Miles From Three Mile Isle; Warming To Nuclear Energy

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I. INTRODUCTION

The United States generally, and the Southwest particularly, has arrived at an extraordinary juncture in our fifty-plus year relationship with nuclear energy. To the casual observer, the relationship might be perceived as a “love-hate” relationship. That seems to be an apt description, particularly when one compares—in rough terms—our relationship with nuclear energy in the third and fourth quarters of the Twentieth Century.

Upon President Dwight D. Eisenhower’s visionary “Atoms for Peace” speech to the United Nations in 1953, which embodied the United States’ post-war commitment to peaceful applications of nuclear technologies, it was love at first sight. Congress in the next year consummated Ike’s vision with the Atomic Energy Act of 1954 (“AEA”), wresting from our government its monopolistic grip on virtually everything nuclear. Thus began a long and prolific honeymoon period during which the private sector, working in tandem with the federal regulators within the Atomic Energy Commission (“AEC”) and its successor-agency, the Nuclear Regulatory Commission (“NRC”), succeeded in propelling our nation and the world into the dawn of a nuclear age.

Then came trouble in paradise, however, beginning in 1979 at Three Mile Island. Although many analysts with the benefit of hindsight consider the partial meltdown at one of that facility’s reactors to have been a net positive in terms of the proven successes in the design and functioning of safety systems at the facility, there is no denying that it leveled a significant blow to the nascent nuclear industry in the United States. Ever since then no new nuclear power generating station has been successfully installed in this country. Thereafter, in an incident vastly more disastrous than Three Mile Island (where nobody was hurt and radiation releases were found to be de minimus), the Chernobyl disaster added the ultimate insult to injury in terms of human toll and proven safety shortcomings of the former Soviet Union facility and its operators. Public perceptions of these two incidents and nuclear waste disposal impasses have dogged us to today.

No doubt everybody at this conference, though, has heard a renewed buzz about nuclear energy. The rumor is our nuclear familial ties may be strong enough to have survived even those worst of times. We have arrived at a moment of truth in this new century. This paper identifies factors surrounding the renewed hope for nuclear energy. Next, the paper discusses some of the chief challenges lying ahead for the industry— challenges which, at least through the rose-tinted glasses of this author and many others, appear to be manageable through patience, diligence, sacrifice and sound science.

II. FACTORS BEHIND THE RENEWED HOPE FOR NUCLEAR ENERGY

Many factors play into the promise of a nuclear renaissance. Here are several:

A. Endorsements of Environmentalists Concerned With Global Warming

The most recent, and symbolically significant, factor pointing the way to a possible nuclear energy resurgence is that a number of high-profile environmentalists have seen fit to break ranks by extolling the virtues of nuclear energy as an alternative—or larger supplement—to burning fossil fuels for energy. In testimony before the U.S. House of Representatives on April 28, 2005, Greenpeace founder Patrick Moore stated:

There is now a great deal of scientific evidence showing nuclear power to be an environmentally sound and safe choice. A doubling of nuclear energy production would make it possible to significantly reduce green- house gas emissions nationwide.

Stewart Brand, the founder, publisher and editor of The Whole Earth Catalog, in an article entitled "Environmental Heresies" that appeared in the May 2005 issue of MIT's Technology Review, had this to say:

Now we come to the most profound environmental problem of all…global climate change. *** The only technology ready to . . . stop the carbon dioxide loading of the atmosphere is nuclear power.

Hugh Montefore, the now-deceased former chairman and trustee for Friends of the Earth, in a October 23, 2004 article in UK's The Tablet entitled "Why the Planet Needs Nuclear Energy," stated:

It is because of the . . . graveness of the consequences of global warming for the planet that I have now come to the conclusion that the solution is to make more use of nuclear energy.

Another good example comes from noted environmentalist James Lovelock, creator of the Gaia theory. In a May 24, 2004 article appearing in UK's The Independent, Lovelock wrote:

By all means, let us use the small input from renewables sensibly, but only one immediately available source does not cause global warming, and that is nuclear energy. Nuclear energy from its start . . . has proved to be the safest of all energy sources.

These and other examples of environmentalist support for nuclear energy may or may not ultimately unravel the public perception-based opposition to nuclear energy that is discussed below as one of the significant challenges facing the industry. Certainly they are a significant start, however, and no doubt the nuclear industry is invigorated by them.

