

Northwestern Journal of International Law & Business

Volume 13

Issue 3 *Spring*

Spring 1993

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Recommended Citation

Thomas J. Daemen, The Need for Liability Constraints in Successful High-Technology Development: A Comparison of the French and U.S. Commercial Nuclear Programs, 13 Nw. J. Int'l L. & Bus. 684 (1992-1993)

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COMMENT

The Need for Liability Constraints in Successful High-Technology Development: A Comparison of the French and U.S. Commercial Nuclear Programs

Thomas J. Daemen

INTRODUCTION

Global warming has become the battlecry of environmental forces throughout the world. Ironically, however, a comprehensive solution to this controversial issue is rarely advanced by such organizations. Although individual countries may take specific measures (e.g., reduce deforestation, ban CFCs, shift to electric cars) to clean the air and slow global warming, such measures are doomed to failure in the absence of an effective, long range energy policy.

Nuclear power is, by definition, environmentally clean.¹ Anti-nuclear organizations have not centered their emotionally charged debate on the issue of clean energy production. Their concern, rather, has been focused upon the primary risk of nuclear energy: the potentially devastating release of radiation. As a result of these realistic and appropriate

¹ This Comment seeks exclusively to analyze the impact of liability constraints on commercial nuclear development. These constraints were intended for front-end nuclear production, and bypass the issue of waste disposal. This Comment, therefore, does not address — and is not intended to address — the relative merits of nuclear power, or issues of waste disposal and alternative energy sources.

concerns, the use of nuclear power is governed by a massive structure of national and international regulations.

Despite the internationalization of nuclear regulation, national regulatory distinctions continue. Consequently, there exists a clear dichotomy in nuclear development. Industries in several countries, most notably Japan and France, have vigorously pursued nuclear development. In the United States, however, after an initial spurt of production, industry has all but rejected the nuclear alternative. This Comment will examine the different nuclear power regulatory schemes of France and the United States. The United States' exclusive reliance upon liability constraints has served to virtually eliminate ongoing nuclear production. French development, however, by avoiding such dependence and utilizing state research and development capabilities, has proven both considerable and safe.

In America's existing anti-litigation fervor, liability constraints have been proposed by a variety of sources. From former Vice President Quayle to specific interest groups, such caps are often presented as a savior—in and of themselves—to an industry's economic difficulties. Public perception of America's litigation crisis to the contrary, limitations on liability do not guarantee successful development and production of risky new technologies. This extreme example of liability constraints indicates that such limits do not independently resolve existing development and production problems.

The history of America's nuclear program is replete with examples of shining brilliance and dismal failure. After examining America's successes and failures, this Comment reviews the highly structured French development history. The internationalization of nuclear safety is then addressed, as international efforts continue to play a critical role in future nuclear production. Finally, a variety of key recommendations for current and future activity are analyzed.

I. THE UNITED STATES NUCLEAR PROGRAM

Early in 1942, the United States entered the nuclear era with the first atomic reaction at the University of Chicago.² The now famous "Manhattan Project" ushered in a new world of global competition and weapons proliferation. After the experiment's successful completion, however, the military retained exclusive control over nuclear development and research until the Atomic Energy Act of 1946.³ Thereafter,

² JOSEPH P. TOMAIN, *NUCLEAR POWER TRANSFORMATION* 6-7 (1987).

³ Atomic Energy Act of 1946, Pub. L. No. 79-585, 60 Stat. 755 (1946).

the United States government remained highly concerned with the proliferation of atomic power.⁴ As other countries entered the nuclear arena, however, U.S. governmental concerns shifted.⁵ Many leaders believed that it was critical for the United States to remain the world leader in commercial and military nuclear research.⁶

The 1954 Atomic Energy Act marked the symbolic beginning of private nuclear development in the United States.⁷ Under this new legislation, the government's complete authority over nuclear power was eliminated.⁸ For the first time, private ownership of nuclear reactors and nuclear production facilities was explicitly authorized.⁹ Despite this new authority, however, private developers were still forced to lease nuclear fuels from the United States government.¹⁰

Concerned that such new technology would not be immediately embraced by industry, the United States government quickly moved to illustrate the tremendous potential of atomic energy.¹¹ The Power Demonstration Reactor Program (PDRP) was initiated in 1955 to demonstrate the effectiveness of nuclear power plants to various private manufacturers.¹² Despite such efforts, American manufacturers remained doubtful.¹³

Citing the astronomical liability risk of an atomic accident, companies in the United States simply refused to develop nuclear power.¹⁴ Francis K. McCune, General Electric Co.'s general manager of atomic products told the Committee that all existing and future construction would be halted "if it appear[ed] that appropriate [indemnity] legislation [would] not be passed."¹⁵ In an attempt to ascertain the extent of the manufacturers' concerns, both Congress and the Atomic Energy Agency

⁴ J. SAMUEL WALKER, *CONTAINING THE ATOM: NUCLEAR REGULATION IN A CHANGING ENVIRONMENT* 8 (1992).

⁵ As one commentator noted:

The 1946 Act attempted to keep secret all information about the development of nuclear power so that other countries would not be able to build a nuclear bomb. The attempt at secrecy failed when both the Soviet Union and Great Britain detonated their own nuclear devices.

TOMAIN, *supra* note 2, at 7.

⁶ *Id.*

⁷ Atomic Energy Act of 1954, Pub. L. No. 83-703, 68 Stat. 919 (1954) (codified as amended in scattered sections of 42 U.S.C.).

⁸ *Id.*

⁹ *Id.* at 928.

¹⁰ *Id.* at 936.

¹¹ WALKER, *supra* note 4, at 9.

¹² *Id.*

¹³ TOMAIN, *supra* note 2, at 8-9.

¹⁴ *Atomic Insurance*, CONG. QUARTERLY ALMANAC, 1957, at 587.

¹⁵ *Id.*

conducted considerable studies.¹⁶ As the hearings came to a close, however, the magnitude of the problems became quite clear.¹⁷ Virtually every manufacturer (most notably, Westinghouse) testified that private production would never begin until Congress acted to remove the threat of unlimited liability.¹⁸ In addition, nearly every insurer testified that the private insurance industry would provide only a fraction of the insurance needed to guarantee adequate compensation in the event of a nuclear incident.¹⁹

Congress, in response to industrial concerns, moved to pass the Price-Anderson Act in 1957.²⁰ Under this legislation, a \$560 million liability ceiling was established for nuclear producers and manufacturers.²¹ In evaluating legislative alternatives, congressional activity was a unique mix of meticulous study and political rancor.²² Ironically, however, after months of painstaking effort, the \$560 million level was "an arbitrary figure" chosen "because it seemed practical at the time and because [the Committee] didn't think an accident would happen."²³ Though a clear victory for the nuclear industry, several problems remained.²⁴ First, American manufacturers were responsible for providing \$60 million of their own insurance.²⁵ Second, the Act was to expire in ten years, at which time industry was presumed mature enough to provide its own insurance.²⁶ Price-Anderson's constitutionality was challenged by various groups, but the Supreme Court eventually upheld the Act as a reasonable economic regulation.²⁷

Ten years later, with Price-Anderson set to expire, Congress was again faced with a manufacturing and insurance lobby demanding ac-

¹⁶ GEORGE T. MAZUZAN & J. SAMUEL WALKER, *CONTROLLING THE ATOM* 97 (1985).

¹⁷ *Id.*

¹⁸ Leslie Lass, *The Price-Anderson Act: If a "Chernobyl" Occurs in the United States, Will the Victims be Adequately Compensated?*, 7 *GLENDALÉ L. REV.* 201, 203 (1987).

¹⁹ Gerald Turkel & William S. Lofquist, *Privatizing Nuclear Power and the Price-Anderson Act: Establishing Limits to Liability*, 11 *STUD. IN LAW, POLITICS, AND SOCIETY* 143, 151-52 (1991).

²⁰ Price Anderson Act, Pub. L. No. 85-256, 71 Stat. 576 (1957) (codified as amended in scattered sections of 42 U.S.C.).

²¹ *Id.* at 577.

²² Despite considerable effort and various existing legislative proposals, for example, consideration of Price-Anderson was delayed by democrats for one year (until the Eighty-Fifth Congress) as simple retaliation against an earlier defeat in the House. Turkel & Lofquist, *supra* note 19, at 158.

²³ *Id.* at 153 (Statement of JCAE Staff Director James T. Ramey).

²⁴ Although industrial concerns played a critical role in Price-Anderson's passage, underlying fears of Soviet domination also spurred government's rapid response. *U.S. Congress, Joint Committee on Atomic Energy, Governmental Indemnity. Hearings Before the Joint Committee on Atomic Energy*, 84th Cong., 2d Sess. 216 (1956).

²⁵ Price-Anderson Act, Pub. L. No. 85-256, 71 Stat. 576 (1957).

²⁶ *Id.* at 577.

