WASTE IN THE 21ST CENTURY: A FRAMEWORK FOR WISER MANAGEMENT

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INTRODUCTION

This article provides a framework for wiser management of both waste handling and site cleanups. With regard to both, we propose a three-pronged test including protectiveness, cost effectiveness, and sustainability. The first two elements—protectiveness and cost—are traditional metrics applied to site cleanup and waste management decisions. The third element—sustainability—is increasingly applied to many aspects of corporate decisionmaking but has not been generally applied to waste management issues. This article attempts to illustrate how the combination of these three criteria could enhance waste management in the 21st century.

Waste management reflects the sensibilities and technologies of the times. Metals are a good example. From the beginning of civilization, people have sought ways to recycle used metal efficiently. This practice stemmed not from a commitment to the environment as much as the economics of virgin metals extraction and the fact that waste metal had intrinsic value. This lesson is still valuable—an awareness of the economics of waste management remains critical to practical prescriptions for wiser

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management.

But, as a society, we now understand that waste management policies can and should look beyond economics and consider an additional factor, namely the environmental impact of our waste and waste practices. An analysis of environmental impact typically considers the protectiveness of human health and the immediate environment (such as the water or air directly affected by the waste). At bottom, the "environmental impact" criterion focuses on local, direct impacts. The immense regulatory construct that addresses the environmental impact of waste is expansive and complex. It involves the application of at least a dozen federal statutes and countless state and local laws.[1] It is thus fair to say that our understanding of and commitment to minimizing the environmental impact of waste management is fairly well developed.

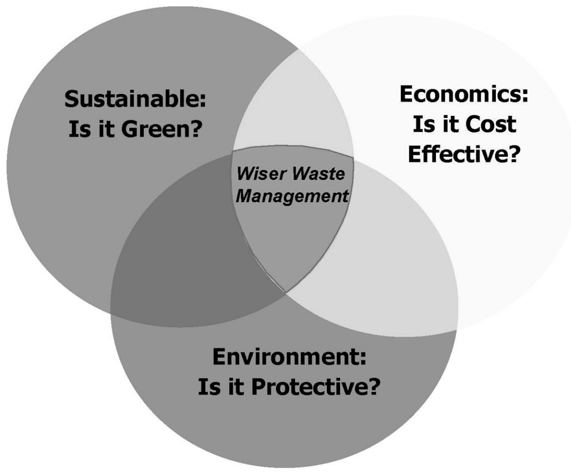
We propose a third criterion—sustainability—which, to date, has not been comprehensively addressed by the existing environmental regulatory regime. Broadly speaking, the concept of "sustainability" looks beyond local or direct impacts of waste management and site cleanup decisions and focuses on global and

[1] *See, e.g.*, Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601–9675 (2000) (providing funding and liability for cleanup of hazardous substances at contaminated sites); Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901–6992k (2000) (creating system to clean up improperly stored or spilled waste, promote conservation and recycling efforts, and to protect the public from harm caused by waste disposal); Toxic Substances Control Act, 15 U.S.C. §§ 2601–2692 (2000) (authorizing EPA to locate and identify all chemical substances used in America and assigning responsibility to EPA to control any of these substances determined to cause an unreasonable risk to the American public); Emergency Planning and Community Right-to-Know Act, 42 U.S.C. §§ 11001–11050 (2000) (requiring EPA to compile a list of extremely hazardous substances, make this list publicly available and establish threshold planning quantities for each); Clean Water Act, 33 U.S.C. §§ 1251–1387 (2000) (enabling the federal government to establish and enforce water quality standards to eliminate pollution and toxins, and make water safe for human consumption); Clean Air Act, 42 U.S.C. §§ 7401–7671 (2000) (authorizing EPA to set regulation standards on air pollutants, including how many pollutants can be localized in a particular part of the country, and to regulate emissions from various sources); Oil Pollution Act, 33 U.S.C. §§ 2701–2762 (2000); 43 U.S.C. §§ 1642, 1656 (2000); 46 U.S.C. §§ 3703a, 7505 (2000) (enacted following the oil spill of the Exxon Valdez; requiring a company shipping oil into America to present a plan for cleanup and containment for any potential oil spills); and Nuclear Waste Policy Act, 42 U.S.C. §§ 10101–10270 (2000) (assigning responsibility to the federal government to locate, evaluate, and regulate location sites for the disposal of nuclear waste, including guidelines on how to protect the environment during storage of the waste).

