Lean and Green? Environmental Law and Policy and the Flexihle Production Economy†

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INTRODUCTION

On April 26, 2002, the *New York Times* published an editorial entitled *A New Swagger at G.M.*[1] The piece described General Motors' ("G.M.") rapid turnaround from a company in decline to one that was outperforming its competitors and increasing its sales. An important reason for this new success, the editorial

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1. Editorial, *A New Swagger at G.M.*, N.Y. TIMES, April 26, 2002, at A28.

explained, was that G.M. had, "without apology, grafted Toyota's more efficient manufacturing system onto G.M.'s."[2] This small newspaper article bespeaks an important story unknown to most Americans. The industrial base of our nation is undergoing a radical transformation. As a direct result of globalization, American manufacturers are moving away from mass production, the industrial form that has been the basis for American economic success for more than a century, and are beginning to adopt a new manufacturing method known as "flexible production."[3]

Flexible production—or, as it is sometimes called, "lean" production[4]—was developed by Toyota Corporation in the 1950s. It is characterized by fast-paced and continuous change to the manufacturing process and to the products that emerge from it.[5] In this respect, it differs markedly from mass production, which has always been geared toward the large-scale, stable manufacture of standardized items. Intel Corporation, the computer chip maker, epitomizes the new approach. Each Intel facility undertakes thirty to forty-five meaningful process changes per year and produces a new generation of semiconductor chips every two to three years.[6] This is lightning speed when compared to the pace of traditional mass production.[7] Implementing the flexible approach requires manufacturers to undertake a fundamental reshaping of the physical and social organization of their facilities. Flexible production has accordingly been said to represent a "shift in manufacturing paradigms,"[8] a "new mode of production."[9]

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2. *Id.*

3. *See generally* MARTIN KENNEY & RICHARD FLORIDA, BEYOND MASS PRODUCTION: THE JAPANESE SYSTEM AND ITS TRANSFER TO THE UNITED STATES (1993) (tracing the gradual adoption and development of Japanese flexible manufacturing systems by U.S. companies); JEFFREY K. LIKER, BECOMING LEAN: INSIDE STORIES OF U.S. MANUFACTURERS (1998) (chronicling the shift to flexible production—or, as it is sometimes called, "lean" production—by U.S. manufacturers across a wide range of industries); ROSS & ASSOCS. ENVTL. CONSULTING, LTD., U.S. EPA, PURSUING PERFECTION: CASE STUDIES EXAMINING LEAN MANUFACTURING STRATEGIES, POLLUTION PREVENTION, AND ENVIRONMENTAL REGULATORY MANAGEMENT IMPLICATIONS (Aug. 20, 2000) [hereinafter U.S. EPA, PURSUING PERFECTION] (discussing the "very real redefinition of the manufacturing landscape" from one based on mass production to a new paradigm based on flexible production); Paul Osterman, *How Common is Workplace Transformation and Who Adopts It?*, 47 INDUS. & LAB. REL. REV. 2 (1994) (finding the significant adoption of flexible production strategies among a large and representative sample of U.S. plants).

4. *See, e.g.*, JOSEPH J. ROMM, LEAN AND CLEAN MANAGEMENT: HOW TO BOOST PROFITS AND PRODUCTIVITY BY REDUCING POLLUTION 6-7 (1994) (employing the term "lean production" to refer to this manufacturing method); Richard Florida, *Lean and Green: The Move to Environmentally Conscious Manufacturing*, 39 CAL. MGMT. REV. 80, 82 (1996) [hereinafter Florida, *Lean and Green*] (discussing various other terms used to describe the new form of manufacturing). The term "lean production" derives from the use of this new manufacturing form to drive waste of all forms out of the production process. ROMM, *supra* at 6-7. For an explanation of why this Article elects to use the term "flexible production," see *infra* note 88.

5. *See* KENNEY & FLORIDA, *supra* note 3, at 302; ROMM, *supra* note 4, at 36; U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 4; JAMES P. WOMACK ET AL., THE MACHINE THAT CHANGED THE WORLD 48-60 (1990).

6. JAMES BOYD ET AL., INTEL'S XL PERMIT: A FRAMEWORK FOR EVALUATION 13 (Resources for the Future, Discussion Paper 98-11, Jan. 1998).

7. For example, the average process at a chemical plant may last up to fifteen years, and the plant itself up to seventy-five. *Id.*

8. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 20.

History teaches us that, when confronted by such fundamental economic and technological innovations, the law has been forced to change as well. We need only consider the field of labor law, which arose in direct response to the rise of mass production and the desire of factory workers to unionize. Today, it is necessary to consider the significance of another shift in manufacturing paradigms: what does the emergence of flexible production mean for the law? A number of scholars have begun to do important work on this topic.[10] A few have started to think specifically about the implications for environmental law and policy.[11]

Flexible production holds particular importance for environmental law. Recent studies suggest that flexible production facilities are far better at pollution prevention than are mass production plants. For example, a U.S. EPA study found that two Boeing airplane production facilities that had made the switch from mass to lean production used thirty to seventy percent less resources per unit of production and achieved substantial reductions in energy use and generation of solid waste.[12] Other studies have reached similar conclusions.[13] At present, environmental law and regulation tend to inhibit, rather than facilitate, this development. As this Article will explain, the existing environmental regulations move far too slowly to accommodate the rapid changes typical of flexible production.[14] The present environmental regulatory scheme also fails to push these facilities to achieve the level of environmental performance of which they are capable. In short, the existing system of environmental law and policy is designed

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9. Stephen S. Cohen, *Geo-Economics: Lessons from America's Mistakes*, *in* MARTIN CARNOY ET AL., THE NEW GLOBAL ECONOMY IN THE INFORMATION AGE: REFLECTIONS ON OUR CHANGING WORLD 108 (1993).

10. *See e.g.*, William E. Scheuerman, *Democratic Experimentalism or Capitalist Synchronization? Critical Reflections on Directly-Deliberative Polyarchy* 17 CAN. J.L. & JURISPRUDENCE 101 (2004); David Weil, *Regulating Noncompliance to Labor Standards: New Tools for an Old Problem*, CHALLENGE, Jan.- Feb. 2002, at 47.

11. *See* BOYD ET AL., *supra* note 6, at 13-14 (analyzing implications of fast-change Intel Corporation operation for environmental permitting); JAN MAZUREK, MAKING MICROCHIPS: POLICY, GLOBALIZATION, AND ECONOMIC RESTRUCTURING IN THE SEMICONDUCTOR INDUSTRY (1999) (insightful analysis of semi-conductor industry, flexible protection and environmental policy); E. Donald Elliott, *Environmental TQM: Anatomy of a Pollution Control Program that Works!*, 92 MICH. L. REV. 1840 (1994) (reviewing PRESIDENT'S COMM'N ON ENVTL. QUALITY, TOTAL QUALITY MANAGEMENT: A FRAMEWORK FOR POLLUTION PREVENTION (1993)) (reviewing total quality management's potential for pollution reduction and suggesting it has implications for environmental regulation).

12. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 12, 20.

13. *See* Andrew A. King & Michael J. Lenox, *Lean and Green? An Empirical Examination of the Relationship Between Lean Production and Environmental Performance*, 10 J. PROD. & OPERATIONS MGMT. 244 (2001); Florida, *Lean and Green*, *supra* note 4.

14. *See* U.S. EPA, LEAN MANUFACTURING AND THE ENVIRONMENT: RESEARCH ON ADVANCED MANUFACTURING SYSTEMS AND THE ENVIRONMENT AND RECOMMENDATIONS FOR LEVERAGING BETTER ENVIRONMENTAL PERFORMANCE 36 (Oct. 2003) [hereinafter U.S. EPA, LEAN MANUFACTURING AND THE ENVIRONMENT].

> Lean methods' focus on rapid, continual improvement frequently necessitates making rapid, and often iterative, operational and equipment changes. . . . Situations where a company must wait weeks for a regulatory applicability determination or months for a permit, permit modification, or other regulatory action can conflict with lean implementation initiatives and valuable waste reduction.

for the mass-production "dinosaurs" that existed at the time the laws were written, and not for the flexible-production facilities evolving on the industrial landscape to replace them.

This mismatch may have implications for many areas of environmental law and policy, including the disposal of hazardous waste under the Resource Conservation and Recovery Act ("RCRA"),[15] the permitting of wastewater discharges under the Clean Water Act,[16] the debate over "command-and-control" versus market-based approaches to environmental regulation,[17] regulatory treatment of environmental management systems,[18] as well as other important topics. These should prove fruitful areas for future research.

The present Article will focus on one particular area of environmental policy: the Clean Air Act's ("CAA") permitting requirements, particularly the New Source Review ("NSR") program and the Title V Operating Permit program. It will attempt to show that flexible production has *already had* a profound effect, largely unremarked upon until now,[19] on two highly significant policy initiatives in that area—the Clinton administration's Environmental Regulatory Reinvention initiative[20] (in which "reinvention" of CAA permitting was an important theme), and the Bush Administration's New Source Review Reform Rule.[21] By bringing to light flexible production's underlying role in the development of these two major initiatives, this Article seeks to providc a basis for evaluating the legal and policy choices that havc been made, and for charting a way forward. In so doing, it will provide an analytical framework for future research evaluating the implications for flexible production for other areas of environmental law and policy.

15. *See generally* 42 U.S.C. §§ 6901-92 (2000) (RCRA statute). For example, the extremely complex RCRA regulations governing when a hazardous by-product is treated as "discarded" and hence subject to stringent treatment, storage, and disposal requirements, and when it is deemed to be "recycled" and hence exempt from these requirements, create uncertainty that may deter lean manufacturers from undertaking process improvements designed to reclaim and reuse such materials. *See* U.S. EPA, LEAN MANUFACTURING AND THE ENVIRONMENT, *supra* note 14, at 39-40.

16. *See generally* 33 U.S.C. §§ 1251-1387 (Clean Water Act) (2000). For example, changes to the manufacturing process may result in new pollutants being discharged from a facility, requiring a revision to the plant's National Pollutant Discharge Elimination System ("NPDES") permit.

17. Market-based approaches such as cap-and-trade programs may give flexible producers additional incentive to utilize their enhanced pollution prevention capacities in ways that traditional, technology-based regulation does not.

18. As will be explained below, *see infra* notes 119-122 and accompanying text, environmental management systems ("EMS") can be viewed as application of flexible production methods to the environmental performance arena. Recognizing the increasing prevalence of flexible production, and its role in the development of EMS, could inform government policies intended to encourage and guide these voluntary efforts.

19. For a valuable book that does examine this issue, see generally MAZUREK, *supra* note 11.

20. *See generally* BILL CLINTON & AL GORE, REINVENTING ENVIRONMENTAL REGULATION (1995) (launching and describing the Reinvention initiative).

21. Prevention of Siguificant Deterioration (PSD) and Nonattainment New Source Review (NSR): Baseline Emissions Determination, Actual-to-Future-Actual Methodology, Plantwide Applicability Limitations, Clean Units, Pollution Control Projects, 67 Fed. Reg. 80,186, 80,207 (Dec. 31, 2002) (to be codified at 40 C.F.R. pts. 51, 52) [hereinafter NSR Reform Rule].

Part I will briefly describe the three key components of flexible production: increased worker involvement in continuous improvement of the manufacturing process; the use of cross-functional teams that can see the entire production system at once; and newer, more malleable technologies that enable facilities to shift quickly from making one thing to producing another. Together, these three features yield a production process subject to rapid change, in which innovation is the norm rather than the exception.

Part II will examine current studies of flexible production and environmental performance. Based on the Boeing study and others, it will conclude that flexible production plants have a far greater ability to engage in pollution prevention than their mass-producing counterparts. This is a significant finding. There is wide agreement that pollution prevention methods can control pollution more cheaply than end-of-pipe technologies.[22] Facilities that are better able to engage in pollution prevention should accordingly be able to achieve greater environmental performance for the same or less cost than traditional plants. It follows that the shift from mass to flexible production could present an opportunity to achieve a more ambitious level of environmental performance.

Part III will examine the Clean Air Act's NSR and Title V Operating Permit programs. As will be further explained below, these programs require facilities to obtain a permit or permit modification prior to changing their manufacturing process.[23] The issuance of such a permit can take from several months to two years.[24] This Article will argue that, while this framework may have worked for slow-moving mass production facilities, it is fundamentally at odds with the flexible production business model premised on rapid and continuous process change and may inhibit facilities from moving to the new approach.[25] In addition, the NSR rules fail to achieve the environmental potential of those plants that *have* made the shift. They give flexible production facilities strong incentives to adopt end-of-stack controls as a means of reducing their emissions and discourage them from employing their enhanced pollution prevention abilities. They accordingly fail to push these facilities to achieve the more ambitious level of environmental performance of which they are capable.[26]

Part IV will attempt to show that both Reinvention and NSR Reform can be partially understood as attempts to address this incompatibility between flexible production and the NSR program. Both initiatives employ the same tool—plantwide emission caps. In contrast to the traditional CAA permit, a plantwide cap

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22. *See* Stephen M. Johnson, *From Reaction to Proaction: The 1990 Pollution Prevention Act*, 17 COLUM. J. ENVTL. L. 153, 159 (1992) ("[I]t often costs less to prevent pollution than to control it."); Richard B. Stewart, *A New Generation of Environmental Regulation*, 29 CAP. U. L. REV. 21, 117 (2001) [hereinafter Stewart, *A New Generation*] ("[P]ollution and waste prevention is generally less costly than disposal of residuals after generation."); Kurt A. Strasser, *Preventing Pollution*, 8 FORDHAM ENVTL. L.J. 1, 8-9 (1996) ("[P]revention offers the prospect of greater environmental protection from pollution at a lower cost.") [hereinafter Strasser, *Preventing Pollution*]; Elliott, *supra* note 11, at 1852 ("[T]here is a strong and growing consensus that redesigning processes to prevent pollution, rather than cleaning it up afterwards with end-of-pipe controls, is cheaper and more efficient in many instances.").

23. *See infra* notes 159-163, 216-21 and accompanying text.

24. NSR Reform Rule, *supra* note 21, at 80,207.

25. *See infra* notes 198-209, 219-21 and accompanying text.

26. *See infra* notes 210-215 and accompanying text.

allows a facility to make as many changes to its production process as it wants, as quickly as it wants, so long as it stays within an emissions cap defined in the permit. It does not require the issuance of a separate permit for each such change. In this way, it fits much better with the rapid pace of flexible production than does traditional CAA permitting. By integrating the cap approach into the regulatory structure, the Reinvention and NSR Reform initiatives can be understood, in part, as early attempts to adapt the existing regulatory framework, initially designed for the era of mass production, to the speed of flexible production.[27]

Demonstrating that the Reinvention and NSR Reform initiatives are similar in this way does not mean that they are equivalent. To the contrary, seeing them in light of flexible production allows the observer to ask which of these policy initiatives does a better job of adapting regulation to the new industrial model, and so which is preferable as a matter of law and policy? Important differences between the two efforts exist. The Reinvention initiatives use emission caps not only to provide flexible production facilities with greater operational flexibility, but also to give them an incentive to achieve better environmental performance than is required under traditional regulation.[28] In this way, these programs tap into the enhanced pollution prevention capacities of the new industrial form. The NSR Reform rule, by contrast, uses the cap approach to provide operational flexibility but fails to require any sort of improved environmental performance.[29] Indeed, the rule would allow facilities in some instances to emit more pollutants than they would under traditional regulatory requirements.[30] Part V will argue that the Reinvention approach—though far from ideal—is the preferable model. It will provide a set of legal and policy recommendations intended to further improve upon the Reinvention model, and so to produce an air permitting approach that can both accommodate flexible production, and realize its green potential.

I. FLEXIBLE PRODUCTION

Flexible production has been described as "a change of revolutionary import in the process of production,"[31] and as "a fundamental supercession and potential successor to mass-production fordism."[32] To describe flexible production, and to explain how it differs from the craft and mass-production methods that preceded it, it will be helpful to begin with these two earlier forms and then compare flexible production to them.

A. From Craft to Mass Production

For hundreds of years, craft production dominated the world economy.[33]

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27. This may be an example of the Marxian axiom that changes in the "mode of production" lead to changes in the "social, political, and intellectual life process in general." KARL MARX, *Preface to a Critique of Political Economy*, *in* KARL MARX, A READER 187, 187 (Jon Elster ed., 1986).

28. *See infra* notes 231-37, 259-63, 273-79 and accompanying text.

29. *See infra* notes 322-23 and accompanying text.

30. *Id.*

31. Cohen, *supra* note 9, at 106.

32. KENNEY & FLORIDA, *supra* note 3, at 9.

33. Cohen, *supra* note 9, at 108-09.

Under this manufacturing form, skilled individuals personally fashioned unique goods one at a time.[34] This way of making things survives today in the form of fine crafted furniture and custom-made cars. In the early nineteenth century, mass-production emerged in the United States.[35] Its key innovation was the introduction of highly specialized machines capable of churning out large numbers of identical parts or products (for example, buttons, pins, ball bearings, and automobile parts).[36] The machines' ability to produce numerous, standardized products gave the new method its name: mass production.

The human worker plays a fundamentally different role in mass production than he or she did in craft production. No longer does the worker function as a skilled artisan. Instead, the factory worker takes his or her place along the assembly line, serving the machine by turning a screw here or positioning a part there.[37] The factory tasks are often menial, requiring almost no knowledge or skill and leaving the mind largely unengaged. The thinking is done, instead, by engineers and managers.[38] These trained personnel design the products and the production process, and supervise the line workers in the performance of their assigned tasks.[39] This results in an almost total division of labor between the thinkers and the doers. The mass production factory also divides its workforce by functional area. The typical mass production operation consists of a number of discrete departments—design, assembly, marketing, environmental health and safety, etc.—each with its own set of responsibilities.[40] Each department reports to high-level managers who coordinate the activities of the organization as a whole. The result is a hierarchical entity, managed from the top, with little interaction between its component departments.[41]

Once mass production emerged on the scene it easily surpassed craft production. The main reason lay in economies of scale. In contrast to craft production where the main expense, skilled labor, remained largely constant from the first item to the thousandth,[42] the principal costs associated with mass-production were fixed investments in the specialized machines. As these machines produced more and more units of product, the cost per unit fell dramatically.[43] By

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34. *Id.* at 108; WOMACK ET AL., *supra* note 5, at 24.

35. Cohen, *supra* note 9, at 109.

36. WOMACK ET AL., *supra* note 5, at 26-27 ("The key to mass production . . . was the complete and consistent interchangeability of parts and the simplicity of attaching them to each other.").

37. *See* ROMM, *supra* note 4, at 21 ("[S]pecialization of work turned what had been skilled work for artisans into highly repetitive and unsatisfying labor done at an ever-increasing pace."). The Charlie Chaplin character in the film *Modern Times* has come to typify these workers, his arm continuing to jerk in its bolt-tightening movement even as he leaves the factory and heads for home. MODERN TIMES (Twentieth Century Fox 1936).

38. Cohen, *supra* note 9, at 109 ("Mass production [is characterized by] highly trained and highly specialized people to design the product and to design, organize, and run the production process; and large numbers of unskilled (or low-skilled) people to perform the simplest, most minutely choreographed tasks of making the product.").

39. *Id.*

40. *See* KENNEY & FLORIDA, *supra* note 3, at 36-37.

41. ROMM, *supra* note 4, at 13 ("[Mass production management is traditionally] hierarchical, centralized, and compartmentalized.").

42. WOMACK ET AL., *supra* note 5, at 22, 25-26.

43. *See id.* at 28-29. The reduction in marginal cost associated with high-volume

engaging in long production runs of identical items, mass producers were able to bring the marginal cost of production down far below the levels that craft production could achieve.[44] In time, mass production came to completely dominate craft production.[45] Yet, the high-volume production of identical items[46]—the basis of mass production's astounding success—can also be a source of weakness. Eager to recoup the large investments in specialized machines and so to start turning a profit, mass producers are highly resistant to product changes that would require them to retool their factories.[47] For these producers, the key to success lies in generating immense quantities of the same product, thereby bringing down the per-unit cost. This makes mass production a static, inflexible form of manufacturing.[48] As Henry Ford is famously said to have quipped, "You can have a Model T in any color as long as it's black."[49]

B. Flexible Production

In the 1950s, a new form of production emerged in Japan that sought to exploit the inflexibility of mass production, and so to outdo it. This new industrial strategy, which has come to be known as "flexible production,"[50] departs from mass production in three principal ways. First, flexible production breaks down the organizational divisions between managers and workers and substitutes a team-based approach that engages the mind of workers in the pursuit of continuous improvement.[51] Second, it lowers the walls between the different functional

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production allowed manufacturers to sell their items for less than what craft producers charged. Since more people could now afford them, demand increased. This made possible even-higher volume production which, by virtue of economies of scale, reduced the cost of manufacturing even further. This, in turn, allowed producers to reduce prices even more, thereby increasing demand, and so on. *Id.* at 37. This cycle has made more and more goods affordable to more and more people, arguably resulting in our "consumer culture."