²⁷ *Duke Power Co. v. Carolina Env'tl. Study Group, Inc.*, 438 U.S. 59 (1978).

tion.²⁸ Despite considerable growth, it was argued the nuclear industry remained in its infancy and was unable to maintain comprehensive liability insurance.²⁹ Unlike the original 1957 enactment, the reauthorization involved only a few hearings and limited additional research.³⁰ In 1966 Congress quietly reauthorized Price-Anderson for another ten years.³¹ Nevertheless, the proportion of privately insured funds was raised from \$60 million to \$74 million.³²

Throughout the next decade, America's nuclear industry underwent tremendous expansion.³³ Reactor orders were at their peak as the United States sought to harness the tremendous potential of this new technology.³⁴ In addition to orders from U.S. utilities, U.S. manufacturers exported nuclear technology throughout the world.³⁵ The vice president of General Electric's Nuclear Energy Division described the orders as exceeding "even the most optimistic estimates."³⁶

The considerable flux in coal and oil prices from 1960-1974 provided strong financial incentives for investment in the new technology.³⁷ In addition, nuclear power was viewed by the government, manufacturers and the public as an energy source for the future.³⁸ It was believed, for example, this clean technology would prove critical in meeting

²⁸ In addition, governmental support for nuclear development was extremely strong. As a result, tremendous pressure was placed upon the Atomic Energy Commission "to show that its reactor programs were producing results." WALKER, *supra* note 4, at 10.

²⁹ Dan M. Berkovitz, *Price-Anderson Act: Model Compensation Legislation? — The Sixty-Three Million Dollar Question*, 13 HARV. ENVTL. L. REV. 1, 11 (1989).

³⁰ Concerned with the possible implications of state tort law, the legislature concluded in favor of waiving various tort defenses in the event of an "extraordinary nuclear occurrence." 42 U.S.C. § 2014(j) (1982). See also Berkovitz, *supra* note 29, at 12.

³¹ Pub. L. No. 89-210, 79 Stat. 855 (1965).

³² *Id.*

³³ As Philip Sporn, past president of the American Electric Power Service Corporation noted, nuclear development during this time was a "great bandwagon market" in which utilities quickly adopted the nuclear alternative. WALKER, *supra* note 4, at 18.

³⁴ *Id.*

³⁵ American manufacturers, primarily General Electric and Westinghouse, provided equipment and technology for nuclear production in Belgium, Brazil, Germany, Japan, Korea, Mexico, the Philippines, the Republic of China, Spain, Sweden, Switzerland, and Yugoslavia. NUCLEAR POWER: POLICY AND PROSPECTS 177 (P. M. S. Jones ed.) (1987).

³⁶ *Joint Committee on Atomic Energy (JCAE), Hearings on AEC Authorizing Legislation Fiscal Year 1970*, 91st Cong., 1st Sess, 975-1017 (1969).

³⁷ In addition, private ownership of radioactive materials was finally authorized in 1964. This allowed enhanced financial planning and reduced long-range development costs. WALKER, *supra* note 4, at 33.

³⁸ The president of the Atomic Industrial Forum even described nuclear power as "a developed, mature industry." W. Kenneth Davis, NUCLEONICS WEEK, Nov. 25, 1965, at 2 (quoted in WALKER, *supra* note 4, at 33).

America's new environmental regulations.³⁹ The difficulties associated with the U.S.'s desire for environmentally sensitive growth seemed finally to have been resolved.⁴⁰

In 1975, with opposition to nuclear power growing, Price-Anderson was again set to expire.⁴¹ Once again, a series of hearings and studies were authorized. Once again, Price-Anderson appeared to be on a fast-track, as the Joint Committee on Atomic Energy actively pursued immediate reauthorization in order to avoid a "disruption and slow-down in the long planning process for new nuclear plants."⁴² Once again, dramatic testimony in favor of reauthorization was heard.⁴³ Once again, Price-Anderson was reauthorized for ten years.⁴⁴ Under this reauthorization, however, the government's portion of insured funds was slowly to be eliminated as utilities were forced to pay a premium for each new reactor.⁴⁵ Despite industry's third apparent victory, the United States' nuclear industry was on the brink of collapse.

After 1974, the nuclear alternative was virtually abandoned by U.S. developers.⁴⁶ "In the years since the oil crisis one event after another has discredited the nuclear option and created obstacles to any revival."⁴⁷ Nearly fifty percent of U.S. nuclear facilities have been cancelled, re-

³⁹ Specifically, it was believed nuclear production would be important in meeting the goals of the 1967 Air Quality Act, and later the 1970 Clean Air Act. See WALKER, *supra* note 4, at 33.

⁴⁰ See generally *Id.*

⁴¹ In addition to increased opposition from various interest groups, the opposition from competing industry had grown increasingly intense since 1964. See generally, WALKER, *supra* note 4, at 116-17.

⁴² *Nuclear Insurance Program*, CONG. QUARTERLY ALMANAC, 1975, at 277.

⁴³ "It appears that, under the present Price-Anderson provisions, nuclear safety does not seem to present a financial problem to the electricians. I have never heard it even mentioned as an important factor in their financial picture." *U.S. Congress, Joint Committee on Atomic Energy, Possible Modification or Extension of the Price-Anderson Insurance and Indemnity Act. Hearings Before the Joint Committee on Atomic Energy*, 93rd Cong., 2d Sess. 405, 543 (1974) (Statement of Richard Walker, partner, Arthur Anderson & Co.).

⁴⁴ Pub. L. No. 94-197, 89 Stat. 1111-15 (1975).

⁴⁵ This modification was far from acceptable to nuclear opponents. Various coal and environmental interests testified against a liability constraint since insurance markets were realistically valuating nuclear risk. Congress should not usurp a proper market valuation, they argued, where the possible consequences were of such tremendous significance. As Ralph Nader described, "The liability limit in Price-Anderson means that the Government has preempted the insurance industry's risk assessment function with regard to these damages and has determined that it, rather than the private insurance industry, will weigh the economic benefits and risk of catastrophic accidents." *Possible Modification or Extension of the Price-Anderson Insurance and Indemnity Act of 1957 in Order for Proper Planning of Nuclear Power Plants to Continue Without Delay: Hearings on H.R. 8631 Before the Joint Committee on Atomic Energy*, 94th Cong., 1st Sess. 1, 60 (1975) (Statement of Ralph Nader).

⁴⁶ Matthew L. Wald, *10 Years After Three Mile Island*, N.Y. TIMES, March 23, 1989, at D1.

⁴⁷ JAMES M. JASPER, *NUCLEAR POLITICS: ENERGY AND THE STATE IN THE UNITED STATES, SWEDEN, AND FRANCE* 187 (1990).

jected or delayed indefinitely.⁴⁸ Indeed, the problem has been so severe that no new reactor orders are anticipated until the mid 1990s.⁴⁹ As John Ahearne, a former NRC commissioner recently noted, "I don't see any new nuclear power plants, at least not in the foreseeable future."⁵⁰ In addition, over twenty percent of America's current plants "may be shut down by the year 2000."⁵¹ Given such results, it seems quite clear that "the U.S. nuclear programme has not been a success judged by the key criteria of operating performance and construction costs and times. . ."⁵²

Although a wide variety of reasons have been cited for the demise of America's nuclear industry, several general problems existed. First, the nuclear electricity demand forecasts upon which development was based proved overly optimistic.⁵³ Second, the tremendous increase in public opposition stymied industry development plans.⁵⁴ Finally, shifting production costs reduced the attractiveness of such capital-intensive development.⁵⁵

In view of these problems, Price-Anderson's 1988 renewal still was

⁴⁸ DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION, U.S. COMMERCIAL NUCLEAR POWER 87 (1988).

⁴⁹ *A Group of Nuclear Utilities Last Week Selected Two Reactors*, INSIDE ENERGY/WITH FEDERAL LANDS, Jan. 18, 1993, at 12.

⁵⁰ Ben A. Franklin, *Participants in NRDC Session Are Not Optimistic About Nuclear's Future*, INSIDE N.R.C., Dec. 14, 1992, at 3.

⁵¹ *Id.* (quoting Paul Parsley, former House committee staffer and currently a vice president of Lehman Brothers)

⁵² S.D. THOMAS, THE REALITIES OF NUCLEAR POWER 108 (1988).

⁵³ See generally, James Cook, *Nuclear Follies*, FORBES 89 (1985); TOMAIN, *supra* note 2, at 11; OFFICE OF TECHNOLOGY ASSESSMENT, NUCLEAR POWER IN AN AGE OF UNCERTAINTY 29-30 (1984); Richard J. Pierce, Jr., *The Regulatory Treatment of Mistakes in Retrospect: Canceled Plants and Excess Capacity*, 132 U. PA. L. REV. 497, 500-02 (1984); Marcie Rosenthal, *How the Price-Anderson Act Failed the Nuclear Industry*, 15 COLUM. J. ENVTL. L. 121, 128 (1990); *U.S. Northeast Has More Electricity Than Needed*, Reuters Ltd., Feb. 22, 1993.