B. Positive Projections About Nuclear Energy's Growth Potential

Positive outlooks for nuclear energy abound in the energy literature today, and not just in the materials of the ever-positive Washington, D.C.-based nuclear industry trade association, the Nuclear Energy Institute (NEI).[(2)] For example, and perhaps most notably, an important study published in 2003 by the Massachusetts Institute of Technology, "The Future of Nuclear Power," was undertaken by an interdisciplinary team of academics who believe that "nuclear power, despite its challenges, is an important option for the United States and the world to meet future energy needs without emitting carbon dioxide and other atmospheric pollutants." While the MIT study's outlook for nuclear energy's future may not be as rosy as the study has been portrayed in Senator Domenici's recent book—A Brighter Tomorrow;[3] Fulfilling the Promise of Nuclear Energy[4] —it identifies increased use of nuclear power as one means of meeting projected global energy demands and the need to reduce greenhouse gas emissions from electricity generation. Both the 2003 MIT study and Senator Domenici's 2004 book are important contributions to the nuclear energy discussion and are excellent resources for anyone embarking on a detailed study of nuclear energy issues.

Even more positive than the cautiously optimistic MIT study and Senator Domenici's heartfelt promotion of nuclear energy (as a tool for, in part, ensuring the laudable goals of world economic fairness and stability), is NEI's "Vision 2020." The NEI policy statement outlines a plan to increase domestic nuclear capacity by 50,000 megawatts (MW) by 2020. Balanced against this nuclear industry-based projection is the Department of Energy's much more modest, but still positive, "Nuclear Power 2010 Initiative," which sets a goal of establishing at least one new advanced nuclear power plant by 2010. It is encouraging to this author that DOE's initiative assumes there will be a commercial-scale hydrogen production system made possible by nuclear energy by 2015. Coinciding with DOE's combined nuclear and hydrogen energy goals, early drafts of the energy legislation about to be unveiled in Congress make it apparent that both goals stand a strong chance of playing a prominent, though perhaps not yet central, role in the coming energy policy directions of this country. This will be thanks, in no small part, to New Mexico's policymakers in Congress, including but not limited to the current Chair of the Senate Energy and Natural Resources Committee, Senator Domenici.

Other recent nuclear energy projections, which are largely positive (some more so than others), include a joint publication by six of our national laboratories, a forecast by the U.S. Energy Information Administration (EIA), a range of estimates by the International Atomic Energy Agency (IAEA), and a long-term forecast by the International Institute for Applied Systems and World Energy Council (IIASA/WEC). For the most part, these studies project formidable increases in world energy needs and potential nuclear energy electric generation capacity and consumption over various temporal horizons. All told, the forecasts in recent nuclear energy literature point to an impending need for a nuclear energy revival and meeting of the industry's challenges.

C. The Safety Record of Existing Reactors Within the United States

Strange as it may sound to some who have easily accepted and perpetuated the myth that Three Mile Island was a nuclear incident of Chernobyl proportions, most serious nuclear observers and scientists are in agreement that United States' nuclear safety record is an overwhelmingly exemplary one. The absence of anything more than de minimus radiological releases and a lack of radiation-derived injuries at the United States' 103 nuclear generating stations over the industry's first 50 years is an amazing tribute to the premium this country's nuclear facility designers and operators have placed on safety. More to the point, it is proof positive that diligence and ingenuity are hallmarks of the domestic nuclear energy industry.

Take, for example, the Southwest’s desert rose: the Palo Verde Nuclear Generating Station. In operation for almost 20 years, Palo Verde is the largest nuclear generating site in the United States. The reactor is a pressurized water reactor design containing 241 fuel assemblies with 236 fuel rods per assembly. Each Palo Verde unit has an ultra-strong metal containment structure and numerous other high-end safety features and contingency plans. The facility’s safety record is an impressive one.

Moreover, the same safety success story is told across the nation’s 103 reactor facilities. Not only are the facilities in the United States safe; they are also efficient. Those 103 domestic nuclear facilities currently supply approximately 20% of our nation’s electric energy consumption, and power uprates authorized by the NRC as well as other efficiency improvements have bought the domestic facilities’ capacity factor to well over 90%—an astonishing accomplishment relative to the nuclear programs in many other countries.

D. Improvements In Designs In the Areas of Efficiency, Safety, Etc.

Much of the American public has come to understand the uranium mining, tailings disposal, enrichment, reactor facility and spent fuel disposal facilities—if at all—through the lens of grand-scale technologies developed initially in the mid-Twentieth Century. Meanwhile, more recently-developed and highly controlled in-situ mining techniques are light-years advanced over conventional mining methods in terms of the limited nature of disturbances, acid rock drainage potential and other traditional concerns. Similarly, new “Generation IV” reactor technologies contemplate employment of smaller-scale nuclear reactors that would contribute less waste and less dangerous byproduct materials. Other advanced nuclear reactor designs would allow the use of mixed fuels, recycling of spent fuels and stored wastes, and other improvements.

