ASSEMBLY ENVIRONMENT AND PUBLIC RESOURCES COMMITTEE MEETING

MINUTES

DATE: MONDAY, MARCH 10, 1975

MEMBERS PRESENT: Chairman Bremner, Messrs. Coulter, Chaney, Jacobsen, Banner, Heaney, Weise, Price and Jeffrey

MEMBERS ABSENT: None

GUESTS: Kay Winters, Santa Maria Ranch, Dayton, Nev;
Sandy McCormick;
Robert Elston, Nevada Archeological Survey;
Donald Tuohy; " " "
Kit Miller;
John Koontz, " " "
Katherine Hale
Dr. Sandorf
Tom Young, Sierra Pacific Power;
Joe Murin, " " "
Ethel Axt, Nevada State Museum
Jean Ford, Assemblywoman and sponsor of AB 21
Jean Myles, Nev. Archaeological Assn;
Keith Ashworth, Assemblyman

The meeting was called to order at 3:15 by Chairman Bremner. He called for testimony from witnesses who had attended the committee meeting Friday, March 7 and because of time, were not able to testify on AJR 15. Miss Katharine Gardiner Hale offered the attached testimony (Exhibit "A") in opposition to the bill. She stated that more time should be spent making a decision on this matter and that a moratorium should be placed on any further nuclear construction so that more facts may be known and citizens can make the decision. "We [the public] should be deluged with facts first", she stated. She asked the committee to determine: 1) will experts continue to work with us if the waste disposal plant is established in Nevada; 2) Will we be expected to take waste from other countries; 3) Will we be funded for solar exploration; 4) Will all this be worth it in 40 years; 5) What will employment figures really be; 6) Will the Federal Government listen to us or will we be forced to take on this waste storage.

Mr. Weise asked Miss Hale is she had collaborated with other organizations also opposing the measure and, if so, why had they not offered testimony from professionals. She explained her source

for her testimony as the Foresta Institute, articles from the Livermore Radiation Laboratory, AEC, ERDA, San Francisco Chronicle, Sacramento Bee and the Smithsonian Institute. She reitterated that this measure should be on the ballot and given much more publicity. Mr. Weise stated that in opposing the measure, there should be more professional testimony to compare with the professional testimony received from the proponents. Miss Hale agreed to send the committee a summary of professional opinions. Miss Susan Orr, from the audience, informed the committee that the best professional in the area is Dr. Terry West of Palo Alto.

To Mr. Weise's questioning, Miss Hale offered wind and solar energy as alternatives and to hold off nuclear energy development until more is known about it. Mr. Jacobsen pointed out that wastes in the Hanford, Washington area must be moved to more isolated areas and out of the area of the Columbia River where slight contamination has been discovered. Mr. Price felt that land in Southern Nevada is suitable enough to handle any leaks that might possibly develop as compared to that in Washington; that this is a much different problem than completely discontinuing nuclear development.

Dr. Irving Jesse Sandorf testified in favor of AJR 15. Dr. Sandorf has been a consulting engineer for many years and is now vice-chairman of the Nevada Public Works Board. His remarks are attached as Exhibit "B". In discussion with Mr. Price regarding various energy sources, Dr. Sandorf discussed the "hydrogen economy", he commends solar energy and geothermal power. However, he feels the major supply of future energy will come from nuclear plants. Others will be used for "spot development" but not as a major utility supply. The University of Nevada presently has a small nitrogen plant used in conjunction with the Navy.

To Mr. Heaney's questioning, Dr. Sandorf explained that the process of nuclear energy does not vary that much from the process of producing other types of energy except that the fluid is partially radio-active.

Chairman Bremner recessed the meeting for ten minutes at 4:00 p.m. A letter was received from Patricia van Betten of Las Vegas in opposition to AJR 15 asking that it be withdrawn. Her letter is attached as Exhibit "C".

Miss Bonnie Brown testified against AJR 15, also asking that the matter be tabled until the committee has further information. Her presentations are attached as Exhibit "D". To Miss Brown's suggestion that the committee request testimony from experts, Mr. Price explained that this was not the function of the committee and that exposure to radiation could be better contained in a small area like Southern Nevada than in a heavily populated area. Mr. Bremner continued to explain that the Legislature does not have

sufficient funds to request experts to attend hearings and that the Committee had visited the Test Site.

Mr. John Miller, a student and opponent of AJR 15, presented the committee with a petition signed by 1,000 persons stating that prior to any legislative action, they would like the following stipulations met: (1) The presentation of detailed information as to the residents of Nevada including but not limited to an explanation of the potential dangers of this waste storage and what, if any, benefits Nevada residents will gain from having the waste stored within state lines and (2) the opportunity afforded to the residents of Nevada to express their opinions on the issue.

A copy of Mr. Miller's petition is filed in the office of the secretary of this committee and marked as Exhibit "E".* Mr. Miller's remarks are attached as Exhibit "F".

Mr. Heaney asked Mr. Miller: "If you knew that we were going to amend the resolution so that the Governor would have absolute veto power over the plant if ERDA doesn't live up to the conditions agreed to, would you feel this a sufficient safeguard?" Mr. Miller replied, "No, this should go to the people and I refute anything the Federal Government says". He felt the people should have a chance to worry and reflect on their children and their children's children.

To Mr. Weise's question as to educating the public in order for them to vote on this resolution, Mr. Miller explained that he had gathered his names on the petition in two weeks, that as a student he does not have a great deal of time, but that he knew concerned citizens would work on it; that it is an absolute necessity that ERDA provide the absolute facts on all aspects of the storage process, including transportation, etc. He felt that the solidification process is still not finalized and that this resolution will not improve the economy that much when people's lives are at stake.

Chairman Bremner called for testimony on AB 210, a bill establishing the Nevada archeological survey. Assemblyman Jean Ford, one of the sponsors of the bill, stated that this is one of the last chances that we will have to look into the past in Nevada; protect and preserve very valuable information in Nevada regarding archeological ruins. She stated that several small groups of interested persons have struggled for many years and their efforts have been supported by many Nevadans. She told of an archeological dig she made with her family in the Red Rock Canyon area outside Las Vegas and that they recovered 68 pounds of artifacts and remnants of the Piutes. The archeological survey needs and deserves recognition by the State. This measure was killed in the last session by the Ways and Means Committee and she urged a DO PASS recommendation on AB 210 this session.

*Exhibit E not with minutes

Jean Myles, Chairman of the Nevada Archeological Association presented a letter from Donald L. Hardesty, Chairman of the Department of Anthropology, expressing their full support of the bill and a small newspaper entitled "Chippings" published by Am-Arcs of Nevada. Both exhibits are attached as Exhibit "G".

of the Nevada Archeological Survey
Mr. Robert Elston/reviewed the testimony presented at the last hearing on AB 210 and discussed the proposed organization of the Nevada Archeological Survey. This proposed organizational chart is attached as Exhibit "H" and a letter from Robert York, Cultural Management Specialist, U.S. Dept of the Interior, Bureau of Land Management, Reno attached as Exhibit "I".

Mr. Heaney suggested that the Archeological Association and Archeological Survey make some attempts to show a connection between their application for funds before Ways and Means and a potential tourist increase as a result of the establishment and recognition of the archeological survey by the State of Nevada. He also suggested that this recognition could be professional prestigious.

Mr. John Koontz stated that the biggest virtue of this bill is to bring all these groups interested in archeology under one umbrella and that the bill has much merit.

Kay Winters, representing Lyon County Park and Recreation, presented a letter in favor of AB 210. Her letter is attached as Exhibit "J". To Mr. Price's questions regarding disturbances at the Nevada Test Site of archeological relics, Mr. Touhy stated that many archeological values have been destroyed, but since an EPA study, the AEC, ERDA and other agencies will have to comply with these regulations. Mr. Heaney felt that it would be helpful if the Association and Survey had information to present to Ways and Means showing the loss to out-of-state contractors in surveys in Nevada. Chairman Bremner recessed the meeting for a break at 5:10.

The meeting re-convened at 5:15 at which time Chairman Bremner asked for action on AJR 15. Mr. Price moved to amend the bill with Amendment No. 4594 and re-refer it to the Commerce Committee. Mr. Banner seconded the motion. Mr. Jeffrey questioned the veto powers provided in the amendment given to the Governor. Mr. Ashworth stated that the Governor was apprised of the fact and agreed that the veto power as provided could jeopardize the waste disposal storage being established in Nevada and agrees with the amendment. Mr. Heaney also expressed his concern over the Governor's veto power and moved to amend the motion amending the bill to include a time limit of four years on the interim storage. After discussion, it was agreed that Mr. Heaney would work out his amendments to the bill when it went to the Commerce Committee. Mr. Price withdrew his motion and moved to adopt amendment no. 4594 to AJR 15. Members voting in favor o

the motion were: Chairman Bremner, Messrs Chaney, Jacobsen, Banner, Heaney, Weise, Price and Jeffrey. Mr. Coulter voted NO.

Mr. Price moved that AJR 15 be referred as amended with a "Do Pass" recommendation. Mr. Banner seconded the motion. Members voting in favor of the motion were: Chairman Bremner, Messr Chaney, Jacobsen, Banner, Heaney, Price and Jeffrey. Mr. Coulter voted "No" and Mr. Weise did not vote.

Mr. Ashworth explained to the Committee that this Resolution merely advises the Federal Government that Nevada is interested in the nuclear waste storage facility being built in Nevada. Additional restrictions and conditions to the resolution would be telling the scientists how to do their job. Discussion was held between Mr. Ashworth and Mr. Coulter and the committee. Mr. Weise stated that he was not objecting to the committee action because he did not vote; only that he did not feel he had sufficient time to make up his mind.

Chairman Bremner stated that the Commerce Committee would be holding more hearings and Mr. Ashworth stated that the state of Washington had changed its mind and was now interested in obtaining the storage facility.

Chairman Bremner adjourned the meeting at 5:30 until the afternoon recess Wednesday.

Respectfully submitted,

PHYLLIS BERKSON, Secretary

ASSEMBLY

AGENDA FOR COMMITTEE ON ENVIRONMENT & PUBLIC RESOURCES 156

Date Mon., March 10 Time 3:00 p.m. Room 214

Bills or Resolutions to be considered	Subject	Counsel requested*
AB 210	Establishes Nevada archeological survey and makes appropriation.	
AJR 15 (continued hearing)	Urges the Energy Research and Development Administration to choose the Nevada Test Site for disposal of n uclear wastes and for solar energy research under the Solar Energy Research, Development and Demonstration Act of 1974.	

*Please do not ask for counsel unless necessary.

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Katharine Gardiner Hale
1101 Keystone Avenue
Reno, Nevada 89503

Transcript of Statement of
Katharine Gardiner Hale
given at
Atomic Energy Commission Hall
Salt Lake City, Utah
on
December 12, 1974

Gentlemen and Gentlewomen,

I am Katharine Gardiner Hale; and have lived in Reno, Nevada, since 1961. I paid my own way here to help you make a decision that affects me as immediately as it does you. This is a country governed "of" and "for" and "by" the people; thus I feel it to be my time to offer my service to this country, by speaking today.

Since I have no special or official title, I'll tell you a little of my background. I'm a third-generation Californian, well-educated and responsible. I have had responsibility for both a surgical and a medical wing, as well as the emergency room, of St. Mary's Hospital. I have worked as a salesgirl, a hostess-cashier, a civilian stewardess flying into Vietnam in 1967, a teacher of pre-school children utilizing Montessori methods, and a teacher of math and reading to adults at our local Mental Health Institute. Currently, I'm raising my husband's 4 1/2 year old daughter and renovating our three-story stone house which is twice as old as the Atomic Energy Commission. I have the honor (a dubious one) of being as old as plutonium. In another thirty years we will be producing 600,000 pounds of plutonium annually. It is a known carcinogenic substance.

I arrived yesterday, having learned of the hearing seven days ago, so as to insure that I get a full night's sleep. Instead, I avidly read Wash-1539. Informative and complete as it is, the words that are most often repeated are "will be designed".

Now we are all excited by new designs, and are in favor of research; after all, I didn't push a handcart, on foot, to get here. Flying is a delight and I will enjoy the improvements that "will be designed", in that, and other fields. But, there is no evidence at all for any safe threshold of radiation exposure.

• "Nuclear power is safe" is an empty message. Dr. Walter Jordan, pro-nuclear member of the Atomic Safety and Licensing Board said, "there is no way to prove that we have succeeded in reducing the hazards to a low level".

If I am to judge the care and planning abilities of the A.E.C. on their recent lack of care and planning in regard to informing the citizens of Nevada, then there is real cause for concern. For, it took the A.E.C. a couple of years to produce the Draft Environmental Impact Statement of Commercial High Level and Transuranic Radioactive Waste, and yet we are expected to digest that tome and issue an answer in a couple of months. If I were to adopt a child, it would take two years and I'd care for it for 20 years and love it for my lifetime. Yet, you ask me to adopt your baby with less than a year's notice and blithely expect me to care for it for 24,000 years; and that's only the baby's "half-life"!! Only a martyr would take on such surrogate motherhood. "Half-life" is such an applicable phrase. Our lives may be halved by any one of many "accidents" which might take place at N.T.S. (Nevada Test Site).

Let me tell you a bit about your "baby's" proposed home. I was raised in lush country, in Southern California when it was vacant lots full of rabbits, birds and other wildlife, and I learned to swim in the ocean. I camped and swam every year. So, Nevada looked empty and barren to me. It took me three years to appreciate that it is a delicately balanced gentle land. It is not a rough sagebrush wasteland. Since the A.E.C. has peppered the East Coast with nuclear plants, I can understand how good our government land must look to you. But it is unthinkable that more time won't be spent finding out about it. A sage decision requires more thought.

We have seismic eruptions (7 on the Richter scale) that are erratically located. No two happen in the same place. We have porous rock and sand because the state was underwater for centuries and any leak could wildfire. We have a lack of H_2O, and our population is growing; Reno has tripled in the last ten years. Consider the problems that you've encountered

by building the Virginia Water and Power and the Diablo Canyon, Los Angeles, sites over fault lines. Consider your admitted failures with the core-cooling system and the possibilities of future failures.

The A.E.C. said to the National Intervenors that giving such information (concerning the troubles with core-cooling) would be proprietary. Proprietary means that the owner has the "exclusive right to the use or disposal of a thing". This is an arrogance which we cannot abide. The people have been able to consider whether or not they want fluoride in their H_2O, or prayer in their schools, or whether or not to use a hexachlorophene product (and those words are understood by lay pre-schoolers), and yet are not asked whether or not they want uranium hexafluoride to move in next door.

As we all realize, "interim" storage site means "forever". If I am forever to be in a "Nuclear Park" then I ask you to consider a moratorium so that the safety factors that "will be designed" may be completed. I advocate a moratorium so that the risks of the operation may be made known, and so that the citizenry of the states involved may, with such knowledge, be heard and make the ultimate decision.

Some people have warned me that it is impossible to stop a $40 billion business in its tracks. That is hardly my goal. I feel that some of the A.E.C. precepts and proposals are naive and I also believe that for every solid scoundrel encountered, I will also meet a sensible human being. Such has been my experience on planet earth. I am speaking now to those people capable of using their highest faculties.

If we can predict the social future for generations, including civil and international strife, revolutions, psychotics, psychopaths, saboteurs of all types, indeed, all criminality, including destructive Acts of God, then nuclear waste storage is acceptable. I am an optimistic cynic. I have great faith in humanity. But, I do not have confidence that some exclusive intelligence will arrive to deal with our wastes in the future. I believe in the longevity of human institutions by which this super race may be trained. Yet I recall that we are the future race in whom the founders of this nation placed such trust and we are having a heck of a time. What sort of control do we have over the volatile spirits currently "doing time" in our penitentiaries? Very little, although we learn every day. We cannot guarantee

that the people of the future will not have even more difficulty with our volatile incarcerated nuclear garbage. These artifacts may be forever entombed without benefit of hieroglyphic warning, and we cannot take the responsibility.

Granted, one person's garbage may be another person's treasure, but genetic deterioration and carcinogenic decline cannot feasibly be treasured.

I feel a little like the "proverbial Indian"; the A.E.C. is "moving west" and arrogantly compromising the earth as a habitable place for this, and essentially all future, generations. All information regarding the dangers of storing nuclear wastes must be presented to the people so that they may make judicious response and the "criticality" must be emphasized in as determined a fashion as any advertisement for toothpaste, so that our understanding becomes second-nature.

Please utilize Nevada's vast natural resources: geo-thermal power, solar power ("the sun shines every day in Nevada"), and wind power (Mark Twain called one of our winds the "Washoe Zephyr"). The fact that these resources are free is economically unpleasant to those vested interests that stand to benefit by the building and licensing of more nuclear plants, and the storage of the resultant wastes. It is an American tradition to find ways to reap profits and I have no doubt that ingenious means will develop by which profits may be realized in using solar, geo-thermal and wind power. Please put your vast people resources to work on this and related modes of research. Thank you.

Katharine Gardiner Hale
1101 Keystone Avenue
Reno, Nevada 89503
January 27, 1975

Dear Editor,

On December 12, 1974, having discovered that none of our "public servants" were going, I paid my way to Salt Lake City to testify at the Atomic Energy Commission hearings, concerning their plan to use Nevada's "barren wasteland" as a Nuclear Power Plant Waste Storage Dump.

Bruce Arkell of Las Vegas testified that Nevadans want this dump because the Nevada Test Site has $150 million worth of usable moth-balled equipment and the geological capability to store wastes indefinitely. He was delighted with the economic opportunities afforded by our acceptance of the A.E.C.'s plan. He stated that he anticipated "no danger" and had complete faith in the A.E.C.

This astonished us all. Nevadans have yet to be informed of the dangers, and our opinions have yet to be heard.