⁵⁴ One should be careful not to overestimate the success of opposition forces. As one commentator has noted,

The influence of public opposition should not however be exaggerated and used as an excuse for the failings of the nuclear industry. Even in the post TMI [Three Mile Island] environment, a number of US utilities have demonstrated that nuclear plant [sic] can be built to time and cost and operated at high capacity factors, so whilst the environment may be difficult it is by no means impossible."

See THOMAS, *supra* note 52, at 108-09.

⁵⁵ See ENERGY INFORMATION ADMIN. OFFICE OF COAL, NUCLEAR, ELECTRIC AND ALTERNATE FUELS, U.S. DEPT. OF ENERGY, COMMERCIAL NUCLEAR POWER 11 (1988); Cook, *supra* note 53, at 89.

"The claim that nuclear was cheaper than coal was demonstrably true prior to TMI. Compared with a coal-fired unit, nuclear was a cheaper plant to build and operate. This assertion is no longer the case." TOMAIN, *supra* note 2, at 11 n.17 (citing OFFICE OF TECHNOLOGY ASSESSMENT, NUCLEAR POWER IN AN AGE OF UNCERTAINTY 57-71 (1984), and Charles Komanoff, *Assessing the High Costs of New U.S. Nuclear Power Plants* (June, 1984) (paper on file with author)).

not a complete surprise.⁵⁶ After considerable opposition and years of political wrangling, industry remained victorious as the liability cap was maintained.⁵⁷ Despite a bruising battle, Price-Anderson was reauthorized for fifteen years.⁵⁸ The liability cap was dramatically expanded, however, to \$7 billion.⁵⁹ Nevertheless, the final demise of United States' nuclear development appears imminent.⁶⁰

II. THE FRENCH NUCLEAR PROGRAM

A. Government Sponsorship

Despite the United States' initial superiority in nuclear research and development, the French government chose a decidedly different route for nuclear development. Unlike the U.S. system of liability caps and private production, the French plan was premised on substantial government involvement in both development and production.

French nuclear development occurred independent of its European Community partners.⁶¹ Although a Geneva Conference on peaceful uses of nuclear energy was held in 1955, members were unable to develop a

⁵⁶ The 1988 reauthorization was a difficult, eight year negotiation between America's best financed and organized interest groups. Although incidents at Three Mile Island and Chernobyl provided anti-Price-Anderson interests with a strong public posture, industry lobbyists were exceptionally successful. After a 1983 Nuclear Regulatory Commission (NRC) report recommended removal of the liability ceiling, for example, the NRC Commissioner noted that "[t]he industry has come around and talked to each of us about 'backing off' of the current position." Vicky Stamas, *NRC May Revise its Price-Anderson Position*, INSIDE ENERGY/WITH FEDERAL LANDS, Apr. 15, 1985, at 1.

A few months later, three of the five NRC commissioners reversed their previous position and concluded a liability ceiling was best to "[assure] timely and adequate compensation in the event of an accident. Mary Louise Wagner, *NRC Majority Flip-Flops to Endorse New Price-Anderson Liability Limit*, NUCLEONICS WEEK, June 7, 1985, at 3. Despite the appearance of a successful industry lobby, each commissioner indicated "that he had come to his own conclusion after rethinking the issue." *Id.*

⁵⁷ Pub. L. No. 100-408, 102 Stat. 1066-85 (1988).

⁵⁸ *Id.* at 1068, 1074.

⁵⁹ *Id.*

⁶⁰ The United States' nuclear industry, though facing a critical juncture, is by no means doomed. A producer of twenty-two percent of America's energy consumption, immediate elimination of the nuclear option would undoubtedly cause an immediate and significant effect on social behavior and lifestyles.

Nevertheless, nuclear advocates should note the evolving situation in Germany. Although one-third of Germany's energy production is nuclear, current discussions concern the *complete elimination* of nuclear power. Chancellor Helmut Kohl has continued his prolific support of nuclear development. Nevertheless, Social Democrats, who govern most of Germany's federal states, have adamantly pursued a moratorium on new development, and elimination of current facilities. See Nao Nakanishi, *Cracks at German Nuclear Plant Renew Energy Debate*, THE REUTER EUROPEAN BUSINESS REPORT, March 4, 1993; *First German Energy Talks End Without Nuclear Agreement*, REUTER EUROPEAN BUSINESS REPORT, March 20, 1993.

⁶¹ Although secondary French development occurred with considerable international coopera-

consensus on an effective European strategy.⁶² In addition, cheap imported oil and coal effectively eliminated any European incentives to develop such a strategy.⁶³ Indeed, neither the Treaties of Rome or Maastricht have established comprehensive energy policies.⁶⁴ France was thus free to pursue its own unique system of nuclear development.

France, the first country to patent a nuclear power station, began development efforts in 1952.⁶⁵ With the release of a five year energy plan, the French government called for positive nuclear development and production.⁶⁶ Nevertheless, many years would pass before the government's recommendation was adopted.

Similar to the 1955 American Power Demonstration Reactor Program, the French government sought construction of several nuclear plants to demonstrate their effectiveness.⁶⁷ In response, the Electricite de France (EDF) quickly established several plants for careful study and analysis.⁶⁸ The demonstration plants proved ineffective in eliciting new support, much like the U.S. program. Consequently, by 1960 only 0.2 percent of French electricity output was derived through atomic power.⁶⁹

As oil prices rose dramatically in the early 1970s, the French nuclear program was poised for a period of new expansion and growth.⁷⁰ Sensing this potential, the Pompidou government established a long term nuclear plan.⁷¹ Under the plan, fifty-five 1,000/MWe nuclear reactors were to be built by 1985.⁷² By 1985, therefore, it was expected that seventy percent of the electricity and thirty percent of total French energy production would be a result of nuclear power.⁷³ In addition, two hundred nuclear reactors (of varying sizes) were to be on-line by the year 2000.⁷⁴

Perhaps the most significant aspect of the Pompidou plan was the process by which development was to be undertaken. Unlike U.S. pro-

tion, initial production was heavily nationalistic and independent. COLIN SWEET, A STUDY OF NUCLEAR POWER IN FRANCE 71 (1981).

⁶² PETER R. MOUNFIELD, WORLD NUCLEAR POWER 97-8 (1991).

⁶³ *Id.* at 98.

⁶⁴ The absence of an energy chapter in Maastricht has been a source of difficulty in Europe's unification process. *See generally, German Coal Deal in Peril*, POWER EUROPE, Aug. 28, 1992.

⁶⁵ MOUNFIELD, *supra* note 62, at 102.

⁶⁶ *Id.*

⁶⁷ Jones, *supra* note 35, at 190.

⁶⁸ *Id.*

⁶⁹ MOUNFIELD, *supra* note 62, at 102.

⁷⁰ SWEET, *supra* note 61, at 22.

⁷¹ *Id.* at 11.

⁷² MOUNFIELD, *supra* note 62, at 103.

⁷³ SWEET, *supra* note 61, at 11.

⁷⁴ MOUNFIELD, *supra* note 62, at 105.

duction efforts, a *single reactor design* was chosen for development.⁷⁵ This decision eased production difficulties, provided uniform safety systems, and has proven considerably more cost-effective.⁷⁶ The plants were also sited closely together, thereby avoiding the difficulties with local opposition groups that would later plague U.S. development.⁷⁷ Localities were also persuaded to accept nuclear facilities through cuts in their individual energy bills and the provision of licensing funds.⁷⁸

As with U.S. manufacturers, French developers quickly realized the tremendous costs of nuclear production.⁷⁹ In only three years the cost of French plants escalated from 1,200 million to 2,000 million French francs!⁸⁰ Consequently, the overall cost of nuclear energy nearly doubled, from 3.83 to 7.0 centimes/kWh, and now exceeded the cost of coal based production.⁸¹ Despite these costs, government commitment continued and the French development effort was sustained.

As President Giscard d'Estaing came to power in 1976, nuclear advocates were fearful the new administration would move to eliminate the Pompidou plan. Such fears appeared excessive when, shortly after coming to power, d'Estaing merely suggested reducing the energy plan's first phase to around fifty reactors.⁸² In addition, as d'Estaing came to power, the previous government changed its justification of the nuclear program.⁸³ No longer the cheapest energy production source, nuclear development was now justified on grounds of national energy dependence.⁸⁴ Nuclear advocates were undoubtedly relieved as the new justification was

⁷⁵ French nuclear experts concluded in favor of fully developing a pressurized water reactor (PWR) instead of pursuing various designs. After reaching a licensing agreement with Westinghouse, therefore, France pursued an independent policy of nuclear development and construction. Jones, *supra* note 35, at 177.

⁷⁶ Recent Organization for Economic Cooperation and Development research indicates that France is the only European country currently recognizing a differential cost advantage from nuclear, as opposed to coal or gas-generated energy production. Howard LaFranchi, *French Lead Europe in Reactors and Power Generation*, THE CHRISTIAN SCIENCE MONITOR, Feb. 24, 1993, at 13. It has even been suggested that PWR production is cheaper in France, with half the reactors and have the construction time, than in the United States. SWEET, *supra* note 61, at 67-68.