indirect impacts. Sustainability in this context refers to practices that minimize impacts to the planet, both short and long term, at both the generation and remediation stages. For example, a sustainability analysis will quantify the energy use and carbon footprint associated with various practices or products. While an analysis of environmental impact is largely focused on the human health risk of the waste itself, an analysis of sustainability is focused on the broader impacts associated with creating the waste and the process of handling the waste once it is in existence. Sustainability considers the entire lifecycle of the product or practice, including the production of raw materials, the environmental costs of transportation, and the potential cultural impacts associated with the proposed action. Importantly, sustainability asks not only how we should manage waste, but also how we can avoid or minimize the creation of waste. For lack of a better term, sustainability asks whether a given industrial process or production methodology is "green."

This article attempts to map out a waste management policy that would consider all three factors: economics, environment, and sustainability. By "economics," we do not mean to ask "which is the least expensive practice?" but rather "which is the most cost-effective?" As we have learned through three decades of environmental law, the failure to meaningfully include cost-effectiveness as a decision criterion results in conflict, delay, and—in all candor—a significant waste of money without necessarily achieving more effective remedies.

Some may ask how one balances or weighs these three factors when designing a policy or making a specific remedial or management decision. Luckily, however, we know which component is most important since protecting human health and the environment is always the paramount objective, both ethically and—in most circumstances—legally. Rather, the issue is how would waste management differ if all three criteria were considered and met. The achievement of all three criteria is what we mean when we say "wiser" management.



Layered on top of this three-prong analysis are critical trends including increasing global resource scarcity, rapid population growth, climate change, transitioning economies, international treaties, and regulatory diffusion. As we developed our "wiser" principles below, we have attempted to remain mindful and responsive to these realities.

In section I, we focus on site remediation and illustrate the potential impact of the sustainability criteria when making cleanup decisions. In addition, we address the growing focus on megasites and recommend some principles that should apply to the management of those sites. In section II, we focus on waste management itself and illustrate our framework in two important areas: electronic waste and waste mining. Finally, in section III, we discuss two important process issues that we believe are important to wiser waste policies, namely fixing the profound regulatory inefficiencies associated with site cleanups, and readjusting enforcement priorities.

I. SITE MANAGEMENT

Three decades after Superfund became law, there remain over 1,200 environmental sites on the National Priority List (NPL)[2] and

[2] The NPL is "the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories," and "is intended primarily to

over 12,000 sites on the Environmental Protection Agency's larger list of identified sites.[3] In addition, there are thousands of sites on analogous state lists. This section discusses how our framework could apply to remedial decision-making at these sites.

A. *Green Remediation: Correcting the Past While Protecting the Future*

At Superfund and other waste sites across the country, regulators must make decisions about what type of remedial action is appropriate, if any. At large sites, cleanup decisions are made based upon a number of criteria, including remedy protectiveness, feasibility, cost, and public acceptance. However, to date, despite some promising initiatives at both the state and federal level, little consideration has been given to sustainability at the typical site. This is a weakness in our current waste site management policy. In the future, we believe that regulators will apply a "sustainability" factor to cleanup decisions.[4]

Here's an example how the sustainability factor may work in practice. In Syracuse, New York, Honeywell International is undertaking the cleanup of Onondaga Lake and certain surrounding sites. This is a very large remediation project involving dredging of Lake sediments, capping portions of the Lake bottom with clean sediment, and habitat enhancement.

As part of this project, Honeywell is evaluating issues of sustainability, in addition to the traditional factors of protectiveness and cost-effectiveness. So, for example, for various remedial options, we are considering energy requirements, materials sourcing, transportation requirements, water demands

guide the EPA in determining which sites warrant further investigation." U.S. ENVTL. PROT. AGENCY, NATIONAL PRIORITIES LIST (NPL), http://www.epa.gov/superfund/sites/npl/ (last visited Oct. 1, 2008). As of February 4, 2008, there are 1,245 sites listed. *See* U.S. ENVTL. PROT. AGENCY, FINAL NATIONAL PRIORITIES LIST SITES, http://www.epa.gov/superfund/sites/query/queryhtm/nplfin1.htm (last visited Feb. 12, 2008).

[3] The Compensation and Liability Information System (CERCLIS) is the database and data management system EPA uses to track activities at sites considered for cleanup under CERCLA. As of January 15, 2008, there are 12,327 sites listed in CERCLIS. *See* U.S. ENVTL. PROT. AGENCY, INVENTORY OF CERCLIS AND ARCHIVED SITES BY STATE (2008), *available at* http://www.epa.gov/superfund/sites/products/archinv.pdf.

