cubic feet of solidified high-level radioactive waste. About sixty cubic feet, or ten canisters-full, of this type of waste would come from

the thirty metric tons of spent fuel taken each year from a typical 1000 megawatt light-water-cooled reacter." 80,000 canisters and 15 square miles are treated as if it were a trivial amount.

We will be creating "Stonehenge" pillars of concrete planned to store A-waste, as noted in the Los Angeles Times on Sunday, May 5, 1975.

In a press release from the Nuclear Regulatory Commission, they say that "More than half (888) of the 'abnormal occurences' reported in 1974 were of little significance in terms of safe operation of the nuclear power plants, and one of the more than 1400 events had any impact on public health and safety." CLN feels that the unsafe operation of Nukes have a deliberate impact on public health and safety. We must take note of the safety record as we can not minimize its effect on future generations. The state of the technology at this time is still experimental. On December 10, 1973, 13 out of the 38 "operable" nuclear plants were completely shut down due to malfunctions or accidents, and several other were operating at a reduced capacity. (Information taken from Ralph Naders, THE SUNDAY BULLETIN, Philadelphia, January 20, 1974.) The WALL STREET JOURNAL reported on May 3, 1973, "Utilities find, the facilities costlier, less efficient than they had expected...The incredibly complex facilities are plagued by breakdowns that experts blams on faulty engineering, defective equipment and operating errors." The October , 1973 AEC Task Force study on safety states, "Review of the operating history (of) 30 nuclear reactors indicated that during the period of 1-1-72 to 5-30-73 approximately 850 abnormal occurences were reported to the AEC. Many of (them) were significant and of a generic nature...forty per cent were traceable to some extent to design and/or fabrication related deficiencies. The remaining

incidents were caused by operator error, improper maintenance, inadequate erection control, administrative deficiencies, random failure, or a combination thereof." (Excerpts from "Study of the Reactor Licensing Process" AEC, Oct. 1973, by The Untion of Concerned Scientists, P.O. Box 289, MIT Br. Sta., Cambridge, MA 02139.) It is difficult to see how the industry claims that the chances of a "maximum credible" accident are almost negible. Accidents which have happened have been caused by unforeseen combinations of human and mechanical failures against which the odds were astronomical. (Excerpt from THE CONGRESSIONAL RECORD, S.6608-9, Human Error and Atomic Power, V.119, No.52, Sen. Mike Gravel.)
The AEC's public pronouncements run counter to the agency's own experts' studies and the opinions of scientists in and out of the AEC. (Found in Hetzger, Peter, THE ATOMIC ESTABLISHMENT, Simon & Schuster, 1972 for examples.) Dixie Ray even claimed on "Meet the Press" on April 14, 1974 that a big nuclear plant accident would be no more serious than an airplane crash, ignoring the effects of radioactivity in the environment that would cause cancers and genetic mutations to future generations.

Two principles have been applied to the problem of radioactive wastes. One is the dilution and dispersal of low-level radioactive wastes that is slowly poisoning our biosphere and that it tends to become concentrated again in the tissues of living organisims. The other principle is containment and concentration of high-level radioactive wastes. Containment of high-level wastes for any length of time had defied solution; there is NO KNOWN MATERIALS that will contain these hot wastes for more than about 20 years. One idea to store long-lived wastes was burial in abondened

salt mines, but after fifteen years of study and over $100 million, the site chosen at Lyons, Kansas, had to be abandoned because it was found to be only a few hundred yards from large holes which were filled with water.

Presently the highly lethal wastes are stored in huge underground tanks in a program of perpetual care. After the spent fuel is removed from the reactors, once a year or so, it is first stored underwater for months to permit the shortest lived radioactive elements to die out. Then, at the reprocessing plant, the fuel is dissolved in acid solutions and the useful materials removed. Further sorting out chemically of shorter-lived elements allows them to be set aside to decay. The highly concentrated long-lived strontium-90 and cesium 137, and others which have half-lives of 30 years or more, are extremely hot radioactively and thermally and will boil into the atmosphere if it is not constantly stirred or cooled. These tanks last about 20 years, or sometimes less, before corrosion and radiation damage causes them to buckle and leak.

With this less than impressive record of safety and utmost concern for the human race and the preservation of the same, the Consumers League of Nevada has adopted the following policy:

A CITIZEN'S BILL OF RIGHTS ON NUCLEAR POWER

1. The public is entitled to full and candid information about the dangers and benefits of nuclear power in language they can understand, not just obscure technical jargon and Madison Avenue propaganda.

2. The nuclear establishment, including the AEC, utility companies, nuclear manufacturers and the insurance industry, has the obligation to disclose all information about the dangers of nuclear power.

3. The nuclear establishment has the obligation to make all relevant information readily available nationwide and not simply to store it in document rooms in Washington. Because of the unprecedented danger, failure to make readily available all information should be subject to severe criminal penalties.

4. The public is entitled to participate fully in all nuclear power decisions at all levels and at the earliest possible time. The public should not have these decisions rammed down their throats.

5. The public is entitled to have nuclear power plant decisions made on the local as well as the state and federal levels of government with meaningful input by citizens who will be directly affected. All decisions should not be made by federal officials.

6. The public is entitled to government regulations of the atomic energy industry designed to protect the citizen rather than to promote and protect the interests of the nuclear establishment. The health and safety of the public should come ahead of the corporate health and safety of the nuclear establishment.

7. The public is entitled to full protection for all damages caused by nuclear accidents. The financial risk of any accident should fall on the nuclear establishment, not on the public.

8. The public is entitled to a legal system that will guarantee compensation for the special types of injuries caused by nuclear radiation, such as genetic damage and delayed diseases, that may not be compensable under present law.

9. The public is entitled to an insurance industry that actively promotes safety and the public interest rather than one that serves as a mere adjunct to the nuclear establishment.

10. The public is entitled to full legislative monitoring of the risks and benefits of nuclear power. Responsibility should not be abdicated to a Congressional Joint Committee on Atomic Energy that has a vested interest in nuclear power and has traditionally been part of the nuclear establishment.

11. The public is entitled to a nuclear policy that protects present and future generations against unreasonable dangers. Future generations should not be given the oppressive burden of the storage of the present generation's nuclear waste.

12. The public is entitled to an energy policy that in no way compromises national security. The public should not be subjected to nuclear Trojan Horses susceptible to sabatoge and attack by conventional weapons.

13. The public is entitled to a comprehensive national energy policy with full environmental protection to assure a safe and sufficient supply of power rather than the present circus of hazards and inadequacies.

14. Until the previously mentioned rights are assured, the public is entitled to a moratorium on the further expansion and operation of the NUCLEAR ESTABLISHMENT.

To conclude my testimony, I wish to quote Dr. Hannes Alfven, Nobel Laureate in Plysics, writing in the May, 1972, Bulletin of the Atomic Scientists;

"FISSION ENERGY IS SAFE ONLY IF A NUMBER OF CRITICAL DEVICES WORK AS THEY SHOULD, IF A NUMBER OF PEOPLE IN KEY POSITIONS FOLLOW ALL THEIR INSTRUCTIONS, IF THERE IS NO SABOTAGE, NO HIJACKING OF THE TRANSPORTS, IF NO REACTOR FUEL PROCESSING PLANT OR . . REPROCESSING PLANT OR REPOSITORY ANYWHERE IN THE WORLD IS SITUATED IN A REGION OF RIOTS OR GUERRILLA ACTIVITY, AND NO REVOLUTION OR WAR--EVEN A "CONVENTIONAL ONE"--TAKES PLACE IN THESE REGIONS. THE ENORMOUS QUANTITIES OF EXTREMELY DANGEROUS MATERIAL MUST NOT GET INTO THE HANDS OF IGNORANT PEOPLE OR DESPERADOS. NO ACTS OF GOD CAN BE PERMITTED."

Thank you for giving the Consumers League of Nevada time to present this testimony for your consideration.

Respectfully submitted,

Ivonne McClain

Submitted by the Intervenors

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A VIEW ON NUCLEAR POWER MORATORIUM

by

John W. Gofman, M.D. Ph.D.

Delivered at CRITICAL MASS '74 Conference

Ralph Nader, Chairman

Statler Hilton Hotel

Washington, D.C.

November 15-16, 1974

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A VIEW ON NUCLEAR POWER MORATORIUM

John W. Gofman

I should like to outline why a moratorium on construction of any further nuclear power plants plus a phaseout of existing plants is essential.

There seems to be a widely-held view that "reasonableness" argues for the discovery of an acceptable middle ground between the opponents and proponents of nuclear power as one of our energy options. I cannot accept this view, since there does not appear to be any reasonable prospect that a middle ground can be found.