Development of a single reactor design was unique to France, as most other countries made wholesale purchases of U.S. technology and understanding. See Jones *supra* note 35. Ironically, this approach was a dedicated effort by the Pompidou government to develop and support the French nuclear industry. SWEET, *supra* note 61, at 24.

⁷⁷ LaFranchi, *supra* note 76, at 13.

⁷⁸ MOUNFIELD, *supra* note 62, at 105.

⁷⁹ SWEET, *supra* note 61, at 68.

⁸⁰ MOUNFIELD, *supra* note 62, at 103.

⁸¹ *Id.* at 103-4.

⁸² *Id.* at 102.

⁸³ Jones, *supra* note 35, at 191.

⁸⁴ *Id.*

apparently adopted by d'Estaing, and orders continued.⁸⁵ Once this new foundation was provided, the original energy plan was generally retained, and significant production goals remained.⁸⁶

Highly fluctuating oil prices in the early 1980s placed the French government in the tenuous position of supporting the extraordinarily expensive nuclear option. Once again, governmental justification for the project shifted in an effort to maintain the aggressive development levels. First, it was argued, nuclear development would help the trade deficit by substituting imported oil for French produced uranium.⁸⁷ Second, even with significant development expenses, the real cost of energy would be reduced.⁸⁸ Third, energy supplies would be shifted from the middle east to more stable regions.⁸⁹ Finally, the French government sought to expand internal development for purposes of export once the technologies were developed.⁹⁰ Although such analysis had proven successful in the past, it appeared French nuclear advocates would soon face their first formidable challenge.

The 1981 election of Francois Mitterand brought the first significant national opposition to nuclear development.⁹¹ Upon taking power, Mitterand's response to the nuclear program was immediate. Production at Plogoff was cancelled, and a freeze was placed on all existing production and development plans.⁹² In addition, the President promised a comprehensive review of the entire nuclear production effort.⁹³

Despite this direct response, Mitterand's opposition to nuclear power slowly slipped as he was forced to deal with the country's complete fiscal and energy situation.⁹⁴ Soon after the election, orders continued, albeit at a slightly reduced rate.⁹⁵ Despite the apparent hard line,

⁸⁵ *Id.*

⁸⁶ The production plan was certainly embraced in the aftermath of a 1978 failure of the French national electricity supply which left the entire country without power for almost four hours. MOUNFIELD, *supra* note 62, at 191.

⁸⁷ *Id.* at 104.

⁸⁸ *Id.*

⁸⁹ *Id.*

⁹⁰ *Id.*

⁹¹ Despite the tremendous resources allocated to nuclear development, most opposition was local in nature, targeting specific development projects. The Mitterand election provided the first official challenge to nuclear development. *Id.* at 104-05.

⁹² Plogoff was a highly controversial plant which symbolized the conflict between pro and anti-nuclear forces. The plant had been targeted by numerous opposition groups and received considerable international attention. Mitterand's action, therefore, was far more significant than merely cancelling this plant. It was "the largest public setback" of the French nuclear program, and symbolized the end of pro-nuclear domination within government. *Id.* at 106.

⁹³ *Id.* at 107.

⁹⁴ See generally Jones, *supra* note 35, at 191.

⁹⁵ *Id.* at 191.

therefore, production continued.

Although the original targets were not met, substantial nuclear capability did exist ten years after the original energy plan was proposed. By 1984 the French government had installed forty-one reactors.⁹⁶ In addition, over twenty reactors were under construction, with several other orders pending.⁹⁷ By this time over fifty percent of French energy was derived from nuclear sources.⁹⁸ As production continued, however, this percentage continued to expand.⁹⁹ Three years later, nearly seventy percent of French energy was nuclear.¹⁰⁰ By 1993, nuclear output had risen to seventy-four percent of French energy production, the highest level of nuclear reliance in the world.¹⁰¹ France continues to pursue "an ambitious reactor-construction program designed to maintain its leading role in nuclear-power generation."¹⁰² Though slightly diminished, the French construction schedule of (roughly) one new reactor per year until the year 2000 easily outpaces the current American timetable of no planned developments.¹⁰³

B. French Liability Constraints

Ironically, French development also occurred under a system of liability constraints. Quite similar to the United States' Price-Anderson approach, the French constraints were based upon a variety of international treaties and accords.

In early 1960, the European Community met in an effort to insure the safe and effective development of nuclear power.¹⁰⁴ This meeting was known as the Paris Convention, and delegates were faced with the same dilemma resolved by U.S. legislatures three years earlier.¹⁰⁵ Not surprisingly, therefore, the resulting agreement proved remarkably analogous to

⁹⁶ *Id.* at 195.

⁹⁷ Notably, sixteen of the reactors were of a 1,300 WMe design. Although reactor orders were below the number anticipated under the original energy plan, this significance was somewhat offset by the newer, high output facilities. *Id.* at 195.

⁹⁸ *Id.*

⁹⁹ *Id.*

¹⁰⁰ MOUNFIELD, *supra* note 62, at 107.

¹⁰¹ LaFranchi, *supra* note 76, at 13.

¹⁰² *Id.* Continued French development is unique, given the virtual moratorium on nuclear development throughout Europe. As Alain Breton, director of economic prospects and strategy for Electricite de France (EDF), describes, "[r]ight now France's nuclear-power policy leaves it isolated." *Id.*

¹⁰³ *Id.*

¹⁰⁴ NUCLEAR ENERGY AGENCY/ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, THIRD PARTY LIABILITY 12 (1990).

¹⁰⁵ *Id.*; See generally *supra* note 4.

Price-Anderson's contentions.¹⁰⁶ As the Convention's Preamble stated, its goal was to ensure continued nuclear development, while providing equitable compensation for those injured by nuclear incidents.¹⁰⁷

Given the tremendous challenge of accomplishing such conflicting goals, the European delegates concluded in favor of limiting liability.¹⁰⁸ As with the American experience in 1957, pro-nuclear sentiment in 1960 Europe produced sweeping success for development forces, particularly in France.¹⁰⁹ Nevertheless, the issue of uncompensated injury remained at issue, and European delegates were soon forced to resolve the publicly distasteful threat.

Because U.S. legislatures could not resolve the issue of uncompensated injury, Price-Anderson's liability cap was an arbitrary level chosen with the recognition that the federal legislature could quickly respond to an extraordinary nuclear incident.¹¹⁰ Unfortunately, such a rapid legislative response was not available in the highly fractured European system. Consequently, in 1963, most of the Paris Convention signatories adopted the Brussels Supplementary Convention preemptively guaranteeing additional compensation should compensation under the Paris Convention prove inadequate.¹¹¹ Nevertheless, government support beyond an oper-

¹⁰⁶ Convention on Third Party Liability in the Field of Nuclear Energy (Paris Convention), opened for signature 29 July, 1960, modified by an Additional Protocol signed 28 January, 1964, in INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL CONVENTIONS ON CIVIL LIABILITY FOR NUCLEAR DAMAGE 21 (1976).

¹⁰⁷ *Id.* at 21.

¹⁰⁸ Ratification or accession to the Paris Convention and Brussels Supplementary Convention, though not especially rapid, has generally been adopted across Europe. The following countries have adopted (through ratification or accession) basic tenants of the Paris Convention (PC), Brussels Supplementary Convention (BSC), 1964 Protocol (1964P) and 1982 Protocol (1982P).

	PC	BSC & 1964P	1982P
Austria	—	—	—
Belgium	1966	1985	1985
Denmark	1974	1974	1989
Finland (acc.)	1972	1977	1990
France	1966	1966	1990
Germany, F.R.	1975	1975	1985
Greece	1970	—	—
Italy	1975	1976	1985
Norway	1973	1973	1986
Netherlands	1979	1979	—
Portugal	1977	—	—
Spain	1961	1966	1988
Sweden	1968	1968	1983
Turkey	1961	—	—
U.K.	1966	1966	1985

Although each country retains the authority to modify these international agreements, basic provisions of the Conventions must be met. THIRD PARTY LIABILITY, *supra* note 104, at 14-15.

¹⁰⁹ See *supra* notes 17-21.

¹¹⁰ See generally Turkel & Lofquist, *supra* note 19, at 153.

¹¹¹ THIRD PARTY LIABILITY, *supra* note 104, at 14; See *supra* note 108.

ator's financial obligation was a fairly limited \$125 million.¹¹² Both Conventions were amended by Protocols in 1964 and 1982, in an effort to increase the amount of compensation and update their structure and legal effect.¹¹³

France has adopted and modified both the Paris Convention and the Brussels Supplementary Convention, as well as a variety of additional international agreements covering additional nuclear liability matters.¹¹⁴ Since adoption of these international agreements, third party liability, while varying from United States levels, has been significantly curtailed in France.¹¹⁵ Although specifying particular levels of liability, both Conventions allow flexible adoption by signatories.¹¹⁶ Under the current French standard, maximum liability for a nuclear incident is 60 million French francs.¹¹⁷ This level varies depending on the type of incident and individuals involved.¹¹⁸ Nevertheless, the general figure demonstrates that French producers operated within an economic environment similar to U.S. corporations. The only remaining distinction, therefore, is the level of governmental commitment to safe and effective development efforts.

