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FINAL REPLY:

Clinton Bastin
Avondale Estates, Georgia

TO:

Chairman Meserve

FOR SIGNATURE OF : ** GRN ** CRC NO: 01-0193

Virgilio, NMSS

DESC:

Study of Reprocessing, "Chemical Separation of Energy Usable Materials from Nuclear Wastes in Spent Nuclear Fuels

ROUTING:

Travers
Paperiello
Kane
Norry
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DATE: 04/06/01

ASSIGNED TO: CONTACT:

NMSS Virgilio

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AUTHOR: CLINTON BASTIN

AFFILIATION: GA

ADDRESSEE: RICHARD MESERVE

SUBJECT: URGES THE COMMISSION TO SUPPORT THE PROPOSAL OF SEN DOMENICI FOR A U.S. STUDY OF REPROCESSING EH CHEMICAL SEPARATION OF ENERGY USABLE MATERIALS FM NUC WASTES IN SPENT NUC FUELS....

ACTION: Direct Reply

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LETTER DATE: 03/15/2001

ACKNOWLEDGED No

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5835

Clinton Bastin, Chemical Engineer (Retired), Nuclear Programs. U.S. Department of Energy
987 Viscount Court, Avondale Estates, Georgia 30002
Telephone 404 297 2005; E-Mail clintonbastin@msn.com

March 15, 2001

Honorable Richard Meserve, Chairman
The United States Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Meserve:

The enclosed letter to President George W. Bush requests that he support the proposal of Senator Pete Domenici for a U.S. study of reprocessing, i.e., the chemical separation of energy usable materials from nuclear wastes in spent nuclear fuels. Enclosures with this letter explain that:

1. Well-managed reprocessing and fast neutron reactor operation by nations with large nuclear power programs are essential for good nonproliferation practice, efficient use of nuclear materials and disposal of nuclear wastes.
2. Proliferation occurred because the U.S. violated initial criteria of President Eisenhower's "Atoms for Peace" by exporting pilot plant reprocessing technology.
3. The myth that reprocessing is a proliferation threat developed because U.S. nuclear program leaders did not clarify differences between pilot plant and well-managed reprocessing.

The letter also recommends that:

1. U.S. nuclear laws and policies based on myths should be changed.
2. Nuclear power plant operators should find or create a corporation to recover energy usable nuclear materials for recycle and dispose of nuclear wastes.
3. Funds paid to the DOE for disposal of nuclear wastes should be returned to nuclear power plant operators with interest, and used by the new corporation to carry out these tasks.
4. The new corporation should conduct its activities with full commitment to excellence. Enclosure 4 is the best model for the excellence needed for spent nuclear fuel management.
5. Energy Secretary Spencer Abraham should reverse the decision of former Energy Secretary William Richardson to decommission the Fast Flux Test Facility at Hanford, and use this facility as the initial component of a vigorous fast neutron reactor development program, in collaboration with other nations with large nuclear power programs.

I hope that you will support Senator Domenici's proposal for a study of reprocessing, and recommendations in this letter. I would be pleased to discuss this with you or provide additional information. Best wishes.

Sincerely

Clinton Bastin

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March 15, 2001

The President
The White House
Washington, DC 20500

Dear Mr. President:

Senator Pete Domenici has proposed a U.S. study of reprocessing, i.e., the chemical separation of energy usable materials from nuclear wastes in spent nuclear fuels. Enclosures 1 and 2 explain that well-managed reprocessing by nations with large nuclear power programs is essential for good nonproliferation practice, efficient use of nuclear materials and disposal of nuclear wastes.

Enclosure 3 explains that proliferation occurred because the U.S. exported pilot plant reprocessing technology. It also explains that the myth that reprocessing is a proliferation threat developed because U.S. nuclear program leaders did not clarify differences between pilot plant and well-managed reprocessing technology. It concludes with recommendations that:

1. U.S. nuclear laws and policies based on myths should be changed.
2. Nuclear power plant operators should find or create a corporation to recover energy usable nuclear materials for recycle and dispose of nuclear wastes, as they did at the outset of nuclear power. Funds paid to the DOE should be returned with interest to carry out these tasks.
3. The new corporation should request guidance from the DuPont Company to ensure that its activities are conducted with full commitment to excellence. (Enclosure 4 describes the excellence achieved by DuPont in nuclear operations at the Savannah River Plant).

These enclosures explain that fast neutron reactors are also essential for efficient use of nuclear energy resources and good nonproliferation practice. The Fast Flux Test Facility (FFTF) at the DOE's Hanford Site is the last remnant of an important U.S. program for fast neutron reactor development. Former Energy Secretary William Richardson recently decided to decommission the FFTF without considering the important national mission for which it was built.