The essence of the problem is exceedingly simple, arising from the immutable laws of physics. If we generate nuclear power to meet any significant proportion of our energy use, we create astronomical quantities of radioactive fission products and plutonium-239. Since no serious opponents or proponents of nuclear power contest the extreme toxicity of long-lived radioactive fission products and of plutonium -239, the problem becomes, straightforwardly, whether or not these substances can be virtually perfectly isolated from the biological environment almost forever.

Let us examine this "almost forever" requirement.

For the prominent long-lived fission products, such as Strontium-90 and Cesium-137, with half-lives of approximately 30 years, the requirement is roughly 99.99% containment (isolation from the biosphere) for some 1000 years.

For plutonium-239, with a half-life of 24,000 years, the requirement is roughly 99.999% containment for some 250,000 years.

The proponents of nuclear power recognize these requirements and say they will provide the technical modalities required to achieve the necessary isolation. In taking this position they demonstrate a total divorcement from common sense and the real world. They ask society to believe a miracle will be accomplished.

It would be difficult enough, given the frailties of all high technology, to promise a technical solution to the requirements. But it is orders of magnitude more difficult to promise this given the frailties of human societies and political entities.

In the past 60 years we have experienced two full-scale World Wars, numerous lesser but bloody conflicts, an acceleration in revolutionary activity, and almost unbounded guerrila terrorism within and between countries. Who is so all-seeing as to predict that suddenly societies will become tranquil and totally peaceful? This would certainly be a requirement for societies basing their energy supply upon nuclear power.

In the USA, for example, a fully developed nuclear power industry will mean the commercial annual handling and transport of some 600,000 pounds of plutonium-239. The consequences of escape of 10 to 100 pounds of plutonium-239 to the environment in certain forms can be beyond comprehension -- for hundreds of thousands of years. Can anyone accept the credibility of those who casually reassure us plutonium-containment will be performed flawlessly, under all circumstances essentially forever?

And can anyone accept the credibility that guardianship of the radioactive fission products, in whatever storage form is decided upon, will be 99.99% perfect for 1000 years?

It is time to dismiss the nonsense of those who promise such miracles as being in the same class as the therapeutic promises of nostrum-vendors in travelling carnivals.

Since the promise of such miracles is patently ridiculous, it follows that going ahead with nuclear power represents a monstrous abrogation of rights, in advance, for the hundreds and thousands of generations of living beings who will follow those alive today. What right do we have to build in the prospect of irreversible health consequences (genetic injuries and deaths, cancers, leukemias) at a level that could negate all public health advances of the past few centuries?

Any statement that the nuclear power industry has thus far accomplished containment is simply false. The nuclear industry monitoring has varied from unreliable to non-existent. There is little reason from experience to believe the nuclear industry even knows what level of containment it has achieved thus far.

Were the problem one of better technical fixes, it might be credible that the learning curve would ultimately lead to an adequate solution. But the problem is not one of technical fixes; rather, it is one of predicting almost perfectly the history of human societies for the next several millenia and hundreds of millenia. Any reasonable person would use common sense in appraising the promises of the latest vintage of super crystal ball gazers.

Finally, the nuclear power proponents end up with the argument that society must accept this monstrous risk because "there is no alternative". It so happens that a considerable body of scientific and engineering opinion holds that such alternatives as solar energy are both technically and economically feasible, particularly when coupled with even rudimentary measures of energy conservation, to solve our energy requirements.

If reasonableness is desired by the proponents of nuclear power, it must start with them. They have mounted an unconscionable propaganda campaign to ridicule alternative sources of energy and to prevent a full,

open objective evaluation of both the feasibility of the technologies and of the economics aspects. Such an objective evaluation is urgently required and must be achieved. But the situation is not so urgent that we must accept nuclear power first. By no means.

It is clear that the nuclear option represents the last gasp of a hopeless world. The proponents of nuclear power recognize this, but they hope for a miraculous technical fix that can abolish the realities of human history.

Far better for the opponents and proponents to set aside the nuclear controversy through a total moratorium on nuclear power for now. All the efforts should then be expended in a serious evaluation of alternative energy sources with prospects brighter than a contaminated planet. There will be plenty of time to choose a horrible alternative later, but I doubt extremely seriously this will be necessary.

11/8/74

APRIL 24, 1975

STATEMENT IN REGARD TO A.J.R. 15

IN GOVERNMENT AFFAIRS COMMITTEE

My name is Elmo J. DeRicco, Director of the Department of Conservation and Natural Resources.

I should like to point out that the Radioactive Materials Storage Advisory Committee did not function within the framework of the Department of Conservation and Natural Resources. It was an independent Committee appointed by the Governor. The Department provided some supporting services, and the Assistant Director, Norman Hall, served as a member, and as its Secretary. He is present if you need additional information.

The First Reprint of A.J.R. 15 includes the recommendations of the Committee.

The Committee recommended that Nevada should continue to be considered as a site for the nuclear waste storage, with the conditions as enumerated in the resolved portion of A.J.R. 15.

I urge your favorable consideration of A.J.R. 15.

For the record, I am submitting copies of the report prepared by the Radioactive Materials Storage Advisory Committee.

UNIVERSITY OF NEVADA SYSTEM

University of Nevada Reno • University of Nevada Las Vegas • Desert Research Institute • Community College Division

NEIL D. HUMPHREY
Chancellor

October 23, 1974

The Honorable Mike O'Callaghan
Governor
State of Nevada
Carson City, Nevada

Dear Governor O'Callaghan:

Report of Nevada Radioactive Materials
Storage Advisory Committee

An error was made in the Committee's report and a clause was omitted which had been agreed to by the Committee. Section 4, Item 6, on page 6, should be amended by the addition of the following wording in the third line from the end of the paragraph:

"...that a seismic hazards study be made, involving the same degree of conservatism as the AEC's 'Seismic and Geologic Siting Criteria for Nuclear Power Plants';..." Paragraph 6 would then read as shown on the enclosed.

I regret that this error was made in the final compilation of the Committee's report.

Very truly yours,

Neil D. Humphrey

Neil D. Humphrey
Chancellor

NDH:ja
Enclosure
cc: ✓ Members of Nevada Radioactive Materials
Storage Advisory Committee

405 Marsh Avenue • Reno, Nevada 89502 • (702) 784-4901

6. If the AEC tentatively selects the Nevada site, the Committee strongly recommends that the Governor take advantage of Dr. Pittman's suggestion that a technical committee be appointed and funded to work with the AEC in development of the site-specific draft environmental impact statement, and to carry out the long-term commitments expressed in the Governor's commission to the present ad hoc Committee. For example, this technical committee should see to it that all of the regulations and handling of waste be accomplished according to the agreement, standards and descriptions as presented in the Atomic Energy Commission's environmental impact statement; that certain specific physical requirements be mutually agreed upon which are not now clearly stated in the draft environmental impact statement, such as that the storage site should be in an enclosed topographic and geologic basin; that specific possible biological effects be carefully studies, especially the possibility of concentration of radioactive materials in the plant-animal chain; that a seismic hazards study be made, involving the same degree of conservatism as the AEC's "Seismic and Geologic Siting Criteria for Nuclear Power Plants"; and, in general, that the risk to the health and safety of the public be reduced to the smallest satisfactory amount.

October 18, 1974

The Honorable Mike O'Callaghan
Governor of Nevada
State Capitol
Carson City, Nevada 89701

Dear Governor O'Callaghan:

The report of the Nevada Radioactive Materials Storage Advisory Committee is enclosed and is respectfully submitted to you on behalf of the Committee.

The Committee instructed me also to inform you that each member of the Committee has reviewed and evaluated the AEC environmental impact statement regarding the storage of commercial high level and transuranium-contaminated radioactive waste, and their personal comments are included in the addendum to the report. The Committee also noted that it was recognized that there were many alternatives which should have been more fully discussed in the final impact statement; however, in view of the short period of time available for review and evaluation, neither the Committee nor its individual members could deal with all of these alternatives.

The Committee thanks you for this opportunity to be of service to the State. Unless further directed by you, we assume that we have completed the assignment you gave us and that we are, therefore, discharged.

Cordially,

Neil D. Humphrey

Neil D. Humphrey
Chairman

NDH:bjs
Enclosure

REPORT OF NEVADA RADIOACTIVE MATERIALS STORAGE ADVISORY COMMITTEE

Section I - Committee's Charge

The Nevada Radioactive Materials Storage Advisory Committee was appointed by Governor Mike O'Callaghan on September 20, 1974.