Nuclear waste contains three deadly man-made radioisotopes: Strontium 90, Cesium 137, and Plutonium 239. Before they lose their toxicity, Strontium and Cesium must be isolated from the environment for 600 to 1000 years, and Plutonium for 250,000 years. Plutonium 239, is carcinogenic. One millionth of a gram causes cancer in animals (of which man is one) when inhaled. Once airborne, it can travel thousands of miles in a short time.

Our society is unstable, economically, politically, and socially. We love it but know it to be unpredictable. With odd extortionist group and terrorist clubs cropping up every week, great precautions must be taken. Forty pounds of enriched uranium or twelve pounds of Plutonium is the amount needed to create a Nuclear weapon capable of killing thousands of people. Two A.E.C. employees have been caught smuggling that amount of Plutonium in their lunchboxes. The A.E.C. has now lost 9,000 pounds of enriched uranium and 600 pounds of Plutonium 239.

This is inexcusable.

Before 1970 Atomic wastes were casually buried in cartons and barrels, with little thought of potential leakage and contamination. The A.E.C. remains confident that methods "will be designed" for safe disposal of these wastes. Yet the A.E.C. says: "No permanent way to dispose of this waste has yet been designed."

I must assume that the reason the A.E.C. has not launched a national and state-wide campaign to inform the people of the risks involved is that such information would terrify the inhabitants. With an informed populace, there would be no one upon whom they might foist the dreadful garbage. I must also assume that a $40 billion business (the A.E.C.) cannot afford such a scare campaign.

We are in an energy bind, but that is no reason to abandon our senses and frantically grab the carousel brass ring of Nuclear Power while relinquishing our hold on the guiding reins of common sense.

I have used large numbers in this letter, and I, like most people, cannot digest those figures. Let me share Richard Carrington's ounce of perspective: "If the earth's history could be compressed into a single year, the first eight months would be without life, the next two would see the most primitive creatures, mammals wouldn't appear until the second (2nd) week in December, and no Homo Sapiens until 11:45 p.m. on December 31. The entire period of humanity's written history would occupy the final sixty (60) seconds before midnight."

We are young and inexperienced inhabitants of the planet, and it is proper that we be willing to learn <u>first</u>, then act upon our knowledge, rather than learn too late.

The A.E.C.'s tendency to depend on the ingenuity of future generations and our tendency to depend on the A.E.C.'s ingenuity shows an appealing kind of "trust", but an appalling lack of responsibility for our own actions.

I want all building and licensing of Nuclear Power plants brought to a halt until the A.E.C. has found a practicable method of safely disposing of their wastes. I want Nevadans to be deluged with facts before the A.E.C. is allowed to bring the wastes into our state. I want the decision to be <u>ours</u>, on a ballot, if necessary.

I remain, as a willing to be informed Nevada citizen, cordially yours,

Katharine Gardiner Hale

ASSEMBLY ENVIRONMENT AND PUBLIC RESOURCES COMMITTEE MEETING EX. "A"

Monday, March 10, 1975

Any errors in my testimony may be attributed, in part, to the lack of accurate public information. Even Mr. Gates could only rely on outdated slides.

To the bill itself: I question the veracity of 2 "whereas's" in line 2: "outstanding concern for nuclear safety". Very little responsible action has yet been based on said "concern". Lines 11-12: "doubts and anxieties" of people and their leaders have narrowed the choice of states to us. I claim that the people of this state have the same doubts and anxieties if only they were informed of the risks and allowed to use their good judgment.

This bill is tantamount to a bribe. Our economic appetites are being tempted by $1-1/2 billion for 40 years and by the solar research plum in a giant poison cake. I and other people, capable of listening to the highest idctates of their conscience, will not accept the bribe.

Mr. Mann's said that salt H_2O would corrode containers dumped in oceans. "Nature would intervene" in the safe disposal of wastes. I say that nature could intervene in our state as well; including both mother nature and human nature.

Culturally, this state asks people to pay money for money. We don't spend a lot of time asking people to pay money for ballet, opera, etc., as a profit-seeking device. This attitude has been much maligned by other states but it may be to our advantage now. For Nevadans are accustomed to turning unusual propositions into commercial successes. I have absolute faith that we can reap a profit by developing solar research, geothermal research and "zephyr" wind power research. Perhaps, we as a State, can beat GE to the punch by claiming legal rights to the sun.

Things to ascertain: Will experts come to work with us? Will we be expected to take wastes for 19 other countries? Will we be funded for solar, geo-thermal and "zephyr" research? Will the economic nibble in a hard economic time be worth the nuisance when the money is spent? What will employment figures actually be? Will our hearings be in vain or will the government listen? If our government doesn't listen, will we be forced to take the wastes because we're owned (83%) by the Government?

APPEARANCE OF IRV.JESSE SANDORF BEFORE THE ASSEMBLY ENVIRONMENT AND PUBLIC RESOURCES COMMITTEE IN BEHALF OF AJR-15

Thank you for giving me the privilege of appearing before you in behalf of the Nevada Test Site as a place most suitable for the storage of radioactive wastes.

Because of the questions asked by members of your committee at the hearing before you last Friday (March 7) I know that you are already aware of the economic advantages to southern Nevada, the beneficial impact upon employment,as well as some information about the potential danger in the most unlikely case of sabotage,or attack in case of war.

My purpose in appearing here is to emphasize that nuclear power can ,and should be, the major factor in making our country independent of foreign supplies of oil ; and that the availability of a disposal site for nuclear power wastes is essential if nuclear power is to have an unobstructed development. I do not disparage the economic benefits to our state; in fact, if I suspected a danger to the health and the environment I would oppose the resolution.

The many witnesses who have appeared here in opposition to this resolution seem to be unaware of the greater danger to our health and environment from the current sources of energy. My experience of over 50 years as an employee or consultant to utilities has shown me this. For example, one of my college classmates was killed within 5 years of graduation while working for a power company. My work for the AT&T took me into West Virginia. There I saw the bodies of miners laid in rows near the mine portals after an underground explosion. We have all seen the black clouds belched from the stacks of power plants and of many industries; we are all aware of the adverse effects of these on our health and environment. We have all travelled along our highways and seen the trees whose death has been sealed by the poisonous gases exhausted from our cars. None of these adverse effects are associated with nuclear power. As yet, no documented claims of damage to health or environment in the vicinity of nuclear power plants have been made.

Mention has been made during these hearings of the removal from service of several nuclear power plants because of the discovery of leaks. No mention is made that most of these leaks are associated with portions of the nuclear plants which are the same as those in the conventional fossil-fuel-fired plants. No mention is made that no serious injuries to man or environment have been associated with these leaks. Nor is mention made that during any given year there will be hundreds of generating units in conventional plants out of service for routine maintenance or possibly because of a blown-up boiler or a fire caused by a burst oil line. These do not make the national headlines. I will bet that none here know that some years back the PG&E lost a major generating unit within a few days of its placement into service.

You are possibly aware that construction of some nuclear plants have been cancelled. The high cost of a nuclear plant rather than the environmentalists are responsible for this. I am one of those who recommended to the SPPCo. many years ago that they build nuclear power plants. It is worth mentioning that if nuclear plants were supplying the power there would not now be the frustration over frequent rate increases. The SPPCo. will build a coal fired plant because nuclear plants are too costly. This excessive cost has been brought about by the inclusion in the designs of every conceivable means to prevent accidents that would result in radiation damage. The evidence from those expert in this field is that a major accident in a nuclear plant is far less likely to occur than in a conventional plant. Or, as one expert said, a major accident might occur once in 3000 years.

Last Friday, General Mahlon Gates showed you pictures of the containers of the radioactive wastes which will be stored in the open, temporarily, until research and development provides a permanent solution to the storage problem. These containers are huge, each weighing tons and are so constructed of steel and concrete as to be practically indestructible by accident during transportation or by sabotage on the storage site.

Mr. Flangas detailed the geology of the proposed area. If by malicious intent or by war the waste material were released the radiation would be confined by the surrounding mountains and would have no harmful effect if it penetrated the surface. And if the radioactive wastes were reduced to a glass-like solid, and this is the direction of much research and development now being carried on, then the radiation would indeed be confined to a limited area. The proposed storage (open storage) area is a few hundred acres out of the more than a thousand square miles of the Test Site.

Mr. Flangas also commented on the feasibility of storing the wastes underground at great depths. He has had a major responsibility for preparing the underground for the nuclear blasts during the past several years. It is possible that an existing chamber created by an earlier blast could be used; if not, a special chamber could be created by a blast with the knowledge that the chamber so created could store the wastes produced during several decades by nuclear power plants or by the military.

In conclusion, I believe that the Nevada Test Site is the most suitable of all the land sites so far considered; it is far more suitable than burial at sea with the possible disastrous later effects of sea life; it is far more suitable than storage on some remote island reachable only by a thousand mile sea voyage. I urge the adoption of AJR-15.

I would also commend the ladies who have appeared here and have shown their concern for our environment; I hope they maintain their vigilance in behalf of protecting our environment and hope that some of the things I have mentioned above will suggest to them some new directions for their zeal.

Ex. C

1-171

1663 La Jolla Avenue
Las Vegas, Nevada 89109
March 6, 1975

To: Bremner, Committee Chm, Environment
Robinson, Committe Chm., Commerce
Schofield, Assemblyman
Governor O'Callaghan

Gentlemen:

Today's mail brought me a copy of AJR 15, and I am writing to tell you of my strong opposition to the language in the resolution which relates to the selection of the Nevada Test Site as the selection site for the disposal of nuclear wastes.

First, I believe that a resolution should deal with one matter for consideration; a resolution which seeks to treat two such totally different issues shows, as a minimum, a lack of sensitivity to the depth of problems involved.

The Atomic Energy Commission, as it had been called, has not begun to answer the kinds of specific concerns regarding transportation and safe storage that have been raised at public hearings on the issue or that have been raised by members of the Governor's advisory committee on the issue.

I was present and testified at the hearing in Clark County. Not one of the persons who has co-sponsored AJR 15 from the Clark County legislative delegation was present at that hearing. Had they been present, they would be more aware of the complexities involved, they would be more aware of citizen concerns, and they would be more aware of the information gaps, both past and present, in presentations from the AEC.

The Governor's Committee had a role to play in reviewing the application for storage, and that committee raised concerns and questions that need to be reviewed. If not raised by the committee itself, then they were raised by interested citizens through public hearings held by that committee.

It is an erosion of the function of that committee to seek a legislative mandate on an issue like this, and particularly when those sponsoring have shown no particular degree of concern in the past. What kind of study have these assemblymen done on the issue?

How can these members of the Assembly justify the glib remark, stated in the Resolution, that "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...." Have they been unaware, or have

they so quickly forgotten the December leak? Have they been unaware of the public concerns at the recent hearings? Have they also remained unaware of the testimony of Maya Miller, speaking for the many of us who could not attend, at the Germantown hearings? I believe that the efforts of these Assemblymen to obtain a legislative mandate on the issue is an insult to me; I do not recall my Assemblyman making this a campaign issue, or even attempting to obtain an opinion from his constituents.

My apologies for not including all of my concerns .... but time is a factor. I am anxious to go to the Post Office with this in hopes that it might reach you before tomorrow's hearing. I also learned of the hearing in today's mail.

As you well know, few of us have the flexibility or the financial resources to make spontaneous trips to Carson City. I would be happy to send to you my testimony from the last hearing; I would also be happy to refer you to other sources for a comprehensive bibliography.

Again, I strongly oppose the resolution to encourage nuclear waste storage in Nevada, and ask that it be withdrawn.

I would appreciate it, should this arrive in time, if you would share my views with your committee.

Sincerely,

Patricia van Betten

Patricia van Betten

FYD

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Testimony submitted to the Nevada State Assembly Committee on

Environment and Public Resources

March 10, 1975

Bonita Brown
Box 102
Silver City, Nevada 89428

My name is Bonita Brown and I have come to express my opposition to the AEC,now ERDA proposal to construct an 'Interim' high-level radioactive waste storage facility in Nevada and particularily object to AJR #15.

I come in recognition that the recommendations that will come from these hearings will effect generations to come.

I base my conclusions upon the reading of the Draft Environmental Statement (WASH-1539); from my own research; from testimony given by Governor O'Callaghan's Waste Study Committee; from testimony given at the Salt Lake Hearings (at which I testified); and, most important... I have talked to many Nevadans.

The United States has been generating wastes for 30 years, and after 30 years no site has been found that is suitable for permanent disposal of the wastes. Thus Nevada is being asked to provide the badly needed 'Interim' site, without much planning time. These highly toxic, commercially produced wastes must be kept out of the biosphere for hundreds of thousands of years. Mankind will be committed to perpetual surveillance ofthese substances for a greater time than is attributed to any civilization. It will be in our responsibility for the life of the planet.
Primarily, the accumulated wastes have been ,thus far, manufactured within the weapons program. The wastes Nevada is to store are these wastes, and the wastes yet to be produced by commercial, profit-making nuclear power plants, and wastes from 19 foreign countries. The federal Government subsidizes the powerplants with technical help, insurance... through the Price-Anderson Act, (as no private insurance company will insure them fully)... and now, further subsidy will be provided in a national depository waste site.

FxD

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The nuclear power program has been designed as a stop-gap to supply energy to this nation until more environmentally sound and reliable sources are developed.

A growing expert and national concern has develped, questioning the economics and safety of the power plants.

23 of the 57 power plats in operation have been shut down twice in the last six months due to damage in the emergency cooling systems.
And those are just a few of the problems that have hit the plants.

Gentlemen, it has been stated many times in these hearings that "we have the wastes and we must put them somewhere"...and, "we must do our part in National Security"... as Mr Flangas states "I don't ever want to be in second Place". The mambers of this committee who have or are employed at the NTS, have an understandable concern in the military aspest of the nuclear program.

I intend to make no comment on that aspect ofthe program. I have no knowledge or desire. What I do suggest is;

1. We have approximately 6 million gallons of highly radioactive wastes now, stored around the country. We shall undoubtedly produce more in the weapons program, but this quantity is negligable when compared to the expected amounts of the year 2000... [redacted] (commercially produced) No more than necessary should be produced.
2. Nevada is being asked to provide an 'Interim' storage site. I propose that all efforts and money be dedicated to the solution of a permanent, as humanly possible safe disposal. and, That energy sources, other than the questionable nuclear be developed, now.

WE have it, it must go somewhere, let it be done right. 'Interim' storage is the proposition of desperation.

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I feel the present proposal fo use the Novada Test Site(N TS) is unexceptable for many reasons.

1. I cannot expept the justification of producing the wastes through nuclear generated power.

2. I feel the AEC'S credibility is suspect in regards to its ability to manage radioactive wastes safely. There have of course been some famous examples of tank structural failure, human errors accompanying the leaks , such at Hanford (106 tank, 1973) . Up until 1970, most wastes were buried in trenches and tanks. Idaho has refused the disposal site, " Idaho cannot consider the site until the removal of the wastly large number of barrels and boxes containing transuranic wastes which were unwisely buried in the ground (at the NRTS) prior to 1970. " What this means gentleman is that robotized mining must be done on 80 acres of the Idaho reservatiom to save the great aquifer of the Snake River that is in danger of being contaminated . In Hanford there is a trench of buried Plutonium that will have to be mined by robotized machined in order to prevent a potential CHAIN REACTION THAT could result in massive comtamination to the Pacific Northwest.

How can we be assured that the planned site at the NTS will be any safer? How will we know of any leaks or accidents when most of the leaks and accidents at Hanford, Savannah River,Idaho have usually been documented by some other agency before admitted by the AEC?

3. With each proposed method of storage there is admittedly an in-site release of radiation. (DES3.1-15) "the radioactive material released during normal operations are very small quantities that would be expected under routine operating conditions due to normal contamination levels." This is of concern in the li ght of recent findings in Canada and theUS.

Michael Christie, on behalf of the State of Idaho. DEC. 12, 1974 AEC. Salt Lake City Hearing.

EXD

concerning the study ofthe long term effects of low level radiation. 1-177
Studies have shown that human radiation damage may not show up until one or two generations following the initial exposure. Thus, workers and citizens within and surrounding nuclear installations such as a power plant and sites such as the NTS are exposed to greater amounts of low-level radiation and are the ones considered in the studies ALONG WITH THE GENERAL PUBLIC The exposed person may have a normal life-span, but the effects of the radiation is showing itself in increased leukemia and genetic changes in the person's children and grandchildren. (Remember we only have had 30/YEARS experience) Not only are leukemia and cancer rates increased in areas surrounding nuclear installations, but effects are seemingly continuing to children having nothing to do with any measured exposure. I lived in the Pacific Northwest, and one would only have to go to any bar in Richland, Washington and talk to people to hear,of many people with cancer.

4. The Water basin concept is gennerally thought to be unexceptable for Nevada, because of its great demands of available water. According to the DES(1.2.3.) "Water consumption would be about 70 million gallons per year (at peak inventory) for either of the two concepts using passive air-cooling.." Consuming these projected amounts of water in Nevada would be and irreversible and irretreivable commitment of its water resources. Las Vegas is growing rapidly, withits own water demands. Do we have enough?

5. Anotherpoint of concern is the seismicity of the area of the NTS. The reservations expressed by Dr. Alan Ryall indicate my concern. " Nevada is one of the most active seismic regions in the United States. During the historic period since about 1840 six earthquakes have occured in western Nevada and southeastern Californie with the magnitude greater than about 7, and one of these (Owens Valley, 1872) may have the magnitude greater than 8. Seismicity in this region

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is characterized by a tendency for great earthquakes not to recur in the same places, over periods which are probably on the order of thousands of years. Thus, the short historic record of seismicity is not representative of areas in which large shocks might ocur in the near futuwe. If the RSSF is to operate for several decades, two or more great earthquakes will be expected to ocuur somewhere in the region during the life time ofthe facility.. Until detailed research proves other wise, the possibility cannot be ruled out that one of these could occur on the Nevada Test Site."

