

DIFFUSING THE PROBLEM: HOW ADOPTING A POLICY TO SAFELY STORE AMERICA'S NUCLEAR WASTE MAY HELP COMBAT CLIMATE CHANGE

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I. INTRODUCTION

Over the past several years, the problem of climate change (also known as global warming)¹ has received significant attention from the public, media, and policymakers. In connection with this increased attention, numerous proposals have been introduced to reduce the amount of carbon dioxide and other human-produced greenhouse gases that contribute to climate change. One common proposal—both in the United States and internationally—is to move towards greater reliance on energy produced by nuclear power plants because of the fact that, unlike most traditional energy sources, nuclear energy results in the emission of little or no carbon dioxide. One example of such a proposal is President George W. Bush's call for an increase in the production of nuclear energy and the construction of new nuclear power plants, which he states will reduce carbon emissions and promote energy independence.²

Despite this increasing support, there has been substantial reluctance in the United States to move ahead with proposed plans to construct new nuclear power plants. In this note, I first discuss the background and history of nuclear power in America, including some of the reasons why Americans may be reluctant to support the construction of new nuclear power plants. I then focus on the problem of how and where the radioactive waste generated by nuclear power plants should be stored, which is a question that must be definitively answered before

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¹ Frequently, the terms “climate change” and “global warming” are used interchangeably but actually have varying definitions. For the purposes of this note, the term “climate change” is used, which is defined as: “[A] change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.” United Nations Framework Convention on Climate Change, Article I (May 9, 1992), *available at* <http://unfccc.int/resource/docs/convkp/conveng.pdf>. *See also* IPCC, 2007: CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS. CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 943-44 (Susan Solomon et al., eds., 2007), *available at* <http://unfccc.int/resource/docs/convkp/conveng.pdf> (reaffirming the 1992 definition and distinguishing it from “climate variability,” which refers to naturally occurring changes in climate).

² Ken Herman, *Bush Turns Focus Back to Nuclear Power*, DESERET NEWS, June 23, 2005, at A11.

proceeding with any large-scale construction of new nuclear power plants—and is a question that is highly controversial, especially in the Western United States.

II. BACKGROUND

A. Nuclear Power in the World

Now that most of the world has accepted that climate change is a reality,³ international leaders have undertaken serious efforts to reduce the emission of greenhouse gases that contribute to elevated temperatures worldwide.⁴ In most cases, the primary focus is to move away from “dirty” sources of energy, such as coal and fossil fuels that result in emissions of carbon dioxide particles, which

³ See generally *Massachusetts v. Env'tl. Prot. Agency*, 127 S.Ct. 1438 (2007) (accepting that global warming is a pressing environmental challenge); IPCC, 2007: CLIMATE CHANGE 2007, *supra* note 1 (accepting climate change as a fact); Sara A. Colangelo, *The Politics of Preemption: An Application of Preemption Jurisprudence and Policy to California Assembly Bill 1493*, 47 ENVTL. L. 175, 190-91 (2007) (reporting that the Senate had passed a non-binding resolution recognizing the reality of climate change); Brendan R. Cummings & Kassie R. Siegel, *Ursus Maritimus: Polar Bears on Thin Ice*, 22 NAT. RESOURCES & ENV'T. 3 (2007) (discussing the real impacts of climate change on animal species, such as polar bears); Zygmunt J.B. Platter, *Dealing with Dumb and Dumber: The Continuing Mission of Citizen Environmentalism*, 20 J. ENVTL. L. & LITIG. 9 (2005) (stating that global warming is a reality, despite public relations efforts by industrial groups to convince people otherwise); Joe Bauman, *Report on global warming lists ways Utahns can help*, DESERET NEWS, Oct. 10, 2007, at A1 (highlighting recommendations of Utah Governor's Council on Climate Change); John Heilprin, *Cooperation Urged in Fight on Warming*, DESERET NEWS, Sep. 28, 2007, at A2 (discussing U.N. and U.S.-led efforts to bring nations together to to implement policies that will help reduce global warming in economical ways); Lisa Riley Roche, *Utahns Warm Anew to Issue*, DESERET NEWS, Oct. 13, 2007, at A1 (citing poll which found that more than 2/3 of Utahns believe global warming or climate change exists); Bryan Walsh, *Green Motors*, TIME, Oct. 22, 2007, at 50-51 (discussing efforts by U.S. automakers to build cars that are more environmentally friendly). *But see* MARCEL LEROUX, GLOBAL WARMING - MYTH OR REALITY?: THE ERRING WAYS OF CLIMATOLOGY (2005) (stating that non-human factors may be responsible for climate change); CHRISTOPHER C. HORNER, THE POLITICALLY INCORRECT GUIDE TO GLOBAL WARMING (AND ENVIRONMENTALISM) (2007) (stating that global warming is a myth); Avi Brisman, *The Aesthetics of Wind Energy Systems*, 13 N.Y.U. ENVTL. L.J. 1, 22 n.41 (2005) (quoting U.S. Senators who stated that global warming is a “myth”); Bruce Yandle & Stuart Buck, *Bootleggers, Baptists, and the Global Warming Battle*, 26 HARVARD ENVTL. L. REV. 177, 189 (2002) (quoting scholars who compare global warming to a fundamentalist puritan religion, and maintain that global warming is a myth); Lisa Riley Roche *Utahns Warm Anew to Issue*, DESERET NEWS, Oct. 13, 2007, at A1 (quoting various state legislators who are skeptical and do not acknowledge that global warming or climate change exists).

⁴ E.g. IPCC, 2007: CLIMATE CHANGE 2007, *supra* note 1; Kyoto Protocol to the United Nations Framework Convention on Climate Change, (Mar. 16, 1998), *available at* http://unfccc.int/kyoto_protocol/items/2830.php.

ultimately become trapped in the Earth's atmosphere and increase the problem of climate change.⁵ However, because worldwide demand for energy is increasing, not decreasing,⁶ nations must develop "clean" sources of energy that result in lower greenhouse gas emissions before completely abandoning the older, "dirty" sources of energy. Currently, solar, wind, hydro, and nuclear power⁷ are the major clean sources of energy that are potentially viable options for addressing the climate change problem while still providing the energy needs for most countries.