44. *See id.* at 37-38.

45. WOMACK ET AL., *supra* note 5, at 30; Cohen, *supra* note 9, at 109.

46. For example, consider that in 1955, the heyday of American automobile production, the U.S. auto industry sold 7 million vehicles. However, fully eighty percent of these cars were variants of just six models. Cohen, *supra* note 9, at 110; WOMACK ET AL., *supra* note 5, at 43.

47. For example, the machines at the early Ford Motor factories, the quintessence of mass production, were so specialized that the company's redesign of the Model A required it to purchase entirely new machines and discard some of the existing ones. WOMACK ET AL., *supra* note 5, at 37.

48. *See* Cohen, *supra* note 9, at 109-10 ("[Mass production is] terribly inflexible."); ROMM, *supra* note 4, at 21-22 (describing Henry Ford's extreme resistance to product development).

49. ROBERT D. ATKINSON & RANDOLPH H. COURT, THE NEW ECONOMY INDEX: UNDERSTANDING AMERICA'S ECONOMIC TRANSFORMATION 16 (1998). *See also* ROMM, *supra* note 4, at 21-22.

50. Cohen, *supra* note 9, at 98. This form of production has also been referred to as "lean production," and by other terms. *See infra* note 88.

51. KENNEY & FLORIDA, *supra* note 3, at 4 ("The key to the new model lies in organizational forms and practices—work teams, rotation, and workers' involvement—which when taken together effectively function to harness the intelligence as well as the physical labor of workers."); ROMM, *supra* note 4, at 125-28 (discussing the use of self-managing teams); WOMACK ET AL., *supra* note 5, at 56 ("The first step was to group workers

departments and brings employees together in cross-functional groupings, thereby allowing them to get a "whole-system" view of the production process. Third, it uses the organizational innovations just mentioned as well as new, more malleable technologies to generate a highly dynamic production process in which rapid change and innovation are the norm.[52] These three features allow flexible production facilities to develop new products, and improve their existing ones, far more quickly than traditional mass-production facilities.[53] This gives them a competitive edge that threatens to make mass production as obsolete as the craft production operations that preceded it.[54]

1. *Kaizen*: Worker Teams Seeking Continual Improvement

Flexible production breaks down the division between management and the factory floor so as to re-engage the mind of the line worker. This gives rise to a host of new ideas and suggestions for improvement from the individuals most closely associated with the production process—the line workers themselves. Flexible production achieves this first by hiring better-trained individuals to staff the production line.[55] It then organizes the workforce into teams consisting of line workers, engineers, and managers.[56] Each team is charged with achieving continuous improvement in its aspect of the production process.[57] Time is set aside for the teams to meet, discuss problems with the production process, and devise solutions.[58] The Japanese firms that developed the method called it *kaizen*, a term that can loosely be defined as "workers' involvement in continuous process improvement."[59] In the United States, it has come to be referred to as Total Quality Management ("TQM"),[60] a term that reflects the initial focus on product quality.[61]

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into teams with a team leader rather than a foreman."); King & Lenox, *supra* note 13, at 248 (explaining that flexible production is characterized by "the use of work system teams").

52. *See* Florida, *Lean and Green*, *supra* note 4, at 91 ("[A]dvanced manufacturing systems are distinguished by a series of organizational and management practices . . . that complement and enhance the performance of new manufacturing technologies.")

53. *See* KENNEY & FLORIDA, *supra* note 3, at 14-16 (labeling this concept "Innovation-Mediation Production").

54. Cohen, *supra* note 9, at 106 (noting that flexible production "represents, in brief, almost as decisive an advantage over mass production as mass production represented over craft production").

55. WOMACK ET AL., *supra* note 5, at 53 ("[T]o make [flexible production] work at all [, a manufacturer needs] both an extremely skilled and highly motivated work force."); King & Lenox, *supra* note 13, at 248 ("[Flexible production] requirements include . . . a pro-active and well-trained work force . . . .").

56. KENNEY & FLORIDA, *supra* note 3, at 39-40; ROMM, *supra* note 4, at 125; *see also* WOMACK ET AL., *supra* note 5, at 56.

57. KENNEY & FLORIDA, *supra* note 3, at 39; WOMACK ET AL., *supra* note 5, at 56.

58. *See* KENNEY & FLORIDA, *supra* note 3, at 41; WOMACK ET AL., *supra* note 5, at 56.

59. KENNEY & FLORIDA, *supra* note 3, at 17; *see also* ROMM, *supra* note 4, at 41 ("*Kaizen* [is] ongoing improvement involving everyone—top management, managers, and workers."); WOMACK ET AL., *supra* note 5, at 56 (defining *kaizen* as a "continuous, incremental improvement process" based on worker teams).

60. *See* Florida, *Lean and Green*, *supra* note 4, at 91.

61. The roots of this approach lie in the work of W. Edwards Deming and Joseph Juran in the 1950s. Deming and Juran focused their work on improving product quality. While American manufacturers were slow to adopt their views, Japanese companies embraced and

This organizational form, so different from the strict division between thinking engineer and menial line worker that has characterized mass production, generates an abundance of ideas for process change and improvement. The team accordingly functions as "the basic organizational mechanism used to harness the collective intelligence of researchers, engineers, and factory workers and turn it into commodities—a new microelectronic product, a new computer, a new piece of software, a new form of genetic material."[62]

Flexible production also pursues this end by means of a second method, the suggestion system.[63] Under this approach, management encourages line employees to offer suggestions on ways to improve products or the production system, and gives them the means to do so.[64] It may also offer prizes for those who make the most useful suggestions.[65] While this method seems simple, it is taken extremely seriously by the companies that have adopted it.[66] In a single year, Canon received almost 900,000 suggestions from its employees. It paid out $2.2 million in prizes but realized more than $200 million in savings as a direct result of the suggestions.[67] Incredibly, Matsushita had 6.5 million suggestions in a single year and implemented ninety-five percent of them.[68] Suggestion systems and worker teams enable flexible production facilities to draw on the mental energies of all company employees. This results in "a major advance over traditional mass production, which was based simply on pumping physical work out of workers and pumping plans and specifications out of researchers and engineers."[69]

2. Cross-Functional Groupings with a "Whole System" View

Flexible production's second main innovation is to break down the functional divisions that are so fundamental to the mass production workplace[70] and to require individuals from different departments to come together regularly in cross-functional groupings.[71] As with the blurring of the divisions between engineer and worker, this more integrated organizational form creates fertile ground for the

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implemented them. *See* PRESIDENT'S COMM'N ON ENVTL. QUALITY, TOTAL QUALITY MGMT: A FRAMEWORK FOR POLLUTION PREVENTION 1 (1993) [hereinafter TQM Report]; ROMM, *supra* note 4, at 22-23. Eventually, Toyota Corporation and other Japanese companies expanded the approach to include all aspects of the business, not just product quality. This gave birth to the flexible manufacturing approach.

62. KENNEY & FLORIDA, *supra* note 3, at 304.

63. KENNEY & FLORIDA, *supra* note 3, at 39, 40; ROMM, *supra* note 4, at 53.

64. ROMM, *supra* note 4, at 53.

65. *Id.*

66. *Id.*

67. *Id.* In the words of one of the founders of flexible production, "How can a company that doesn't have such a program compete with a company that does?" *Id.* at 54 (quoting Shigeo Shingo, one of the founders of the Toyota production system).

68. *Id.* at 53. On average, Japanese companies implement seventy-six percent of employee suggestions. *Id.* at 54.

69. KENNEY & FLORIDA, *supra* note 3, at 15.

70. *Id.* at 43 ("Japanese organization contrasts sharply with traditional corporate organization characterized by extreme functional specialization and highly compartmentalized information flows.").

71. *See* U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 7 (describing "cross-functional manufacturing"); ROMM, *supra* note 4, at 126 (discussing importance of "cross-functional teams").

generation of process improvement ideas. Mass production's department-by-department structure has often led managers to focus on improving one, discrete aspect of the plant's operation without regard to its effect on other parts of the operation (which are, after all, the responsibility of a different department).[72] By contrast, cross-functional groups are able to see the entire production system at once.[73] This system-wide view allows such groups to perceive a host of improvements that would not otherwise be visible if one looked only at the work of a discrete department.[74] For example, it might show that paying a higher price for raw materials at an early stage of the production process, which will increase costs for the purchasing department, will result in less waste material at the assembly stage and so save money overall.[75] This "whole system" approach to process improvement is a second defining characteristic of flexible production.[76]

Design for Manufacturability ("DFM"), a common feature of many flexible production facilities, exemplifies this approach.[77] The DFM method brings the design and production teams together at the time that the product is first being conceptualized.[78] The dialogue between these two departments may generate designs that employ fewer parts, use less raw material, or fit together more easily.[79] A company that focused separately on improving "design" or "assembly," and failed to take a cross-functional, system-wide view, might well miss such opportunities. Taken together, team-based worker involvement and the use of cross-functional groupings generate an abundance of ideas for process improvement.[80]

3. Rapid and Continuous Process Change

This leads to the third way that flexible manufacturing differs from mass production: whereas mass production is static and slow-moving,[81] flexible production is in a constant state of change and innovation.[82] In part, this is a direct

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72. ROMM, *supra* note 4, 126-27 (discussing shortcomings of "compartmentalization of functions").

73. *See id.* at 33-36.

74. *Id.* at 33 (explaining how a systematic approach, employing cross-functional teams, permits understanding of entire product life-cycle and thus is the best means of generating productivity improvements).

75. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 6 ("This new way of thinking empowers factory managers to accept higher costs on low value items that may be associated with a given functional department, to produce substantial overall cost savings throughout the production cycle.").

76. ROMM, *supra* note 4, at 27 (describing the whole-system approach "as the basis of Taiichi Ohno's Toyota production system"); U.S. EPA, PURSUING PERFECTION, *supra* note 3, at i (explaining that the fundamental focus of lean production is on the "systematic elimination of waste"); *id.* at 6-7 (describing "whole system thinking" and "cross-functional manufacturing" as key components of flexible manufacturing).

77. *See* U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 7.

78. *Cf. id.* at 6.

79. *See id.* at 6; *cf.* ROMM, *supra* note 4, at 7 (describing lean and clean management as "the most comprehensive approach to minimizing all types of company waste").

80. KENNEY & FLORIDA, *supra* note 3, at 16.

81. *See supra* notes 46-49 and accompanying text.

82. KENNEY & FLORIDA, *supra* note 3, at 302 (contrasting flexible production where

result of the organizational features just described, which lead to a continuous flow of ideas for process and product improvement. It also results from the introduction of new, more flexible production technologies that enable the facility to shift from making one thing, to producing another, far more quickly than the large, specialized machines that characterize mass production.[83] Together, these innovations yield a "manufacturing environment subject to constant, on-going change"[84] in which "modifications to material inputs, product outputs, non-product outputs, equipment, equipment configurations, and operating parameters" are the norm.[85] This results in a distinct competitive advantage as flexible producers are able to introduce new products,[86] and improve existing ones, far more quickly than their mass production counterparts. It has led some to refer to this new method as "fast-cycle manufacturing"[87] or as "innovation-mediated production,"[88] and to claim that it represents a fundamental divergence from traditional mass production.[89]

"innovation constantly mediates and informs the production process" with the "discontinuous nature of innovation under fordism"); *see also* ROMM, *supra* note 4, at 36; U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 4.

83. KENNEY & FLORIDA, *supra* note 3, at 38 ("Japanese assembly lines are more adaptable than traditional assembly lines. They can be rapidly reconfigured to shift between different products . . . ."); WOMACK ET AL., *supra* note 5, at 13 (explaining that lean producers "use highly flexible, increasingly automated machines to produce volumes of products in enormous variety"); Florida, *Lean and Green*, *supra* note 4, at 91 ("[A]dvanced manufacturing systems are distinguished by a series of organizational and management practices . . . that complement and enhance the performance of new manufacturing technologies."). For example, Toyota developed new techniques for rotating manufacturing equipment so as to shift from producing one line of vehicles to making another in a matter of hours, rather than months or even years as was typical at American mass production auto facilities. Cohen, *supra* note 9, at 111. This meant that Toyota could easily produce several different vehicle models at a single facility, and could quickly adapt to changes in customer demand. *See* WOMACK ET AL., *supra* note 5, at 52-53.

84. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at iv.

85. *Id.*

86. An example is the swift pace at which the next generation of semiconductor chips and personal computers have been introduced over the past decade or so. KENNEY & FLORIDA, *supra* note 3, at 16.

87. ROMM, *supra* note 4, at 17.

88. KENNEY & FLORIDA, *supra* note 3, at 4. Other terms used to describe this new form of manufacturing include "lean production," ROMM, *supra* note 4, *passim*; U.S. EPA, PURSUING PERFECTION, *supra* note 3, *passim*; WOMACK ET AL., *supra* note 34, *passim*, "the Japanese System," KENNEY & FLORIDA, *supra* note 3, at 8, "the Toyota System," Cohen, *supra* note 9, at 110, "agile manufacturing," Florida, *Lean and Green*, *supra* note 4, at 82, and "advanced manufacturing," *id. passim*. All of these terms basically refer to the same method developed in Japan in the 1950s and 1960s by Toyota Corporation and other companies. Cohen, *supra* note 9, at 110-11; Florida, *Lean and Green*, *supra* note 4, at 82. This Article chooses the term "flexible production," *see* Cohen, *supra* note 9, at 98, because it best captures the method's most significant feature—its rapid pace of change—and because it best contrasts with the inflexibility of mass production.

89. KENNEY & FLORIDA, *supra* note 3, at 4 (describing flexible production as an "epoch-making new model of technology, work, and production organization"); Cohen, *supra* note 9, at 108 ("We are dealing with a new mode of production."); *id.* at 18 (describing "a profound transformation in the *organization* of production and of economic activity in general. This change can be described as a shift from standardized mass

4. Globalization and the Rise of Flexible Production

Toyota developed flexible production in the 1950s. Why did American manufacturers wait until the 1990s to adopt the method in significant numbers?[90] Globalization, the shift from relatively closed, national economies to a highly integrated, global one,[91] is the likely catalyst.[92] While this trend opened up new markets for American companies, it also confronted them with greater competition, from more parts of the world, than ever before.[93] In this fiercely competitive environment, companies have found that they can only succeed by bringing out new products faster than their competitors and by producing a greater variety of items tailored to specific consumer preferences. Globalization accordingly puts a premium on manufacturing speed and flexibility.[94] In the words of an Intel representative, the alternatives are to be "quick or dead."[95] In this context, the faster pace and greater product variety associated with flexible production are becoming a

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production to flexible customized production . . . .") (emphasis in original).

90. KENNEY & FLORIDA, *supra* note 3, at 4; ROMM, *supra* note 4, at 22.

91. *See* ATKINSON & COURT, *supra* note 49; THOMAS FRIEDMAN, THE LEXUS AND THE OLIVE TREE (1999); Cohen, *supra* note 9. While this trend dates back at least to the 1920s, it greatly accelerated during the 1990s. FRIEDMAN, *supra*, at 40, 87; James Salzman, *Beyond the Smokestack: Environmental Protection in the Service Economy*, 47 UCLA L. REV. 411, 425 (1999) ("The latest trend is globalization—the increasing interconnectedness and interdependence of commerce and culture across national borders.").

92. ROMM, *supra* note 4, at 35 (suggesting that "frenetic global competition" has driven American companies to embrace flexible principles).

93. ATKINSON & COURT, *supra* note 49, at 14; Cohen, *supra* note 9, at 98-99; Thomas A. Stewart, *Welcome to the Revolution*, FORTUNE, Dec. 13, 1993, at 66, 66-67. For example, in 1965, IBM had 2500 competitors in all of its markets. By 1992, it faced 50,000 such competitors. ATKINSON & COURT, *supra* note 49, at 14. IBM's experience is not unique. The share of the U.S. economy subject to foreign competition rose by fifty percent between 1985 and 1994. *Id.* Moreover, foreign competition for American products has grown from a "marginal phenomenon" in the 1960s to one that affected approximately seventy percent of American products in 1993. Cohen, *supra* note 9, at 98-99.

94. ATKINSON & COURT, *supra* note 49, at 17 ("The ability to innovate and get to market faster is becoming a more important determinant of competitive advantage."); ROMM, *supra* note 4, at 107; Manuel Castells, *The International Economy and the New International Division of Labor*, *in* MARTIN CONVOY ET AL., THE NEW GLOBAL ECONOMY IN THE INFORMATION AGE: REFLECTIONS ON OUR CHANGING WORLD 15, 18 (1993) (describing increased need for production flexibility); Michael E. Porter & Claas van der Linde, *Toward a New Conception of the Environment-Competitiveness Relationship*, 9 J. OF ECON. PERSPECTIVES, Fall 1995, at 97, 98. According to one commentator on globalization,

> [T]he speed by which your latest invention can be made obsolete or turned into a commodity is now lightening quick. Therefore, only the paranoid, only those who are constantly looking over their shoulders to see who is creating something new that will destroy them and then staying just one step ahead of them, will survive.

FRIEDMAN, *supra* note 91, at 9-10.

95. BOYD ET AL., *supra* note 6, at 41. As stated less colorfully in a U.S. EPA report, "[In] the highly competitive marketplace of the 21st Century . . . pressure to reduce the time-to-market cycle will continue to intensify for most companies. Such companies will need to conceive and deliver innovative products faster than the competition . . . . " U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 20.

competitive necessity.[96] The globalization of the 1990s is thus driving American manufacturers to undertake the difficult transition from mass to flexible production[97] and is bringing about a "dramatic shift in manufacturing paradigms."[98]

II. FLEXIBLE PRODUCTION AND ENVIRONMENTAL PERFORMANCE

The manufacturing sector is a major contributor to the nation's pollution problems. Does the emerging shift from mass to flexible production hold any meaning for the environment? Several years ago, the U.S. EPA asked this question and commissioned a report to explore it.[99] The EPA study focused on two Boeing airplane manufacturing facilities in Washington state that were about to undergo the shift from mass to flexible production—a project undertaken for business, not environmental, reasons.[100] The study examined several key indicators of environmental performance, both before and after the change. Its findings were striking. As compared to the prior mass production operations, the Boeing units implementing flexible approaches used thirty to seventy percent less resources per unit of production and achieved substantial reductions in energy use and generation of solid waste.[101] In seeking to explain this result, the report concluded that the core attributes of flexible production—the use of teams, looking across the entire system, and continuously seeking process improvements—were similar to the qualities needed for effective pollution prevention.[102] By developing these attributes, flexible production had strengthened the Boeing facilities' capacity to engage in pollution prevention.[103] This, in turn, led to the observed environmental improvements.

This thesis finds support on three fronts. Basic pollution prevention principles support it; current trends in environmental management help to explain it; and additional studies that have looked at flexible production and environmental performance affirm it.

Pollution prevention seeks to reduce (or, ideally, to eliminate) pollution by

96. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 11 ("[A]s global competitive pressures continue (and increase), production processes will increasingly be converted to operate in conformance with Lean principles."); Cohen, *supra* note 9, at 112 (stating that "there is no way to stay competitive over time" without adopting flexible production).

97. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at ii ("American industries are actively implementing Lean Manufacturing as a key strategy for remaining competitive in today's manufacturing environment, and implementation of this manufacturing paradigm shift is taking place across numerous industrial and source sectors."); *see also supra* note 3 (citing additional sources for the proposition that American industry is adopting flexible production).

98. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 20.

99. *See generally id.*

100. *Id.*

101. *Id.* at 12, 20.

102. *Id.* at 6, 22.