The Governor's Executive Order cited the Committee's purpose and responsibilities as follows:

1. To review and evaluate the Atomic Energy Commission's Environmental Impact Statement[1] regarding the storage of high-level radioactive materials.
2. To ensure that the Atomic Energy Commission adequately advises the public of its proposal and disseminates relevant information pertaining thereto.
3. To elicit and encourage maximum public comment on the proposal.
4. To request any and all additional information from the Atomic Energy Commission pertaining to the environmental consequences of storing high-level radioactive waste material in the manner and location proposed.
5. To appear at and participate in hearings, conferences and meetings conducted by the Atomic Energy Commission or other agencies, institutions or entities investigating the environmental consequences of storing

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[1] U.S., Atomic Energy Commission, Management of Commercial High Level and Transuranium-Contaminated Radioactive Waste, Draft Environmental Statement, No. WASH-1539 ([Washington]: n.n., September, 1974).

radioactive material.

6. To conduct those public meetings necessary to properly evaluate the environmental ramifications of using the Nevada Test Site as a repository for high-level radioactive material.

7. To prepare a summary of the Committee's findings, conclusions and recommendations relating to the aforesaid project and submit that summary to the Governor no later than October 21, 1974.

Section II - Organization

The Committee is composed of the following members:

Dr. Neil D. Humphrey, Chairman
Chancellor
University of Nevada System
405 Marsh Avenue
Reno, Nevada 89502

Mr. Norman Glaser, Vice Chairman
State Environmental Commission
Box 1
Halleck, Nevada 89824

Senator Richard Blakemore
P. O. Box 672
Tonopah, Nevada 89049

Dr. H. E. Grier
Senior Vice President
EG&G, Inc.
P. O. Box 15090
Las Vegas, Nevada 89114

Mr. Harley E. Harmon
P. O. Box 990
Las Vegas, Nevada 89101

Mr. Hank Tester
KLVX-TV
5700 Mountain Vista
Las Vegas, Nevada 89120

Mrs. Daisy Talvitie
1421 Dorothy Avenue, #2
Las Vegas, Nevada 89109

Dr. James Deacon
Biology Professor
University of Nevada, Las Vegas
Las Vegas, Nevada 89109

Dr. Alan Ryall
Seismologist
Mackay School of Mines
University of Nevada, Reno
Reno, Nevada 89507

Dr. George B. Maxey
Director
Center for Water Resources Research
Desert Research Institute
Reno, Nevada 89507

Mr. Harry Wald
Caesar's Palace
3570 Las Vegas Boulevard South
Las Vegas, Nevada 89109

Dr. A. T. Whatley
Executive Director
Western Interstate Nuclear Board
P. O. Box 15038
Lakewood, Colorado 80215

Mr. Jack Parvin
District Engineer
Nevada Highway Department
P. O. Box 170
Las Vegas, Nevada 89101

Mr. Dick Thomas
Teamsters Local No. 995
P. O. Box 1870
Las Vegas, Nevada 89101

Mr. H. M. Byars
Byars Construction Company
P. O. Box 748
Reno, Nevada 89504

Mr. Norman Hall, Assistant Director
Department of Conservation and
Natural Resources, Room 213
201 South Fall Street
Carson City, Nevada 89701

Mr. Roger Trounday, Director
State Department of Human Resources
308 North Curry, Room 203
Carson City, Nevada 89701

Mr. Noel Clark, Chairman
Public Service Commission
222 East Washington Street
Carson City, Nevada 89701

Section III - Committee's Activities

1. A meeting was held October 1, 1974, in Las Vegas, which all members attended. Dr. Frank Pittman, Director of the Division of Waste Management and Transportation, Atomic Energy Commission, Washington, D. C., reviewed with the use of slides the environmental impact statement entitled Management of Commercial High Level and Transuranium-Contaminated Radioactive Waste (WASH-1539).

Following an extensive discussion, Chairman Humphrey appointed a subcommittee to prepare a preliminary draft of a report, and urged all members of the Committee to submit their statements to the subcommittee to be incorporated in the preliminary draft. This subcommittee was composed of Norman Hall, Chairman, Dr. James Deacon, Dr. H. E. Grier, and Dr. George B. Maxey.

2. The subcommittee met on October 7, 1974, in Las Vegas, with all members present.

3. On October 8, 1974, the Committee toured the proposed area at the Nevada Test Site.

4. Public hearings were held in both Las Vegas and Reno, conducted by a hearing officer and court reporter to receive comments from the public, during the hours of 4:00 to 8:00 p.m. on October 11.

5. The Committee met October 17, 1974, in Las Vegas.

6. The media were notified of all meetings of the Committee.

Section IV - Summary of Opinions of Committee Members

The comments of Committee members who wished to present individual statements are attached hereto, and while there is a healthy diversity of opinion, several salient points emerged.

1. The Committee members feel the present conceptual impact statement presents insufficient data to recommend positively either against or for the acceptance of the project in Nevada before the site-specific draft environmental statement is prepared, debated, and understood by the general public. However, the feeling is that we should encourage the Atomic Energy Commission to continue to consider Nevada as a possible storage site in their deliberations.

There is a strong feeling that an agreement between the State and Federal governments outlining the exact responsibilities of each should be negotiated if the Nevada Test Site

is chosen and that the State should do sufficient investigation and monitoring to ensure that over the long period of time envisioned, the necessary safeguards are implemented and continue, both as to storage and transportation. It is believed that the Governor of Nevada should have veto power over the location of a storage site and that the Atomic Energy Commission should agree that if further evaluation of the proposed site shows it to be unacceptable to the State of Nevada the AEC will not seek to use it for storage purposes.

2. The Committee feels that if the water-shield concept is to be used, Nevada should not be considered. The commitment of the State's precious water resources to a project where equivalent air-cooled alternatives exist is not warranted.

3. From the presentations made to the Committee, the consensus is that the simplicity and apparent safety of the sealed-cask system is to be preferred since the Site has more than adequate land for this type of installation.

4. The limited transportation network in Nevada makes it imperative that secure and safe transportation be a prime consideration from the beginning of the project, and the provision for a railroad should be implemented before waste operations start.

5. While there is general public acceptance of the AEC's activities at the Nevada Test Site that present radiation problems, the further use of the Site as a storage area must

be undertaken only after an extensive and timely series of 1972 public disclosures and meetings, concurrent with the development of the final environmental impact statement.

6. If the AEC tentatively selects the Nevada site, the Committee strongly recommends that the Governor take advantage of Dr. Pittman's suggestion that a technical committee be appointed and funded to work with the AEC in development of the site-specific draft environmental impact statement, and to carry out the long-term commitments expressed in the Governor's commission to the present ad hoc Committee. For example, this technical committee should see to it that all of the regulations and handling of waste be accomplished according to the agreement, standards and descriptions as presented in the Atomic Energy Commission's environmental impact statement; that certain specific physical requirements be mutually agreed upon which are not now clearly stated in the draft environmental impact statement, such as that the storage site should be in an enclosed topographic and geologic basin; that specific possible biological effects be carefully studied, especially the possibility of concentration of radioactive materials in the plant-animal chain; that a seismic hazards study be made; and, in general, that the risk to the health and safety of the public be reduced to the smallest satisfactory amount.

Section V - Recommendations to the Governor

1. Nevada should continue to be considered as a site for

the waste storage project if

a. air cooling is utilized;

b. rail transportation to the site is established;

c. State and local entities can cooperate in and contribute to the development of the AEC's site-specific environmental impact statement;

d. it can be demonstrated that adequate radiation safeguards for storage and transportation can be developed and implemented.

2. The Governor should establish a funded technical advisory committee, the committee to include at least two members of the general public, to provide Nevada's input to and evaluation of the Atomic Energy Commission's site-specific environmental impact statement.