6. Transportation Safety. One of the most obvious places for potential problems concerning the proposed RSSF could be in the transportation of the wastes from the spent fuel reprosseeing plant to the site. According to (DES 9.1-23) "a decision on whether to build an RSSF may be made without regard to the potential risks of transportation". This Statemant is based upon the assumption that a release of radioactive m aterial caused by as accident (truck or rail) is an impossibility, and that the the radiation emanating from the sealed casks in transit is so small as it doesn't warrent considerqtiom.

One must review governmental protestations of safety, when mumerous cases of gross laxity have developed in the handling of Nerve gas, explosives, and radioactive materials, which have been documented. The DES(9.1-6) "that they will take title to and be responsible for the waste upon receipt at the site." This places the greatest burden of safety upon the 8commom carrier'. DOT regulations are not fully developed or maintained in this vital area. In many cases, the drivers have no real training in the handling and hauling of nuclear wastes. Many radioactive cargoes are not properly identified, and cargo routes are not made known to local authorities responsible in the protection of the local populace. Train and Truck accidents happen regularly and predictably. as the

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number of shipments go up, th risk of serious accidents actually happening increases. The AEC admitted 2 months ago, that thousand of pounds of radioactive material cannot be accounted for.
There have been radiation leaks during shipments. A case in point is one cited by Dr. James Deacon*...."that a leak of low level radioactive material occured about 2½ years ago in North Las Vegas, during transfer from rail to truck." This leak was denied by the AEC until documented by the EPA. Wastes are regularly transported through Las Vegas.
According to the DES(3.1-18) "normal releases will originate primarily from waste canister receiving and handling area., where routine surface contamination is much more probable than in storage areas."
The DES then goes on to list many other areas of routine estimated releases of radiation. It is incredible.

7. The AEC is again suspect in its ability to handle radioactive wastes safely as no shipping cask specifically designed for high-level waste has yet been built(DES3.3-1). The AEC says the technology exists... and that "there will be additional experience from 10,000 more shipments which will be made in the next seven years. The cask designs for the high-level waste shipments required to begin in the next ten years can incorperate the best dafety featured based on this experience". (DES 13-5 and 1.3-7)
Thus for the next seven years actual shipment will be tests for the new cask design?

8. Last Friday, Dr. Douglas DeNike spoke of the myrid possibilities for destructive sabotage all along the nuclear program. This is another objection.

9. Finally, there cannot be and kind of human error or as HansAlfren said, "No acts of God abe permitted".

* J.OF.N.L.V. BIOLOGY GOVERNOR'S COMMITTE ON NUCLEAR WASTE Oct. 1974

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There are many alternatives that I could list, and are listed in the Draft Environmental Statement, that could be done with the waste instead of Interim storage. The DES indicates we could leave the waste where it is, until a final solution is implemented. (DES1.5-4) ONe solution that has been forwarded by the DES and Critics alike is the possibility of using/Transmutation a method of and partitioning on the waste. This is wherethe waste is separated into fractions of significantly different properties so that the fractions may then be given different treatment. The more long-live radionuclide whould then be subjected to nuclear bombardment with the object of changing significant numbers of its radioactive atoms into atoms with shorter half-lives. (DES5.3.4.) Thus shortening the term of containment form millions of years to hopefully, thousands .

My concern is primarily with the pre-maturity of the resolutiom AJR #15. One request that has been constant throughout Nevada , from the Governor to Nevada's residents has bee that Nevada needs more time, more information and hearings throughout the state to properly evaluate the proposal. This has not been done.

On one hand we have a population that has repeatedly asked for facts, and hearings and not gotten them, and on the other , today we have a resolution that in essence will stand as a mandate from Nevadans, asking for the site they know little about. You have said Southern Nevadans don't worry about the NTS, that they are used to it, and trust it. Well , gentlemen, perhaps Las Vegas is 'nuclear orientated ' as they say, either through experience as many of you have or perhaps ignorance . But the only testimony I have heard here on the resolution favoring the waste storage are people who will directly gain from it, monitarily.

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The other Las Vegas Citizens who testified were opposed to it.

We all have a deep concern for the rising rate of unemployment and economic problems of southern Nevada...as in the nation.

In no way can this grave problem be minimized. More Jobs; more jobs are needed, but I feel that very few Nevadans given a fair knowledge of this proposition would consider the potential economic boost the facility may give to Las Vegas worth the inherant and irreversible danger that come with the site.

What other industy could Nevada attract except nuclear orientated ones if this facility were to be come actual? Most likely study centers in medicinerelaled to radiation. What about the tourists?

This decision cannot be made so quickly.

I ask that AJR # 15 Be tabled.

Alternatives must be actively sought to help aleviate the economic situation. I feel that to suggest that Nevada seek to be a national solar and geothermal research center is a valid avenue for investigation.

We are talking about the future, not just the next 40 years.

In closing I would like to quote Dr. John Gofman:

"There is no significant technical controversy that can be resolved by a debate on the merit of specific gadgets in the nuclear power industry. What is really at issue is a moral question...the right of one generation of humans to take upon itself thearrogance of probably compromising the earth as a habitable place for this and essentially all future generations."

Thank you

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 [redacted] at 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 Cutter 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 i[redacted]e fuel."

From page 71 of HOW TO BE A SURVIVOR

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. Amazingly, 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 indus[redacted] is vigorously promoting the construction of more heavily-subsidized nuclear powerplants, perhaps the most dangerous single trend in the environment-technology area today.

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 competence is all that stands between us 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 105-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" 20 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; 14,000 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 estimated 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 Baneberry, 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-

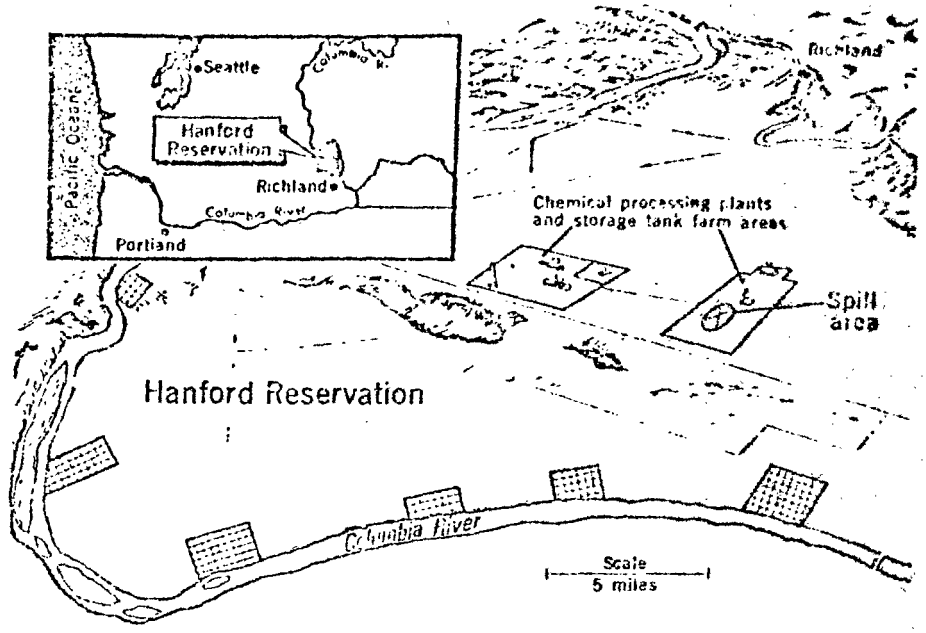
column banner across the front page declaring, "Nuclear Wastes Peril Thousands." Thomas A. Nemzek, the AEC's general manager at Hanford, has even been getting worried letters from his relatives. "They're wondering what's going on," he says. "Are we dropping into a hole, slipping into the sea?"

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 preventive maintenance program for monitoring equipment existed; and no evidence

could be found that top-ranking ARHCO 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 ARHCO 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 108 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 "suspicious" oscillations, but that "we are persuaded 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 month later, the GAO made public a 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 sleeping watchdogs in the local AEC office.

In spite of all precautions, though, more spills from Hanford's worn-out tanks are inevitable. Thomas Nemzek said so late in June, and sure enough, on 6 July, yet another one sprang a leak of high-level waste. This time, 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,-893,155 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 these 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 $1,098,-299." Mr. Marrone said. The pool has cancelled two risks over the years and refused to write one, he added.

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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.

EX.D 187

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.

EXD
/- 188

$E = MC^2$ = 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

Herbert S. Denenberg
Insurance Commissioner

Ex D
189

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F.D
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NUCLEAR DISARMAMENT WITHOUT SECRECY

An Address By

Dr. Fred C. Iklé
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 socieities, 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 rhetoric: I mean it quite literally. It would be the greatest mistake to underestimate the intellectual and moral impact which we can have on world affairs.

Since the beginning of the nuclear era, the intellectual foundation of arms control and disarmament efforts has stemmed largely from American contributions, the product of our scholars and diplomats, our military and our scientists. The fact that the United States Government was the first to create an agency devoted to arms control and disarmament is in itself a reflection of a profoundly American quality – a practical optimisim about the manageability of human affairs.

Because the United States is both an open society and also the foremost nuclear nation, we alone can communicate these realities to the world at large. It is now the fate of every country to remain imprisoned in a world made small and terribly fragile by modern instruments of destruction. If we ourselves openly address the implications of nuclear war and the requirements of disarmament, we will then be able 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.

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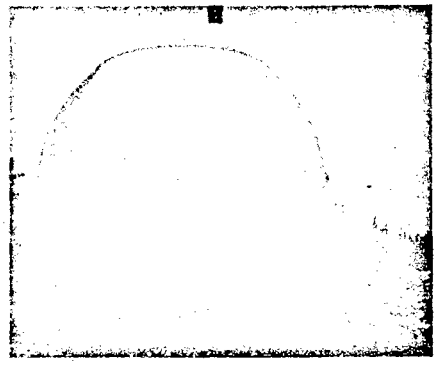
A joint project of Environmental Alert Group and Environmental Education Group.

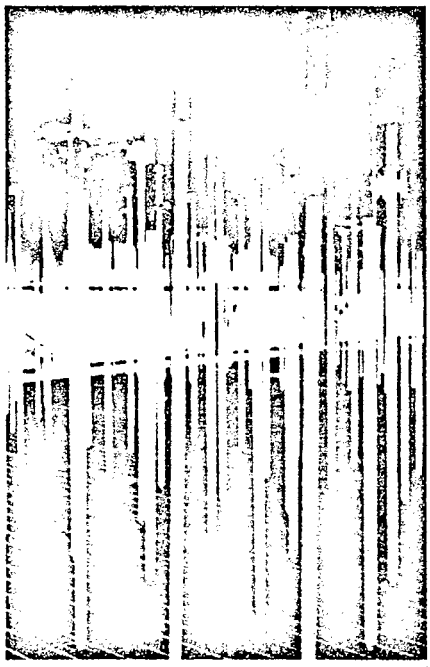
PUBLIC INTEREST REPORT

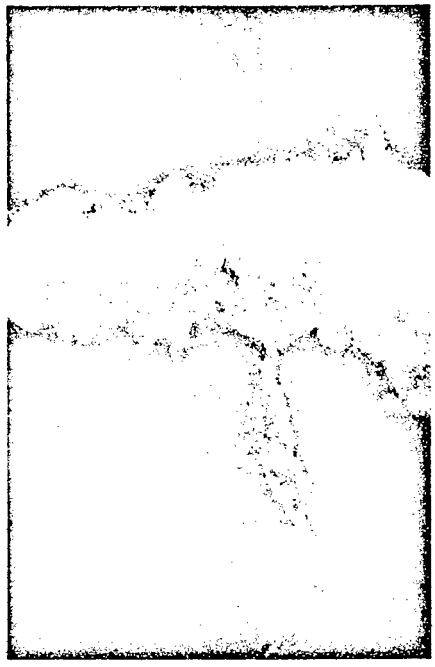
NUCLEAR TERRORISM

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 race-track 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 past 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 Austra 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 3,600 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. S 6621-6630.

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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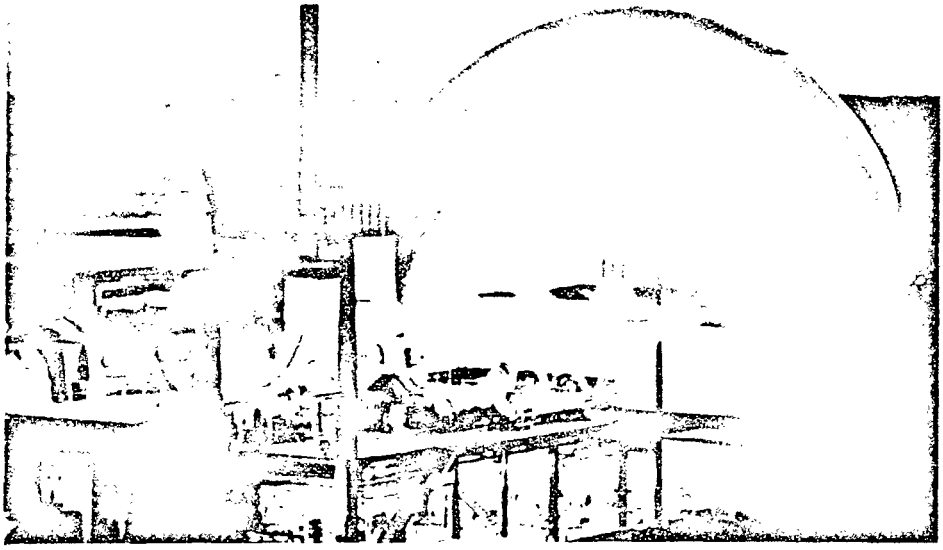
PUBLIC INTEREST REPORT

NUCLEAR POWER PLANTS



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.

"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."

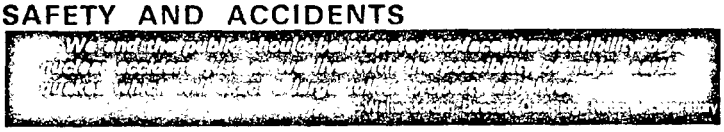
—from Dr. Hannes Alfven, Nobel Laureat in Physics, writing in May, 1972 BULLETIN OF THE ATOMIC SCIENTISTS

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



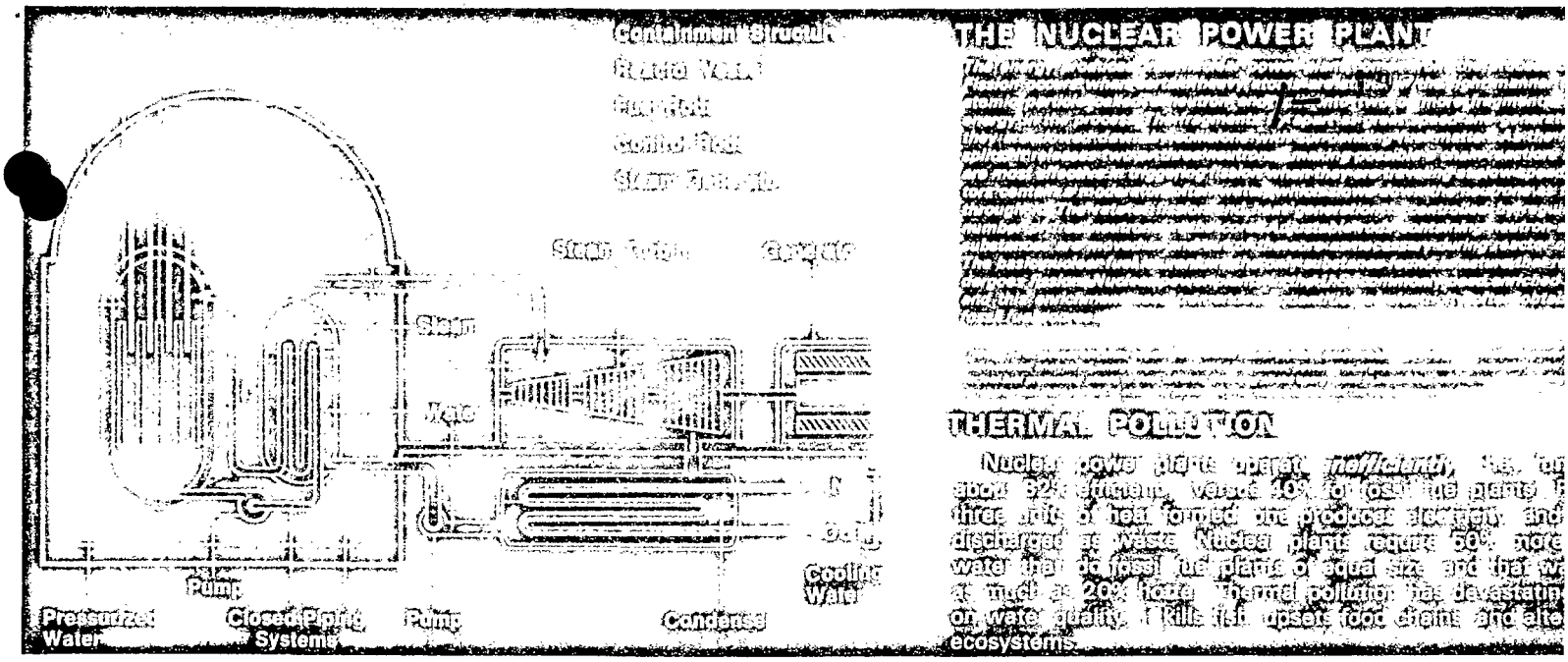
Great reliance is placed on engineered safety systems to prevent or mitigate the consequences of a ***nuclear power plant accident,*** an accident which might release enormous quantities of ***radioactive materials,*** creating a nuclear catastrophe. And, yet, according to a report released by the AEC, 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.***

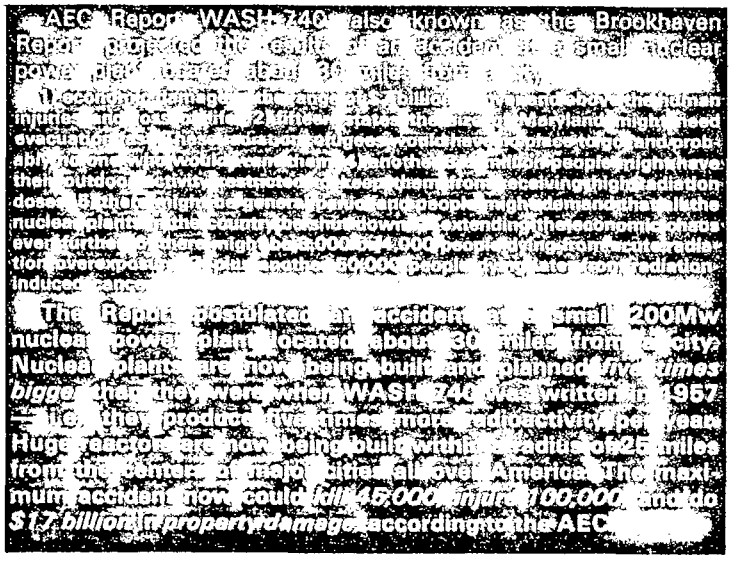
When an AEC member was asked whether a full-scale test could be conducted, his answer was: "It could be done, but it would be terribly expensive to ***wipe out*** all of that equipment." It should be noted that the system is supposed to save the equipment, not wipe it out.