103. *Id.* at 22 (surmising that flexible production "holds the potential to support American industry in its efforts to compete globally, make important advances in pollution prevention, and move us more swiftly along the road to a more sustainable form of capitalism"); *see also id.* at 8 ("The focus of Boeing's Lean effort is continuous elimination of waste in the Company's manufacturing processes, including reducing costs, cycle time, and defects.").

altering the production process itself.[104] It can be contrasted with "end-of-pipe" approaches to pollution control that assume pollution will be created and employ control technologies at the end of the production line to capture it.[105] There is a general consensus that, due to the high cost of add-on controls, pollution prevention often achieves reductions more cheaply than end-of-pipe methods.[106] In order to implement pollution prevention successfully, a business must possess two qualities. First, it must be able to identify the "upstream" changes to the production process that will reduce pollution further on down the line.[107] A facility's ability to do this is often influenced by the degree to which it involves operations employees, who tend to have the most intimate knowledge of the production process, in the search.[108] Second, the company must have the willingness and ability to implement these changes once it has identified them.[109]

American mass producers have traditionally been lacking on both of these fronts. As was explained above,[110] they often focus on improving discrete parts of the manufacturing operation[111] and find it difficult to take a system-wide view. This can prevent them from seeing how upstream changes might result in pollution reduction elsewhere in the production process.[112] Instead, it leads most such companies to treat pollution control as a separate problem to be handled by the environmental manager working largely in isolation from operations, design, and other business personnel. This hinders the development of pollution prevention strategies that require coordination across the entire production system.[113] Even

104. *See* Kurt A. Strasser, *Cleaner Technology, Pollution Prevention and Environmental Regulation*, 9 FORDHAM ENVTL. L.J. 1, 8 (1997) [hereinafter Strasser, *Cleaner Technology*] ("Pollution prevention usually requires . . . process modifications, product design alterations, materials substitutions, or combinations thereof.").

105. *Id.* at 1, 3.

106. *See* Stewart, *A New Generation*, *supra* note 22, at 117 ("[Pollution] and waste prevention is generally less costly than disposal of residuals after generation."); Strasser, *Preventing Pollution*, *supra* note 22, at 7-8; Elliott, *supra* note 11, at 1852; Johnson, *supra* note 22, at 159 ("[I]t often costs less to prevent pollution than to control it."). The reasons for this vary, and include the high cost of add-on controls, the fact that pollution prevention strategies are tailored to the individual facility while add-on controls generally are not, and other factors. Strasser, *Preventing Pollution*, *supra* note 22, at 8.

107. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 14 (explaining that effective pollution prevention requries "a systematic approach to continual improvement").

108. *Id.* (stating that effective pollution prevention requires "systematic and on-going evaluation of waste that is embraced and implemented by operations personnel.").

109. *See* Strasser, *Cleaner Technology*, *supra* note 104, at 11-12.

110. *See supra* text accompanying note 72.

111. *See* ROMM, *supra* note 4, at 30, 147.

112. *Id.* at 30. American businesses have a hard time engaging in pollution prevention "because they do not know how to take a systems approach to improving processes. This weakness results from the traditional U.S. focus on operations—a tradition that is one reason so few discuss systems thinking." *Id.*; *see also* Strasser, *Cleaner Technology*, *supra* note 104, at 70 (connecting the mass production mindset with an unwillingness to adopt anything but end-of-pipe pollution controls).

113. Johnson, *supra* note 22, at 165-66 ("[C]orporate environmental decisions are often institutionally separate from production decisions. Corporate environmental decision makers are familiar with pollution control technologies yet unfamiliar with production processes. Therefore, they focus on the implementation of pollution control technologies rather than on changes in the production processes . . . . ").

where mass production facilities are able to identify pollution prevention opportunities, they are often reluctant to implement them. Both culturally and technologically the mass production facility is designed for the stable, high-volume production of standard items.[114] This makes it resistant to the type of product or process change on which pollution prevention depends,[115] but receptive to end-of-pipe controls that do not require alterations elsewhere in the production process. For all of these reasons, mass production operations are not well suited to pollution prevention and have tended to favor end-of-pipe solutions.

Flexible production facilities, by contrast, excel in the very qualities that pollution prevention requires. They use cross-functional groups to gain a system-wide view of the production process. They engage their line employees in the search for process improvement ideas. These qualities should enable them to more easily identify "upstream" opportunities for pollution reduction.[116] Flexible producers, geared towards rapid change, should also be more willing to undertake the product and process alterations on which effective pollution prevention depends.[117] In short, the qualities that are needed for successful pollution prevention—the ability to see the whole system, worker involvement, and the embrace of process change—are the very attributes that serve to distinguish flexible from mass production.[118]

Flexible producers should be able to apply these capacities to environmental ends. Indeed, current trends in environmental management suggest that this is happening today. One piece of evidence is private businesses' increasing use of environmental management systems ("EMSs"). An EMS is a process by which a company sets ambitious environmental goals, challenges its employees to come up with innovative ways to meet those objectives, monitors progress towards the goals, and commits to continuous improvement in environmental performance and compliance.[119] As this description makes plain, EMSs share many of the characteristics of *kaizen* management techniques,[120] and can be understood as an adaptation of this strategy to environmental purposes.[121] EMSs have been shown to

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114. *See supra* notes 37-49 and accompanying text; *see also* Strasser, *Cleaner Technology*, *supra* note 104, at 12 ("[M]anufacturing machinery becomes increasingly specialized in order to increase efficiency and reduce costs. Consequently, major product or process changes become much more difficult.").

115. Strasser, *Cleaner Technology*, *supra* note 104, at 12.

116. ROMM, *supra* note 4, at 29 ("Clean production, which in its highest form is pollution prevention, forces a manufacturer to look at the whole production process rather than only at operations. It forces a company to use many of the same techniques for minimizing wasted resources that Shingo and Ohno used to minimize wasted time, including cross-functional teams.").

117. *See id.* at 6 (noting that both flexible production and pollution prevention "have the same goal: systematically reducing waste"). *Cf.* Strasser, *Cleaner Technology*, *supra* note 104, at 20 (emphasizing that the fluidity of a company's core technology is a critically important factor in its attitude towards process and product change and so in its ability to adopt pollution prevention strategies).

118. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 21 (stating that flexible production's "systematic approach is highly parallel to existing pollution prevention . . . efforts").

119. *See generally The ISO 14001 Environmental Management Systems Standard: A Modest Perspective*, 27 ENVTL. L. INST. 10,622 (Dec. 1997).

120. *See supra* notes 55-62 and accompanying text.

121. *See* Elliott, *supra* note 11 (describing corporate efforts to use Total Quality

be an effective method of generating and carrying out pollution prevention strategies.[122] Accordingly, the rise of EMSs supports the thesis that flexible production strategies can facilitate pollution prevention; indeed, it shows that they are presently doing so.

Another such development is the increasing use of design for environment ("DFE") practices. As the name would suggest, the DFE approach seeks to incorporate environmental considerations into product design in order to bring about environmentally preferable manufacturing processes and products.[123] To accomplish this, DFE brings environmental experts and design engineers together at an early stage in the process so that they can jointly consider the environmental impacts of design decisions.[124] Such collaboration can lead to the development of new product designs that make the production process less polluting or make a product easier to disassemble and hence to recycle.[125] It can also help to identify and eliminate environmentally harmful process steps,[126] or to generate ideas about new materials that cause less environmental impact. Design for environment thus bears a strong conceptual resemblance to cross-functional manufacturing, particularly design for manufacturability, and can be understood as an offshoot of it. The rise of environmental management systems and design for environment practices suggests that flexible producers not only can apply their techniques to pollution prevention, but that some are already doing so.[127]

Empirical studies further confirm the efficacy of flexible production techniques in the environmental context. In 1993, the President's Commission on Environmental Quality[128] set out to examine whether Total Quality Management ("TQM"), the American term for *kaizen*,[129] could contribute to pollution

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Management ("TQM") techniques in order to improve environmental performance and compliance, especially in the area of pollution prevention).

122. *See* EPA Position Statement on Environmental Management Systems and ISO 14001 and a Request for Comments on the Nature of the Data to be Collected From Environmental Management System/ISO 14001 Pilots, 63 Fed. Reg. 12,094, 12,095 (Mar 12, 1998).

123. Braden R. Allenby, *Integrating Environment and Technology: Design for Environment, in* THE GREENING OF INDUSTRIAL ECOSYSTEMS 137, 139 (Braden R. Allenby & Deanna J. Richards eds., 1994).

124. *See id.* at 139-41.

125. *Id.* at 139, 142.

126. *Id.* at 141-42.

127. This is not to say that every firm that implements an EMS or utilizes DFE methods is a flexible producer. Other firms may adopt these environmental management methods without also taking on the other elements of flexible production. However, studies have shown that flexible producers are more likely than others to implement an EMS, *see* King & Lenox, *supra* note 13, at 245, and to adopt DFE strategies, *see* Florida, *Lean and Green*, *supra* note 4, at 80.

128. The Commission consisted of individuals from the business, foundation, and environmental communities. TQM Report, *supra* note 61.

129. *See* Florida, *Lean and Green*, *supra* note 4, at 83, 91. Total Quality Management, as described in the report, closely mirrors the above description of *kaizen*. *See supra* notes 55-62. It includes employee empowerment that encourages line workers to "recognize problem areas [and] identify possible solutions," TQM Report, *supra* note 61, at 18, the use of "cross-functional team[s]," *id.* at 20, and an emphasis on "continuous improvement," *id.* at 2; *see also id.* at 39 ("The heart of TQM is the systematic analysis of processes or services by empowered, cross-functional, multi-disciplinary teams.").

prevention.[130] The study focused on twelve facilities around the country that had volunteered to try to reduce pollution through the application of TQM methods.[131] It evaluated whether the adoption of these methods had any effect on actual pollution reduction. The result, in the words of one commentator, was a series of "stunning success stories of rapid and dramatic reductions in pollution that are uncommon, if not unprecedented, in the history of U.S. environmental law."[132] For example, a General Electric facility reduced its use of 1,1,1 Trichloroethane by 95 percent.[133] A Dupont facility reduced its generation of ammonium sulfate from 100 million pounds per year to 40 million pounds per year.[134] A Dow Chemical facility achieved a 67 percent reduction in the amount of material sent to waste treatment facilities.[135] According to the report, the reason for these results was that "Total Quality Management (TQM) and pollution prevention are complementary concepts."[136] Both rely on the same set of core strategies: empowered workers, operating in cross-functional teams, to engage in a systematic analysis of how to improve the process.[137] The adoption of TQM (*kaizen*) techniques accordingly enabled the facilities to engage far more effectively in pollution prevention. The TQM Report strongly supports EPA's thesis, set out in its study of the two Boeing facilities, that the implementation of flexible production techniques significantly enhances a facility's ability to engage in pollution prevention.[138]

Other studies point in the same direction. In 1996, Professor Richard Florida conducted a national survey of American manufacturing firms using a combination of written surveys, phone interviews, factory visits, and on-site interviews.[139] The purpose of this research was to probe for connections between flexible production methods and innovative approaches to environmental performance,[140] particularly pollution prevention activities.[141] Florida's surveys revealed that firms that undergo frequent process changes are far more likely to introduce environmental considerations into the design of their products (green design) than firms with more static processes.[142] He attributed this to the fact the more dynamic firms are already bearing the fixed costs associated with process change and therefore face lower incremental costs from implementing green design.[143] "[F]irms that are innovative and engaged in continuous improvement of and frequent changes to their products and product designs have a greater opportunity and incentive to take environmental

130. TQM Report, *supra* note 61, at vii; *see generally* Elliott, *supra* note 11 (analyzing the Commission's report).

131. TQM Report, *supra* note 61, at 3 (listing facilities).

132. Elliott, *supra* note 11, at 1843.

133. TQM Report, *supra* note 61, at 41.

134. *Id.* at 41-42.

135. *Id.* at 41.

136. *Id.* at 39.

137. *Id.* ("The heart of TQM is a systematic analysis of processes or services by empowered, cross-functional, multi-disciplinary teams. The same is true regarding pollution prevention.").

138. *See supra* notes 102-03 and accompanying text.

139. Florida, *Lean and Green*, *supra* note 4, at 81, 101-02.

140. *Id.* at 80.

141. *Id.* at 83.

142. *Id.* at 99.

143. *See id.*

considerations into account [in their own product design] . . . ."[144] Florida's study showed that the more dynamic firms are also more likely to engage in other forms of pollution prevention.[145] This again suggests that the adoption of flexible manufacturing techniques facilitates a plant's ability to engage in pollution prevention. The implementation of flexible strategies thus "produces spill-over benefits to the environment and creates the context for innovative approaches to emission reduction and pollution prevention."[146]

In a 2001 study, Professors Andrew King and Michael Lenox sought to examine the connection between flexible production and pollution prevention.[147] To do so, they analyzed environmental performance data on over 17,000 U.S. manufacturing companies as provided by the Toxic Release Inventory ("TRI").[148] They then correlated this data with firm adoption of flexible production strategies.[149] Their findings suggest a strong relationship between flexible production and pollution prevention. According to the study, flexible production firms are more likely than others to adopt an EMS and hence to involve workers in the cross-functional pursuit of continuous environmental improvement.[150] The study attributes this connection to the reduced marginal cost of implementing such a whole-system environmental approach for those firms that have already done so for other business purposes.[151] Such firms are also more likely to employ pollution prevention strategies, rather than end-of-pipe controls, to meet their environmental obligations.[152] Finally these firms, by virtue of their pollution prevention methods, emit fewer toxic pollutants per unit of production than other manufacturing firms.[153] Taken together with the EPA report mentioned above, these studies send a strong and unified message: the adoption of flexible production techniques increases a facility's capacity to engage in pollution prevention, and this can lead to meaningful environmental gains.

This finding, if confirmed by further study, could present exciting opportunities for environmental protection. There is a virtual consensus among policymakers and commentators that pollution prevention is a less expensive way of controlling pollution than an end-of-pipe approach.[154] This means that flexible production facilities, with their greater ability to engage in pollution prevention, should be able to reduce pollution more than similarly situated mass production plants for the same or less cost. The shift to a flexible production economy may, accordingly, allow better environmental protection without appreciably increasing the cost to regulated facilities or to society as a whole.

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144. *Id.*

145. *Id.* at 85-87.

146. *Id.* at 101.

147. King & Lenox, *supra* note 13, at 244.

148. *Id.* at 245-46.

149. *Id.* at 245.

150. *Id.* at 245, 253. For a description of environmental management systems, see *supra* notes 119-22 and accompanying text.

151. King & Lenox, *supra* note 13, at 245-46. This is similar to Florida's analysis. *See supra* note 143 and accompanying text.

152. King & Lenox, *supra* note 13, at 245, 253.

153. *Id.* at 253.

154. For a list of authorities that support this proposition, see *supra* note 22.

III. FLEXIBLE PRODUCTION AND THE CLEAN AIR ACT PERMITTING REQUIREMENTS

The industrial infrastructure of the United States is undergoing a major transformation. Mass production, the form of manufacturing that has dominated the American economy for more than a hundred years, is starting to give way to flexible production.[155] This new form of manufacturing is far better suited to pollution prevention than is mass production and should be able to support more stringent levels of environmental performance. Do these developments have any implications for environmental law and policy? As we stand at the threshold of the flexible manufacturing era, this is a critical question that bears examination. Only a few environmental scholars have begun to think about it.[156]

This Part will argue that flexible production conflicts with at least one major area of environmental law: the Federal Clean Air Act permitting programs, especially the NSR program and related state programs, and the Title V Operating Permit Program.[157] This conflict is rooted, first, in speed. As will be explained in greater detail below, the CAA permit programs require a facility to obtain a permit or permit modification before undertaking certain changes to its manufacturing process.[158] The issuance of the permit or permit modification can take months to complete for each such change. This does not fit the fast pace of flexible production which may entail dozens of such changes each year. In short, the CAA permit programs and flexible production operate at different speeds. This mismatch threatens to undermine the work of both the companies and the regulators. The second part of the conflict, which relates more specifically to the NSR program, stems from the fact that this program encourages facilities to meet their emission control requirements by adopting a specific, end-of-pipe control technology. Such an approach fails to take advantage of flexible production's enhanced capacity for pollution prevention. As the next Part will argue, the Environmental Regulatory Reinvention movement of the 1990s and the Bush administration's NSR Reform Rule can each be seen, in part, as attempts to address the conflict between the CAA permit programs and flexible production (albeit in very different ways). To understand this, it is necessary first to learn something about the permit programs themselves.

A. The New Source Review Program

The CAA directs the EPA Administrator to promulgate national standards that define the permissible ambient concentrations of "criteria" air pollutants.[159] The

155. *See* Florida, *Lean and Green*, *supra* note 4, at 80-81.

156. For the few who have begun to consider it, see MAZUREK, *supra* note 11 (examining environmental regulation of the semiconductor industry); BOYD ET AL., *supra* note 6 (analyzing the Intel Corporation permit negotiated through Project XL); Elliott, *supra* note 11, at 1844-54 (discussing environmental potential of Total Quality Management); Dennis D. Hirsch, *Globalization, Information Technology, and Environmental Regulation: An Initial Inquiry*, 20 VA. ENVTL. L.J. 57 (2001) [hereinafter Hirsch, *Globalization*].

157. It may also create points of "friction" with the RCRA and Clean Water Act permit programs. *See supra* notes 15-16 and accompanying text. The nature and extent of these conflicts would be a productive area for future research. Professor Richard Stewart helpfully pointed this out.

158. *See infra* notes 159-63, 216-21 and accompanying text.

159. Clean Air Act § 109, 42 U.S.C. § 7409(a) (2000). The Administrator is directed to

issuance of such a national standard has the effect of dividing the nation into those areas that meet the standards, known as "attainment" areas, and those that do not, known as "nonattainment" areas.[160] The NSR program operates in both attainment and nonattainment areas.[161] It requires new emitters of criteria air pollutants[162] to obtain a permit prior to commencing construction, and to meet certain emission standards and other requirements.[163]

For the purposes of the program, "new" sources include those that are newly constructed, as well as those existing sources that seek to undertake a physical or operational change (known as a "modification").[164] The NSR program does not apply to all such new sources of air emissions. It covers only those facilities that will emit meaningful amounts of pollution and so pose a threat to air quality. Thus, it governs only those newly built facilities that will emit more than a specified amount of a pollutant,[165] known as "major sources,"[166] and those modifications at existing major sources that will cause a "significant net emissions increase" of a pollutant,[167] known as "major modifications."[168]

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promulgate such national standards for those pollutants that "may reasonably be anticipated to endanger public health or welfare" and that result from "numerous or diverse mobile or stationary sources." *Id.* § 108(a)(1), 42 U.S.C. § 7408(a)(1). These pollutants are referred to as "criteria" pollutants because air quality criteria documents have been issued for them. *See id.* At present there are six criteria air pollutants: sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead. *See* ROY S. BELDEN, CLEAN AIR ACT 12 (2001).

160. *See* BELDEN, *supra* note 159, at 23.

161. In an effort to prevent this summary from becoming too complex, this section will focus on the requirements in attainment areas. The NSR requirements for nonattainment areas follow much the same pattern, although they differ in some important respects. For a summary of how the NSR program applies in these two types of areas, see generally Bernard F. Hawkins, Jr., *The New Source Review Program: Its Prevention of Significant Deterioration and Nonattainment Analysis Programs*, *in* THE CLEAN AIR ACT HANDBOOK 98 (Robert J. Martineau, Jr. & David P. Novello eds., 1998).

162. Criteria air pollutants are those that EPA has identified as posing a danger to public health or welfare and that result from numerous stationary or mobiles sources. Clean Air Act § 108(a), 42 U.S.C. § 7408(a) (2000). To date, EPA has identified six such pollutants: sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead. *See* BELDEN, *supra* note 159, at 12-13.

163. The NSR program applies only to those air pollutants that EPA has identified as posing a danger to public health or welfare and that result from numerous stationary or mobiles sources. Clean Air Act § 108(a), 42 U.S.C. § 7408(a). To date, EPA has identified six such pollutants: sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead. *See* BELDEN, *supra* note 159, at 12-13.

164. Hawkins, Jr., *supra* note 161, at 101.

165. *See id.* at 108-09. For the NSR program governing clean-air areas, known as the Prevention of Significant Deterioration ("PSD") program, this threshold is 250 tons per year, although it is 100 tons per year for facilities in specified industrial categories. *Id.*; *see also* Clean Air Act § 169(1), 42 U.S.C. § 7479(1) (defining "major emitting facility").