An unfortunate circumstance is that certain advanced American designs have been installed elsewhere around the globe, but they remain invisible in the United States. Like ex-patriot jazz artists thriving on actual fan bases in places like Paris and Tokyo, advanced light water reactors (ALWRs), mixed oxide (MOX) fuel facilities and other advanced designs stand tall overseas for wont of fitting in here at home. This state of affairs is particularly troubling given that the NRC has actually pre-approved certain advanced designs that still are not being built on our soils. Timid investors, still smarting from the nuclear industry downturn following Three Mile Island and high-profile failures in the domestic regulatory arena since then, have located greener pastures elsewhere, and in turn may compound things by keeping those same foreign pastures greener than ours.

E. Increasing Worldwide Enthusiasm For Nuclear Energy

It is no secret that emerging world powers such as France, Japan, China, India, Italy and others have gotten behind nuclear energy in a big way. In France, for example, over 75 percent of domestic electricity demand is supplied by nuclear energy, plus France exports lots of nuclear-generated electricity to its European neighbors. Tiny Japan has more than half the number of existing nuclear stations that are on vast American soils, and supplies 34 percent of its electric energy demand. China and Russia each have embarked on major expansions of their nuclear programs. There is a growing sense among writers commenting on the United States nuclear scene that the international train is leaving the station, and we may not want to be left whistling Dixie.

F. Nuclear Energy's Improving Outlook for Economic Feasibility

MIT's 2003 academic study found that, "[i]n deregulated markets, nuclear power is not now cost competitive with coal and natural gas." The authors go on to challenge the industry to take advantage of and demonstrate opportunities to reduce new reactor construction costs. The MIT study also recommends that the government offer carbon emission credits and a sharing of "first mover" costs to allow a more competitive position. Other similar ideas have emerged from DOE's Nuclear Power 2010 Initiative, including new design advance certifications, site banking and the theoretically more efficient "combined construction and operating license" (COL) process. The more of these ideas that are enacted and successfully taken advantage of by industry, the more we can expect to see concrete progress towards a nuclear renaissance in this country.

Even without such policy and regulatory vehicles, however, there are signs of increasing competitiveness of nuclear energy. Not the least of these signs is the vastly improved and still improving efficiencies of even the older online reactors, not to mention the newer designs. Although an economic assessment of the feasibility of nuclear reactors is beyond the scope of this paper, suffice it to say that many commentators have commented that, especially with policymakers' increasing demands for emissions control technologies and forced reductions in such things as CO2 and NOX emissions, the competitiveness of nuclear facilities is becoming a constantly brighter prospect.

III. SIGNIFICANT CHALLENGES FACING THE NUCLEAR INDUSTRY

Having reviewed some of the key factors that help explain why a second honeymoon with nuclear energy may be in the offing, I would be remiss not to address the key challenges facing nuclear energy presently and as we progress farther into the Twenty-First Century. A few of those challenges are briefly raised and discussed here:

A. Anti-Nuclear Public Perceptions Environmental- and public health-based opposition to virtually anything seems to take on a life of its own these days, both in the public psyche and in the governmental regulatory arena. Anti-nuclear sentiment is no exception. Obviously the nuclear misfires that have occurred on the world stage make the sentiment rational in the first instance. It would be a mistake, for example, not to apply a healthy skepticism to nuclear development issues given the radiological contamination, materials and technology proliferation, and waste disposal issues that appertain. Add to those the risks associated with terrorism. Although proliferation and terrorism risks are beyond the scope of this discussion, those subjects are appropriately the subject of much attention. Given the gravity of the issues, one rightly wonders whether proponents of nuclear energy have any chance at all of winning the hearts and minds of the public.

The same doubts might have been entertained, of course, following the horrors of World War II when President Eisenhower delivered his "Atoms for Peace" speech at the United Nations. Further, there are circumstances existing today that even Ike did not have at his disposal. First is the perception of global warming and the growing sense among environmental advocates that nuclear may have to be part of a solution in the near-term, as discussed above. Second is the decades-long exemplary track record of the domestic nuclear industry, in which Third Mile Island should be placed in an appropriate light. Third is the inherently finite nature of the nation's and world's fossil fuel resources. Fourth is the growing recognition that we simply cannot, as a country, be led consciously or unconsciously by our increasing dependence on foreign oil.

