Minnesota Annual Conference

The United Methodist Church

Room 400, 122 West Franklin Avenue (612) 871-8733
MINNEAPOLIS, MINNESOTA 55404

June 30, 1980

Nuclear Regulatory Commission
L. V. Gossick, Dexec Director, Opr.
Washington, DC 20555

Dear Mr. Gossick,

Nuclear power is everybody's concern --- including members of the United Methodist Church. The 1979 Minnesota Annual Conference of the United Methodist Church, comprised of 1000 delegates representing 125,000 United Methodist adult members throughout Minnesota acted positively on a nuclear moratorium but the Conference also took action to continue the dialogue on this issue by inviting those involved with nuclear power to respond to their concerns. Since you play an active role in nuclear power, we hope you will be willing to facilitate this dialogue.

In 1978 the Minnesota Annual Conference mandated the Conference Board of Church and Society to appoint a special task force to study nuclear power and to report its conclusions to the 1979 Annual Conference. The task force spent considerable time and effort interviewing experts and citizens groups representing a wide variety of views about nuclear power, both pro and con. They also reviewed a large volume of printed material and attended debates and lectures. The result was a carefully balanced report that neither condemns nor endorses nuclear power. Rather, it points out that there are energy consequences of non-nuclear as well as nuclear decisions. The report also discusses why nuclear power issues are especially important to church members.

> "BE IT RESOLVED that the Minnesota Annual Conference of the United Methodist Church support a moratorium on the construction of nuclear power plants in the United States until such times as the problems concerning health, safety and waste disposal can be resolved.
> BE IT FURTHER RESOLVED that the Minnesota Annual Conference through its Board of Church and Society, submit a report to various nuclear organizations setting forth the specific concerns in the report of the task force on nuclear energy and request plans for improving responsibility, control, and sensitivity to citizen concerns. Responses to this report will be evaluated and reported to the 1980 Annual Conference for consideration."

The Annual Conference delegates certainly understand that domestic energy supplies are vital. However, before the United Methodist Church leadership can support the nuclear option, we need your response to vital questions raised in the report. Specifically, we would like to hear your response to our concerns about "responsibility, health, safety and waste disposal." We feel that industry has the management capability and the creativity to respond to these concerns.

A summary of the task force report is enclosed. A pre-addressed envelope is enclosed for your convenience in responding.

We plan to prepare a further report summarizing the ideas of the respondents. Please let us know if you do not want us to identify your name or company with your comments.

Sincerely,

Loren Grage

Rev. Loren Grage, Chairman
The Board of Church and Society, MN Conference
United Methodist Church

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A RESPONSE TO NUCLEAR POWER

The Report of the Task Force on Nuclear Energy
of the Board of Church and Society of the Minnesota Annual Conference

At the 1978 session of the Minnesota Annual Conference, a resolution was introduced by the Administrative Board of the Winona Immanuel-Stockton charge. It read as follows:

> "Be it resolved that the Minnesota Annual Conference of the United Methodist Church pledges to support a moratorium on the construction of nuclear power plants in the state of Minnesota until such time as the problems concerning health, safety, and waste disposal can be resolved."

In the course of its debate, the Legislative Committee realized that the Conference did not have enough information on the issue of nuclear power to make a decision on this matter. The Legislative Committee submitted the following resolution as a substitute for the above:

> "Be it resolved that, whereas there appears to be a great deal of confusion about the relative merits and hazards associated with the use of nuclear power in the U.S., therefore the Board of Church and Society is asked to appoint a committee of five to seven persons who will study and interpret the information and facts in research being done on nuclear power, and then prepare guidelines to assist the Minnesota Annual Conference in making a decision on this issue, and report these to the 1979 Annual Conference."

The Annual Conference accepted this resolution.

Roger Parks, chairperson of the Conference Board of Church and Society, asked Mark Johnson to organize a task force for this purpose. Names were suggested from various sources and, after contacts were made, seven persons agreed to serve on the Task Force:

Dale Bowen, member of Fridley United Methodist Church
Winfield Forsberg, member of First UMC, New Ulm
George Hanks, member of Emmanuel UMC, Winona
Eric Hucke, pastor of Wesley UMC, Minneapolis
Mark Johnson, pastor of Morgan and New Avon UMC
Ruth Saari, member of Lake Harriet UMC
Larry Schedin, member of Minnetonka UMC

After the first two meetings, Dale Bowen and George Hanks elected not to participate in the work of the Task Force.

The Task Force had eight meetings and interviewed the following persons:

Roth S. Leddick, project manager at the Prairie Island nuclear power plant with responsibility for design and construction of NSP's nuclear power plants.

Paul Steinback, physicist, formerly of the Battel Institute where he worked in nuclear fuel research, but has now become an opponent of nuclear power.

Madge Zitlow, American Friends Service Committee, an opponent of nuclear power.
Terry Hokenson, Northern Sun Alliance, an alliance of anti-nuclear groups.
Dean Abrahamson, professor in Hubert H. Humphrey Institute of Public Affairs, an opponent of nuclear power.
John Dunlop, director of the Minnesota Solar Office.
David Buller, with the Minnesota Energy Agency.
James Burtness, professor, Luther Theological Seminary.

In addition, Task Force members reviewed a large volume of printed material and attended debates and lectures.

As a Task Force, we express our appreciation to the Minnesota Annual Conference for the privilege of serving in this way and we express our hope that the Conference will continue to be concerned about nuclear energy and the whole field of energy in general.

Mark Johnson
Larry Schedin
Ruth Saari
Eric Hucke
Winfield Forsberg

The following is the report of the Task Force. It is preceded by a summary. It is divided into the following sections:

Part One -- What is Nuclear Power?
Part Two -- Why is the Church Concerned about Nuclear Power?
Part Three- Nuclear Energy - Good or Evil?
Part Four - What are the Major Issues Involving Nuclear Energy?
Part Five - Is Nuclear Energy Economical?
Part Six -- What are the Alternatives to Nuclear Energy and What are the Risks?
Part Seven- Recommendations

A SUMMARY OF THE REPORT OF THE TASK FORCE ON NUCLEAR ENERGY

The following is a summary of the full Task Force report. The sections of that report are identified below by number and title. "Part One — What is Nuclear Power?" is intended to be background information and is not summarized here. Also, "Part Seven --- Recommendations" is not summarized.

