

Cold Fusion

The Cold Fusion "Miracle" Was No Mistake

The Strange Birth of the Water Fuel Age

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Cold Fusion Memo to the White House

The following Memorandum, prepared by Dr. Eugene F. Mallove for President Clinton, was requested in a phone call to Infinite Energy Magazine in February 2000 by the White House Office of Communications. The request for this memorandum was made by the White House following the gracious personal recommendation by our friend Sir Arthur C. Clarke that the President receive this briefing material. This is the first time that this Memorandum, "The Strange Birth of the Water Fuel Age," has been made available for electronic distribution.

Readers may distribute this COMPLETE memorandum to whomever they wish, provided that this introductory note and address-phone-fax-electronic information is attached up front. Dr. Mallove is still waiting for a reply of some kind from the President, as was promised by the official in charge of compiling the several dozen essays (of which this is one) from futurists, technologists, and others such as Sir Arthur C. Clarke. This Memorandum is very timely in view of increasing concerns about energy, the environment, and adequate electrical power for our computer-intensive economy.

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SUMMARY for President Clinton

Beginning in 1989, a class of new energy technologies has been developed that has the potential to provide pollution-free energy of a magnitude far greater than fossil fuel, using forms of hydrogen from water as the fuel in novel catalytic conditions. The technologies challenge the understanding of physics which has been used to justify continued investment in fossil fuels, nuclear power plants, and the so-called "hot fusion" energy research programs. The U.S. government has spent at least \$15 billion on hot fusion without achieving the "breakeven" point already achieved by the new energy technologies.

Hydrogen as a fuel in engines and fuel cells has been discussed and demonstrated for several decades. Fuel cells are emerging into the commercial market, using hydrogen-rich chemical compounds. These systems are based on chemical reactions whose energy density (energy per unit of fuel) is very low. There are serious problems in making, storing, and transporting hydrogen. The new energy technologies use hydrogen in a far different way that extracts thousands to millions of times the ordinary chemical combustion energy of hydrogen. Thus, water is fuel!

In 1989, after five years of work and investment of \$100,000 of their own money, Professors Stanley Pons and Martin Fleischmann announced the release of nuclear-scale energy from an electrochemical cell using palladium as the cathode metal. In the cell, heavy hydrogen is forced into the palladium until a new class of nuclear reactions occurs, in which energy of great intensity is released without the deadly radiation or radioactive by-products produced by other nuclear energy processes. The Pons-Fleischmann announcement ignited a controversy that is documented in the body and references of this memorandum. The DOE Energy Research Advisory Board "Cold Fusion Panel" was convened at the direction of President Bush to review the "cold fusion" controversy in its early days. The panel relied heavily on misleading reports from the California Institute of Technology, Harwell (England), and the Massachusetts Institute of Technology. Reports from all three sources were negative, and ERAB

recommended against any government investment in "cold fusion." This had far-reaching consequences, which seriously impeded but did not stop advances in the field.

After over a decade of work, hundreds of peer-reviewed scientific papers from laboratories around the world confirm the Pons-Fleischmann discovery. It was just the tip of an iceberg of a whole class of nuclear reactions--and other new hydrogen reactions--which occur in metals that are heavily loaded with heavy or normal hydrogen by any of several means. These are often called Low-Energy Nuclear Reactions (LENR), or Chemically-Assisted Nuclear Reactions (CANR). There is also a process, pioneered by BlackLight Power, Inc., that produces catalytically altered hydrogen atoms. What these processes have in common is the release of intense, nuclear-scale energies without damaging radiation or radioactive by-products. Reactors are small scale, requiring simple apparatus and common materials with hydrogen as the fuel. Transmutations of the metal cathode materials are commonly produced. In some cases, where radioactive materials such as uranium and thorium are used in the cells, these are rapidly transmuted into harmless by-products without production of harmful radiation or explosions. In principle, radioactive waste from nuclear reactors can similarly be deactivated without the political and economic costs of burial.

Collectively, these emerging technologies point to a much brighter future for mankind. They do not require resources controlled by any small group of countries. They are concentrated, portable, and democratic. Low cost realization and distribution of devices and systems based on these technologies will require the resources of a market economy and the removal of internal opposition from vested interests in the U.S. government and industries, including arbitrary blocking of "cold fusion" patent applications by the U.S. Patent Office. Originators of these technologies may make fortunes, but in the end mankind will be the beneficiary. Mr. President, you need do only one thing now: Publicly state that you are going to investigate this matter and then do it.

"Anything that is theoretically possible will be achieved in practice, no matter what the technical difficulties, if it is desired greatly enough." Arthur C. Clarke, Profiles of the Future, 1963

It was 1870, just five years after the carnage of the American Civil War. Jules Verne's *The Mysterious Island* challenged readers with an audacious prediction: "I believe that water will one day be employed as a fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable...I believe then that when the deposits of coal are exhausted, we shall heat and warm ourselves with water. Water will be the coal of the future." Though Verne predicted advanced submarines and flights to the Moon--even the competition between the United States and Russia in a lunar race, he was more prescient than anyone could have imagined, at least not until the last decade of the 20th Century. He turned out to be more than right about the power of water. Water will begin to be the fuel of the future, in all probability this decade.

There is an incontrovertible fact well known to scientists working to control thermonuclear fusion energy for peaceful power production: Within only one cubic kilometer of water, there exists enough heavy hydrogen isotope, deuterium (heavy hydrogen), such that if it is fused to the element helium at multi-million-degree temperatures, enough energy is released to equal the combustion energy of all the world's known oil. This planet has at least one billion cubic kilometers of water; there is no danger of running out of this fuel. Or, look at it this way: In only one gallon of ordinary water, there is enough heavy hydrogen to produce the energy equivalent of 300 gallons of gasoline. For worry warts: The heavy hydrogen comprises only 0.015 percent of all the hydrogen in the ordinary water, ergo there is no danger of a water depletion crisis from fusion energy! Heavy hydrogen or deuterium, by the way, is simply hydrogen that bears an extra neutron in its nucleus. It is non-radioactive and easy to extract from water very cheaply.