B. The Waste Disposal Dilemma The long-term nature and risks of radiological contamination are well known and not insignificant. A National Academy of Science study just released on June 29, 2005 substantiated the controversial views of some scientists that exposure to even very low levels of ionizing radiation carries long-term risks where there are extended periods of accumulated exposure. The study, known as BEIR VII, does not really change what most regulators and regulated already assumed, however, which is that it is imperative that we handle, store and dispose of nuclear waste safely. The real debate, it seems, is whether the safe storage must be on a permanent basis or, alternatively, on an "interim" basis. A growing number of scientists and others are pointing out that interim storage probably would be more appropriate from a couple of standpoints.

First, the wastes associated with milling of uranium ores to make yellowcake, such as tailings repositories in New Mexico's celebrated uranium belt, might conceivably retain enough energy fuel potential that re-mining and further refinement could become feasible in the future. This does not mean, however, that the industry should run to Congress and seek repeal of the Uranium Mill Tailings Radiation and Control Act or resist regulatory efforts to close such facilities and ensure their safety and stability. Overall, UMTRA appears to provide a sensible permitting regime for dealing with large volume tailings repositories.

Second, byproduct material from enrichment plants such as the one proposed by LES Partnership and Urenco near Eunice, New Mexico, likewise have the potential to be recycled, either by burning the material in mixed fuel reactors or, in the case, of some waste streams, by re-enriching certain materials. Again, that does not mean that NRC regulatory permitting regimes for handling of radioactive materials should be gutted or abandoned; rather, it means that the byproduct should be stored safely on an interim basis until further use or re-storage of the material becomes advisable depending on the science and needs of society under existing conditions that may evolve and change over time.

Uranium Fuel Supply Transactional and Regulatory Challenges One of the biggest frustrations of executives functioning at the production end of the nuclear fuel cycle, is the fact that so many circumstances play into the supply and demand economics surrounding the uranium market, including many of the same factors and uncertainties already discussed in this paper. Although world surpluses of uranium in the late 1970s had already begun to negatively impact the once-thriving uranium mining and milling operations in western New Mexico, the Three Mile Island incident brought a fairly emphatic end to any hope of a rebound in uranium prices at the time. Moreover, the United States' subsequent HEU Agreement with Russia, designed in part to ensure world marketability for highly enriched uranium (HEU) from dismantled warheads of the former Soviet Union, helped keep demand for uranium to a level below which it would have been economical for any serious New Mexico uranium operations.

More recently, however, uranium prices have returned to prices reaching over $30 per pound, up from $7 per pound not too long ago. Meanwhile, some have observed that already mined uranium (AMU) and known uranium reserves may not be adequate supply to sustain some of the projections of world nuclear energy source material needs, so the price could continue to climb. These price trends, and the general perception that nuclear energy may be close to a period of revival in the United States (as already seems to be occurring elsewhere), has led to a significant amount of leasing, speculation and exploration activities in New Mexico's uranium belt. This, in turn, has sent lawyers reaching for such resources as the thirty-year old "Uranium Exploration and Development Institute" proceedings of the Rocky Mountain Mineral Law Foundation.

Several circumstances have changed since the last uranium boom, however, and lawyers need to tread these waters carefully. Five such changes are identified here:

First, many of the transactions being pursued are trans-boundary in the sense that they are taking place between American and foreign entities, mostly Canadian. A whole set of international legal considerations beyond the scope of this paper apply to such transactions and should be investigated and researched before representing either side in such a transaction.

Second, the laws surrounding the attorney-client privilege and corporate and transactional disclosure obligations as applied to minerals transactions is not the same as it used to be, and seems to be evolving as we speak. That subject too is beyond the scope of this paper, but suffice it to say that the protections traditionally provided by the attorney-client privilege has somewhat eroded in this context.

Third, in 1993 New Mexico adopted the New Mexico Mining Act, and subsequently New Mexico's Courts have interpreted that reclamation permitting and bonding scheme to apply to uranium mining and exploration operations. This law represents unique and difficult challenges to any company falling within its net, particularly where the activities are new (as will be the case for virtually any operation conducted in the uranium belt, with one or two exceptions).

Fourth, earlier this year New Mexico's Water Quality Control Commission adopted a new, very stringent standard for uranium in ground water, changing the old standard of 5 mg/l to .03 mg/l, which is the same as the Maximum Contaminant Level (MCL) under the federal Safe Drinking Water Act and associated regulations adopted by New Mexico's Environmental Improvement Board. There are uncertainties lawyers need to be aware of about exactly how and to what the new standard will be applied by the New Mexico Environment Department.