Although some argue that France over-developed its nuclear capa-

¹¹² NUCLEAR THIRD PARTY LIABILITY AND INSURANCE: STATUS AND PROSPECTS (Proceedings of the Munich Symposium, Sept. 10-14, 1984), at 143.

¹¹³ One notable enhancement was replacing the European Monetary Agreement (EMF) unit with the Special Drawing Right (SDR) of the International Monetary Fund with regard to liability compensation levels. *Id.* at 142. In addition, the 1982 Protocol would increase Brussels Supplementary Convention financial protection to a maximum of 300 million SDRs (approximately 300 million U.S. dollars). *See Id.* at 143.

The 1982 Protocol is not yet in force. It is dependent upon the complete ratification of all parties to the Brussels Supplementary Convention. *Id.*; *See supra* note 108.

¹¹⁴ *See supra* note 108. Additional agreements include, for example, legislation concerning maritime transport of nuclear material. France has ratified the December 17, 1971 Brussels Convention on Civil Liability in the Field of Maritime Carriage of Nuclear Material. THIRD PARTY LIABILITY, *supra* note 104, at 97.

¹¹⁵ Act. No. 90-488 of June 16, 1990 (published in JOURNAL OFFICIEL DE LA REPUBLIQUE FRANCAISE, June 17, 1990).

¹¹⁶ *See generally* NUCLEAR THIRD PARTY LIABILITY AND INSURANCE *supra* note 112, at 142-43. The Paris Convention established a maximum liability of fifteen million International Monetary Fund Special Drawing Rights (approximately fifteen million U.S. dollars). Signatories may, taking into account the availability of financial security, fix a higher or lower amount, to a lower limit of five million SDRs, by national legislation. THIRD PARTY LIABILITY, *supra* note 104, at 12-13.

¹¹⁷ Under the Paris Convention and its progeny, this specific amount must be viewed as an International Monetary Fund Special Drawing Right (SDR). Accordingly, the 600 million FF limit is worth approximately 80 million SDRs, or \$80 million U.S. dollars. *See* THIRD PARTY LIABILITY, *supra* note 104, at 12, 100.

¹¹⁸ Maximum liability for incidents involving the transport of nuclear materials, for example, is limited to 150 million French francs. Act, *supra* note 115, at § 9.

bility, the distinction with U.S. production remains clear.¹¹⁹ While coal and oil development dominate U.S. energy production efforts, the French nuclear program has proven so successful it exports energy throughout Europe.¹²⁰ Reduced U.S. development would still easily be justified if it were the result of improved safety standards and requirements in the United States.¹²¹ Unfortunately, this is simply not the case.¹²²

III. THE INTERNATIONALIZATION OF NUCLEAR SAFETY

Once it became clear that the United States would not remain the only atomic state, U.S. legislators quickly worked to establish international agreements with respect to nuclear power. Although most such efforts were dedicated to containing nuclear proliferation, many of the international accords also contained detailed specifications with respect to nuclear safety. As a result, most safety issues associated with nuclear development have been baselined through international cooperation.¹²³ Due in part to such international agreements, the extraordinary growth of French nuclear production did not result in a significant safety decrease.

¹¹⁹ "We [France] could eventually cut down to 20 reactors and still maintain our standard of living." LaFranchi, *supra* note 76, at 13 (quoting Raymond Sene, a nuclear physicist).

¹²⁰ Henry R. Linden, *Energy, Economy, and the Environment*, PUBLIC UTILITIES FORTNIGHTLY, May 15, 1992, at 31.

¹²¹ In reviewing the constitutionality of Price-Anderson, the Supreme Court rejected the idea that reduced liability would lead to decreased safety. *Duke Power*, *supra* note 27, at 87.

¹²² A variety of articles and texts have criticized Price-Anderson for removing the nuclear industry from normal market pressures, thereby reducing industrial safety considerations. See Marcie Rosenthal, Note, *How the Price-Anderson Act Failed the Nuclear Industry*, 15 COLUM. J. ENVTL. L. 121 (1990); Joseph P. Tomain, *Law and Policy in the Activist State: Rethinking Nuclear Regulation*, 38 RUTGERS L. REV. 187 (1986); Green, *Nuclear Power: Risk, Liability and Indemnity*, 71 MICH. L. REV. 479 (1973). The U.S. Supreme Court has soundly rejected such analysis. See *supra* note 121.

In any event, since French and U.S. developers both operated under liability constraints such analysis is moot, and safety distinctions must be attributed to other factors. In addition, it is highly doubtful that the elimination of nuclear liability constraints would have a statistically significant effect on industrial safety policy. As one economist described:

The regulated firm with limited liability will accept higher probabilities of an accident and also will locate to raise the damage from accident. Simple comparative statistics show that safety drops when liability does, but a sensitivity analysis indicates that the gains to increasing liability may already be nearly exhausted if firms are acting as though they face losses of \$1.5 billion or more. . . Thus, if we can be confident that the government has exploited more cost-effective safety measures already and is constantly moving toward more expensive safety measures, we can expect the level of safety to be higher already than changes in liability could achieve.

WILLIAM C. WOOD, *INSURING NUCLEAR POWER: LIABILITY, SAFETY, AND ECONOMIC EFFICIENCY* 42 (1982).

¹²³ Most countries maintain a considerable independent nuclear regulatory structure. This is particularly significant since many agreements are not binding upon member countries. Nevertheless, maintenance of uniform international guidelines guarantees a certain consistency in nuclear development between countries such as the United States or France, which are members of most such treaties.

As World War II came to a close, there were strong indications that a variety of countries were actively developing atomic technologies.¹²⁴ In an attempt to forestall and contain such efforts, western countries, particularly the United States, sought to regulate nuclear development.¹²⁵

The 1945 Baruch Plan was one of the first attempts to foster international cooperation.¹²⁶ Despite early success, it eventually proved ineffective as the Soviet Union refused to cooperate with its organizational requirements.¹²⁷ As attempts to find agreement and cooperation failed, the United States moved toward a hard-line approach. The Atomic Energy Act of 1954, for example, prohibited the dissemination of information about U.S. nuclear research.¹²⁸ As countries independently established atomic capabilities, without the guidance and supervision of the international community, this approach had clearly failed.¹²⁹

The most successful attempt at international regulation began in 1956 with the establishment of the International Atomic Energy Agency (IAEA).¹³⁰ Created by the United Nations, more than one hundred signatories currently endorse IAEA requirements.¹³¹ Although the IAEA works to advance a variety of goals, the establishment of uniform safety guidelines remains the driving force.¹³² Indeed, Article III of the agency's directive specifically states that it shall work to protect the safety and health of member countries.¹³³ To accomplish this difficult task, the IAEA maintains on-site testing programs to ensure compliance with IAEA initiatives.¹³⁴ Inspection efforts are limited, however, to situations in which concerned parties make specific enforcement requests.¹³⁵ As a result, the IAEA has recently come under heavy criticism.¹³⁶ Such

¹²⁴ See *supra* note 5.

¹²⁵ See Atomic Energy Act of 1946, Pub. L. No. 79-585, 60 Stat. 755 (1946).

¹²⁶ U.S. State Department Publication 2498, Report on the International Control of Atomic Energy, Mar. 1946.

¹²⁷ Peter Riley, *The Legal Control of Nuclear Energy Between States*, 21 CAL. W. INT'L L.J. 303, 307 (1990/1991).

¹²⁸ Atomic Energy Act of 1954, Pub. L. No. 83-703, 68 Stat. 919 (1954) (codified as amended in scattered sections of 42 U.S.C.).

¹²⁹ See TOMAIN, *supra* note 2.

¹³⁰ Statute of the International Atomic Energy Agency, Oct. 26, 1956, 8 U.S.T. 1094, T.I.A.S. 3873 (hereinafter IAEA Treaty).

¹³¹ Riley, *supra* note 127, at 309.

¹³² *Id.*

¹³³ HA VINH PHUONG, IAEA SAFETY STANDARDS, THEIR LEGAL STATUS AND IMPLEMENTATION 3-7 (1985), cited by Riley, *supra* note 127, at 309.

¹³⁴ See IAEA Treaty, *supra* note 130, at Art. XII(A)(6).

¹³⁵ *Id.*

¹³⁶ "The IAEA has proved itself a worthless organization. . . They proved that in Iraq. They are proving it again in their inspections of Iran. They are a toothless watchdog." Jonathan Kaufman, *Buying the Bomb*, THE BOSTON GLOBE, June 21, 1992, at 1 (quoting Kenneth Timmerman).

criticisms are generally directed to IAEA's enforcement capability.¹³⁷ They are not related to IAEA's technical mandates. Consequently, for countries such as France and the United States, which have adopted IAEA directives, the IAEA has been successful in fulfilling its directive of safety and protection.