Some of the benefits associated with nuclear energy include the relatively inexpensive operating costs for nuclear power plants (after a larger initial investment to build a new plant), increases in higher-paying technical jobs in communities surrounding nuclear power plants, greater energy independence for nations that currently rely on importing fossil fuels, and—perhaps most significantly—a reduced impact on the environment.⁸ Although many international organizations oppose the development of new nuclear power plants (and the continued operation of many existing nuclear plants),⁹ the environmental benefits associated with nuclear energy, as well as the economic benefits and the potential for energy independence in some nations, have led many international policymakers to increase their reliance on nuclear power.¹⁰ In fact, nuclear energy

⁵ See IPCC, 2007: CLIMATE CHANGE 2007, *supra* note 1; *Pew Center Provides Agenda for Climate Action*, 16 NO. 5 AIR POLLUTION CONSULTANT 1.11 (2006).

⁶ ANNUAL ENERGY OUTLOOK 2007 WITH PROJECTIONS TO 2030, Report #: DOE/EIA-0383(2007) (Dep't of Energy 2007).

⁷ See generally *id.*; see also INTERNATIONAL ENERGY ASSOCIATION [IEA], KEY WORLD ENERGY STATISTICS 2007 (2007) [hereinafter IEA, KEY STATISTICS]. Some experts have debated nuclear power's inclusion as a "clean" source of energy because of the potentially negative impact of radioactive waste generated by nuclear power plants. However, for the purposes of this note, I include nuclear power as a "clean" source of energy because it results in virtually no greenhouse gas emissions.

⁸ See Interview by the International Atomic Energy Agency [IAEA] with Alan McDonald, Senior Officer, IAEA, in Vienna, Austria (Jan. 2006), *available at* http://www.iaea.org/blog/Infolog/?page_id=47. See also LARRY FOULKE & H. STERLING BURNETT, DISPELLING THE MYTHS ABOUT NUCLEAR POWER, BRIEF ANALYSIS 1 (National Center for Policy Analysis 2005); WORLD NUCLEAR ASSOCIATION, THE BIOSPHERE AT RISK (2007), *available at* <http://www.world-nuclear.org/why/biosphere.html>; accord PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY [POST] CARBON FOOTPRINT OF ELECTRICITY GENERATION 2-3, Postnote (Oct. 2006).

⁹ See, e.g., NUCLEAR, GREENPEACE (2007), <http://www.greenpeace.org/usa/campaign/s/nuclear>; Press Release, Institute for Energy and Environmental Research, Landmark Energy Policy Study Points the Way to U.S. Energy Future without Fossil Fuels or Nuclear Power (Jul. 30, 2007), *available at* <http://www.ieer.org/carbonfree/pressrelease.html>.

¹⁰ See *60 Minutes: France: Vive Les Nukes* (CBS television broadcast Apr. 8, 2007); Interview with Alan McDonald, *supra* note 8; WORLD NUCLEAR ASSOCIATION, NUCLEAR ENERGY IN ITALY (2007), *available at* <http://www.world-nuclear.org/info/inf101.html>. See also Daniel C. Rislove, *Global Warming v. Non-proliferation: The time has Come for*

is one of the fastest-growing sources of electricity in the world, now accounting for approximately 11% of the total electricity worldwide—up from 1.3% in 1973.¹¹

B. Nuclear Energy in the United States

Although the United States is the world's leading producer of nuclear energy—accounting for 29% of all nuclear energy production in the world¹²—nuclear energy in America has received only mixed support during the past two decades. Despite the prevalence of nuclear power in the United States and the potential benefits of nuclear power (not to mention President Bush's stated support for an increased reliance on nuclear energy¹³), there have been no new nuclear power plants constructed in the United States in the past quarter of a century.¹⁴ Perhaps several factors explain why the United States moved away from developing new nuclear energy sources, but the Three Mile Island Incident is a main reason why Americans decided to cease development of nuclear energy.

C. The Three Mile Island Incident

Beginning at 4:00 a.m. on March 28, 1979, the nuclear power plant reactor Three Mile Island Unit 2 (TMI-2), near Middletown, Pennsylvania, experienced problems with the cooling system. The problems with the cooling system eventually led to a partial meltdown of the reactor core and the significant release of radioactive material into the atmosphere. Although studies showed that no human deaths were attributable to the incident, it did provoke widespread concern about the safety of nuclear power in the United States and vastly increased the public's distrust of the government's regulation of nuclear reactors.¹⁵

Following the Three Mile Island Incident, governments at both the state and federal levels became increasingly reluctant to allow construction of new nuclear

Nations to Reassert their Right to Peaceful Use of Nuclear Energy, 24 WIS. INT'L L.J. 1069 (2007).

¹¹ By contrast, oil has fallen from 53% in 1973 to just less than 40% in 2005. See IEA, KEY STATISTICS, *supra* note 7 at 1 (2007).

¹² The United States leads with 29% of the world's nuclear energy production, followed by France, which accounts for 16%, and Japan, which accounts for 11%. These three countries alone account for almost 57% of the world's nuclear energy production. See *id.* at 16-17.

¹³ See George W. Bush, President of the U.S., State of the Union (Feb. 2, 2005); George W. Bush, President of the U.S., State of the Union (Jan. 31, 2006).

¹⁴ Dave Flessner & Pam Sohn, *Nuclear Revival*, CHATTANOOGA TIMES, Jan. 28, 2007.

¹⁵ See *Fact Sheet on the Three Mile Island Accident*, Nuclear Regulatory Commission (2007), available at <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html>; Cass Peterson, *A Decade Later, TMI's Legacy is Mistrust*, WASH. POST, Mar. 28, 1989, at A1.

power plants, and several states instituted moratoriums on the construction of new plants.¹⁶ In order to address the immediate need of ensuring the safety of existing plants, the federal government re-evaluated their safety standards, instituted stricter regulations for plants, and strengthened the newly-established Nuclear Regulatory Commission (NRC) to oversee the safety regulation of nuclear power plants.¹⁷ These actions, combined with improved technology, have made nuclear power plants safer in America—although many Americans remain skeptical of how safe nuclear plants really are.