If we only had a way to tap this fusion energy safely and cheaply, the world's energy problems would be over; most if not all environmental problems would be

well on their way to solution. If we could find a way to release this fusion energy benignly without deadly radiation, and on a small scale, rather than in the stadium-like tokamak thermonuclear fusion reactors--smaller, dysfunctional prototypes of which are being tested at fantastic cost at Princeton, MIT, and elsewhere--a millennial revolution in energy technology would break out. It would mean an age in which the recurring cost of energy production would approach zero, since the heavy hydrogen is virtually free. The scope of that revolution would dwarf today's Internet-World Wide Web upheaval. The age of "free information" would have a partner: the age of virtually free energy! It may surprise you to learn that the energy discovery described above was made in the United States in the early 1980s, announced in 1989, and subsequently confirmed by solid published scientific research--some of that by Federal laboratories.<sup>1-7</sup>

So why have you not heard about it? This new energy revolution is, indeed, in progress around the world. It is called "cold fusion" energy, but, like many other scientific revolutions of great import, the infant discovery and technology is having a very difficult birth. One hopes that the influential readers of this essay will stay the hands of the paradigm-paralyzed critics in the scientific community who have maliciously and in some cases illegally obstructed the field at every turn. Whether from ill will, jealousy, or sheer misinformation, the antagonists "know not what they do" to one of the the brightest promises of our age. Now for the rest of the story...

#### The Stage is Set

After Verne's astonishing suggestion of 1870, oil from the bowels of the Earth, not water, emerged as the "coal of the future." We entered the 20th Century and wars were fought over this black gold. Even World War II had its roots, in part, over the control of oil by Japan or the United States. That war was ended by fission nuclear weapons, the sequel to a controversial discovery made in Europe in 1938--a discovery, incidentally, that was itself almost missed, but for some open-minded, concentrated thinking. Fission was the "cold fusion" of the 1930s, sans critics!

In 1988, physicist Emilio Segre' reflected on the 1930s discovery of fission by Hahn, Strassman, and Meitner: "Their early papers are a mixture of error and truth as complicated as the mixture of fission products resulting from the [neutron] bombardments. Such confusion was to remain for a long time a characteristic of much of the work on uranium." In their remarkable paper of December 22, 1938 in *Naturwissenschaften* announcing the fission discovery, Hahn and Strassman wrote, "As nuclear chemists working very close to the field of physics, we cannot yet bring ourselves to such a drastic step, which goes against all previous experience in nuclear physics." Yet nuclear fission was real. It became a world-changing discovery, relatively easy to reproduce, but a bit harder to make into bombs (fortunately!). It ended a terrible war and it preserved the peace among superpowers long enough for Communism to collapse in Europe.

Yet as the 20th Century merges into the 21st, oil, coal, and natural gas have remained kings. The Chernobyl disaster of 1986 dealt a devastating political blow to plans for expanding the fission economy, which might have given some respite from the tyranny of fossil fuels. Even in peacetime, oil and other fossil fuels take their tolls in death and destruction--from burnings and explosions in transportation, to slow deaths from atmospheric pollution. Late in the 20th Century, a greater consciousness about the environment arose, yet still the world remained in the grip of fossil fuels. Ordinary renewable energy technologies, for all their good, remained much too limited and problematic to be the solution to the world's energy problems. Millions of people continue to die every year from a variety of ills attributable directly or indirectly to the global dependence on fossil fuel combustion. The threat of global warming hangs in the air. Whether real or misjudged, the threat has to be considered. As you will increasingly see, cold fusion energy is the perfect preventative.

The exemplar of all that was wrong with the Age of Oil struck on March 24, 1989 at 12:04 a.m. In the pristine waters of Prince William Sound off the coast of Alaska, the Exxon Valdez ran aground and spilled eleven million gallons of crude oil. The horrific, foolish disaster symbolized the ultimate futility of our dangerous

dependence on the planet's subterranean fossil fuels. In what may eventually be considered one of the most profound coincidences in history, less than twelve hours before the Exxon-Valdez grounding, the difficult opening stages of a modern-day "miracle" was taking place beneath the snow-covered Wasatch Mountains of Utah. Thursday, March 23, 1989, brought a glimmer of hope from a city that had grown up near the barren flatlands of the Great Salt Lake. At 1:00 p.m. in Salt Lake City, chemistry professors Martin Fleischmann and Stanley Pons burned their names into the history of the quest for energy from water. Essentially unknown to the thermonuclear, hot fusion community, they claimed to have achieved what seemed to be impossible: power-producing fusion-like reactions at or near room temperature--without deadly radiation that the hot fusioners had planned to use to make electricity from their reactors! Fleischmann and Pons, and those who would later confirm their work, posed an immediate threat to the hot fusion and physics establishments. The heretics were dealt with as one might expect. The argument became, "Since you are not dead from the radiation our theory expects from your process, you must be incompetents or frauds."

The massive Exxon-Valdez oil spill drew deserved national attention and outcry, but it did not eclipse the extraordinary news from Utah about cold fusion--a concept that seemed to drop from the sky like an alien intruder straight into the public psyche. At the press conference held at the University of Utah, American Stanley Pons, professor of chemistry and chairman of the Department of Chemistry at the University of Utah, and British colleague Martin Fleischmann, professor of electrochemistry at the University of Southampton, England and Fellow of the Royal Society, really did disclose an amazingly simple method to create power-producing nuclear reactions--possibly fusion--not at hundreds of millions of degrees in imitation of the stars, but at room temperature from a solid-state reaction.