166. Hawkins, Jr., *supra* note 161, at 108.

167. *See* 40 C.F.R. § 52.21(b)(2)(i) (2003) (defining "major modification"); Hawkins, Jr., *supra* note 161, at 112-13. The "significance threshold" differs for the various regulated pollutants. Hawkins, Jr., *supra* note 161, at 112. For example, for nitrogen oxides, an increase of 40 tons per year would be "significant." *Id.* For carbon monoxide, an increase of 100 tons per year is significant. *Id.*

168. Hawkins, Jr., *supra* note 161, at 110.

The requirements governing major modifications are most relevant to flexible production. These provisions require a plant that is changing its production process to determine whether each such change constitutes a major modification and, if so, to obtain an NSR permit prior to undertaking it. To determine whether a given change qualifies as a major modification, the regulations require the facility to determine whether the emissions increase associated with the proposed change will be "significant." If it is, the source must evaluate whether the proposed increase, when considered along with all other recent emission increases and decreases, would yield a significant "net" emissions increase. Only if there is a significant net emissions increase will a permit be required. The complex and time-consuming nature of these determinations have a direct bearing on fast-paced, flexible protection and it is worth explaining them in a bit more detail here. Tbey can be broken down into five steps.

Step 1: First, a facility undertaking a change would have to determine wbether the change itself produces a "significant" emissions increase.[169] To make this assessment, the facility would have to identify a "baseline" level of emissions, defined as the plant's average emissions during any consecutive twenty-four month period within the last five or ten years depending on the type of unit.[170] It would then estimate the projected post-change emissions,[171] a calculation that would have to include not only increases at the modified unit itself, but also any increases at other units that might be able to increase production due to the change (known as "debottlenecking" increases).[172] Finally, it would subtract the baseline amount from the projected post-change emissions in order to arrive at the emissions increase resulting from the change.[173] If the increase turned out not to be significant, no NSR permit would be required. If it were significant, the plant would move on to the other four steps in the analysis.

Step 2: The second step would be to determine whether the project fit within one of the NSR exemptions. These include exemptions for "[r]outine maintenance, repair and replacement,"[174] certain types of fuel switching,[175] increases in the hours of operation or production rate,[176] as well as a number of other exemptions.[177] There is often some ambiguity as to whether a given change falls within one of these exemptions.[178]

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169. U.S. EPA, NEW SOURCE REVIEW WORKSHOP MANUAL: PREVENTION OF SIGNIFCANT DETERIORATION AND NONATTAINMENT AREA PERMITTING A-46 (Oct. 1990) [hereinafter U.S. EPA, NEW SOURCE REVIEW]. The regulations set out the significance threshold for each of the criteria pollutants. *See* 40 C.F.R. § 52.21(b)(23) (defining "significant" as that term applies in attainment areas).

170. 40 C.F.R. § 52.21(b)(48).

171. *Id.* § 52.21(a)(2)(iv)(c). The regulations define this as the "maximum annual rate, in tons per year, at which an existing emissions unit is projected to emit a regulated NSR pollutant in any one of the 5 years (12-month period) following the date the unit resumes regular operation after the project . . . ." *Id.* § 52.21(b)(41)(i).

172. U.S. EPA, NEW SOURCE REVIEW, *supra* note 169, at A-46.

173. 40 C.F.R. § 52.21(a)(2)(iv)(c) (defining "actual-to-projected-actual" test for projects at existing emission units).

174. *Id.* § 52.21(b)(2)(iii)(a).

175. *Id.* § 52.21(b)(2)(iii)(b)-(e).

176. *Id.* § 52.21(b)(2)(iii)(f).

177. *See id.* § 52.21(b)(2)(iii).

178. Traditionally, the "routine maintenance, repair and replacement" exemption was

Step 3: Even where a change produces a significant increase and is not exempt, the regulations only require a permit if the sum of the increase and all other "contemporaneous" and "creditable" increases and decreases at the plant result in a significant "net" emissions increase.[179] To evaluate this, the plant would begin by identifying all "contemporaneous" increases and decreases at the facility, that is all those that occurred during the five years prior to the contemplated change.[180]

Step 4: It would then assess whether the decreases it had identified were "creditable," that is practically enforceable as of the time that actual construction on the change begins,[181] and not relied on when a prior NSR permit was issued.[182]

Step 5: Finally, the facility would sum the emissions increase along with all other contemporaneous and creditable increases and decreases to arrive at its net emissions increase.[183] If the net increase were significant, the change would constitute a major modification and the source would be subject to NSR permitting requirements.[184]

Two principal requirements would apply: the source would have to obtain a permit prior to beginning construction and it would have to reduce its emissions consistent with the "best" control technology then available. Issuance of the NSR permit itself is a multi-step process that includes, at a minimum, preparation of a permit application, review of the application for completeness, drafting of the proposed permit, initial agency review of the document, release of the draft permit for public comment (usually thirty days), writing of the final permit and response to comments, and final agency review.[185] This process typically takes from several

applied on a case-by-case basis and was quite ambiguous. The EPA has recently attempted to clarify (some would say to greatly expand) the exemption by rule. *See* Prevention of Significant Deterioration (PSD) and Non-Attainment New Source Review (NSR): Equipment Replacement Provision of the Routine Maintenance, Repair and Replacement Exclusion, 68 Fed. Reg. 61248 (Oct. 27, 2003) (to be codified at 40 C.F.R. pts. 51-52).

179. 40 CFR § 52.21(b)(2) (defining "major modification" as a physical or operational change that results in a "significant emissions increase" and a "significant net emissions increase").

180. *Id.* § 52.21(b)(3)(ii).

181. *Id.* § 52.21(b)(3)(vi).

182. *Id.* § 52.21(b)(3)(iii)(a).

183. *Id.* § 52.21(b)(3)(i).

184. *Id.* § 52.21(b)(2)(i).

185. For a comprehensive description of the typical permitting process, see James M. Thunder, *Reinventing Environmental Permitting: Drafting the Permit*, 27 ENVTL. L. REP. 10,617 (1997). As Thunder explains, the company must first complete and submit a lengthy permit application form. *Id.* at 10,618. Next, a government official must review the permit application for completeness. *Id.* The official will return the permit application if it is incomplete, possibly requiring another round of technical work. *Id.* Once a complete application has been submitted, the government official drafting the permit will review all federal and state laws, regulations, and guidance documents that might apply to the anticipated construction, including best available technology requirements. *Id.* The permit writer will then draft the permit and submit it for review by others within the agency. *Id.* Once the agency signs off on the permit, it is formally proposed and the company and the public (neighbors, community members, environmental groups, competitors, etc.) are given an opportunity to comment upon it. *Id.* at 10,619. When the comment period closes (usually after thirty days, although it may be extended), the permit writer reviews the comments and revises the draft permit. *Id.* The official then submits it for a second round of review at the agency. Once the agency is satisfied with the document, it issues it as a final permit. *Id.* At

months to two years.[186] In the meantime, the facility is prohibited from implementing the proposed change.

Second, the NSR program requires all covered facilities to meet the level of pollution control that they would achieve through application of the "best available" pollution control technology. The precise meaning of this requirement differs depending on where the facility is located. Sources in areas where the air is relatively clean must comply with the "best available control technology" ("BACT").[187] Those in dirty-air regions must meet a stricter "lowest achievable emission rate" ("LAER") standard.[188] While these standards vary in subtle ways, they essentially require the most stringent emissions control level that the EPA on a case-by-case basis finds to be economically and technically feasible for the facility in question.[189] A plant must commit to meeting this emissions control standard before it can obtain its NSR permit.[190] In theory, the facility retains discretion in determining how it will achieve the required level of emission control. In practice, the situation is quite different. Companies seeking to avoid a misunderstanding with the agency almost universally adopt the end-of-stack control technology that the agency found to be "best" for the industry and on which the agency based the standard (known as the "reference" technology). Firms believe that, so long as they are utilizing the reference technology, the agency cannot claim that they are exceeding the required emissions level (the reference technology being, after all, the benchmark from which that standard was set).[191] In addition, agency permit writers tend to be comfortable with this familiar technology and are willing to accept it as meeting the control requirement. Where facilities depart from this arrangement (e.g., by utilizing a unique pollution prevention approach to achieve their emission standards), the permit writer is often more resistant, requires far more monitoring and reporting from the facility, and is more likely to find a

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this point, the company or a commentator on the permit may decide to appeal this final agency action, first through an administrative appeals process and, if this proves unsatisfactory, through the courts. *Id.*

186. NSR Reform Rule, *supra* note 21, at 80,207.

187. *See* Clean Air Act § 165(a)(4), 42 U.S.C. § 7475(a)(4) (2000).

188. *See id.* § 173(a)(2), 42 U.S.C. § 7503(a)(2).

189. *See id.* § 169(3), 42 U.S.C. § 7479(3) (defining "best available control technology"); *id.* § 171(3), 42 U.S.C. § 7501(3) (defining "lowest achievable emission rate"); *see also* Hawkins, Jr., *supra* note 161, at 120-25, 143-44 (describing the Clean Air Act's best available technology requirements); *see generally* Bruce A. Ackerman & Richard B. Stewart, Comment, *Reforming Environmental Law*, 37 STAN. L. REV. 1333, 1335 (1985) (noting that the "best available technology" standard requires that sources apply the most stringent technology "so long as the costs of doing so will not cause a shutdown"). In theory, the LAER standard looks only at the most stringent technology achieved in practice and does not consider cost or technical feasibility for the source in question. Hawkins, Jr., *supra* note 161, at 143. In practice, however, the EPA is often unwilling to cause a facility shutdown and feasibility works its way into the statutory scheme even in dirty-air areas. *Cf. id.* (stating that the EPA may substitute an alternative if the LAER standard is technically infeasible).

190. Hawkins, Jr., *supra* note 161, at 102.

191. *See* ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE AND POLICY 156 (3d ed. 2000); Richard B. Stewart, *Regulation, Innovation and Administrative Law: A Conceptual Framework*, 69 CAL. L. REV. 1256, 1268-69 (1981) (noting that facilities "have strong incentives to adopt the particular technology underlying the standard because its use will readily persuade regulators of compliance").

violation.[192] For this reason, virtually all facilities decide to install the reference technology.[193] Thus, the Clean Air Act permitting requirements create an almost irresistible incentive to install end-of-stack control technologies and to avoid pollution prevention methods.

In addition to the major source NSR program just described, all states have their own "minor source" pre-construction permitting program.[194] These programs cover smaller new constructions or modifications that would not qualify as "major" under the Clean Air Act. These minor source permitting programs, while less rigorous, typically require some form of pre-construction review, control technology, and public participation.[195] The minor source permit process can take up to several months, usually including up to sixty days for the public review and comment alone.[196] The state programs may also impose control technology requirements, but do not always do so.[197]

These federal and state new source review requirements have important implications for flexible production. Consider first the requirement that a facility obtain a permit before changing its manufacturing process, an undertaking that may take anywhere from a month (for a state minor source permit) to a year or more (for a federal NSR permit). Such a time frame may have been acceptable during a prior era. Mass-production facilities, geared towards high-volume production of standard items, engaged in few changes and, when they did alter their production process, had plenty of lead time in which to obtain a permit.[198] The situation is far more problematic for fast-cycle, flexible-production operations.[199] These facilities are characterized by rapid and continuous process change and may undertake a modification every few weeks.[200] Indeed, as mentioned above,[201] an Intel chip-manufacturing plant engages in thirty to forty-five process changes each year and

192. Telephone interview with David C. Bray, Special Assistant to the Director, Office of Air Quality, U.S. Environmental Protection Agency Region 10 (October 31, 2003) [hereinafter Bray Interview].

193. *Id.*; ROMM, *supra* note 4, at 13 (recognizing that regulations "creat[e] de facto standards, as many books and studies have noted").

194. BELDEN, *supra* note 159, at 49.

195. *Id.*; Timothy Mohin, *The Alternative Compliance Model: A Bridge to the Future of Environmental Management*, 27 ENVTL. L. REP. 10,345, 10,350 (1997).

196. BOYD ET AL., *supra* note 6, at 8. One recent report indicated that the delay was more like 90 to 180 days. U.S. EPA, EVALUATION OF IMPLEMENTATION EXPERIENCES WITH INNOVATIVE AIR PERMITS 27 (2002) [hereinafter U.S. EPA, EVALUATION OF INNOVATIVE AIR PERMITS].

197. BELDEN, *supra* note 159, at 49.

198. *See supra* notes 46-49 and accompanying text.

199. *See* TERRY DAVIES, REFORMING PERMITTING 84 (2001) (explaining that as the pace of technological change accelerates, companies will need new permits more frequently, and as the number of companies whose competitive position depends on keeping up with that pace increases, waiting for a new permit will become more and more intolerable); U.S. EPA, ACTION PLAN FOR ACHIEVING THE NEXT GENERATION IN ENVIRONMENTAL PERMITTING 8 (1999), *at* http://www.epa.gov/permits/pap0299.pdf [hereinafter U.S. EPA, NEXT GENERATION PERMITTING] ("The need to undergo a time-consuming process for issuing or modifying permits is a similar source of concern, especially in businesses where making process changes rapidly is economically important.").

200. *See* John H. Cushman, Jr., *U.S. Seeking Options on Pollution Rules*, N.Y. TIMES, May 27, 1996, at A11.

201. *See supra* notes 81-89 and accompanying text.

develops an entirely new product every two to three years.[202] A facility operating on this schedule cannot wait a month, much less a year, to have each process change pre-approved.[203] In short, the time delays associated with NSR permitting pose a major ohstacle to the flexible-production husiness model. Strictly applied, they could make it very difficult to engage in fast-cycle production.[204] This was the finding of the U.S. EPA Boeing report, which concluded that flexible production's

> continual improvement culture means that modifications to material inputs, product outputs, non-product outputs, equipment, equipment configurations, and operating parameters are likely to be the norm, and result in a manufacturing environment subject to constant, on-going change. In this environment, even minimal regulatory delay holds the potential to erode quickly a process improvement's financial return. . . . In other words, the business case for Lean initiatives is highly sensitive to implementation time frames. Thus, regulatory agencies have a new challenge to keep timely pace with these changes while ensuring enforceability and environmental protectiveness.[205]

Even where it turns out that no NSR permit is required, the analysis necessary

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202. DAVIES, *supra* note 199, at 19 (referring to an Intel official's statement that the company makes over fifty process changes per facility per year, each of which is subject to lengthy permit review); Thunder, *supra* note 185, at 10,618; BOYD ET AL., *supra* note 6, at 13.

203. In the words of one such company, "[t]he only competitive advantage that we have . . . is time." Cushman Jr., *supra* note 200, at A11. In this regard, it is relevant that many other nations do not require the type of rigorous permitting that characterizes the traditional American environmental regulatory system. Thus, American businesses are not competing on a level playing field with respect to these timing issues. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at iv (explaining that the rise of flexible manufacturing results in the need for "increased regulatory agency receptivity to innovative process change . . . and timely (preferably real time) responses to construction and modification actions").

204. *See* Thunder, *supra* note 185, at 10,618 ("If the cycle time for permitting is longer than, or even an appreciable percentage of, the cycle time for developing and commercializing American manufactured products, permitting will kill American manufacturing."); U.S. EPA, NEXT GENERATION PERMITTING, *supra* note 199, at 8. *Cf.* Stewart, *supra* note 191, at 1287-88 (explaining that the existing regulatory system is not well designed for firms that engage in innovation). This conclusion may seem to be at odds with the fact that an increasing number of facilities are making the transition to flexible manufacturing. *See supra* note 3 and accompanying text. However, the two are not necessarily inconsistent. Permitting innovations, discussed below, that adapt the permitting scheme to the realities of fast-cycle manufacturing may be allowing some facilities to adopt flexible methods. Other facilities may adopt flexible methods in portions of their facilities that are not covered by environmental permitting requirements. For example, the EPA found that the Boeing plants it studied had not adopted flexible strategies in the most environmentally sensitive parts of its processes. This stemmed from the company's fear that its flexible strategies applied to these areas of the operation would trigger permitting requirements. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at 17-19. Still other facilities may be adopting flexible strategies without fully complying with environmental permitting requirements. Finally, it may be the case that a far greater number of facilities would have adopted flexible methods by now had they not faced the type of permitting issues that we have described. Thus, the growing number of flexible facilities does not mean that the regulatory obstacles we have described are not a major issue.

205. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at iv.

to make this determination is itself sufficiently time consuming and fraught with uncertainty to pose a significant obstacle for flexible producers.[206] As described above,[207] the facility must identify the increase associated with the change, determine whether any of the exceptions apply, identify all the "contemporaneous" and "creditable" increases and decreases, and calculate whether there has been a "net" emissions increase. Each of these steps can itself require additional determinations (e.g. to compute the increase you have to identify the "baseline" and evaluate any "debottlenecking" effects), any of which can pose uncertainties, and hence risks, for the facility.

In the words of an EPA official who has worked extensively with fast-change facilities, this type of analysis "can work if facility has time, but doesn't work if facility has to make changes quickly."[208] By posing such significant obstacles for flexible production operations—a manufacturing form that brings with it an enhanced capacity to engage in pollution prevention—the regulatory system may be working at cross purposes with itself.[209]

The NSR program's emissions control requirement will also frustrate efforts to achieve flexible production's green potential. As explained above, the NSR program gives facilities an overwhelming incentive to install the "best" end-of-stack control technology that has been implemented and is deemed to be feasible.[210] Such an approach has worked reasonably well for mass-production facilities that divide environmental management off from other functional departments.[211] These facilities tend to prefer end-of-stack solutions that can be tacked onto the production process without the need for in-depth coordination with other areas of the business.[212] By contrast, the best available technology approach works directly against the environmental strength of flexible producers. These manufacturers are better able to see the entire production system and to identify and implement low-cost "upstream" pollution prevention measures. This should allow them to provide improved environmental performance for the same or less cost. If the legal structure pushes these facilities to install a specific end-of-pipe technology, then that advantage is lost. In this sense, the Clean Air Act's best available technology approach is too prescriptive. The Act pushes flexible producers towards end-of-pipe solutions and effectively deters producers from using their new pollution prevention capabilities to do better than this.[213] This problem is compounded by the

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206. *See* BELDEN, *supra* note 159, at 47 ("The calculation of a net emissions increase is one of the more complicated and time-intensive exercises in the air permitting process.").

207. *See supra* notes 169-197 and accompanying text.

208. Bray Interview, *supra* note 192.

209. *See* U.S. EPA, PURSUING PERFECTION, *supra* note 3, at iv (stating that if regulatory delay erodes financial incentives to adopt flexible manufacturing, this could lead to "foregoing the resource productivity enhancements associated with the change").

210. *See supra* notes 187-91 and accompanying text.

211. U.S. EPA, PURSUING PERFECTION, *supra* note 3, at v (stating that the current regulatory system "grew up and evolved regulating a batch and queue, mass production environment" and is shaped by this).

212. *See* ROMM, *supra* note 4, at 30 (American businesses have a hard time engaging in pollution prevention "because they do not know how to take a systems approach to improving processes. This weakness results from the traditional U.S. focus on operations—a tradition that is one reason so few discuss systems thinking."); Strasser, *Cleaner Technology*, *supra* note 104, at 70.

213. As one commentator has concluded, "The traditional system . . . has emphasized

fact that technology-based permitting schemes provide no reward, and hence little incentive, for coming up with new pollution reduction methods that go beyond the prescribed level of control.[214] As a result, these standards tend to reinforce existing technologies rather than bring about environmental innovations.[215] They fail to ask enough of flexible manufacturers and, consequently, relinquish the environmental benefits that might otherwise be gained from this new manufacturing method. In short, the NSR program fails both to meet the pace of flexible production and to push this new form of manufacturing to achieve the environmental benefits of which it should be capable. It is designed for the mass production facilities that were dominant at the time the NSR regulations were drafted, and not for the flexible production plants that are beginning to replace them.

B. The Title V Operating Permit Program

The operating permits program, passed into law as Title V of the 1990 CAA Amendments (and accordingly known as the "Title V" program), requires all major sources of air pollutants to obtain a permit in order to operate.[216] Even existing major sources (i.e., those that are not "new" sources under NSR) must obtain a Title V operating permit.[217] A Title V permit does not create any additional substantive requirements for the source. Its function is to bring together, in one document, all air emission limitations, reporting, monitoring and recordkeeping requirements, as well as any work practice limitations that are applicable to the facility.[218] The permit does specify certain existing parameters for the facility. Alterations to these parameters, including alterations to the manufacturing process not contemplated by the permit, require a permit modification with public review.[219] This process can take forty-five days or longer to complete.[220] This portion of the Title V permit scheme conflicts with flexible production's emphasis on speed and constant change in much the same way that the NSR program does.[221] It therefore poses many of the same issues as those discussed above with respect to

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controlling pollution at the end-of-pipe or smokestack and has given little thought to preventing pollution by using new environmental technology inside the plant." Strasser, *Cleaner Technology*, *supra* note 104, at 105.