D. The Safety of Nuclear Energy Compared to Other Energy Sources

While initially understandable in light of the Three Mile Island Incident, America's continued lack of support for nuclear energy based on operational safety concerns is likely an overreaction, and is probably not justified when the safety records of nuclear power plants are compared with the safety records of other energy producers.

Although there were some problems prior to the Three Mile Island Incident, there have been no significant operational safety problems reported at any of America's nuclear power plants since that time.¹⁸ Even more significantly, according to some experts, the technological advances that would be implemented in new nuclear power plants would make these plants significantly safer¹⁹—perhaps even “100 times safer than current plants,” according to one nuclear energy executive.²⁰ The validity and accuracy of such statistics may rightly be

¹⁶ See, e.g. Chuck Devore, *Is Global Warming Serious Enough To Lift Calif. Ban On Nuke Plants?* INVESTORS BUS. DAILY, Aug. 22, 2007; Anthony Gad, *Rethinking the Moratorium on Nuclear Energy*, WIS. BRIEFS (Wis. Legis. Reference Bureau), May 2006, at 1.

¹⁷ Cass Peterson, *supra* note 15.

¹⁸ While no operational safety incidents have been reported since the Three Mile Island Incident in 1979, some other safety concerns, such as groundwater contamination, have been raised. See, e.g. Press Release, Office of the Illinois Attorney General, Madigan, Glasgow File Suit for Radioactive Leaks at Braidwood Nuclear Plant (Mar. 16, 2006), available at http://www.illinoisattorneygeneral.gov/pressroom/2006_03/20060316.html. Additionally, there have been operational safety incidents at international nuclear plants—including the Chernobyl incident—that could possibly be cited as examples of continuing problems with plant safety.

¹⁹ Jon Entine, American Enterprise Institute (AEI), Welcome and Introduction at the AEI panel discussion: Is Nuclear Power a Solution to Global Warming and Rising Energy Prices? (Oct. 6, 2006), available at <http://www.aei.org/events/filter.all,eventID.1394/transcript.asp>. See also Bush sees Green Reasons for Nuclear Power, MSNBC NEWS, (June 22, 2005), available at <http://www.msnbc.msn.com/id/8315963/> (quoting President Bush as stating that “[n]uclear power is one of America’s safest sources of energy”).

²⁰ Edward Cummins, Westinghouse Nuclear, Next Generation Nuclear Panelist at the American Enterprise Institute panel discussion: Is Nuclear Power a Solution to Global Warming and Rising Energy Prices? (Oct. 6, 2006), available at <http://www.aei.org/events/filter.all,eventID.1394/transcript.asp>.

questioned,²¹ and any new American nuclear power plant technology is unproven (due in part to the lack of new plants in the past quarter century). However, it is a reasonable assumption that any new nuclear plants would be at least as safe as—if not safer—than existing plants in America, which have been relatively problem-free for a quarter of a century.

In contrast, other major energy sources in America have had numerous safety incidents during the time since the Three Mile Island Incident. In 2006 alone, forty-seven coal miners died in mining accidents in the United States, with 400 total deaths reported by the Mine Safety and Health Association between 1996 and 2007.²² Internationally, thousands more coal miners have died, including in China, where 5,986 miners died in 2005, and more than 36,000 miners have died in the time from 2000–2005.²³

Similarly, there have been a number of deaths at oil refineries in the United States since the Three Mile Island Incident. The exact death toll for oil and refinery workers in the United States is unclear, due to concerns over the reporting of deaths to the U.S. Bureau of Labor Statistics (BLS).²⁴ Confirmed deaths include at least twenty people killed in refinery accidents between 2003 and 2005,²⁵ and scores more have likely died in other accidents that may not have been included in BLS reports.²⁶

Based on these statistics, it is clear that, in terms of operational safety, nuclear power plants in the United States may actually be safer than other energy producers. It is also clear that concerns about operational safety at nuclear power plants, standing alone, would not justify the moratorium on constructing new nuclear power plants in the United States.

E. Regulation of Nuclear Energy in the United States

One of the main reasons that, in terms of operational safety, nuclear power plants are safer than other sources of energy is the fact that the government has imposed myriad regulations on nuclear plants. Although the Three Mile Island Incident spurred extensive new regulation of nuclear power plants, the regulation of nuclear power first began in 1954, with the passage of the Atomic Energy Act

²¹ *Id.* (stating that the “100 times safer” statistic is “not strictly true,” but is “a measure of goodness.”).

²² U.S. DEPT. OF LABOR, MINE SAFETY AND HEALTH ADMINISTRATION COAL FATALITIES BY STATE, (2008), available at <http://www.msha.gov/stats/charts/coalbystate.asp>.

²³ *Deconstructing Deadly Details from China’s Coal Mine Safety Statistics*, CHINA LABOUR BULLETIN (Jan. 6, 2006), available at <http://www.clb.org.hk/en/node/19316> (citing official statistics from China’s State Administration of Work and Safety).

²⁴ Lise Olson, *Murky Stats Mask Plant Deaths*, HOUS. CHRON., May 16, 2005, at A1.

²⁵ *Id.*

²⁶ Lise Olson, *BP Refinery Deaths Top Industry in U.S.*, SEATTLE POST-INTELLIGENCER, May 16, 2005, at A1.

(AEA) of 1954,²⁷ for the primary purpose of promoting the use of nuclear power.²⁸

Among other things, the AEA officially authorized private ownership of nuclear power plants and established the Atomic Energy Commission (AEC), granting them the authority to promote and regulate the use of nuclear power.²⁹ Congress subsequently amended the AEA in 1959 to clarify that the Federal government had the sole authority to regulate nuclear power, providing that states could only regulate certain aspects associated with nuclear plants.³⁰

In several instances, courts have held that the AEA pre-empted the ability of states to regulate nuclear power, and that the Federal government has the exclusive power to regulate radiological matters such as the licensing, operations and construction of nuclear power plants, while the states only have the authority to regulate nonradiological matters connected to nuclear power plants.³¹ Courts have not explained why the line has been drawn at radiological matters, but they have made it clear that states *can* regulate nonradiological matters like nuisances in connection with nuclear power plants,³² and that states may impose some conditions for locating a plant at a particular site.³³ However, state regulatory efforts that would impermissibly encroach into radioactive safety efforts and effectively prohibit nuclear facilities—including facilities for the disposal of radioactive waste—have been struck down on the grounds that the AEA pre-empts state law.³⁴

²⁷ 42 U.S.C. § 2011 (1956).