The Genie of fusion shrugged in his ancient vessel that year and amazed the world. The spring of 1989 will long be remembered as a time of unexpected shaking, when extraordinary claims by groups of researchers in Utah and

subsequently around the world led some scientists, even open-minded ones in hot fusion (especially in Japan), to reexamine a decades-long, multi-billion dollar quest to tame nuclear fusion. The struggle is to bring this power of the stars down to Earth, much as fabled Prometheus snatched fire from the gods. The interest of the scientific community and the public at large in 1989 was temporarily galvanized by the idea that a new kind of fusion process might soon lead to a way to get the fusion Genie to stop shrugging and come completely out of his bottle. He's half out now and will soon be out completely.

#### Paradigm Paralysis and Confirmation

Startling events occasionally make us step back to get a better view of our pursuits and to examine cherished assumptions. This often leads to rededication, to unforeseen possibilities, and to new directions. The shaking of complacency now and then in a positive way is healthy, no more so than in the fields of science and technology, where intense concentration on an established course sometimes promotes a too narrow focus. Sadly, there arose an unusual brutality about the way the cold fusion claims and confirmations were treated.

Confirmation of the remarkable cold fusion claims of 1989 was not to come easily. Unusual doubt and confusion (inevitably termed "fusion confusion") beset a baffled, bemused, and even outraged scientific community. A long quest ensued to confirm or disprove the claims that nuclear fusion reactions can occur in apparatus no more complex than a laboratory electrochemical cell, in pieces of metal infused under pressure with heavy hydrogen gas, or in other systems. Many more variants of the cold fusion process have been discovered and even patented since 1989. Some of these employ the ordinary (light) hydrogen in water; others operate at high temperatures in the gas phase--having nothing to do with electrochemistry; still others employ thin, layered metallic films that seem destined to draw from the advanced materials science and manufacturing infrastructure of the semiconductor industry. And, strange but true, there may even be significant implications for the biotechnology industry. It now seems that what Fleischmann and Pons discovered in the early 1980s was but the tip of the iceberg of a much larger class of fantastically important phenomena connected

with the catalysis of hydrogen and its isotopes. There will likely be found multiple, interlocking physical mechanisms necessary to encompass it all. The implications transcend energy science, but energy alone would be enough reason to make it one of the highest national priorities: All obstacles must be removed from this science and technology--from obstruction at the U.S. Patent Office to official interference by DOE officials. The subject must be discussed openly by officials.

A small fraction of the compendious scientific findings that support the phenomena of cold fusion energy are referenced at these web sites: and . Anyone who pontificates against this science ought to perform a step-by-step critique of this evidence. The opinion of anyone who argues against the experimental scientific evidence solely on theoretical grounds should be immediately dismissed. Science does not move forward only by gauging new discoveries against past theories. This seems to have been forgotten by some of the elite purveyors of nonsense against cold fusion. Not that there are not large numbers of theories in support of cold fusion; there are. The late Julian Schwinger (physics Nobel prize co-winner with Feynman) was a noted cold fusion theorist. He was so outraged by the treatment of cold fusion by the American Physical Society (APS) that he resigned from the organization. Dr. Michael McKubre at SRI International, prime author of the 1994 Electric Power Research Institute (EPRI) study,<sup>8,9</sup> which concluded that the Fleischmann and Pons discovery had been confirmed by their work, had this to say: "Fortuitous or not, in the first experiment that we ran, some three or four months after the initial announcement, we saw some evidence of excess heat, which has really sustained me ever since. Having seen the effect with my own eyes, the claims from a few that this is impossible, or inconsistent with all known laws of nuclear physics, these suggestions are in fact irrelevant. There is no theoretical objection to cold fusion, it's just unlikely given our experience with hot fusion."

The uninitiated might gauge the "religious belief" against cold fusion in the almost humorous utterance by physics Nobel laureate, theorist Steven Weinberg, who in

an aside attacked cold fusion in a recent New York Review of Books article,<sup>10</sup> even though he gives no evidence of having considered experimental data:

"There do not seem to be any exceptions to this natural order, any miracles....The evidence for all these [biblical] miracles seems to be considerably weaker than the evidence for cold fusion, and I don't believe in cold fusion."

To give another example of egregious misconduct against science by the critics, here are the foolish words of Dr. Robert L. Park, who claims to speak for the American Physical Society. In his book, *Voodoo Science: The Road from Foolishness to Fraud*, Park dismisses cold fusion at its very first mention, referring to it as "the discredited 'cold fusion' claim made several years earlier by Stanley Pons and Martin Fleischmann." He says that a "dwindling band of believers" continue to gather each year "at some swank international resort" in an attempt to "resuscitate" cold fusion. He asks, "Why does this little band so fervently believe in something the rest of the scientific community rejected as fantasy years earlier?" He speculates later, "Perhaps many scientists found in cold fusion relief from boredom." He complains that no helium nuclear ash results were forthcoming from Fleischmann and Pons by June 1989, ergo, cold fusion is fraud. Since at least 1991, Park has been informed by fellow APS scientists, such as Dr. Scott Chubb of the Naval Research Laboratory (NRL), about helium detection in cathodes and in the gas streams of cold fusion experiments. These independent experiments have been published in the U.S. and Japan in peer-reviewed journals. There is absolutely no doubt that Park knows this, yet *Voodoo* contains no mention of this data, an egregious fraud by Park on journalists, government leaders, and the general public. Mr. President, this is the level of inappropriate discourse that you must see through.

