THE GULF OIL SPILL: THE ROAD NOT TAKEN[1]

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Prometheus stole fire from the gods and brought it to humans. The gods found out and sent Pandora, whose box was opened to visit evils upon the world. Prometheus was chained to a rock, to have his liver eternally eaten by vultures. (He was saved by Hercules.)

Prometheus is the oil company stealing fire in the form of oil from the gods. Pandora gave us the spill. Along with the oil-soaked birds, the fouled beaches, and the decimated fishing and recreation industry of the Gulf states, the recent Gulf oil spill has another consequence. It reminds the nation of past failed opportunities to control the unwanted effects of failed technology in deep sea drilling and, for that matter, the inability of environmental law to confront other failures of technology during the past half-century.[2] Dredging up the details of this history may be useful in designing permanent solutions to avoid future catastrophes. To be sure, the oil spill may be the result of a combination of human error, the proliferation of oil drilling in deep waters, and a variety of possible technology failures.[3] But public focus has been upon the failure of the "blowout

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[1] This article is part of a larger inquiry into the legal issues surrounding the "basic drivers" of environmental problems—population growth, large-scale corporations, economic growth and our consumer society, modern science, and technology. For one early discussion of environmental problems in these terms, see ALLAN SCHNAIBERG, THE ENVIRONMENT: FROM SURPLUS TO SCARCITY 4–5 (1980).

[2] For a broad history of recent problems with technology, see EDWARD TENNER, WHY THINGS BITE BACK: TECHNOLOGY AND THE REVENGE OF UNINTENDED CONSEQUENCES (1996).

[3] "Technology" is an ambiguous term, but we shall employ it to mean the application of science and technical knowledge to industry, manufacturing, commerce, and the arts, and knowledge itself. "Technology failure" can refer to defects in the machinery, the defects in the use of the machinery, which may include human error, or the impact of the use of machinery, whether defective or not, upon society and the environment. The context of our discussion will hopefully make clear to which of these meanings we are referring. In the case of the Gulf oil spill, several causes have been identified including, but not limited to, faulty cement and its testing, inadequate well design, human error, including mistaken diversion of the rising

preventer" ("BOP") and its "shear ram," which operate to cut off the flow of oil in emergencies.[4] It is this alleged failure of the BOP which provokes reflections on the broader problem of achieving control over the technological contributions to environmental pollution. The central player in my reflections is the Technology Assessment Act of 1972.[5] I trace its history and eventual defunding in 1995. I trace the subsequent effort to find a rational technology policy by reliance upon quantitative policy analysis which is not fully successful. I urge the resurrection of the Technology Assessment Act, but with major amendments to help Congress assess the technologies of the future, with major reservations regarding any effective implementation in light of the political economy of our age.

I. THE EARLY HISTORY: THE HOPES AND FEARS OF THE 1960S

I will begin the story in the 1960s, although ambivalence about technology lies deep in the history of western civilization and, more recently, in American civilization itself.[6] It was the 1960s

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fluid and delays—both due to an absence of procedures and training for emergencies, as well as the failure of the blowout preventer, the absence of a backup shear ram, and an inadequate record of maintenance. Many, including myself, have extended technology to include intellectual "products" as well. Richard Brooks, *Intellectual Technology: The Dilemma of Environmental Law*, 15 RUTGERS COMPUTER & TECH. L.J. 411, 414, 424–31 (1989); *see also* DONELLA MEADOWS ET AL., GROPING IN THE DARK: THE FIRST DECADE OF GLOBAL MODELLING 127–28, 157–58 (1982) (considering "technology" and "technological advance," in the context of global modeling, to include accumulated general knowledge and other intellectual products).

[4] *See, e.g.*, Mika Gröndahl et al., *Investigating the Cause of the Deepwater Horizon Blowout*, N.Y. TIMES, June 21, 2010, http://www.nytimes.com/interactive/2010/06/21/us/20100621-bop.html (discussing the failure of the blowout preventer and blind shear ram).

[5] Technology Assessment Act of 1972, Pub. L. No. 92-484, 86 Stat. 797 (codified at 2 U.S.C. §§ 471–481 (2006)).

[6] *See* LEWIS MUMFORD, THE MYTH OF THE MACHINE: THE PENTAGON OF POWER (2d prtg. 1970) (discussing the history of technology in western civilization). Perhaps the most famous revolt against machines was the Luddite rebellion in England in 1811 against the introduction of the wool finishing machines. KIRKPATRICK SALE, REBELS AGAINST THE FUTURE: THE LUDDITES AND THEIR WAR ON THE INDUSTRIAL REVOLUTION 3–5 (1995). This rebellion symbolized a generalized suspicion of technology, whether defective or not. *Id.* at 5. For a discussion of the history of America's attitudes toward technology, see VICTOR FERKISS, NATURE, TECHNOLOGY AND SOCIETY: CULTURAL ROOTS OF THE CURRENT ENVIRONMENTAL CRISIS 64–104 (1993). Karl Marx documents the human costs of the factory system in *Capital*, KARL MARX, CAPITAL: A CRITIQUE OF POLITICAL ECONOMY (Frederick Engels ed., Samuel Moore & Edward Aveling trans., The Modern Library 1906) (1867). Several authors have documented the reaction to technological progress. *See, e.g.*, DAVID SHI, IN SEARCH OF THE SIMPLE LIFE: AMERICAN VOICES PAST AND PRESENT 3–4 (1986) (discussing the persistence, in America, of the concept of returning to the "simple life"). Aside from Thoreau's *Walden*, perhaps it was Henry Adams, in his classic, *The Education of Henry Adams*, who best expressed revulsion against technology, symbolized by reference to the "dynamo." HENRY ADAMS, THE EDUCATION OF HENRY ADAMS 318, 353, 396 (Vintage Books 1990) (1907).

when many were concerned about technological growth and its effects on America, and across the world. Concerns about technology, including the proposed building of the supersonic transport, the construction of nuclear power plants, off-coast drilling, and the manufacture of pesticides, dominated the news.[7]

In the 1960s, the opposition to technology was not merely concern with defective technology or emissions from such technology. Rather, there was a profound reaction against technology itself, viewed as part of what was perceived as a more general social and political failure in society.[8] This is exemplified in the student revolt against being treated in large universities as IBM punch cards; "do not fold, spindle or mutilate!" was the slogan.[9] Some associated technology with science and suggested a democratic reform of the governance of science itself.[10] Others, such as Barry Commoner, found a fatal flaw in technology's creation of synthetic chemicals created by the reductive sciences—chemicals which could not be recycled in "the closing circle" of the ecosystem.[11] Commoner believed that the reductive sciences, especially chemistry, were employed by the capitalist economic system to create non-recyclable substances.[12] Still others, such as Rachael Carson, although also interested in synthetic chemicals (i.e. DDT in the ecosystem), were content to recommend more immediate steps such as banning the manufacture, sale, and use of the chemical.[13]

The latest issue pertaining to technology is biotechnology. FRANCIS FUKUYAMA, OUR POSTHUMAN FUTURE: CONSEQUENCES OF THE BIOTECHNOLOGY REVOLUTION xii–xiii (2002). Underlying many of the writings on technology is a deep animosity towards "the technical" which can be traced back to Aristotle. More recently, with the works of Bacon, Dewey, and Heidegger, technology has been rehabilitated. For a remarkable history of this development, see DAVID ROTHENBERG, HAND'S END: TECHNOLOGY AND THE LIMITS OF NATURE (1993).

[7] *See, e.g.*, RICHARD O. BROOKS ET AL., LAW AND ECOLOGY, THE RISE OF THE ECOSYSTEM REGIME 87–117 (2002) (discussing concern over the development and utilization of pesticides, including DDT). For an account of the supersonic transport and technology assessment, see LAURENCE H. TRIBE, CHANNELING TECHNOLOGY THROUGH LAW 101–54 (1974).

[8] Georgine M. Pion & Mark W. Lipsey, *Public Attitudes Toward Science and Technology: What Have the Surveys Told Us?*, PUB. OPINION Q., Autumn 1981, at 303, 310.

[9] Seymour Martin Lipset & Phillip G. Altbach, *Student Politics and Higher Education in the United States*, COMP. EDUC. REV., June 1966, at 320, 329; *see also* Steven Lubar, *"Do Not Fold, Spindle or Mutilate": A Cultural History of the Punch Card*, J. AM. CULTURE, Winter 1992, at 43, 46.

[10] This concern resulted in, among other things, proposals for "science courts" to assess complex science and technology. *See* Arthur Kantrowitz, *Proposal for an Institution for Scientific Judgment*, SCI., MAY 1967, at 763, 763–64.

[11] BARRY COMMONER, THE CLOSING CIRCLE: NATURE, MAN AND TECHNOLOGY 260–61 (1971).

[12] *Id.* at 130–33.