[4] Pursuant to the National Contingency Plan, EPA applies a nine-factor test to its remedial decisions. *See* 40 C.F.R. § 300.430(f) (2008). We propose that "sustainability" should be the tenth factor in the analysis.

and the like. To the extent that we are able to shift technologies or practices to less energy intensive and more sustainable practices—while also protecting human health and the environment and remaining cost-effective—we will have implemented a better remedy with a smaller and lighter footprint on the planet.

While the Syracuse example is only a pilot project at this stage, there are already indications that it is working. For instance, scientists at the SUNY School of Environmental Sciences and Forestry, in partnership with Honeywell, developed an ingenious biocapping alternative for the settling basins that will be used for dredge spoils. Instead of using clay or other synthetic material to cap the basins, we are proposing willow trees. The willow trees are fast growing, thirsty species that will be periodically harvested to create biofuel. Through a process called evapotranspiration, the trees are projected to be as effective as a traditional landfill cap in preventing leaching of substances from the basins. There is also the possibility of using biosolids from the Onondaga County publicly-owned waste water treatment plant down the road for fertilization and soil improvement. Finally, because the trees will sequester carbon and replace the need for other fuel, the entire project is a carbon sink; i.e., the project has an overall positive impact on carbon loadings to the atmosphere and any associated climate change. At Honeywell, we call this project "Willow Power" and several pilot plots are showing great promise. The New York State Department of Environmental Conservation is currently evaluating this remedy, and we are optimistic that some version of this approach will be accepted and implemented at the site.

Honeywell, of course, is not alone in looking to improve the remediation process to include sustainability concerns. Dupont, for example, has been advocating for "sustainable approaches to remediation" that will, among other objectives, minimize or eliminate energy consumption or other natural resources, harness or mimic a natural process and result in the reuse or recycling of land.[5]

Similarly, the U.S. Environmental Protection Agency's Office of Solid Waste and Emergency Response recently published a

[5] DAVID E. ELLIS, DUPONT'S WORK ON SUSTAINABILITY IN REMEDIATION (2008), *available at* http://www.brownfields2008.org/proxy/SessionDocument.1878.aspx.

technology primer entitled, "Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites."[6] In this report, the Environmental Protection Agency (EPA) defines "green remediation" as "the practice of considering all environmental effects of remedy implementation and incorporating options to maximize net environmental benefit of cleanup actions."[7] In addition to providing an excellent discussion of the core elements of green remediation (including energy use, material consumption, water requirements, etc.) the EPA primer also provides a number of useful case studies from across the country.

Notwithstanding these important developments, achieving sustainable remediation sites will not be easy and will require a paradigm shift for both regulators and responsible parties. Some sustainable solutions do not resemble traditional remedial approaches—willows do not look the same as clay or other impermeable caps, for example. The unfamiliarity of these approaches will challenge our government agencies to step out of their comfort zones and embrace new approaches that do not yet have long and established track records. Moreover, responsible parties will have to demonstrate that sustainability is not a ruse to achieve a cheaper remedy. Yet, the technical principles are sound and the policy point is compelling. Remediation of waste sites is fundamentally about correcting the legacy of past waste management decisions. To the extent practicable, we should not cause new problems in the process. If we can infuse cost-effective and sustainable practices in our waste site management, we will be able to protect the future while correcting the past.

B. *Megasites: Applying Reuse Principles to the Largest Remediation Sites*

In the coming years, the nation's portfolio of contaminated sites will decrease in number and increase in complexity. The number of sites will decrease because existing ones are being cleaned up and, thanks to RCRA and other statutes, there are fewer new sites being created. Here are some illuminating statistics:

[6] U.S. ENVTL. PROT. AGENCY, INCORPORATING SUSTAINABLE ENVIRONMENTAL PRACTICES INTO REMEDIATION OF CONTAMINATED SITES (2008), *available at* http://www.clu-in.org/download/remed/Green-Remediation-Primer.pdf.

[7] *Id.* at 1.