#### The Politics of Cold Fusion

Cold fusion energy offers the prospect of energy abundance over times comparable to geological ages, in contrast to the microscopic blip in human history of reliance on fossil fuel. If we expect our descendants to live virtually indefinitely on this planet--until perhaps our Sun, our hot fusion reactor in the sky, "dies" some five billion years hence--we had better plan now to possess a source

of inexhaustible power. Cold fusion is one energy resource that is virtually infinite, but how to bring it about sooner rather than later? To understand how to move forward, we need to back up and examine what happened and what has been discovered this past decade.

When as an MIT undergraduate I read George Gamow's book, *Thirty Years that Shook Physics: The Story of Quantum Theory* (1966) it was impossible to imagine that in less than 25 years another revolution, such as has been brought about by cold fusion, would shake physics in ways every bit as dramatic as what happened from 1900 to 1930.

For just over a decade, the Cold Fusion and Low-Energy Nuclear Reactions revolution has been underway, whether or not the mainstream physics/chemistry establishment and the general science media wish to agree. The barrier that separated conventionally understood chemistry and nuclear physics has come crashing down like the infamous Berlin Wall. The barrier does not exist, at least not within special microphysical domains of palladium, nickel, and other metals in contact with hydrogen. Exotic new physics is at work. The myth of the "End of Science" again disproved.

The revolution does not even have a name on which all the revolutionaries can agree. "Cold Fusion" is likely to stick, if for no other reason than that is where it all began. The terms LENR (Low-Energy Nuclear Reactions) and CANR (Chemically Assisted Nuclear Reactions) have been tried. Dr. Randell Mills of BlackLight Power, Inc., has a radically different theoretical approach and an apparently robust commercial activity. Recent reports suggest that Morgan Stanley-Dean Witter is about to take his company public in 2000. (In February 2000 his company belatedly received U.S. Patent 6,024,935 on its process.) This may be the first of many other private ventures in cold fusion/new energy.

Another company, Lattice Energy, LLC, has just been formed to further the LENR work of nuclear engineering Professor George Miley at the University of Illinois. Several Fortune 100 companies are becoming involved in all this work, though they are not quite ready to declare themselves--in a few more months, perhaps.

The revolution began inauspiciously, with Drs. Martin Fleischmann and Stanley Pons working for five years and spending some \$100,000 of their own funds before they announced their findings. Circumstances forced disclosure at a press conference some eighteen months before the scientists had wanted to publish. These complex matters, of historical importance only, are chronicled in *Fire from Ice: Searching for the Truth Behind the Cold Fusion Furor* (Mallove, John Wiley & Sons, 1991). The scientific documentary video, *Cold Fusion: Fire from Water* (1999) updates that story and provides insight into the political dynamics of the controversy. (The White House was sent these items in February 2000 and earlier.)

On that fateful day in 1989, Fleischmann and Pons made their central claim, which has been abundantly proved and never retracted, that in a heavy water electrochemical cell near room temperature they had produced excess energy orders of magnitude beyond explanation by chemistry. This was like discovering a new kind of match that would not "burn out" for weeks or months, yet would leave no initially obvious signs of a reaction product. Certainly there was no chemical ash. They said that they had detected neutrons and tritium in addition to the excess heat. These were all signatures of nuclear reactions.

Unfortunately, they did not emphasize the difficulty of producing the effects. At the time, because their hands were tied by lawyers focussed on patent issues and conflicts with nearby Brigham Young University, they were not even able to provide at their news conference a preprint of their forthcoming *Journal of Electroanalytical Chemistry* paper. Their neutron measurements were flawed, as they later admitted. This was a failing, yet others would later confirm in cold fusion experiments both low-level neutron radiation as well as tritium evolution. The latter astonishing evidence has been irrefutably proved by the work of Dr. Thomas Clayton's group at Los Alamos National Laboratory.<sup>1</sup> For national security reasons alone, the President of the United States should cause heads to roll about this matter! This is at least as important as the security breach of computer files at LANL. Radioactive tritium, the irrefutable evidence of a nuclear reaction--proof of the reality of cold fusion, and a key material ingredient in

thermonuclear weapons-can now be produced in small quantities by means far easier than with several multi-billion-dollar proposals. However, this work cannot and should not be classified. It is already in the public domain. (Significant improvement of the process to practical tritium-production level might well need to be classified.)

Most important to an understanding of the heated debate of the past decade: The Fleischmann-Pons announcement threatened an entrenched Federal research program. Over \$15 billion had been invested by the U.S. government in its decades- long hot fusion program, which sought to emulate the thermonuclear conditions in the cores of stars. Hot fusion had promised a distant era of safe, clean, infinite energy--variously estimated by funding seekers to begin by 2050 to 2100. These programs may have resulted in useful plasma physics research, but no net energy release in fusion energy beyond the magnitude of the electric power put in--ever. Thermonuclear bombs were at "breakeven," but controlled thermonuclear fusion reactors at Princeton and at MIT are not. The magnetic hot fusion energy program should be terminated quickly to prevent any more waste of research funding.

Fleischmann and Pons said in 1989 that they had achieved breakeven already and, unlike hot fusion, there were no deadly emissions. The claim of a chemically-assisted nuclear fusion reaction with net energy release threatened to divert Congressional funding from the hot fusion program. With private zeal, and later public scorn, scientists supported by the hot fusion program--particularly at MIT, my alma mater--sought errors in the Fleischmann-Pons work.

When the exact radiation signatures and end-products of hot fusion reactions in a vacuum were not found in the Fleischmann-Pons results or in quickly-done tests at other laboratories, scientists at the MIT Plasma Fusion Center yelled "possible fraud," "scam," and "scientific schlock." On May 1, 1989, the story planted in the Boston Herald by the then MIT hot fusion director unleashed a torrent of anti-scientific bigotry. It did not occur to most scientists that a new class of nuclear reactions might have been discovered. As Nobel laureate Julian Schwinger

would say in a lecture at MIT in November 1991, "The circumstances of cold fusion are not those of hot fusion." He was ignored.