Mr. President, I hope that you will support Senator Domenici's proposal to study reprocessing, changes in nuclear laws and policies that are based on false premises, and management of nuclear materials and disposal of nuclear wastes by a corporation that is competent to do so. I also hope that you will ask Energy Secretary Abraham to reverse the decision to decommission the FFTF, and direct its restart and use as the initial component of a vigorous fast neutron reactor development program, in collaboration with other nations with large nuclear power programs.

I would be pleased to discuss this with you or others, provide additional information, and help in any way to ensure that Americans enjoy the great benefits of nuclear technology and avoid its dangers. Enclosure 5 is an editorial about the great benefits of nuclear technology. Enclosure 6 is a summary of relevant experiences.

Best wishes for you and your wonderful family!

Sincerely

Clinton Bastin

Clinton Bastin

Lists of enclosures and recipients of copies: See next page

List of Enclosures:

1. Letter in *Science* "Nuclear Power and Climate without Proliferation," August 18, 2000
2. Letter in *Issues in Science and Technology* "Spent fuel and Nuclear Waste," Summer 1994
3. Letter to M. R. Buckner, Chairman, ANS Special Committee on Nuclear Nonproliferation, March 14, 2001, with attached letter in *Nuclear News* "Proliferation Resistant Fuel Cycle?," March 2001
4. "DuPont at the Savannah River Plant: A Model for Nuclear Excellence," March 15, 2001
5. Editorial in *Community Review* "Nuclear Technology: A Tool and a Gift of God," Sept. 21, 2000
6. Summary of relevant experiences of Clinton Bastin

List of recipients of copies:

The Vice President, The White House
Honorable Dennis Hastert, The Speaker of the House of Representatives
Honorable Trent Lott, Senate Majority Leader
Honorable Pete Domenici, Chairman, Senate Appropriations Subcommittee for Energy and Water Development
Honorable Frank Murkowski, Chairman, Senate Energy and Natural Resources Committee
Honorable Max Cleland, United States Senate
Honorable Zell Miller, United States Senate
Honorable Cynthia McKinney, United States House of Representatives
Honorable Spencer Abraham, The Secretary of Energy
William D. Magwood, Director, Office of Nuclear Energy, Science and Technology, DOE
Gail Marcus, Principal Deputy Director, Office of Nuclear Energy, Science and Technology, DOE, and
Vice President, President Elect, American Nuclear Society
Honorable Richard Meserve, Chairman, U.S. Nuclear Regulatory Commission
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David P. Smith, Jr., Austin, Texas
J. M. McKibben, Executive Director, Citizens for Nuclear Technology Awareness, Aiken, SC
M. R. Buckner, Chairman, ANS Special Committee on Nuclear Nonproliferation

Nuclear Power and Climate without Proliferation

(Letter in *SCIENCE*, Vol 289, 18 August 2000 Page 1141)

The analysis in the Policy Forum "A Nuclear Solution to Climate Change?" by W.C. Sailor, D. Bodansky, C. Braun, S. Fetter, and B. Van der Zwaan (*Science's* Compass, 19 May, p. 1177) is diminished by inclusion of the myth - popular in the United States - that efficient use of nuclear resources is a proliferation threat. Quite the contrary, destruction of weapons materials in spent nuclear fuel by their use for production of electricity in fast, so-called breeder reactors is an essential component of good non-proliferation practice. Depleted uranium at U.S. enrichment plants, which was used by the United States Department of Energy (DOE) to produce plutonium for weapons, would also be destroyed in fast reactors. The electricity produced from existing nuclear by-products would be equivalent to that needed by the United States, at present use rates, for hundreds of years.

The nuclear solution presented by Sailor *et al.* would recover less than 1% of the energy from uranium. Spent fuel would be disposed of in a geologic repository. Depleted uranium - millions of tons of weapons source material - would accumulate indefinitely.

International Atomic Energy Agency (IAEA) safeguards are required for plutonium-239 in spent fuel in a geologic repository. However, virtually no one accepts the IAEA contention that planned satellite surveillance can be reasonably assured for 10,000 years. Moreover, the time required for significant decay of plutonium-239 is not 10,000 but 240,000 years.

Since safeguards for these periods of time are not credible, spent fuel must be reprocessed to permit permanent disposal of unwanted fission products, i.e., high level radioactive waste. Disposal of this waste is essential for viability of nuclear power and is a requirement of virtually all nations. Reprocessing only in well-designed, well-managed and safeguarded facilities operated by nations with large nuclear power programs, and immediate fabrication of weapons materials into fuel assemblies for their destruction through production of electricity, provide the greatest assurances against a proliferation threat from nuclear power.