[13] *See generally* RACHAEL CARSON, SILENT SPRING 15–37 (1962) (discussing the development of synthetic pesticides and their affect on the environment and human species,

The quest for power and the search for profit have continued to remain the dominant themes of the German philosophers of the Frankfurt School, beginning with Marcuse in the 1960s, and extending to the present day with Foucault and others.[14] Perhaps the most famous of the writings on technology of the day was Jacques Ellul's *The Technological Society*.[15] Ellul found technology in the assemblage of instruments which reflected a mode of thought designed to achieve efficiency.[16] Ellul believed that technology stimulated a new way of life, a new kind of society, changing the manner of thought in modern society.[17] He believed that "*la technique*," reliance upon a reasoning by ends and means rather than deliberation of ends, would lead to a future dominated by the power of technology without guidance.[18]

In the wake of these and other theories, the "radicals" of the 1960s and 1970s proposed a cultural revolution, broad economic reforms, "a softer path" to energy production, and a variety of other reforms.[19] Charles Reich, with his popular *The Greening of America*,[20] found technology to be "mindless" (like Leo Marx's *The Machine in the Garden*[21]), offensive to a simpler way of life, and interfering with the achievement of harmony with nature.[22] Nothing less than a change in the mindset of the people could produce needed reforms. Ferkiss hoped for a "technological man" who could understand science and technology, but control them with a "new humanism."[23] Economic reforms were suggested by Galbraith who, in *The Affluent Society*, urged a rebalancing of consumption between private desires and public needs.[24] Others, such as Helen and Scott Nearing, following a long American

and questioning why such pesticides are still in use).

14 Douglas Kellner, *Frankfurt School*, U.C.L.A., http://gseis.ucla.edu/faculty/kellner/essays/frankfurtschool.pdf (last visited Jan. 10, 2011).

15 *See* JACQUES ELLUL, THE TECHNOLOGICAL SOCIETY (John Wilkinson trans., Alfred A. Knopf, Inc. 4th prtg. 1967) (1954).

16 *Id.* at 19–20.

17 *Id.* at 5–6.

18 *See generally id.* (discussing the concept that humans must accept and adapt to technology, not by relying on the reasoning of the ends and means, but by a deliberation of the means themselves).

19 CHARLES REICH, THE GREENING OF AMERICA 223 (1970).

20 *Id.* at 7.

21 *See generally* LEO MARX, THE MACHINE IN THE GARDEN: TECHNOLOGY AND THE PASTORAL IDEAL IN AMERICA (1964) (documenting the literary responses to the industrial revolution and the growing technology).

22 REICH, *supra* note 19, at 28–29.

23 VICTOR FERKISS, TECHNOLOGICAL MAN: THE MYTH AND THE REALITY 271–72 (1969).

24 JOHN KENNETH GALBRAITH, THE AFFLUENT SOCIETY 198 (1958).

tradition extolling the simple life, simply recommended bailing out of the market nexus, and heading back to a self-sufficient life on the land.[25] Many followed in their wake. At a more modest level, Schumacher suggested the search for alternative "small scale" technologies.[26] His recommendations were to be followed in later years by those promoting "appropriate technology."[27] Others followed in their footsteps and proposed more specific technological reforms such as "soft energy paths."[28]

Despite the fervor of 1960s, these radical alternatives were not adopted.[29] By the 1970s, the 1960s radical concerns over the social, economic, and political consequences of technology as a dominant force in our society had disappeared from the public consciousness.[30] Instead, with Earth Day in 1970, the public sought to directly control, primarily through "end-of-pipe" solutions, those pollutants continuously emerging in a steady stream from the technologies found on farms, in factories, and from automobiles.[31] Thus, neither the onrush of technology itself, nor large-scale accidents resulting from technological failure, were addressed.

The National Environmental Policy Act of 1969 required environmental impact statements of significant federal actions.[32] Some of these actions included the use of new technologies, but unfortunately, for the most part, the statements did not focus carefully upon the technologies and their flaws.[33] This failure can

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[25] *See generally* HELEN NEARING & SCOTT NEARING, LIVING THE GOOD LIFE: HOW TO LIVE SANELY AND SIMPLY IN A TROUBLED WORLD (Schocken Books Inc. 1970) (1954) (discussing how to live a self-sufficient life away from the modern world).

[26] E.F. SCHUMACHER, SMALL IS BEAUTIFUL: ECONOMICS AS IF PEOPLE MATTERED 20 (1973).

[27] *Id.* at 167–69.

[28] *See generally* ARMORY B. LOVINS, SOFT ENERGY PATHS: TOWARD A DURABLE PEACE (1977) (discussing a transition to "soft" energies that tend to be more flexible and sustainable than the "hard" energies currently in use).

[29] Understanding fully the failure of the "cultural revolution" of the 1960s is important for those who continue to promote such grand reforms. For one recent fine effort to continue the tradition of the 1960s, see JAMES GUSTAVE SPETH, THE BRIDGE AT THE EDGE OF THE WORLD: CAPITALISM, THE ENVIRONMENT, AND CROSSING FROM CRISIS TO SUSTAINABILITY (2008). Speth offers some suggestions for achieving such changes. *Id.* at 194–95. What is required may be an in-depth study of the environmental and other social movements and revolutions to determine how the changes he recommends might take place. *Id.* at 215.

[30] *Id.* at 116.

[31] *Id.* at 18–19.

[32] National Environmental Policy Act of 1969, Pub. L. No. 91-190, § 102, 83 Stat. 852, 853–54 (1970) (codified at 42 U.S.C. § 4332(C) (2006)).

[33] Exceptions to ignoring the flaws in technology include those of us who sought to stop the building of nuclear plants at the time, and Ralph Nader, who found flaws in the machinery of automobiles. *See* RALPH NADER, UNSAFE AT ANY SPEED: THE DESIGNED-IN DANGERS OF THE AMERICAN AUTOMOBILE vii–xi (1965) (discussing how, at the time, the automobile was "the only transportation vehicle to escape being called to meaningful public account," even though

be seen in a review of the environmental impact statements prepared by the Minerals Management Service ("MMS") in the course of its leasing outer continental shelf lands.[34]

In the early 1970s, amendments to the Clean Air Act,[35] the Clean Water Act,[36] and other toxic control laws were also adopted.[37] These laws sought to promote technologies through "technology forcing"—requiring technologies for the end-of-pipe minimization of effluents and emissions of pollutants.[38] Thus, these laws focus upon assessing pollution control devices, rather than assessing the technology as a whole. For example, these laws require an assessment of the catalytic converter, but not the car or truck. Thus, they do not prevent the initial undertaking of dangerous new technologies in the first place, nor do they do not anticipate large-scale accidents from new technology during their extended

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the automobile was responsible for the death of, or injury to, millions of people).

[34] The Outer Continental Shelf Lands Act provides for the Secretary to maintain an oil and gas leasing program. 43 U.S.C. § 1344 (2006). Section1344(a)(1) of the Act states:

> Management of the outer Continental Shelf shall be conducted in a manner which considers economic, social, and environmental values of the renewable and nonrenewable resources contained in the outer Continental Shelf, and the potential impact of oil and gas exploration on other resource values of the outer Continental Shelf and the marine, coastal, and human environments.

43 U.S.C. § 1344(a)(1). Section 1344(a)(2) lists factors that the Secretary should consider. 43 U.S.C. § 1344(a)(2). Subsections B, G, and H deal with environmental factors. 43 U.S.C. §§ 1344(b), (g), (h). NEPA is specifically mentioned in Section 1344(b)(3). This section states that "The leasing program shall include estimates of the appropriations and staff required to— . . . (3) conduct environmental studies and prepare any environmental impact statement required in accordance with this subchapter and with section 4332(2)(C) of title 42." 43 U.S.C. § 1344(b)(3). For a detailed account of the complete procedure, see EXECUTIVE OFFICE OF THE PRESIDENT OF THE U.S., REPORT REGARDING THE MINERALS MANAGEMENT SERVICE'S NATIONAL ENVIRONMENTAL POLICY ACT POLICIES, PRACTICES, AND PROCEDURES AS THEY RELATE TO OUTER CONTINENTAL SHELF OIL AND GAS EXPLORATION AND DEVELOPMENT (2010), *available at* http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100816-ceq-mms-ocs-nepa.pdf. There has been some recent litigation over how NEPA applies to the OCSLA. In *Ctr. for Biological Diversity v. U.S. DOI*, 563 F.3d 466, 480–82 (D.C. Cir. 2009), the D.C. Circuit court applied the ruling from *Wyoming Outdoor Council v. U.S. Forest Serv.*, 165 F.3d 43 (D.C. Cir. 1999), and held that the petitioners' NEPA challenges were not ripe for review. They were not ripe because the Court determined that NEPA obligations do not apply at the pre-leasing stage of the leasing program. *Ctr. for Biological Diversity*, 563 F.3d at 480. The Department of Interior had only approved the Leasing Program at issue—no lease-sales had yet occurred. *Id.* Therefore, the Leasing Program had not yet reached that "critical stage" where an "irreversible and irretrievable commitment of resources" has occurred that will adversely affect the environment. *Id.*

[35] 42 U.S.C. §§ 7401–7671q (2006).

[36] 33 U.S.C. §§ 1251–1387 (2006).

[37] For a detailed historical account of these laws, see ABA SECTION OF ENV'T, ENERGY AND RES., THE EVOLUTION OF NATURAL RESOURCES LAW AND POLICY (Lawrence J. MacDonnell & Sarah F. Bates eds., 2010).