- In the five year period from 2003–2007, EPA proposed only 79 for the NPL.[8]
- Comparatively, in the five year period from 1998–2002, EPA proposed 165 sites for the NPL.[9]
- While there is a downward trend of new sites, there is an upward trend of sites being remediated. For example, from 2000 to 2007, EPA proposed 173 sites for the NPL, while EPA designated 360 sites construction complete.[10] Construction complete means the remedial actions are in place, although the operation and maintenance is on-going.
- In addition to the 360 construction complete milestones from 2000 to 2007, EPA deleted another 123 sites from the NPL.[11]

While the overall number of sites will continue to decrease, the number of complex megasites will not. A megasite is sometimes defined as a site where the remediation costs are expected to exceed $50 million.[12] Many of the megasites, however, will require hundreds of millions of dollars or more and decades to remediate. These sites include large mining sites, complex river systems, large landfills, and massive manufacturing facilities.

Megasites have become the main focus of the EPA Superfund program.[13] As of 2006, EPA estimates that there are approximately 189 megasites or potential megasites across the country, not including federal facilities.[14]

The three-prong framework of protectiveness, cost-effectiveness, and sustainability should be applied to megasites. One example would be the application and expansion of approaches such as EPA's Brownfields Program. "Brownfields"

[8] *See* U.S. ENVTL. PROT. AGENCY, NPL SITE STATUS INFORMATION, http://www.epa.gov/superfund/sites/npl/status.htm (last visited Feb. 25, 2008).

[9] *See id.*

[10] *See id.*

[11] *See id.*

[12] ELIZABETH SOUTHERLAND, U.S. ENVTL. PROT. AGENCY, PRESENTATION FOR THE NACEPT SUPERFUND SUBCOMMITTEE (2003), *available at* http://epa.gov/oswer/docs/naceptdocs/megasites.pdf.

[13] *Id.*

[14] ELIZABETH SOUTHERLAND, U.S. ENVTL. PROT. AGENCY, EPA MEGASITES (2006), *available at* http://www.niehs.nih.gov/news/events/pastmtg/2005/sbrpamrt/agenda/docs/southerland.pdf.

are abandoned or under-used industrial/commercial facilities where expansion or redevelopment is complex due to environmental contamination.[15] Facilitating the safe reuse of these sites furthers the goal of sustainability because, among other reasons, it protects undeveloped "green" sites from future industrial uses. Yet, most brownfield projects are relatively small. Brownfield sites are, on average, five to fifteen acres in size and typically exist in industrial sectors of towns or cities, or in more remote areas which formerly housed factories or commercial buildings.[16]

Redevelopment of brownfield sites has become increasingly common due to the growing shortage of developable land, particularly in urban or highly populated areas. Given these circumstances, EPA in 1995 launched its Brownfields Program with the goal of empower states and local communities to work cohesively and efficiently to prevent, assess, remediate and sustainably reuse brownfield sites. EPA's initial approach was to provide small amounts of "seed money" to hundreds of local governments, which used the grants to launch pilot projects. The success of these projects ultimately led to the passage of the Small Business Liability Relief and Brownfields Revitalization Act, which increased funding available under the program and provided important liability safeguards for certain prospective purchasers.

According to EPA, the Brownfields Program has leveraged more than $6.5 billion in cleanup and redevelopment, resulting in the assessment of more than 7,000 sites.[17] Beyond its environmental benefits, EPA states that the program has created more than 25,000 new jobs.[18] Moreover, the program's flexibility has facilitated a number of highly innovative—and flexible—approaches. For example, a number of environmental firms have partnered with insurance companies to underwrite the cleanup of brownfield sites and to provide a guaranteed cleanup cost for a

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15 *See* U.S. ENVTL. PROT AGENCY, BROWNFIELDS & LAND REVITALIZATION, http://www.epa.gov/swerosps/bf/ (last visited July 3, 2008).

16 *See* U.S. ENVTL. PROT. AGENCY, BROWNFIELDS STAKEHOLDERS REPORT (2005), *available at* http://www.epa.gov/swerosps/bf/news/stake_report.htm. EPA estimates that there are more than 450,000 brownfield sites in the U.S., of which only 10–15 percent have been identified. *See* U.S. ENVTL. PROT. AGENCY, ABOUT BROWNFIELDS, http://www.epa.gov/swerosps/bf/about.htm (last visited July 3, 2008).

17 *See* U.S. ENVTL. PROT. AGENCY, ABOUT BROWNFIELDS, *supra* note 16.