Respectfully submitted,

Neil D. Humphrey

Neil D. Humphrey
Committee Chairman

Addendum

A. Statements of Committee members

1. Dr. H. E. Grier
2. Mr. Hank Tester
3. Mrs. Daisy Talvitie
4. Dr. James Deacon
5. Dr. Alan Ryall
6. Dr. George B. Maxey
7. Dr. A. T. Whatley
8. Mr. Jack Parvin
9. Mr. H. M. Byars
10. Mr. Norman Hall
11. Mr. Roger Trounday

B. Statements of the public

1. Transcript of public hearing held October 11, 1974, in Las Vegas.

2. Transcript of public hearing held October 11, 1974, in Reno.

3. Letter from Neil B. Jensen, County Clerk, on behalf of the Board of County Commissioners, White Pine County.

4. Letter from Mr. Nick Orphan, City Clerk, on behalf of the City Council of Ely.

5. Letter from Dr. Joseph A. Warburton, Chairman, Radiological Safety Board, University of Nevada System.

6. Letter from Dr. Richard H. Brooks, Department of Anthropology, University of Nevada, Las Vegas.

7. Letter from Dr. Andrew C. Tuttle, Department of Political Science, University of Nevada, Las Vegas.

8. Letter from Mr. Lewis Scott, Instructor in Radiologic Technology, Western Nevada Community College.

9. Letter from Mr. Larry Franks, Radiological Safety Officer, University of Nevada System.

10. Letter from Dr. David L. Conroy, Department of Philosophy, University of Nevada, Reno.

11. Letter from Mrs. Jeanne Hewitt.

12. Letter from Mr. Andrew V. Anderson.

13. Letter from Mr. Bill Fiero.

14. Letter from Dr. Thomas P. O'Farrell, Laboratory of Desert Biology, Desert Research Institute.

15. Letter from Dr. David Dickinson, Electrical Engineering Department, University of Nevada, Reno.

16. Letter from Mrs. Charles H. Pearson.

17. Letter from Mr. Paul R. Duckworth.

18. Letter from Dr. Terry Lash and Mr. John E. Bryson of the Natural Resources Defense Council.

19. Letter from Mr. J. E. Washum.

20. Letter from Mr. Jerry Chernik.

21. Letter from Amy Bargiel.

22. Comments of Frank Young, Interstate Nuclear Board.

23. Letter from Mrs. Elizabeth A. Riseden.

24. Letter from Mrs. Karen Ernst.

25. Letter from Mrs. Vivian Graham.

26. Letter from Mr. and Mrs. Clarence Johnson.

27. Letter from Patricia van Betten, with enclosures.

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
WASHINGTON, D.C. 20545

AJR-1296

May 5, 1975

1654

Mrs. Susan Orr
620 Franktown Road
Carson City, Nevada 89701

Dear Mrs. Orr:

This is the confirmation of our telephone conversation that you requested. Please remember my words of caution in regard to the accuracy or officialness of my knowledge. I am really providing you with the information I am using as the basis for planning waste management projects. I will say, however, that I go to a considerable amount of trouble to get the best information available to me. This, of course, does not allow me to predict shifts in priority at higher levels of management or in the executive and legislative branches of the Government; neither does it allow me to predict actions to be taken by the Nuclear Regulatory Commission (NRC).

The only thing I am absolutely positive of is that the request for authorization for the construction of the Retrievable Surface Storage Facility (RSSF) has been withdrawn because we have withdrawn our environmental statement supporting the funding authorization (WASH-1539). This latter action was taken in response to comments by the Environmental Protection Agency (EPA) and the Natural Resources Defense Council (NRDC), which said that the scope of the environmental statement was too narrow. The decision to withdraw the environmental statement rather than to resist the pressures applied by these comments was in part based on a lack of a firm need for the facility at this time. There is no high-level waste to be shipped to ERDA in the near future; and I will discuss this later. In planning for the rewrite of the increased scope environmental impact statement and considering the complexities of the scope and the numbers of organizations involved, we are arriving at the conclusion that the entire process, including hearings, is more likely to delay us two years rather than one year.

We are, however, continuing with the design and analysis program of the RSSF which was begun in 1972. Because of the deliberate pace of the project, the design has progressed about as far as it can. We will continue analyses, particularly of unusual safety-related events like sabotage. A major effort will be the demonstration of electrically heated sealed storage cask units which are instrumented

to confirm the transfer calculations. We will do a demonstration with heat-producing radioactive material. We will continue site suitability studies, including gathering environmental data in Nevada, as well as at the other sites. We will have specific sites in all three locations inspected by NRC for an evaluation of their licensability.

I mentioned that we did not expect to receive high-level waste in the near future. Obviously, NRC is the best source of information on what it will do. However, the following is the information, or misinformation, on which I am basing our planning for waste management facilities. I understand that no licensing actions on any nuclear reprocessing plants will be taken until the issues associated with the generic environmental statement on the mixed-oxide fuel cycle are resolved. One issue which is helping to hold it up is that of safeguarding the plutonium, which will be separated in the reprocessing plant and used in the mixed-oxide fuel cycle. My personal guess is that it will be two years before any construction for a waste solidification facility at a reprocessing plant will be permitted. Design and construction of such a facility will take five years. With these assumptions, no commercial high-level waste will be solidified until 1981 or 1982. The reprocessors are then allowed to store the waste on site for another five years and waste storage/disposal, design and cost features will make it economical for them to do so. The funding, design and construction interval for the RSSF is about five years. Therefore, if it weren't for pressures from people who oppose nuclear power on the basis that we don't know what to do with the waste, we could possibly wait until the FY 1981 budget to request construction authorization.

However, just in case things don't go as we have guessed, we are about to begin evaluations of the suitability of existing facilities for short-term storage. The E-MAD Building at the Nevada Test Site (NTS) seems to be ideal for this purpose. Facilities in Idaho and Washington also should have the required capability to store waste for the five years required to produce the RSSF.

There is another ironic factor operating. High-level waste has been of intense interest for the past five years. As a result, several research and development programs are far enough advanced to require actual waste. (We will be forced to use simulated waste for our own radioactive sealed storage cask demonstration.) So, people will be standing in line to get the first few hundred canisters of this valuable research material. In addition, by 1985 or so we may well be looking for a thousand or more canisters for one or more geologic pilot plants.

In our phone conversation, I also mentioned that Nevada had been considered for storage of the transuranic-contaminated waste (plutonium) covered in the environmental impact statement (WASH-1539). In my opinion, the decision on whether to require industry to ship such waste is also entangled in the two-year delay involved with increasing the scope of the environmental impact statement. I understand that EPA and NRDC are pressing to have the waste shipped to us, but I don't think they will get very far with that since they were the very people who forced us to withdraw the environmental impact statement and delay the actions contained therein. There is no real time involved in construction of temporary storage pads, and the waste generator is allowed to store on site for five years, so no preparations are required. At any rate, no significant quantities are likely to be shipped before 1982 (two years to untangle the environmental impact statement plus five years on-site storage). More importantly, the bulk of this waste is generated in reprocessing plants so perhaps we are really talking 1981 plus five years for that source. There is some low-level waste presently generated in nuclear fuel fabrication plants which would be shipped in 1982. This quantity is so low, however, that a new operation in Nevada would be hard to justify.

I hope you will forgive me for not wishing you luck. Frankly, it would be nice to have somebody say they wanted us. A lot of planning, study, and field testing goes into site selection. It would be nice to have the threat of State political difficulties removed so we could concentrate all our efforts on the technical issues.

Sincerely,

Owen P. Gormley, Chief
Engineering Branch
Division of Waste Management
and Transportation

S E N A T E

AGENDA FOR COMMITTEE ON GOVERNMENT AFFAIRS

DATE THURSDAY April 8, 1975 TIME Approx. 2:45 PM ROOM 345

BILLS OR RESOLUTIONS TO BE CONSIDERED		COUNSEL REQUESTED
S. B. 357	SUMMARY—Authorizes the City of Reno to issue tax increment securities which may be also payable from other tax proceeds and other revenues and provides other provision concerning the foregoing. Fiscal Note: No. (BDR S-1318) Notify: City of Reno	
S. B. 595	SUMMARY—Permits certain counties to exercise control over health aspects of subdivisions in certain instances. Fiscal Note: No. (BDR 22-1754) Notify: Sen. Bryan, Ernie Gregory & Clark Count	
S. B. 597	SUMMARY—Rectifies inequity in computation of longevity pay for Carson City supervisors. Fiscal Note: No. (BDR 20-2039) Notify: Sen. Sheerin	
A. B. 498	SUMMARY—Creates Washoe County Airport Authority. Fiscal Note: No. (BDR S-1300) Notify: Al Wittenberg, City of Reno Washoe County	
A. B. 543	SUMMARY—Permits local governments to provide additional disability benefits for law enforcement officers and firemen. Fiscal Note: No. (BDR 20-1149) Notify: Firefighters, Bob Kerns Bob Warren Bob Broadbent	
A. J. R. 15	SUMMARY—Urges the Energy Research and Development Administration to choose the Nevada Test Site for disposal of nuclear wastes and for solar energy research under the Solar Energy Research, Development and Demonstration Act of 1974. (BDR 1030) FOR COMMITTEE ACTION - NOT A HEARING	
A. B. 526	SUMMARY—Limits possibility of consolidation of North Las Vegas. Fiscal Note: No. (BDR S-1501) Notify: Assemblyman Price	
A. B. 587	SUMMARY—Entitles employees under state personnel system to obtain payment for portion of unused sick leave upon retirement. Fiscal Note: No. (BDR 23-1442) FOR COMMITTEE ACTION - NOT A HEARING	
A. B. 578	SUMMARY—Limits application of veterans' preference points under the state personnel system. Fiscal Note: No. (BDR 23-1617) SAME AS ABOVE	
A. B. 56	SUMMARY—Authorizes local governments to inspect factory-built housing and manufactured buildings. Fiscal Note: No. (BDR 40-428) SAME AS ABOVE	

Over

AB-453 Places control of certain county hospitals in board of county commissioners and creates hospital advisory board. (BDR 40-1299)

Richard Bunker, representing the Board of County Commissioners and Clark County, indicated that they were in favor of this bill. This bill turns over the total control of the hospital to the County Commissioners with the option in line 4 of page 1 to appoint an advisory board of five members.