The DuPont Company completed designs for such facilities in 1978, based on its experience in reprocessing at the DOE Savannah River Plant and on the experience of others. Among many important features of these designs was the elimination of accumulations of separated plutonium. Unfortunately, these designs were rejected by leaders of DOE in order to support national laboratory reprocessing concepts that had led to earlier problems (failures and proliferation) and poorly focused research on "proliferation-resistant" fuel cycles. During this same time period, political decisions were made that led ultimately to cancellation of US fast reactor development.

US nuclear policies based on best science and best applications of science will result in nuclear power being used as the solution for climate change and other energy and environmental problems.

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Nuclear Waste and Spent Nuclear Fuel

(Letter in *Issues in Science and Technology*, Summer 1994, pages 12-13)

Luther Carter is right ("Ending the Gridlock in Nuclear Waste Storage," Issues, Fall, 1993). It is time to take another look at the Nuclear Waste Policy Act (NWPA) of 1982. But the reevaluation should go far beyond that proposed by Mr. Carter. We should reconsider the plan to release to the environment - at Yucca Mountain or elsewhere - the huge amounts of long lived radioactive material in spent nuclear fuel. We should also give up the idea that it is responsible to abandon to future generations, without any controls, excess plutonium from weapons programs and plutonium in spent fuel that could be used to produce up to 100,000 nuclear weapons.

The alternative to indefinite storage or abandonment of plutonium and other actinide elements is their use to produce electricity in nuclear reactors, eventually in reactors with a "fast" neutron spectrum, in which all of the long-lived actinide elements will be fissioned and destroyed. Fast neutron reactors are an excellent "sink" for excess plutonium, which becomes intimately mixed with intensely radioactive fission products.

Spent fuel reprocessing plants are the focus of proliferation concern. But co-located fuel reprocessing and refabrication plants can be designed and operated that would preclude access to and accumulation of separated plutonium. The DuPont Company, former operating contractor for the Department of Energy (DOE) Savannah River Plant, prepared designs for such a fuel recycle complex. Unfortunately, leadership of DOE and its predecessor agencies set aside this design concept and removed key personnel with good management experience in reprocessing. When Presidents Gerald Ford and Jimmy Carter and the Congress conducted assessments of reprocessing, there was no one in a position of authority who could provide good information. As a result, demonstration of reprocessing and the fast neutron reactor were deferred. The NWPA grew out of this bureaucratic folly and a belief that we must solve the nuclear waste problem in a manner that does not require management by future generations.

The intense, penetrating radiation associated with spent fuel and high level radioactive waste from reprocessing will provide protection of the plutonium from diversion to weapons use - but only for a limited time. Plutonium, with a half-life of 24,000 years, will be available for weapons use for hundreds of thousands of years. The penetrating radiation in spent fuel and high level radioactive waste is almost totally from fission products with maximum half-lives of about 30 years, and these will provide protection for only a few hundred years.

I hope we will soon accept the responsibility to future generations and restart a process for appropriate management of spent fuel from nuclear power plants, and for excess plutonium from DOE stockpiles. We can do this for less money than is being wasted on present DOE programs to "cleanup" and "dispose" of nuclear wastes. With fast neutron reactors, we can manage the waste with less risk, less adverse environmental impact, and less radiation exposure to humans while supplying energy for America's needs for millennia to come.

Clinton Bastin
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(Clinton Bastin managed the Atomic Energy Commission's spent fuel receipt program from 1959 until 1962 and reprocessing activities at the Savannah River Plant from 1962 until 1972.)

Clinton Bastin
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March 15, 2001

Dr. M. R. Buckner, Chairman
American Nuclear Society Special Committee on Nuclear Nonproliferation
c/o Westinghouse Savannah River Company
Building 773-A
Aiken, SC 29808

Dear ~~Dr. Buckner:~~ Mel

A strong U.S. nuclear enterprise will enhance global proliferation management, and recommendations of the ANS Special Committee on Nuclear Nonproliferation (SCNN) will help achieve that objective. But the recommendations are incomplete. Following are major concerns and recommendations that address those concerns:

1. "Proliferation resistant fuel cycle" is an oxymoron. Uranium enrichment, reprocessing and indefinite storage of spent fuel in nations of proliferation concern are proliferation threats. This was recognized in initial criteria for U.S. atoms for peace which included supply of enriched uranium and return of spent fuel for reprocessing, not export of enrichment or reprocessing technology. These criteria were violated by U.S. export of pilot plant reprocessing technology[1]. Failure of nuclear program leaders to clarify the differences between pilot plant and success-based technology[2] led to the myth that well-managed reprocessing by nations with large nuclear power programs was a proliferation threat, and U.S. nuclear laws and policies based on that myth. Those laws and policies must be changed if the U.S. is to enhance global proliferation management.
2. South Africa and Iraq demonstrated that nations under IAEA safeguards could clandestinely enrich uranium for nuclear weapons. The U.S. used depleted uranium for weapons plutonium and detonated a nuclear explosive made with neptunium-237. During early years of the U.S. Atomic Energy Commission (AEC), natural and depleted uranium required safeguards. If there is to be any hope for "a world unthreatened by nuclear weapons proliferation," all weapons usable and weapons source materials must be safeguarded.
3. Fissionable materials must be removed from spent fuel so that wastes can be disposed of without need for indefinite safeguards - which is not possible. The recovered fissionable materials must be transmuted to non-weapons usable material or rendered inaccessible by use in existing and advanced nuclear power plants. The U.S. Department of Energy (DOE) has collected $20 billion from nuclear power generators for disposal of nuclear wastes but has no policies, programs or plans to do so. Although full deployment of advanced nuclear systems may not be needed for electricity until the middle of this century, advanced nuclear systems - well managed reprocessing, plutonium recycle, and fast neutron reactors for transmutation of all fissionable materials - are needed now for responsible management of nuclear wastes and nuclear materials. Funds collected by DOE, with interest, should be returned to nuclear utilities to carry out this task, but sound nuclear policies are also needed. The longer the delay, the more difficult the task, which must not be left as a legacy for future generations.

4. Nuclear fuel cycle technology can not be fully developed, and safety, environmental, and proliferation control issues can not be properly addressed by scientists and engineers who do not have full understanding of the challenges of fuel cycle technology. The SCNN, the DOE and many nuclear professionals endorsed the Argonne National Laboratory Integral Fast Reactor fuel cycle as proliferation resistant; evaluation by experienced fuel cycle staff showed that it was not (Explained in the attached letter in the March 2001 issue of *Nuclear News*, "Not Proliferation-Resistant Reprocessing"). Manhattan Project Director Leslie Groves in 1942, AEC Chairman Gordon Dean and President Harry Truman in 1950, AEC Chairman Dixy Lee Ray[3] after U.S. commercial reprocessing failure, and nuclear program leaders of Britain, France and Japan[4] understood the need for experienced corporations to manage nuclear fuel cycle technology. Nuclear power generators should find or create a corporation to manage all of the by-products and dispose of the wastes from nuclear power operations, as they did at the outset of nuclear power as the Industrial Reprocessing Group (IRG)[5]. DuPont Company achieved world-best safety and performance records in both nuclear and conventional chemical operations through its commitment to total quality management principles. The new IRG should request guidance from DuPont to ensure that nuclear excellence is achieved in management of all nuclear fuel cycle activities.

I hope that the American Nuclear Society Special Committee on Nuclear Nonproliferation and the Southern Coalition on Nuclear Nonproliferation will support these recommendations. I would be pleased to discuss these recommendation with you or others, or provide additional information.

Sincerely

Clinton Bastin

1 . **Gross overstatement of the productivity of reprocessing technology incorporated in the pilot plant built by DuPont at Oak Ridge, TN, during World War II led to its use by the AEC at Idaho, commercial use at West Valley, NY, export to other nations including India, and planned use at Barnwell, SC. This technology is adequate for recovery of enough plutonium for several nuclear weapons, but not for safe sustained operations needed to support nuclear power.**

2 . **Success-based reprocessing technology is that used by DuPont at the Savannah River Plant (SRP), including lessons learned from that and other reprocessing experiences and incorporated in DuPont design studies for nuclear power plant fuel recycle after failure of commercial reprocessing in the U.S.**

3 . **In each instance, DuPont was asked to provide direction for nuclear fuel reprocessing programs.**

4 . **Reprocessing programs managers in each of these nations requested and needed DuPont reprocessing technology. The Soviet Union incorporated SRP canyon design concepts in its reprocessing plant at Tomsk, but compromised important containment criteria. Germany had full access to SRP reprocessing technology during a period of maximum embargo (legally under a nuclear waste management technology exchange agreement), and incorporated that technology in its most recent plant design. The German facility was not built, but the technology may have been shared with Britain and France.**

5 . **The initial Industrial Reprocessing Group relied on information from AEC program leaders, scientists and engineers who did not have experience with successful reprocessing technology and grossly overstated productivity experience in AEC pilot plant reprocessing facilities.**

Not Proliferation-Resistant Reprocessing

(Letter in *Nuclear News*, March 2001)

Bert Wolfe has good vision for nuclear power in the 21st Century (*Nuclear News*, November 2000). He correctly points out that fast reactors will use nuclear resources efficiently, produce wastes that (with good reprocessing) decay away in a few hundred years, and use plutonium from light water reactors so that it cannot be diverted for use in nuclear weapons. But his mention of a "special reprocessing system (that) can prevent the diversion of plutonium" needs further discussion.