Finally, the Navajo Nation recently signed into law the "Dine Natural Resources Protection Act." That was a Navajo Nation Council resolution that was signed into law by President Joe Shirley on April 29, 2005. It purports to be an outright prohibition on uranium mining and processing on any sites within "Navajo Indian Country." This law gives rise to a number of uncertainties and questions of application and interpretation that area also beyond the scope of this paper.

V. CONCLUSION

Nuclear energy's apparent resurgence may not be a panacea, but neither is it cause to panic. At this important juncture in our relationship to nuclear energy and the nuclear fuel cycle, it is critical that we make decisions and take actions on the basis of a careful and balanced consideration of policies, sound science, and up-to-date legal advice. The future may indeed be bright as a result of the renewed promise offered by nuclear energy, but love-hate relationships are not for the faint of heart.

ENDNOTES

1. The author wishes to gratefully acknowledge Matthew Park for his assistance in researching, assembling, cataloging and highlighting germane text from a plethora of material on the topics addressed in this paper. Mr. Park, a 2005 summer associate with the Modrall Sperling Law Firm, is between his second and third years of law school at the University of Southern California School of Law in Los Angeles.

2. Much helpful information about the nuclear energy industry is located on NEI's website, www.nei.org.

3. As discussed in the author's attached Compendium of Nuclear Terminology and Acronyms, by his chosen book title, Senator Domenici possibly alluded to President John F. Kennedy's use of the phrase "a brighter future" in a poetic 1963 passage about New Mexico's uranium and atomic research capabilities in the midst of such natural beauty and historic significance. Whether or not an allusion was intended, it is symbolically befitting that politicians separated by four decades and of such diverse ideologies would both settle on virtually identical phrases in their mutual praise for the promise of nuclear energy.

4. (2004), at p. 55.

A COMPENDIUM OF NUCLEAR ENERGY TERMINOLOGY & ACRONYMS

Compiled by Stuart R. Butzier, Modrall Sperling Law Firm, in July 2005

Atoms for Peace – The common name given to an historic speech before the General Assembly of the United Nations by President Dwight D. Eisenhower on December 8, 1953, which offered President Eisenhower's vision that the peaceful application of nuclear technologies can and should contribute to the betterment of mankind:
[M]y country's purpose is to help us move out of the dark chamber of horrors into the light, to find a way by which the minds of men, the hopes of men,the souls of men everywhere, can move forward toward peace and happiness and well being. *** The United States knows that peaceful power from atomic energy is no dream of the future. That capability, already proved, is here—now— today. Who can doubt, if the entire body of the world's scientists and engineers had adequate amounts of fissionable material . . . , that this capability would rapidly be transformed into universal, efficient, and economic usage. *** [T]he United States pledges before you—and therefore before the world—its determination to help solve the fearful atomic dilemma—to devote its entire heart and mind to find the way by which the miraculous inventiveness of man shall not be dedicated to his death, but consecrated to his life.

A Brighter Future – A prophetic, sadly ironic, phrase used by President John F. Kennedy in the context of discussing New Mexico's vast uranium resources in his forward to the 1963 edition of Calvin Horn's book entitled New Mexico's Troubled Years. In the year of his assassination, President Kennedy wrote:

The largest known deposits of uranium in the world are in New Mexico. The state is celebrated for its atomic and space research facilities. Yet the scenic grandeur on every hand forever reminds us of New Mexico's foundations in the past. Not the least of New Mexico's resources is the quiet spectacle of yesterday dwelling in harmony with tomorrow—a spectacle which offers the hope of a brighter future for men and women all over the world.

A Brighter Tomorrow – The title of New Mexico Senator Peter V. Domenici's 2004 book—perhaps alluding to President Kennedy's passage—in which he presents a thorough and detailed vision that is best summarized in the Senator's own words:

In the twenty-first century, nuclear power will be a major contributor to global peace and a better quality of life for both the developed and developing world. My ultimate goal is that in the year 2045, one hundred years after the detonation of the first atomic bomb and the birth of the nuclear age, the world will evaluate the role played by nuclear technologies and conclude that their overall impact was strongly positive. The world will be a better place in the twenty-first century because of nuclear power.

AEA – Atomic Energy Act of 1954. This Act, following as it did on the heels of President Eisenhower's 1953 "Atoms for Peace" speech before the General Assembly of the United Nations, ended the federal government's monopoly over nuclear technology and gave the private sector a role in the development of the nuclear power industry. The Act serves as the primary source of federal and state authority concerning nuclear energy.