[38] These laws and their descendants now occupy the central curriculum for environmental lawyers and their preparation for practice in the fields of environmental law.

lifecycle.[39]

In 1990, both the Clean Air Act and the Clean Water Act were amended to include attention to large-scale accidents. The "Bhopal Amendments," adopted in response to a toxic explosion in India, amended the Clean Air Act to deal with toxic explosions.[40] In response to the *Exxon Valdez* oil spill, the Oil Pollution Act of 1990 was adopted.[41] Both of these laws, at least in theory, might address the technological concerns of the Gulf spill. The amendments to the Clean Air Act took a preventive approach through planning and regulation.[42] The Oil Spill Act included an insurance approach which required liability insurance for the responsible parties of the spills.[43]

More specifically, the Clean Air Act might apply to the air pollution resulting from the spill in the following manner. Air pollution from both the oil in the water and the dispersants is presently being monitored by EPA.[44] The Clean Air Act contains a multitude of provisions designed to force better technologies for controlling air pollution from stationary sources. Some of these provisions reach beyond end-of-pipe solutions to authorize the review of the entire process of production, as well as scattered smaller sources which produce the pollution.[45] However, the most relevant section of the Clean Air Act is the so-called "Bhopal Amendment," which addresses toxic and flammable air pollutants that result from industrial accidents. This amendment requires industry to adopt careful plans for detecting possible sources of explosions, correcting deficiencies, adopting safer methods of production, and adopting a remedial plan in the event of an accident.[46] Unfortunately, EPA has excluded oil production from

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[39] The failure of old technology is an especially important risk. One recent example is the failure of a natural gas pipeline. Andrew W. Lehren, *Millions of Miles of Pipe, and Years of Questions*, N.Y. TIMES, Sept. 25, 2010, at A1.

[40] Clean Air Act Amendments of 1990, Pub. L. No. 101-549, § 301, 104 Stat. 2399, 2563–74 (codified as amended at 42 U.S.C. § 7412(r) (2006)).

[41] Oil Pollution Act of 1990, Pub. L. No. 101-380, 104 Stat. 484 (codified as amended in scattered sections of 14, 16, 23, 26, 33, 43, 46 U.S.C.); *see also* 33 U.S.C. §§ 2701–2762 (2006).

[42] 42 U.S.C. § 7412(r).

[43] *See* 33 U.S.C. §§ 2701–2720.

[44] U.S. Envtl. Prot. Agency, *EPA Response to BP Spill in the Gulf of Mexico: Monitoring Air Quality Along the Gulf Coast*, EPA, http://www.epa.gov/bpspill/air-mon.html (last updated Oct. 9, 2010); *see also* U.S. Envtl. Prot. Agency, *EPA Response to BP Spill in the Gulf of Mexico: Questions and Answers on Dispersants*, EPA, http://www.epa.gov/bpspill/dispersants-qanda.html (last updated Oct. 8, 2010).

[45] 42 U.S.C. § 7412(d)(2).

[46] 42 U.S.C. § 7412(r)(1). Another interesting provision in the Clean Air Act distinguishes between "essential" and "nonessential" products. 42 U.S.C. § 7671i.

this provision, suggesting that the crude oil does not meet the threshold standards of toxicity or flammability.[47]

But, even if we recognize these modest laws for reviewing technology, the problem lies much deeper. As we witnessed in the Gulf oil spill, the regulatory enforcement of these laws was undercut by inadequate staff, a revolving door of personnel between industry and government, and incentives for government to limit its enforcement.[48] All of these problems are due to the way in which business is done in Washington, and will not be completely fixed until those changes are made. Such changes were precisely the practices to be reformed by the abandoned broad cultural and economic agenda suggested during the 1960s.

In addition to the statutory efforts to control technology, in the last quarter of the twentieth century another legal form of technology control emerged, but without the name "technology control." This was the rise of the mass tort suit, which modified common law tort rules, either by judge-made or statutory law.[49] Lawsuits are brought by classes of persons harmed by industrial accidents and the products of old and new technologies. Toward the end of the century, however, resistance arose to the use of mass tort remedies. At the turn of the century, after 9/11, other public funds were created by statute to reimburse victims.[50] In the present Gulf oil suit, both reimbursement through private funds and tort lawsuits are underway;[51] the cost of these lawsuits may deter other oil companies from negligent practices. The virtue of such suits is that they can circumvent the failure of legislative regulatory remedies which do not fully compensate the victims. The limits of such common law remedies include the difficulty of formulating

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[47] *See* 40 C.F.R. §§ 82.66, 82.70; 42 U.S.C. §§ 7671i(b), (d).

[48] Thus, in the current licensing of drilling, enforcement was limited by the need to get drilling up and running to insure employment and garner tax revenues from the resulting oil revenues.

[49] *See* TRIBE, *supra* note 7, at 55–56; Milton Katz, *The Function of Tort Liability in Technology Assessment*, 38 U. CIN. L. REV. 587 (1969) (examining the implications of certain doctrines and theories of tort liability for technology assessment, and the reciprocal implications of technology assessment for the tort theories and doctrines).

[50] *See generally* 28 C.F.R. §§ 104.1–104.71 (2009) (implementing the provisions of the September 11th Victim Compensation Fund of 2001; *see also* KENNETH FEINBERG, WHAT IS A LIFE WORTH?: THE UNPRECEDENTED EFFORT TO COMPENSATE THE VICTIMS OF 9/11 (2005) (examining the author's experience in the implementation of the 9/11 Victims Fund).

[51] Jef Feeley & Margaret Cronin Fisk, *BP Will Face 'Thousands' of Spill Cases, Judge Says*, BLOOMBERG BUSINESSWEEK (Sept. 16, 2010), http://www.businessweek.com/news/2010-09-16/bp-will-face-thousands-of-spill-cases-judge-says.html; *see also BP to Pay a Second Month of Loss of Income Claims*, BP (June 04, 2010), http://www.bp.com/genericarticle.do?categoryId=2012968&contentId=7062660.

relevant doctrines upon which these remedies might be based, the high transaction costs of such tort suits, and the courts' institutional incapacity to handle such mass torts.

II. A SECOND START IN HISTORY: THE TECHNOLOGY ASSESSMENT ACT

Shortly after Earth Day, a little known second alternative for the control of technology was adopted. Promoted by the National Academy of Sciences, and shaped by the House Subcommittee on Science, Research, and Development, the Technology Assessment Act of 1972 was adopted.[52] The Technology Assessment Act established a Congressional Office of Technology to assess new technologies which might result in or create serious harms or benefits, whether economic, social, or environmental.[53] The Office was to inform Congress regarding these technologies and their harms and benefits.[54] Such oil-related technologies as oil shale mining, oil production in the Arctic National Wildlife Refuge, tanker transportation of oil, and offshore energy systems were assessed.[55]

The principal purpose of the Technology Assessment Act was to assess the consequences of technologies as such, and inform Congress regarding these technologies.[56] However, the assessments were at the request of individual Congress members, and there was no centralized Congressional structure to receive and evaluate them.[57] Only secondarily did the assessments focus upon the

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[52] Technology Assessment Act of 1972, Pub. L. No. 92-484, 86 Stat. 797 (1972); Katz, *supra* note 49, at 588.

[53] Technology Assessment Act §§ 2(b), 3. This assessment might include both the consequences of operating the technology without defects, as well as technology with anticipated defects. All such defects might be known as "defects." For example, a car with tail pipe pollution, or unanticipated defects such as exploding machinery, could be considered a defect.

[54] Technology Assessment Act §§ 3(c)–(e).

[55] *See generally* Federation of American Scientists, *OTA Publications: OTA Archive*, FAS, http://www.fas.org/ota/otareports/ (last visited Jan. 10, 2011) (follow "Reports by Year" hyperlink, and follow the corresponding year's hyperlink to find reports on oil production in the Arctic (1989), oil shale technologies (1980), coastal effects of offshore energy systems (1976), and oil transportation by tankers (1975)). In 1974, a young, relatively unknown law professor, Laurence Tribe, published *Channeling Technology Through Law*, which reviewed many theoretical approaches to technological control, described specific existing laws affecting technology, such as patent law, and reviewed a variety of technologies, concluding with a cautious endorsement of the Technology Assessment Act. *See* TRIBE, *supra* note 7. Like the radical thoughts of the 1960s, Tribe's work has disappeared into the annals of legal literature, and Tribe moved on to become a leading constitutional law scholar and appellate advocate.

[56] Technology Assessment Act § 2(b).