²⁸ *Id.*

²⁹ *Id.* See also 82 A.L.R. 3d 751 (1978).

³⁰ See 42 U.S.C. § 2021 (1962).

³¹ See *Silkwood v. Kerr-McGee Corp.*, 464 U.S. 238 (1984) (holding that “states are precluded from regulating the safety aspect of nuclear energy,” but distinguishing state standards for nuclear safety from state tort remedies); *Pacific Gas & Electric Co. v. State Energy Conservation & Development Comm’n*, 461 U.S. 190 (1983) (holding that “the safety of nuclear technology was the exclusive business of the Federal Government.”); *O’Conner v. Commonwealth Edison Co.*, 13 F.3d 1090 (7th Cir. 1994) (stating the rule that “federal nuclear safety regulations preempt all state safety regulations.”).

³² *E.g.* *Marshall v. Consumers Power Co.* 237 N.W.2d 266 (Mich. Ct. App. 1975) (holding that states may require nuclear power plants to abate nonradiological nuisances).

³³ *E.g.* *Ass’n. to Preserve Bodega Head & Harbor, Inc. v Public Utilities Comm.* 390 P.2d 200 (Cal. 1964) (holding that states may impose restrictions on the siting of a proposed nuclear power plant because of the safety concerns associated with particular plant locations).

³⁴ See *Skull Valley Band Of Goshute Indians v. Nielson*, 376 F.3d 1223 (10th Cir. 2004) (holding that the AEA pre-empted Utah laws which established state and county licensing requirements for nuclear power plants, banned certain types of companies from owning plants, gave the state regulation of roads around plants, and imposed restrictions on employees working at plants).

The governing statute also gives the Nuclear Regulatory Commission (NRC),³⁵—the federal agency responsible for overseeing nuclear power plants—the ability to enter into agreements with states, wherein the NRC discontinues its regulation of certain types of nuclear materials, while the individual state takes over the regulation of the materials.³⁶ However, the statute expressly prohibits the NRC from giving up or sharing its regulatory authority over other matters such as the construction and operations of facilities, the export and import of nuclear materials, and the disposal of nuclear materials.³⁷ For example, in *Skull Valley Band of Goshute Indians v. Nielson*,³⁸ the 10th Circuit Court of Appeals held that Utah regulations having the effect of regulating a proposed storage facility were pre-empted by federal law. In their ruling, the court stated that the federal government could not delegate their regulatory authority over nuclear waste disposal.³⁹

F. Regulating the Disposal of Nuclear Waste

As one of several measures following the Three Mile Island Incident, Congress passed the Nuclear Waste Policy Act of 1982 (NWPA),⁴⁰ which requires the Department of Energy (DOE) to select a site to serve as a permanent repository for radioactive waste generated by nuclear power plants and other sources.⁴¹ The NWPA required the DOE to enter into contracts for the disposal of radioactive waste, and to begin accepting spent nuclear fuel (SNF) at the repository by January 31, 1998.⁴² However, various delays in the selection and construction of a permanent repository led the DOE to interpret the statute loosely, stating that before they have a duty to accept SNF, they must first have an operating repository.⁴³

³⁵ The initial federal regulatory body was the Atomic Energy Commission (AEC), but the AEC has now been superseded by the Nuclear Regulatory Commission (NRC), which oversees, among other things, the licensing, design, and inspections of nuclear power plants. The NRC has all the same authority as the AEC, and is established as an “independent regulatory commission,” with members of the NRC appointed by the President with the advice and consent of the Senate. *See* 42 U.S.C. §§ 2021, 5841-5842 (2004).

³⁶ 42 U.S.C. § 2021(b) (2004).

³⁷ 42 U.S.C. § 2021(c) (2004).

³⁸ 376 F.3d 1223 (10th Cir. 2004).

³⁹ *Id.* at 1254.

⁴⁰ 42 U.S.C. §§ 10101-10270 (1982).

⁴¹ *See id.*

⁴² 42 U.S.C. § 10222 (2004). It should be noted that one court has held as unconstitutional the portion of this statute dealing with fee collection procedures. However, the court left the remainder of the statute untouched, including the requirement to begin accepting waste. *See Alabama Power Co. v. U.S. Dep’t of Energy*, 307 F.3d 1300 (11th Cir. 2002).

⁴³ *See* Final Interpretation of Nuclear Waste Acceptance Issues, 60 Fed.Reg. 21,793, 21,794 (May 3, 1995).

The expressly stated requirement that the DOE must begin accepting SNF at permanent repositories has met with substantial resistance, particularly in Utah and Nevada, where groups have proposed or started constructing repositories. The Utah site (which Congress claimed would only be a temporary storage facility) is no longer being considered as a possible location for a repository.⁴⁴ At Yucca Mountain—the Nevada site—significant planning and construction activities have already occurred.⁴⁵ Even though the Utah site is no longer under serious consideration for use as a repository, many Utahns and others in the Western United States have joined Nevadans in opposing the Yucca Mountain repository.⁴⁶

As will be discussed later in this note, there are many reasons why Westerners oppose the DOE's plans for Yucca Mountain. While some of the opposition is probably a typical "not in my backyard" (NIMBY) reaction, those opposed to the Yucca Mountain plan have also raised several legitimate concerns, including the safety of the site, the safety of transporting of the waste to the site, and the potential of terrorist attacks.