AEC – Atomic Energy Commission, created by the Atomic Energy Act. AEC was the predecessor agency to the Nuclear Regulatory Commission (NRC). The AEA gave the AEC exclusive jurisdiction over licensing the "transfer, delivery, receipt, acquisition, possession and use of nuclear materials." Although this exclusive grant of jurisdiction to the AEC essentially precluded the states from licensing in these areas, 1959 amendments to the AEA paved the way for agreements between AEC and particular states (known as "agreement states") for the regulation of source, byproduct and special nuclear materials in quantities not sufficient to form a critical mass. Subsequent federal case law in the preemption area also has allowed limited state regulation in the field of nuclear power where the state has a very convincing non-safety rationale for the regulation.

AMU – Already mined uranium, which serves as one of the significant current and future sources of uranium supply for nuclear reactors. The private sector currently owns 16 percent of the estimated 534 million pounds of AMU in the United States. Global AMU is estimated to be the equivalent of 1,677 pounds of U_3O_8 (uranium oxide, or yellowcake), much of which is in the form of HEU (highly enriched uranium) owned by the United States and Russia and is the subject of a delicately structured HEU Agreement between the two nations designed for several purposes. Two of those purposes include the dismantling of nuclear warheads and the preservation of Russia's ability to sell HEU for use in mixed fuel reactors worldwide. Pursuant to this second purpose, more than half of DOE's commercial grade uranium, which is a second category of AMU, is “frozen” from sale until 2009. A third category of AMU is uranium-bearing enrichment tails and other nuclear processing waste streams, and many nuclear energy scientists advocate that the storage of such waste streams be maintained as “interim storage” so the AMU will be available for future fuel usage in advanced nuclear reactors.

APS – Arizona Public Service, which jointly owns (along with PNM and others) the hugely successful Palo Verde Nuclear Generating Station near Phoenix, Arizona.

BEIR VII – A study, begun in 1998 and just released in June 29, 2005, by the National Academy of Science Committee on Health Risks from Exposure to Low Levels of Ionizing Radiation. Among other things, this study reportedly substantiates the use of the LNT (linear no-threshold) model used to scientifically interpolate the limited and long-term exposure risks from low level ionizing radiation, a model which had been strongly criticized by Senator Domenici (R-NM) in his book A Brighter Tomorrow.

Btu – British thermal unit. One Btu is the amount of energy needed to increase the temperature of one pint of water by one degree Fahrenheit.

Byproduct Material – Defined in 10 CFR §30.4 as “any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material.” Significantly, however, under 10 CFR §40.4 the term is defined somewhat differently to mean “the tailings or wastes produced from the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute ‘byproduct material’ within this definition.”

Canadian Advanced Candu Reactor 700 – An advanced nuclear reactor design by a consortium consisting of Bechtel Corporation, Dominion Energy, Hitachi America and AECL Technology.

Carbon Dioxide – The main so-called greenhouse gas that has been a major focus of global discussions on reducing emissions of greenhouse gases. Carbon dioxide emissions are estimated by scientists to bear 50% of the asserted responsibility for global warming.

CCNS – Concerned Citizens for Nuclear Safety, a watchdog citizens’ group based in Santa Fe, New Mexico that concerned itself with, among other things, LANL and WIPP.

Dine Natural Resources Protection Act - A Navajo Nation Council Resolution recently signed into law by Navajo Nation President Joe Shirley, Jr., on April 29, 2005. This law purports to be an outright prohibition covering all uranium mining and processing on “any sites within Navajo Indian Country.”

DOE – Department of Energy.

EAR – Estimated additional resource. In the nuclear energy context this term is typically used in reference to estimating not yet mined uranium reserves.

EIA – Energy Information Administration within the United States Department of Energy.

EPA – Environmental Protection Agency.

EPACT – Energy Policy Act of 1992, which, among other things, sought to eliminate nuclear plant permitting roadblocks by authorizing the NRC to issue Combined Construction and Operating Licenses and to pre-certify specific reactor models.

ERA – Energy Reorganization Act of 1974. This Act, along with the AEA, serves as the source of authority for NRC's issuance of specific and general radioactive materials licenses as identified in 10 CFR §30.31.

Greenhouse Effect – A negative atmospheric effect on the ozone layer that a growing number of scientists believe is causing global warming borne of so-called greenhouse gas emissions (e.g., carbon dioxide and carbon monoxide) from automobile combustion engines and traditional electrical power generating stations that burn fossil fuels such as coal, oil and gas. The perceived greenhouse effect has prompted many noted environmentalists to espouse nuclear energy as a means of forestalling global warming.

GW – Gigawatt, which equals one billion watts.