Part Two -- Why is the Church Concerned About Nuclear Power?

Energy resources are a part of God's created order. Christian stewardship includes the responsible use of these resources.

Part Three -- Nuclear Energy, Good or Evil?

Nothing indicates that nuclear energy is contrary to God's purposes in creation. The Task Force looks on nuclear energy as a technological discovery about God's universe. Like other technological discoveries it can be used either to help or hinder humanity. However, the choices which a citizen faces regarding the deployment and control of large-scale nuclear projects are much different from choices about other technological advances such as air travel. From a practical viewpoint there are few control channels which an ordinary citizen can effectively use to express concern about nuclear power. These channels (discussed in the report) are inadequate for the average citizen because of a lack of time and resources to attend hearings, a lack of accurate information and skills to interpret technical jargon, and a lack of confidence in government agencies to regulate the industry competently.

Part Four -- What are the Major Issues Involving Nuclear Energy?

There are six major objections to nuclear power; and for each, arguments pro and con are offered.

First, opponents of nuclear power point to the possibility of proliferation; that is, countries using nuclear power technology to develop nuclear weapons. They argue that "any country using the nuclear fuel cycle to generate electrical power can develop nuclear weapons (quoted from report). Supporters of nuclear power say that the technology is not all that similar and different kinds of uranium must be used in the two processes. Opponents argue that plutonium, which is extracted from spent nuclear fuel by reprocessing, can be used rather easily to make a bomb. For this reason, the Carter administration has discouraged reprocessing. Supporters also point to the Nuclear Non-proliferation Treaty as a way to control proliferation.

Second, opponents point to the potential problem of diversion; that is, the use of nuclear weapons by terrorist groups. Such groups could acquire the needed plutonium (about 10 pounds) by theft and use it to make a crude weapon or simply disperse it in a populated area. Supporters point to security measures on the part of the industry which make theft unlikely. They also point out that "other substances (i.e. arsenic, bacteria, etc.) could be dispersed in a populated area with comparable results" (from report).

Third, the catastrophic release of radioactive matter from nuclear power plants either by accident or act of malice is cited by opponents. Supporters point to safeguards in construction and operation of plants and to "the fact that no deaths or serious injuries have resulted from commercial nuclear accidents" (from report).

Fourth, opponents talk about the large volume of radioactive waste while supporters say that the only problem is presented by high-level waste, the volume of which is relatively small. There is disagreement over the length of time waste must be stored and over whether or not we, at present, have the adequate technology to store high-level waste.

Fifth, there is controversy over low-level radiation released in normal plant operation. Opponents point out that radiation exposure is cumulative over one's lifetime and that there is no safe level of exposure. Supporters point out that there are many sources of low-level radiation including medical X-rays, high altitude plane flights, and coal-powered generating plants.

Sixth, opponents argue that we do not want the kind of society nuclear power requires. Nuclear power demands centralization and the control of electrical power production by a "technological elite." Also, extreme security measures are required. Supporters point out that other areas of society are technologically sophisticated and require security. They also say that some foreign countries "have no option for meeting their energy needs, other than nuclear power" (from report).

Part Five — Is Nuclear Energy Economical?

There is no solution to America's energy problem which will not be economically costly. Nuclear power is more capital intensive than coal, oil, and natural gas for generating electricity. However, the high capital costs are accompanied by comparatively low operating costs. This makes nuclear power attractive in areas distant from large coal deposits. The long lead time required to build a nuclear plant (10-12 years) along with changing design requirements and inflation is driving the cost of nuclear power upward. Unfortunately, these same forces are also driving upward the cost of other energy sources such as coal-fired plants. The proper selection of the most economical type of energy alternative requires a complete knowledge of capital costs and operating costs plus a knowledge of any hidden subsidies. Conservation is also a viable alternative but it, too, has its costs (insulation is not free). None of the choices is without risk.

Nuclear energy can serve as a direct substitute for other energy sources (such as petroleum in the case of electricity generation). Nuclear energy can also indirectly affect the amount of petroleum available for transportation and the amount of natural gas available for home heating. Therefore, if nuclear energy is eliminated, the scarcity and price of these other fuels will increase.

Part Six — What are the Alternatives to Nuclear Energy and What are the Risks?

We have seen that there are many risks associated with nuclear power. However, other energy sources also have risks.

Coal use increases the atmospheric load of carbon dioxide and could increase "average world temperature (by) 2 to 7 degrees" (from report). Black Lung Disease is common in coal miners and the burning of coal may cause respiratory diseases in the young and elderly. Negative environmental effects include strip mining and transporting hazards, as well as negative effects on agricultural production and acid rain. Some say that radiation doses from coal-fired plants are greater than from nuclear plants.

Oil is needed for other uses and the burning of oil for electrical generation increases our dependence on foreign sources.

Geothermal plants would be limited to certain parts of the U.S. and would polute both air and water.

Hydroelectric power is now being fully utilized in this country and does pose potential hazards in terms of a dam collapsing.

Solar power has good potential for small residential applications, but, at present, high cost precludes its use for large-scale electrical generation.

Conservation is "the most viable energy alternative" (from report). Conservation means eliminating waste, developing new technologies and changing life-styles. "The Task Force believes that we have a moral obligation to protect the environment and conserve natural resources. Christians, we believe, should set an example of good stewardship by consciously and seriously limiting their use of all energy sources." (from report).

All energy sources have risks. Eliminating nuclear power would eliminate its associated risks, but would increase risks associated with other sources.

A RESPONSE TO NUCLEAR POWER

(THE FULL REPORT)

Part One -- WHAT IS NUCLEAR POWER?

Nuclear Power plants come in all shapes and sizes ranging from small devices for powering satellites to intermediate sizes for powering submarines to large installations for producing electricity for hundreds of thousands of people. It is this latter size (large central power stations) that the Task Force is primarily concerned about in this report. Large central power stations use nuclear fuel to produce steam. The steam can be used for industrial manufacturing purposes, for heating buildings, and for producing electricity. The following is a short description of how nuclear plants work.