G. The Push for Increased Nuclear Power

As discussed already, the federal government and all fifty states have refused to approve the construction of new nuclear plants in the United States since the Three Mile Island Incident—largely because of safety concerns and lingering skepticism regarding government regulation of nuclear power plants and the storage of radioactive waste. However, that may be changing, as there has been a noticeable push recently—due in large part to concerns about climate change and reducing greenhouse gas emissions in the United States—to move forward with the planning, development, and construction of new nuclear power plants in the United States.

Several states have considered lifting their moratoriums on new nuclear plants,⁴⁷ President Bush included nuclear energy as a key component of his energy plan,⁴⁸ and Congress passed the Energy Policy Act of 2005,⁴⁹ which included

⁴⁴ Suzanne Struglinski, *PFS Site Looks Doomed*, DESERET NEWS, Sept. 8, 2006, at A1.

⁴⁵ Steve Tetreault, *Yucca Funding Advances*, LAS VEGAS REV. J., May 12, 2006, at 14A; *A rare victory over Energy Department*, LAS VEGAS REV. J., Sept. 6, 2007, at 6B.

⁴⁶ See Suzanne Struglinski, *Yucca N-dump – Doubled?*, DESERET NEWS, Oct. 6, 2007, at B1 (discussing opposition of Utah and Nevada Congressional representatives to proposed Yucca plans); Press Release, Utah Democratic Party, Utah, Nevada Join Forces to Stop East Dumping Nuke Waste on the West (Dec. 14, 2005), available at <http://www.utdemocrats.org/ht/display/ReleaseDetails/i/716168>.

⁴⁷ *Supra* note 16. See also Joe Bauman, *Utah is stepping closer to N-Plant*, DESERET NEWS, Jul. 19, 2007, at A1 (reporting on efforts in the Utah Legislature to approve the construction of a new nuclear power plant in the state).

⁴⁸ See *supra* note 13

⁴⁹ Energy Policy Act of 2005, 42 U.S.C.A. § 15961 (West Supp. 2006).

various incentives for activities connected with the construction of new nuclear power plants in the United States.⁵⁰ Among other things, these incentives include an annual budget of \$1.25 billion for research and development into new nuclear power technology, and the construction of new nuclear power plants.⁵¹

With all of these incentives and increasing political pressure to combat climate change, it seems that building new nuclear power plants is an idea whose time has come. Yet, there are still several obstacles that must be overcome before the United States can proceed with an energy policy that includes large-scale construction of new nuclear power plants.

First, despite the government's assurances that nuclear energy can be produced safely, many Americans remain skeptical about the safety of nuclear power plants. The operational safety issue has already been addressed in this note⁵² so I will not discuss it again here. Second—and the focus of the remainder of this note—is the question of how and where to store SNF and other radioactive waste generated by nuclear power plants safely. This question presents a significant obstacle in the way of any pro-nuclear energy policy, and the development of new nuclear power plants in the United States can proceed only after determining how and where radioactive waste generated by nuclear plants will be safely stored.⁵³

III. FINDING A SOLUTION FOR STORING NUCLEAR WASTE

As briefly mentioned already in this note, there has been significant opposition to the idea of using a single, concentrated, permanent repository (i.e. Yucca Mountain) for SNF and other radioactive waste.⁵⁴ To date, the only viable storage alternative that has been presented is to store nuclear waste on-site at

⁵⁰ *Id.*

⁵¹ 42 U.S.C. 16025(d) (2006).

⁵² *See supra*, section II. D.

⁵³ Even if the problem of how and where to store SNF and other radioactive waste is solved, there are other policy questions that also need to be answered before the development of new nuclear power plants can proceed. For example, lingering concerns from the Three Mile Island Incident about the overall safety of nuclear power production may not yet be fully addressed in the public's mind. Additionally, the potential benefits of alternative, renewable sources of energy—such as wind power—have been advocated by many people as more effective, and less damaging to the environment than nuclear power. While those arguments have only briefly been touched upon here, it is clear that they need to be considered and addressed if a national policy in favor of nuclear power is going to be adopted. Furthermore, this note does not foreclose consideration of alternative solutions to nuclear power or address other safety concerns associated with the development of new nuclear power plants. Rather, this note primarily discusses the problems associated with storage of SNF and radioactive waste, which is only one of several critical issues that need to be considered in answering the larger question of whether large-scale development of nuclear energy should be adopted as part of a comprehensive national energy policy.

⁵⁴ *See supra* Section II. D.

nuclear power plants (nonviable options include shooting the waste into outer space⁵⁵). In this section, I discuss the arguments for and against each of these two proposals, and make some recommendations. The single, concentrated repository option is addressed first, followed by the diffused, on-site storage option. Finally, I draw conclusions about the viability of these proposals and make recommendations about which option is likely to be the best solution for the storage problem.

A. *The Single, Concentrated Repository Alternative*

The leading choice for the storage and disposal of SNF and other radioactive waste—as adopted in NWPA and favored by President Bush—has been to construct a permanent, concentrated repository where radioactive waste from existing and new nuclear power plants would be stored. Under the terms of NWPA, nuclear power plants currently employ temporary storage of SNF and other high-level radioactive waste (HLW) on-site at nuclear power plants until a permanent repository is established. Under the permanent repository plan, radioactive waste would be sealed and buried for hundreds of years, until the waste would lose its radioactivity.

Yucca Mountain in Nevada was selected as the permanent repository for the nation's SNF and HLW, and Congress has now spent hundreds of millions of dollars to prepare the site to receive the waste.⁵⁶ The State of Nevada has fought this through various court processes, but has been turned down virtually every time—for reasons ranging from standing to federalism,⁵⁷ and the NRC has repeatedly approved different portions of the Yucca Mountain project.

Despite NRC approval and the support of many political leaders, the opposition to building the Yucca Mountain repository—and other concentrated repositories—has been substantial. In addition to numerous lawsuits, the Yucca Mountain plan has come under fire for being inherently unsafe because the proposed transportation routes would take SNF through metropolitan cities, and would be stored in large quantities only a few miles from Las Vegas, where

⁵⁵ See Angela Charlton, *Disposal Key to N-Power Future?*, DESERET NEWS, Jan. 20, 2008, at A6.