HRI – Hydro Resources, Inc., a uranium mining company that has proposed an in situ uranium mining operation near Crownpoint, New Mexico.

HEU – Highly enriched uranium, typically weapons-grade plutonium.

HEU Agreement – A bilateral agreement between the United States and Russia to enable the blending down of excess stockpiles of HEU from dismantled nuclear weapons arsenals so that the for use as energy fuel in civilian reactors.

IIASA – International Institute for Applied System.

IIASA/WEC Study – A significant long-term forecast study from 1998 by IIASA and WEC that, among other things, optimistically projects that world nuclear power capacity will increase to 2,000 GW of electricity by 2050 (from less than 400 GW today), and will further increase to 6,000 GW of electricity by 2100.

IEA – International Energy Agency.

In situ uranium mining – A modern method of mining uranium deposits "in place" using solution extraction techniques (often a fizzy sodium-based solution) that are relatively benign environmentally in that they avoid the significant surface and/or underground excavation disturbances from traditional uranium mining operations.

ISL – In situ leach mining.

Isotopes – The Simpson's-inspired team name for Albuquerque's professional baseball team. In the non-baseball realm, an isotope is any two or more species of atoms of a chemical element with the same atomic number and position in the periodic table and nearly identical chemical behavior but with differing atomic mass or mass number and different physical properties. In the nuclear realm, radioactive isotopes associated with fissionable materials often are referred to as radionuclides.

kW – Kilowatt, which equals one thousand watts.

kWh – Kilowatt-hour, or the use of one kilowatt of power in one hour's time.

LANL – Los Alamos National Laboratory, founded in 1943 in order to research, develop and produce the world's first nuclear weapons as part of the Manhattan Project. Robert Oppenheimer was the first director of LANL, which was the central facility that coordinated university and federal laboratories nationwide to produce nuclear materials and components for the weapons that were manufactured during World War II. LANL has remained involved in nuclear research ever since, including significant nuclear energy-related programs.

LEU – Low enriched uranium.

LES – Louisiana Energy Services, a consortium of companies that has proposed a uranium enrichment facility for Eunice, New Mexico, to process U3O8 (uranium oxide) into UF4 (uranium fluoride) for subsequent out-of-state shaping into pellets for use in nuclear fuel rods that serve as the source of fuel for traditional nuclear power reactors.

LNT Model – Linear no-threshold scientific model of, for example, interpolating low level ionizing radiation exposure risks. As applied to ionizing radiation, the model was strongly criticized as suspect science by Senator Dominici (R-NM) in his book A Brighter Tomorrow, but then largely substantiated as a valid scientific methodology by BEIR VII, a National Academy of Science study just released on June 29, 2005.

LWR – Light water reactor, one of the types of nuclear reactors in use today.

MACT – Maximum achievable control technology, which is a concept employed by EPA to, for example, achieve emissions control through regulatory reductions in mercury and greenhouse gas emissions over time. The application of this concept and attendant emission reduction expectations at generating stations that burn fossil fuels has been a significant factor in the observable trend toward the economic and environmental viability of nuclear energy as a means of highly efficient power production and the minimization of impacts of fossil fuel-burning generating stations on the environment.

MMD – The New Mexico Mining and Minerals Division, which at one time implemented certain NRC programs for New Mexico as an "agreement state" under the AEA. MMD currently implements, among other things, the New Mexico Mining Commission's reclamation permitting program under the New Mexico Mining Act. The Mining Act's reclamation program has been determined by the New Mexico Courts to apply retroactively to New Mexico's past traditional uranium mining operations and likewise would apply to any new traditional uranium mining and exploration operations. The Act should not be read to apply to ISL uranium mining operations, however, under federal field preemption principles and the logical extension of New Mexico's judicial rule establishing the Act's application to traditional uranium operations.

MIT Study – An important Massachusetts Institute of Technology study from 2003 entitled "The Future of Nuclear Energy." Among other things, the study forecasts that both world electricity consumption and worldwide nuclear generating capacity will nearly triple by 2050.

MOX – Mixed oxides.

MW – Megawatt, which equals one million watts.

Navajo Nation Uranium Mining and Processing Prohibition – *See* Dine Natural Resources Protection Act

NCI – Nuclear Cities Initiative.

NEI - Nuclear Energy Institute, a domestic nuclear energy industry organization.

NEI Vision 2020 – A plan by the domestic nuclear energy industry to bring 50,000 new megawatts of nuclear power capacity online in the United States by 2020, which translates to approximately fifty new nuclear power plants.