The furor over cold fusion in the spring of 1989 prompted President George Bush, through Energy Secretary Admiral James Watkins, to convene a "Cold Fusion Panel" of the U.S. Department of Energy's Energy Research Advisory Board (ERAB). The late Nobel laureate Glenn Seaborg had told President Bush in the Oval Office on April 14, 1989 that the Utah discovery was "not fusion," thus poisoning the well and precluding an honest investigation. One of the 22 ERAB panelists had thought at the time: "Just by looking at Fleischmann and Pons on television you could tell they were incompetent boobs." (Professor William Happer of Princeton, quoted by G. Taubes in the book *Bad Science*.) So much for the claim that the ERAB panel was "unbiased." The head of the panel, Professor John Huizenga, was initially opposed to having any investigation at all, yet he was allowed to lead it!

This panel, convened by the Department of Energy, was assigned to assess reports from various laboratories and to make recommendations to the U.S. government. Three major laboratories submitted negative reports. These were MIT, Caltech, and Harwell (England). The ERAB report was negative, and quickly so. A preliminary negative conclusion came in July 1989 and the final report November 1, 1989, with the following consequences: 1) No special funding by the U.S. government for further research; 2) Flat denial by the U.S. Patent Office of any application mentioning cold fusion directly; 3) Suppression of research on the phenomenon in government laboratories; 4) Citation of cold fusion as "pathological science" or "fraud" in numerous books and articles critical of cold fusion in general, and of Fleischmann and Pons in particular. Drs. Fleischmann and Pons would leave the United States to work on cold fusion in France for a subsidiary of the Toyota Corporation (IMRA Europe). Stanley Pons became a citizen of France, in legitimate disgust with his treatment in the United States. Mr. President, you simply must have the courage to redress this outrage and have our government apologize to these extraordinary scientists. The probably illegal killing of their patent application must be redressed too.

The 1989 reports of MIT, Caltech, and Harwell have each been analyzed by competent scientists and these analyses have been published.<sup>11-16</sup> Each of the widely cited 1989 "null" experiments has been found to be deeply flawed in experimental protocols, data evaluation, and presentation. Each, in fact, contained some evidence of excess heat as claimed by Fleischmann and Pons. In the case of the MIT data, there is evidence of deliberate alteration of laboratory measurements by a lower-echelon worker to erase an indication of excess heat in official MIT publications and reports to a government agency under the official seal of MIT. Certainly this report had a dramatic impact on the perception of numerous scientists and most journalists. (Mr. President, this very unfortunate matter has now been referred to the Inspector General's Office at two Federal agencies.)

A great irony: Each of these negative results were themselves the product of the kind of low quality work of which Fleischmann and Pons were accused. The difference was that the reports said what the hot fusion community wanted to hear. This was the legacy of the 1989 ERAB report, but that legacy must now be reversed--and it will be, however long that takes. One method of ending the charade would be for the President of the United States to issue an executive order to the Secretary of Energy to conduct a thorough, unbiased investigation of the entire cold fusion, low-energy nuclear reactions question and to explore how the DOE came to play such a negative, obstructionist role. DOE laboratories should be compelled to work under the direction of those who have achieved significant positive results, such that there can be no doubt in anyone's mind about these phenomena.

Almost two years after they were concocted, Professor Ronald Parker of MIT's Plasma Fusion Center publicly stated that the MIT PFC cold fusion calorimetry data were "worthless" (June 7, 1991). In the same period (August 30, 1991) after his data had been challenged, Parker stated that "MIT scientists stand by their conclusions." Which is it? The full story is given in detail in a "Special Report: MIT and Cold Fusion" in the 10th Anniversary issue of Infinite Energy, which The White House has been provided. You will find the names of former Federal

officials in this document: CIA Director John Deutch and Air Force Secretary Sheila Widnall.

Fleischmann and Pons have been vindicated--if not by the media and by the establishment, certainly by mountains of high quality published results. The literature on the Fleischmann-Pons effect is now voluminous. These are not fantasies. This is solid work, the kind of pioneering, exhaustive experimentation that could have been done at places such as MIT, Caltech, and Harwell, but wasn't. We must now go beyond this sorry past.

The production of excess heat in the range of hundreds of megajoules per mole of metal has been confirmed, as well as the production of helium, tritium, and other elements. Power densities of kilowatts per cubic centimeter of electrode have been achieved by some researchers. The field of Low-Energy Nuclear Reactions has been established, if not yet widely recognized. Low-energy neutrons or weak gamma radiation are seen in some experiments, but most produce excess heat with no radiation or radioactive by-products. Rapid remediation of radioactive materials has been demonstrated. What a fantastic opportunity for universities such as MIT and private industry to become involved in one of the most exciting scientific and technological revolutions of all time. No massive Federal expenditures are required. This is a process that private industry can run with, as long as it is unhampered by bureaucratic interference. Certainly the replication and commercial application of the Fleischmann-Pons effect and similar effects has been inhibited by a lack of understanding of the exact nature of the reactions, which are not those known to plasma physicists. There is a severe and widespread materials and theory problem related to materials that produce the effects. Criteria are available to test materials for potential activity, but knowledge of how to produce such material at will is not yet available.