⁵⁶ Tetreault, *supra* note 45 (reporting that Congress has already appropriated more than \$544.5 million for the Yucca Mountain project).

⁵⁷ See, e.g. Nevada v. United States Department of Energy, 133 F.3d 1201 (9th Cir. 1997); Nevada v. United States Dep't of Energy, 993 F.2d 1442 (9th Cir. 1993); Nevada v. Watkins, 943 F.2d 1080 (9th Cir. 1991) (Watkins III); Nevada v. Watkins, 939 F.2d 710 (9th Cir. 1991) (Watkins II); County of Esmerelda v. United States Dep't of Energy, 925 F.2d 1216 (9th Cir. 1991) (Esmerelda); Nevada v. Burford, 918 F.2d 854 (9th Cir. 1990) cert. denied, 500 U.S. 932 (1991) (Burford I); Nevada v. Watkins, 914 F.2d 1545 (9th Cir. 1990), cert. denied, 499 U.S. 906 (1991) (Watkins I); Nevada v. Herrington, 827 F.2d 1394 (9th Cir. 1987) (Herrington I); Nevada *ex rel.* Loux v. Herrington, 777 F.2d 529 (9th Cir. 1985) (Herrington II).

millions of people live.⁵⁸ The State of Nevada has also criticized Yucca for its proximity to numerous earthquakes and other seismic events, calling the earthquake risk a “safety concern” that the DOE has failed to address at Yucca Mountain.⁵⁹ It should be noted that similar safety concerns (as well as political pressure and extensive public comment in opposition to the proposed repository) led the federal government to reject a temporary repository approximately fifty miles west of Salt Lake City, Utah.⁶⁰ In approving the Yucca Mountain plan, the NRC has addressed some of these site-specific concerns, but final approval is still far from assured, as other agencies could also deny approval—as in the case of the Utah repository, where the Bureau of Indian Affairs and the Bureau of Land Management had the ability to effectively veto the NRC’s approval.⁶¹

In addition to the specific safety concerns associated with the Yucca Mountain plan, scholars have criticized the concentrated repository plan for its violation of state sovereignty principles.⁶² Although courts have historically held that federal law pre-empts state law in the area of nuclear and radioactive waste regulation,⁶³ one scholar argues that allowing the federal government to site a concentrated repository in a state without that state’s approval “would clearly violate Tenth Amendment and federalism principles.”⁶⁴

Proponents of a concentrated repository have answered that the original reasoning of courts—that issues associated with nuclear power plants and the storage of SNF are a matter of national concern, and are thus not appropriate for state regulation⁶⁵—remains valid today. In addition to the need for national safety regulations of nuclear power plants, proponents also point to the national interest in establishing energy independence,⁶⁶ the threat of terrorism in the United States,⁶⁷ and, of course, the need to find a solution to the storage issue so that the

⁵⁸ See, e.g. Issue Statements on Yucca Mountain, Senator Hary Reid (2007), available at <http://reid.senate.gov/issues/yucca.cfm>; Fact Sheet on Nuclear Waste Transport, Sierra Club (2007), available at http://www.sierraclub.org/nuclearwaste/yucca_factsheet.asp.

⁵⁹ Earthquakes In The Vicinity Of Yucca Mountain, State of Nevada (2007), (on file with author).

⁶⁰ Suzanne Struglinski, *Nuclear Waste Site Looks Doomed*, DESERET NEWS, Sept. 8, 2006, at A1.

⁶¹ See *id.*

⁶² See generally William Mabry III, *Can you Say N? NIMBY, NWPA and Nuclear Preemption*, 33 NAT. RESOURCES J. 493 (1993); Sonny Swazo, *The Future of High-Level Nuclear Waste Disposal, State Sovereignty and the Tenth Amendment: Nevada v. Watkins*, 46 NAT. RESOURCES J. 127 (1996).

⁶³ See *supra* note 31 and accompanying text.

⁶⁴ See Swazo, *supra* note 62, at 143.

⁶⁵ Pacific Gas & Electric Co. v. State Energy Conservation & Development Comm’n., *supra* note 31.

⁶⁶ See generally Justin Stolte, *The Energy Policy Act of 2005: The Path to Energy Autonomy?*, 33 J. LEGIS. 119 (2006).

⁶⁷ See Victoria Sutton, *The George W. Bush Administration and the Environment*, 25 W. NEW ENG. L. REV. 221, 222 (2003) (stating that terrorism concerns drove approval of

United States can develop new energy sources without increasing the problem of climate change. One scholar also argues that the failure to establish a concentrated repository may hurt the United States policy favoring nuclear nonproliferation, because it severely limits the country's ability to accept foreign waste and remove HLW from countries who could otherwise use the materials to build nuclear weapons.⁶⁸ Furthermore, even those who do not necessarily favor a concentrated repository point out that the interests of sovereign Indian nations may outweigh state sovereignty interests where, as in the case of the now-rejected Utah site, the repository is proposed to be built on an Indian reservation.⁶⁹

Despite these legitimate arguments and the largely successful efforts of concentrated repository proponents, the political landscape has recently changed, making it more likely that construction on the Yucca Mountain project will be halted—and that a single concentrated repository is unlikely to be built in the near future. With the Democratic takeover of Congress after the 2006 elections, Senate Democrats elected Senator Harry Reid (D–Nev.) as Senate Majority Leader. This gives him the power to shape the legislative agenda and use the threat of a filibuster to ensure that there will be no additional funding allocations for the Yucca Mountain repository. Further, several leading presidential candidates have also expressed their opposition to the Yucca Mountain project, and have promised to eliminate the project if elected.⁷⁰ Since significant time and resources have already been committed to the project, there may be some resistance to these efforts, but with Senator Reid's new political power and the growing opposition to the project, it appears likely that the Yucca Mountain project will be halted, and along with it, the plans for a concentrated repository.