NMMA – New Mexico Mining Act, a hardrock reclamation permitting regime which has been held to apply to traditional uranium mining (as opposed to milling) activities.

NRC – Nuclear Regulatory Commission, which succeeded to the Atomic Energy Commission, is the United States' primary regulator and permitting authority that oversees nuclear generating facilities and the nuclear fuel cycle.

NTI – Nuclear Threat Initiative.

Nuclear Power 2010 Initiative – A DOE initiative which has as a goal the deployment of at least one new advanced nuclear power plant in the United States by 2010. The study assumes the development by 2015 of a commercial hydrogen production system using nuclear energy, and the development between 2010 and 2031 of a next-generation nuclear system that provides improvements in safety, terrorism and proliferation resistance, sustainability and economics.

NUSTART – A consortium consisting of Exelon Generation, Entergy Nuclear, Constellation Generation, Duke Energy, Progress Energy, Florida Power & Light, Southern Company, TVA, EDF International North America, Westinghouse Electric and GE Energy, formed to demonstrate a new process for obtaining the Combined Construction and Operating License for an advanced nuclear power plant.

Plutonium 238 – An isotope used for decades in radioisotope thermoelectric generators that power long-distance spacecraft such as Cassini, which is currently exploring Saturn and its moons. The Bush Administration wants to move production of Plutonium 238 from two existing laboratories, including Los Alamos National Laboratory, to the Idaho National Laboratory, a lab managed by the Batelle Energy Alliance, a consortium of which the University of New Mexico is one of five universities participating with research giant Batelle Memorial Institute.

PNM – Public Service Company of New Mexico, which is a 10.2% owner (along with APS and others) of the celebrated Palo Verde Nuclear Generating Station located near Phoenix, Arizona.

Price-Anderson Act – In a nutshell, this Act establishes certain federal statutory indemnification protections against nuclear accidents.

Radioactive Materials License – Under 10 CFR ' 30.3, activities requiring such a license include the manufacture, production, transfer, receipt, acquisition, ownership, possession or use of "byproduct material."

Source Material – Defined in 10 CFR §40.4 to mean "(1) uranium or thorium, or any combination thereof, in any physical or chemical form, or (2) ores which contain by weight [0.05%] or more of (i) uranium, (ii) thorium or (iii) any combination thereof. Source material does not include special nuclear material." Notably, certain federal laws—e.g., Resource Conservation and Recovery Act)—and state laws—e.g., the New Mexico Mining Act—exclude "source material" from definitional terms—e.g., "solid waste" and "minerals," respectively. However, despite the exclusion of "source material" from the "minerals" definition in New Mexico Mining Act, New Mexico's courts have held the Act covers uranium mining on the basis that traditional mining of uranium per se is not regulated by the NRC.

SO2 – Sulfur Dioxide is an acid rain-contributing emission from fossil fuel-burning plants the reduction of which is a main objective of amendments to the Clean Air Act.

Special Nuclear Material – Defined in 10 CFR §70.4 to mean "(1) plutonium, uranium 223, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission [NRC], pursuant to Section 51 of the act [AEA], determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material."

TMI - Three Mile Island.

TVA – Tennessee Valley Authority.

TW – Terawatt, which equals one trillion watts.

UMTRCA – Uranium Mill Tailings Radiation Control Act.

USEC – United States Enrichment Corporation.

UF4 – Uranium fluoride, an enriched uranium product used in traditional nuclear generating stations.

UFO – Type of vehicle often seen flying, particularly near Roswell, New Mexico, that may or may not use Plutonium 238 in on-board radioisotope thermoelectric generators.

U3O8 – Uranium oxide, a product of processed uranium known as “yellowcake” in the industry.

WEC – World Energy Counsel.

WIPP – A radioactive waste disposal facility opened in March 1999 near Carlsbad, New Mexico.

WCS - Waste Control Specialists, located in Texas just across the border from LES’ proposed enrichment facility in Eunice, New Mexico, has filed a license application with the NRC to dispose of low-level radioactive waste, such as depleted uranium, and has offered to take waste from the proposed LES facility.

WQCC – New Mexico’s Water Quality Control Commission, which recently tightened its standard for uranium in groundwater from 5 mg/L to .03 mg/L, i.e., the same as the Maximum Contaminant Level (MCL) for uranium in drinking water under EPA’s and NMED’s regulations adopted under the federal Safe Drinking Water Act.

Yellowcake – Uranium oxide, or U3O8, a product of processing uranium in uranium mill facilities.

Yucca Mountain – A proposed nuclear waste storage facility in Nevada—for wastes from around the country—that has been met with much political opposition in that state.