18 *See id.*

specific site, thus limiting land developers' exposure to environmental remediation costs and pollution lawsuits.[19] Under this approach, the environmental firm first performs an extensive investigation of the brownfield site to ensure that the guaranteed cleanup cost is reasonable. Additionally, a number of venture capital firms have invested in brownfield-related enterprises, e.g., companies that develop and manufacture cleanup technology and remediation.[20] The program has also sparked extensive research—currently underway—to determine whether brownfield sites can eventually be used for agricultural purposes, namely, production of biofuels.[21]

In sum, federal and state brownfields programs must be expanded to include megasites. This can be done through continued expansion of both state and federal programs and, in many cases, will require legislative action. But expanding brownfields is only part of the sustainable solution for megasites. In order to address these sites in a protective, cost-effective and sustainable manner (not to mention expeditious) regulatory agencies will need to become more flexible and creative. For example, cleanup standards will often need to be tailored to industrial and/or commercial reuse. Also, in many cases, megasites present terrific opportunities to reclaim contaminants or waste materials for safe reuse, including energy, as discussed below. Lastly, megasites will require joint funding. A largely successful example of joint funding is the Great Lakes Legacy Act of 2002, which provides up to $270 million in joint funding for remediation of contaminated sediments.[22] This type of joint funding program often encourages responsible parties and agencies to short-circuit the cumbersome investigation and assessment process and achieve a rapid and effective site cleanup.

II. WASTE MANAGEMENT

Waste management refers to the process of disposing,

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[19] *See* ICF INTERNATIONAL, U.S. ENVTL. PROT. AGENCY, FINANCING BROWNFIELDS: STATE PROGRAM HIGHLIGHTS, *available at* http://www.epa.gov/brownfields/partners/finan_brownfields_epa_print.pdf.

[20] *See id.*

[21] *See* Press Release, Michigan State Univ., Brownfields May Turn Green With Help From MSU Research (July 20, 2006), *available at* http://news.msu.edu/story/1072/.

[22] 33 U.S.C. § 1268 (2000).

recycling, or reusing consumer products as well as the waste material from the manufacturing process itself. In addition to considerations of protectiveness and cost, waste management decisions can and should consider the larger issue of sustainability. Here are two examples:

A. *Lifecycle Responsibility: The Example of Electronic Waste Regulation*

As discussed in the introduction, a true sustainability focus requires policy makers to look at the full temporal life cycle of a product, including the source and method of obtaining raw materials, product transport, and the eventual disposal of products after they reach the end of their useful life. With regard to disposal, a sustainability focus means that the disposal of a product (not just its manufacturing) is considered as part of the product's overall environmental costs. This life cycle examination is not simple and is rife with potential problems. Yet, when coupled with the objectives of cost-effectiveness and protectiveness, such a focus may reveal wiser waste management practices.

One potential example is the segment of "e-waste" or electronic waste. The term e-waste encompasses a wide range of electronic devices, including personal computers, televisions and cell phones, all of which have reached the end of their useful lives.[23] Each year in the United States alone, 3.5 million tons of electronics end up in landfills.[24] This growth has major consequences for the environment, as e-waste can sometime contain materials such as lead, chromium, and brominated flame retardants.[25]

Several nations have attempted to address the issue of e-waste in innovative and sustainable ways. Most notably, the European Community has adopted stringent measures that condition market access for household appliances and other electronics on compliance with product-based environmental requirements. Specifically, the European Community adopted the Waste

[23] *See* U.S. ENVTL. PROT. AGENCY, ECYCLING, FREQUENT QUESTIONS, http://www.epa.gov/epaoswer/hazwaste/recycle/ecycling/faq.htm#general (last visited Feb. 12, 2008).

[24] *See* U.S. ENVTL. PROT. AGENCY, FACT SHEET: MANAGEMENT OF ELECTRONIC WASTE IN THE UNITED STATES (2007), *available at* http://www.epa.gov/osw/conserve/materials/ecycling/docs/fact7-08.pdf.

[25] *See generally* U.S. ENVTL. PROT. AGENCY, ECYCLING, *supra* note 23.

Electrical and Electronic Equipment Directive (WEEE Directive),[26] which, together with the Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS Directive)[27], became law in February 2003. The WEEE and RoHS Directives require the manufacturers to establish an infrastructure for collecting e-waste in such a way that "users of electrical and electronic equipment from private households should have the possibility of returning WEEE at least free of charge."[28] Additionally, manufacturers are required to use the collected waste in an ecological-friendly manner, either by ecological disposal or by reuse/refurbishment of the collected WEEE. China has likewise attempted to address e-waste by "going straight to the source": effective March 2007, China's National Development and Reform Commission in conjunction with Ministry of Information Industry and other ministries are adopting policies to minimize industrial pollution from the production of electronic and telecommunication products.[29] Similarly, Korea's Ministry of Environment in 2003 implemented an Extended Producer Responsibility System, which requires producers of consumer electronics (including washing machines, cellular phones, and printers) to produce and design "recycle-friendly products" and to establish and manage recycling facilities.[30] Further, the EPRS requires producers to report recycling results to the government. The critical feature of all of these regulations is the shift of responsibility for waste handling from trash haulers and consumers to manufacturers. In essence, this shift is forcing a sustainability review by manufacturers of applicable products.