B. *The Diffused, On-Site Storage Proposal*

The only realistic alternative to storing SNF at a concentrated repository is to store the SNF on-site at nuclear power plants. One of the leaders internationally

the Yucca Mountain facility). See generally Louis Rene Beres, *The United States and Nuclear Terrorism in a Changing World: A Jurisprudential View*, 12 DICK. J. INT'L L. 327 (1994); Robert Busby, *The United States Failure to Establish a High-Level Nuclear Waste Storage Facility is Threatening its Ability to Effectively Support Nuclear Nonproliferation*, 30 GEO WASH. J. INT'L L. & ECON. 449 (1996-1997); Samantha Brady Carter, *Combating Terrorism in the Environmental Trenches*, 9 WIDENER L. SYMP. J. 549 (2003).

⁶⁸ See Busby, *supra* note 65.

⁶⁹ See generally Jon D. Erickson, Duane Chapman, Ronald E. Johnny, *Monitored Retrievable Storage of Spent Nuclear Fuel in Indian Country: Liability, Sovereignty, and Socioeconomics*, 19 AM. INDIAN L. REV. 73 (1994); Alex Tallchief Skibine, *High Level Nuclear Waste on Indian Reservations: Pushing the Tribal Sovereignty Envelope to the Edge*, 21 J. LAND RESOURCES & ENVTL L. 287 (2001).

⁷⁰ In fact, all of the Democratic candidates for president have voiced their opposition to the Yucca Mountain project and promised to eliminate funding for it if elected. See *Democratic Presidential Candidates Oppose New Yucca Bill*, US FED. NEWS, May 31, 2007 (on file with author).

in on-site storage is France, which is second only to the United States in their production of nuclear energy.⁷¹ Under the French system, SNF is initially reprocessed (or partially recycled) to extract all the fission energy possible out of spent fuel rods. The remaining material is then stored on-site in secure concrete casks.⁷² While this method has generated some controversy,⁷³ the French have adopted reprocessing and on-site storage as their preferred way of storing SNF and HLW generated by nuclear power plants, and now receive a higher percentage of their power from nuclear sources than any other nation in the world.⁷⁴

Despite France's success with their on-site storage program, few other nations have adopted similar programs. As outlined earlier, the official United States policy under NWPA is to transfer all SNF and HLW to a single, concentrated repository as soon as it is completed—although the current practice is for nuclear power plants to store SNF on-site in temporary casks (usually in pools of water).⁷⁵

Proponents of a large-scale on-site storage policy point to the fact that SNF and HLW have been successfully stored on-site for several decades as evidence that on-site storage is safe. Critics of the on-site storage plan cite growing terrorism threats, and maintain that on-site storage would give terrorists multiple targets to attack, rather than a single target under a concentrated repository plan.⁷⁶ However, what critics fail to note is that nuclear power plants are *already* likely to be terrorist targets, and that on-site storage would not significantly increase the risk of a terrorist attack on the plants if adequate security measures are in place. Further, one scholar maintains that a diffused, on-site storage policy helps reduce the overall risks by spreading them across the country, thereby avoiding the possibility of an "enormous disaster."⁷⁷ He also adds that on-site storage would allocate the costs evenly throughout the country, rather than having only one state bear the costs associated with a concentrated repository, and that the allocation of risk and costs allows consumers nationwide to make a more informed assessment of the real costs and benefits of nuclear energy.⁷⁸

An additional concern for opponents of on-site storage is the environmental damage that exists with storage of SNF and HLW. This is of particular concern

⁷¹ KEY STATISTICS, *supra* note 12.

⁷² As outlined in *Frontline: Nuclear Reaction* (PBS television broadcast April 1997).
See also Charlton, *supra* note 55.

⁷³ *See, e.g.*, NUCLEAR, *supra* note 9.

⁷⁴ Charlton, *supra* note 55.

⁷⁵ *See* Joseph F. Schuer Jr., *Nuclear Waste's Slow Boil*, 137 NO. 11 PUB. UTIL. FORT. 34 (1998); Jason Hardin, note, *Tipping the Scales: Why Congress and the President Should Create a Federal Interim Storage Facility For Radioactive Waste*, 19 J. LAND RESOURCES & ENVTL. L. 293 (1996).

⁷⁶ *See supra* note 67 and accompanying text.

⁷⁷ Cinnamon Gilbreath, *Federalism in the Context of Yucca Mountain: Nevada v. Department of Energy*, 27 ECOLOGY L. Q. 577, 600 (2000).

⁷⁸ *Id.*

because the health effects of indirect exposure to radioactive material can be severe.⁷⁹ In one instance, the Illinois Attorney General alleged that stored SNF and HLW leaked out of its storage casks and contaminated area groundwater, increasing the risk of cancer and other diseases in the surrounding towns.⁸⁰ However, past problems are not necessarily indicative of future problems because, until recently, existing on-site storage was designed to be *temporary* rather than permanent. Thus, whether permanent on-site storage facilities are environmentally safe is a question that has not been conclusively answered.

Another component of the French on-site storage program is their reprocessing of the radioactive waste. To date, the United States has prohibited reprocessing, due in part to concerns about nuclear proliferation, since reprocessing produces plutonium that can be used in nuclear weapons.⁸¹ The most significant advantage to reprocessing is that it greatly reduces the volume of SNF or HLW that must be stored,⁸² but reprocessing is also quite expensive—often costing even more than the initial production of nuclear energy⁸³—which helps explain why only a few nations have embraced reprocessing. If new technologies could help defray the costs of reprocessing, and if adequate security measures are implemented, reprocessing could be part of the solution to the storage problem—as part of either the diffused or concentrated storage proposal—in the United States. However, it is not necessarily a required element of either storage plan.

Because of the advantages of the French on-site storage program, Sen. Harry Reid (D–Nev.) and Rep. Jim Matheson (D–Utah) introduced companion bills⁸⁴ during the 109th Congressional Session requiring permanent storage of all SNF on-site at nuclear power plants, with the DOE (rather than the individual nuclear power plants) responsible for security, maintenance, and management of the waste.⁸⁵ Past versions of the bill have enjoyed a measure of bipartisan support,⁸⁶ but have not made it out of committee. Senator Reid introduced a similar bill in 2007,⁸⁷ and his new version of the bill is more likely to pass because of his election as Senate Majority Leader, and with Democrats now comprising a

⁷⁹ See Charlton, *supra* note 55.