Nuclear fuel is placed in a steel vessel called a reactor. Nuclear particles released from the fuel cause neighboring atoms of the same fuel to split apart. This splitting in turn releases more particles and causes more splitting. The process multiplies into a chain reaction. The splitting apart is called fissioning, and the fissioning releases heat. The heat is used to boil water and to create steam. The steam usually operates a large machine called a turbine. The turbine is much like a windmill or pinwheel except it is operated by steam rather than wind. The turbine then operates a large electric generator.

After operating the turbine, the steam must be cooled in order to create a vacuum (or suction) which pulls other steam through the turbine. The cooling is usually done with river water which in turn is circulated through a large radiator (called a cooling tower) which releases most of the excess heat to the atmosphere. The river water does not come into contact with radioactive steam.

The fuel used must be a heavy element which is highly susceptible to splitting. There are naturally existing elements called uranium and thorium which meet this requirement. Unfortunately, only a small percentage of these naturally existing elements are of the type which is highly susceptible to splitting. The special type of uranium which is highly susceptible to splitting is called the fissionable isotope U_{235}. To make the fuel usable, the uranium must be concentrated to a strength of 4 or 5 times the concentration that U_{235} exists in nature. This special concentration step is called enrichment. It is a highly specialized process and was the key to making the first nuclear bomb. Fuel enrichment takes a considerable amount of electrical energy. In the U. S. the enrichment is done by a process called gasseous diffusion at places such as Oak Ridge, Tennessee.

As heat and electricity are generated during the fission process, the uranium is split into many fragments. Some of the by-products are dangerous because they are highly radioactive. A large part of the radioactivity decays away to harmless level within a few weeks after the spent fuel is removed from the reactor and stored at the plant. However, certain by-products remain highly radioactive and contaminate the spent fuel. The spent fuel can be reprocessed to remove the desirable products and to dispose of only the unwanted by-products.

Plutonium is one of the useful by-products that can be removed by reprocessing the spent fuel. The Plutonium can also be recycled through a nuclear reactor to produce more energy. However, Plutonium is a highly toxic substance if ingested by a living organism. Plutonium can also be used relatively easily to make a nuclear bomb. Therefore plutonium must be handled carefully. The present policy of the Carter Administration is that spent fuel should be buried rather than recycled because of the risks involved in reusing plutonium.

A variety of nuclear reactors are in use throughout the world. The major nuclear nations are specializing in the types of reactors which they think are best. The U. S. primarily uses light water reactors, Canada uses heavy water reactors, and the United Kingdom uses gas-cooled reactors. Each has its advantages. A special type of reactor is now being hotly debated within congress. It is the breeder reactor now being developed in France and the USSR.

The breeder reactor is special because it uses plutonium to convert commonly occuring uranium (U_{238}) into more plutonium as well as to generate electricity. The new plutonium which this special reactor "breeds" can then be removed from the reactor and used to breed even more plutonium and to generate more electricity. In this way the amount of energy obtainable from a given amount of uranium can be multiplied many hundreds of times. This is a great increase over the amount that would simply be obtained by using the fuel only once through a simple kind of reactor. The controversy about the breeder reactor centers around the dangers of having more plutonium in existence and not over the technological potential to get more energy from the fuel. The U.S. has built small breeder reactors for demonstration purposes and now has proposed a large breeder reactor called Clinch River for construction in Tennessee. The Clinch River Project is now on "hold" because of President Carter's non-proliferation policy.

A nuclear reactor which has great promise for the future is called the fusion reactor. A fusion reactor joins together or "fuses" lighter elements such as hydrogen. A fusion reactor has many more times the potential of a breeder reactor without the risks associated with plutonium. Fusion power is now in the experimental stage, and commercial application will take some major technological breakthroughs. Nevertheless, some scientists feel that commercial fusion power may be available in 25-30 years.

Part Two -- WHY IS THE CHURCH CONCERNED ABOUT NUCLEAR POWER?

Energy supplies or lack of supplies will affect people all over the world. Depletion of non-renewable resources for production of energy as well as other products will drastically affect the lives of generations of people who follow us. Disposition of waste products from energy generating plants already vitally affect the health and welfare of many people.

Christians believe humanity and earth were divinely created to co-exist; so the earth and all within and upon it is meant for human use. At the same time, the divine intent was for man to use all these resources wisely. Responsible Christian stewardship requires strict attention be paid to the

sharing of these gifts. We believe humanity is endowed with intellect which should enable it to develop technologies and life styles that will benefit all people for all time. Production of energy from nuclear sources is part of that scene.

These statements as set down are, we believe directly related to the Social Principles of the United Methodist Church. They should be of concern to every Christian for they affect or have the potential to affect for good or evil all of the peoples of the earth now and in the future.

Part Three -- NUCLEAR ENERGY, GOOD OR EVIL?

Is nuclear energy good or evil in an absolute sense? The task force conclusion is "No!" Nothing indicates that nuclear energy is contrary to God's purpose in creation.[1] The sun is a natural nuclear power plant and is the source of organic fuels from coal, oil and natural gas to firewood and dung. Enrico Fermi's reactor in Chicago in 1942 was not the first nuclear fission reactor on earth. A natural reactor began operating in the Gabon Republic in West Africa nearly two billion years ago.[2]

The earth, however, is unique from other observable bodies in the universe because the atmospheric blanket shields us from much of the harmful nuclear reaction by-products from the sun and other sources. The earth is also special because it supports combustion of organic fuels and other conditions that makes life as we know it possible. A theological view of nuclear energy and biblical references are well laid out in the Pollard reference.

Since the task force could see no basis for labeling nuclear energy good or evil in an absolute sense, we asked ourselves how we should judge nuclear energy? The task force looks on nuclear energy as a technological discovery about God's universe. Like discoveries from medical research, it can be used to help or hinder mankind. In this context, discoveries from genetic research which reduce birth defects would be considered good while genetic discoveries which lead to breeding monsters or a super race would be considered bad.