[57] Technology Assessment Act § 3(d).

possible failure of the technology and the consequences of that failure.[58] In a sense, the Act was radical—its presupposition was that a given technology, no matter how it operated, might be harmful as well as beneficial. On the other hand, since the Act merely assessed technologies, including benefits as well as detriments, and, for the most part, avoided any recommendation for blocking a specific technology, the Act was also conservative.[59]

In 1985, the Office of Technology Assessment evaluated the technologies of deep sea oil drilling.[60] By concentrating upon the entire technologies of deepwater mining, including the platforms and drilling apparatus, the assessment failed to provide a detailed examination of the adequacy of backup controls, including blowout preventers in the event of failure, and it offered low estimates of possible amounts of oil released if such failures took place.[61]

Ten years later, in 1995, the Technology Assessment Act was defunded by the Republican Congress, although the Act itself remains on the books.[62] It was defunded primarily for reasons of economy, but it was also argued in Congress that the program resulted in delayed, biased, and redundant reports.[63]

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[58] *See* Technology Assessment Act §§ 2(b), 3(c)(1)–(8) (stating that it is essential to understand and anticipate the consequences of technological applications, yet never providing that it is essential to explore the consequences of the failure of such technological applications).

[59] If the Act were to actually block the private undertaking of any technology, a host of legal and political issues would arise, including the question as to whether such prohibition would conflict with the Constitutional provision which enables Congress to promote science and the useful arts, and protects the right of the inventors to their discoveries. U.S. CONST. art. I, § 8, cl. 8.

[60] *See generally* OFFICE OF TECHNOLOGY ASSESSMENT, OIL AND GAS TECHNOLOGIES FOR THE ARCTIC AND DEEPWATER 47–88 (1985), *available at* http://www.fas.org/ota/reports/8518.pdf (discussing the technologies available for the exploration and development of energy resources in the Arctic and other deepwater areas).

[61] *See generally id.* It is difficult to determine exactly why the assessment failed. However, a review of the assessment suggests that the reasons for the failure were the timing and the scope of the report, which was principally concerned with developing all of the necessary technologies to drill for oil in the Arctic and in deepwater. Consequently, the report covered the entire subject of deepwater drilling, which included a myriad of technologies, in a relatively short report. The report, however, recognized the need for comprehensive safety plans and careful monitoring, as well as adequate evacuation plans. *Id.* at 15. It also recognized that many previous accidents were due to human error. *Id.* at 7. The report also made reference to necessary research by the MMS, and the need to clarify BAST regulations under the amendments to the Clean Water Act. *Id.* at 107–08.

[62] *See* OFFICE OF TECHNOLOGY ASSESSMENT, ANNUAL REPORT TO THE CONGRESS: FISCAL YEAR 1995 3, 11 (1996), *available at* http://www.fas.org/ota/reports/9600.pdf.

[63] *Id.* at 11. For a brief, unofficial history of the Office of Technology Assessment, see Gregory C. Kunkle, *New Challenge or Past Revisited?: The Office of Technology Assessment in Historical Context*, 17 TECH. IN SOC'Y 175, 175–196 (1995).

III. THE THIRD STEP: THE SEARCH FOR QUANTITATIVE RATIONALITY

Since the defunding of the Technology Assessment Act, there have been scattered efforts elsewhere to assess new and old technologies employing "new quantitative techniques." The Government Accountability Office has recently undertaken some technology assessments. In particular, the MMS of the Department of Interior[64] has followed a two-track program, conducting environmental impact assessments as part of the leasing process, and technology assessments as part of its technology assessment and research effort.[65] The environmental impact statements concentrate only upon environmental analysis, not the workings of technologies.[66] The research program focuses, for the most part, on the workings of technologies. As part of that program, in 1979 the MMS assessed deepwater drilling and since that time has continued to perform research assessments of aspects of drilling over the years.[67] The 1985 study was followed by a series of risk assessments of blowout prevention systems and, specifically, the shear ram controls in the 1990s and in the past decade.[68] I will discuss these efforts briefly below. These assessments were undertaken in light of the Outer Continental Shelf Lands Act requirements for drilling to embody "BAST"—the best and safest (feasible and practical) technology.[69]

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[64] In the wake of the Gulf spill, the MMS has been reorganized as part of the Bureau of Ocean Energy Management, Regulation and Enforcement ("BOEMRE"), which seeks to separate the collection of mineral revenues from the leasing and regulation of the drilling. *Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE): Frequently Asked Questions*, BOEMRE, http://www.boemre.gov/ooc/newweb/frequentlyaskedquestions/frequentlyaskedquestions.htm (last visited Jan. 10, 2011).

[65] *See* BOEMRE Offshore Energy & Minerals Mgmt., *Environmental Program: Branch of Environmental Assessment (BEA)*, BOEMRE, http://www.boemre.gov/eppd/compliance/nepa/policy/assessments/index.htm (last updated Oct. 18, 2010); BOEMRE, *Technology Assessment & Research (TA&R) Program Homepage: Introduction*, BOEMRE, http://www.boemre.gov/tarphome/ (last updated Sept. 9, 2010).

[66] *See* BOEMRE Offshore Energy & Minerals Mgmt., *supra* note 65; BOEMRE, *supra* note 65.

[67] Offshore Energy & Minerals Mgmt., *008-Blowout Prevention Procedures for Deepwater Drilling*, MMS, http://www.boemre.gov/tarprojects/008.htm (last updated Dec. 22, 2009).

[68] *See, e.g.*, MARINE COMPUTATION SERVS., INC., RISK ANALYSIS OF USING A SURFACE BOP (2010), *available at* http://www.boemre.gov/tarprojects/640/aa.pdf (analyzing the risk of using a surface blowout preventer); *see also* WEST ENG'G SERVS., INC., SHEAR RAM CAPABILITIES STUDY (2004), *available at* http://www.boemre.gov/tarprojects/463/(463)%20West%20Engineering%20Final%20Report.pdf (questioning the mathematical formulae used to evaluate the engineering effectiveness of the shear ram).

[69] *See* STAFF OF AD HOC SELECT COMM. ON THE OUTER CONTINENTAL SHELF, 95TH CONG., REPORT ON THE OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1977, H.R. REP. NO.

In 1990, Congress adopted the Oil Pollution Act of 1990, which enabled research on "the current status of knowledge on oil pollution prevention, response, and mitigation technologies."[70] Most of this research has been low-visibility research within "the bowels of the [government bureaucracy]," receiving little attention from the public and decision makers.[71] The Gulf spill and other oil spills may result in air pollution either from the explosion itself, or from evaporation of oil on the surface. The Clean Air Act has its own myriad of mechanisms for technology-forcing controls, and, in 1990, the Clean Air Act amendments included the "Bhopal Amendment," which sought to prevent catastrophic industrial accidents by requiring systematic accident prevention plans to be adopted by industry.[72]

Along with the ad hoc assessments, there have been significant developments in the tools necessary to perform technology assessment;[73] specifically, the adoption of the concept of complexity, the refinement of techniques in feasibility analysis, risk assessment, and cost-benefit evaluation, and, most recently, attention to catastrophe and worst case analysis.[74]

95-590, at 159 (1977) (discussing the requirement of "best available and safest technologies"). The language in the report stresses that determining whether technologies used meet this requirement is based on a balancing of costs and benefits; the words "if practicable," "economically achievable," and "balancing" occur frequently. *Id.* This seems to allow a good amount of agency discretion. There is no indication whether the select committee was referring to environmental safety, as opposed to worker safety. *Id.*

There has also been some litigation on the meaning of BAST. In *Conservation Law Found. of New England v. Andrus*, 623 F.2d 712, 719 (1st Cir. 1979), the First Circuit held that nothing in the statute suggests that BAST regulations must be promulgated prior to a lease sale. According to the court, OCSLA "clearly provide[s] that whatever BAST regulations the Secretary promulgates will apply to preexisting leases, indicating a duty on the Secretary to develop regulations [in] an ongoing process, which allows for flexible, changing standards as the available technology evolves." *Id.*; *see also* N. Slope Bor. v. Andrus, 642 F.2d 589, 595 (D.C. Cir. 1980) (reiterating the holding of *Conservation Law Foundation of New England, Inc.*).

[70] 33 U.S.C. § 2761(b)(1)(B) (2006).

[71] Steven Thomma, *Obama Overlooked Key Points in Giving OK to Offshore Drilling*, MCCLATCHY NEWSPAPERS, June 11, 2010, http://www.mcclatchydc.com/2010/06/11/95755/obama-overlooked-key-points-in.html.

[72] U.S. EPA, *Reducing Toxic Air Pollutants: Plain English Guide to the Clean Air Act*, EPA, http://epa.gov/oar/caa/peg/toxics.html (last updated Aug. 29, 2008).

[73] *See generally* Armin Grunwald, *Technology Assessment: Concepts and Methods*, *in* 9 HANDBOOK OF THE PHILOSOPHY OF SCIENCE: PHILOSOPHY OF TECHNOLOGY AND ENGINEERING SCIENCES 1103–47 (Anthonie Meijers ed., 2009) (providing a history of technology assessment).

[74] I have not included the full range of techniques, which include forecasting and systems analysis. The importance of forecasting can be seen in the gradual multiplication of drilling activity in the Gulf. Systems analysis may be used both in the description of technological systems, the Gulf ecosystem, and the social systems of fishing and tourism. For an overview of these other techniques, see MICHAEL CARLEY, RATIONAL TECHNIQUES IN POLICY ANALYSIS 8

A. Complexity

There is an increased recognition of the complexity of technology; thus, the blowout preventer is part of a complex system of drilling which itself is part of a larger program of drilling in the Gulf. The impacts of explosions and spills can react upon a complex and little understood ecosystem. The complexity of the deepwater drilling technology, as addressed in numerous documents, suggests in itself the importance of addressing such complexity. Those who have discussed complexity have generally noted three major complexities: of cognitive, technical, and social systems.[75] Much of the effort to describe large-scale ecosystems reveals the limits of our cognitive systems.[76] The complexity of the oil drilling apparatus reveals the complexity of technical systems. The complexity of the social systems is revealed in the myriad of economic and social harms resulting from the Gulf oil spill, and the uncoordinated response to the spill. One common way of handling complexity is through systems analysis, both engineering and ecological.