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 fully 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

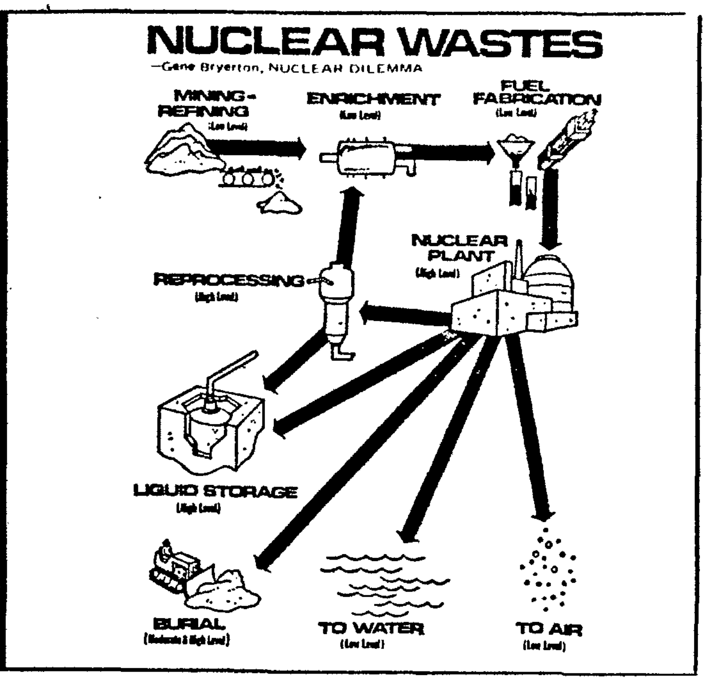
During the year 2000, the forecast 1200 atomic power plants would create as much strontium-90 and other long-lived radioactive poisons as the fissioning of about ***1,200,000 Hiroshima bombs,*** plus at least 600,000 pounds of radioactive plutonium* (more, if there are breeder reactors in operation). 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 needed in tremendous quantities to fuel the new 'breeder' reactors — so called because they may create or breed fuel — which are currently being pushed ahead 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:

> *"These huge quantities of radioactive wastes must somehow be removed from the reactors, must — without mishap — be put into containers that will never rupture; then these vast quantities of poisonous stuff must be moved to the burial ground or to reprocessing and concentration plants, handled again, and disposed of, by burial or otherwise, with a risk of human error at every step."*

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. Rolling over the roads and rails, the metal and liquid contents of the nuclear waste casks are superheated, turning the container into a "huge pressure cooker", ready to spew out gases and fluids at pressures up to 300 pounds per square inch if its metal skin is cracked. The report warns that ***within a half mile of major leaks, "deaths of infants, young children and susceptible people 'are likely' and land would remain contaminated for over 14 years."*** Based on population density the report estimated that thousands of people would experience gradual deaths from one train wreck near a large city. The investigation found that drivers have ***no real training*** to handle nuclear ware and are ***not equipped with radiation leak detectors;*** that police aren't notified of the nuclear cargo routes and that casks of atomic wastes are not adequately marked. If by the year 2000 we have nuclear power projected by the AEC, including the power from breeder reactors, there will be ***7000 to 12,000 annual shipments*** of spent fuel from reactors to chemical plants, with an average ***60 to 100 loaded casks in transit at all times.*** These casks will offer opportunities for ***sabotage*** and ***terrorism.***

SABOTAGE, DIVERSION, AND BOMBS

The recent plague of aircraft hijackings, terrorism, and bombings has made it clear that ***society is highly vulnerable to determined efforts at sabotage*** and that these are extraordinarily difficult to prevent. It is clearly not beyond possibility that a nuclear power plant could be held hostage for financial gain or for political purposes.

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

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

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

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

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

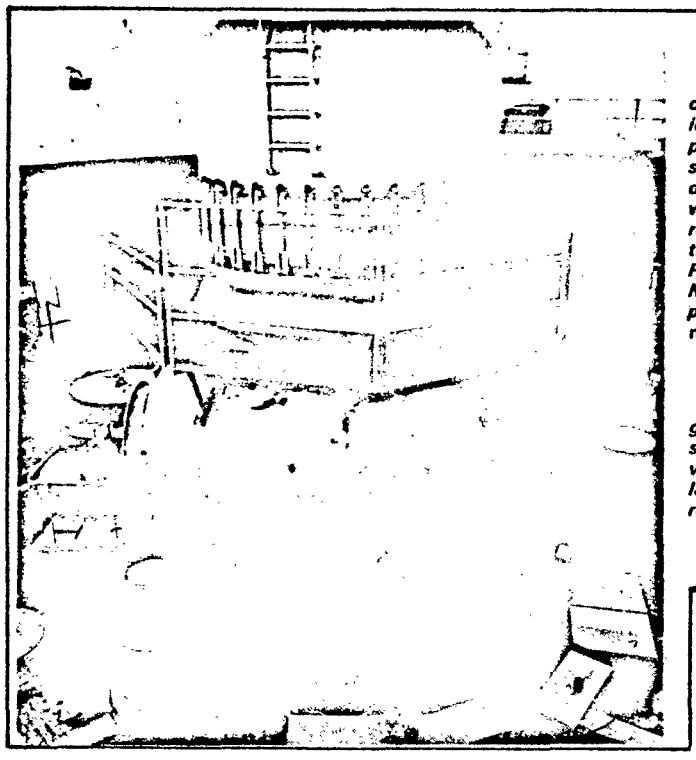
In November 1971, arson caused $5 to $10 million damage at the Indian Point No. 2 plant at Buchanan, N.Y., just prior to its completion. A maintenance employee was accused of the crime.

INSURANCE

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."*

If you look at your Homeowner's Insurance Policy, you will find that there is ***specific exclusion for damages caused by radiation contamination.*** No one is protected for an accident in which lethal radiation contaminates the property. The Price-Anderson Act is basically an insurance policy in which a limited amount of coverage is provided in the event of an accident in which large amounts of radioactivity are released from a nuclear power plant. The Act limits the amount of money which can be recovered by the public to $560 million. S. A. Szalewic, chief of the Atomic Energy Commission's Research and Development Branch, Division of Reactor Development, reports that estimates indicate that the ***total damage from an accident could reach $480 billion — 40 times the amount previously estimated by the AEC.*** Thus, the public could recover virtually nothing on this policy, while the 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.

A long time ago in 1946 Albert Einstein said "Our representatives depend ultimately on decisions made in the village square. To the village square we must carry the facts of atomic energy. From there must come America's voice. The facts are just beginning to come.

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 for nuclear 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 moratorium bills, an initiative is being circulated in California, by a wide based coalition of organizations, 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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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.

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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 Bugwash 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,

Exp 202

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 nuclear industry.

Questions Are Posed

But the documents, some of them written by staff members still in the Government's atomic energy bureaucracy, raise a number of continuing questions. Among them are these:

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

¶In its effort to deal with the sharp rise in world oil prices and the political problems of coal, should the United States Government continue to push for the construction of about 500 more reactors in the next 25 years?

¶Why did the Government agency responsible for protecting the public from the hazards of reactors try 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. H. Imhoff, head of development engineering for General Electric's nuclear division, in a letter to a top commission official.

"We believe future safety program plans should give more attention to possible future needs and that some funding should be available to resolve important safety issues before-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 were 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 present goal should be a paper that can be published without hurting the A.E.C. and without inciting a cause celebre for squelching 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 and 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 answereing 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 forcer 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 document

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 confiedence 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 stndies 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 thie hypothetical Brookhaven National Laboraatory accident are more severe than those q equivalent to a good-sized weapon and the correlaation can readily be made by experts if the Brookhaven National Laboratory results are published. . . .

Area For a 'Big Acr ident'

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 pr
epared iso-
tope 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," ihe 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 abont Mr. Szawlewicz's view to those working on a rewrite of the Wash-740 revision.

"One concern that Szawlewicz exrpressed was that the reamctor 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 Pooint rejection, which is situated 36 miles south of Osewego, N.Y., began generating commercial power in 1969. Oyster Creek, nine miles o 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 Frorum 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 reveale 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 t10 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 newest 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 twice met with the commission's review staff and that they "strongly urge" 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 maior 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 Annonnced

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."

Dnring h recent telerhone 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 thi 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 read th reid the report in qnestion.

"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.

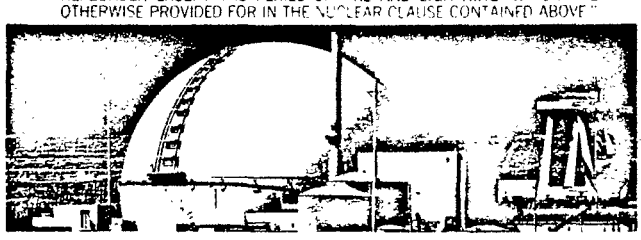
A joint project of Environmental Alert Group and Environmental Education Group

PUBLIC INTEREST REPORT

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

From Homeowner's Insurance Policy:

"NUCLEAR EXCLUSION—SECTION I: THIS POLICY DOES NOT INSURE AGAINST LOSS BY NUCLEAR REACTION OR NUCLEAR RADIATION OR RADIOACTIVE CONTAMINATION, ALL WHETHER CONTROLLED OR UNCONTROLLED, OR DUE TO ANY ACT OR CONDITION INCIDENT TO ANY OF THE FOREGOING WHETHER SUCH LOSS BE DIRECT OR INDIRECT, PROXIMATE OR REMOTE, OR BE IN WHOLE OR IN PART CAUSED BY, CONTRIBUTED TO, OR AGGRAVATED BY ANY OF THE PERILS INSURED AGAINST BY THIS POLICY. AND NUCLEAR REACTION OR NUCLEAR RADIATION OR RADIOACTIVE CONTAMINATION ALL WHETHER CONTROLLED OR UNCONTROLLED, IS NOT 'EXPLOSION' OR 'SMOKE.' THIS CLAUSE APPLIES TO ALL PERILS INSURED AGAINST HEREUNDER EXCEPT THE PERILS OF FIRE AND LIGHTNING WHICH ARE OTHERWISE PROVIDED FOR IN THE NUCLEAR CLAUSE CONTAINED ABOVE."



"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 560 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.[1]

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 eventually 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.*[2]

"By requiring 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.***[4]

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 tonquantities 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.

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

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."

1. There is vigorous opposition to conclusions found in the WASH-1400 (Rasmussen) study. See: "Preliminary Review of the AEC Reactor Safety Study — Joint Review Committee: Sierra Club and Union of Concerned Scientists," written by Sidney Moglewer and Henry W. Kendall, November 1974.

2. At this time, it is impossible to make an adequate assessment of the delayed and unpredictable somatic and genetic effects that have resulted from nuclear power plant activities. Further complicating the matter, it is also difficult to establish natural background radiation levels and radioactive contributions by nuclear facilities. Claimants may find it frustrating to prove a nuclear plant's added radiation increments to an environmental radiation background already artificially raised by nuclear activities in concert.

3. Low level: should not be construed as to mean biologically harmless or of no health consequence. Low level wastes often the result of isotopes formed when impurities in the coolant water and corrosion products from the coolant pipes are bombarded with neutrons escaping from the reactor core area, are routinely discharged by nuclear plants into the environment. Low level wastes also refer to routine gaseous emissions.

4. In 1974, the Environmental Protection Agency was to announce a 100 fold reduction in the amount of radiation a nuclear plant might release to the environment. The Agency's scientists had noted disturbing trends in the health of populations near such plants. The Atomic Energy Commission prevented release of the restrictions statement maintaining the Agency had pre-empted the Commission's authority in setting standards. The setting of radiation standards is involved in continuing controversy.

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Los Angeles Times

WEDNESDAY MORNING, AUGUST 1, 1973

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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 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. 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.

Pacts 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."

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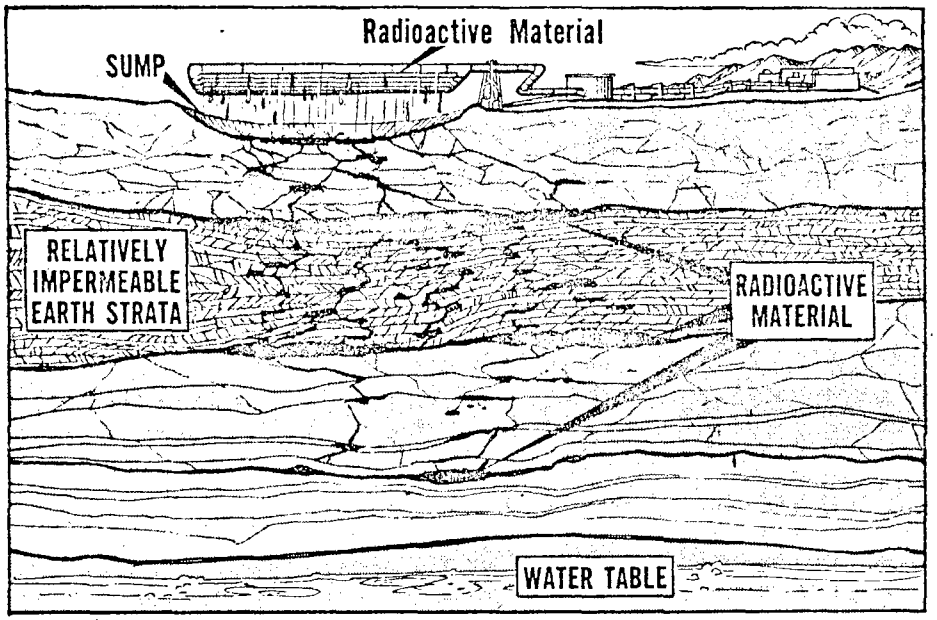
Los Angeles Times

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 125, 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 acquifiers 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 1964 a substantial amount of radioactive liquid was dumped into a Hanford "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.