214. *See* Ackerman & Stewart, *supra* note 189, at 1336 ("[Best available technology] controls can ensure that established control technologies are installed. They do not, however, provide strong incentive for the development of new, environmentally superior strategies, and may actually discourage their development."); Stewart, *Regulation, Innovation*, *supra* note 191, at 1283 (stating that firms are "penalized for falling short, but not rewarded for going beyond").

215. Strasser, *Cleaner Technology*, *supra* note 104, at 26-28 ("There also is evidence and widespread opinion that [best available technology] standards in fact tend to require only a lowest common denominator of existing technology, and that they do not typically force real innovation. . . . By reinforcing the status quo, these technology-based standards have the potential to retard future innovation.").

216. *See* BELDEN, *supra* note 159, at 96.

217. *Id.*

218. *See id.* at 94.

219. *See id.* at 104-05.

220. *Id.*

221. *See, e.g.*, BOYD ET AL., *supra* note 6, at 8; David P. Novello, *Overview of the Title V Operating Permit Program*, *in* THE CLEAN AIR ACT HANDBOOK 444, 461 (Robert J. Martineau, Jr. & David P. Novello eds., 1998).

the NSR program.

IV. A NEW UNDERSTANDING OF RECENT DIRECTIONS IN ENVIRONMENTAL REGULATION

Two major recent developments in environmental policy—the Clinton Administration's Environmental Regulatory Reinvention effort, and the Bush Administration's NSR Reform Rule—can be partially understood as attempts to address the tension between flexible production and the CAA permitting requirements. As this Part will show, both employ the same basic regulatory method. They offer to cap emissions for the facility as a whole. They then provide that, so long as the facility remains within this plantwide emission limit, it may make as many process changes as it likes, as quickly as it likes, without having to obtain a permit or permit modification. In this way, the Reinvention programs and NSR Reform Rule attempt to adjust the NSR and Title V Operating Permit programs to better fit the fast pace of flexible production. While both initiatives employ the same basic method, they implement it in very different ways. Part V will compare these two contrasting approaches and, based on this evaluation, develop concrete proposals for how plantwide emission limits should be used in the future to adjust the CAA permitting requirements to the new realities of flexible production.

A. Reinvention, Clean Air Permitting, and Flexible Production

Launched with great fanfare in the mid-1990s, Environmental Regulatory Reinvention was the signature environmental initiative of the Clinton Administration and of several state environmental agencies.[222] It consisted of a set of pilot programs that experimented with new approaches to environmental regulation,[223] some of which continue to operate today.[224] The leading Reinvention programs shared three core themes: (1) they provided flexibility to participating facilities as to how they should go about meeting environmental standards (including flexibility as to permit requirements); (2) they set ambitious environmental standards for these facilities and required them to deliver environmental performance *superior* to that which would otherwise be required under traditional regulatory requirements; and (3) they required participating facilities to reach out to interested parties (community members, environmental groups, local regulators, etc.) and engage these stakeholders in a discussion of the facility's environmental management and performance.[225] The hope was that

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222. *See generally* CLINTON & GORE, *supra* note 20 (launching and describing the Reinvention initiative).

223. *See id.*; Dennis D. Hirsch, *Symposium Introduction: Second Generation Policy and the New Economy*, 29 CAP. U. L. REV. 1, 5-15 (2001) (describing Reinvention initiatives).

224. *See* U.S. EPA, INNOVATING FOR BETTER ENVIRONMENTAL RESULTS: A STRATEGY TO GUIDE THE NEXT GENERATION OF INNOVATION AT EPA (2002), *available at* http://www.epa.gov/innovation/plan/final4_10.pdf [hereinafter U.S. EPA, INNOVATION STRATEGY]. The Bush EPA has adopted the rubric of regulatory "innovation" rather than "reinvention," but the programs remain largely the same in substance.

225. *See generally* CLINTON & GORE, *supra* note 20.

aggressive performance measures combined with flexibility in implementation and greater stakeholder involvement might offer improved environmental protection for less cost, and with greater accountability than traditional regulation. Or, as the Clinton administration liked to say, Reinvention would provide a "cheaper, cleaner and smarter" approach to environmental regulation.[226]

The Clinton Administration billed the Reinvention effort as a way to bring "common sense" to environmental regulation and develop fundamentally new and more effective approaches to the field.[227] Some commentators agree with this characterization.[228] Others have come to view Reinvention more cynically. They see it as an attempt by the Clinton Administration to portray environmental policies as being less costly, and so to deflect the recently-elected (in 1994) Republican Congress's attacks on environmental regulation.[229]

There may be another way to understand certain, important aspects of Environmental Regulatory Reinvention. Three of the most significant Reinvention initiatives experimented with the plantwide emission cap approach to CAA permitting, representing some of the first sustained regulatory efforts at utilizing this new method. Moreover, as will be demonstrated below, these programs employed the caps for the specific purpose of adjusting the NSR and Title V programs to the fast pace of flexible production facilities. While Reinvention is a multi-faceted initiative, one of its themes appears to be the adaptation of environmental regulation to the new realities of flexible production.[230]

1. Environmental Contracting Under Project XL

The flagship program of the Clinton Administration's Reinvention effort was Project XL.[231] This initiative experimented with a regulatory method known as

226. *EPA Aims to Sign First Detailed 'Project XL' Agreements in May*, WASTE BUS., Feb. 28, 1996, at 4.

227. Regulatory Reinvention (XL) Pilot Projects: Solicitation of Proposals and Request for Comment, 60 Fed. Reg. 27,282-83 (May 23, 1995) [hereinafter Solicitation of Proposals]; CLINTON & GORE, *supra* note 20, at 1, 14.

228. *See generally, e.g.*, Karl Hausker, *Reinventing Environmental Regulation: The Only Path to a Sustainable Future*, 29 ENVTL. L. REP. 10,148 (Mar. 1999); Lisa C. Lund, *Project XL: Good for the Environment, Good for Business, Good for Communities*, 30 ENVTL. L. REP. 10,140 (Feb. 2000); Mohin, *supra* note 195.

229. *See* Christopher H. Foreman, Jr., *The Civic Sustainability of Reform*, *in* ENVIRONMENTAL GOVERNANCE: A REPORT ON THE NEXT GENERATION OF ENVIRONMENTAL POLICY 159 (Donald F. Kettl ed., 2002) (discussing this "widely shared perception" but concluding that it "distorts the history and motivations underlying reinvention efforts").

230. Reinvention has been a multi-faceted initiative that pursues a number of agendas and goals. I do not claim that the attempt to adapt the regulatory system to flexible production is the only, or even the prime, motivation behind this set of policies. But, as the analysis below will show, it is an important theme in several of the most significant reinvention programs. At least one other author has also made this connection. For a comprehensive analysis of flexible production in the micro-chip industry and its connection to the common sense intiative and project XL, two of the principal reinvention initiatives, see MAZUREK, *supra* note 11.

231. CLINTON & GORE, *supra* note 20, at 5 (explaining that Project XL is the "most notable" of the Reinvention programs). The Bush Administration continued the experimental program for a time, but ceased accepting new project proposals in January, 2003. *See* http://www.epa.gov/projectxl.

environmental contracting.[232] Under this approach, the EPA invited regulated parties to design their own strategies for achieving pollution control.[233] It then offered to provide them with the flexibility to implement these new compliance methods, even where this required a departure from existing regulatory requirements.[234] In exchange, participating facilities had to do two things. Following the basic Reinvention model, they had to commit to levels of environmental performance that were more stringent than those that they would have achieved under existing requirements,[235] and they had to seek out and engage a diverse group of stakeholders and attempt to gain their support for the project.[236] This bargain—regulatory flexibility from the government in exchange for better environmental performance and increased stakeholder participation from the facility—constituted the "environmental contract."[237]

While the XL projects are quite varied in nature,[238] one theme that emerges from them is that participating companies seem interested in obtaining regulatory flexibility with respect to air permitting requirements.[239] These requests appear to be generated by companies engaged in rapid process change whose main concern is regulatory speed.[240] For example, Intel Corporation turned to Project XL to resolve the conflict between its fast-cycle operation and NSR permitting requirements. The project encompassed virtually all of the central themes that this Article has developed thus far.[241] It concerned a new Intel chip manufacturing plant located in Chandler, Arizona, that produced Pentium microprocessors.[242] The company represented that, in its globally competitive business, success depended on its ability to develop new chips faster than its competitors. The company developed an entirely new generation of microprocessors every two to three years,[243] and undertook thirty to forty-five meaningful changes to its manufacturing process per year.[244] The Intel facility was a minor source for NSR purposes. Thus, it was the state minor source NSR permit program that applied.[245] Intel maintained that these

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232. *See generally* PERCIVAL ET AL., *supra* note 191, at 154 (describing the environmental contracting method); Stewart, *A New Generation*, *supra* note 22, at 63-68.

233. Regulatory Reinvention (XL) Pilot Projects: Notice of Modifications to Project XL, 62 Fed. Reg. 19,872-73 (April 23, 1997) [hereinafter Notice of Modifications].

234. Solicitation of Proposals, *supra* note 227, at 27,282-83.

235. *Id.* at 27,287.

236. *Id.*

237. Stewart, *A New Generation*, *supra* note 22, at 63-65.

238. For a description of the various projects that have been implemented, see *U.S. EPA, PROJECT XL: IMPLEMENTATION AND EVALUATION* [hereinafter U.S. EPA, PROJECT XL: IMPLEMENTATION AND EVALUATION], *at* http://www.epa.gov/projectxl/implemen.htm (last updated Aug. 8, 2003).

239. *See, e.g.*, *id.* (describing the XL projects for Intel Corporation, Merck & Co., Inc., Andersen Corporation, and Imation Corporation); *see also id.* (describing 3M Corporation's XL Project, which was proposed but never implemented) *at* http://www.epa.gov/projectxl/inactive.htm (last updated Aug. 8, 2003).

240. *See* U.S. EPA, PROJECT XL: IMPLEMENTATION AND EVALUATION, *supra* note 238.

241. *See generally* Mohin, *supra* note 195; INTEL CORPORATION, PROJECT XL: FINAL PROJECT AGREEMENT FOR THE INTEL CORPORATION OCOTILLO SITE (1996), *at* http://www.intel.com/intel/other/ehs/projectxl/fpa/Xlfpa1TOC.htm.

242. Mohin, *supra* note 195, at 10,347-48.

243. BOYD ET AL., *supra* note 6, at 13.

244. *Id.*

245. As was mentioned above, these permitting procedures can take several months to

requirements, with their delays on new constructions and modifications, were fundamentally incompatible with its fast-change business model. According to the company, permitting delays cost it millions of dollars in lost revenue per day.[246]

The company and the EPA used Project XL to develop a solution. Under the terms of the environmental contract, Intel agreed to cap pollutant emissions from the facility at a level more stringent than that which existing standards would otherwise have required and to take steps to increase public involvement. So long as the company remained within this emissions limit, the regulatory authorities would allow it to change its manufacturing process without obtaining a permit—the plantwide emissions limit approach to permitting. According to the company, it was able to meet the stringent plantwide limit by using a "design for the environment" approach that allowed it to build pollution prevention into the design of its products.[247]

The above discussion of flexible production provides a way to understand what is going on here. A fast-cycle producer (Intel) finds itself fundamentally at odds with air permitting requirements. The regulatory agency offers greater operational flexibility through an emissions cap approach, but does so on the condition that the flexible producer use its pollution prevention capacities to achieve improved environmental performance, and that it engage in an enhanced stakeholder process. The organizational and technological innovations that made the company a flexible producer in the first place provide it with the ability (manifested in its design for the environment program) to produce the desired environmental benefit and take the agency up on its offer.

While the Intel XL Project demonstrates the potential benefits of such an approach, it also brings out some weaknesses, particularly with respect to the superior environmental performance and stakeholder participation aspects. Intel's XL agreement set a number of caps on different types of emissions. One of these governed the emission of a specific category of pollutants known as hazardous air pollutants ("HAPs").[248] Some hazardous air pollutants are more dangerous than others. Critics argued that, by grouping these pollutants as a category and setting an overall cap, the agreement would allow Intel to increase emissions of a more toxic pollutant while decreasing emissions of a less dangerous one.[249] This could result in worse, not better, environmental performance. This dispute almost derailed the project.[250] This experience argues in favor of defining superior environmental

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complete and prevent the facility from making the desired change in the interim. *See supra* notes 185-86 and accompanying text. The same innovative regulatory approach, utilizing emission caps, has been applied to an Intel facility that is a major source subject to federal NSR permitting. *See* Mohin, *supra* note 195, at 10,350 n.52.

246. BOYD ET AL., *supra* note 6, at 1.

247. Mohin, *supra* note 195, at 10,349-51.

248. *Id.* at 10,350. This cap promised to keep the company's HAP emissions five tons *below* the twenty-five ton per year ("tpy") major source threshold set by the Clean Air Act, *see* Clean Air Act § 112(a)(1), 42 U.S.C. § 7412(a)(1) (2000) (defining "major source"), and so appeared to meet Project XL's requirement of better environmental performance.

249. Mohin, *supra* note 195, at 10,350; *see also* Cushman, Jr., *supra* note 200.

250. Mohin, *supra* note 195, at 10,350. Intel responded to these concerns by conservatively assuming that each specific HAP would be emitted at the full ten tpy level (an unlikely scenario) and then modeling what the environmental effects of this would be. The company found that, with the exception of two HAPs, the concentrations of these pollutants would remain within the environmental guidelines for those pollutants set by the

performance on a pollutant-by-pollutant basis, rather than for categories of pollutants.[251] Except where they are manifestly beneficial to the environment, cross-pollutant "trades" (such as increasing emissions of one pollutant in exchange for decreased emissions of another) should be avoided.[252]

With respect to stakeholder involvement, a concern emerged that national environmental groups would not have the resources to monitor a large number of site-specific XL agreements such as the one negotiated with Intel,[253] while local groups do not havc sufficient expertise to make their participation meaningful.[254] The EPA tried to address this problem by providing these groups (local or national) with a $25,000 grant for the hiring of experts.[255] Another issue is that, in Intel's XL project and others, the EPA has let the company convene and run the stakeholder group.[256] This poses an obvious conflict of interest.[257] A better approach would be to have the EPA itself choose and moderate the stakeholder group.[258] In sum, the Intel project provides some cautionary lessons about the emissions cap method. Yet it also points up the need for such an approach, and the role of Reinvention in addressing that need.

2. The Pollution Prevention in Permitting Program (P4)

A second Reinvention pilot program, the Pollution Prevention in Permitting Project (P4),[259] also demonstrates a connection to fast-cycle industry. The P4 initiative focused on permit modification requirements under the Title V Operating Permit Program. The EPA invited facilities to submit a list of upcoming physical and process changes that would typically trigger review and modification of these facility air permits. The agency then offered to pre-approve these changes if the facility, in return, would agree to an emissions cap set below the level traditionally

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state of Arizona. *Id.* at 10,351. The company accepted specific, lower limits for the two pollutants that would not have met the state guidelines. The environmental groups were not satisfied by this in-house company analysis and retained their objections.

251. *See* Rina I. Steinzor, *Reinventing Environmental Regulation: Dangerous Journey from Command to Self-Control*, 22 HARV. ENVTL. L. REV. 103, 188 (1998).

252. *Id.* at 137. In a small number of instances, the benefits may be so clear that it would be environmentally beneficial to pursue the trade. *See* Dennis D. Hirsch, *Project XL and the Special Case: The EPA's Untold Success Story*, 26 COLUM. J. ENVTL. L. 219, 250 (2001).

253. *See* Steinzor, *supra* note 251, at 144; U.S. GENERAL ACCOUNTING OFFICE, ENVIRONMENTAL PROTECTION: CHALLENGES FACING EPA'S EFFORTS TO REINVENT ENVIRONMENTAL REGULATION 52 (1997).

254. Steinzor, *supra* note 251, at 142.

255. Notice of Modifications, *supra* note 233, at 19,881.

256. *See id.* at 19,878-79; Steinzor, *supra* note 251, at 142.

257. *See* Bradford C. Mank, *The Environmental Protection Agency's Project XL and Other Reform Initiatives: The Need for Legislative Authorization*, 25 ECOLOGY L.Q. 1, 73 (1998) (stating that in Project XL the project sponsor "can wield enormous power by selecting community groups that are more likely to favor the sponsor's viewpoint and by excluding those that may be less amenable to industry's positions").

258. *Id.* at 74 (supporting selection by the EPA of participants in the stakeholder group).

259. *See* U.S. EPA, POLLUTION PREVENTION IN PERMITTING PROGRAM (P4), *at* http://www.epa.gov/earth1r6/6en/xp/synth.pdf (last visited Apr. 18, 2004) (describing the P4 initiative as a Reinvention program).

required, and would use pollution prevention measures to achieve this more ambitious level of performance.[260] This allowed facilities to have all their anticipated changes approved at once, rather than going through a separate permitting process for each[261] and so created an incentive for pollution prevention and for better environmental results. A later EPA report found that all the participating facilities reduced their emissions during the terms of their P4 permits, some by substantial amounts,[262] although others have disputed these results.[263]

Six facilities participated in the P4 pilot.[264] According to a later study, the common themes that linked them were a commitment to rapid process change[265] and the ability to implement upstream design and process changes in order to achieve pollution reductions elsewhere in the operation.[266] The EPA's own statements further demonstrate the link to flexible production. An agency official explained that the program is not designed for "a slowly changing company that needs to make only one facility permit revision per year. . . . But if you're making a change every month, all of a sudden the scale changes. The need for predictability increases the value of the P4 permit."[267] Elsewhere, the EPA described the P4 program as designed for "sources in highly competitive industries characterized by frequent and/or unpredictable movement within product lines" that are "technically capable of . . . promot[ing] P2."[268] In other words, the P4 program was designed not for slow-changing mass production facilities, but rather for fast-cycle flexible producers that have the capacity to reduce emissions through pollution

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260. *See The P4 Project: A Look Back, a Look Ahead*, POLLUTION PREVENTION NORTHWEST (Pac. Northwest Pollution Prevention Res. Ctr., Seattle, Wash.), Spring 1999, *at* http://www.pprc.org/pprc/pubs/newslets/newssp99.html.

261. *See* U.S. EPA, OFFICE OF POLICY, ECONOMICS AND INNOVATION, DRAFT: SUMMARY OF INNOVATIVE PERMIT INITIATIVES 9 (June 4, 2001).

262. *See* U.S. EPA, EVALUATION OF INNOVATIVE AIR PERMITS, *supra* note 196, at 5 (reporting that Intel facility lowered actual emission of volatile organic compounds ("VOC") from 190 tpy to 56 tpy; 3M lowered its actual VOC emissions from 4300 tpy to 1000 tpy; DaimlerChrysler lowered its actual VOC emissions from 1400 tpy to less than 800 tpy).

263. *See* Letter from Natural Resources Defense Council to Michael Trutna, Office of Air Quality Planning and Standards, U.S. EPA 18 (Sept. 14, 2000) (copy on file with author).

264. These were Intel Corporation (Aloha, Oregon facility), Lasco Bathware (Yelm, Washington facility), Imation Enterprises (Weatherford, Oklahoma facility), Cytec Industries (Wallingford, Connecticut facility), Rio Grande Portland Cement (Tijeras, New Mexico facility) and Searle Chemical (Augusta, Georgia facility). *See The P4 Project: A Look Back, a Look Ahead*, *supra* note 260.

265. *See id.* (stating that facilities participating in the P4 program are those "that make frequent process changes to stay ahead in fluid, highly competitive industries").

266. For example, the Intel Aloha facility changed its chip cleaning process so as to reduce emissions of hexafluoroethane, a potent greenhouse gas, by fifty percent per wafer. *See id.* at 6.

267. *See id.* (quoting Dave Dellarco, EPA P4 project coordinator).