B. Risk Estimation and Evaluation

Equally important, since the early 1970s there has been an elaboration of risk analysis techniques which, in addition to the assessment of pollution risks, are increasingly employed in the assessment and evaluation of technology.[77] Assessment refers to the effort to estimate, quantitatively, the range of risks. These risks

(1980) (providing a "'disintegration' of policy analysis to find out what the pieces are, how they work, how the parts interacts, and how they relate to their environment"); IDA R. HOOS, SYSTEMS ANALYSIS IN PUBLIC POLICY: A CRITIQUE (rev. ed. 1983) (discussing systems analysis and the central role it plays in public planning); *see also* DAVID C. COLEMAN, BIG ECOLOGY: THE EMERGENCE OF ECOSYSTEM SCIENCE ix (2010) ("[A]ll ecosystems are inherently complex, and are the resultant of numerous physical, chemical, and biological phenomena.").

[75] NICHOLAS RESCHER, COMPLEXITY: A PHILOSOPHICAL OVERVIEW 138 (1998).

[76] For a history of the limits of early efforts to describe large ecosystems, see BROOKS ET AL., *supra* note 7, at 86–117. For an overview of the techniques adopted see WILLIAM W. LOWRANCE, MODERN SCIENCE AND HUMAN VALUES 115–49 (1985) (reviewing and evaluating policy analysis tools, and placing such tools within the complex institutional setting of the government's relationship to both science and technology).

[77] For a history of risk analysis, see Harry Otway, Luncheon Address at the 1986 Annual Meeting of the Society for Risk Analysis: Experts, Risk Communication, and Democracy, *in* 7 RISK ANALYSIS 125, 125–29 (1987). For a discussion of risk analysis as part of technology assessment, see Sven Ove Hansson, *Risk and Safety in Technology*, *in* 9 HANDBOOK OF THE PHILOSOPHY OF SCIENCE: PHILOSOPHY OF TECHNOLOGY AND ENGINEERING SCIENCES 1069–1102 (Anthonie Meijers ed., 2009); *see also* NAT'L RESEARCH COUNCIL COMM. ON RISK ASSESSMENT OF HAZARDOUS AIR POLLUTANTS, SCIENCE AND JUDGMENT IN RISK ASSESSMENT (1994) (discussing several approaches to risk assessment, strategies for improving risk assessment, and methods for implementation of the Committee's findings).

may be evaluated by a series of criteria, including general qualitative criteria, cost and effectiveness, statutory standards, and comparisons with other technologies.[78] Risk assessment and evaluation were employed by the MMS, as part of its technology assessment and research program, to assess surface blowout preventers, with some ad hoc comparisons to the subsurface blowout preventer used in the Gulf spill.[79] This assessment identifies the specific elements of the technology, describes the environmental conditions surrounding the technology, identifies the variety of possible defects of the equipment and the human errors in using the equipment, and posits the probability and ranks the consequences of each possible problem. It does not address the costs of prevention or remediation, the costs of harms in lives or environmental damage, nor, for that matter, the nature and degree of environmental damage.

There have been many critiques of risk assessment. Critiques include the difficulty of measuring risks, especially where such risks are multiple, and the product of a combination of technological and human error.[80] Thus, in the Gulf spill, there appear to be numerous

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[78] Otway, *supra* note 77, at 126–27; *see also* NAT'L RESEARCH COUNCIL COMM. ON RISK ASSESSMENT OF HAZARDOUS AIR POLLUTANTS, *supra* note 77, at 25–29 (discussing the general concepts and methods of risk assessment, and the relationship between risk assessment, research, and regulatory decisionmaking).

[79] MARINE COMPUTATION SERVS., INC., *supra* note 68, at 1. This report also sets forth methods of risk assessment as employed in the report. *See generally id.* Other evaluations by the MMS include tests of the reliability of deepwater blowout prevention systems, and tests of the shear ram itself. *See* PER HOLAND, RELIABILITY OF SUBSEA BOP SYSTEMS FOR DEEPWATER APPLICATION, PHASE II DW 11–12 (1999), *available at* http://www.boemre.gov/tarprojects/319/319AA.pdf (finding 11 failures of the ram preventer, and 60 failures of main control systems out of 117 failures); *see also* WEST ENG'G SERVS., INC., MINI SHEAR STUDY 3, 13 (2002), *available at* http://www.boemre.gov/tarprojects/455/Final%20Report.pdf (finding up to a fifty percent failure in the effectiveness of the shear ram); WEST ENG'G SERVS., INC., *supra* note 68, at 1-1–1-3, 8-1–8-2 (questioning the mathematical formulae used to evaluate the engineering effectiveness of the shear ram).

[80] For a recent discussion, see CASS R. SUNSTEIN, LAWS OF FEAR: BEYOND THE PRECAUTIONARY PRINCIPLE (2005) (critiquing the assessment of risks and the subsequent application of the precautionary principle, because reaction to such risk is based on fear, and because there is risk on both sides of all social issues); *see also* CASS R. SUNSTEIN, RISK AND REASON: SAFETY, LAW AND THE ENVIRONMENT (2002) (promoting a shift to cost-benefit analysis due to the human errors inherent in risk assessment—primarily the inability of humans to assess risk in an objective manner); K.S. SHRADER-FRECHETTE, RISK AND RATIONALITY: PHILOSOPHICAL FOUNDATIONS FOR POPULIST REFORMS (1991) (discussing issues with risk assessment, primarily by arguing that the current model of risk assessment relies too heavily on rationality, and casts aside layperson's opinions as irrational); Ellen K. Silbergeld, *Risk Assessment: The Perspective and Experience of U.S. Environmentalists*, 101 ENVTL HEALTH PERSPS. 100, 100–04 (1993) (arguing that risk assessment is a policymaking tool, not an optimal scientific method, and that it is practically impossible to insulate risk assessment from the political and environmental parts of policymaking).

sources of risk and mistake. The consequences of the resulting accident are also difficult to determine since they are visited upon a complex ecosystem and social system. No one pretends to measure the costs of the Gulf oil spill, nor the benefits of deepwater oil drilling. Finally, there is the problem of evaluating the benefits and costs, even if they are determined. Even a comparative approach to risk runs into many difficult problems. Perhaps the best contribution of such analyses is simply the careful enumeration of the risks, and the possible consequences if the risks mature.

C. Effectiveness, Feasibility, and Cost-Benefit Analysis

As part of risk analysis, there may be an assessment of the effectiveness of the technology in question, and the use of cost-benefit techniques. Effectiveness simply looks at whether the technology will accomplish its stated purpose; if the technology is new, feasibility analysis may be conducted.[81] Thus, the MMS conducted research pertaining to the feasibility of employing the blowout preventer in deepwater.[82] The language of the standard for drilling under the Outer Continental Shelf Lands Act is, in fact, the language of feasibility.[83] The regulations, however, mandate a cost-benefit analysis.[84] The MMS has resisted articulating a standard beyond cost-benefit analysis.[85] Cost-benefit analysis seeks to assess the technology in light of the stream of intended and unintended benefits and costs over time. These analyses may be mandated in many laws—they are part of the BAST requirements under the Clean Water Act and the Outer Continental Shelf Land Act.[86] The Technology Assessment Act may implicitly authorize cost-benefit analysis because it provides for attention to the benefits as well as

[81] For a discussion and critique of feasibility analysis, see Jonathan S. Masur & Eric Posner, *Against Feasibility Analysis*, 77 U. CHI. L. REV. 657 (2010).

[82] *See, e.g.*, MARINE COMPUTATION SERVS., INC., *supra* note 68 (researching the effectiveness of blowout preventers).

[83] 43 U.S.C. § 1347(b) (2006) (requiring the use of the "best available and safest technologies" that are considered "economically feasible," and only requiring existing oil drilling and production operations to conform when "practicable").

[84] 30 CFR § 250.107(d)(3) (2010).

[85] *See* Conservation Law Found. of New England, Inc. v. Andrus, 623 F.2d 712, 719 (1979); *see also supra* note 69.