Shortly after the IAEA was introduced, the European Community initiated additional efforts toward uniform development. The Organization for Economic Cooperation and Development (OECD) was established in 1961.¹³⁸ Since that time, the OECD has worked to promote sustained international economic growth, the expansion of world trade, and establish consistent safety specifications for nuclear development throughout member countries.¹³⁹ Although the original signatories included nineteen European states and the United States, several non-European governments have joined since that time.¹⁴⁰

The Nuclear Energy Agency (NEA), OECD's nuclear development branch, was created in 1972.¹⁴¹ Dedicated to the promotion of cooperation in the safety and regulatory aspects of nuclear development, the NEA constantly assesses the economic value of nuclear energy for each member country.¹⁴² In addition, the NEA has pursued the uniformity of nuclear development and safety regulations.¹⁴³

Finally, OECD's efforts have been supplemented by the European Atomic Energy Community (EURATOM). EURATOM was created by the European Atomic Energy Community Treaty of 1959.¹⁴⁴ Unlike other nuclear treaties and agreements, EURATOM's central mission was clear and immediate: develop exchanges between countries to sponsor the speedy establishment and growth of nuclear industries.¹⁴⁵ Despite this developmental goal, however, Article 2 of EURATOM's charter concludes that the Community must establish and ensure the application of uniform safety standards for the protection of health.¹⁴⁶

¹³⁷ As a Cold War instrument, the IAEA's organizational structure is ill prepared to deal with the current proliferation of trade in nuclear materials. *Id.* at 1. For example, under the current IAEA mandate, the Agency is unable to inspect Russian nuclear materials. *Id.*

¹³⁸ Convention on the Organization for Economic Cooperation and Development, December 14, 1960, 12 U.S.T. 1728, T.I.A.S. 4891 (hereinafter OECD Treaty).

¹³⁹ *Id.* at Art. I.

¹⁴⁰ Riley, *supra* note 127, at 309 (citing Twelfth Report of the OECD-NEA (1983)).

¹⁴¹ *Id.* at 308.

¹⁴² *Id.*

¹⁴³ *Id.* (citing OECD-NEA, DESCRIPTION OF LICENSING SYSTEMS AND INSPECTIONS OF NUCLEAR INSTALLATIONS 149-55 (1980)).

¹⁴⁴ Treaty Establishing the European Atomic Energy Community (EURATOM), January 1, 1958, 298 U.N.T.S. 169.

¹⁴⁵ *Id.* at 172.

¹⁴⁶ *Id.*

IV. ANALYSIS

Despite the highly charged, emotional nature of the nuclear debate, most supporters and opponents would agree with a single tenet: the history of U.S. nuclear development is riddled with administrative mistakes and technological optimism. Without question, both U.S. policy makers and the nuclear industry made a variety of critical decisions which drastically impaired the country's program of nuclear development.

There is little doubt that America's nuclear production effort has failed.¹⁴⁷ Although no new reactors have been completed since the 1970s, new development appears years away.¹⁴⁸ Additionally, plant delays and cancellations have cost taxpayers billions of dollars.¹⁴⁹ Ironically, the demise of America's nuclear program comes at a time when French development, though slowing, continues its recognition of nuclear power as a reasonable energy source of the future.¹⁵⁰

Despite the pleas of America's nuclear manufacturers, a cap on nuclear liability has failed to insure nuclear development.¹⁵¹ The central issue, therefore, is whether a reduction in liability costs, standing alone, is sufficient to initiate significant production and development efforts. As demonstrated by the French nuclear experience, liability constraints are clearly insufficient.

Manufacturers look to a variety of expenses other than liability costs in making development decisions. Nevertheless, liability expenses are routinely cited as a *key* problem for various manufacturers and professionals.¹⁵² This was certainly true in the 1950s, when industry officials testified that development would not be a problem once Price-Anderson's liability constraints were implemented.¹⁵³ Unfortunately, such reliance

¹⁴⁷ See *supra* notes 46-48.

¹⁴⁸ See *supra* notes 49-50.

¹⁴⁹ The famous Shoreham plant, for example, was constructed at a cost of \$5.3 billion — and then never used. See Arthur Gottschalk, *Junked Nuclear Plant May Burn Gas*, THE HOUSTON CHRONICLE, July 26, 1992, at 13.

The Nuclear Regulatory Commission has established specific decommissioning procedures and regulations in an attempt to close facilities in an efficient manner. General Requirements for Decommissioning Nuclear Facilities, 53 Fed. Reg. 24018-01, July 27, 1988.

For a discussion of plant closures as externalities, see Martin J. Pasqualetti and Geoffrey Rothwell, *Who Pays to Close a Nuke?*, PUBLIC UTILITIES FORTNIGHTLY, Jan. 15, 1993, at 35.

¹⁵⁰ See *supra* notes 101-3.

¹⁵¹ See *supra* notes 46-50.

¹⁵² Such analysis certainly came to the forefront in the 1992 presidential election. Charging that Bill Clinton was 'totally in the pocket of the trial lawyers', Vice President Quayle's continuing referendum on tort and civil liability reform garnered broad support. See editorials: *Doing Business in America: a Real Liability*, THE WASHINGTON TIMES, Sept. 24, 1990, at G2; *Campaign '92: Bush More Progressive On Legal Reform*, THE DALLAS MORNING NEWS, Oct. 31, 1992, at 30A.

¹⁵³ See *supra* notes 14-15.

is clearly misplaced. In the rapid pursuit of liability constraints a variety of additional factors have been overlooked.¹⁵⁴

Although Price-Anderson did not cause the nuclear demise, U.S. reliance (historically, and in modern debates over litigation expenses) on liability caps is unfortunate. As the French nuclear program illustrates, the development of extraordinarily expensive, risky new technologies mandates governmental support far beyond simple liability legislation.¹⁵⁵ This need has been repeatedly acknowledged by U.S. leaders where the technology requires considerable development time and would not be developed as a purely profitable (e.g., product based) enterprise. For example, long term government assistance is provided for a variety of military development efforts and technologies. In the nuclear arena, the decision to avoid concentrated governmental support was made in 1956.

In the early 1950s, as Congress deliberated over nuclear power, nuclear proliferation, and the need for liability constraints, a variety of proposals were considered. Instead of pursuing such alternatives, however, Congress concluded in favor of independent industrial efforts.¹⁵⁶ History has proven the folly of such a decision.¹⁵⁷ Congressional adoption of one such alternative, however, would have produced a drastically different U.S. nuclear development program.

During original Price-Anderson deliberations in the 1950s, Senator Albert Gore, Sr. (D-Tenn.) and Representative Chet Holifield (D-Ca.) proposed a unique alternative to indemnification. As nuclear manufacturers lobbied for exclusive control over this new technology, these congressmen sought to restrain such unbridled enthusiasm. Gore and Holifield called for the government to build and run six nuclear reactors.¹⁵⁸ Unlike the 1955 Power Demonstration Reactor Program, the Gore-Holifield proposal would have created more than a 'showpiece' reactor designed to impress industry.¹⁵⁹ Instead, the Gore-Holifield proposal sought to establish the government sponsored Civilian Atomic Power

¹⁵⁴ This Comment is *not* intended as a referendum on the general merits of civil liability reform. It addresses only the factual pattern of a highly expensive, unstable technology, and the level of government support necessary to insure adequate development.

¹⁵⁵ While the U.S. government has provided financial and research support for nuclear manufacturers, assistance has been disorganized and haphazard, spread between dozens of initiatives, agencies and industries. This is in sharp contrast to the "almost fanatical drive" sometimes present in the French nuclear program. MOUNFIELD, *supra* note 62, at 103.

¹⁵⁶ Atomic Energy Act of 1954, Pub. L. No. 85-256, 71 Stat. 576 (codified as amended in scattered sections of 42 U.S.C.).

¹⁵⁷ See *supra* notes 46-50.

¹⁵⁸ Rosenthal, *supra* note 122, at 139.

¹⁵⁹ See WALKER, *supra* note 4, at 9.

Acceleration Program (CAPAP).¹⁶⁰ The Program was to spend \$400 million in the development, construction, and operation of six different nuclear reactors.¹⁶¹ The plan was designed to “advance the art of generation of electrical energy from nuclear energy at the maximum possible rate.”¹⁶² In addition to the Program’s exorbitant expense, however, it was opposed as unnecessary government involvement in a private sector development process.¹⁶³ Although the bill received Senate approval, it was opposed by the Eisenhower administration and failed in the House.¹⁶⁴ Its rejection was based entirely upon the premise that private industry would develop nuclear technology once the risk of unlimited liability was resolved.¹⁶⁵ Lewis Strauss, chairman of the Atomic Energy Commission, openly chided opponents as aiding “the attack which is being directed against the free enterprise development of nuclear power in this country.”¹⁶⁶ Despite such sentiment, as the final obstacle to Price-Anderson’s adoption, the defeat of Gore-Holifield proved the beginning of the end for U.S. nuclear manufacturers.