268. U.S. EPA, ENVIRONMENTAL PERMITTING CLEARINGHOUSE, PERMITTING INNOVATIONS DATABASE, POLLUTION PREVENTION IN PERMITTING PROGRAM (P4), *available at* http://www.epa.gov/ooaujeag/permits; *see also The P4 Project: A Look Back, a Look Ahead*, *supra* note 260 (stating that P4 is "better suited for industries in the fast lane. Companies that make frequent process changes to stay ahead in a fluid, highly competitive industries will likely have greater interest in P4's flexibility provisions than companies in industries that change more slowly.").

prevention.[269]

While the P4 program appears to have worked for certain fast-cycle facilities, it too provides some cautionary lessons. Stakeholder involvement was insufficient. The pre-approval agreement encompassed an array of future changes, yet the EPA granted no more public review than it does for standard permits that involve only a single change.[270] In addition, the continuous improvement nature of flexible production means that it will often be hard, if not impossible, to predict the precise future process changes that a facility will want to make. This means that the list of anticipated changes (pre-approved so long as the facility remains within its emissions cap) will have to be broadly worded and short on detail. But this will hamper the Agency's (and the public's) ability to determine exactly what the facility has in mind, and what the emissions implications of these changes will be. The pre-approval approach accordingly introduces an element of uncertainty into the regulatory process.

3. The Performance Track Approach

Performance track programs at the state and federal levels are among the most significant Reinvention initiatives.[271] These programs create a separate, more flexible regulatory pathway for facilities that can demonstrate that they are top environmental performers. They thereby seek to encourage better environmental stewardship. This section will offer a view of Reinvention at the state level by focusing on Oregon's performance track initiative, known as the Green Permits program.[272]

To be admitted to the Green Permits program, a facility must achieve environmental results "significantly better than otherwise required by law;"[273] engage stakeholders in a discussion of the facility's environmental planning;[274] "consider [the] results of stakeholder involvement in decisionmaking, and respond to comments received;"[275] and implement an environmental management system.[276]

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269. In a rare statement, a non-profit organization working with the EPA on the P4 project actually makes this precise connection. According to the Pacific Northwest Pollution Prevention Resource Center, "the pre-approval aspect of the P4 approach complements the business strategy of 'lean manufacturing,' which in turn encourages P2—continuous improvement to root out waste and get the most value for the least expenditure of resources." *The P4 Project: A Look Back, a Look Ahead*, *supra* note 260, at 2.

270. *See* U.S. EPA, SUMMARY OF INNOVATIVE PERMIT INITIATIVES, *supra* note 261, at 9.

271. *See* U.S. EPA, INNOVATION STRATEGY, *supra* note 224, at 18 (describing Performance Track as a "flagship" innovation program).

272. For general information on the program *see* http://www.deq.state.or.us/programs/greenpermits/index.htm. The Green Permits program had an original sunset date of December 30, 2003. The Oregon legislature recently extended that date to January 2, 2008. H.B. 3175 (Or. 2003). At the time of this writing, three new permit applications were under review. *See* http://www.deq.state.or.us/programs/greenpermits/ gpupdate.htm. However, due to a state-wide budget shortfall, resources for the program have been reduced. *Id.*

273. OR. ADMIN. R. 340-014-0115(3) (2004).

274. *See id.* 340-014-0115(7).

275. *Id.* 340-014-0120(7).

276. *See id.* 340-014-0115(1); *id* 340-014-0120(1). The program actually creates three levels of participation, with slightly varying requirements for participation in each. *See generally* OR. DEP'T OF ENVTL. QUALITY, THE OREGON GREEN PERMITS PROGRAM GUIDE

The benefits to participating companies range from public recognition, to technical assistance, to the designation of a single point of contact with the agency.[277] Of greater relevance here, facilities also can receive "regulatory flexibility" with respect to existing environmental requirements,[278] including the replacement of traditional state air permitting requirements with plantwide emission limits (as were used in the Intel XL project) and pre-approvals (as in the P4 program).[279] In short, the Green Permits program—much like Project XL and the P4 program—offers permit flexibility (among other regulatory benefits) in exchange for improved environmental performance and increased stakeholder involvement.

The Green Permits program adds an important feature not found in the other two programs. It requires that all participants implement an environmental management system (EMS). This only serves to reinforce the tie between the program and flexible production. EMSs are essentially an environmental analogue to the flexible production management system known as *kaizen*.[280] The EMS requirement draws on the management strengths of flexible producers and thereby tailors the regulatory approach even more closely to the new industrial conditions.

The characteristics of the participating facilities further demonstrate the link to flexible production. Fully three-quarters of the companies in the Green Permits program engage in frequent process changes and entered the program, in large part, out of a desire for increased permit flexibility and speed.[281] Due to the small number of participants, this data is more suggestive than definitive.[282] Nonetheless, it supports the thesis that Oregon's performance track program is functioning as a bridge between the environmental regulatory system and a new form of industrial production.

As with Project XL, the Green Permits experience points up the difficulty in defining superior environmental performance. The Oregon DEP's rules require that all participating facilities "achieve environmental results that are significantly better than otherwise required by law,"[283] but leaves it entirely up to the agency to

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(2000) (describing the three levels of the program). These subtleties are not relevant here and a description of the general contours of the program should suffice.

277. OR. ADMIN. R. 340-014-0130.

278. *Id.* 340-014-0135. This incentive is only available to facilities participating in the upper two levels of the program.

279. *See* OR. DEP'T OF ENVTL. QUALITY, *supra* note 276, at 3-12, 3-13; OR. ADMIN. R. 340-014-0135 (stating that the permitting authority may "provide expeditious reviews of proposed modifications to existing permits, [or] modify existing permits for maximum flexibility for process changes").

280. *See supra* notes 55-62 and accompanying text.

281. JERRY SPEIR, GREEN PERMITS AND COOPERATIVE ENVIRONMENTAL AGREEMENTS: A REPORT ON REGULATORY INNOVATION PROGRAMS IN OREGON AND WASHINGTON 37-39 (2000), *available at* http://www.napawash.org/pc_economy_environment/epafile04.pdf. These included: LSI logic, a semiconductor manufacturer, which sought "expedited permits" because "the present system of permitting impedes the company's market flexibility"; Louisiana Pacific Corporation, a producer of wood products that "changes technologies and production processes frequently, and needs to avoid slow-downs from the permitting process"; and OCI Semiconductor Manufacturing, another semiconductor producer, which sought "expedited permit approvals." *Id.*

282. It would be productive to conduct a further study of participants in the state and federal performance track programs and identify what proportion could be characterized as fast-cycle, flexible producers. This research has not been done as yet.

283. OR. ADMIN. R. 340-014-0115(3).

determine what counts as "significant."[284] According to an early report, this open-ended definition of better performance has allowed participating facilities to be vague in defining just how their performance would be "superior."[285] Green Permits also provides some lessons with respect to stakeholder involvement. Here too, the regulations are broadly worded. They require participating facilities to "encourage public inquiries and comments" and "provide mechanisms" for public input on environmental performance,[286] but do not specifically define how this is to occur.[287] This has led to under-inclusive stakeholder participation that, in some cases, has excluded environmental groups.[288]

The lens of flexible production provides a new way of seeing the Reinvention initiatives. Several of these programs appear to be responding to the rise of the fast-cycle economy. They are developing new regulatory forms that fit better with this emerging form of industrial production, and then using these methods to achieve better environmental performance. They contrast with traditional CAA permitting approaches, such as the New Source Review program, which move more slowly and are less ambitious in seeking environmental gains.[289] Perhaps this should come as no surprise. The New Source Review program was developed during the time of, and is premised on, the slow pace of stable mass production. The Reinvention programs discussed above may represent the beginnings of an effort to adapt the environmental regulatory system to the fast-paced manufacturing conditions, and environmental potential, of flexible production.[290] Much has been written about

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284. *Id.* 340-014-0105(20) (defining the term "significant").

285. SPEIR, *supra* note 281, at 47.

286. OR. ADMIN. R. 340-014-0120(7)(a), (b).

287. SPEIR, *supra* note 281, at 48-49.

288. *Id.* at 49.

289. *See supra* notes 166-215 and accompanying text.

290. Some who accept the premise that global competitive pressures are forcing American businesses to become faster and nimbler, nonetheless assert that law and regulation should not attempt to become quicker in response. William Scheuerman argues against attempts to "synchronize" the pace of law and regulation with that of fast-cycle businesses. *See* Scheuerman, supra note 10, at 106. Sheuerman maintains that traditional law and regulation is slow because the deliberative processes, debates and political exchange that inform the liberal, democratic method of government inevitably take time. *Id.* He argues that attempts to speed up the regulatory process in order to adapt it to the increased pace of modern production will work against the liberal, democratic values at the core of the system, and will thereby undermine its political legitimacy. *Id.* Attempts to make law more flexible and nimble will also risk undermining important rule of law values that depend on a certain degree of legal consistency and stability. *Id.* at 122. He asserts that, rather than quickening the pace of regulation to keep up with industry, we should consider slowing the pace of industry to bring it more or less into line with the pace of liberal democracy. *Id.* at 127.

The problem with this argument in the environmental context is that it fails to take into account flexible production's enhanced capacity for pollution prevention and hence for better environmental performance. Were society to take steps to turn industry away from the flexible production model and back towards slower mass production, it might better serve the procedural requirements of traditional environmental regulation but would arguably detract from its substantive goal—a cleaner environment. Moreover, as shall be argued below in section V.B, there may be ways to restructure democratic participation in the permitting process so as to increase both its pace *and* its effectiveness. *See infra* notes 350-80 and accompanying text. Thus, in the environmental permitting context at least, Scheuerman may pose a false dilemma.

Reinvention in law reviews and elsewhere,[291] yet few have as yet made this connection.[292]

B. Flexible Production and the NSR Reform Rule

The rise of flexible production also provides insight into another major environmental policy initiative of the past decade: the Bush administration's New Source Review Reform Rule which entered into force on March 3, 2003.[293] As the name would suggest, the Rule enacts changes to the Clean Air Act's New Source Review permitting program.[294] It has been the subject of heated debate and controversy. The Bush administration has claimed that the Rule will allow plants to install more efficient equipment and thereby will decrease air pollution.[295] Opponents have maintained that the Rule amounts to a "rollback" of Clean Air Act protections that will harm air quality.[296] One Democratic Senator proposed legislation that would have prevented EPA from implementing the rule for six months. The Senate rejected the bill on a close vote mainly along party lines.[297] Environmental groups and nine northeastern states have filed suit to challenge the Rule and have vowed to overturn it.[298] In the raging debate over the Rule, there has been little attention paid to the rise of flexible production. Yet an understanding of the Rule, and a review of the rulemaking record, suggest that the link is there.

The Rule modifies the NSR program in a number of ways.[299] For the present

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291. For a sampling of this wide-ranging and diverse discussion, see generally, for example, Thomas E. Caballero, *Project XL: Making It Legal, Making It Work*, 17 STAN. ENVTL. L.J. 399 (1998); Hausker, *supra* note 228; Dennis D. Hirsch, *Bill & Al's XL-ent Adventure: An Analysis of the EPA's Legal Authority to Implement the Clinton Administration's Project XL*, 1998 U. ILL. L. REV. 129; Hirsch, *supra* note 252; Lund, *supra* note 228; Mank, *supra* note 257; Mohin, *supra* note 195; Mark Seidenfeld, *Empowering Stakeholders: Limits on Collaboration as the Basis for Flexible Regulation*, 41 WM. & MARY L. REV. 411 (2000); Steinzor, *supra* note 251; Rena I. Steinzor, *Regulatory Reinvention and Project XL: Does the Emperor Have Any Clothes?*, 26 ENVTL. L. REP. 10,527 (Oct. 1996); Lawrence E. Susskind & Joshua Secunda, *The Risks and Advantages of Agency Discretion: Evidence from EPA's Project XL*, 17 UCLA J. ENVTL. L. & POL'Y 67 (1998/1999).

292. In addition to my own brief essay taking an initial look at this relationship, *see generally* Hirsch, *Globalization*, *supra* note 156. Two other studies that make the connection in a direct way are BOYD ET AL., *supra* note 6 and MAZUREK, *supra* note 11.

293. NSR Reform Rule, *supra* note 21, at 80,186.

294. *See supra* Part III.A.

295. *New Source Review: EPA Issues Changes to Enforcement Program; Nine States File Lawsuit to Block Final Rule*, 34 Env't Rep. (BNA) 5, 5 (2003) [hereinafter *Lawsuit*]; Matthew L. Wald, *EPA Says it Will Change Rules Governing Industrial Pollution*, N.Y. TIMES, Nov. 23, 2002, at A1.

296. *Lawsuit*, *supra* note 295, at 5; Wald, *supra* note 295, at A1.

297. *New Source Review: Senate Rejects Effort to Delay Changes in EPA Regulations for Modified Plants*, [2003] 34 Env't Rep. (BNA) 173, 173 (2003).

298. *Lawsuit*, *supra* note 295, at 5.

299. NSR Reform Rule, *supra* note 21, at 80,189-90 (providing overview of Rule). First, it alters the methodology by which sources calculate whether physical or operational changes at the plant generate emission increases. *Id.* As a result of this revision, fewer facility changes will be likely to trigger NSR permitting requirements. Second, the Rule exempts from NSR permitting those units at a plant that have recently obtained an NSR

purposes, the most significant component of the rule is its express authorization of plantwide applicability limits ("PALs"), a form of facility emissions cap applicable to major sources under the NSR program. A PAL establishes an annual emissions cap for a facility at a level below that at which a "major modification" would be deemed to have occurred (i.e., less than a significant emission increase).[300] If the facility remains within this limit, it can make all the changes it wants without having to obtain an NSR permit.[301] A permit is required only where a change causes the facility to exceed the cap.[302] One way to think about this is that the PAL approach changes the definition of "major modification."[303] The facility need no longer examine each individual change to determine, on a case-by-case basis, whether it will result in a significant net emissions increase. Instead, the plant can keep a twelve-month rolling emissions balance[304] and know that a major modification will be deemed to have occurred only if the twelve month measurement indicates that the facility is going to exceed its annual cap.

The PAL approach increases a facility's ability quickly to alter its manufacturing process in two ways. First, certain process changes that might have triggered the NSR permit requirement under the traditional definition of major modification (i.e., changes that would have caused a significant net emissions increase) will not require a permit so long as they do not cause the facility to exceed its cap.

Second, the PAL approach greatly simplifies the process for determining whether a given change will trigger the NSR permit requirement. A facility governed by a PAL is faced with a single question: do annual emissions (calculated on a rolling, twelve month basis) exceed the emissions cap? As long as emissions are within the cap, changes at the facility will not require an NSR permit. Under such a regime a plant getting ready to alter its manufacturing process no longer

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permit and installed the required control technologies. *Id.* EPA refers to these portions of the plant as "Clean Units." Third, the Rule revises the NSR regulations to allow sources to adopt an overall cap on regulated emissions known as a plantwide applicability limit (PAL). *Id.* Sources that opt to be regulated through a PAL can make as many physical or operational changes as they like without triggering NSR permitting requirements, so long as they do not exceed their emissions cap. Finally, the NSR Reform Rule exempts from NSR permitting requirements those facility changes deemed to be "pollution control projects." *Id.* Where a change qualifies as a pollution control project ("PCPs"), the source need not go through NSR permit review even if the action results in a significant emissions increase of a pollutant other than the one being controlled. The NSR Reform Rule has been highly controversial.

300. *See, e.g.*, Prevention of Significant Deterioration (PSD) and Nonattainment New Source Review (NSR), 61 Fed. Reg. 38,250, 38,264 (July 23, 1996) (defining PAL for purposes of the proposed NSR Reform Rule) [hereinafter Proposed NSR Reform Rule]; U.S. EPA, EVALUATION OF INNOVATIVE AIR PERMITS, *supra* note 196, at 27.

301. Proposed NSR Reform Rule, *supra* note 300, at 38,264; NSR Reform Rule, *supra* note 21, at 80,189.

302. Proposed NSR Reform Rule, *supra* note 300, at 38,264; NSR Reform Rule, *supra* note 21, at 80,189; *see also* Mohin, *supra* note 195, at 10,350 (describing an Intel facility plantwide emissions cap).

303. David Bray, an EPA official who has worked extensively with PALs, provided this helpful characterization. *See* Bray Interview, *supra* note 192.

304. U.S. EPA, EVALUATION OF INNOVATIVE AIR PERMITS, *supra* note 196, at 13; NSR Reform Rule, *supra* note 21, at 80,208.

needs to go through the five-step process described above[305] for determining whether the change will constitute a major modification. Instead, it simply needs to keep track of its rolling twelve month emissions balance and make sure it remains within the cap.[306] As compared to the typical "netting" analysis, this greatly decreases the time and effort involved in evaluating whether a given change will trigger the NSR requirement. It thereby allows the plant to undertake process changes far more rapidly than it would under the traditional NSR permitting method, and with far greater certainty. The PAL approach thus renders the NSR program far more amenable to fast-change flexible production facilities.

Prior to the issuance of the NSR Reform Rule, the NSR regulations had not expressly authorized the use of PALs. The Rule changes this. Under the Rule's PAL provisions, major sources of air pollution can voluntarily commit to a binding cap on the amount of pollutants that they will emit per year.[307] Facilities that make this commitment can undertake all the process changes they want without triggering federal NSR permitting requirements, so long as they stay within their cap.[308] In setting the emissions cap, the Rule allows a facility to look back over the past ten years of its operating history, choose the two-year period in which emissions were at their highest level (perhaps because production was at a maximum) and use its actual emissions during this period as its "baseline" emissions amount.[309] The Rule then directs sources to *add* to the baseline level the amount of a de minimis increase in the pollutant (i.e., the amount that distinguishes a "major modification" from a minor one).[310] The emissions cap is set at the sum of these two amounts.[311] This cap remains in place for ten years, at which point it must be renewed.[312] The permitting authority is required, before issuing or renewing a PAL permit, to notify the public, make available a copy of the proposed permit, and allow at least thirty days for public review and comment.[313]

The rulemaking record strongly suggests a connection between the NSR

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305. *See supra* notes 169-84 and accompanying text.

306. The rolling balance can be calculated by a number of different methods, including: Continuous Emission Monitors ("CEMs"), which measure actual emissions on a continuous basis; a "mass balance" system under which a source would consider all potential air pollutants contained in or created by a raw material to be emitted; and other methods. *See* NSR Reform Rule, *supra* note 21, at 80,211-13 (describing measurement methods). These methods do not entail identification of contemporaneous and creditable increases and decreases.

307. *Id.* at 80,189 ("If you keep the emissions from your facility below a plantwide actual emissions cap (that is, an actuals PAL), then these regulations will allow you to avoid the major NSR permitting process when you make alterations to the facility or individual emissions units.").

308. *Id.*

309. *Id.* at 80,208. To account for changes at the facility that post-date this period, facilities are further instructed to add to this figure an amount equal to the potential-to-emit of any emissions unit added after the baseline period, and to subtract an amount equal to the actual emissions of any unit that has been permanently shut down in the years since the baseline period. *Id.* at 80,208-09.

310. The theory here appears to be that, even without the PAL, the source would have been allowed to increase its emissions by the de minimis amount without triggering NSR permit requirements.

311. NSR Reform Rule, *supra* note 21, at 80,208.

312. *Id.* at 80,209. A renewed PAL also lasts for ten years. *Id.* at 80,210.

313. *Id.* at 80,208.

Reform Rule's PAL provisions and the rise of flexible production. The preamble[314] to the final Rule states that the PAL provisions will allow a company to "make changes quickly at [its] facility"[315] and so "to respond rapidly to market changes."[316] It further justifies PALs on the grounds that they will "reduce the administrative 'friction' (time delays and uncertainty) associated with making operational and equipment changes . . . [and so are] critical for responding to product development needs and market demand, and for maintaining overall competitiveness."[317] While these statements do not identify flexible production by name, they speak about facilities that engage in rapid process change in order to remain competitive in a global economy. These are flexible production facilities.[318] An EPA report, relied on in the development of the Rule's PAL program,[319] makes the connection even more explicitly. The study, entitled *Evaluation of Implementation Experiences with Innovative Air Permits*, evaluated EPA's experience with six experimental PAL permits. In explaining the importance of the PAL approach, it states that

> [t]hough the factors differ somewhat for each source, the companies indicated that the *combination of increasingly globalized competition and a shift to new modes of production* substantially increased the pressure to operate highly flexible, nimble, and responsive research, development, and production operations. In this context, conventional, case-by-case air permitting, which the companies state can cause delay and uncertainty, can act as a mission-critical bottleneck to their operations.[320]

The report portrayed PAL permits as a possible solution to this regulatory problem.[321] This document strongly suggests a direct connection between the NSR Reform Rule's PAL provisions and the rise of flexible production. Thus, one can read the NSR Reform Rule's PAL component as a further step in the adaptation from a CAA permit system premised on mass production, to one geared towards the new realities of flexible production. In this sense, there is a connection between the leading Reinvention programs of the 1990s, and the recent NSR Reform Rule.