Sad to say, solving the materials problem may be beyond the financial resources of the scattered researchers who have worked to validate the Fleischmann and Pons effect, but it is heartening that private corporations are taking the lead in correcting the problem caused by some in government and the academic

establishment. Unfortunately, the negative reports by key hot fusion laboratories to ERAB prevented diversion of government funding from the failed hot fusion program to the promising field of cold fusion. The patent-crushing ERAB report also became a severe deterrent to private investment in the new energy field. We return to George Gamow's musings of 1966. Gamow thought that the next major physics revolution would be in understanding the very existence of elementary particles. He wrote, "There is hardly any doubt that when such a breakthrough is achieved, it will involve concepts that will be as different from those of today as today's concepts are different from those of classical physics." He was both wrong and right. He could not have suspected that the next physics revolution would begin not with high energy particle physics but with fundamental electrochemistry--and that it would end with the birth of what might be called "modern alchemy." The revolution will be the end of the world that we have known, this time for the better.

#### Snatching Victory from Defeat

Recent events: Senator John McCain, running in the New Hampshire primary for the Republican presidential nomination, agreed to be briefed on cold fusion. He kept his word. Within a week of his promise, he sent a top aide to our offices at the Bow Technologies Center. He received briefing materials that were to be handed to the Senator. Thus, Senator McCain became the very first major party presidential candidate in history to receive a high-level briefing about cold fusion. This briefing occurred before he won the February 1 New Hampshire Republican primary by a large margin over Governor Bush of Texas and others.

I later sought to ask Vice President Al Gore, while he was campaigning in Concord, New Hampshire for the Democratic Presidential nomination, whether he too would agree to a cold fusion briefing. On January 13, I attended a Gore question-and-answer meeting at Temple Beth Jacob in Concord, but was unable to ask him the question--the Vice President was very long in responding to so many of the other questions that time simply ran out. This was the same venue in which eight years earlier, almost to the day, I had asked you about cold fusion when you were a candidate, Mr. President! You seemed to know something

about it, because you said that some Arkansas scientists had been "stonewalled" on cold fusion by the DOE. In all probability they were.

As has been reported in Infinite Energy, it is our understanding that in the early 1990s Vice President Gore shied away from a cold fusion briefing by qualified scientists, after being urged to do so by a colleague at Apple Computer Corporation. The Vice President then reportedly stated that the topic was "too controversial, too complex--give it to the science advisor." With your encouragement, we hope that the Vice President will now be more open to discussions.

For the record, the question that was handed to Mr. Gore's representative on January 13, 2000:

Question for Al Gore from Dr. Eugene Mallove, Bow, NH

Mr. Vice President:

I'm Dr. Eugene Mallove, a member of this Temple and editor of the scientific journal Infinite Energy magazine. I would like to ask you two critical questions about energy and the environment, because I know those topics are dear to you--it may even help you win over Bradley because of the boondoggle going on in his state at Princeton! [The Princeton tokamak fusion reactor.] I hope that you will be very forthcoming in your response -- as Senator John McCain was when I asked him last week in Bow, at a Town Hall Meeting. You can be instrumental in ending a scientific scandal over energy that has been going on since the Exxon-Valdez ran aground on March 24, 1989-- the day after Drs. Fleischmann and Pons made their cold fusion announcement at the University of Utah. Candidate Bill Clinton, right here in this room on January 12, 1992, told those assembled that he knew something about the scandal--he said Department of Energy scientists had "stonewalled Arkansas scientists." Despite that, I regret to tell you

he has done nothing about it except [by inaction due to being misinformed] make the scandal grow worse. Here are the two questions:

1. Will you agree to help end the Cold Fusion controversy by agreeing to a scientific briefing here in New Hampshire, by representatives of the hundreds of American scientists working in the cold fusion and low-energy nuclear reactions field-including my colleague Dr. Edmund Storms of Los Alamos National Laboratory?

2. After this, would you consider proposing a National Academy of Sciences review of the cold fusion and low energy nuclear reactions issue based on the large body of scientific evidence that has built up since what we regard as the indefensible, rush-to-judgment, even fraudulent report by the Department of Energy in 1989?

Mr. President, the rest may be up to you. You have heard the story. It is true. Every word. Nothing will hold back the cold fusion/new energy revolution from happening in due course, but with the stroke of your pen, a few taps on your computer, or perhaps a few telephone calls, you have it in the power to help accelerate the Cold Fusion/New Energy Age. Just as Secretary of War William Howard Taft in the Roosevelt Administration cut through bureaucratic opposition and forced the Army to call the Wright brothers in 1908 to demonstrate their "flyer" to a crowd of thousands at Ft. Meyer, Virginia--and thereby ended years of doubt about their 1903 accomplishment, launching the Aerospace Age--you can break the opposition of the perpetrators of the "HeavyWatergate" scandal. That act of courage and imagination will never be forgotten. Thank you.

Let me end as I began with a few remarks by Sir Arthur C. Clarke, who recommended that your staff request this essay from me:

"Like everyone else, I was very excited when the so-called 'cold fusion' announcement was made. And then, again like everybody else, I became disappointed and forgot about the whole thing when it seemed to be a mistake, though I was rather puzzled why two world-class scientists could have made such fools of themselves. Well, during the years that followed, slowly, from time to time, there came news of other laboratories repeating the experiment and

getting positive results. And there has been a sort of groundswell, all over the whole world, of new information. And during the course of the last five years or so, I've slowly become convinced, from my original skepticism, to 99% certainty that it is for real. The evidence now is really overwhelming." Cold Fusion: Fire from Water, 1999

"If these new sources of energy do turn out to be real - and as I say there are several totally different varieties - the question is: What effect will this have on our society? On the future? Well, it's just possible they may be no more than laboratory curiosities, and can't be scaled up to commercial levels. I think that's rather unlikely. Nuclear energy was once a laboratory curiosity. So let's assume that these devices can be developed. The future is then almost unlimited. It could be the end of the fossil fuel age: the end of oil and coal. And the end, incidentally, of many of our worries about global pollution and global warming."