A reference work which seemed to tie all of this together is Robert Persig's book Zen and the Art of Motorcycle Maintenance.[3] Persig is a philosopher as well as a writer of technical computer manuals for a large computer company. He feels good about his motorcycle because he can control it, he can repair it, he can understand it, and he can use it for transportation while feeling close to the environment he is riding through. Persig also discusses how technology can either be used as a monster to control and manipulate people or used as an instrument to keep us in harmony with our universe (through the concept of quality). This potential loss of control is not only on Persig's mind but also on the mind of church members.

A typical church member's response to questions about nuclear energy is underlain with fear about how he/she can maintain control over something which he/she cannot hear, see, feel or taste and which is controlled by large organizations which can easily be unresponsive to his/her concerns about

control. A church member can make choices about mode of travel (if he/she feels certain airplanes or transportation vehicles are unsafe) and about using a particular consumer product (if he/she feels the additives are unsafe). However, there are no comparable choices about nuclear energy and other large scale energy projects operated by monopolies.

The recent DC-10 airplane crash is not so threatening because of the choice that allows a passenger to consider in advance whether he/she wants to ride on a DC-10, and the choice to avoid riding an airplane operated by an airline with a poor safety record. The DC-10 threat is quite different from the Three Mile Island plant incident where choices (in view of the conflicting information about safety) were limited to staying or leaving one's permanent residence.

Control of power currently exists through:

1. public participation in the licensing hearing and hearings about need and necessity
2. enforcement agencies such as the Federal Nuclear Regulatory Commission (NRC) and state agencies which set guidelines and maintain surveillance
3. social responsibility which is voluntary on the part of the owning organization
4. elected officials.

However, these channels of control are difficult for most concerned church members to use because of a lack of time and resources to attend hearings, a lack of accurate information, a lack of skills to interpret much of the technical information, and a lack of confidence in government agencies to regulate the industry without being unduly influenced by the industry it is attempting to regulate.

Nuclear power certainly has the potential of enhancing the quality of life. A good example is the nuclear energy source that activates an ocean buoy to warn ships away from a navigation hazard in a remote region that requires a low maintenance energy source. However, the extent of its use is very much in question.

Part Four -- WHAT ARE THE MAJOR ISSUES INVOLVING NUCLEAR ENERGY?

Opponents of nuclear power cite what they call "unprecedented hazards"[4] associated with nuclear power. In this section, we discuss areas of concern most frequently mentioned by opponents and attempt to present, briefly, the pros and cons in each area.

A. Proliferation

Opponents point out that any country using the nuclear fuel cycle to generate electrical power can develop nuclear weapons. Safeguards can complicate the process but they can never guarantee non-proliferation. Several developing countries have already declared their intent to develop weapons. Among them are Brazil, Argentina, South Korea, Taiwan and South Africa.[5] Referring to specific recent examples of international hostility, the opponents ask:

Would the Pakistani military government have allowed India to take half of its territory in 1971 if it had possessed nuclear weapons? Would the Greek Junta have sat by helplessly while Turkey invaded Cyprus if it had had nuclear capability in 1974? Would Libya or Iraq start nuclear war in the Middle East if they succeed in current efforts to obtain such weapons? If Taiwan is successful in developing nuclear capability, how will China, which already has hydrogen weapons, respond?[6]

Supporters of nuclear power say that the technology required for power generation and for nuclear weapons is not all that similar.[7] Bombs and power plants use different kinds of uranium. Natural uranium contains less than one percent of the fissionable isotope U_{235}. Atomic power plants are fueled with this natural uranium or with uranium that has been enriched to contain about 3.5 percent U_{235}. Nuclear bombs, on the other hand, use uranium that has been enriched to more than 90 percent U_{235}. Experts believe uranium would have to be enriched to at least 20 percent for use in even a crude nuclear device. Uranium enrichment technology is costly and very complex. It took the Union of South Africa about 15 years to master the secrets of the technology and to build a pilot enrichment plant.[8]

Opponents point out that plutonium, which is a by-product of nuclear fission, can be used to make a nuclear bomb. Supporters point out, however, that when plutonium is removed from a power plant it is part of a dangerous mix of exceedingly radioactive products and is not usable apart from reprocessing.

It is in the area of reprocessing of spent fuel from reactors where arguments concerning proliferation (and diversion discussed below) are most cogent. Reprocessing extracts plutonium from spent fuel. The technology to do this is simpler and cheaper than the technology required to enrich uranium as discussed above. Plutonium can be used rather easily in building atomic weapons, as well as in refueling nuclear power plants. The Carter administration has discouraged the construction of reprocessing facilities, preferring instead to leave the plutonium in the dangerous mixture of spent fuel where it is too hot to handle.

Some have argued, however, that nuclear power makes no sense apart from the full development and utilization of reprocessing facilities.[9] Once the plutonium is available, opponents argue, it can then be used just as easily for weapons as for power plants.

Supporters stress that the problem of such proliferation can be handled by international agreement. One hundred sixteen nations have signed the Nuclear Non-proliferation Treaty, under which nations agree not to acquire or seek aid in developing nuclear weapons. In return for this agreement they receive assistance, usually from the United States, with their peaceful atomic power programs.[10] Nations that sign the treaty agree to put their nuclear facilities under the safeguards of the Internationsl Atomic Energy Agency (IAEA). Under this arrangement, IAEA keeps track of all nuclear material provided to a country for use in its nuclear research and power plants. This is to insure that none of its is diverted to make weapons.[11]

Opponents point out, however, that half a dozen countries that currently have nuclear research programs have refused to sign the treaty. These are India, Israel, South Africa, Pakistan, Brazil and Argentina. Also, two countries, Iraq and Libya, have signed the treaty but still say they want to

acquire nuclear weapons.[12]

Among the major weapons states, the United States, the Soviet Union, France and West Germany, there is agreement that reprocessing technology should not be exported to developing countries. However, that means that developing countries will continue to be dependent on these major powers for their supply of uranium. Some have questioned how long these nations will be willing to be dependent on foreign sources of power rather than proceeding full force in the development of their own reprocessing plants.[13]

B. Diversion

The potential diversion problem is related to the problem of proliferation, but differs in that it refers to the use of nuclear weapons by terrorist groups. Such groups would likely acquire needed materials by theft which means that it is a particular problem where reprocessing technology is present, since these groups must have access either to enriched uranium or plutonium.