Many nuclear professionals - including Dr. Wolfe - are aware of significant potential advantages of the Argonne National Laboratory (ANL) metal-fueled fast reactor and its integral, electrorefining, pyrochemical-based fuel cycle. During the early 1990s, the U.S. Department of Energy's Office of Nuclear Energy (DOE/NE) proposed funding for test operation of this fuel cycle in order to demonstrate proliferation resistance. As part of these plans, DOE/NE in 1991assigned its experienced fuel cycle staff to make a detailed review of processes and equipment of the ANL fuel cycle and develop criteria for evaluation of the demonstration.

Results of this review revealed significant problems, including great difficulties for material balance measurements in the electrorefiner and high process losses in electrorefining and fuel fabrication. These findings, and the fact that plutonium is handled in weapon usable form and concentration, led to a conclusion that the safeguards challenge would be difficult and the fuel cycle would not be proliferation-resistant.

Good reprocessing to permit disposal of wastes without need for multi-thousand year isolation and safeguards will require removal of about 99.8% of weapons usable materials. This high recovery was achieved in "F" canyon reprocessing plant at the Savannah River Site with solvent extraction and ion exchange processes. Use of electrorefining or other pyrochemical processes will require supplemental - probably aqueous - processes to produce wastes that do not require safeguards.

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(Clinton Bastin provided leadership for detailed review of the Integral Fast Reactor fuel cycle. A summary of concerns about this fuel cycle can be obtained from Mr. Bastin.)

DuPont at the Savannah River Plant: A Model for Nuclear Excellence

Clinton Bastin

From 1953 until 1989, The DuPont Company operated major nuclear facilities at the U.S. Government's Savannah River Plant (SRP), near Aiken, South Carolina, the most comprehensive, diverse and safest nuclear complex ever. During this time, there was only one radiation exposure above the Federal standard of 5,000 millirem[1] and not a single nuclear criticality accident. During this same time period more than three thousand workers at other U.S. Government nuclear facilities were exposed to radiation above the Federal standard and there were 28 criticality accidents.[2]

DuPont at SRP had the best safety record for both production and construction employees during the 1946-1974 history of the Atomic Energy Commission, and the best safety record for the Department of Energy. The safety philosophy extended to non-work activities; seat belts were mandatory in SRP employee car pools many years prior to laws that required their use. The philosophy was contagious; AEC workers at SRP had the best safety record for AEC offices.

The SRP nuclear facilities: five large reactors; separate fuel fabrication and reprocessing plants for natural uranium, fully enriched uranium, neptunium-237 and curium-244; chemical plants for conversion of products to forms suitable for use or shipment; and facilities for receipt, storage and shipment of spent fuel and storage and processing of high level radioactive waste - were by far the most comprehensive and diverse in the world. Products of these facilities included plutonium-238 for space exploration; uranium-233 for U.S. Navy reactor development; cobalt-60 for medical therapy, radiography and food irradiation experiments; plutonium-239 for defense and advanced reactor development; neptunium-237, plutonium-242 and 244, Americium-241 and 243, curium-244, californium-252, and many other isotopes for research and development, medical diagnosis and treatment and many industrial applications; and enriched uranium for reuse. Materials were produced at reasonable costs to meet needs; facilities were built on schedule and within estimated costs. Nuclear wastes were safely stored to facilitate their conversion to forms suitable for final disposal.

The reprocessing facilities at SRP incorporated unique design features that permitted safe and cost effective operations to meet requirements without accumulations of separated plutonium. If at the outset of nuclear power the AEC had clarified to the US nuclear power industry the unique and outstanding successes of SRP reprocessing and had shared that technology with other nations with large nuclear power programs, major problems in the US and worldwide would have been avoided.

The SRP facilities were also unique in avoiding accumulations of plutonium scrap. In 1970, SRP was designated as the site for recovery of some plutonium scrap from other sites[3]. If the AEC had designated SRP as the site for recovery of all plutonium scrap at AEC operations, major problems at other AEC sites, particularly Rocky Flats, would have been avoided.