Chairman Gibson read an amendment to this bill and indicated that the Legislative Counsel Bureau felt that the amendment was constitutional.

Motion of "amend and Do Pass" by Senator Schofield, seconded by Senator Hilbrecht. Motion carried unanimously.

AB-56 Authorizes local governments to inspect factory-built housing and manufactured buildings. (BDR 40-428)

Senator Dodge suggested leaving this bill in its original language in Section 3 and add new language, creating Section 4. The committee decided on the following for Section 4 "provided that they give notification directly to the Department of Commerce." With this new language it was felt that subsection 3 could be deleted.

Motion of "amend and Do Pass" by Senator Dodge, seconded by Senator Gojack. Motion carried unanimously.

Senator Dodge would be responsible for the amendments to AB-56.

AJR-15 Urges the Energy Research and Development Administration to choose the Nevada Test Site for disposal of nuclear wastes and for solar energy research under the Solar Energy Research, Development and Demonstration Act of 1974. (BDR 1030)

The committee felt that action on this bill should be postponed until all committee members were present.

AB-526 Limits possibility of consolidation of North Las Vegas. (BDR S-1501)

Motion to "Indefinitely Postpone" by Senator Hilbrecht, seconded by Senator Schofield. Voting as follows: Yea's - Senator Gibson, Sen. Dodge, Senator Schofield, Senator Hilbrecht, Senator Gojack. Na's, Senator Walker, Senator Foote. Motion carried.

AB-587 Entitles employees under state personnel system to obtain payment for portion of unused sick leave upon retirement. (BDR 23-1442)

The committee discussed AJR-15 and the following comments were made:

Senator Dodge felt that we should explore the nuclear waste storage aspect along with the solar energy field if the federal government favors this. Senator Dodge feels that we must explore all avenues of energy.

Senator Gojack indicated that it was her opinion that further study should be done before acting on this piece of legislation. She passed out a letter sent to her from Susan Orr of Foresta Institute. (see the attached)

Senator Hilbrecht thought that the bill would be more favorable if the Governor's intervening action was placed back into AJR-15.

Assemblyman Hickey agreed with Senator Hilbrecht's suggestion although he indicated that even if this was not in the bill the Governor still had the authority to intervene.

Motion to "Amend and Do Pass" by Senator Schofield, seconded by Senator Hilbrecht. Motion carried - Voting went as follows: Yea's Senators Gibson, Walker, Dodge, Hilbrecht, and Schofield. Na's Senators Gojack and Foote.

As there was no further business, meeting adjourned at 7:00 p.m.

Respectfully submitted,

Janice M. Peck
Committee Secretary

Approved:

Chairman

Amend the title of the bill, line 1, by deleting "requiring", and inserting: "authorizing".

Senator Blakemore moved the adoption of the amendment.

Remarks by Senator Blakemore.

Amendment adopted.

Bill ordered reprinted, re-engrossed and to third reading.

Assembly Bill No. 724.

Bill read second time.

The following amendment was proposed by the Committee on Health, Welfare and State Institutions:

Amendment No. 9005.

Amend the bill as a whole by inserting a new section, to be designated as section 2, following section 1, to read:

"Sec. 2. NRS 634A.220 is hereby repealed."

Amend the bill as a whole by renumbering section 2 as section 3.

Amend the title of the bill, line 2, by deleting "and".

Amend the title of the bill, line 3, by deleting the period and inserting: "; repealing requirement for Food and Drug Administration approval of herbal medication prescribed; and providing other matters properly relating thereto."

Senator Walker moved the adoption of the amendment.

Amendment adopted.

Bill ordered reprinted, re-engrossed and to third reading.

Senate Joint Resolution No. 38.

Resolution read second time, ordered engrossed and to third reading.

Assembly Joint Resolution No. 15.

Resolution read second time.

The following amendment was proposed by the Committee on Government Affairs:

Amendment No. 9043.

Amend the resolution, page 2, by deleting line 26 and inserting:

"5. Public hearings are held in at least four counties in the state prior to choosing a specific site for the facility; and be it further".

Senator Gibson moved the adoption of the amendment.

Remarks by Senators Gibson, Neal, Gojack and Bryan.

Amendment adopted.

Bill ordered reprinted, re-engrossed and to third reading.

INTRODUCTION, FIRST READING, AND REFERENCE

By the Committee on Government Affairs:

Senate Bill No. 615—An Act relating to county officers and employees; providing an exception to the limitation on salaries of county employees employed by or working under election county officers; and providing other matters properly relating thereto.

Senator Gibson moved that the bill be referred to the Committee on Government Affairs.

Motion carried.

250A

(REPRINTED WITH ADOPTED AMENDMENTS)
SECOND REPRINT **A. J. R. 15**

ASSEMBLY JOINT RESOLUTION NO. 15—ASSEMBLYMEN MANN, ROBINSON, PRICE, HICKEY, MAY, GETTO, JACOBSEN, HAYES, MOODY, CHANEY, SCHOFIELD, BENKOVICH, DREYER, HOWARD, HEANEY, BENNETT, CHRISTENSEN, JEFFREY, VERGIELS, SENA AND BROOKMAN

FEBRUARY 26, 1975

Referred to Concurrent Committees on Environment and Public Resources and Commerce

SUMMARY—Urges the Energy Research and Development Administration to choose the Nevada Test Site for disposal of nuclear wastes and for solar energy research under the Solar Energy Research, Development and Demonstration Act of 1974. (BDR 1030)

EXPLANATION—Matter in *italics* is new; matter in brackets [ ] is material to be omitted.

ASSEMBLY JOINT RESOLUTION—Urging the Energy Research and Development Administration to choose the Nevada Test Site for the storage and processing of nuclear material and for solar energy research under the Solar Energy Research, Development and Demonstration Act of 1974.

WHEREAS, The now supplanted Atomic Energy Commission has, over the years, demonstrated an outstanding concern for nuclear safety and has compiled, at the Nevada Test Site, an equally outstanding safety record; and

WHEREAS, The people of Southern Nevada have confidence in the safety record of the Nevada Test Site and in the ability of the staff of the site to maintain safety in the handling of nuclear materials; and

WHEREAS, The unemployment rate in Clark County, Nevada, is 20.7 percent higher than the disturbingly high national unemployment rate; and

WHEREAS, The people and the leaders in many states being considered as sites for the storage and processing of nuclear material have serious anxieties and doubts about providing storage and processing sites; and

WHEREAS, The existing facilities and the years of expertise in nuclear material handling at the Nevada Test Site are a tremendous existing resource; and

WHEREAS, Southern Nevada also offers an excellent environment in which to explore the potential of solar energy; and

WHEREAS, National energy independence and a clean environment are dependent upon tapping nonfossil fuel sources of energy for heating, cooling and electricity; and

WHEREAS, The existing facilities of the Nevada Test Site and its support infrastructure are available and well suited to scientific research in addition to nuclear projects; and

WHEREAS, The storage and processing of nuclear material, and solar energy research can both be carried out at the Nevada Test Site with minimal capital investment relative to other locations; now, therefore, be it

Resolved by the Assembly and the Senate of the State of Nevada, jointly, That the legislature of the State of Nevada strongly urges the Energy Research and Development Administration to choose the Nevada Test Site for the storage and processing of nuclear material provided that there is an acceptance by the Energy Research and Development Administration of the following conditions:

1. Air cooling is used at the storage facility;
2. Rail transportation avoiding the Las Vegas metropolitan area is established to the site;
3. Appropriate state agencies and local governments can cooperate in, and contribute to, the development of the Energy Research and Development Administration's site-specific environmental impact statement;
4. It is satisfactorily demonstrated that adequate radiation safeguards for storage and transportation can be developed and will be implemented;
5. Public hearings are held in at least four counties in the state prior to choosing a specific site for the facility; and be it further

Resolved, That under the provisions of the Solar Energy Research, Development and Demonstration Act of 1974 the Energy Research and Development Administration utilize the extensive resources and facilities of the Nevada Test Site to explore the potential uses of solar energy; and be it further

Resolved, That copies of this resolution be prepared and transmitted by the legislative counsel to the administrator of the Energy Research and Development Administration, to the assistant administrators for nuclear energy and for solar, geothermal and advanced energy systems and to all members of Nevada's congressional delegation; and be it further

Resolved, That this act shall become effective upon passage and approval.