Such groups could use these materials in two ways. First only about ten pounds of plutonium is needed for a crude weapon. (It should be noted that this is not a weapon in the military sense. A weapon in the military sense must have three characteristics. It must be reliable, it must have a predictable yield, and it must be compact so that it can be put in a land mine, an artillery shell, etc. A crude weapon, on the other hand, is one that will probably go off, the yield will be uncertain, and it can be transported in a vehicle.) Second, plutonium could simply be dispersed in a populated area with catastrophic results.[14]

Supporters of nuclear power answer these arguments by pointing to the security measures taken by the nuclear power industry and to the fact that other substances (i.e. arsenic, bacteria, etc.) could also be dispersed in a populated area with comparable results.

One final argument relevant to both proliferation and diversion. Supporters point to the existence of 50,000 bombs at present. These, they say, may be stolen by foreign countries or terrorist groups thus rendering the fabrication of a bomb unnecessary. However, opponents argue that, because of military security measures and the complex construction of nuclear bombs making them difficult to detonate, it is easier to steal materials and make a bomb than to steal a bomb from the military.[15]

C. Catastrophic Releases of Radioactive Matter

Opponents cite two major sources for the release of radioactive matter from nuclear power plants. The first is by way of accident, because of design failure, component failure, operator failure, earthquake, plane crash, war. The other is by intentional acts of malice, such as by terrorist groups or disgruntled workers.[16]

Supporters again point to the safeguards in the construction and operation of nuclear power facilities and to the fact that no deaths or serious injuries have resulted from nuclear accidents.[17]

D. Waste Management

Supporters and opponents disagree over the volume of radioactive material, over how long it must be stored, and over how this should be done.

Opponents say that utilities have not been honest about the total volume of radioactive waste produced by nuclear power plants. Nuclear plants produce both high and low level radioactive waste. High-level waste is produced in the fuel and the material surrounding the fuel as a direct result of nuclear fission. Low-level waste is an indirect result of the same process. It would include laundry waste and water from the primary cooling system.

Opponents lump both high and low level waste together and say that it amounts to thousands of cubic meters per reactor year.[18] Supporters say that the amount of high-level waste requiring special handling is quite small (perhaps 3 or 4 cubic meters per reactor year), and, further, that the weapons industry creates 100 times more waste than the nuclear power industry.[19] Countering this argument, opponents say that while that may be true, more radioactivity is now being generated by the power industry than by defense.[20]

Concerning the length of time waste must be stored, opponents claim that high-level waste must be stored for thirty times the half-life, or about 100,000 years. Supporters, however, point out that nuclear waste will decay to natural levels in 700 to 800 years.[21]

Regarding waste storage, opponents point out that at the present time we do not have the technology for disposal. and that the repositories will not be ready until 1988 or later.[22] Supporters, on the other hand, contend that there are now ways to concentrate and stabilize high-level radioactive waste. Two plans are currently being considered for waste storage. One is surface man-made "mausoleums"' the other is burial in stable geologic formations, such as deep salt deposits or granite. The problem, they argue, is political rather than technological. The federal government has accepted responsibility for waste disposal bu as not, as yet, developed a plan.

E. Low-Level Radiation

Low-level radiation is released in normal plant operation. Opponents point to the increased risk of cancer caused by low-level radiation. They point to data which shows that the exposure to low-level radiation is cumulative over one's life-time and that there is no safe level of exposure and no dose of radiation so low that the risk of malignancy is zero. When radiation passes through the human body, it may damage the nucleus of a cell. That cell can then multiply and after a period of time (5 to 70 years) form a malignant tumor.[23] One researcher has compiled information to support his theory that there is a cause and effect relationship between low-level radiation and Legionnaire's disease.[24]

Supporters point out that the greatest danger from low-level radiation is not from nuclear power plants but from medical X-rays. They also point out that coal power plants emit low-level radiation in their normal operation, and that the amount of radiation received from nuclear plants is no more than the amount of radiation a traveler receives in a high altitude plane flight or living in a high altitude city like Denver.

F. Social Implications

Opponents argue that nuclear power demands centralization. It is a centralized form of producing power (as opposed to, for example, residential solar heating). It is technologically sophisticated which means that it must be under the control of a "technological elite." Nuclear power also requires extreme security measures such as armed guard, surveillance, and loyalty assessment of employees.[25]

Supporters say that while the above may be true there are other areas of society that are technologically sophisticated and that require security measures such as municipal water supplies, oil refineries, air traffic control centers and chemical plants. They point out, as well, that there are no other realistic options for meeting the energy needs of the next several decades. Even some opponents admit that if we are to maintain present lifestyles and present economic growth, nuclear power is a necessity.[26]

Supporters also point out that several foreign countries have no option for meeting their energy needs, other than nuclear power. The Assistant Minister for Planning in South Korea's Ministry of Energy Resources had said, "We've almost exhausted our hydroelectric potential. We don't produce any thermal coal. Oil burning is too expensive - completely out of the question."[27] Japan is in a similar situation. The U.S. can turn its back on nuclear power, but the nuclear options, supporters say, will continue to be pursued by other countries. Related to this, supporters point out that the opponents of nuclear power are comfortable middle-class Americans while those who stand in the greatest need of this source of energy are the poor in our own country and around the world.[28]

Part Five -- IS NUCLEAR ENERGY ECONOMICAL?

The Economics of Energy - Nuclear Fuel and Alternatives

There is no solution to America's energy problem which will not be economically costly. In the 1950's many believed that nuclear fuel would one day provide an unlimited supply of cheap energy. It has not worked out that way. Nuclear power is becoming increasingly costly in terms of capital investment, research, licensing, maintenance, safety, and waste disposal. Unfortunately, there is no easy alternative. Other sources of fuel such as coal, oil, gas, and solar are also going to be very expensive for many of the same reasons. As energy demands continue to rise, inflation continues upward and the availability of resources diminishes, the most economical approach to energy use may be conservation. The following sections on capital investment, consumer cost, public policy, types of energy needs, and lifestyle address the issues involved in energy economics.