Cold Fusion: Fire from Water, 1999

References:

### **Los Alamos National Laboratory**

1) "Tritium Production from a Low Voltage Deuterium Discharge on Palladium and Other Metals," T.N. Claytor, D.D. Jackson, and D.G. Tuggle, published on WWW and reprinted in Infinite Energy, No. 7, March-April 1996, pp. 39-42, Over the past year we have been able to demonstrate that a plasma loading method produces an exciting and unexpected amount of tritium from small palladium wires. In contrast to electrochemical hydrogen or deuterium loading of palladium, this method yields a reproducible tritium generation rate when various electrical and physical conditions are met. . . We will show tritium generation rates for deuterium-palladium foreground runs that are up to 25 times larger than hydrogen-palladium control experiments using materials from the same batch. [See also, "Tritium Evolution from Various Morphologies of Deuterated Palladium," Proceedings of the Fourth International Conference on Cold Fusion, December 6-9, 1993, Maui, Hawaii, Edited by Y.O. Passell, EPRI TR-104188, July 1994.]

2) "Electrolytic Tritium Production," by Edmund Storms and Carol Talcott, Fusion Technology, Vol. 17, July 1990, pp. 680-695.

Fifty-three electrolytic cells of various configurations and electrode compositions were examined for tritium production. Significant tritium was found in 11 cells at levels between 1.5 and 80 times the starting concentration after enrichment corrections are made.

3) "Review of Experimental Observations About the Cold Fusion Effect," by Edmund Storms, Fusion Technology, Vol.20, December 1991, pp. 433-477.

The experimental literature describing the cold fusion phenomenon is reviewed. The number and variety of careful experimental measurements of heat, tritium, neutron, and helium production strongly support the occurrence of nuclear reactions in a metal lattice near room temperature, as proposed by Pons and Fleischmann, and independently by Jones.

**Naval Air Warfare Center Weapons Division, Research Department, Chemistry Division and University of Texas, Department of Chemistry** 4) "Anomalous

Effects Involving Excess Power, Radiation, and Helium Production During D<sub>2</sub>O Electrolysis Using Palladium Cathodes," by Melvin H. Miles, Benjamin F. Bush, and Joseph J. Lagowski, Fusion Technology, Vol. 25, July 1994, pp. 478-486.

Previous experiments showed that eight electrolysis gas samples collected during episodes of excess power production in two identical cells contained measurable amounts of <sup>4</sup>He while six control samples gave no evidence for helium... This places the <sup>4</sup>He production rate at 10<sup>11</sup> to 10<sup>12</sup> atom/s per watt of excess power, which is the correct magnitude for typical fusion reactions that yield helium as a product... Simultaneous evidence for excess power, helium production, and anomalous radiation was present in these experiments.

Completely new experiments with more precise helium measurements are reported that again show simultaneous evidence for excess power, helium production, and anomalous radiation. 5) "Anomalous Effects in Deuterated

Systems," by Melvin H. Miles, Benjamin F. Bush, and Kendall B. Johnson, NAWCWPNS Technical Publication 8302, September 1996, 99 pages.

Excess power was measured in 28 out of 94 electrochemical experiments conducted using palladium or palladium-alloy cathodes in heavy water. . .Results from our laboratory indicate that helium-4 is the missing nuclear product accompanying the excess heat. Thirty out of 33 experiments showed a correlation between either excess power and helium production or no excess power and no excess helium. The collection of the electrolysis gases in both glass and metal flasks place the helium-4 production rate at 1011 to 1012 atoms per second per watt of excess power. This is the correct magnitude for typical deuteron fusion reactions that yield helium-4 as a product. Anomalous radiation was detected in some experiments by the use of X-ray films, Geiger-Mueller counters, and by the use of sodium iodide detectors. There was never any significant production of tritium in any of our experiments. . . Our results provide compelling evidence that the anomalous effects in deuterated systems are real...It is highly unlikely that our heat and helium correlations could be due to random errors. . . Our best experiments produced up to 30% excess heat, 0.52 watts of excess power, and 1400 kilojoules (kJ) of excess enthalpy. This amount of excess enthalpy is difficult to explain by any chemical reaction. . . Anomalous radiation was detected in some experiments by the use of X-ray films, several different types of Geiger-Mueller (GM) counters, and sodium iodide (NaI) detectors. Normal radiation counts were always observed when no electrolysis experiments were running. . .

**Naval Ocean Systems Center and U.S. Department of Energy (Washington)**

6) "On the Behavior of Pd Deposited in the Presence of Evolving Deuterium," S. Szpak (Navy), J.J. Smith (DOE), J. Electroanalytical Chemistry, 302 (March 11, 1991), pp. 255-260.

. . .Three sets of preliminary experimental results are presented here, i.e., the production of excess enthalpy, the production of tritium, and the presence of some form of radiation.

**NASA Lewis (Glenn) Research Center**

7) "Replication of the Apparent Excess Heat Effect in a Light Water-Potassium Carbonate-Nickel Electrolytic Cell," by Janis M. Niedra, Ira T. Meyers, Gustave

C. Fralick, and Richard S. Baldwin, NASA Technical Memorandum 107167, February 1996.

Replication of experiments claiming to demonstrate excess heat production in light water-Ni-K<sub>2</sub>CO<sub>3</sub> electrolytic cells was found to produce an apparent excess heat of 11 watts maximum for 60 W electrical power into the cell. Power gains ranged from 1.06 to 1.68. . .

### **SRI International and Electric Power Research Institute**

8) "Development of Advanced Concepts for Nuclear Processes in Deuterated Metals," M.C.H. McKubre, et al., EPRI TR-104195, Research Project 3170-01, Final Report, August 1994, 128 pages, plus 342 pages on microfiche.

This work confirms the claims of Fleischmann, Pons, and Hawkins of the production of excess heat in deuterium-loaded palladium cathodes at levels too large for chemical transformation... Although nuclear reaction products commensurate with the excess heat have not yet been observed, small but definite evidence of nuclear reactions have been detected at levels some 40 orders of magnitude greater than predicted by conventional nuclear theory.