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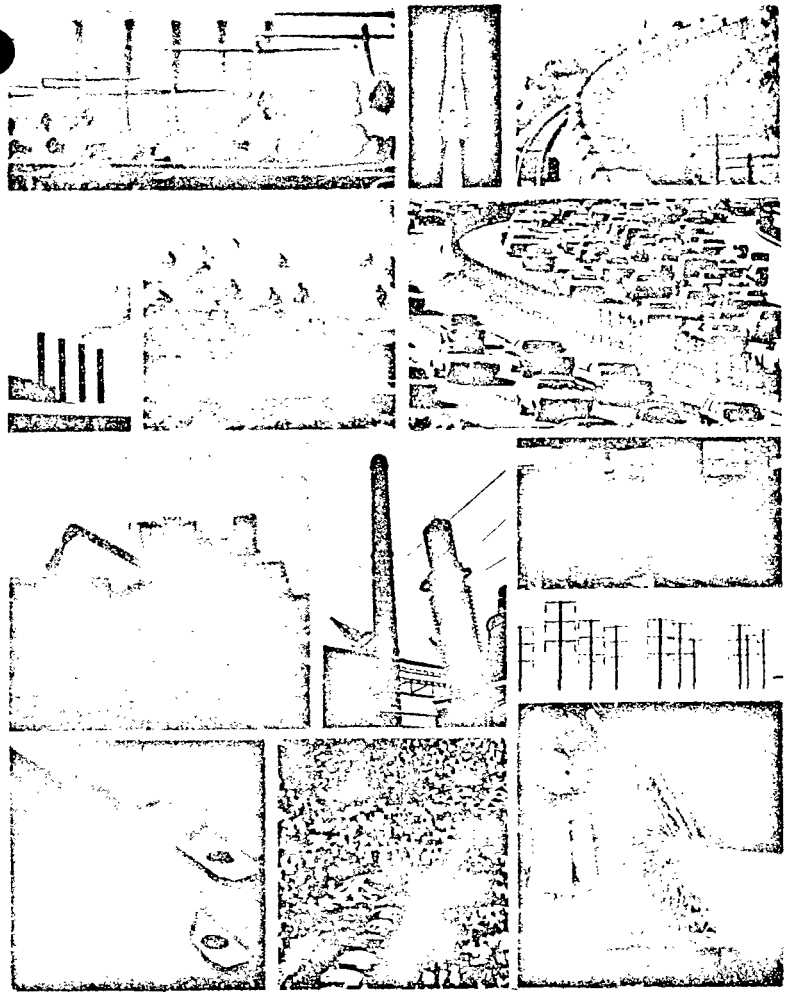
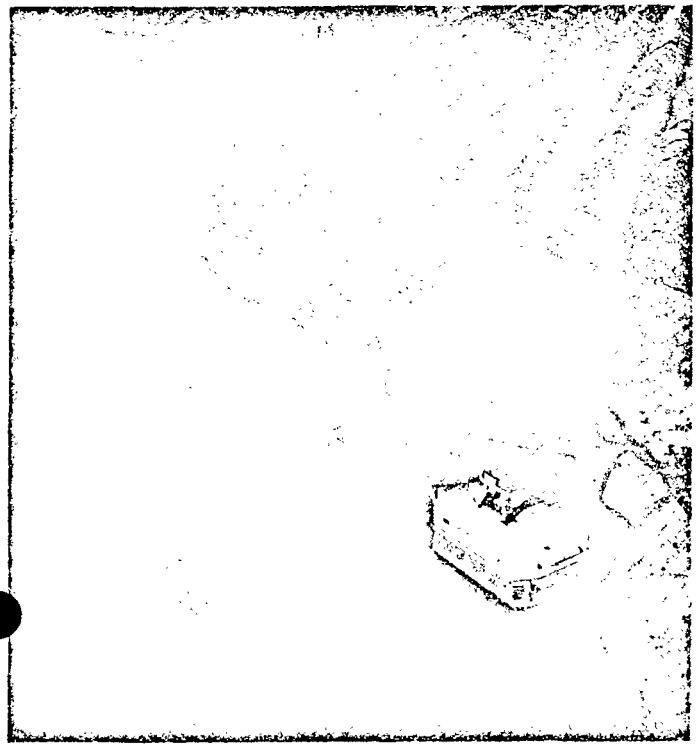
PUBLIC INTEREST REPORT

SOLUTIONS TO THE "ENERGY CRISIS"

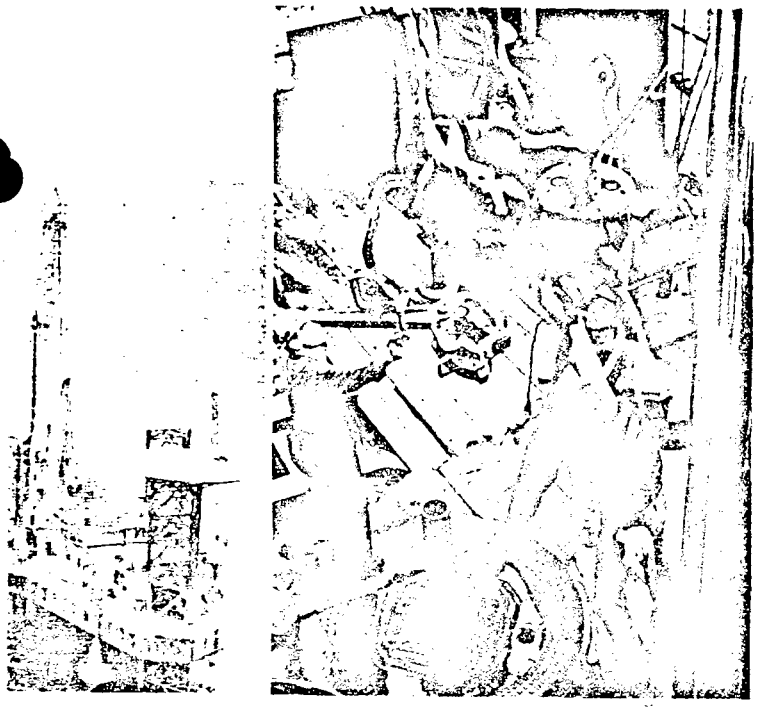


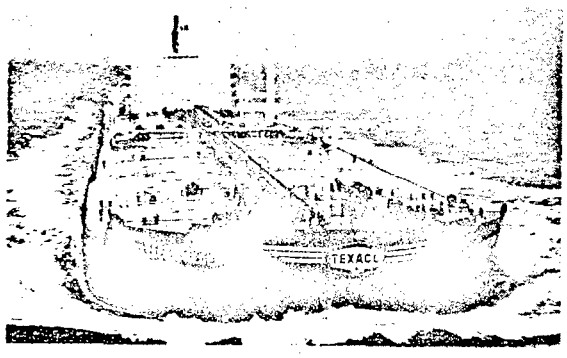
Between now and 2001, just 30 years away, the United States will consume more energy than it has in its entire history. By 2001 the annual U.S. demand for energy in all forms is expected to double, and the annual worldwide demand will probably triple. These projected increases will tax man's ability 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:

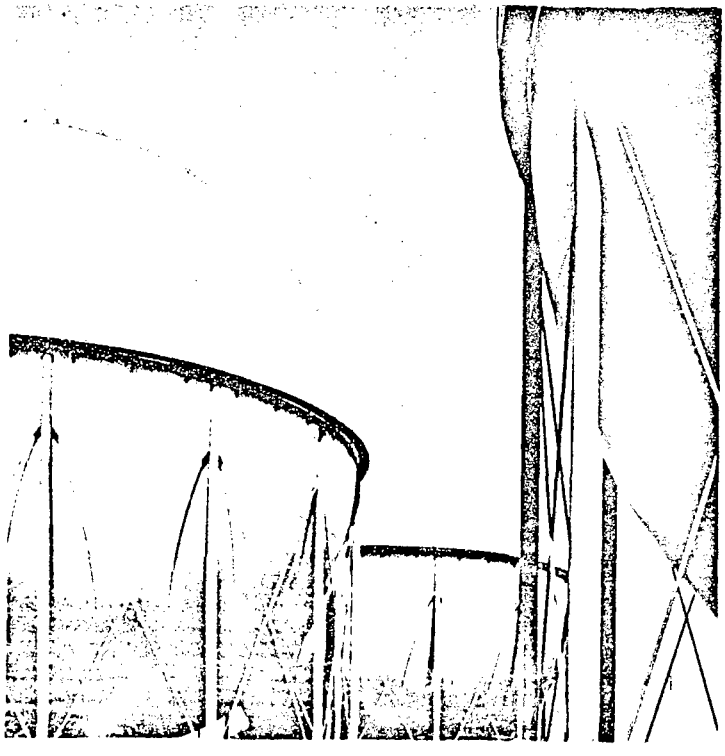
Petroleum is a *fossil fuel,* emanating from the conversion of organic materials after millions of years of heat and pressure. We combust petroleum to release its stored chemical energy. With the projected high demand for oil, experts believe that by the year 2000, 90% of the world's oil may be exhausted. 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.

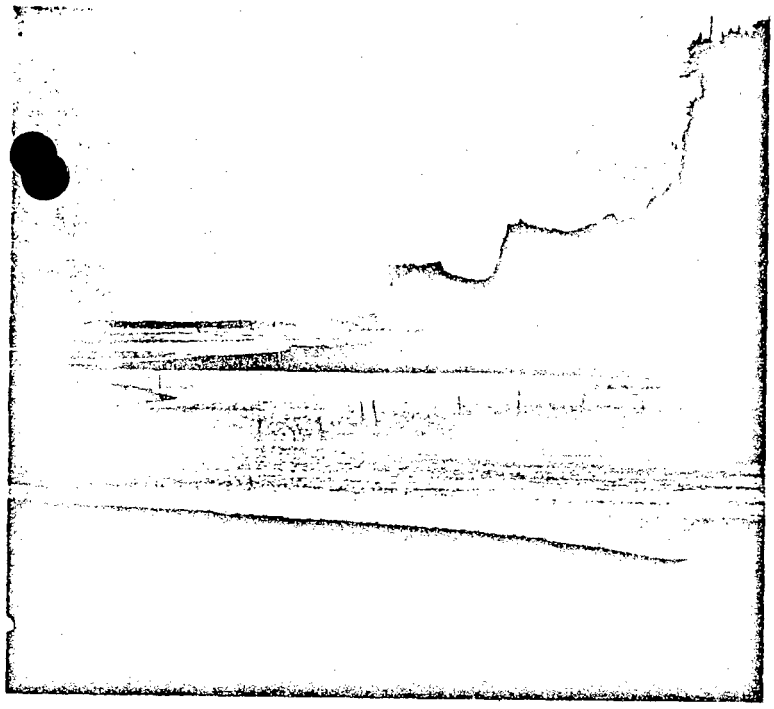


NATURAL GAS:

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:

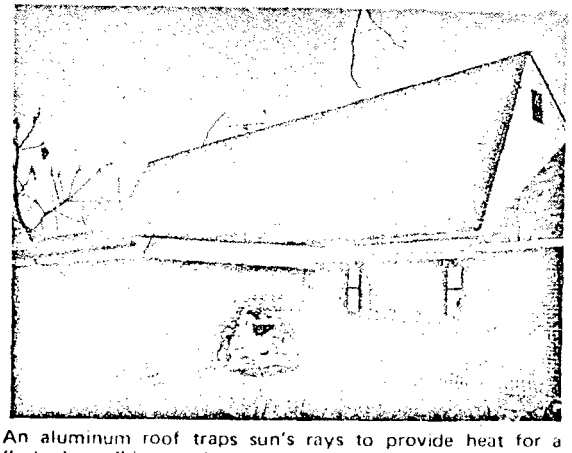
If *1% of the solar energy falling on the Sahara Desert were converted to electrical power, it would supply all of the world's needs for electrical power for the year 2000* . . . technological breakthroughs are not needed to solve this problem: the means to convert solar energy to electrical power is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

The problem is an economic one. (V. Bearinger) 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.

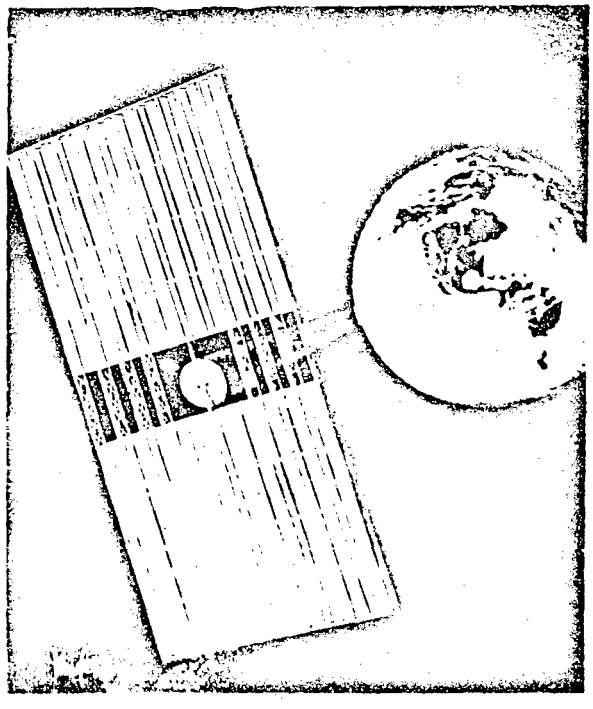
—Illustration by NASA

This is one design for a "solar farm." The flat top 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.

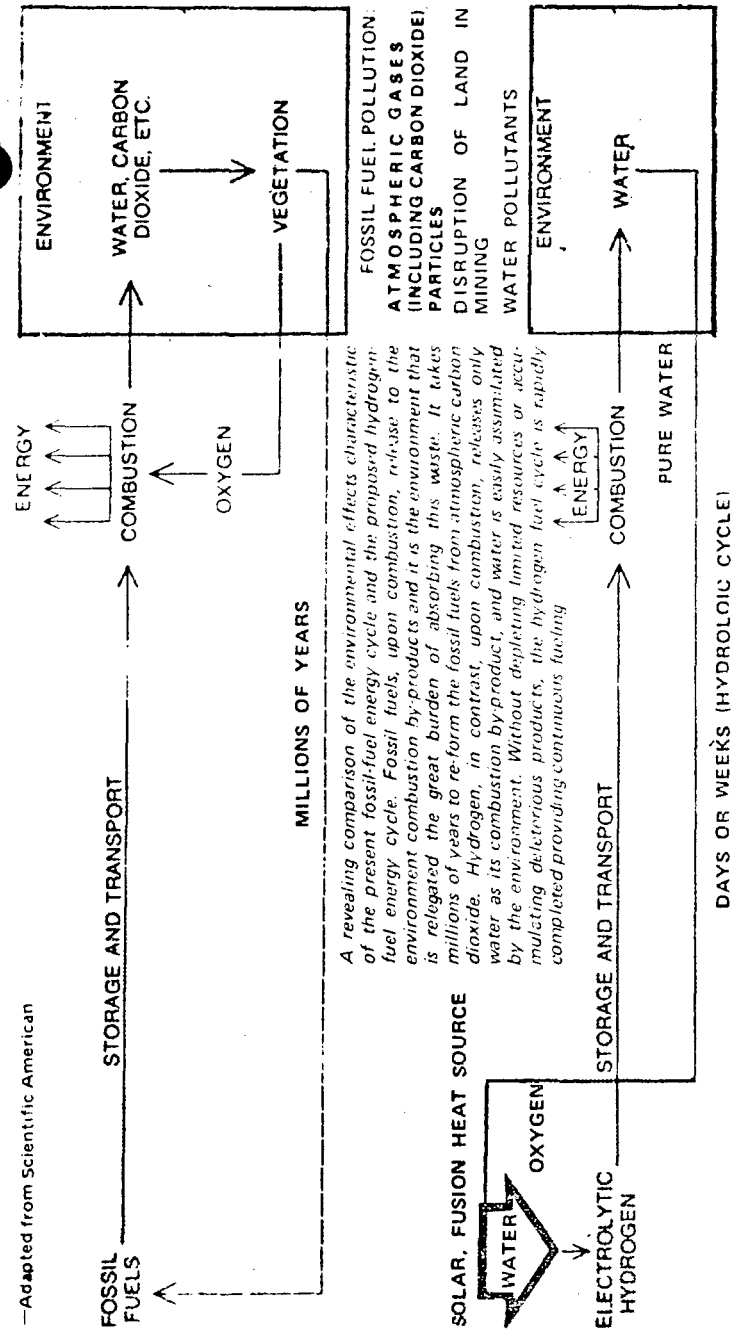


An aluminum roof traps sun's rays to provide heat for a "solar house" in suburb of Washington, D.C.

—U.S. News and World Report



RIGHT: 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 superconducting 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 this 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:

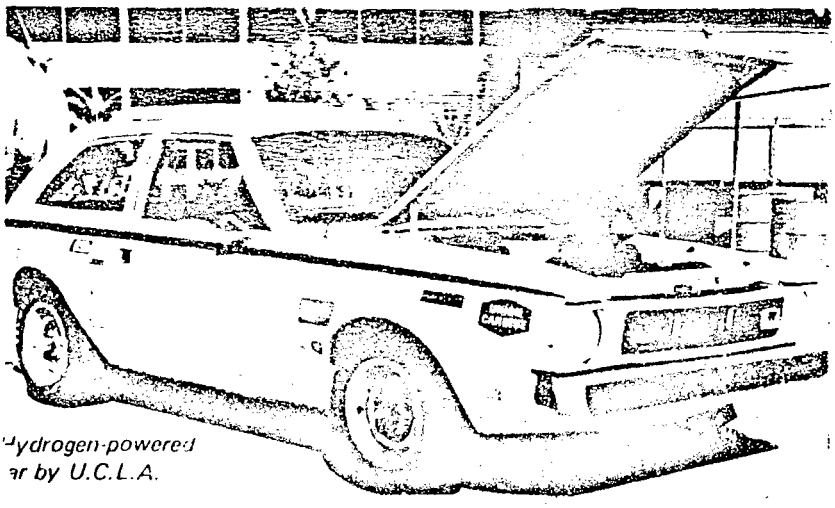
Hydrogen, by far the most abundant, energetic, and clean of all the elemental fuels in the universe, may well be the decisive technology of this century. From the inexhaustible seas, hydrogen would flow continuously. Hydrogen can be produced by central plants by many of several methods, most prominently 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.



Hydrogen-powered
ar 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.

GEOTHERMAL:

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 13% 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.

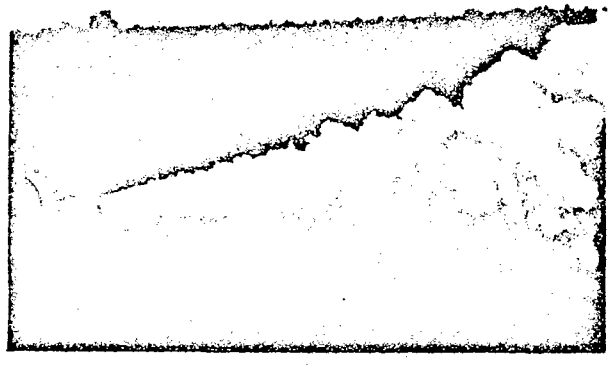
There are two broad classes of geothermal fields. One is the fumerole (natural steam vent) in which heat, pressure and reservoir flow are so balanced that the vent of wells at the surface produce mainly "dry," slightly superheated steam. The second class, much more common, is the hot-spring or geyser 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.

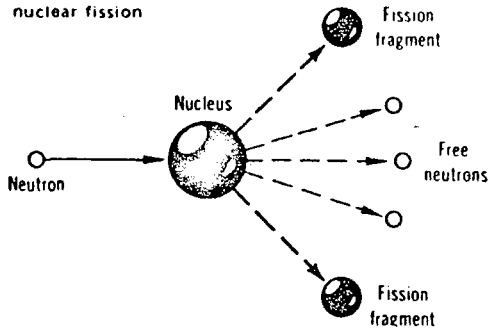
There are environmental problems with geothermal power. Disposal of waste waters from steam or hot water wells could pose a substantial problem, particularly where the water is highly mineralized (minerals in high concentrations can poison fish and other aquatic life). Air pollution is also a problem, 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.