Capital Investment and Operating Costs

Capital Investment is required in all areas of energy development. Major sources of capital include: private individuals, corporations, pension funds, and the government. In recent years vast amounts of private and public funds have underwritten the development of oil, gas, coal, and

nuclear power. Just to drill an oil well, to mine and transport coal, or to start up a nuclear power plant requires considerable planning, research, and expenditure before any result is forthcoming. Northern States Power now estimates 10-12 years lead time for coal or nuclear plants to be in operation.

Advocates say that nuclear power is viable economically because the low fuel and operating costs more than compensate for the high investment costs.

Operating costs relate mostly to the cost of fuel and the efficiency of the plant. Uranium fuel is very inexpensive compared to coal, oil, and natural gas. Uranium and enriched fuel costs have been increasing, however, because of the amortization of disposal costs, stricter safety laws, and the lack of plutonium credits from the spent fuel (because of a moratorium on reprocessing). It is also important to point out that coal mine worker safety laws, leasing costs, reclamation costs, and escalating transportation costs have made coal prices rise rapidly. The recently passed energy acts do not allow the burning of oil or natural gas in new large power plants.

The question one is left with is this: With only a specific amount of private and public money to invest, and with all alternatives being costly, which is the most desirable alternative? To choose one path could eliminate others once the money is spent. To continue to develop nuclear energy may mean less emphasis on solar research and vice versa. Today we must make difficult choices between uncertain alternatives with limited financial resources. Economic choices for large energy facilities are made one at a time. A choice for one option now should not preclude a choice for a different option in the future. The name of the game in risk taking is to optimize your position now while leaving options open for the future.

Public Policy

More than ever energy is public policy today. Present energy sources including oil, gas, coal, and nuclear rely heavily on public support both politically and in the form of subsidies. (Subsidies are sometimes referred to as "incentives" or "depletion allowances" and other euphemisms.) In fact, as citizens, we are already paying for energy even before we receive our electric bills or get in line at the gas station. It is a reality today that government decisions can critically undermine or favorably advance nuclear power or any other fuel source. Some have even argued that if public support for alternative energy sources (i.e. solar, biomass, and geothermal) had been as extensive as that given to oil, coal, and nuclear power they would be more affordable. Thus far, there is no conclusive data supporting or refuting this position. Fortunately or unfortunately, when nuclear power became a reality twenty-five years ago coal, oil, and natural gas were relatively inexpensive and decisions were made which precluded development of alternative sources. At that time, nuclear was thought to be the most economical path in regions of the country where coal was not nearby. Today, that decision is being re-examined. As citizens we are involved in that decision process through public policy. It is very important to recognize that public policies can be enacted to influence economic decisions. For example, investment tax credits enacted to provide jobs favor capital intensive investments. Insurance subsidies through government

indemnification are another example. The task force feels that these subsidies should be clearly stated in economic comparisons so that citizens will know the sum total of major hidden subsidies both for nuclear and fossil. Energy decisions should bear their full economic costs unless public policy is clearly stated as a basis for subsidies. Public policy may well result in special credits to solar power to get the industry off the ground -- but only to the point that it can overcome the high startup costs of a new industry. Continued subsidies to any energy alternative does not make sense if it cannot be economically competitive on its own (over the long haul). Any decision involves economic risks, but it is important to have those risks clearly stated.

Substitution Amond Energy Forms

Nuclear energy currently produces about 12% of the electricity in the U.S. (Coal 44%, oil and gas 30%, hydro-power 12%; Newsweek, April 16, 1979.) As oil and gas become increasingly scarce, prices will continue to rise.

It is important to recognize that some energy resources are more suitable for certain uses than others. For example, petroleum is the fuel best suited for transportation. Coal and nuclear energy are not viable substitutes for petroleum in the transportation industry. However, it is feasible to use natural gas, petroleum, nuclear and coal to fuel large generating plants. Therefore, by substituting coal and nuclear cources for petroleum and natural gas at generating plants it is possible to release petroleum for use in transportation. Home heating is another example where natural gas, petroleum, electricity (generated by nuclear and coal and solar) are substitutes. The changing avilability and prices of oil and natural gas are complicating many of the traditional consumer choices. However, it is important to point out that nuclear energy can serve both as a direct and indirect substitute for coal, petroleum, and natural gas. Decreased availability of nuclear energy will therefore place increased demand on these other energy resources, Decreased availability will mean higher prices

Our Lifestyle and Use of Energy

In the final analysis, the question of lifestyle is an equally crucial economic factor. If we conserve more today we will need to worry a bit less and will have more time to make decisions tomorrow. If we want to continue economic growth at past and present rates we have less time. Continued growth also presents increasing risks for we are gambling with scarce resources. Some favor increased growth and others are opposed. Many refuse to accept shortages as anything more than business and political deception. We are a long way, it seems, from fully facing the energy question face-on. This avoidance of the issue is at the heart of the problem. How we want to live tomorrow is the economic decision we face today.

Part Six -- WHAT ARE THE ALTERNATIVES TO NUCLEAR ENERGY and WHAT ARE THE RISKS?

Many social, environmental and health factors need to be addressed when considering any source of energy. But some are specific to nuclear power,

i.e. low-level radiation, accidents and plans for evacuation, proliferation, economic costs and disposition of wastes. The latter will necessitate leaving a legacy for future generations into the hundreds of thousands of years. Even if technology solves the problem of "safe" disposal, there must be constant surveillance to be absolutely certain that the sites are not accidentally disturbed. Studies, reports, and opinions of experts on the question of cancer risk from radiation vary considerably. Continued studies of persons many years after exposure to low-level radiation reveal cancerous diseases and mutations not found in earlier studies. This would suggest that there are still many unknown factors as far as health hazards are concerned.

However, other energy sources also have risks. In this section, we attempt to outline some of the risks inherent in other sources of electrical power: coal, oil, geothermal, hydroelectric, solar, and conservation.