9) "Isothermal Flow Calorimetric Investigations of the D/Pd and H/Pd Systems," M.C.H. McKubre, S. Crouch-Baker, R.C. Rocha-Filho, S.I. Smedley, F.L. Tanzella, T.O. Passell, and J. Santucci, Journal of Electroanalytical Chemistry, 368, 1994, pp.55-66.

. . .the generation of "excess power" was observed in a series of deuterium-based experiments, but not in a hydrogen-based experiment. The results of these experiments enable several (tentative) conclusions to be reached concerning the conditions necessary for the reproducible observation of this anomalous thermal effect.

10) Steven Weinberg, New York Review of Books, Oct. 21, 1999.

11) Swartz, Dr. Mitchell R., "Re-Examination of a Key Cold Fusion Experiment: 'Phase-II' Calorimetry by the MIT Plasma Fusion Center," Fusion Facts, August 1992, pp. 27-40.

12) Swartz, Dr. Mitchell R., "A Method to Improve Algorithms Used to Detect Steady State Excess Enthalpy," Proceedings: Fourth International Conference on

Cold Fusion (December 6-9, 1993, Lahaina, Maui, Hawaii), and in Transactions of Fusion Technology, Vol. 26, December 1994, pp. 369-372.

13) Swartz, Dr. Mitchell R., "Some Lessons from Optical Examination of the PFC Phase-II Calorimetric Curves, Proceedings: Fourth International Conference on Cold Fusion (December 6-9, 1993, Lahaina, Maui, Hawaii).

14) Noninski, Drs. V.C. and C.I. "Comments on 'Measurement and Analysis of Neutron and Gamma Ray Emission Rates, Other Fusion Products, and Power, in Electrochemical Cells Having Palladium Cathodes," Fusion Technology, Vol. 19, May 1991, pp. 579-580.

15) Miles, Melvin H., B.F. Bush, and D. Stillwell, "Calorimetric Principles and Problems in Measurements of Excess Power During Pd-D<sub>2</sub>O Electrolysis," J. Physical Chemistry, Feb. 17, 1994, pp. 1948-1952.

16) Hansen, Wilford N. and M.E. Melich, "Pd/D Calorimetry-The Key to the F/P Effect and a Challenge to Science," Proceedings: Fourth International Conference on Cold Fusion (December 6-9, 1993, Lahaina, Maui, Hawaii), and in Transactions of Fusion Technology, Vol. 26, December 1994, pp. 355-368.

### **Biographical Note for Dr. Eugene F. Mallove**

Since 1995, Dr. Mallove has been the Editor-in-Chief and Publisher of the bi-monthly Infinite Energy Magazine, based in Concord, New Hampshire. Now in its fifth year of publication, Infinite Energy covers advances in the field of cold fusion and new energy technology and has subscribers in 38 countries, with an average print run of 5,000.

The magazine's New Hampshire-based parent company, Cold Fusion Technology, Inc., operates the New Energy Research Laboratory (NERL) and the magazine publishing facility at the Bow Technologies Center in Bow, New Hampshire.

Dr. Mallove holds a Master of Science Degree (SM, 1970) and Bachelor of Science Degree (SB, 1969) in Aeronautical and Astronautical Engineering from the Massachusetts Institute of Technology and a Science Doctorate in Environmental Health Sciences (Air Pollution Control Engineering) from Harvard University (1975). With broad experience in high technology engineering at

companies including Hughes Research Laboratories, TASC (The Analytic Science Corporation), and MIT Lincoln Laboratory, he has also had extensive hands-on experience in laboratory settings

Since 1991 he has worked as a consultant to U.S. corporations and investment firms doing R&D in cold fusion. He is the author of three science books for the general public, including the Pulitzer-nominated book on cold fusion, *Fire from Ice: Searching for the Truth Behind the Cold Fusion Furor* (John Wiley & Sons, 1991). He has taught science journalism at MIT and at Boston University; he was Chief Science Writer at the MIT News Office when cold fusion erupted. Prior to that he was a top science writer and broadcaster with the Voice of America in Washington, DC and also wrote science and technology articles for magazines and newspapers, including MIT Technology Review and The Washington Post. Articles about Dr. Mallove's cold fusion work have appeared in TWA Ambassador Magazine (September 1997) and in Wired (November 1998). Dr. Mallove's review article, "Cold Fusion: The Miracle Was No Mistake," appeared in the July/August 1997 Analog. Dr. Mallove is often called upon for radio interviews as an expert in the field of cold fusion and new energy.

Eugene Mallove was the Technical Advisor to the 1997 Paramount Pictures techno-thriller, "The Saint," starring Val Kilmer and Elisabeth Shue, and is credited in the film. The central theme of the movie is cold fusion. In April 1999, the definitive cold fusion video documentary written by Dr. Mallove and his colleagues, "Cold Fusion: Fire from Water," was released. Its narrator is James Doohan, "Scotty" of "Star Trek" fame.

### **President Clinton Responds During His Last Days in Office**

January 18, 2001

Dr. Eugene F. Mallove

Director

New Energy Research Laboratories

Post Office Box 2816  
Concord, New Hampshire 03302-2816

Dear Eugene:

Thank you for your memorandum "The Strange Birth of the Water Fuel Age," which was compiled into a book entitled *Visions of the Future from Leading Thinkers*. I was glad to have your insights about the critical challenges in the field of high technology, and I commend you for your commitment to improving our world. I hope you will remain involved in the important issues of this new century.

Best wishes for every happiness in the years to come.

Sincerely,

Bill Clinton [The signature appears to be an official signature, not an autopen or stamp!]