Clarity of hindsight is both illustrative and unfair. Nevertheless, in light of the French nuclear experience, it clearly appears that Congressional approval of Gore-Holifield would have resulted in an extraordinary U.S. nuclear development program, one which would have permanently established the U.S. as the world leader in nuclear technology.

First, the six test plants would have produced consistent technologies for use by manufacturers.¹⁶⁷ As with most start-up technologies, nuclear development was marred by duplication of effort and highly inefficient initial research activities. Instead of redundant research and de-

¹⁶⁰ Turkel & Lofquist, *supra* note 19, at 158.

¹⁶¹ *Id.*

¹⁶² *Joint Committee on Atomic Energy (JCAE), Hearings on Accelerating Civilian Reactor Program*, 84th Cong., 2nd Sess. 1-71 (1956), cited by WALKER, *supra* note 4, at 10.

¹⁶³ See generally Rosenthal, *supra* note 122, at 139 n.97 (citing H. GREEN & A. ROSENTHAL, *GOVERNMENT OF THE ATOM* 256 (1963)); William Lanouette, *Dream Machine*, *THE ATLANTIC MONTHLY* Co., April, 1983, at 37.

¹⁶⁴ Despite the bill’s tremendous cost, it retained considerable support. Indeed, once it was defeated in the House, “Democrats refused to allow consideration of the Price-Anderson bill, thereby delaying Congressional hearings until the beginning of the Eighty-Fifth Congress.” See Turkel & Lofquist, *supra* note 19, at 158.

¹⁶⁵ The proposal sparked major debate between members of the Joint Committee on Atomic Energy (JCAE), who were concerned with maintaining American nuclear leadership, and the Atomic Energy Commission (AEC) which argued in favor of continued private development. WALKER, *supra* note 4 at 10.

¹⁶⁶ Lanouette, *supra* note 163, at 37.

¹⁶⁷ Possible antitrust difficulties associated with such development processes have recently been rejected. See generally Division Raises No Antitrust Objection to Proposed Venture For Nuclear Reactors, *ANTITRUST AND TRADE REGULATION REPORT*, Sept. 17, 1992, p. 346.

velopment efforts, therefore, a central research effort would have concluded in favor of a single, efficient reactor design to be followed by private manufacturers. As the French nuclear program graphically illustrates, U.S. development consolidation would have produced a highly efficient and powerful nuclear industry.¹⁶⁸

Second, the development, construction and operation of six distinct reactors would have produced more accurate cost estimates for future production. As early nuclear development decisions were made, U.S. legislators believed national, economic and energy security concerns mandated U.S. leadership.¹⁶⁹ The country soon discovered, however, that technological leadership brought considerable expense.¹⁷⁰ Though this issue appears relatively insignificant when compared to the emotional debate over safety and waste disposal, exorbitant cost overruns have repeatedly proven the primary cause of plant cancellations and delays.¹⁷¹ The cost overrun problems became especially significant as nuclear plants became less competitive with coal in the late 1980s.¹⁷² Development of all new technologies elicits a variety of obvious and hidden expenses. Creation of these limited facilities would have uncovered the hidden costs of nuclear development. In turn, the plants would have provided critical cost-effectiveness and competitiveness data, resulting in enhanced decision making process with regard to later commercial development. As France discovered, with the accurate internalization of production costs, development can continue and expand as necessary.¹⁷³

Finally, the consolidation of research and design efforts would have produced a safer system of nuclear design and construction. Instead of unique, manufacturer-dependent safety designs, a single system would have been identified and refined. In addition, safety issues involving the construction and manufacturer of facilities would also have been identified during the experimental program. Critics of the French program, however, counter that uniformity has produced an inherently unsafe environment as every reactor would experience any latent, generic defects.¹⁷⁴ In reality, however, such system-wide difficulties are easily resolved once the problem is identified. As Alain Breton, director of economic prospects and strategy for Electricite de France (EDF), describes,

¹⁶⁸ See *supra* notes 96-103.

¹⁶⁹ See *supra* note 6.

¹⁷⁰ See *supra* note 21.

¹⁷¹ ENERGY INFORMATION ADMIN., OFFICE OF COAL, NUCLEAR, ELECTRIC AND ALTERNATE FUELS, U.S. DEPT. OF ENERGY, COMMERCIAL NUCLEAR POWER 11 (1988).

¹⁷² See *supra* note 55.

¹⁷³ See *supra* notes 96-103.

¹⁷⁴ LaFranchi, *supra* note 76, at 13.

“[w]hen the design is the same, we can undertake quick preventive intervention when we become aware of a problem.”¹⁷⁵

The potential success of such a joint venture is dramatically illustrated by a more recent creation: the First-Of-a-Kind Engineering Program (FOAKE). A five year initiative, FOAKE is a collaboration between the Department of Energy and the nuclear industry.¹⁷⁶ Under the plan, two nuclear plants have been selected for comprehensive development and analysis.¹⁷⁷ The \$200 million project will be financed by a \$100 million Department of Energy contribution, and a consortium of electric utilities.¹⁷⁸ Ironically, nearly forty years after the Gore-Holifield proposal, the goal of FOAKE is remarkably familiar: “to allow potential buyers to project the time and cost it will take to build a plant before they make any financial commitments.”¹⁷⁹ America’s industrial and legislative leaders, undoubtedly influenced by the French success story, have finally rejected original Atomic Energy Commission analysis and concluded in favor of a consolidated research effort.¹⁸⁰ Loosely associated with the National Energy Policy Act of 1992, FOAKE has received broad support in its efforts to revitalize America’s nuclear industry.¹⁸¹

In the 1950s there was undoubtedly a general belief in U.S. technological dominance, and a complete indifference toward energy sufficiency issues. It should not come as a surprise, therefore, that the \$400 million request — for a pilot program industry was willing to establish independently — met considerable resistance. Nevertheless, such fiscal concerns have proven short-sighted. As the United States finally implements consolidated research efforts, it is quite clear that rejection of Gore-Holifield was a fatal error in U.S. nuclear history.

¹⁷⁵ *Id.*

¹⁷⁶ David Stellfox, *Vendors Told To Stop Whining As FOAKE Process Moves Forward*, NUCLEONICS WEEK, Aug. 33, 1992, at 1.

¹⁷⁷ Specifically, the Westinghouse AP-600 and the General Electric Advanced Boiling Water Reactor have been selected for advanced study. INSIDE ENERGY/WITH FEDERAL LANDS, Jan. 18, 1993, at 12.

¹⁷⁸ Sixteen utilities are currently involved in the program. They are organized as the Advanced Reactor Corporation (ARC) by the Nuclear Power Oversight Committee (NPOC), the nuclear industry’s governing organization. *The Plan: At Age Two, Some Progress*, NUCLEAR NEWS, Jan. 1993, at 21.

¹⁷⁹ INSIDE ENERGY, *supra* note 177, at 12.

¹⁸⁰ See *supra* note 166.

¹⁸¹ The National Energy Policy Act of 1992 streamlined the licensing process of nuclear plants. A utility can receive an operating license before construction so long as the facility is built according to a certified design. FOAKE assists in the creation of such a certified “safe” design.

V. RECOMMENDATIONS

As always, it is easy to analyze and criticize past governmental efforts. Recommendations for current legislation and activity, however, are far more difficult. The U.S. public has repeatedly shown tremendous apathy regarding the nation's energy policy. Absent any dramatic changes in world energy activity, therefore, U.S. nuclear development will remain at a standstill.¹⁸² Even if new nuclear development is years away, several viable options remain available.

First, the United States government should assist efforts toward inter-utility cooperation in nuclear development. Compared to the enormous European state-run organizations, U.S. utility companies remain regional and quite small. As a result, they are in no position to finance billion dollar nuclear projects.¹⁸³ Cooperative efforts such as the Advanced Reactor Corp.'s involvement in FOAKE must be continued and supported.¹⁸⁴

As the U.S. nuclear industry learned, the tremendous expense of nuclear development requires a cooperative (government and inter-industry) effort. Such endeavors reduce the expense of innovative leadership and assist industry in developing practical applications from primary research.¹⁸⁵ Cooperative efforts are uniquely important in the nuclear context, given the exorbitant expense of production, and the tremendous economies of scale available through unified research.¹⁸⁶

Second, as nuclear development returns to the United States, existing facilities should be expanded before additional sites are established. The placement of additional reactors within existing facilities should reduce siting and regulatory delays. The creation of such 'nuclear parks' has been effectively used by France in the avoidance of NIMBY (Not In My Back Yard), NIMTOO (Not in My Term of Office) and BANANA (Build Absolutely Nothing Anywhere Near Anyone) syndromes.¹⁸⁷ The use of nuclear parks is the most efficient manner of surviving the tremendous time and expense associated with plant siting and construction. Simply put, with respect to public concern and regulatory needs, it is far easier to expand an existing facility than to develop a new site.