DuPont efforts to protect the environment at and near the SRP began prior to start of construction and were improved as new technology became available. Radiation exposures from SRP operations to off-site populations were small fractions of 1 percent of allowable limits - much less than the additional exposures to populations of Atlanta from cosmic radiation because of the higher altitude. Small amounts of tritium were released to the Savannah River, but the concentration of tritium in water available for drinking was a small fraction of 1 percent of allowable limits - much less than the concentration of tritium in rain from a summer shower[4]. Prevention of release of particulate radioactivity to the atmosphere from reprocessing plants - even from fire or explosion - was assured by filtration of ventilation exhaust through rugged, deep-bed sand filters..

The outstanding safety and performance resulted from strong commitment to excellence, i.e., quality management principles, some of which were adopted almost 200 years ago when The DuPont Company was formed. Eleuthere Irenee du Pont, student of Antoine Lavoisier and friend of Benjamin Franklin and Thomas Jefferson, built the home for his own family and homes for his work supervisors on property adjacent to the gunpowder plants - insurance that none of them would take casually the safety of operations. Workers knew that their supervisors wanted to know about any safety concern. In addition, safety was designed into the plants. DuPont plants have received many "safest in the world" awards; SRP was often at the top of DuPont lists of safest plants.

Good communication between SRP workers and supervisors, including worker acceptance of responsibility for safety and empowerment for full input and resolution of safety concerns, was a major factor in achieving outstanding safety[5]. Full involvement of senior managers and executives in DuPont corporate, engineering and research offices and AEC and DOE operations and headquarters offices were also major factors in achieving outstanding safety and performance.

The experiences gained by DuPont in 150 years of safe operations with hazardous materials - particularly the experience gained in safe introduction of complex nuclear technology at the Hanford, Washington site during World War II - were essential for the outstanding successes at the SRP. This was acknowledged by President Harry S. Truman in his letter to DuPont President Crawford Greenewalt requesting that DuPont design, construct and operate the SRP facilities.

The most important factor in achieving low radiation exposures and high performance was the incorporation of robotics systems - remote technology - for operations and maintenance of equipment in highly radioactive environments. Use of remote technology was crucial for fuel reprocessing, not only to minimize radiation exposure to workers and achieve high productivity, but also to deny access to weapons-usable materials, thus preventing their undetected diversion. Moreover, the complexity of properly designed reprocessing plants made them feasible only in nations with a strong technological base. Their high capital cost made them suitable only for high capacity operations, which was a strong incentive for their deployment only in nations with major nuclear programs.

The US (and Soviet Union) began nuclear export programs with policies that required return of spent fuel to avoid the potential for nuclear weapons proliferation from these programs. SRP was designated as the site for receipt of spent fuel from US supplied nuclear reactors in other nations, and that from US commercial nuclear power plants[6]. The US program was canceled when commercial reprocessing began in low capital cost reprocessing pilot plants which were maintained by humans in direct contact with highly contaminated equipment. The U.S. not only endorsed use of such facilities in the US, which resulted in failures and high radiation exposure to workers, but exported the technology to other nations, which resulted in nuclear proliferation in India[7], proliferation threats in other nations, and reprocessing difficulties worldwide. (Russia has been criticized for continuing the Soviet Union policy requiring return of spent fuel for reprocessing, but there has been no report of nuclear proliferation from Soviet/Russian nuclear export activities.)

In 1974, the AEC asked DuPont to prepare plant designs for commercial fuel recycle based on its successful experience and experiences of others. The designs, completed in 1978, incorporated features that would have provided best assurances against diversion of nuclear materials, such as avoiding accumulations of separated plutonium by its immediate fabrication into fuel assemblies in contiguous, remotely operated and maintained facilities. The facilities would have provided for appropriate disposition of spent fuel from US and non-US reactors, and resolved safety, radiation exposure, operability and proliferation concerns associated with reprocessing. The designs could have been provided to other nations with large nuclear power programs such as Japan, France, Britain, and Germany - and yes, the Soviet Union. Many major problems would have been avoided[8].

Unfortunately, experienced AEC leaders were replaced by persons with little understanding of reprocessing. The DuPont designs were rejected in favor of concepts that had led to problems. There was no explanation to political leaders of the difference between well designed reprocessing plants and the pilot plants that had resulted in proliferation, nor that proliferation had occurred not from commercial fuel recycle, but from "research" unrelated to nuclear power. As a result, the US accepted the myth that commercial fuel recycle and efficient use of nuclear materials were proliferation threats. The US abandoned its role as a leader for efficient use of nuclear technology and adopted policies that precluded sharing important technology with other nations. These flawed policies preclude transmutation of weapons materials through their beneficial use for energy, and responsible disposal of nuclear wastes. Their continuation will result in serious proliferation threats for future generations.

1. This overexposure was in a tritium processing facility at SRP in 1956. Tritium processing is not a part of the commercial nuclear fuel cycle.