[86] *See* 30 CFR § 250.15 (2010) (defining BAST as "the best available and safest technologies that the Director determines to be economically feasible wherever failure of equipment would have a significant effect on safety, health, or the environment"); *see also* 30 CFR § 250.107(d) ("The Director may require additional measures to ensure the use of BAST: (1) To avoid the failure of equipment that would have a significant effect on safety, health, or the environment; (2) If it is economically feasible; and (3) If the benefits outweigh the costs.").

the negative effects of the technology to be considered.[87] Our superficial review of the cost-benefit analyses performed by OTA reveals that they do consider the effectiveness as well as the benefits and possible harms of technology, but they do not economically quantify these risks and benefits, nor do they seek to determine a balance between the costs and benefits to arrive at a benefit to cost ratio.[88] Cost-benefit analysis has been vigorously supported and attacked over the years; environmentalists are especially suspicious of such techniques.[89] A recent cost-benefit analysis has been performed on deep sea drilling, finding it to be economically beneficial, even with the environmental damage from spills.[90]

D. "Disasters," "Catastrophes," and "Worst Case Analysis"[91]

The Gulf oil spill may be classified as a disaster, along with recent events such as earthquakes, tsunamis, pandemics, hurricanes, and other large-scale catastrophes, which call forth efforts to detect them in advance, mitigate or prevent them, compensate the victims, and engage in large-scale restoration efforts. With the advent of Katrina in New Orleans, policy analysts and legal scholars have become interested in the planning and laws pertaining to disasters.[92] Richard Posner, in *Catastrophe: Risk and Response*, offers a powerful argument for the usefulness of a modified benefit-cost analysis in weighing approaches to possible

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[87] 2 U.S.C. § 472(c) (2006).

[88] OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 60, at 8–9 (stating that "[e]xploration and development of oil and gas resources in . . . deepwater frontiers will result only if the promise of economic returns outweighs the associated risks and costs," but failing to explore the costs associated with specific risks, and failing to address the proper balance between the costs and benefits).

[89] For one of the most recent attacks on benefit-cost analysis, see FRANK ACKERMAN & LISA HEINZERLING, PRICELESS: ON KNOWING THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING 35–40 (2004) (criticizing the application of a cost-benefit framework to environmental and health policy development).

[90] Robert Hahn & Peter Passell, *The Economics of Allowing More U.S. Oil Drilling*, 32 ENERGY ECON. 638, 641–49 (2010). The estimate was based upon the MMS determination of the cost of economic damage in MINERALS MGMT. SERV., U.S. DEP'T OF THE INTERIOR, PROPOSED FINAL PROGRAM: OUTER CONTINENTAL SHELF OIL AND GAS LEASING 2007–2012 (2007). *Id.* at 641. The estimate of spill damage was $700,000, substantially below the projected Gulf spill damage estimates. *Id.* at 643.

[91] "Disasters" and "catastrophes" may be defined as low risk, high impact events.

[92] *See, e.g.*, DANIEL A. FARBER & JIM CHEN, DISASTERS AND THE LAW: KATRINA AND BEYOND (2006) (discussing the issues arising from the Katrina disaster, the development of disaster law in the context of federalism and social vulnerability, and how future disasters should be handled).

catastrophes.[93] He also offers a series of creative suggestions for new institutions which might oversee aspects of the detection, mitigation, and compensation of catastrophic risks.[94]

One method which has sometimes been adopted for planning for catastrophes is "worst case analysis."[95] This analysis undertakes assessments and evaluations of low-probability, high-impact events, especially when uncertainty characterizes the determination of the probability of failures, and the consequences of those failures.[96] In the 1980s, the possibility of oil spills from a proposed Galveston terminal initiated legal concern about worst case analysis.[97] The Corps of Engineers did not perform such an analysis, and the federal court required them to do so under the National Environmental Policy Act.[98] As a consequence, the Council on Environmental Quality changed its regulations so as not to require such analysis, and the Supreme Court upheld this change.[99]

The debate over worst case analysis pits those who think that any such analysis merely feeds irrational and speculative fears, against those who regard it as simply a sensible precaution. Cass Sunstein, in the most extensive examination of this issue, suggests the need for such an analysis, but emphasizes that such an analysis should be informed by a modified risk-benefit analysis, which includes consideration of the "social amplification" of the harms, a cost-benefit assessment of the proposed measures to reduce risk, the possible creation of margins of safety, and the elimination of uncertain risks where the costs of elimination are low.[100]

The prospect of the Gulf oil spill qualifies as a low-probability, high-impact spill suited to worst case analysis, which, in addition to the risk-benefit analysis, would take into account the social

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[93] *See generally* RICHARD A. POSNER, CATASTROPHE: RISK AND RESPONSE 139–48 (2004) (calling cost-benefit analysis an "indispensible step in rational decision making in [responding to catastrophic risks and] in other areas of government regulation").

[94] *See generally id.* at 216–44 (discussing the possibility of an international EPA, an international bio-weaponry agency, and a congressionally-mandated catastrophic risk assessment board, among other ideas, to detect and handle catastrophic risks).

[95] *See, e.g.*, Village of False Pass v. Watt, 565 F. Supp. 1123, 1149, 1153 (D. Ala. 1983) (determining that worst case analysis is not required for oil spills, but requiring such analysis when considering noise pollution!).

[96] *Id.* at 1149.

[97] *See generally* Sierra Club v. Sigler, 695 F.2d 957 (5th Cir. 1983) (addressing whether conducting a worst case analysis was required for the Army Corps of Engineers to issue permits allowing the construction of a crude oil distribution system).

[98] *Id.* at 969–70, 972–73, 981.

[99] Robertson v. Methow Valley Citizen's Council, 490 U.S. 332, 333 (1989).

[100] *See generally* CASS R. SUNSTEIN, WORST-CASE SCENARIOS (2007).

amplification of harm (to the fishing industry, the tourist industry, and the ecosystem), and would set margins of safety (based upon the costs and benefits of such margins). As Sunstein reveals, such worst case analysis, and the risk and cost-benefit analysis, rests upon a complex myriad of assumptions, including how to identify risks, how to handle uncertainty, how to weigh probability and risk, what role irreversible harms should play, what role monetary analysis should play, how to measure harms to future generations, and how to assess proper remedies.[101]

E. The Analysis of Public Objectives

Implicit in risk analysis and cost-benefit analysis is the positing of certain values.[102] These values may or may not overlap with the objectives stated in the Gulf-related energy recovery, coastal management, and environmental legislation. In the center of other leasing situations, other values, such as the rights of Native Americans, are at issue. Specific quantitative techniques of analysis of objectives[103] have been undertaken, but these techniques are subject to a variety of objections. The alternative is a public process of qualitative deliberation with an appropriate role for legislatures, courts, administrative agencies, and the people. Recently, Henry Richardson has spelled out an account of such deliberation.[104]

To recapitulate, the efforts of the first round of technology assessment in the 1970 laws, the second round efforts of Technology Assessment in 1972, and the third round subsequent assessment research have been ad hoc efforts to deal with technology and environmental impacts. If history is any guide, similar efforts in the future are unlikely to be successful. Part of the failure is due to the fact that, with the elimination of the Technology Assessment Act, none of these assessments are funneled to Congress. Unlike the Congress in 1972, Congress is now blind to the need for comprehensive, in-depth technology assessment.

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[101] *See generally id.*

[102] The values in risk analysis are contained primarily in the evaluative phase determining the acceptability of risk. The values in cost-benefit analysis, as its name suggests, lie in the selection and monetization of the costs and benefits. WILLIAM W. LOWRANCE, OF ACCEPTABLE RISK: SCIENCE AND THE DETERMINATION OF SAFETY 18, 41, 75–76 (1976).

[103] Goal indicators and multiobjective analysis are two such techniques.

[104] *See* HENRY S. RICHARDSON, DEMOCRATIC AUTONOMY: PUBLIC REASONING ABOUT THE ENDS OF POLICY 97–113 (2002) (discussing the "Biaggi Amendment" as an example of deliberative democracy).

This blindness, combined with the regulatory agency's failure to enforce the findings of any assessment, is perhaps due to "the revolving door" and corruption of regulatory staff identified above—a corporate culture which ignores risks and regulations in pursuit of profit, and the limits of forecasting, planning, risk assessment, cost-benefit, and implementation techniques. Some or all of these reasons for failure will presumably be documented by studies of the Gulf oil spill case presently underway.

However, part of the failure lies in the very real difficulties of implementing a technology assessment system. Since technology permeates our modern way of life, it is difficult to imagine how one would select the relevant technologies, let alone measure the consequences of their use and defects.[105] Complicating matters is the difficulty of drawing a distinction between the spread of quantitative technologies, such as the automobile which would be controlled primarily through controls of the production process, and the operation of stand-alone technologies, such as nuclear power plants which pose significant qualitative threats to large numbers of people and significant ecosystems.

Unfortunately, several historical developments may also make such assessments and consequent control of technology difficult, even with the help of new concepts and techniques of analysis, and even if the controversies surrounding these new techniques could be resolved.[106] First, the government is now more deeply involved in promoting technology, and hence it may be difficult for it to police itself through government-sponsored technology assessment.[107] Thus, the U.S. government benefits from

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[105] For three excellent recent accounts of the permeation of technology in our lives, see WILLIAM POWERS, HAMLET'S BLACKBERRY: A PRACTICAL PHILOSOPHY FOR BUILDING A GOOD LIFE IN THE DIGITAL AGE (2010) (discussing how people have found a way to bring digital technology into every available corner of existence); MATTHEW B. CRAWFORD, SHOPCRAFT AS SOULCRAFT: AN INQUIRY INTO THE VALUE OF WORK 68–71 (2009) (describing how techonological advancements have left people with "too few occasions to *do* anything, because of a certain predetermination of things from afar."); ALBERT BORGMANN, TECHNOLOGY AND THE CHARACTER OF CONTEMPORARY LIFE: A PHILOSOPHICAL INQUIRY 114–43 (1984) (discussing technology, how it has infiltrated numerous aspects of everyday life, problems with technology, and potential solutions to such problems).