Coal

This is the most abundant fuel resource in the United States in terms of the energy recoverable with existing technology and currently supplies approximately 44% of our electricity. Unfortunately, coal may have the greatest health and environmental impact of current electric power sources and extensive and expensive pollution controls will be required. Some of the adverse effects are as follows:

A. Climate -- Fortune Magazine in a November 20, 1978, article cites evidence that "at the rate at which fossil-fuel burning has been accelerating--not only in industrial countries but also the much more populated developing countries -- the atmospheric load of carbon dioxide could double during the next 60 to 75 years." Experts then suggest that the end result could be an average world temperature increase of 2 to 7 degrees Fahrenheit with even higher increases in the polar regions resulting in melting much of the ice pack and, thereby, affecting the elevations of the oceans and possibly bringing about a traumatic relocation of the agricultural productive lands such as those in the cornbelt.

B. Respiratory Diseases -- For the miners this include a number of ailments loosely referred to as "Black Lung Disease." Treatment is now financed by Federal taxes on coal costing up to a billion dollar per year. The routine emissions from burning coal in a single large (1,000 megawatt) coal plant may, according to some studies, cause from two to two hundred deaths each year mostly among the young and elderly. The impact varies with coal quality, pollution control and other factors.

C. Environment -- These vary from the adverse effects of strip mining and land subsidence (from underground mining) to the hazards of transporting vast quantities of coal across the nation. Also included are adverse effects on agricultural production in some areas and adverse effects from acid rain on lakes in the northeastern part of the U.S.

D. Radioactivity -- Radiation doses from airborne effluents of a coal-fired plant may be greater than those from a nuclear plant, according to a study by J.P. McBride and others reported in the December 8, 1978, issue of Science Publication.

Oil

While oil currently supplies a significant proportion of the energy for electrical generation, it is evident that it is needed for more critical uses such as "feed stocks," transportation needs, etc. Furthermore, the increasing costs and the dependence upon foreign sources makes it imperative that oil be used for other purposes. The use of oil for generating electricity is now severely limited by passage of several Carter energy acts.

Geothermal

This source of energy is limited to certain areas of the country and the World and also has the potential for adverse environmental impacts. The "Energy Research Group" estimates that a large (1,000 megowatt) geothermo power plant would discharge about three billion gallons of water per year containing about 10,000 tons of damaging solids. The same plant would also release about fifteen billion gallons of steam yearly containing large quantities of ammonia, methane, and hydrogen sulphide.

Hydroelectric

Most of the readily available dam sites in the Nation have been utilized and are now producing power. Therefore, this source of energy offers relatively little room for expansion. Furthermore, the sudden collapse of a major dam has the potential for the loss of thousands of lives depending upon the circumstances at the time of rupture. The breaking of the Teton Dam in Idaho is estimated to have caused damage approximating one billion dollars.

Solar Power

The public at large seems to have an implicit faith in the capability of science and technology to produce unlimited sources of energy from solar power if only adequate funding is provided. Unfortunately, there is evidence according to scientists such as William G. Pollard, formerly Executive Director of the Oak Ridge Associated Universities, that solar-energy systems can, without question, be developed and made to work from an engineering standpoint but the central issue is whether once achieved they would be commercially feasible as a practical component of the Nation's energy system in competition with alternative means for providing the same energy. Indications are that solar power has a practical application for water heating and also for solar heating of buildings in many situations. However, the cost would likely be considerable, at least for the present.

Pollard believes that the cost of using solar power for large scale electrical generation will be so expensive as to preclude its use in most populated areas. Furthermore, he estimates that a large (1,000 megowatt) plant would require from seven to ten square miles of land depending upon location and other factors. This might be a questionable use where land is scarce.

Dr. Herbert Inhaber, a scientific advisor to the Atomic Energy Control Board of Canada, in a New Scientist magazine article (May 18, 1978) reports on an interesting Canadian study. It suggests that because of the vast technology and huge quantities of material required for wind and solar power, the risk to human health per unit of energy is apparently higher than that from conventional sources such as natural gas and nuclear power.

Conservation

Experts on both sides of the nuclear power issue agree that the most viable energy alternative is conservation and that energy consumption can be greatly reduced. Conservation is a mixture of changing life-styles, elimination of waste, development of new technologies, and capital investment in energy saving goods (i.e. insulation). The Task Force believes that we have a moral obligation to protect the environment and conserve natural resources. That obligation extends to future generations, to the poor in our own country and to the poor around the world. Christians, we believe, should set an example of good stewardship by consciously and seriously limiting their use of all energy sources. There are some experts who believe this has to be done voluntarily very soon or it will have to be mandated.

In summary, a study of the alternative sources of power suggests that all energy sources have risks. Eliminating nuclear power would eliminate nuclear risks but would increase the risks inherent in other sources.

From the viewpoint of risk, it appears that the best alternative source of energy is a non-source, namely, conservation. This could do far more than anything else to alleviate the present energy crunch.!

Part Seven -- RECOMMENDATIONS

1. At this time, the Task Force does not recommend arbitrarily closing currently existing nuclear power plants. Whether or not one favors a moratorium on future plant construction the closing of present facilities does not seem appropriate for the following reasons:

    A. Existing plants are making a significant contribution to the nation's electrical energy output. (12% nationally, and up to 50% in some areas; in Minnesota nuclear power plants contribute about 30% of the state's electrical usage). Immediate elimination of nuclear power without time to develop alternatives would result in higher costs and a greater dependence on insecure foreign oil sources. Furthermore, facilities are not currently available to make this transition without serious consequences even if it were desirable for other reasons.
    B. The safety of existing plants is being seriously examined by various regulatory agencies including the N.R.C. (Nuclear Regulatory Agency). A decision before these bodies have made their reports would be premature.

2. The Task Force does recommend that the Minnesota United Methodist Church should encourage conservation throughout its membership. Conservation includes not only the elimination of obvious waste but also a change in the living patterns and investment in energy efficient equipment. Conservation will reduce the need for all types of energy resources including nuclear power.