⊛

Roll call on Assembly Bill No. 724:

YEAS—17.
NAYS—None.
Absent—Close, Gojack, Herr—3.

Assembly Bill No. 724 having received a constitutional majority, Mr. President declared it passed, as amended.

Bill ordered transmitted to the Assembly.

Assembly Bill No. 737.

Bill read third time.

Roll call on Assembly Bill No. 737:

YEAS—17.
NAYS—None.
Absent—Close, Gojack, Herr—3.

Assembly Bill No. 737 having received a constitutional majority, Mr. President declared it passed, as amended.

Bill ordered transmitted to the Assembly.

Assembly Bill No. 753.

Bill read third time.

Roll call on Assembly Bill No. 753:

YEAS—17.
NAYS—None.
Absent—Close, Gojack, Herr—3.

Assembly Bill No. 753 having received a constitutional majority, Mr. President declared it passed, as amended.

Bill ordered transmitted to the Assembly.

Assembly Joint Resolution No. 15.

Resolution read third time.

Remarks by Senators Wilson, Gibson, Neal, Gojack, Sheerin, Hilbrecht and Blakemore.

Senator Gojack requested the following statement be entered in the Journal:

In studying the testimony and materials presented at the committee hearings on A.J.R. 15, I find that I oppose the resolution as it is now written, and oppose the idea of extensive radioactive waste storage in Nevada.

The proposed joint resolution is based on short range points of view and depends on facts that are in error or are subject to other interpretation. With this resolution, Nevada is inviting the use of its land as the sole respository for most of the world's radioactive waste, and encouraging our nation and others to try to meet future energy demands in a way that is likely to produce horrible consequences.

The idea for commercially generated radioactive wastes to be stored in Idaho, Washington or Nevada was developed in the AEC (now ERDA) draft environmental impact statement on the "Management of Commercial High-Level and Transuranium Contaminated Radioactive Waste, commonly referred to as WASH 1539. High-Level Wastes are predominantly Strontium 90, Iodine 131 and Cesium 137." They are hard-to-shield, penetrating radioactive materials which remain potent for 900 to 1,000 years. Transuranic wastes are radioactive materials including, and heavier than, uranium. They include Plutonium, a man-made substance which remains potent for 250,000 years. Plutonium is a basic ingredient in atomic bombs; a material that even in minute quantities can cause death from ingestation, inhalation or absorption through the skin.

A decision which makes an irretrievable commitment for 250,000 years demands careful and rational judgments made by well informed people. The rushed testimony I heard didn't begin to answer many vital questions of budget, safety, technology or suitability of the Nevada Test Site for surface storage of nuclear wastes. If for no other reason, the need for caution should defeat this resolution. There is no need or justification for it at this time.

There are, in fact, many other reasons why I oppose A.J.R. 15. Foremost is my response to the cruel hoax I feel the resolution represents.

A.J.R. 15 suggests that jobs and money will be on the way to rescue Southern Nevada's *current* economic distress. The fact is, that no money will be forthcoming for this project for several years even if the plan is accepted. Robert Seamans, Director of ERDA, has withdrawn all waste storage budget authorization requests for fiscal year 1976, pending release of the final impact study, which is not expected to be completed for more than a year. Dave Jackson, Public Information Director for the Las Vegas ERDA operations office, said last week that there would not even be a cost analysis "for several years," meaning no detailed budget, no authorization requests, no money allocated. The $1.5 billion that Assemblyman Mann and others have been referring to comes from the *original* impact statement prepared by the AEC and may be invalid when the final statement is released in 1976 or 1977. Even were it valid, it pertains to the whole storage process for 140 years! That we have all been vulnerable to the promise of money is clear; three committees have passed this resolution without seriously questioning how real the $1.5 billion figure is or how soon the funds would be available.

The radioactive wastes in question don't yet exist, and it will be 1985, before any that are produced will be ready for shipment to a storage facility * * * this means that the promised jobs, as well as the promised money, are a long way off and won't meet today's economic crisis in Southern Nevada.

Our committees have been reassured by the proponents of the resolution that the geology and hydrology of the Nevada Test Site are well known and suited to both nuclear waste storage and disposal. But ERDA has withdrawn the environmental impact statement because they weren't ready to make that determination, the Governor's office is now involved with ERDA and the U.S. Geological Survey in evaluating the existing studies of the Nevada Test Site to see what they have and what more they need to know in order to determine how suitable the Nevada Test Site *is* for a surface storage facility. It was brought out in testimony in our committee that there are volcanic weak spots in the vicinity of the Nevada Test Site that make it a very unstable area, that earthquakes are a near-certain future occurrence, and that Nevada is one of the most seismologically and geologically active areas in the country. It was also brought out, too late for most committee members to hear, that even the air cooled storage casks will require 70,000,000 gallons[1] of water per year for the life of the facility. Can Southern Nevada commit such incredible quantities of water for an indefinite time? To me, these facts challenge the credibility of the A.J.R. 15 proponents' testimony and enthusiasm.

The resolution cites the excellent record of the AEC in Nevada as evidence that ERDA can be trusted with safe handling of radioactive wastes. I would urge you to consider, however, that the greatly increased quantities of radioactive materials which would be brought through the State for storage greatly increase the potential for accident and hazard. Predictions are for 60 million gallons of wastes, or 75,000 cannisters, by the year 2000, four times that by 2020. These vast quantities of such incredibly potent materials must be safe-guarded against *any* accident, faulty design, human error, moment of frustation or distraction, that could cause faulty construction of any single, small part of this operation, budget cuts, natural acts of destruction, changes in social systems, for longer than humanity has existed. The AEC safety record in terms of hazard of the studies of nuclear weapons effects deals with events that required surveillance only for short periods of time, but waste storage demands constant surveillance forever. The transportation and storage of radioactive waste are particularly open to accidents and highjacking. ERDA's national safety record presents credibility problems. The GAO reported this winter that 9,000 pounds of plutonium and uranium were unaccounted for, some believed to be lost in the "crude statistical methods used to keep track of the material." We've all heard of the continuing experience with spills of radioactive waste materials—now totaling over 500,000 gallons, at Hanford, Washington—an experience that should have brought about concentrated cautionary efforts, but another leak was reported in the press just last week.

Last year the AEC's Rasmussen report defined the probability of various nuclear

[1]WASH 1539 1.3–3.

power plant accidents ever happening. One, predicted to occur once in a trillion years, actually occurred last month at the Barnwell, South Carolina, power plant.

I simply do not understand the rationality of "urging" nuclear waste storage in Nevada when there is so much potential for human harm and so little solid information and experience to rely on. I think we have to be very aware, as Professor Sill warned in testimony to our committee, that this resolution will encourage the production and proliferation of plutonium, small amounts of which can be made into highly destructive bombs. The technology for making these bombs is readily available to any citizen that wants it—Professor Sill stated that he could make a shaped charge, at home, in an afternoon.

There was a change in language when the amendments were added to this resolution that seems to imply we are asking for more than a temporary storage facility for nuclear wastes. We are now urging the location of a facility for the "storage and processing of nuclear materials." Are we asking also for a reprocessing plant? For what? Are we opening our State's doors to even *more* atomic materials being carried around the State and endangering the lives of our people and livestock?

Idaho is concerned about a nuclear waste storage facility because people back east have expressed fears about buying contaminated trout. Shouldn't we think about the potential harm to the ranching economy in our State, as well as the tourist economy, if we get the image of a "nuclear garbage dump?"

The "maximum credible accident" factor, as forecast by ERDA does not adequately consider social systems, budgetary systems, maintenance of water supplies and electric power systems, and training of competent personnel.

By providing such vulnerable and rewarding "action points" to the terrorist, the agents of foreign powers, and to the emotionally disturbed will guarantee that sabotage, physical disruption, and blackmail will indeed come about. Willrich and Taylor,[3] discussing a related problem of theft of weapons grade fissionable material, discuss motives and opportunities of individuals and groups for the theft and manufacture of atomic bombs. Many of the same considerations apply to terrorist disruption of the later stages of the fuel cycle that would be involved in implementing A.J.R. 15.