[106] For a depressing study of the influence of the oil industry, see ROBERT ENGLER, THE BROTHERHOOD OF OIL: ENERGY POLICY AND THE PUBLIC INTEREST (1977) (discussing the amount of power that oil companies have due to their economic control of oil production, prices, and markets).

[107] *See, e.g.*, Erica Werner, *Obama Promotes Clean Energy; GOP Hits Dem Spending*, WASH. TIMES, Oct. 2, 2010, http://www.washingtontimes.com/news/2010/oct/2/obama-promotes-technology-gop-calls-tax-cuts/ (discussing the Obama Administration's efforts to promote wind, solar, and other clean energy technologies).

the oil revenues and employment consequent to deepwater drilling. Second, such technologies may be central to large firms' economic interests, and to the consumers they serve;[108] hence, both the industry and consumer would resist giving up such technologies, and/or accepting expensive modifications to prevent low-risk harms. We have witnessed with the Gulf spill an unwillingness to stop the headlong search for oil and oil production. Third, many technologies which may result in significant harms are largely "invisible" to the public and their representatives.[109] This invisibility is partly due to the fact that the practice of such technologies, as part of industry, has been removed from urban areas, where there are decreased numbers of people exposed to high technology plants when compared to the manufacturing plants of the old central city. In the case of the Gulf spill, this phenomenon was apparent as the public only gradually learned about the scope of the drilling in the Gulf. In addition, many technologies and their possible defects are invisible either because these technologies are enmeshed in our everyday lives, or the environment's systematic, buffering and threshold effects which mask their impact upon in the environment.

F. A Note on Technological Transition and Technology Forcing

The above discussion is a static analysis of technology, but the facts of the Gulf spill reveal the picture of a technology in flux. For example, the development of a surface blowout prevention system was underway and, in fact, had been used in some, and tested in other, circumstances.[110] MMS consultants are now evaluating its use in deepwater as an alternative to the subsurface preventer.[111] Thus, when technology assessment takes place, it is focused upon specific technology at a selected moment within the flux of

[108] *See, e.g.*, Jad Mouawad, *Not So Green After All,* N.Y. TIMES, Apr. 8, 2009, at B1 (discussing oil companies' reluctance to switch to green technologies, which are not guaranteed to be profitable, especially when oil production is a known profit-making operation).

[109] *See, e.g.*, Christy Law, *Up in Smoke: Setting Fire to the Waste Problem*, USA TODAY, July 1, 1993 (Magazine) (discussing issues with waste disposal, and how the development of both landfills and incinerators eased public concerns, even though both methods had the potential to cause adverse effects on the human population).

[110] *See Shell's Evolutionary Technology Program—SBOP for Egypt*, GULF OIL & GAS.COM, http://www.gulfoilandgas.com/webpro1/MAIN/Mainnews.asp?id=93 (last visited Jan. 10, 2011) (discussing Shell's development and testing of a "Surface Blow Out Prevention package" as early as 2003).

[111] *See generally* MARINE COMPUTATION SERVS., INC., *supra* note 68 (providing a risk analysis of using a surface blowout preventer).

technological innovation. The presence of such a stream of technological innovation suggests that technology assessment might have two goals. First, it might assess in order to stop or modify the technology midstream. Second, it might operate to encourage, or even force adoption of, new technologies which are presently under development. It is, of course, not clear that the same technology assessment can serve both purposes and, if so, whether both purposes are ultimately compatible. This second function of technology assessment—technology forcing discussed above—is a customary concept in the environmental law which governs continuous pollutants. Thus, the range of technology-based standards in the Clean Air Act, such as Mact, Bact, Laer, Ract, and so forth, all serve to promote new technologies. In a sense, such standards choose between new and old technology, seeking to promote new technologies.[112]

In the case of oil drilling, the forcing of technology might occur at different levels. At one end of the spectrum, it might promote technological development of alternatives within the broad energy sector, i.e., fossil fuels, hydro-power, nuclear, etc.[113] At the other end of the spectrum, the assessment might evaluate a specific piece of equipment within some phase of exploration, extraction, modification, and distribution of a given energy source. Where it is preferable to conduct, such assessment may, in part, depend upon where it might be most effective.

Thus, the question arises as to what encourages technological change. Although such a discussion is beyond this brief article, it is worth pointing out that there are different theories as to what promotes technological change, and a variety of empirical studies of such change.[114] The choice between allowing or freezing old

[112] *See* Thomas O. McGarity, *Radical Technology-Forcing in Environmental Regulation*, 27 LOY. L.A. L. REV. 943 (1994) (discussing "radical technology-forcing," and determining that it is a superior solution to many environmental problems); Peter Huber, *The Old-New Division in Risk Regulation*, 69 VA. L. REV. 1025, 1060–62 (1983) (discussing the concept and implementation of technology forcing regulations).

[113] JON ELSTER, EXPLAINING TECHNICAL CHANGE: A CASE STUDY IN THE PHILOSOPHY OF SCIENCE 185–207 (1983) (describing "apply[ing] decision theory to illuminating the structure of the choice between alternative modes of energy production that most Western societies face at the present time").

[114] *Compare id.* (suggesting a number of theories as to how innovation takes place, reviewing the major normative theories, and suggesting that different theories may be classified broadly into trial-and-error approaches and goal-oriented approaches), *with* GIOVANNI DOSI, TECHNICAL CHANGE AND INDUSTRIAL TRANSFORMATION: THE THEORY AND AN APPLICATION TO THE SEMICONDUCTOR INDUSTRY 52–53 (1984) (identifying a variety of factors which explain why the U.S. has led in innovation). The issue now is whether these factors are present in the energy sector and, specifically, within the oil industry.

technology and promoting new technology raises difficult questions of fairness in situations where investments have been made in old technology, only to be followed by new knowledge and new investment.[115]

IV. ALTERNATIVES OR SUPPLEMENTS TO AD HOC QUANTITATIVE TECHNOLOGY ASSESSMENT

There are several broad options available in response to the present accident and in anticipation of future accidents.[116] First, revolutionary changes in the economy and culture might be hoped for. Such changes may remove the need for using some dangerous technologies. Such a revolution was urged in the 1960s and has been recently suggested again, but it seems unlikely to take place at this time or in the foreseeable future.[117] Another broad approach is to transition to less dangerous forms of technology through implementing an industrial policy.[118] President Obama's energy plan recommends transition to solar, wind, and conservation.[119] However, the plan also envisages drilling for oil in the short term, adopting nuclear power, considering "clean coal," and relying on

[115] In this sense, technology forcing raises problems of transitional justice, as described in Eric A. Posner & Adrian Vermeale, *Transitional Justice as Ordinary Justice*, 117 HARV. L. REV. 761 (2004) (discussing the concept of transitional justice and analyzing issues and consequences that arise as a result of transitional justice). For an application of considerations of transitional justice, see William F. Pederson, Jr., *Why the Clean Air Act Works Badly*, 129 U. PA. L. REV. 1059 (1981).

[116] I have not included here the more extensive options for strengthening both the autonomy and responsibility of the science policymaking community, which Lowrance provides in his work, and which includes a series of recommendations. *See* LOWRANCE, *supra* note 76, at 108. Nor have I included the variety of interesting proposals by Richard Posner and others for new institutions to cope with disasters. *See* POSNER, *supra* note 93, at 199–245.

[117] One proponent of such radical change is James Gustave Speth, who has argued that only radical reforms are sufficient. *See supra* note 10 and accompanying text; *see also* SPETH, *supra* note 29, at xiii (arguing that our country is in such deep trouble that "strong medicine," such as government intervention, is necessary to address environmental crises).

[118] For a discussion of the advantages and disadvantages of industrial policy, see OTIS L. GRAHAM, JR., LOSING TIME: THE INDUSTRIAL POLICY DEBATE (1992). The notion of transition away from dangerous technologies is a special instance of industrial policy that has been rejected by the past political system, and will encounter vigorous opposition if attempted again. We are now witnessing the watering down of Obama's modest effort to promote a clean energy alternative.