3. The Task Force recommends that United Methodists in Minnesota should fully utilize the channels now open to them for influencing energy decisions by seeking information, attending hearings, and requesting to be on energy-related Boards, agencies, organizations, and activist groups. Church members should insist that subsidies and other hidden influences be fully brought to light during proceedings to determine the need for energy facilities. Members should become familiar with energy alternatives so that they will know that risks and economic trade-offs are involved in any alternative (including "do nothing" and conservation).

4. At present, the authorization of new nuclear power plants is at a standstill throughout the United States. None are planned for Minnesota in the near future. However, as an outgrowth of increased public concern over the pros and cons of nuclear energy, the possibility of a publicly imposed moratorium is currently being debated. Such a moratorium would effectively prevent the construction of new nuclear powered electric generating plants for an indefinite time. The results of such a moratorium would have far-reaching effects on the lives of everyone in the U.S. After carefully reading the summary and full report of this task force and considering the following consequences the Minnesota Annual Conference may wish to vote favorably or unfavorably on a moratorium resolution.

Consequences of a Moratorium:

A. Provides time for industry to develop further safeguards and opportunities for citizen control.
B. Allows for time to educate the public on the issues involved in the long-term development of nuclear power.
C. Provides time for funding and research into alternatives to nuclear energy.
D. Creates a delay in power plant construction and the likelihood of shortages in the short-run.
E. Creates dependence on other resources which may be more costly and could cause economic hardship especially for low-income persons.
F. Limits the short-run range of choices and risks to coal and other alternatives which are also accompanied by risks which may or may not be more harmful than nuclear power.
G. If nuclear power eventually proves to be a viable alternative the recovery time for the nuclear industry could seriously prolong shortages and costs in the long run.

It is beyond the scope of the task force to take a stand on this issue. We believe that the matter is best decided by the Annual Conference as a whole body. We therefore urge all members to seriously consider all aspects of the energy issue before voting.

5. The Task Force believes that an important aspect of responsible deployment of large-scale nuclear energy for producing steam and electricity in the U.S. lies in the adequate control, the full information, and viable choices that are made available to the average church member and to the general public. The Task Force believes that the United Methodist Church should consider calling upon private industry, publicly-owned corporations, and government to use their skills to make nuclear power organizations more responsive to concerns of ordinary citizens. For example, the Task Force suggests consideration of a new type of organization to avoid the fragmented responsibility that now exists in mining, transporting, enriching, fabricating, fissioning, storing, reprocessing, and disposing of nuclear materials. The new organization could be called a "cradle-to-grave" corporation with a special charter to handle all aspects of nuclear fuel and a special Board with citizen representation to insure corporate responsibility and sensitivity. The industry could also promote small radiation measuring devices to be worn by everyone like wrist watches or necklaces so that citizens can monitor their own exposures to radiation. This could help allay the fears of not being able to see, hear, taste, or touch radiation.

In light of the above recommendation and the existence of a "de-facto" moratorium, the Conference may wish to consider an alternative to voting for or against a moratorium at this time. In this instance, the Minnesota Annual Conference might, through its Board of Church and Society, submit a report to various nuclear organizations setting forth the specific concerns of this Task Force. Such a report could request plans for improving responsibility, control, and sensitivity to citizen concerns. Responses to this report could be evaluated and reported to the 1980 Annual Conference at which time the matter of a moratorium could be reconsidered.

In order for the Conference to adequately consider and vote on the issue of Nuclear Energy the Task Force submits the following alternative resolutions. Both are for equal consideration. The Task Force takes no position on them pro or con.

A. This resolution is a restatement of the 1978 resolution on a moratorium. It has been revised to include the United States as a whole and not merely the state of Minnesota. It reads as follows:

WHEREAS THE DEVELOPMENT OF NUCLEAR ENERGY IN THE UNITED STATES AFFECTS RESIDENTS OF MINNESOTA IRREGARDLESS OF WHETHER SUCH FACILITIES ARE LOCATED WITHIN THE STATE'S BOUNDARIES.

BE IT RESOLVED THAT THE THE MINNESOTA ANNUAL CONFERENCE OF THE UNITED METHODIST CHURCH PLEDGES TO SUPPORT A MORATORIUM ON THE CONSTRUCTION OF NUCLEAR POWER PLANTS IN THE UNITED STATES UNTIL SUCH TIME AS THE PROBLEMS CONCERNING HEALTH, SAFETY, AND WASTE DISPOSAL CAN BE RESOLVED.

B. This resolution is an alternative to a moratorium at this time and proposes that nuclear organizations be contacted and asked to respond to the report of this Task Force.

WHEREAS THE AUTHORIZATION OF NEW NUCLEAR POWER PLANT CONSTRUCTION IS AT A STANDSTILL THROUGHOUT THE UNITED STATES AND NONE ARE UNDER ACTIVE CONSIDERATION IN MINNESOTA.

BE IT RESOLVED THAT THE MINNESOTA ANNUAL CONFERENCE DOES NOT FAVOR A MORATORIUM UNTIL SUCH TIME THAT IT BECOMES ABSOLUTELY NECESSARY. BE IT FURTHER RESOLVED THAT THE MINNESOTA ANNUAL CONFERENCE, THROUGH ITS BOARD OF CHURCH AND SOCIETY, SUBMIT A REPORT TO VARIOUS NUCLEAR ORGANIZATIONS SETTING FORTH THE SPECIFIC CONCERNS IN THE REPORT OF THE TASK FORCE ON NUCLEAR ENERGY AND REQUEST PLANS FOR IMPROVING RESPONSIBILITY, CONTROL, AND SENSITIVITY TO CITIZEN CONCERNS. RESPONSES TO THIS REPORT WILL BE EVALUATED AND REPORTED TO THE 1980 ANNUAL CONFERENCE FOR CONSIDERATION.

6. Whether or not the nuclear power issue is resolved favorably or unfavorably, the Task Force believes that further study and research into alternative sources of energy be considered by individuals, business, and government. At this point any and all options such as solar power, solar heating. wind power, geo-thermal, bio-mass, fusion, and other possibilities should not be ignored. The more available alternatives that we can develop, the more likely we are to be in a position to make wise choices for the future. The Task Force therefore recommends that the Board of Church and Society create an ongoing study group to keep abreast of nuclear and other energy developments and make regular reports to the Board.

Footnotes

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