⁸⁰ Press Release, Office of the Illinois Attorney General, *supra* note 18.

⁸¹ *Id.*

⁸² *Id.*

⁸³ See *id.*; Interview by the International Atomic Energy Agency [IAEA] with Alan McDonald, *supra* note 8; FOULKE & BURNETT, *supra* note 8.

⁸⁴ Spent Nuclear Fuel On-Site Storage Security Act of 2005, S. 2099, 109th Cong. (1st Sess. 2005) (as introduced in the Senate, Dec. 14, 2005); H.R. 4538, 109th Cong. (1st Sess. 2005) (as introduced in the House, Dec. 14, 2005).

⁸⁵ *Id.*

⁸⁶ Suzanne Struglinski, *House, Senate Bills Call for On-Site Nuclear Waste Storage*, DESERET NEWS, Dec. 14, 2005, at B1 (noting that several Republican senators supported Reid's bill).

⁸⁷ Federal Accountability for Nuclear Waste Storage Act of 2007, S.784, 110th Cong. (1st Sess. 2007); H.R. 4062, 110th Cong. (1st Sess. 2007).

majority in both the House and Senate. However, as of this writing, the bill remains in committee, where no action has been taken yet.

In the meantime, the DOE has recognized that Yucca Mountain or another concentrated repository may never be built,⁸⁸ and some nuclear power plants are already implementing changes to make their on-site storage facilities permanent, rather than temporary.⁸⁹

C. Recommendations

There are benefits and drawbacks to both the concentrated and diffused storage options, with valid arguments existing in favor of both options. However, the current political winds seem to be blowing in favor of the on-site storage option. Assuming that the political landscape remains the same in the near future, the Yucca Mountain/single concentrated repository will not be completed soon enough to meet the current need for permanent storage, let alone accommodate any new nuclear power plants. At the same time, the temporary storage facilities on-site at nuclear plants across the United States are nearing the end of their intended lifespan, and the waste needs to be permanently stored. Policymakers are also advocating nuclear energy as a way to address climate change, so there is a growing sense of urgency to settle on a storage option that would allow the construction of new nuclear power plants.

Based on these factors, it is a reasonable conclusion that permanent on-site storage is the most viable option to address nuclear energy needs in the United States. However, nuclear power plants have not demonstrated that SNF and HLW can be safely stored on-site over an extended period. Proponents of on-site storage have not definitively answered questions about the environmental safety of permanent on-site storage, nor have they fully answered questions about protecting on-site facilities from terrorism and other security threats. Because a failure to address these questions would carry with it severely negative consequences, a large-scale policy of on-site storage would be unwise until these questions are adequately addressed.

Inasmuch as those questions cannot be fully addressed until the technology is observed in real-world situations, I would recommend that the DOE select several existing nuclear power plants as test facilities to determine whether SNF and HLW can be stored permanently on-site. Because several existing plants have temporary storage facilities that are nearing the end of their intended life spans, they would likely be prime candidates for the test construction of new, permanent on-site storage facilities. Other selection criteria might include the surrounding population, potential environmental and safety risks, and the facilities that already

⁸⁸ Busby, *supra* note 67 at 459 n. 86 (quoting the Secretary of Energy as saying that on-site storage may become America's waste storage policy by default).

⁸⁹ *Id.* at 458.

exist at specific plants.⁹⁰ Furthermore, existing plants must also be required to take the steps necessary to ensure the safety of all SNF and HLW that is stored on-site until the testing period is complete, and it becomes clear whether permanent on-site storage is viable. If on-site storage proves viable, the remaining money allocated for Yucca Mountain could then be diverted to existing power plants in the form of grants or low-interest loans to help defray the costs associated with constructing permanent on-site storage facilities.

In addition to addressing the storage issue at existing plants, accommodations must also be made for the construction of new nuclear power plants (if the United States decides to embrace an energy policy that includes the promotion of nuclear energy), in order to meet future needs and address the effects of climate change. To accommodate these new plants, I would recommend that the NRC require new plants to have facilities designed to store SNF and HLW permanently on-site. Even if the diffused, on-site policy proves unworkable in the long-term, it may take several years—if not decades—to complete Yucca Mountain or another concentrated, permanent repository, and all new plants need to be prepared to store their waste on-site indefinitely. However, because on-site storage would still be unproven, and because alternative clean sources of energy may ultimately prove more viable, it would also be wise to limit the approval and construction of new nuclear power plants to the amount required to address current energy needs, and those that will exist in the foreseeable future.

The ultimate goal of this plan is to develop clean sources of energy in a way that will be safe, environmentally sound, and viable, both economically and politically. Thus, this plan balances and takes into account current political realities, the environmental and public safety concerns associated with on-site storage of SNF and HLW, and the need for new clean sources of energy—including the potential for non-nuclear sources of clean energy that may be more viable.

IV. CONCLUSION

The increased attention given to global warming has caused policymakers in the United States to consider nuclear power as a source of clean energy. Normally, the debate on nuclear energy focuses on the threat of reactor meltdown—as in the Three Mile Island and Chernobyl incidents. However, that debate ignores the equally significant problem of how and where to store SNF and HLW generated by nuclear power plants.

This note has discussed the two leading solutions to the problem of how and where to store that waste: (1) Storing the waste in a single, concentrated

⁹⁰ As noted earlier, some plants are already designing their on-site storage facilities to be permanent. See Busby, *supra* note 67 at 458-59 (discussing the measures plants have already taken to make their storage facilities permanent and the Department of Energy's recognition that "on-site storage may become the permanent solution for waste management").

permanent repository; or (2) Storing the waste in a diffused manner in permanent facilities on-site at nuclear power plants. In light of the current political climate and the urgent need to settle on a storage alternative, it is clear that permanent on-site storage is the better, more viable option. However, many of the assumptions underlying on-site storage are unproven in the real world. For these reasons, the best policy the United States can adopt is to cautiously proceed with on-site storage and ensure that it is safe, while allowing for some construction of new nuclear power plants, but also encouraging the development of other clean energy alternatives that may also be viable solutions to the problem of climate change.