2.Data on worker safety, radiation exposures, criticality incidents, operations and performances at SRS and other USAEC installations are from the USAEC report "Operational Accidents and Radiation Exposure Experience (WASH 1192) Fall 1975, *History of DuPont at the Savannah River Plant*, by W.P. Bebbington, and personal experiences.

3.I was assigned responsibility as "Central Scrap Management Officer" for this activity, which included mixed plutonium-uranium and plutonium-238 scrap.

4.Tritium is produced and accumulates in the upper atmosphere from cosmic radiation (proton and alpha particle bombardment) of nitrogen. It is eventually absorbed by water in cirrocumulus or cumulonimbus clouds. Rain from a sudden summer shower from these clouds will often contain higher concentrations of tritium than that in the Savannah River from an SRP release.

5. This was the most important experience that provided the basis for ideas adopted by the Russian Ministry for Atomic Energy and Russian Nuclear Workers Union of worker-manager partnerships to ensure employee empowerment for input on safety for nuclear operations and safeguards of nuclear materials.

6.I was assigned lead technical responsibility in AEC for this program. DuPont assigned a senior executive in its corporate offices and a senior nuclear facility manager at SRP to lead this effort. One of many important activities was participation in development of spent fuel shipping cask criteria, which have been adopted throughout the world. There has never been a transportation accident that involved significant release of nuclear material or radiation exposure to populations.

7.Proliferation in India was not from reprocessing of power reactor spent fuel, but pilot plant reprocessing of spent fuels from a "research" reactor, "CIRUS," which was modeled after a reactor operated by Canada to produce plutonium for US nuclear weapons. Other proliferation threats were from similar "research" reactors and reprocessing, or from clandestine uranium enrichment facilities. There has never been a credible proliferation threat from any legitimate nuclear power program. Potential for proliferation exists because nuclear materials and nuclear technology exist. Nuclear power provides a base for an international safeguards regime that - with full cooperation for use of best nuclear technology - provide the greatest assurance against proliferation.

8.Nuclear program leaders in all five nations were aware of DuPont SRP reprocessing excellence and all requested or attempted to obtain full access to the technology. The Soviet Union attempted to copy the SRS design for its reprocessing plant at Tomsk, but used three-feet thick brick panel containment/shielding walls instead of the five to six-feet thick, heavily reinforced concrete walls used at SRP. An explosion at Tomsk that resulted in release of large amounts of radioactivity would have been contained in the SRP plants.

The President, March 15, 2001 - Enclosure 5

Nuclear Technology: *A Tool and a Gift of God*

Editorial in ***Community Review***, Sept. 21 2000 (Bi-weekly newspaper published in Decatur, GA)

God used nuclear technology to create the universe, and gave humans the ability to use it to improve our lives. The most important uses are in medicine. Indeed the discovery of the nuclear fission process was made by researchers seeking radiochemicals for medical uses. More than one-third of the patients admitted to medical facilities in the United States receive treatment that includes use of nuclear technology, including X-rays, MRIs, cat-scans, radiation therapy for cancer, and radioactive iodine to diagnose and treat thyroid disorders. More than 80% of prescription drugs are developed using radioactive tracers. A recent development, radiation angioplasty, appears to have major health advantages compared to other procedures. Modern medicine would not be possible without nuclear technology.

Industrial uses of nuclear technology include weld radiography, emergency lighting, measuring road and airstrip surface density, logging oil wells, detecting fires, strengthening plastics, vulcanizing rubber, sterilizing cosmetics and medical instruments, determining the authenticity of works of art and the age of historical materials, irradiating wood floors to improve wear resistance, and measuring thicknesses of films and papers and contents of packages. One of the most exciting uses is micro-lithography, for making computer chips. Present techniques are limited by use of light, which has a wavelength about the same size as the circuits on the chip. By using nuclear technology, much smaller chips can be produced. Computers are large users of electricity; smaller chips will significantly reduce the amount used.

Nuclear technology is used in agriculture to develop new plant species, determine mineral content of soils, and destroy pests. About 40,000 tons of spices are irradiated in the U.S. each year for improved hygienics. Radiation can be used to destroy salmonella, botulism, E-coli and other deadly bacteria in meats and other foods. This process does not leave residual radioactivity in the food, and has been demonstrated to be safe in tests conducted over more then forty years. The Food and Drug Administration has approved its use in foods, and some companies are considering the sale of irradiated meat.

The U.S. Space Exploration Program would not be possible without nuclear technology. The Voyager, Galileo, and Cassini missions to outer planets require radioisotope thermoelectric generators to power instruments. Any spacecraft that travels on the dark side of the Moon or any planet requires radioisotope heaters. Without this heat, instruments would freeze, and batteries would not operate.