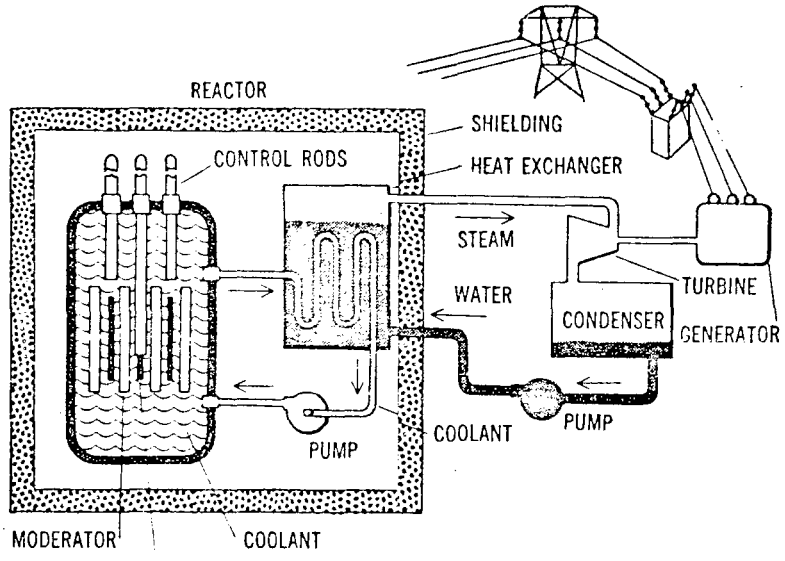
There is also pollution from the release of ammonia and boron. Also, injection and withdrawal of geothermal fluids may trigger seismic effects whose nature is not well known. And there are problems of odor and noise.

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.

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







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.

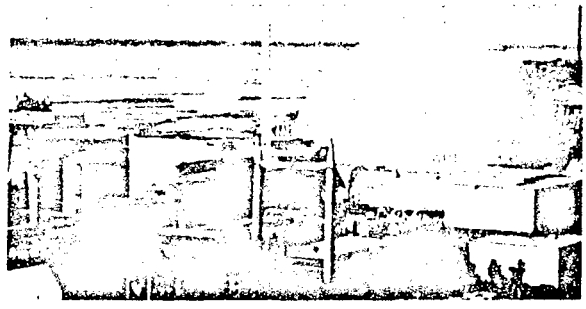
Great volumes of liquid wastes are produced which must be stored in tanks, some underground, above ground, and in the water. These millions of gallons of wastes are enormously toxic and are so hot that many times they make their containers boil like teakettles. Radioactive substances must be stored for 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.

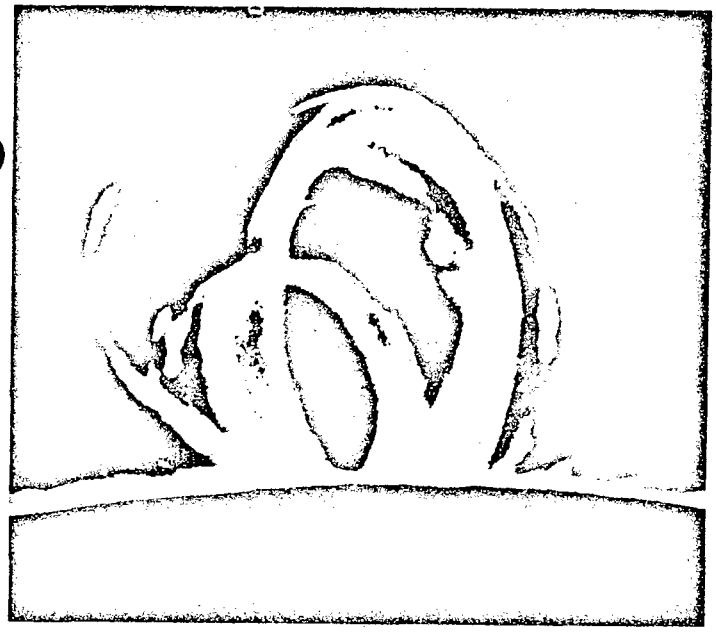
There are, moreover, dangers in the transportation of nuclear wastes and in the possibility of sabotage and diversion of nuclear materials for use in nuclear weapons. And one of the greatest hazards associated with this form of energy is the possibility of a catastrophic accident in which large amounts 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.

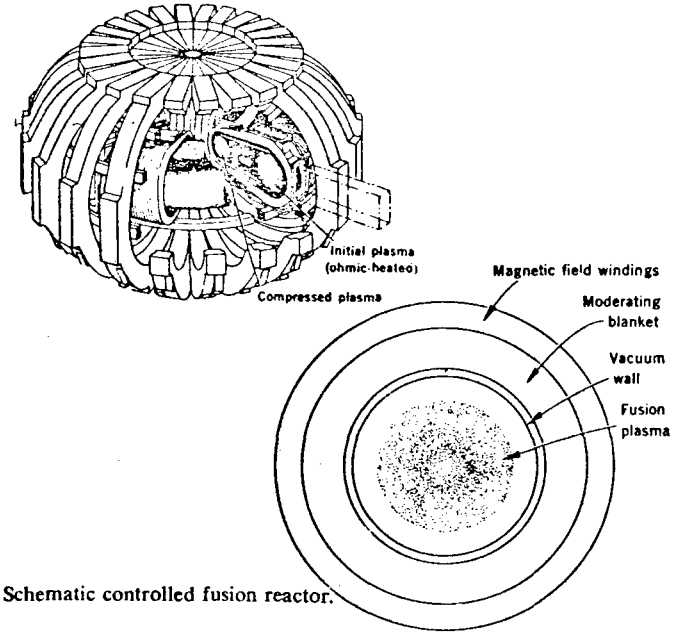
Browns Ferry nuclear fission power plant under construction. With three boiling-water reactors, and generating over **3 million kilowatts,** *it will be the largest atomic generating project in the world.*



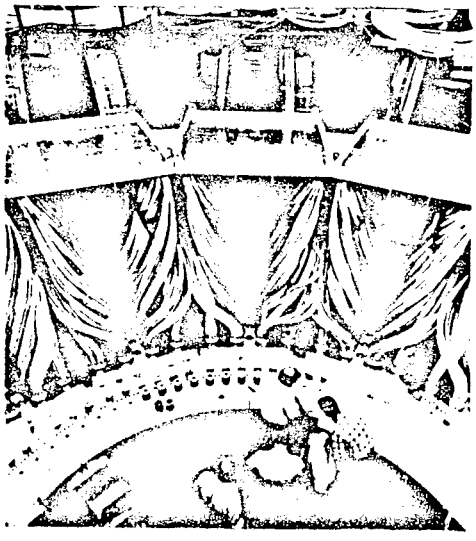


Large loop prominences on the sun, caused by a locally intense magnetic field. The ultimate source of energy on earth, the sun derives its energy from fusion reactions. Current energy research hopes to harness this fusion power for terrestrial use.

—A.E.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.

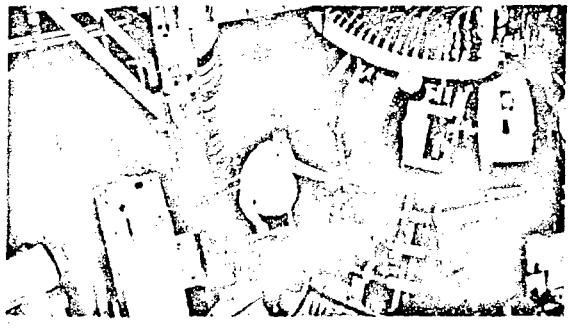
One important aspect of nuclear fusion technology is *plasma physics. Plasma* is the fourth state of matter, different from solid, liquids, and gases. Plasma is an ionized gas. Some of the atoms have had one or more electrons ripped away. A plasma is a mixture of ordinary neutral atoms, ions (atoms that 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.

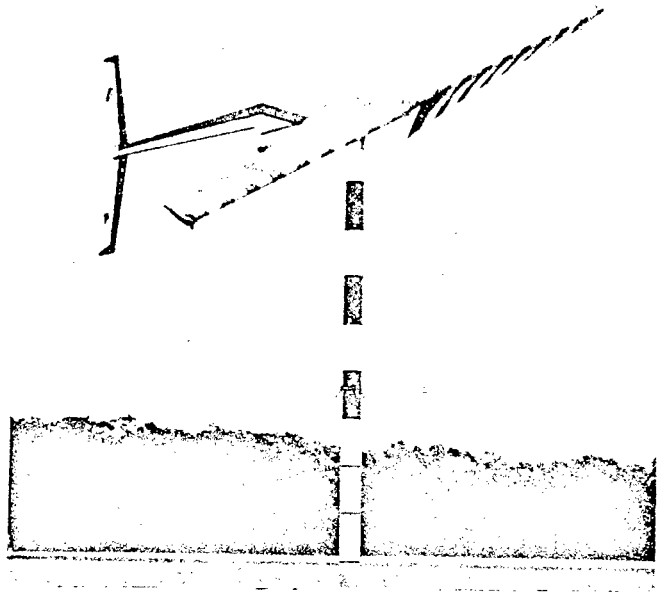
One method of releasing this energy is through thermonuclear fusion, or the controlled thermonuclear reactor. Fusion energy is the power of the stars. Scientists throughout the world, through various processes, are trembling close to producing fusion reactions in their laboratories. Although fusion energy 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 harnass 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:

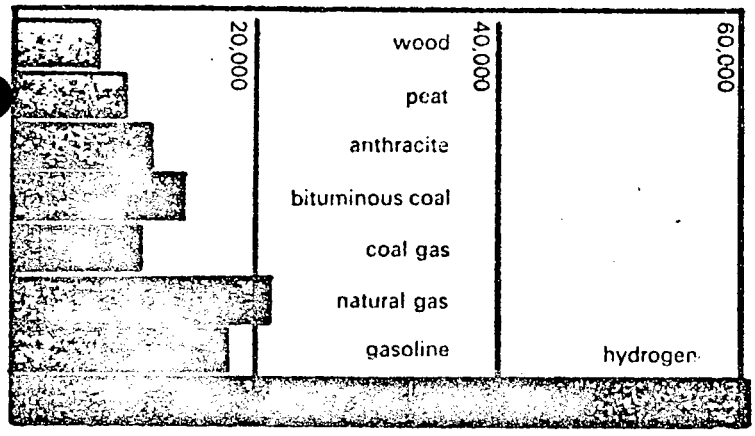
Wind is continuously regenerated in the atmosphere under the influence of radiant energy from the sun. Like solar power itself, wind is a self-renewing source of energy capable of producing harnassable power. Windmills have had a long history. Thousands of streamlined windmills have lighted farms or 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

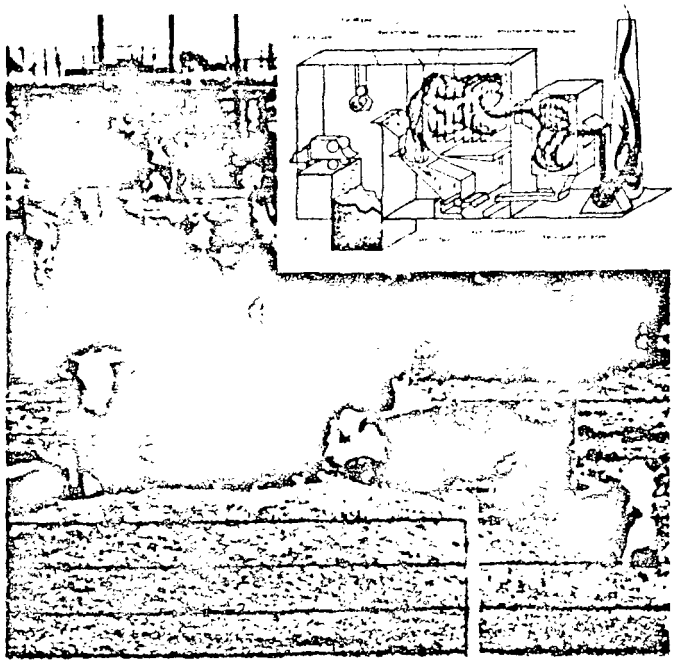
Wood – A statement here should be made for the use of wood for conversion to energy for man's use. Wood, of course, has been used for thousands of years as a source of heat for domestic comfort and for cooking. In some places it is still used for providing heat for conversion into power. Wood and charcoal 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.



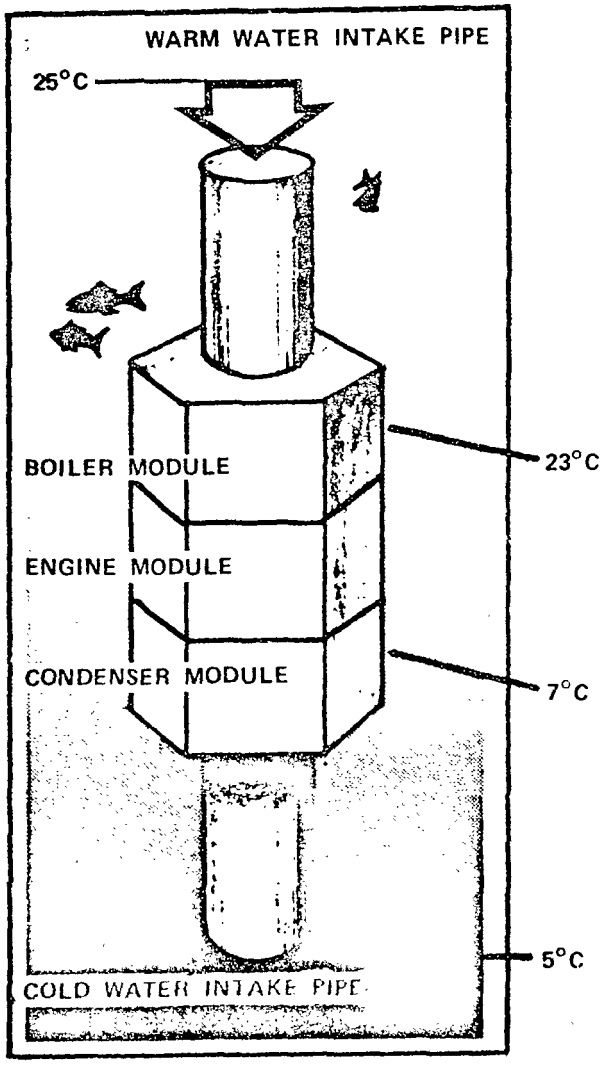
-Environment, Scientist's Institute for Public Information

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):

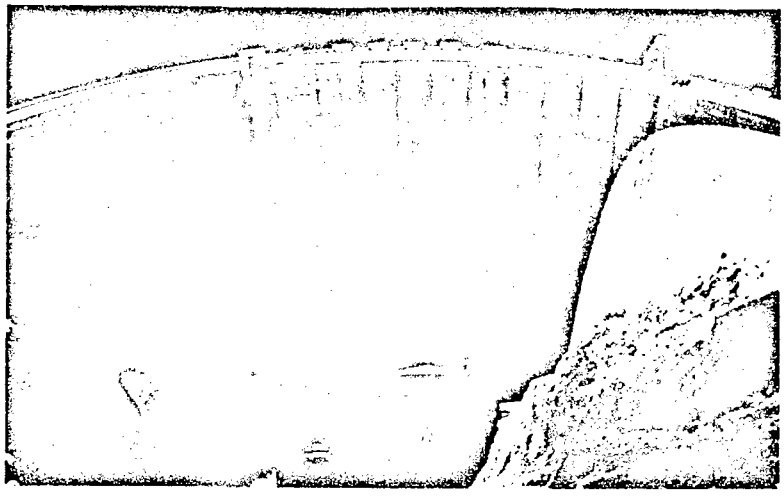
Insolation at the surface of the seas, plus seasonal meltdown of the polar ice caps by solar energy, creates astronomically huge volumes of warm surface water and near-freezing deep ocean water. The thermal gradient that exists between water at the surface and water 1000 feet beneath that surface can 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.

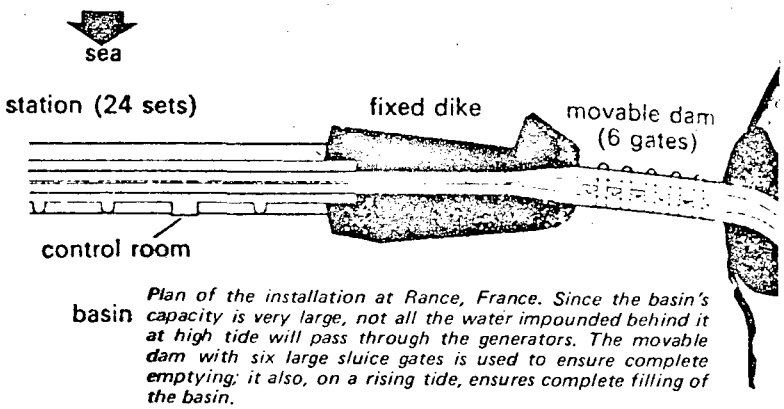
There are at least two systems that have been proposed to harness this power. In one, the ocean thermal gradients are used to generate water vapor (steam) or the vapor of some intermediate working fluid such as freon. This vapor is then expanded through turbines to drive generators, synchronized at an 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:

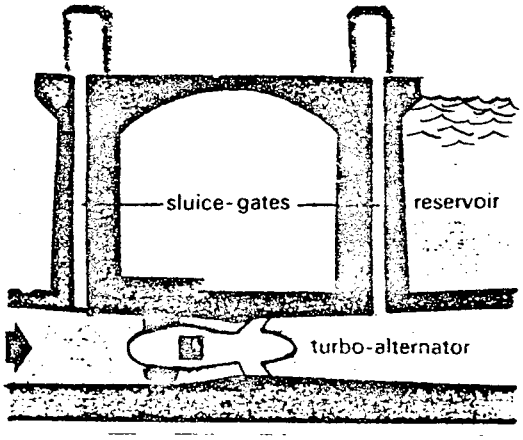
Three scientists, two of them with the Commerce Dept.'s National Oceanic and Atmospheric Administration, suggest that man may one day use the energy of the northward flowing Gulf Stream to spin electric generators in systems the scientists liken to "underwater windmills." The Florida Current, a major 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 harnassed.