Heilbroner[5] points out that "the possibility must then be faced that the underdeveloped nations which have 'nothing' to lose will point their nuclear pistols at the heads of * * * the (developed nations) who have everything to lose."

The growing famine in the world indicates such nuclear blackmail can be expected to try to force the United States to provide food it may not have to the starving peoples around the world.[4] The Second Report to the Club of Rome notes[6] "if development aid is to lend a truly helping hand to the hungry billions who must find a way out of their poverty, more than investment capital is needed. Unless this lesson is learned in time, there will be a thousand desperadoes terrorizing those who are 'rich,' and eventually nuclear blackmail and terror will paralyze further orderly development."

A.J.R. 15 encourages the United States to meet the projected energy demands by increasing reliance on nuclear generating facilities which sooner or later must switch from ordinary reactors using uranium 235 and go to breeder reactors which made use of the much more abundant uranium 238. This sets the stage for a regime of terror based on the widespread use of small homemade nuclear devices. The disruption and dispersal of the core material of an operating nuclear generating plant, of a fuel processing or reprocessing plant, of substantial quantities of radioactive materials being transported or of the radioactive waste stored in a waste disposal site are obvious targets.[8] The now withdrawn draft Environmental Impact Statement WASH 1539 says clearly[7] that "retrievable surface storage facilities will not be designed for continued waste confinement following the direct impact of massive or explosive missiles such as large meteorites or aircraft. Such events are of such low probability of occurrence that they are considered to be incredible."

[3]Nuclear Theft: Risks and Safeguards, by Mason Willrich and Theodore B. Taylor, a report to the Energy Policy Committee of the Ford Foundation, Ballinger, 1974, Ch. six.
[4]The Human Prospect by Robert Heilbroner, Norton, 1974, Chapter two, (page 44).
[5]Richard C. Sill, Testimony April 24, 1975.
[6]Mankind at the Turning Point, E. P. Dutton, 1974, p. 69.
[7]Willrich and Taylor, Ibid. Ch. 2. See especially p. 22.
[8]Page 3.1-33.

That homemade bombs are now feasible and may become common must now be accepted as a fact. They can be prevented from becoming common if the nation does not adopt the nuclear option which A.J.R. 15 encourages. Plans for homemade atomic bombs have already been widely circulated.[9]

Such concerns are not the exclusive property of the opponents of nuclear power. Alvin Weinberg, formerly director of the Oak Ridge National Laboratory, now director of energy research and development for the Federal Energy Administration, a long time proponent of nuclear power, says[9] a decision to select the nuclear option is the greatest single risk ever taken by mankind, one that should be accepted only after intensive public education and debate.

In particular, Dr. Weinberg states[10]:

> It is a Faustian bargain that we strike: in return for this inexhaustible energy source, which man must have if he is to maintain himself at anything like his present numbers and at his present state of affluence, we extract a commitment —especially forever—that man will exercise the vigilence and discipline necessary to keep our nuclear fires well behaved. As a nuclear technologist who has devoted his career to this quest for an infinite energy source, I believe the bargain is a good one, and that it may even be an inevitable one. It is well that the full dimension and implication of the Faustian bargain be recognized, especially by the young people who will have to live with the choices that are being made on this vital issue.

The very scale of the projected nuclear operation invites accident and deliberate disruption. In the United States, by 2000 A.D., it is expected there will be 100,000 shipments of nuclear material moving around the country each year, "Although much concern has been expressed about nuclear plant safety, the two most vulnerable points in the system may be the shipments, which could easily be highjacked for conversion to nuclear bombs or for use as a form of unpreventable blackmail of the radioactive waste storage facilities."[11]

Flangas and Gates and WASH 1539, all testify to the impervious nature of the shipping casks. There is *no indication* they would be impervious to sabotage. Use of shaped charges could breach an ordinary container readily and cheaply and hundreds of thousands of Americans know all that is necessary to know about use of shaped charges, materials for which could be purchased for a few quarters as stock items, whose across-the-counter purchase would excite no comment. One would not even need plastic explosive, so easy is the technique. *Richard Sills stated in committee that he could do it in an afternoon.*

This Legislature has no business taking premature action that will encourage the nation to take decisive and quite possible irreversible steps toward this nuclear nightmare. We have not studied the matter enough ourselves at this time.

There is considerable indication that the nuclear option for our society is not the only one. There are others which in no way carry the hazards the nuclear option does and which offer desirable and viable futures for America and Nevada. We should be studying these and encouraging the Desert Research Institute, University of Nevada, et cetera, to help us study these.

We should table?—defer?—A.J.R. 15 until next session and in the meantime support Senator Schofield's resolution on solar energy.

I call for an interim study by the Legislature of the nuclear problem in cooperation with the University of Nevada. This could take the form of a continuing series of conferences for all legislators with the University of Nevada faculty on a once a month basis, with appropriate national experts and leaders also in attendance. This series would occur over the next 18 months; with any reports due not later than November 1976.

Senator Hilbrecht requested the following remarks be entered in the Journal:

Mr. President and Members of the Senate, I too think it appropriate to enter in the record a few brief remarks, on this issue.

When I first considered this measure I had reactions to it that were not favorable.

[9]Miller, Ibid. p. 68.
[9]Miller, Ibid. p. 41.
[10]Quoted in Miller, Ibid. p. 77.
[11]Miller, Ibid. p. 40.

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I have had a number of conferences with the introducers of this measure. I have studied with some care approximately 300 pieces of material that was considered by the Assembly committee and sat in on all of the hearings held by the Senate committee on the matter. It is appropriate to direct to Senator Wilson's query the fact that in my opinion, the record will not support objections to the proposal. Whether or not the proponents of the measure were better orchestrated or better equipped, in terms of verification data than the opponents, the fact remains that by and large the opposition was a visceral reaction to placing a radioacive waste site in the State of Nevada.

In my opinion, the opponents did not carry the burden of persuasion. On the contrary, I think the proponents had by far the better of the evidence; and for that reason alone I believe I would have to support the measure on the record. Nevertheless, I was reluctant to do so without a "safety valve," and in the committee, I indicated that I would not support the measure unless a gubernatorial veto were incorporated into the measure. I understand since that time, that the Governor has declined that as being inappropriate in view of the written data that he has from ERDA indicating that in any event that would be the situation. In lieu thereof there has been created hearing procedure so that before being implemented this matter would be referred to the people in four separate areas of the State.

Even with this, I would still not support the measure if it were not for the fact that the ERDA representative testified to the committee that they would be taking no action on this matter—nor indeed would they even probably have the final Environmental Impact Report which is a condition precedent to any action on their part—prior to the next session of the Legislature. For these reasons, I will support the measure with the reservations that I have indicated.

Roll call on Assembly Joint Resolution No. 15:

YEAS—12.

NAYS—Foote, Gojack, Lamb, Raggio, Wilson, Young—6.

Absent—Close, Herr—2.

Assembly Joint Resolution No. 15 having received a constitutional majority, Mr. President declared it passed, as amended.

There being no objections, Mr. President declared the Preamble adopted.

Resolution ordered transmitted to the Assembly.

Assembly Bill No. 516.

Bill read third time.

The following amendment was proposed by the Committee on Judiciary:

Amendment No. 9066.

Amend section 2, page 1, line 5, after "*may*" by inserting: "*, with the prior approval of the prosecuting attorney,*".

Amend section 3, page 2, line 14, after "*may*" by inserting: "*, with the prior approval of the prosecuting attorney,*".

Senator Wilson moved the adoption of the amendment.

Remarks by Senator Wilson.

Amendment adopted.

Senator Wilson moved that rules be suspended, that the reprinting of Assembly Bill No. 516 be dispensed with, and that the Secretary be authorized to insert the amendment adopted by the Senate.

Motion carried unanimously.

Roll call on Assembly Bill No. 516:

YEAS—17.

NAYS—None.

Absent—Close, Herr, Walker—3.

Assembly Bill No. 516 having received a constitutional majority, Mr. President declared it passed, as amended.

Bill ordered reprinted, re-engrossed and transmitted to the Assembly.

Assembly Bill No. 664.

Bill read third time.

The following amendment was proposed by the Committee on Judiciary:

Amendment No. 9049.

Amend sec. 2, page 1, line 3, by deleting ""*Rape*" and inserting: "*As used in sections 2 to 8, inclusive, of this act, "rape*".

Amend the bill as a whole by adding a new section designated section 2.5, following section 2, to read as follows:

"Sec. 2.5. *The board of county commissioners of any county may provide by ordinance for the counseling and medical treatment of rape victims in accordance with the provisions of sections 2 to 8, inclusive, of this act.*"

Amend sec. 3, page 1, line 8, by inserting: "*, not exceeding $1,000,*" after "*treatment*" and before "*shall*".