While the NSR Reform Rule shares something important with the Reinvention programs, it also differs in two critical ways. First, the Rule does not require participating facilities to beat the performance that traditional NSR permitting would have mandated. Rather, it allows facilities to set their cap by taking their highest-emitting two-year period out of the last ten years, adding the amount of a de minimis increase for the given pollutant, and using that as the basis for the

314. A preamble is a narrative description of the rule published along with the regulatory language itself in the Federal Register. The agency uses the preamble to describe and explain the new rule.

315. NSR Reform Rule, *supra* note 21, at 80,189.

316. *Id.* at 80,206.

317. *Id.* at 80,207.

318. *See supra* notes 84-89 and accompanying text.

319. NSR Reform Rule, *supra* note 21, at 80,207 (citing report entitled "Evaluation of the Implementation Experience with Innovative Air Permits").

320. *See* U.S. EPA, EVALUATION OF INNOVATIVE AIR PERMITS, *supra* note 196, at 25 (emphasis added).

321. *Id.* at 23.

emissions cap.[322] This will often result in an emissions cap that is *higher* than the facility's current actual emissions of the pollutant in question. It could thereby condone an *increase* in emissions over current actual levels rather than pushing facilities toward a meaningful emissions decrease.[323] This is the basis for the allegation that the Rule constitutes a "rollback" of Clean Air Act protections. Second, the Rule does nothing to improve stakeholder participation. It requires only public notice of a proposed PAL permit and a thirty-day comment period.[324] In contrast to Project XL and the Green Permits program, it does not require participating facilities to reach out early on to interested parties and consider their views. In sum, while the NSR Reform Rule shares with the Reinvention programs an emphasis on operational flexibility, it departs from them by not requiring, as a condition of this flexibility, better environmental performance and stakeholder participation.

V. AIR PERMITTING FOR THE FLEXIBLE PRODUCTION ERA

The shift from mass to flexible production is having a subtle, yet powerful

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322. NSR Reform Rule, *supra* note 21, at 80,208. EPA's position is that, in light of the fluctuations of the business cycle, it would be unfair to allow sources anything less than a ten-year look-back period for setting their emissions baseline. *Id.* at 80,216.

323. EPA would likely respond to this criticism by claiming that the NSR Reform Rule's PAL option does give facilities an incentive to engage in pollution prevention. In the preamble to the Rule, the agency maintains that facilities will seek to reduce their emissions below the level established in their PAL permit so as to generate additional operational flexibility under the cap, and that they will use pollution prevention methods to do so. *Id.* at 80,207 ("[W]e expect that PALs will encourage you to undertake such projects as: replacing outdated, dirty emissions units with new, more efficient models; installing voluntary emission controls; and researching and implementing improvements in process efficiency and use of pollution prevention technologies, so that you can maintain maximum operational flexibility."). There may be some truth to this. But a cap set at a level that reflected superior environmental performance would create a far stronger incentive. Moreover, insofar as the NSR Reform Rule creates an incentive to reduce emissions through pollution prevention, the provisions governing *renewal* of PAL permits undercut it. If, at the time that the PAL comes up for renewal (ten years after it is first established), actual baseline emissions are at eighty percent or more of the original PAL level, the Rule requires the permitting authority to reset the PAL at the original level. *Id.* at 80,209. If, on the other hand, the baseline emissions at the time of permit renewal are less than eighty percent of the original PAL level, then the permitting authority has discretion to lower the PAL to a level that it believes more accurately reflects baseline emissions or is more appropriate considering improvements in control technology. *Id.* at 80,209, 80,216, 80,219, 80,220. This arrangement will give participating facilities a perverse incentive *not* to reduce their actual emissions by more than 20% below the original PAL level during the ten years in which the PAL permit is in place. Stated differently, the Rule dissuades sources from reducing their emissions by more than 2% per year (on average) over the ten years of their permit term. Were they to do so, they would risk having their PAL renewed at the lower level of emissions. This hardly provides flexible production facilities with a powerful incentive to engage in pollution prevention. EPA itself cites the example of a facility that agreed, in exchange for a PAL arrangement, to reduce its actual emissions hy 54%. The facility achieved this goal, and then went even further by "increasing capture efficiency and incorporating pollution prevention strategies into its operations." *Id.* at 80,209. The present Rule would discourage such a facility from achieving any reduction greater than 20% during a ten-year period.

324. NSR Reform Rule, *supra* note 21, at 80,208.

effect on environmental regulation. As Part IV has shown, it is influencing the shape of important Environmental Regulatory Reinvention programs and seems to have been one of the motivating forces behind the NSR Reform Rule's controversial PAL provisions.[325] These two high-profile policy initiatives can each be seen, in part, as an attempt to adapt the clean air permitting system to new industrial conditions. Yet they go about this task in fundamentally different ways. The Reinvention programs provide operational flexibility on the condition that the facility, in return, provides improved environmental performance and enhanced stakeholder involvement. The NSR Reform Rule, on the other hand, offers flexibility as a good unto itself and does not push regulated facilities to make strides on the other two fronts. The two initiatives thus offer fundamentally different visions for how to modify the air permitting system to respond to the underlying industrial shift.

Which of these approaches is the better one as a matter of law and policy? If this question has received little attention among commentators and policymakers, it is probably because few, as yet, appreciate how flexible production relates to these two initiatives and connects them. The first purpose of this Article has been to draw out and explain this connection. Having laid that foundation, it turns now to a comparative evaluation of the two approaches. This Part will examine each of the three central policy elements discussed above: superior environmental performance, enhanced stakeholder participation, and increased operational flexibility. It will compare the Reinvention and NSR Reform approaches in each of these areas as a matter of both law and policy. This analysis will yield specific recommendations for Congress and EPA that, taken together, will begin to chart a path for air permitting in the era of flexible production.

A. Superior Environmental Performance

The Reinvention initiatives described above require superior environmental performance as a condition of permit flexibility. The NSR Reform Rule does not. Which of these approaches makes more sense as a matter of policy and law? A similar issue has arisen in relation to the Reinvention initiatives themselves. Some commentators have maintained that conditioning faster permitting on a facility's willingness to provide better environmental performance is a form of "greenmail."[326] This view sees the NSR permitting system as slow and inefficient. It argues that EPA should not use this regulatory imperfection as a lever through which to force companies to offer up environmental benefits not required under existing regulations. Why, these commentators ask, should businesses have to pay a "penalty" in the form of superior environmental performance in order to get the good government that they deserved in the first place?[327] They maintain that new

325. That is not to say that it is the only, or even the primary, force behind these initiatives. The claim is that it is one important underlying motivation.

326. *See, e.g.*, Mohin, *supra* note 195, at 10,353 (discussing perspectives of those who view Reinvention bargain as "a thinly veiled attempt to leverage environmental gains from the regulated community by offering to repair the obvious inefficiencies in the current system. 'Greenmail' is the term often used to describe [this] type of deal.").

327. *See, e.g.*, Frank B. Friedman, *ABA Resolution Encouraging Environmental Management Systems*, SECOND GENERATION ISSUES COMMITTEE NEWSLETTER (A.B.A., Sec. of Env't, Energy and Res., Chicago, Ill.), Sept. 2001, at 18, *available at*

regulatory approaches that provide the *same* environmental return for less cost are themselves socially valuable and should be pursued by regulators.[328] The NSR Reform Rule, by offering permit flexibility without demanding an environmental return, codifies this view.

The problem with this argument is that it relies on the wrong baseline for judging whether something extra is being demanded of these facilities. It assumes that all facilities in a given industry, be they mass or flexible production operations, should be required to meet the same level of pollution reduction. Any requirement beyond this accordingly constitutes a "penalty." This is contrary to the underlying theory of the Clean Air Act's NSR program. The statute instructs EPA to set the best available technology standard at the most stringent level that EPA determines, on a case-by-case basis, to be technically and economically feasible for a given facility.[329] Thus, the baseline under the CAA is the level of pollution control that the individual facility will find feasible. Flexible production operations are able to engage more effectively in pollution prevention.[330] As such, they should be able to achieve better levels of environmental performance for the same or less cost than similarly-situated mass production facilities. It is thus economically feasible for them to go further (and technically more feasible too if we consider their advanced management methods to be a "technique"). If a program that grants them greater operational flexibility asks, in return, that they achieve this improved environmental performance, it is not exacting something extra from them. Rather, it is just asking them to go as far as is feasible—the same demand that is being made of mass production facilities under traditional NSR.[331] Both types of facilities are

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http://www.abanet.org/environ/committees/secondgeneration/newsletter/archive.html (citing views of some who take this position).

328. *See* SPEIR, *supra* note 281, at 31 (stating that industry takes the position that achieving environmental results more cost-effectively is a sufficient goal for Reinvention program).

329. Clean Air Act § 169(3), 42 U.S.C. § 7479(3) (2000) (best available control technology means the degree of control that the EPA "on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility"); BELDEN, *supra* note 159, at 150 (BACT determined "on a case-by-case basis"); SPEIR, *supra* note 281, at 51 (LAER determined on a case-by-case basis). *Cf.* Ackerman & Stewart, *supra* note 189, at 1335 (arguing that under a best available technology regime, a plant "must install whatever technology is available to reduce or eliminate this risk, so long as the costs of doing so will not cause a shutdown").

330. *See supra* notes 99-154 and accompanying text.

331. Some might argue that the goal of environmental regulation should be to require the level of pollution reduction that is optimal or efficient, rather than the level that is feasible. While this view is attractive as a matter of theory, it runs into significant problems in implementation. Scientific understanding of the environmental and health impacts of specific types of pollution is often incomplete. Even where the impacts are known, it can be very hard to put a dollar figure on them (e.g., the value of a human life). This makes it difficult to carry out an accurate cost-benefit analysis of the optimal level of pollution. Perhaps for this reason, Congress, through the CAA chose to require regulated facilities to achieve the level of pollution reduction that was feasible. Clean Air Act § 169(3), 42 U.S.C. § 7479(3) (best available control technology means the degree of control that the EPA "on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility"). A requirement that flexible production facilities, too, go as far as is feasible would be consistent with this statutory policy.

being held to the same standard, that is to do all that is feasible.[332] By failing to require this, and by holding flexible production facilities only to the level of control that mass production plants can achieve, NSR reform is making it easy for these companies. It is also passing up a historic opportunity to take advantage of the new, advanced forms of manufacturing in order to move to the next level of environmental performance.[333] Greater operational flexibility should be conditioned on superior environmental performance.[334] Such an approach has been adopted by at least one other agency in a related context.[335]

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332. The superior environmental performance requirement only appears to be "greenmail" if one leaves out of the picture flexible production facilities' increased capacity for pollution prevention. This is essentially what the NSR Reform Rule does. It comprehends the fast-cycle nature of flexible production and its conflict with traditional NSR permitting. But it essentially ignores these companies' ability to achieve better environmental performance through pollution prevention. This leads it to provide flexible production facilities with the operational flexibility that they need but to forget to ask, in return, for the improved environmental performance that they can provide. A fuller understanding of flexible production would counsel doing both.

333. Indeed, the NSR Reform Rule will cut the legs out from under the Reinvention initiatives described above. Why would a facility agree to provide better environmental performance in exchange for increased operational flexibility, when it has the option of obtaining such flexibility for "free"? Will not Intel now come back to the table asking to renegotiate the terms of its innovative permit so as to eliminate the superior environmental performance requirement? In light of the NSR Reform Rule, the company would be foolish not to do so—and that is precisely what is wrong with the Rule.

334. Two other reasons also support a requirement of superior environmental performance. First, PAL permits require more than the level of resources that an agency would devote to issuance of a standard permit. An environmental agency's main priority is protection of the environment. If it is going to expend extra resources in an area, there should be an environmental return. Superior environmental performance is this return. It therefore makes sense to require it. Second, pollution prevention approaches, such as those employed in Intel's XL permit or the P4 program, are sui generis and, as such, are more difficult to monitor and evaluate than standard end-of-pipe controls. Asking the public to move from the familiar best available technology approach to a strategy that is different and more difficult to track, is in a sense asking it to take a risk in exchange for a greater environmental return. Once again, better environmental performance is the return.

335. *See generally* Weil, *supra* note 10. Under the "hot cargo" provision of the Fair Labor Standards Act, the Department of Labor has the authority to embargo goods produced by underpaid workers in violation of the Act and to hold them until such time as remedial payments are made to the workers. *Id.* at 4, 14-15. *See also* Fair Labor Standards Act of 1938, § 15(a), 29 U.S.C. § 215(a) (2000). Traditionally the retail industry operated on relatively long time frames and could accommodate these delays. It was not much concerned about the Department of Labor's use of its embargo power. Weil, *supra* note 10, at 14. Recently a new breed of fast-cycle retailers, who change their inventory much more frequently and operate on compressed time frames, have become far more sensitive to time delays. *See id.* at 7, 14. The Department has offered to speed up the release of embargoed goods to these manufacturers if they will agree to implement and monitor a labor compliance program for all of their contractors, thereby improving overall compliance with labor standards. *Id.* at 15-17. Such an approach essentially trades regulatory speed for enhanced compliance. It shares much in common with the model endorsed here. Just as the Department of Labor speeds up the release of embargoed goods for those manufacturers who take additional steps to assure compliance, so the EPA could offer to quicken environmental permitting for those flexible companies that take steps to achieve better environmental performance. As in the labor context, such an arrangement would not take the form of a

Policy recommendation: following the Reinvention model, EPA should grant increased operational flexibility through plantwide emission caps and other mechanisms only on the condition that the permittee achieve superior environmental performance[336]

While the Reinvention approach to superior environmental performance is preferable to the NSR Reform Rule's, it is far from perfect. As was mentioned above, the Reinvention pilots have raised significant issues with respect to how superior environmental performance should be defined and measured. This experience provides some useful lessons for the future. Except in cases of obvious environmental benefit, superior performance should generally exclude cross-pollutant trades of the sort involved in the Intel XL project. It should, instead, be defined in terms of actual decreases in the same pollutants as were being emitted at the "baseline" period.[337] In addition, the emission reductions must be closely and reliably monitored. This means employing continuous emission monitors, which measure actual emissions on a constant basis, wherever possible. These criteria would help to ensure real, verifiable emission reductions.

Policy recommendation: superior environmental performance should generally be defined in terms of closely monitored, actual reductions in the same pollutants as were being emitted at baseline

Were the EPA to incorporate superior environmental performance into the NSR Reform Rule, it would not only make the Rule more successful from an environmental standpoint, but might also make it more legally sustainable. As was mentioned above, a group of states and environmental organizations have brought suit challenging the legality of the NSR Reform Rule's PAL program.[338] While no proceedings have as yet been held and the basis for the suit is not yet clear, the

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requirement. Rather, it would use regulatory speed as an incentive to get these manufacturers to use their new pollution prevention abilities to achieve the environmental improvements of which they are now capable.

336. The NSR Reform Rule could easily be updated to reflect this policy. EPA would require that emission caps for the PAL program be set at a level that reflects better environmental performance. The precise level should be determined on a case-by-case basis after an assessment of the facility's opportunities for pollution prevention, but should in all cases represent a meaningful improvement over traditionally required emission levels. The EPA should further require that this emissions cap decline at specified intervals over time. This will reflect the fact that, as time passes and new control technologies become "available," the traditional standards also become more stringent. The PAL emissions cap should remain more stringent than evolving "best available" end-of-stack controls. Altered in this way, the NSR Reform Rule's PAL program would encourage the transition from mass to flexible production while drawing from flexible producers the improved environmental performance of which they are capable.

337. *See supra* notes 248-52 and accompanying text. On occasion, there may be a manifest benefit that should not be passed up. *See, e.g.*, Hirsch, *Success Story*, *supra* note 252, at 250 (large reductions in a pollutant exchanged for small increases in a clearly less harmful one).

338. *See supra* note 298 and accompanying text; *Lawsuit*, *supra* note 295.

petitioners' claim is likely to be grounded in *Alabama Power Co. v. Costle*,[339] a foundational CAA decision. *Alabama Power* concerned a broad-based challenge to the EPA's initial NSR regulations for clean-air areas (known as the Prevention of Significant Deterioration ("PSD") program).[340] The D.C. Circuit decided dozens of issues related to these regulations. One of the court's important holdings concerned the regulations governing major modifications.[341] The court held that, where the EPA allows a facihty to offset current emission increases with prior emission decreases and thereby avoid a significant emissions increase that would trigger NSR permitting, the increases and decreases must be "substantially contemporaneous" with one another.[342] That is, the EPA cannot allow facilities to offset current increases with decreases from some earlier period that is too far back in time. The court stated it was within the agency's reasonable discretion to define the meaning of "contemporaneous" in this context.[343] Subsequently, the EPA determined that changes within five years of each other would be deemed contemporaneous.[344]

A PAL arguably allows a source to avoid NSR permitting by offsetting current emission increases with past decreases (that is how the source stays within the emissions cap). Thus, the NSR Reform Rule's PAL program may be subject to the *Alabama Power* holding that all such increases and decreases be "contemporaneous." A legal challenge based on *Alabama Power* would focus on the NSR Reform Rule's ten-year look-back period for determining the emissions baseline and would argue that it violates this holding.[345] This claim is best illustrated through an example. Assume that a facility received a PAL permit in 2003, and that the emissions cap was based on the plant's emissions level in 1993-1994 (the two years out of the last ten in which it had its highest emissions). In 1995, the facility made a change that resulted in a large emissions decrease. At the time that the PAL was established (in 2003), actual emissions were still substantially below the 1993-1994 "baseline" due exclusively to the eight-year-old decrease. Further assume that in 2008 (that is, five years into the ten-year PAL permit), the facility made a change that caused it to emit more of the pollutant but, due to the 1995 decrease, did not lead it to exceed its 1993-1994 "baseline" amount. In a sense, the facility would be using a thirteen-year-old decrease (the 1995 decrease) to offset the new (2008) increase.[346] An argument could be made

339. 636 F.2d 323 (D.C. Cir. 1980). *See also* NATURAL RES. DEF. COUNCIL, GUTTING NEW SOURCE REVIEW: LETTING POLLUTERS LIE ABOUT TODAY'S POLLUTION LEVELS SO THEY CAN POLLUTE MORE LATER 1 (2002), *available at* http://www.nrdc.org/media/docs/020320a3.pdf [hereinafter NRDC BACKGROUNDER] (identifying this legal argument).

340. NRDC BACKGROUNDER, *supra* note 339, at 1.

341. For an explanation of these terms, *see supra* notes 164-68 and accompanying text.

342. *Ala. Power Co.*, 636 F.2d at 402.

343. *Id.* ("The agency has discretion, within reason, to define which changes are substantially contemporaneous.").

344. Protection of Environment, Air Programs, Approval and Promulgation of Implementation Plan's Prevention of Significant Deterioration of Air Quality, 40 CFR § 52.21(b)(3)(ii)(a) (2003).

345. *See* NRDC BACKGROUNDER, *supra* note 339, at 1.

346. This is so because, if one did not take the 1995 decrease into account, then the 2008 increase would bring the emissions over the "baseline" amount. It is only because of the 1994 decrease that this does not occur. Thus, the facility is relying on the 1995 decrease to prevent the 2008 change from resulting in a significant increase.

that thirteen years is not "contemporaneous" and that the NSR Reform Rule's PAL provisions, with their ten-year look-back period, violate *Alabama Power*.[347]

A PAL agreement might follow the Reinvention model and require superior environmental performance in exchange for the greater operational flexibility that the agreement would provide. For example, if a facility's actual emissions at the time it applied for the PAL permit were 600 tons per year ("tpy") of a given pollutant, the agency might set the emission cap at 500 tpy, thereby requiring the facility to improve upon its prior performance. A PAL arrangement of this sort would stand on much stronger legal footing with respect to *Alabama Power*. Where a PAL is set at a level *below* current actual levels, and the facility achieves that level through pollution prevention measures, there is no need to rely on historic decreases (that is, those that occurred prior to the establishment of the PAL) to stay within the cap. So long as *future* emissions increases and decreases offset each other, the facility should be able to stay within the terms of the PAL permit. Such future increases and decreases are far more likely to be "contemporaneous" with one another than those in the above example (which had a thirteen-year gap between them).