Finally, the United States must adopt a comprehensive, long-term

¹⁸² See *supra* notes 49-51.

¹⁸³ Even a standardized 1000 M/WE plant design, as developed by FOAKE, could cost over \$1 billion. Casey Bukro, *At Age 50, Nuclear Power Struggling With a Midlife Crisis*, CHICAGO TRIBUNE, Nov. 16, 1992, at C1 (quoting A. David Rosin, President of the American Nuclear Society).

¹⁸⁴ See success of French nuclear program, *supra* notes 96-103.

¹⁸⁵ Possible antitrust violations of such a policy have already been rejected. See *supra* note 167.

¹⁸⁶ LaFranchi, *supra* note 76, at 13.

¹⁸⁷ *Id.*

national energy policy. As parties within and outside of the Department of Energy and Nuclear Regulatory Commission repeatedly testify, however, both entities are highly politicized institutions.¹⁸⁸ In addition, these organizations *are not responsible for*, the formulation of an effective U.S. energy policy. Unfortunately, in the absence of executive or legislative direction, both organizations have been forced to adopt this new responsibility. The time has come for leadership and direction from the country's elected officials.

President Clinton's early comments regarding the Department of Energy appeared quite promising. In addition, Hazel O'Leary, the new Secretary of Energy, has received wide praise as a utility executive and former regulator.¹⁸⁹ An executive vice-president of Northern States Power Co., Ms. O'Leary has already faced the nuclear impasse — Northern States “nearly became the first utility in the country to have to shut a nuclear power plant for a lack of waste storage.”¹⁹⁰ Nevertheless, Ms. O'Leary is faced with the unenviable task of resurrecting an agency floundering in the absence of a clear nuclear agenda.¹⁹¹ Given this difficult condition, a short term resolution to the nation's nuclear development dilemma appears doubtful.¹⁹² Steps must immediately be taken, however, to evaluate current U.S. losses, and protect critical technology for future applications. Accordingly, the following actions should be taken by Ms. O'Leary early within her administration:

1. FIRMLY DETERMINE THE COUNTRY'S FUTURE ENERGY NEEDS

One of the primary reasons for America's nuclear demise was over-

¹⁸⁸ As one commentator has noted, “The [Nuclear Regulatory] Commissioners are frequently characterized as being too political and arguing from entrenched positions rather than responding flexibly to the current situation.” See THOMAS, *supra* note 52, at 112.

¹⁸⁹ See generally, Michael Parrish, *The Search For Clinton's Energy Omens*, LOS ANGELES TIMES, Dec. 29, 1992, at D1.

¹⁹⁰ *Id.*

¹⁹¹ The nuclear industry has voiced cautious support of Ms. O'Leary, citing her March 1992 testimony before the Senate Energy & Natural Resources Committee:

If the waste issue is not resolved, there will be no new investment in nuclear power under present circumstances. . . It is not reasonable to assume that responsible business people will risk billions of dollars to invest in new nuclear plants when there is no place to store spent fuel.

Dave Airozo & Elaine Hiruo, *O'Leary Appointment Is a Mixed Bag For Commercial Nuclear Industry*, INSIDE N.R.C., Dec. 28, 1992, at 1.

¹⁹² Such success appears even less likely if, as recent reports suggest, Ms. O'Leary holds little influence over the nation's energy policy. As THE WALL STREET JOURNAL reported,

Meanwhile, some cabinet secretaries have learned just how limited their authority really is. Energy Secretary Hazel O'Leary had little if any influence over the president's proposed energy tax, which would be the most important change in energy policy in a decade, and has had no private meetings with the president since taking office.

Michael K. Frisby, *At The White House, Titles Offer Few Clues About Real Influence*, THE WALL STREET JOURNAL, Mar. 26, 1993, at A1.

development based upon incorrect energy demand forecasts.¹⁹³ As with previous development, a variety of different interests have advanced different energy need predictions. Although energy projections may appear fairly objective in nature, "there is always room for different figures to be put forward."¹⁹⁴ Inevitably, each such prediction is laced with individual agendas, ideology and bias. As one commentator has noted, which of us tend to believe the experts who warn that our system of resources is limited? And which of us optimistically follow those who teach that they cannot possibly tell yet what resources might lie unknown beneath the soil or in the sea or even in the air? And the same question about our own bias may be raised for the bias of the experts themselves.¹⁹⁵

Ms. O'Leary must first work to evaluate such predictions, and establish firm guidelines for future needs. In the absence of effective planning and a clear understanding of the nation's energy requirements, the problem of improper development is sure to be repeated — for any energy resource advanced by President Clinton.

2. IDENTIFY FOAKE AS A BUDGETARY PRIORITY

As with most other aspects of society, the Department of Energy will be forced to absorb budget cuts and fiscal constraints. Indeed, in President Clinton's February 17, 1993 address to Congress he specifically identified nuclear research and development as a paradigm program which is "no longer needed" and should be reduced.¹⁹⁶

Given such constraints, Ms. O'Leary should establish the First-Of-A-Kind-Engineering Program as a top priority.¹⁹⁷ All parties agree that budget cuts must be made. Nevertheless, if FOAKE were eliminated "it would be a severe setback."¹⁹⁸ As the nuclear industry responded, programs such as FOAKE "must be maintained to conclude these cost-shared initiatives that will benefit the nation at the turn of the cen-

¹⁹³ See *supra* note 53.

¹⁹⁴ GEOFFREY GREENHALGH, *THE FUTURE OF NUCLEAR POWER* 49 (1988).

¹⁹⁵ *Id.* (quoting M. Douglas, *Environments at Risk: Culture and Nature*, in *ECOLOGY, THE SHAPING INQUIRY* 132 (J.C.M. Benthall ed., 1972)).

¹⁹⁶ Dave Airozo et al., *Clinton Singles Out Nuclear R&D as Good Candidate For Budget Ax*, *NUCLEONICS WEEK*, Feb. 25, 1993, at 1.

¹⁹⁷ President Clinton has not yet released his final budget proposal. Nevertheless, his general budget plan has called for continued funding of nuclear R&D to maintain the current generation of reactors and the "licensing actions for reactors that have a commercial interest" — an apparent reference to DOE's ongoing first-of-a-kind engineering (FOAKE) and design certification program. *Id.*

¹⁹⁸ Robert C. Cowen, *Nuclear Power Faces Uncertain Fate*, *THE CHRISTIAN SCIENCE MONITOR*, Feb. 24, 1993, at 12.

ture.”¹⁹⁹ A uniquely American version of the development consolidation which produced the successful French nuclear program, FOAKE should be maintained for the benefit of America’s future energy needs. At \$40 million/year (half of which is financed by industry), FOAKE funding should remain a high priority, even at the expense of other primary research efforts.²⁰⁰

3. INTER-AGENCY CONSOLIDATION

The nuclear industry is currently regulated by nearly one-dozen agencies, departments and committees in the federal government. Their redundant efforts have produced an extraordinarily inefficient system of control and review. In addition to increased costs, this jurisdictional haze reduces the effectiveness of otherwise well-intentioned safety regulations.

Ms. O’Leary should immediately identify each such organization, and work to consolidate their influence. A clear accounting of agency authority, or lack thereof, should be established. Nuclear review should be limited to the specific authority exercised by a reviewing body. Currently, high-profile issues such as nuclear safety are repeatedly and needlessly debated before entities reviewing any aspect of nuclear production. Such media grandstanding would be reduced once jurisdictional lines are clearly established. In addition, more effective control over the review process would be exercised by the newly empowered agencies.

In the absence of a proper assimilation of data, Ms. O’Leary’s office is doomed to repeat mistakes of the past. Consolidation of nuclear legislative review and national research efforts are a critical first step in the development of a new, activist Department of Energy.

President Clinton’s policy must establish America’s energy concerns and goals with respect to environmental, dependence and financial needs. Although America’s resources appear cheap and unlimited; they remain finite. In the absence of a national energy policy, the exploitation of such resources will continue unabated. President Clinton will undoubtedly, and reasonably, advance research for a variety of energy sources. Nevertheless, nuclear power remains a significant aspect of U.S. — and world — energy policy, and efforts should be made to streamline its effectiveness.

¹⁹⁹ Airozo, *supra* note 196, at 1 (quoting Edward Davis, president of the American Nuclear Energy Counsel).

²⁰⁰ See *supra* note 178.

CONCLUSION

The impact of these regulatory structures is clear. Although baseline performance and safety standards have been established by various international agreements, national regulations play a critical role in nuclear development. The United State's development effort, based upon limited liability, has clearly failed. Although government involvement in private research efforts is *per se* undesirable, a few crucial exceptions exist. As the French program has demonstrated, nuclear power can be used effectively and safely as a primary energy source. This is not to suggest, however, that mere emulation of the French efforts would produce a successful U.S. nuclear industry. France's considerable success certainly merits respect and thorough analysis. Nevertheless, the U.S. political and industrial complex is unique. First-Of-A-Kind Engineering maintains this uniquely American approach to research consolidation, and should be continued by the current Administration.