Amend sec. 3, page 1, line 10, by deleting "*victim.*" and inserting: "*victim and if the county has an ordinance providing for the payment of such costs.*"

Amend sec. 4, page 1, by deleting line 16 and inserting:

"*2. The board may approve*".

Amend sec. 4, page 2, line 2, by deleting "*not*".

Amend sec. 5, page 2, by deleting lines 9 through 12 and inserting:

"*2. Any costs for treatment provided pursuant to this section, not exceeding $1,000, shall be paid by the county which authorized the treatment.*"

Amend sec. 6, page 2, line 13, by deleting "*may at any time,*" and inserting: "*shall*".

Amend sec. 6, page 2, line 15, after "*certify*" and inserting: "*from time to time*".

Amend sec. 8, page 2, line 30, by deleting "*5*" and inserting: "*3*".

Amend sec. 8, page 2, line 32, by deleting "*5*" and inserting: "*3*".

Amend the title of the bill to read as follows: "An Act relating to victims of rape and their spouses; authorizing counties to adopt ordinances providing counseling and medical treatment for such persons at county expense; and providing other matters properly relating thereto."

Senator Wilson moved the adoption of the amendment.

Remarks by Senator Wilson.

Amendment adopted.

Senator Wilson moved that rules be suspended, that the reprinting of Assembly Bill No. 664 be dispensed with, and that the Secretary be authorized to insert the amendment adopted by the Senate.

Motion carried unanimously.

Roll call on Assembly Bill No. 664:

YEAS—13.

NAYS—Blakemore, Dodge, Sheerin, Young—4.

Absent—Close, Herr, Walker—3.

Amend section 1, page 1, line 5, by deleting "[$23.64] *$35.20*" and inserting: "$23.64".

Amend the title of the bill to read: "An Act relating to state employee group insurance premiums; revising amounts allowable for payment by state employer; and providing other matters properly relating thereto."

Amendment No. 9106.

Amend section 1, page 1, line 4, by deleting "*$23.64*" and inserting "*$30*".

Amend section 1, page 1, by deleting line 5 and inserting: "*1975–1976,* or [$23.64 for the fiscal year 1974–1975,] *$32 for each fiscal year thereafter,*".

Amend section 1, page 1, line 12, after the period, by inserting: "*State participation in the cost of monthly premiums shall not exceed the amounts specified in this subsection.*"

Assemblyman Mello moved that the Assembly concur in the Senate amendments to Assembly Bill No. 227.

Remarks by Assemblyman Mello.

Motion carried.

Bill ordered enrolled.

Assembly Joint Resolution No. 15.

The following Senate amendment was read:

Amendment No. 9043.

Amend the resolution, page 2, by deleting line 26 and inserting:

"5. Public hearings are held in at least four counties in the state prior to choosing a specific site for the facility; and be it further".

Assemblyman Mann moved that the Assembly concur in the Senate amendment to Assembly Joint Resolution No. 15.

Remarks by Assemblymen Mann, Murphy, and Weise.

Motion carried.

Resolution ordered enrolled.

Assembly Bill No. 210.

The following Senate amendment was read:

Amendment No. 8035A.

Amend sec. 19, page 4, line 38, by deleting "$98,929.09" and inserting: "$50,000".

Amend sec. 19, page 4, line 40, by deleting "$103,601.42" and inserting "$50,000".

Assemblyman Bremner moved that the Assembly concur in the Senate amendment to Assembly Bill No. 210.

Remarks by Assemblyman Bremner.

Motion carried.

Bill ordered enrolled.

Assembly Bill No. 685.

The following Senate amendment was read:

Amendment No. 8154A.

Amend the bill as a whole by inserting a new section, to be designated as section 3, following section 2, to read:

"Sec. 3. Section 1 of Senate Bill No. 119 of the 58th session of the Nevada legislature is hereby amended to read as follows:

Senate Resolution No. 19—Senator Brown

FILE NUMBER 183

SENATE RESOLUTION—Designating certain members of the senate as members of the legislative commission in the legislative counsel bureau.

Resolved by the Senate of the State of Nevada, That pursuant to the provisions of NRS 218.660 and the joint rules of the legislature, Senators Richard H. Bryan, Melvin D. Close, Jr., Carl F. Dodge, James I. Gibson, Lee E. Walker and Thomas R. C. Wilson are designated as the regular senate members; Senator William J. Raggio is designated the alternate member for Senator Dodge; and Senators Norman Ty Hilbrecht, Richard E. Blakemore, Mary L. Gojack, Joe Neal and Gary A. Sheerin are designated as first, second, third, fourth and fifth alternate members respectively for the other members, to serve until their successors are designated.

Assembly Joint Resolution No. 15—Assemblymen Mann, Robinson, Price, Hickey, May, Getto, Jacobsen, Hayes, Moody, Chaney, Schofield, Benkovich, Dreyer, Howard, Heaney, Bennett, Christensen, Jeffrey, Vergiels, Sena and Brookman

FILE NUMBER 184

ASSEMBLY JOINT RESOLUTION—Urging the Energy Research and Development Administration to choose the Nevada Test Site for the storage and processing of nuclear material and for solar energy research under the Solar Energy Research, Development and Demonstration Act of 1974.

WHEREAS, The now supplanted Atomic Energy Commission has, over the years, demonstrated an outstanding concern for nuclear safety and has compiled, at the Nevada Test Site, an equally outstanding safety record; and

WHEREAS, The people of Southern Nevada have confidence in the safety record of the Nevada Test Site and in the ability of the staff of the site to maintain safety in the handling of nuclear materials; and

WHEREAS, The unemployment rate in Clark County, Nevada, is 20.7 percent higher than the disturbingly high national unemployment rate; and

WHEREAS, The people and the leaders in many states being considered as sites for the storage and processing of nuclear material have serious anxieties and doubts about providing storage and processing sites; and

WHEREAS, The existing facilities and the years of expertise in nuclear material handling at the Nevada Test Site are a tremendous existing resource; and

WHEREAS, Southern Nevada also offers an excellent environment in which to explore the potential of solar energy; and

WHEREAS, National energy independence and a clean environment are dependent upon tapping nonfossil fuel sources of energy for heating, cooling and electricity; and

WHEREAS, The existing facilities of the Nevada Test Site and its support infrastructure are available and well suited to scientific research in addition to nuclear projects; and

WHEREAS, The storage and processing of nuclear material, and solar energy research can both be carried out at the Nevada Test Site with minimal capital investment relative to other locations; now, therefore, be it

Resolved by the Assembly and the Senate of the State of Nevada, jointly, That the legislature of the State of Nevada strongly urges the Energy Research and Development Administration to choose the Nevada Test Site for the storage and processing of nuclear material provided that there is an acceptance by the Energy Research and Development Administration of the following conditions:

1. Air cooling is used at the storage facility;
2. Rail transportation avoiding the Las Vegas metropolitan area is established to the site;
3. Appropriate state agencies and local governments can cooperate in, and contribute to, the development of the Energy Research and Development Administration's site-specific environmental impact statement;
4. It is satisfactorily demonstrated that adequate radiation safeguards for storage and transportation can be developed and will be implemented;
5. Public hearings are held in at least four counties in the state prior to choosing a specific site for the facility; and be it further

Resolved, That under the provisions of the Solar Energy Research, Development and Demonstration Act of 1974 the Energy Research and Development Administration utilize the extensive resources and facilities of the Nevada Test Site to explore the potential uses of solar energy; and be it further

Resolved, That copies of this resolution be prepared and transmitted by the legislative counsel to the administrator of the Energy Research and Development Administration, to the assistant administrators for nuclear energy and for solar, geothermal and advanced energy systems and to all members of Nevada's congressional delegation; and be it further

Resolved, That this act shall become effective upon passage and approval.

Assembly Joint Resolution No. 38—Assemblymen Coulter, Mann, Sena, Murphy, Hayes, Dreyer, Benkovich, Polish, Glover, Mello, Wittenberg, Weise, Bennett and Christensen

FILE NUMBER 185

ASSEMBLY JOINT RESOLUTION—Memorializing Congress to authorize and fund a veterans' hospital in Southern Nevada.

WHEREAS, There are 92,000 veterans living in Nevada who have honorably served their country; and

WHEREAS, Approximately 50,000 of these veterans reside in Southern Nevada; and

WHEREAS, The closest veterans' hospitals for these 50,000 veterans are in Los Angeles and Reno, a fact which makes hospital care for any of these veterans an extreme inconvenience and even a real hardship; and