Moreover, it would be reasonable for the EPA, in its discretion, to extend the time frame for determining what is "contemporaneous" where a PAL is set at a level more stringent than that required by traditional regulation. The EPA could plausibly argue that facilities will only invest in pollution prevention opportunities where they have confidence that the investment will secure their regulatory compliance for some time to come. A moving target approach to regulatory standards, by contrast, discourages such pollution prevention efforts.[348] Thus, it will be important for any PAL arrangement to remain in place long enough to provide flexible production firms with the necessary degree of certainty.[349] An extended PAL period is arguably therefore necessary for achieving better environmental performance through pollution prevention. The more stringent the level at which the original cap is set, the more the EPA should be legally able to extend the time frame for summing future increases and decreases to stay below that cap. In this way, an approach that combines PALs with a requirement of superior environmental performance (the Reinvention approach) is more clearly in line with *Alabama Power* than one that sets the cap according to a ten-year-old baseline (the NSR Reform approach). One reason to prefer the Reinvention PAL approach to the NSR Reform strategy is that the former is more consistent with governing law.

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347. *See* NRDC BACKGROUNDER, *supra* note 339, at 1.

348. *See* Stewart, *Regulation, Innovation*, *supra* note 191, at 1318.

349. By the same token, it will be important that a PAL not last too long. As time passes, control technologies get more effective. In order for a PAL to remain "superior" in terms of environmental performance, it will need to decline over time to reflect the increasing stringency of traditional, technology-based regulation. Such a "declining cap" would also be consistent with flexible production's commitment to continuous improvement. These factors create a tension between certainty, which is essential for company investment in pollution prevention measures, and better environmental performance, which requires that the PAL become more stringent over time. The key to a successful regulatory approach will be finding the proper balance between these two competing objectives.

Legal Recommendation: the Reinvention model, which establishes the PAL emissions cap based on superior environmental performance is more legally defensible than the NSR Reform model, which allows a ten-year look-back period for establishing the PAL baseline

B. Improved Stakeholder Participation

The Reinvention and NSR Reform approaches also diverge with respect to public participation. Reinvention initiatives such as Project XL or the Oregon Green Permits program require participating companies to reach out to interested stakeholders during the initial stages of project development, inform them about the project, consider their comments, and, to some extent, gain their support.[350] Once the government and the company have settled upon the final arrangement (trading regulatory flexibility for better environmental performance), these programs provide members of the public with a further opportunity to comment. The NSR Reform Rule dispenses with the earlier stage of stakeholder involvement, limiting itself to the more traditional approach of public notice and a thirty-day comment period.[351]

A regulatory model that increases permit flexibility should also seek to enhance public participation. The permitting process has traditionally provided the public with its principal opportunity to learn about the environmental impacts of a given facility, and to have a say in how it is regulated. By reducing the number of permitting exercises, a PAL approach threatens to decrease the public's role in environmental regulation. Public review of a single PAL permit once every ten years as specified by the NSR Reform Rule[352] is simply not equivalent to the multiple permit review opportunities that would exist under traditional permitting. In addition, a PAL arrangement, especially one based on pollution prevention, is harder for the public to evaluate than a traditional permit based on control technology. Citizens wishing to determine whether a facility is complying with traditional requirements need only assess whether the specific technology is in place and is operational. By contrast, where a facility employs pollution prevention strategies citizen evaluation requires an understanding of facility operations, specific pollution prevention steps, and how these efforts will impact facility emissions. This requires more resources and expertise than are needed under traditional permitting. Once again, this warrants an improved role for the public.

Recent thinking about public participation suggests the Reinvention emphasis on early public involvement may not only compensate for lost permit review opportunities; it may leave the public better off than it is under traditional permit review. Commentators have criticized the traditional permit process, in which the public is limited to comment on the draft permit, as ineffective. They have pointed out that by the time a draft permit is issued for public comment high-level officials in the agency have already signed off on it.[353] As a result, even under traditional

350. *See supra* notes 236, 274-75 and accompanying text.

351. *See supra* note 313 and accompanying text.

352. NSR Reform Rule, *supra* note 21, at 80,209.

353. SPEIR, *supra* note 281, at 49 ("[C]itizens often come to an announced public meeting only to learn that all the substantive work on the permit under review has been done.").

permit review procedures citizens often have difficulty getting the agency to change its position with respect to the permit, or even to seriously listen to arguments that it should do so.[354] To cure this, these commentators have suggested that citizens be integrated into the "front-end" environmental planning for facilities that takes place before the permit has been committed to paper.[355] Such a method would allow members of the public to express their views *before* the agency had committed itself to a draft permit, and so to have more impact on agency decisions.[356]

The negotiation of a PAL permit, especially one relying on pollution prevention to achieve better performance, should serve as an effective vehicle for front-end public involvement. Stakeholders included in such a process would gain access to a wealth of currently unavailable information about facility operations, anticipated process changes, pollutant emissions, and opportunities for pollution prevention. They would not be limited to commenting on the control technologies specified in the draft permit.[357] Moreover, they would gain this information at a time when senior agency officials had not yet signed off on the draft permit and were open to suggestions.[358] The Reinvention programs, which require facilities to engage stakeholders early on and listen to their ideas, may thus create a more effective system of public participation. By contrast, the NSR Reform Rule ignores altogether the need for enhanced stakeholder participation and limits itself to traditional, back-end permit review. In so doing, it risks undermining the accountability of the air permitting system.

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354. *See* U.S. EPA, NEXT GENERATION PERMITTING, *supra* note 199, at 7 ("[C]urrent requirements may not always offer meaningful opportunity for community input. Citizens may perceive that their concerns are considered too late in the process and that they don't have tools to participate effectively.").

355. *See* J. Charles Fox, *A Real Public Role*, ENVTL. F., Nov.-Dec. 1998, at 19, 21 (environmental decisionmaking works best when citizens are involved "in the early stages, when their suggestions can substantially influence how decisions take shape"); Thomas C. Beierle & Rebecca J. Long, *Chilling Collaboration: The Federal Advisory Committee Act and Stakeholder Involvement in Environmental Decisionmaking*, 29 ENVTL. L. REP. 10,399 (1999) [hereinafter *Chilling Collaboration]*.

356. SPEIR, *supra* note 281, at 49 (stating that new permitting initiatives "attempt to generate public input and dialogue at an earlier stage, when the opportunity for influence is greater").

357. *See* U.S. EPA, NEXT GENERATION PERMITTING, *supra* note 199, at 2 ("In theory, a system that focuses more on a facility's overall environmental impacts, and less on narrow decisions about particular technologies or process changes, should be more meaningful for the public . . . .").

358. It is always possible that, following the initial negotiation of a PAL permit, environmental conditions may change or more may be learned about the harms caused by a facility's emissions. This counsels in favor of reconvening the stakeholder group periodically (e.g., every three to five years) to discuss whether the terms and conditions of a long-term PAL should be modified. Given the investments that the regulated party may have made in reliance on the PAL agreement, the presumption should be strongly against changing the PAL agreement prior to the end of its term. However, periodic meetings of the stakeholder group to consider whether any new developments showed an imminent and substantial threat of harm to the public or the environment would provide an added level of comfort. This might facilitate public support for such agreements. I am indebted to Professors Lee Paddock and Kurt Strasser for this point.

> *Policy recommendation: in exchange for permit flexibility, the EPA should require flexible production facilities to engage stakeholders in a front-end participation process that provides comprehensive information on facility operations and environmental impacts, and affords an opportunity to make suggestions as to ways in which product design or the production process could be changed in order to prevent pollution*[359]

While the Reinvention pilots represent a step in the right direction, they leave much room for improvement. As was discussed above, the Oregon Green Permits program does a poor job of defining the scope of public access to company information and engagement in company decisionmaking.[360] Project XL has been criticized for putting a difficult burden on national environmental groups who lack the resources to monitor a host of site-specific regulatory deals[361] and for giving the participating company, which has the greatest stake in the project moving forward, the delicate task of organizing and running the stakeholder group.[362] These shortcomings lead to three further policy recommendations:

> *Policy recommendation: in carrying Reinvention forward, the EPA should further define the precise scope of stakeholder access to decisionmaking and involvement in the negotiation process*

> *Policy recommendation: following the practice in Project XL, the EPA should provide funding to national and local citizen groups to enable them better to participate in front-end stakeholder processes*[363]

> *Policy recommendation: the EPA, not the participating company, should organize and manage the stakeholder participation process. The agency should operate on the presumption that any citizen or group that wishes to participate will have an opportunity to do so, unless the process becomes so*

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359. The up-front model of stakeholder involvement may offer some middle ground between the "*fait accompli* and absolute veto power." James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STANFORD L. REV. 607, 688 (2000). Professors Salzman and Ruhl have argued that excluding members of the public from the permit negotiation process until such time as a draft permit has been released presents them with a *fait accompli*. At the other end of the extreme, providing stakeholders with veto power over the bargain can make the negotiation process unworkable. *Id.* Early participation by a limited group of stakeholders, with an understanding that it is advisory only and that the EPA retains the authority to make the final decision, may provide a middle ground that would render public participation more meaningful while keeping the process manageable. Admittedly, this leaves open the difficult question of how such stakeholders are to be chosen where a large number of interested parties wish to participate. *Id.* at 689.

360. *See supra* notes 286-88 and accompanying text.

361. *See supra* note 253 and accompanying text.

362. *See supra* notes 256-58 and accompanying text.

363. *See* Stewart, *Regulation, Innovation*, *supra* note 191, at 1347.

> *large as to be unmanageable; in which case the EPA should determine the makeup of the stakeholder advisory group.*[364]

The last of these recommendations—that the EPA itself organize and manage the stakeholder involvement process—raises an important legal issue. Were the EPA to convene such a group it would likely trigger the Federal Advisory Committee Act (FACA),[365] a statute that regulates the process by which members of the public advise federal agencies.[366] The Act applies to "advisory committees," a term that includes "any committee, board, commission, council, conference, panel, task force, or other similar group . . . which is . . . established or utilized by one or more agencies, in the interest of obtaining advice or recommendations. . . ."[367] Where an agency uses an advisory committee, the Act requires that it fulfill a number of procedural requirements such as chartering the committee,[368] providing notice in the Federal Register of the committee's establishment[369] and of all committee meetings,[370] and making all committee documents available for public inspection.[371] To limit agency expenses, a 1993 Executive Order sets a tight cap on the number of committees that each agency can utilize.[372]

A stakeholder group convened hy the EPA to provide front-end input on a PAL permit would likely constitute a "committee . . . or other similar group" that had been "established or utilized" to provide an agency with "advice or recommendations."[373] It would almost certainly trigger the FACA.[374] This would require the agency to give up one of its few advisory committee slots[375] and to take on the resource-intensive tasks of chartering the committee, publishing Federal Register notices, preparing committee minutes, and fulfilling the other duties set out under the Act. Interested stakeholders could face delays of months, or even years, while waiting for the agency to fulfill these duties.[376] These administrative costs and delays would serve as a significant deterrent to the effective and

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364. Another option would be for the EPA to hire an external moderator. If the EPA itself were not moderating the discussion, this might decrease the distance between the EPA and the other stakeholders and so facilitate a more complete and open discussion.

365. 5 U.S.C. §§ 1-16 (2000).

366. *Chilling Collaboration*, *supra* note 355, at 10,399-400; Steven P. Croley, *Practical Guidance on the Applicability of the Federal Advisory Committee Act*, 10 ADMIN. L.J. AM. U. 111, 118 (1996).

367. 5 U.S.C. app. § 3(2)(A)-(C); *see* Croley, *supra* note 366, at 127.

368. 5 U.S.C. app. § 9(c).

369. *Id.* § 9(a)(2).

370. *Id.* § 10(a)(2).

371. *See generally* Croley, *supra* note 366, at 118; *Chilling Collaboration*, *supra* note 355, at 10,402.

372. Exec. Order No. 12,838, 58 Fed. Reg. 8,207 (Feb. 12, 1993). The cap is actually set by OMB Circular A-135, the implementing directive for Executive Order 12,838. Croley, *supra* note 366, at 114.

373. 5 U.S.C. app. § 3(2)(A)-(C).

374. Croley, *supra* note 366, at 164 (the FACA clearly applies to a stakeholder group advising the EPA on policy); *accord Chilling Collaboration*, *supra* note 355, at 10,410 (identifying "the site and region-specific committees to which FACA seems to do the most harm").

375. *Chilling Collaboration*, *supra* note 355, at 10,407.

376. *Id.* at 10,403.

widespread use of front-end stakeholder groups.[377] Indeed, the EPA may have turned the Project XL stakeholder process over to the participating company precisely in order to avoid FACA applicability.[378] The Act could pose a major barrier to up-front stakeholder participation.

A few legal reforms would serve to reduce this impediment. First, the President should take note of the new role of stakeholder groups in environmental management and expand the EPA's advisory committee quota.[379] Second, Congress should amend the statute to allow the EPA to employ ready-made generic charters for local stakeholder groups, thereby decreasing costs and delays. The local nature of such groups, as compared to the national advisory committees for which the statute was written, justifies such an approach. Finally, Congress should recognize that some of the Act's procedural requirements, such as national publication in the Federal Register, are less necessary with respect to local stakeholder groups. It should amend the statute to exempt agencies from these requirements when dealing with local groups.[380]

> *Legal recommendation: the Executive branch should expand the EPA's ceiling on advisory committees so as to allow the agency to utilize more site-specific stakeholder groups*

> *Legal recommendation: Congress should amend the FACA to allow for generic charters for site-specific, local advisory committees*

> *Legal recommendation: Congress should amend the FACA to exempt site-specific, local advisory committees from some of the FACA's procedural requirements such as Federal Register publication of committee meetings*

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377. *Id.* at 10,402 (noting that FACA has a "chilling effect" on stakeholder participation). Some have theorized that this unintended effect occurs because the FACA, drafted in 1972, was written for an era where agencies generally worked through broad rulemakings and that the statute is not well designed for the newer forms of more frequent, site-specific agency/stakeholder collaboration popularized by Reinvention and similar efforts. *See* Croley, *supra* note 366, at 114; *Chilling Collaboration*, *supra* note 355, at 10,407.

378. *See Chilling Collaboration*, *supra* note 355, at 10,408 ("EPA avoids triggering FACA by keeping CAG [community advisory group] formation at arm's[]length. They explicitly do not set up committees, fund them, or run them. Instead, the Agency simply encourages their formation and supports their work."). If the facility convenes and manages the stakeholder process, then the group is not "established" by the agency. Moreover, if the EPA remains at arm's length from the process then the group is not one that is being "utilized" by the agency. By remaining distant from the group the EPA can avoid triggering the FACA.

379. *See id.* at 10,409 (arguing that the Executive branch should "lift the administrative ceiling on advisory committees").

380. *See id.* at 10,410 (arguing that Congress should reduce the procedural requirements for certain types of committees).

C. Operational Flexibility

Both the Reinvention programs and the NSR Reform Rule are on the right track with respect to operational flexibility. Flexible production is premised on fast-paced and constant changes in the manufacturing process. Were these changes to trigger permit or permit modification requirements at every turn, and occasion weeks or even months of delay each time that they did so, this would create a significant obstacle for this new industrial form.[381] To facilitate the competitive and environmental benefits of flexible production, the air permitting system must provide these facilities with greater operational flexibility. The plantwide emission cap approach, shared by both the Reinvention initiatives and the NSR Reform Rule, is one way of achieving this. For both environmental and economic reasons this policy innovation should be supported and maintained, especially where it is combined with demands for better environmental performance and improved stakeholder participation.[382]

Policy Recommendation: the EPA should continue to utilize PALs and other types of emission caps to provide operational flexibility to facilities engaged in flexible production

While emission caps provide a useful tool for the regulation of flexible production industry, they are only one of several possible mechanisms for providing more operational flexibility to these sources and may ultimately prove not to be the best option. For example, a system of tradable emission quotas would provide flexible producers with complete freedom to alter their manufacturing processes and an incentive to utilize their pollution prevention capacities.[383] Under such an approach, regulators would first establish the desired level of a given air pollutant for a region or for the nation.[384] They would then divide this amount into separate units that would be allocated or sold at auction to existing sources or to new sources seeking to undertake construction.[385] So long as a flexible producer possessed sufficient quotas to cover its emissions, there would be no limits on its ability to undertake process changes. These emission quotas would be completely tradable between sources and would increase in value as demand for emission rights increased.[386] This would give flexible producers an incentive to reduce their emissions through pollution prevention wherever doing so was less costly than

381. For example, prior to receiving its flexible permits, Intel Corporation took the position that the delays associated with state minor source NSR permitting might "cause the company to 'seriously question whether it could remain committed to the construction and expansion of [its] U.S. sites.'" BOYD ET AL., *supra* note 6, at 9. While this statement no doubt reflects a strategic bargaining position, it makes sense in light of Intel's fast-change operations and cannot be completely dismissed.

382. This does not mean doing away with the NSR regulations which play an essential role in creating a baseline of regulation. The emission cap approacb would provide an alternative to, not a replacement of, traditional NSR. Flexible production facilities would likely opt for the emissions cap approach, while slower-moving mass producers might remain with the familiar NSR system.

383. I am indebted to Professor Richard Stewart for suggesting this connection.

384. *See* Stewart, *supra* note 22, at 95.

385. *Id.*

386. *Id.* at 95-96.

purchase of additional quotas.

A system of tradable emission quotas might also pose problems. For example, it might lead to the creation of "hot spots" where a number of facilities located near to each other purchased a large number of quotas, generating a localized pollution problem.[387] A full discussion of the merits and downsides of such an approach, and a comparison to emission caps and other methods, are beyond the scope of this Article. For now, it is sufficient to note that emission caps, while quite useful for flexible production facilities, are but one method of achieving greater operational flexibility. They will ultimately need to be evaluated in comparison to other policy options. In addition, it is worth noting that the issues flexible production poses for environmental regulation are not limited to CAA permitting and may extend to the Resource Conservation Recovery Act and Clean Water Act.[388] Exploration of these and other issues related to flexible production should prove fruitful areas of future research.

CONCLUSION

Major social changes often produce shifts in law and policy. Yet the direction that this evolution will take is not preordained. If those with decisionmaking authority properly understand the nature of the change taking place around them, they can exercise real choice in determining how to respond to it. This Article has argued that Congress and the EPA currently face such a choice. The nation's industrial base is beginning to undergo a fundamental transformation from mass production—the root of American economic success for over a century—to flexible production, a method based on fast-paced change and constant innovation. This shift is posing important challenges for environmental law and policy. Two regulatory initiatives, Environmental Regulatory Reinvention and the New Source Review Reform Rule, have emerged as possible contenders for responding to the new industrial conditions. Both revise the air permitting system so as to allow flexible producers to alter their processes quickly without encountering serious regulatory delay. Reinvention, but not the NSR Reform Rule, further requires these companies to achieve better environmental performance and to allow enhanced stakeholder involvement in the environmental management of their facilities.

This Article has argued that a fuller understanding of flexible production favors the Reinvention approach. Flexible production is characterized, not only by fast-cycle change, but also by an increased ability to engage in pollution prevention. This should allow flexible producers to go farther in pollution reduction than their mass-producing counterparts at the same, or less, cost. The Reinvention programs described above take advantage of this attribute. By conditioning the grant of operational flexibility on improved environmental performance and stakeholder involvement, they encourage flexible producers to achieve the environmental gains of which they are capable. New Source Review Reform, on the other hand, does not include this additional element. This results in an incomplete policy response that forgets to ask more of these facilities on the environmental front. In so doing, NSR Reform risks missing out on a historic opportunity to achieve the next level of environmental protection.

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387. *Id.* at 100-01.

388. *See supra* notes 15-16 and accompanying text.

The Reinvention strategy, while preferable, has shortcomings as a matter of policy and is in tension, at several points, with the existing legal structure. This Article has offered specific recommendations for improving the Reinvention method and for changing the law to better fit this new regulatory approach. Taken together, these ideas map out a path for environmental law and policy that will both accommodate flexible production and realize its green potential.