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.



HYDROELECTRIC:

Today, only a small portion of the power needs of most countries is met from hydroelectric sources. Although these sources are clean means of generating power, there are many environmental and societal damages associated with them. Damming inundates vast areas of some of the best lands in an era when we cannot afford to lose such acreage; this form of power generation precipitates a process of backwater sedimentation which, in many cases, spreads indefinitely upstream and into tributaries with damage to good farmland; it is not needed for power because steam-generated power in low-gradient areas is now cheaper than hydroelectric power; it provides an expensive, temporary structure — in an average prairie plowland the large dam has a life expectancy of only about 50 years due to rapid siltation. It is inhospitable to wildlife because of rapid siltation which chokes out spawning beds and destroys aquatic vegetation. Probably the most important obstacle in the development of this form of water power is the limitation of use. The growing shortage of natural sites and the high cost of construction rule out dependence on this form of energy in the future.

TIDAL:

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

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

WAVES:

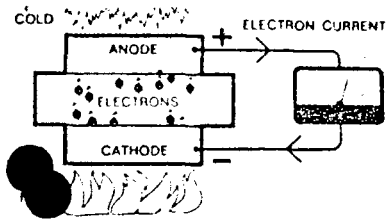
It has been proposed to obtain electric power from waves and tides. Since waves exhibit tremendous power, schemes have been put forth to harness it. One plan is to have each incoming wave force water, by means of valves and a pressure chamber, into a tank above sea level; this water would run a turbine 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

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.

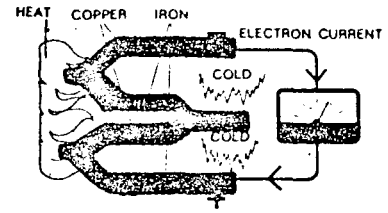
In efforts to increase energy production and reduce pollution concurrently, efficiency is the key factor with respect to conversion devices. "The higher the efficiency of an energy system, the more usable power is produced per unit of fuel, and the less pollution and waste. Conventional steam power plants, 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 turbine 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.



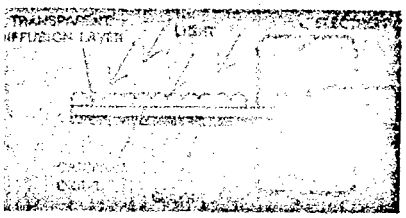
Direct Conversion — Almost all the world's energy is now transformed by rotating or reciprocating machines. We couple the energy of fast-moving gasoline jets to the automobile's wheels by a reciprocating engine. The hydrogenerator at a hydroelectric plant extracts energy from falling water and turns it into electricity. Such rotating or reciprocating machines are called dynamic converters.

A revolution is currently underway. We now know that we can force the heat and electricity carrying electrons residing in matter to provide us with energy without the use of shafts and pistons. This is a major accomplishment of modern technology: energy transformation without moving parts — direct conversion. The main advantage of direct conversion devices are high reliability 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 or 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 principal 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.

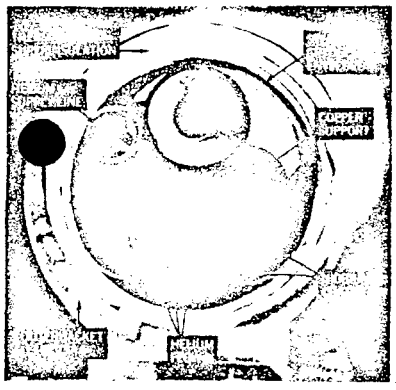
Superconductivity. It has been discovered, by Dutch Nobel Prize physicist Heike Onnes, that at temperatures near absolute zero (minus 460 degrees F), certain metals suddenly lose all resistance to an electric current and become perfect conductors. They carry current without any heat or other energy losses. 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.

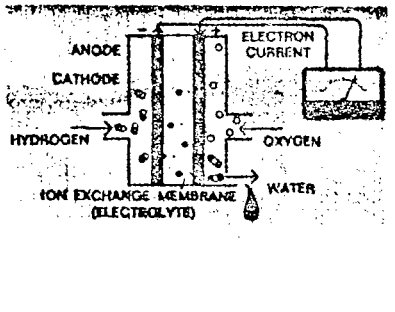
The first use of superconductivity was in electromagnets. An electromagnet with super-conductive coils needs only one large injection of current, rather than the enormous and constant amount necessary before, which then circulates in the coils almost endlessly without loss as long as the coils remain 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 gargantuan 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).



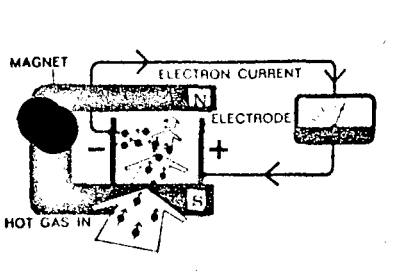


FUEL CELL:

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 100 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.



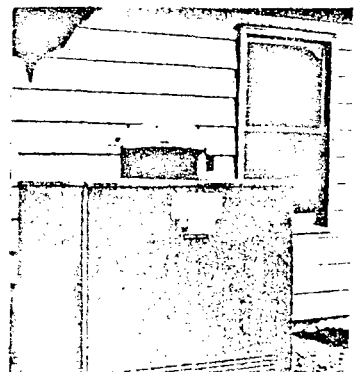
MAGNETOHYDRODYNAMICS:

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 uses 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 60% efficiency in conversion. MHD promotes more complete combustion of hydrocarbons, 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, because it 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 reduces 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.



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 become in 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 less 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 fired 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-powered installations — 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 — ferrohydrodynamics. In one experiment, a cold ferrofluid within a pipe is attracted to a magnet where its pressure rises. Heating the fluid within the field reduces its magnetic strength, so it leaves 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.

ROCKET ENGINE

Rocketdyne and Commonwealth Edison Company of Chicago are currently working on a joint plan to install an experimental space power machine or Non-polluting 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.

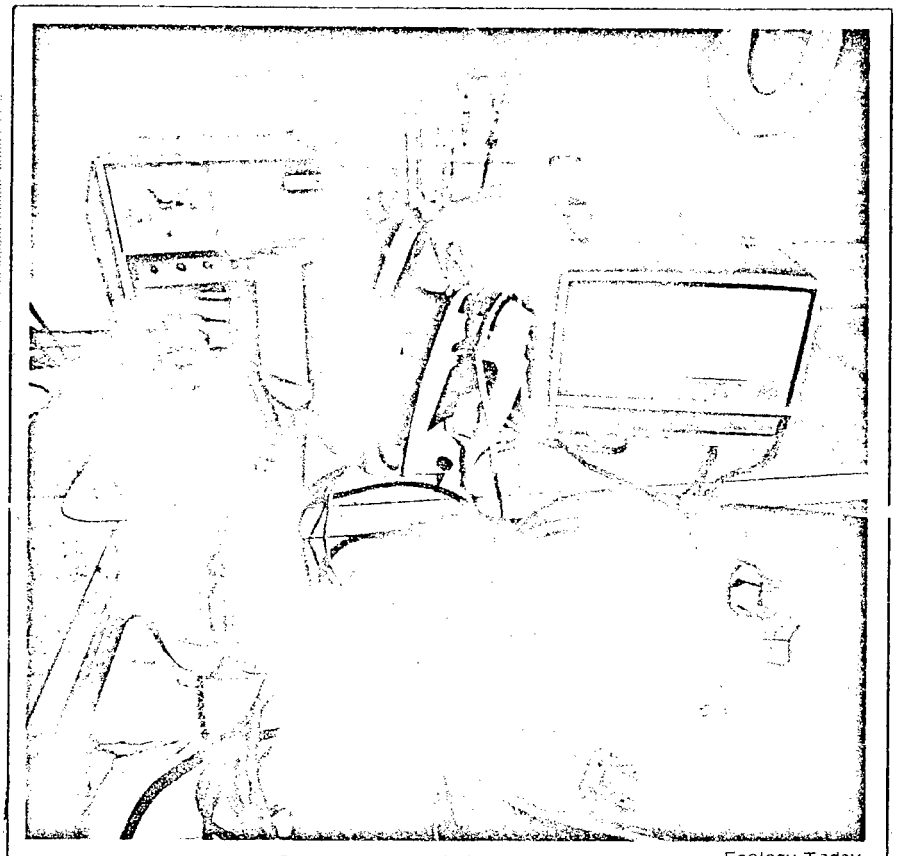
The new power unit — utilizing technology similar to that of the rocket engine that helped to power many of the nation's most important space launches — will have a combustion system fueled by a mixture of light hydrocarbons and liquid oxygen. Instead of producing thrust, the engine, via heat from the combustion process, will turn water into steam to drive a turbine generator, much as coal and oil boilers do in a conventional power plant. This process is effected in a manner that will virtually eliminate emissions of particulates and other pollutants without the noise normally associated with rocket engines.

The combustor is designed to replace a coal-fired boiler 500 times its size. The engine is compact and efficient. And the engine can be adapted to older units that would otherwise be scrapped. It appears the total operating cost would be no more than those of current gas turbines.

ENERGY STORAGE:

There are many battery and other storage facility units that are currently being investigated that will increase the capacity of electrical storage. Studies in lithium and cadmium batteries brings more hope to the concept of battery powered vehicles. There is also pumped storage, which is the pumping of water during nonpeak times into reservoirs that can be tapped for energy use at later times — thus creating a sort of water battery. There are also proposals for storage of energy in compressed air. Hydrogen, which can be produced by many energy sources, is a form of storage that may be the storage battery for windmills and solar thermal energy sources. Research in solar battery storage has also brought up increased capacity in the form of advanced photovoltaics.

CONSERVATION OF ENERGY



—Ecology Today

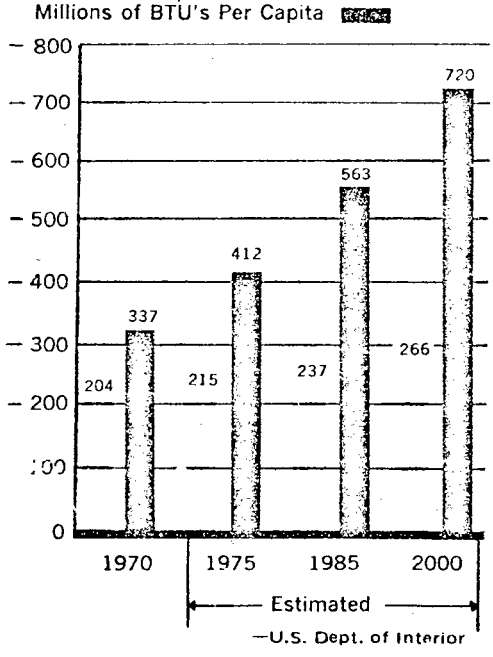
Power consumed by appliances:

	watts		watts
Electric range	12,205	Refrigerator/freezer	325
Laundry dryer	4,855	Laundry washer	285/510
Air conditioner (window)	1,565	Television set	235
Dishwasher	1,200	Fan (window)	225
Electric fry pan	1,195	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

"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

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

Trends in U.S. Per Capita Energy Use



—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, magneto-hydrodynamics 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 sclutions 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 (non profit, tax-exempt scientific, educational public foundation) under grants derived from citizen contributions to Environmental Alert (non profit, tax exempt charitable organization). Projects by Alan A. Tratner, Director of Environmental Education, Tony Shultz, Ph.D. Director of Investigative Research, Ms. Karen Lee Tratner, Projects Editor. Additional copies may be obtained by writing to E.A., 1543 North Martel, L.A., Calif. 90046, U.S.A.

Plutonium is a "fiendishly toxic" material.
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 by commercial nuclear power plants.

The world was created out of oxygen, hydrogen, carbon, iron and other elements; there are 92 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, for 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.

Plutonium's threat to life is more than just the 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.

Plutonium is, in addition, very persistent. 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

Ex. P

1— 222

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

Ex.D

children who get leukemia after age 10, suggesting a long latent period /- 225 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.

GRAHAME A. ROSS
& ASSOCIATES
ECONOMIC CONSULTANTS

Ex. D

MARCH 6, 1975

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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 ~~kkk~~ 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. 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 ~~either~~ solar energy. This is a competitive land use to a RSSF site, and we should

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

(pg 34) "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 appelation of Nevada as the site of the National Nuclear Dump. Such a designation 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. Deacon's 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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E & D
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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 [illegible] 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.

Ex. F

/- 230

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

CHIPPINGS

ARCHEOLOGICAL SURVEY - UNIVERSITY OF NEVADA - RENO NEVADA

PUBLISHED BY AM-ARCS OF NEVADA

A SOCIETY FOR THE STUDY OF PREHISTORY & ARCHEOLOGY

VOLUME IX | 1st QUARTER | MARCH 1975

IN APPRECIATION

An open letter to Don Tuohy

/- 233

Dear Don,

you may or may not be wondering why Am-Arcs saw fit to present you with a token of our esteem at the recent picnic held in connection with the Great Basin Anthropological Conference. The simple "THANKS" on that plaque is for a variety of things.

It has been a long time since your first appeared before our group and hit us all between the eyes with your "Coyote" speech. (Half of that group never came back!) Some of us took a serious look at ourselves, however, and decided that we would try to shape up, if you, as a professional would just listen to us. You see, Don, many of us had been fascinated with artifacts and archeology for years, but we were given the runaround by University and Museum people. They told us that we mustn't pick up artifacts--that only professionals had been ordained to do that--but, when we would plead with them to study a site, they were bubbling over with reasons why they couldn't do it.

Some of us are natives of this state, others have lived here many years and what we lack in scientific, technical skill we compensate for with a genuine feeling for the tools that were once a vital part of the lives of the people who were the native Nevadans of so long ago. You seemed to realize that, though we were amateurs in the field of archeology, we were not <u>all</u> fiery-eyed pot-hunters bent on destruction--at least <u>intentionally</u>.

We saw you cringe when we showed you boxes of unlabeled artifacts, and flower beds filled with broken stone implements. We didn't know a Mojave point from a Sandia: but you took the time and trouble to teach us. Oh, we still collect artifacts-you could never have changed that-but we now label, catalog, map and photograph everything, and you and other professionals have access to our collections for scientific study. We have lost some of our old friends who think you only want to confiscate their collections and who choose to collect artifacts only to compete with each other-like small boys with bags of marbles.

What it boils down to, Don, is that you seem to respect people in their own rights, whether they are native Nevadans (the <u>original</u> ones--Paiutes, Washoes, Shoshones) or whether they are "hard-hat" workers or professionals in some other field.

Because of this, we want you (and your peers in the hollowed annals of professional archeology) to know that we respect <u>you</u>.

With hopes for a continued and growing understanding among all of us who have a sincere concern for the treasures of the past.

Am-Arcs of Nevada

COMING EVENTS--MARK YOUR CALENDARS

March 13 Don Hardesty, Chairman of the Anthropology Dept. UNR will speak on "Little Valley". He will show and discuss the interesting slides he has of the area.

April 14 Byrd Sawyer will lecture on the native foods of the Paiute Indians. Not only will she tell us about the foods, but she will have some on hand which she will prepare and perhaps there will be "pine-nut soup tasting" for some lucky members.

May 10 Carolyn Cleland will speak on Indian Fetishes. You will hear more about this later; but if you have any fetishes you would like to discuss or have discussed bring them along.

FIELD TRIP Apr. 5-6 FIELD TRIP Apr. 5-6 FIELD TRIP Apr. 5-6

Mark your calendar for this event. Phil Hutchinson, who has accepted the Chairmanship of the committee to arrange field trips, will announce the plans for this overnight trip at the March 13 meeting. You will be notified of final plans. Be sure to make room for it among your April activities.

DISPLAYS DISPLAYS DISPIAYS

PLEASE share with the Am-Arc group your private collections. Members have remarked how rewarding it was last year to see and discuss the artifacts so generously shared with us by members: Gary Noyes, Phil Hutchinson, Sharon Dalton, Mary Dick and Pete Ting.

NOTES OF INTEREST FROM PAST MEETINGS

February This meeting was held in Carson at the State Museum. Don Tuohy; Director of Archaeology on the Museum staff, spoke on "Baja Revisited". Don showed the slides he took while participating in the "dig"

Nov. 1974 Dr Claude Warren, UNLV spoke on the studies he made of prehistoric Lake Majave-especially in relation to the different water levels during the ages and the effect on human habitation.

Oct. 1974 Peg Wheat, Geologist and author spoke on the "Geology of Lake Lahonton". Not only did we gain valuable scientific knowledge of the area, but Peg regaled us with her personal experiences as she clambered over rocks and brush and other impediments. Peg generously offered to take the Am-Arcs to a site on the road to Pyramid Lake where the ancient water levels are readily discernable. This is a trip we hope to take at Peg's convenience.

JUST WHAT IS AB 210 ALL ABOUT?

AB 210 is a bill before the Nevada Legislature that will establish the Nevada Archaeological Survey as a department of the Nevada State Museum to coordinate a cooperative program to record, study and preserve salvage objects, localities and information of historic, prehistoric and paleoenvironmental significance.