Nuclear technology is the source of all energy. Decay of radioactive materials in the Earth's core provides the energy that keeps our planet warm. A nuclear fusion reactor - our Sun - provides heat during the day to partially offset heat lost at night. The Sun provides the radiation that is essential for photosynthesis, an essential process for life, which is the source of fossil fuels. The Sun also provides the energy for wind and hydro power.

Nuclear materials - uranium and thorium - are our most abundant potential energy source to light, heat and cool our homes, hospitals, schools and offices; fuel our factories and rail-based transportation systems; operate our computers, television sets and other electronic devices; and provide other benefits that are the foundation of civilization. Their use for energy avoids the atmospheric pollutants that cause acid rain, smog and human respiratory problems, and the greenhouse gases that threaten global warming. Nuclear technology can be used to produce the hydrogen for fuel cells that are being considered for future transportation needs.

Use of U.S. type nuclear power plants to produce electricity is one on humankind's safest endeavors. It has been made even safer as a result of coordinating efforts of the Atlanta-based Institute of Nuclear Power Operations (INPO), formed after the Three Mile Island nuclear power plant accident. A companion organization, the World Association of Nuclear Operators (WANO), formed after the Chernobyl accident, coordinates safety efforts for all of the worlds nuclear power plants. Efforts of INPO and WANO, working closely with the U.S. Nuclear Regulatory Commission and similar regulatory organizations in other nations, ensure that best ideas for safety and protection of workers and offsite populations from radiation are used by all reactor operators. They also ensure that any safety problem is known and avoided by all operators.

The use of nuclear materials for nuclear power provides the foundation for the international safeguards regime. International safeguards provide the only assurance to nations that their neighbors are not using nuclear materials for potential destructive purposes.

God gave humans the ability to develop the wisdom needed for safe, beneficial uses of nuclear technology. The wisdom and safeguards to ensure safe use and avoid misuse can only be developed and implemented through beneficial and appropriate uses of nuclear technology.

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Clinton Bastin

The President, March 13, 2001 - Enclosure 6

Summary of Relevant Experiences of Clinton Bastin

Clinton Bastin, a retired chemical engineer (Georgia Tech, 1950), is a signer and director of the Eagle Alliance[1], Secretary of the Atlanta Local Section of the American Nuclear Society, and coordinator for Community Awareness of Nuclear Benefits for the section. He writes for public enlightenment about the great benefits of nuclear technology.

For 42 years, Mr. Bastin managed US Government nuclear programs including reprocessing, spent fuel and nuclear waste management and disposal, gas centrifuge development, plutonium-238 (for space nuclear power) and plutonium-239 operations and fast neutron reactor testing. He provided technical leadership for initial supply of U.S. Atoms for Peace, the initial (success-based) U.S. program for disposition of spent fuel from nuclear power plants in the US and other nations, and a major nonproliferation initiative with the Government of India.

In 1974, after indications of failure of US commercial fuel reprocessing, he chaired USAEC task force studies leading to a recommendations that fuel reprocessing and recycle development be under direction of an organization with successful experience in the technology. The recommendation was accepted by the AEC but implementation was canceled by the Energy Research and Development Administration and Department of Energy.

He was US coordinator for reprocessing technology exchange with the United Kingdom and collaborative nuclear fuel cycle and robotics development with Japan, and a lead technical consultant to US national security agencies on nuclear proliferation threats. From 1970 through 1996, he provided briefings on worldwide reprocessing activities and plans for the Department of Energy, Central Intelligence Agency, National Security Agency and others.

At retirement in March 1997, Mr. Bastin was recognized in a DOE Distinguished Career Service Award as "the US authority on reprocessing and an advocate and initiator of total quality management and partnership agreements." In April 1997, the Russian Ministry for Atomic Energy and Russian Nuclear Workers Union adopted his ideas for improved safety of nuclear activities and safeguards for nuclear materials by employee empowerment through worker-manager partnerships.

From 1983 through 1996, Clinton Bastin was President of the DOE headquarters employees' union and editor of its award winning newsletter. He and his wife Barbara live in Avondale Estates, GA; they have four children and one grandchild.

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1 The Eagle Alliance is a signed partnership agreement of individuals and leaders of corporations, societies, laboratories, universities, unions and other organizations who have worked to develop peaceful uses of nuclear technology, believe that nuclear technology is a proper, safe, and essential element of advanced civilizations, and are committed to the task of preserving, enhancing and fully utilizing nuclear technology for the enduring benefit of humanity. The Eagle Alliance is also a not-for-profit corporation created to carry out the mission of the partnership agreement by providing full and accurate information to America's citizens and leaders about the great benefits of nuclear technology.