[119] Memorandum from Joseph Biden, Vice President of the U.S., to Barack Obama, President of the U.S. 2, 7 (Dec. 15, 2009), *available at* http://www.whitehouse.gov/sites/default/files/administration-official/vice_president_memo_on_clean_energy_economy.pdf (describing the Administration's commitment to renewable energy resources); *Energy & Environment*, WHITE HOUSE, http://www.whitehouse.gov/issues/energy-and-environment (last visited Jan. 10, 2011) (discussing President Obama's commitment to land conservation).

natural gas, all of which involve dangerous technologies.[120]

A second set of options concentrates on compensating those harmed by the spill. The advantage of such compensation remedies is that they may tacitly accept the proposition that technology may fail, and spills may be inevitable. One approach to compensation is to turn to the common law, seeking changes in its basic rules to facilitate property ownership in those rights affected by the oil spill to facilitate and expand recovery of damages, both to common nature and the private parties who rely upon that nature. Another approach is to create public or public/private funds, such as the fund provided in the 1990 Oil Pollution Act.[121] The recent 9/11 fund, identified above, suggests possible new directions in compensation based upon some tort principles.[122]

Aside from broad societal changes and compensation programs, regulations may be adopted to prevent or minimize harms; technology assessment falls into this category. One might strengthen existing regulations, such as restoring worst case analysis, refunding and revamping the Technology Assessment Act, and reforming the environmental enforcement process. All of these have been suggested in the past, and these suggestions have been renewed as a result of the oil spill.

A final alternative is organizational reform, i.e., corporate reform with revisions of corporate boards, and the identification of responsible corporate executives held criminally and civilly liable for both negligent and intentional acts resulting in harms. There are public reports that the U.S. Justice Department is currently exploring criminal penalties against the executives responsible for the BP oil spill.[123] Similar organizational reforms may be needed for government to escape the influence of industry.

All of these options may be viewed as ways in which the costs of technology are internalized. After such internalization, competition in the market place may operate to encourage the best (i.e., safest) technology.

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[120] Memorandum from Joseph Biden, *supra* note 119, at 1, 6–7.

[121] 31 U.S.C. § 2701(11) (2006); 26 U.S.C. § 9509 (2006).

[122] *See supra* note 50 and accompanying text; *see also* Daniel A. Farber, *Tort Law in the Era of Climate Change, Katrina, and 9/11: Liability for Extraordinary Risks*, 43 VAL. U. L. REV. 1075, 1075–76, 1124–25 (2009) (discussing the use of administrative compensation schemes, such as the 9/11 fund, as a form of "corrective justice").

[123] *Deep Horizon (BP) Oil-Spill Fraud*, U.S. DEPARTMENT OF JUST., http://www.justice.gov/criminal/oilspill/ (last visited Jan. 10, 2011) ("The Department of Justice is placing a high priority on promptly investigating and prosecuting all meritorious reports of fraud related to the oil spill and its aftermath . . . .").

V. CONCLUSION: THE REFORM OF THE TECHNOLOGY ASSESSMENT ACT

Environmental law scholars and practitioners should pay careful attention to the history of the Gulf oil spill and the failed assessment of deepwater drilling technology. Technology, whether defective or not, is clearly a major contributor to our environmental problems.[124] Such technology is part of a complex system of extraction, energy production, manufacturing, and residual disposal which constitutes the subject of efforts to secure a sustainable environment.[125] Obviously, any effort to control technology must be viewed in this broader context.

The history of the efforts to assess and control technology since the 1960s, suggests that there are significant obstacles to our abilities to put the technological genie back in the bottle, and effectively regulate new or old technologies. We do not even understand the full complexities of these technologies and their consequences. At the present time, our technology assessment effort is largely designed to force new technology, not ban dangerous technology. At the same time, we are not yet willing to adopt more radical alternatives, such as changed lifestyles, a restructured economic system, a new mix of industry, or energy systems which forgo the use of complex fossil fuel technologies and their products.[126] The twenty-first century United States seems worlds

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[124] My contention is that environmental law scholars might usefully attend the legal issues surrounding the "basic drivers" of environmental problems—population growth and distribution, corporate growth, multiplication of complex technologies, economic growth, and our consumer society. For one of many early discussions of these issues, see SCHNAIBERG, *supra* note 1, at 4 (describing the "seek[ing of] an explanation of the social roots of expanded production, through an analysis of social institutions involved in the creation and distribution of social surplus"). The interest in such broad and deep inquiries seems, for the most part, to have lapsed.

[125] For a book which describes environmental law in light of its applicability to extraction, energy, manufacturing, and disposal systems, see SUSTAINABLE ENVIRONMENTAL LAW: INTEGRATING NATURAL RESOURCE AND POLLUTION ABATEMENT LAW FROM RESOURCES TO RECOVERY (Celia Campbell-Mohn et al. eds., 1993).

[126] Many of the authors who wrote in the 1960s continued to write throughout the twentieth century, and even into the twenty-first century. In doing so, some of them retained their pessimism (and even deepened it!). *See, e.g.*, JACQUES ELLUL, THE TECHNOLOGICAL SYSTEM 325 (Joachim Neugroschel trans., 1980) ("Man can choose, but in a system of options established by the technological process. He can direct, but in terms of the technological given. He can never get out of it at any time, and the intellectual systems he constructs are ultimately expressions or justifications of technology."). Others saw deep conflicts among the sectors of society, suggesting that technology was not necessarily dominating all aspects of society. *See, e.g.*, DANIEL BELL, THE COMING OF POST INDUSTRIAL SOCIETY: A VENTURE IN SOCIAL FORECASTING 44 (1973) (pointing out conflicts arising out of meritocracy, science's increased dependence on government funding, and the clash between culture and the social

away from the heady days of the 1960s and the "greening of America."

The historic effort to assess technology in a comprehensive manner failed. The new piecemeal efforts and proposals to assess technology through bureaucratic analysis of complexity, risk assessment and evaluation, cost-benefit analysis, and the worst case analysis of catastrophes are not promising when measured against the headlong rush of technological change. As Barry Commoner recognized years ago, the underlying economic and political forces make full prevention efforts unlikely.

Most Americans remain captured in the thrall of technological optimism, with its faith in science, the corresponding belief in progress, and the resulting affluence. The history of "the roads not taken" to control deepwater drilling, or other technologies, suggests that we may wish to reconsider our faith in such technological progress and our capacity to control technology.

Perhaps Jacques Ellul was right to be profoundly pessimistic about our prospects in our technological society. However, his pessimism rested upon his vision of the failure of a technological society to pursue substantive goals, and the failure to deliberate about these goals. In fact, the objectives of drilling for oil and gas are specifically identified in the law governing the leasing program, and in a variety of related environmental, coastal zone, and energy laws.[127] The Secretary of the Interior is authorized to strike a balance between oil and gas recovery, environmental damage, and adverse impacts to the coastal zone.

My pessimism, unlike Ellul, rests upon the recognition that the American people, their representatives, and their courts appear willing to accept the risks involved in the pursuit of oil and gas for their myriad benefits. Unfortunately, that acceptance has not been based upon a deliberative process which fully considers the ends of energy environmental and coastal policy, and is warped by the

structure). Finally, at the end of the twentieth century and in the twenty-first century, there are those who see a "conflictful" pluralism of power within technology. *See* ANDREW FEENBERG, ALTERNATIVE MODERNITY: THE TECHNOLOGICAL TURN IN PHILOSOPHY AND SOCIAL THEORY 14 (1995) ("Modern technologies open not only possibilities internal to the particular world they shape but metapossibilities corresponding to other worlds they can be transformed to serve.").

[127] 43 U.S.C. § 1344(a) (2006). Other laws, including the National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–4370(f) (2006), the Coastal Zone Management Act of 1972, 16 U.S.C. §§ 1451–1466 (2006), the Federal Water Pollution Control Act, 33 U.S.C. §§ 1251–1387 (2006), the Energy Reorganization Act of 1974, 42 U.S.C. §§ 5801–5891 (2006), and other energy legislation may be relevant as well.

"politics of oil."

Despite my pessimism, I recommend the refunding of the Technology Assessment Act and its reform. The Act should be focused upon the complete technological process, and not simply specific machinery. This broader assessment can draw upon more specific studies of technological components within these processes. The studies should be limited to those processes which threaten catastrophic risks, since it is not feasible to provide in-depth studies of the myriad of risks in modern society. The purpose of the assessment should be to entertain the possibility of recommending the banning of certain technologies, the modification of them, and/or the promotion of technology forcing. The variety of intellectual tools identified above should be employed with an awareness and full statement of their limits. *This entire analysis should be undertaken within the context of a statement of the specific objectives of each statute relevant to the technology in question, and a discussion of their relationship, one to another.*[128] The assessment should be communicated to a newly-formed special joint committee in Congress established for the sole purpose of evaluating technologies.[129]

[128] The kind of deliberation which I have in mind is brilliantly discussed in HENRY S. RICHARDSON, DEMOCRATIC AUTONOMY: PUBLIC REASONING ABOUT THE ENDS OF POLICY (2002) (discussing the achievement of legislative objectives by first studying the "relationship between truth and commitment in practical reasoning"). I cannot urge the reader strongly enough to turn to this book in considering the democratic assessment of technology.

[129] The strengthening of technology assessment, and the communication of this assessment to Congress, need not interfere with the more specific "drilling safety rule" and "workplace safety rule" announced by the Secretary of Interior on September 30, 2010. *See* Press Release, U.S. Dep't of the Interior, Salazar Announces Regulations to Strengthen Drilling Safely, Reduce Risk of Human Error on Offshore Oil and Gas Operations (Sept. 30, 2010), *available at* http://www.doi.gov/news/pressreleases/salazar-announces-regulations-to-strengthen-drilling-safety-reduce-risk-of-human-error-on-offshore-oil-and-gas-operations.cfm.