The survey will have four divisions: (1) Central administration at the Nevada State Museum (2) University of Nevada, Reno (3) University of Nevada, Las Vegas (4) Desert Research-Western Studies Center, Reno. The Nevada Historical Society and the Lost City Museum will also have representation on the governing council.

With the passage of national and state laws regarding environmental impact studies and site surveys, it is necessary to have an agency to coordinate these studies. This agency would be a clearing house for other state agencies such as BLM, parks and recreation departments, public utilities and construction firms. All permits for any archaeological studies would be issued through the survey.

In the past, monies were not available for these studies and we lacked a strong state survey program. States surrounding Nevada, who themselves have a good, strong program, have used Nevada as a vast field school. Contract work that should have gone to our state has gone to survey programs of other states. When these studies have been completed, gone are the study materials, artifacts and monies paid for these studies. With our own program these studies will be done by Nevada archaeologists and the materials and artifacts will be here in our own state for our use and study.

This bill has the support of all the professional archaeologists in the state and we hope, the amateurs. For us as a group, this bill will make more surveys available and hopefully we will be called upon as certified trained amateurs to help in the preservation of our past.

Am-Arcs has contributed financially to help with the cocktail party for legislators held at the museum on February 18th. Also some members were at the party to help promote the bill and answer any questions concerning it. Won't you as individuals help by letting your legislator know you support this bill? Contact; Environment and Public Resources Committee-Douglas Bremner, chairman and Ways and Means Committee-Don Mello, chairman.

Great news; Am-Arcs will be conducting our very own "dig" at Washoe Lake. Thanks to Don Tuohy, who got permission from the State Park Service, we will do the impact study and site survey at their new park sites on Washoe Lake. This will be a chance to show what a professional job we are capable of. Because this is a sanctioned dig, there will be NO private collecting done at this site. Anything found must be turned over to the site director for recording and study.

Work will begin on the site on Saturday March 15th by a special surveying crew picked by Don at our March meeting. This small crew will map and stake the area in preparation for the dig. On Sunday all interested Am-Arcs members will meet at the New Washoe City turnoff at 9:30 AM. From there we will proceed to the site for an inspection and concentrated surface collection before the actual digging begins.

Don will be presenting more details at the March meeting. Be sure to attend to offer your services for your special area of interest.

Dues for the year 1975 are now due. Your membership form has been mailed. Will you please complete the form and return it with your check as early as possible. Non-paying members will be dropped from our mailing list if dues are not paid by June 1, 1975.

"Broken Treaty at Battle Mountain" is a much talked about film. Would you as a group be interested in seeing this film? A fee of $75.00 is being charged for each showing. If you want to see the film and would be willing to pay for it, let Jean Myles, program chairman, know your wishes on the matter.

Don Hardesty, Chairman, Anthropology Department, UNR has agreed to be one of our advisors as outlined in our Am-Arc by-laws. Don will be joining our other advisors: Mary Rusco and Don Tuohy.

Due to the efforts of Dr. Robert Myles, we have a new meeting place. Am-Arcs will meet in the conference room at the Washoe Medical Center. Directions have been included with your meeting notice.

An Am-Arc scholarship was presented to graduate Steven R. Simms at our February meeting in Carson City. We do wish to congratulate Steven as this years recipient. Steven is now an employee of the Nevada State Museum.

Have you written or read any articles you would care to share with our group? "Chippings" will be happy to publish any articles written by members. In the past we have had many good papers we hope we can get more of them from you.

UNIVERSITY OF NEVADA, RENO

1- 237

DEPARTMENT OF ANTHROPOLOGY
Mack Social Science Building
Room 201 B
Reno, Nevada 89507
(702) 784-6704

March 10, 1975

Hon. Roger Bremner
Chairman
Environment and Public Resources Committee

Dear Sir:

As chairman of the Department of Anthropology at the University of Nevada, Reno, I wish to convey our full support of AB 210, the bill to establish a Nevada Archaeological Survey. The need to protect Nevada's heritage is nowhere more evident than in its archaeological resources and the establishment of a statewide survey would go a long way toward fulfilling this need.

Sincerely,

Donald L. Hardesty

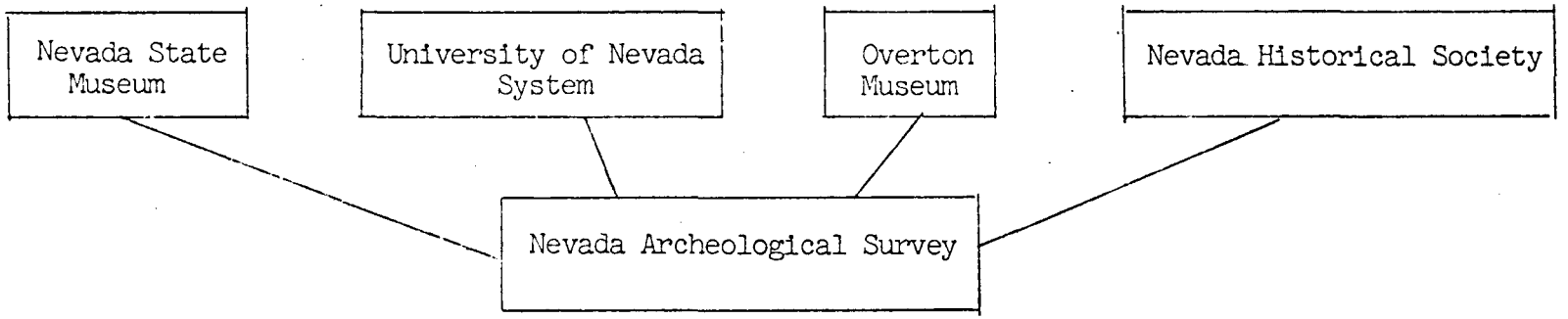
Donald L. Hardesty
Chairman

DLH/bt

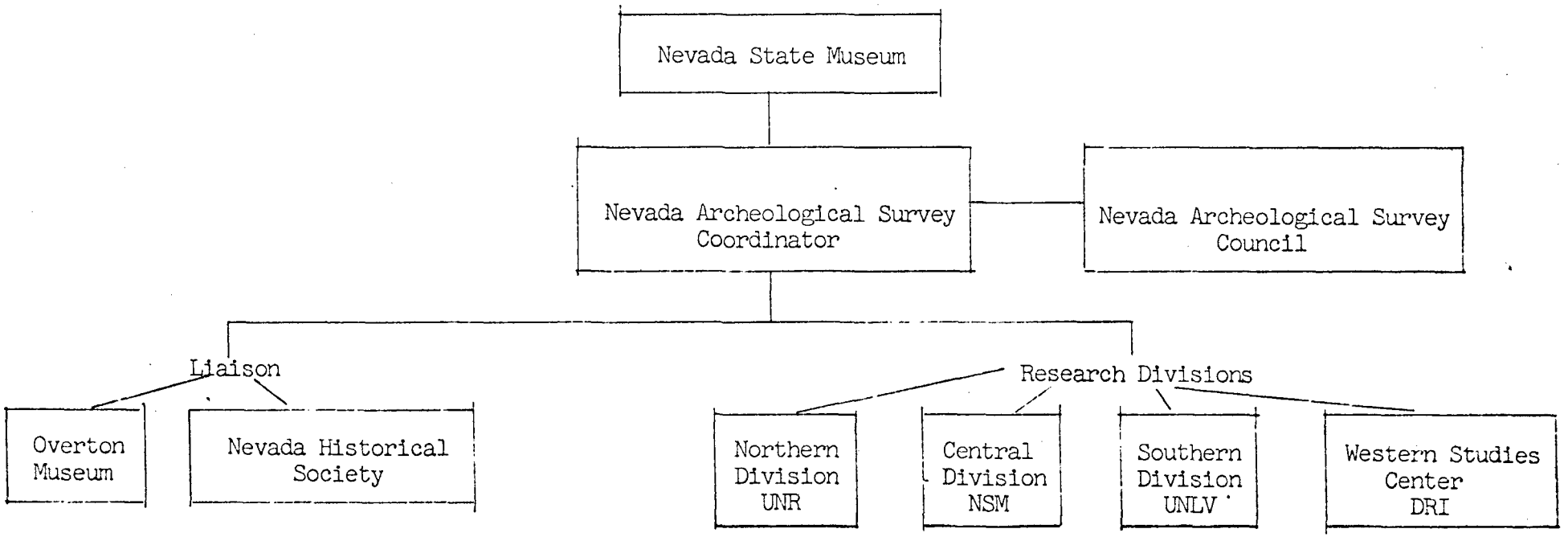
Ex. H

I-238

Proposed Nevada Archeological Survey
Permanent Institutional Membership



Proposed Nevada Archeological Survey Organization



Council

Nevada State Museum Director
Nevada Archeological Survey Coordinator
Research Division Directors
Lost City Representative
Historical Society Representative

Ex. H

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CURRENT AND PROPOSED

STATE ARCHEOLOGICAL SUPPORT IN NEVADA

COMPARED TO THAT IN OTHER STATES *

States	Number of professional positions in f.t.e's (full-time equivalents)	Funds for operating and staff positions in addition to salaries for professional positions
Arkansas	11	$ 200,000.00
California	8	100,000.00
Hawaii	7	100,000.00
Arizona	6	75,000.00
Washington	5	30,000.00
Utah	3	40,000.00
New Mexico	4	20,000.00
Idaho	3	25,000.00
Oregon	2	5,000.00
Wyoming	.5	1,000.00
Nevada (1974-75)	1	1,000.00
Nevada (proposed)	3.75	ca. 41,000.00

* These figures are based on support in 1974; several of these programs have been strengthened since then. See American Antiquity, Vol 40, No. 1, Jan. 1975 for figures from all 50 states.

Ex. H

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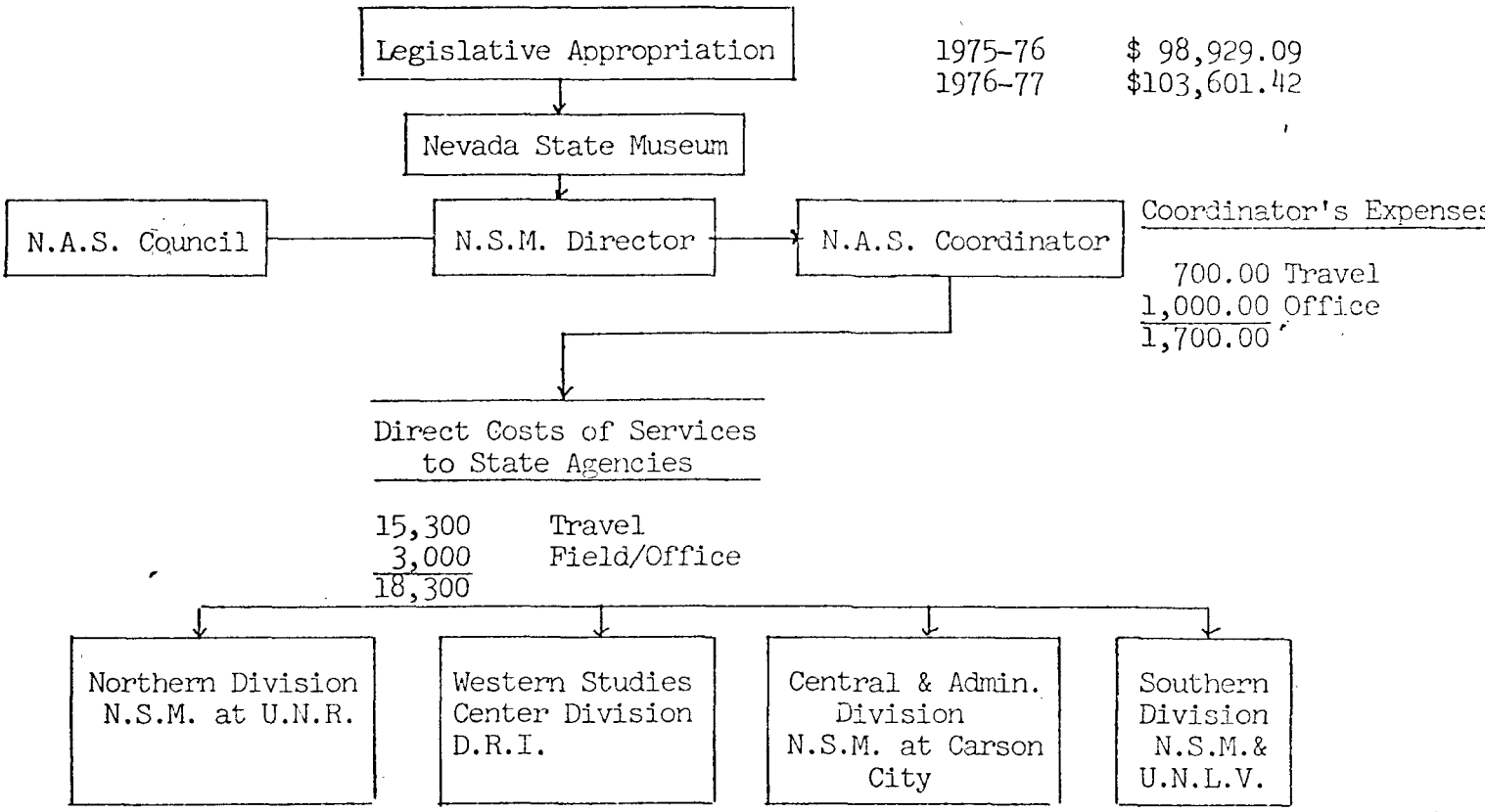
FLOW CHART FOR STATE APPROPRIATED FUNDS IN PROPOSED NEVADA ARCHEOLOGICAL SURVEY (A.B. 210)



	Northern Division N.S.M. at U.N.R.	Western Studies Center Division D.R.I.	Central & Admin. Division N.S.M. at Carson City	Southern Division N.S.M.& U.N.L.V.
Director	12,383.00[1]	(No appropriation requested)	12,383.00[2]	3,942.00 (.25 fte)[3]
Field Arch.	10,326.00			10,326.00
Clerk-Typist	6,371.00		7,248.00	3,185.00 (.5 fte)[3]
Salary costs	3,744.00		2,520.00	2,150.00
Travel	450.00		450.00	450.00
Office	1,000.00		1,000.00	1,000.00
	32,824.00		23,601.00	21,054.00

TOTAL: Fiscal 1975-1976 $98,929.09 Fiscal 1976-1977 $103,601.42 (75-76 + 5%)

1. .5 fte of this position is currently being funded by UNR but will not be funded in the coming fiscal period.
2. This position will be filled by the existing Staff Archeologist of the Anthropology Dept. in the NSM.
3. These positions are already being funded in part through the Museum of Natural History at UNLV.

Exh I

From: Robert York, Cultural Mgmt. Specialist
U.S. Dept. of the Interior
Bureau of Land Management
Nevada State Office
300 Booth Street
Reno, Nevada

Ph: 702-784-5455

March 10, 1975

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To: Nevada State Legislature, Assembly Committee

Subject: Additional remarks to be read into the record, Nevada State Legislature.

I send my apologies to this comittee for being unable to appear today. I do not wish to greatly add to my previous remarks except to reiterate the BLM's continuing support for AB 210 and, to supply a brief rebuttal to certain concluding remarks that were made at the previous session. These remarks were to the effect, "--- Why should the State chip in anything --- let the feds carry the ball ---."

First, that seems a rather odd thing to say? One usually gets the impression that most Nevada residents would like to see less federal involvement here, not more.

Second, and more to the point, "the feds" are not going to do the job -- at least not alone and certainly not without State and local support. The National Historic Preservation Act of 1966 and Executive Order 11593 both mandate federal agencies to work in close cooperation with State and local agencies toward the goal of Cultural Resources preservation. And, The NHPA 1966 set-up federal dollars to help the states with Historic Preservation Plans. Most of this is on a matching fund basis. The NHPA 1966 and most other bits of federal legislation either implicitly or explicitly recognize that the various states have the biggest stakes in the area of Cultural Resources Management. We (The Nevada BLM) are gearing-up internally to help

us better protect and preserve Nevada Cultural Resources from our own actions. We are certainly not going to be able to handle State or private enterprise cultural resources problems. And, if the State of Nevada shows no particular interest (meaning financial interest, not just lip service) in the area of Cultural Resources Management then I would predict neither will "the feds."

If your committee, or any other legislators, would like clarification of any of my statements or remarks or would like additional data from me, please contact me at the above adress or phone.

Robert York
Cultural Mgmt. Specialist
Nevada State Office
Bureau of Land Management

Ex. J

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AB 210

STATEMENT BY KAY WINTERS REPRESENTING

LYON COUNTY PARK AND RECREATION BOARD

This bill is a very good one for it would provide services that are greatly needed.

You are probably aware of the federal law concerning 86% of our state lands that says an archaelogical survey must be made on any "disposal" lands that show traces of an historic site. In the past this was often handled by outside groups who "skimmed off" historic items for their own musuems.

There are numerous historical areas in Nevada - many in Lyon County and we would like to take advantage of the services offered by this bill.

ASSEMBLY ACTION	SENATE ACTION	ASSEMBLY / SENATE AMENDMENT BLANK
Adopted ☐	Adopted ☐	Amendments to Assembly /xSenate
Lost ☐	Lost ☐	Bill/Joint Resolution No. 15 (BDR 1030)
Date:	Date:	Proposed by Mr. Mann
Initial:	Initial:	
Concurred in ☐	Concurred in ☐	
Not concurred in ☐	Not concurred in ☐	
Date:	Date:	
Initial:	Initial:	

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:

Resolution

Amendment No. 4594 to Assembly Joint Bill No. 15 (BDR 1030) Page 2

"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/~~xxxisfxxxxxx~~ 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, ~~Nxxxxx~~ Devel-".