There is no comprehensive federal e-waste scheme in place in the United States. However, Congress is currently considering the National Computer Recycling Act (NCRA), which would direct

[26] Council Directive 2002/96, 2003 O.J. (L 37) 25, *available at* http://www.epeat.net/Docs/EU%20WEEE%20Directive.pdf.

[27] Council Directive 2002/95, 2003 O.J. (L 37) 19, *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0095:EN:HTML.

[28] Council Directive 2002/96, *supra* note 26.

[29] Weitao, Li, *China Jumps into E-Waste Initiative*, CHINA DAILY, Jan. 12, 2004, *available at* http://www.chinadaily.com.cn/english/doc/2004-12/01/content_396382.htm (last visited Sept. 10, 2008).

[30] *See* Il-Ho Park, Dir. Res. Recyling Div., Ministry of the Env't, Republic of Korea, Policy Direction on E-Waste Recycling in Korea (2006), *available at* http://www.env.go.jp/recycle/3r/en/asia/02_03-4/07.pdf.

EPA to develop a grant program to encourage municipalities, individuals and organizations to implement e-waste recycling programs.[31] The NCRA would also require a comprehensive study by EPA, for the purpose of making continual recommendations for addressing e-waste.[32] The NCRA directs EPA to assess a fee of up to $10 on new computers to fund the grant program.[33] Manufacturers and retailers who have existing recycling programs are exempt from the fee.[34] The bill is currently under consideration in the House.

In the meantime, several states have undertaken initiatives to address e-waste. For example, California in 2003 passed the Electronic Waste Recycling Act, which requires retailers to collect a $6–10 recycling fee from consumers, to be remitted to the state.[35] The Act further requires manufacturers to notify retailers of the obligation to collect the fees, label devices with the manufacturer's brand name and to provide information to consumers about recycling opportunities.[36] Some states, including Illinois,[37] Oregon[38] and Washington[39] have enacted variations of the California model. Maine has passed an e-waste law that places the cost burden of e-waste disposal on manufacturers,[40] while Maryland now requires manufacturers to pay an annual fee.[41]

This trend of requiring manufacturers to incorporate the disposal costs into the marketing of a product will likely continue to other products beyond electronic waste. In some instances, such

31 *See* H.R. 233, 110th Cong. (2007).

32 *Id.*

33 *Id.*

34 *Id.*

35 CAL. PUB. RES. CODE §§ 42460, 42464 (West 2007).

36 CAL. PUB. RES. CODE §§ 42465.1, 42465.2(a)(2), 42465.3 (West 2007). Section 42465.3 references CAL. HEALTH & SAFETY CODE § 25214.10.1 (West 2007).

37 Press Release, Illinois Dep't of Commerce, Gov. Blagojevich Praises Ribbon Cutting of Electronic Recycling Permanent Drop-Off Facility at Goose Island (Nov. 18, 2006), *available at* http://www.commerce.state.il.us/dceo/News/2006+Archives/pr11182006.htm (describing Executive Order directing state government to recycle electronic equipment when it reaches the end of its usable life).

38 OR. REV. STAT. § 459A.300 (2007).

39 WASH. ADMIN. CODE § 173-900-010 et seq. (2007).

40 ME. REV. STAT. ANN. tit. 38, § 1610 (2008), *available at* http://janus.state.me.us/legis/statutes/38/title38sec1610.pdf.

41 MD. CODE ANN., ENVIR. §§ 9-1701 to 9-1730 (LexisNexis 2008).

as raw materials, this shift may not be efficient or appropriate. However, in other contexts, the manufacturer will be well-positioned to encourage cost-effective, protective, and sustainable waste practices. As with any regulatory shift, manufacturers who are thinking ahead in this regard will likely realize a competitive advantage.

B. *One Person's Garbage . . . Waste as Raw Material*

In addition to consumer products, another area to apply the sustainability heuristic is the potential use of waste itself. Heretofore, policy makers have generally viewed garbage as, well, garbage. (A notable exception is recycling although recycling is really a way to prevent waste rather than a way to use waste.) The sustainability focus, however, extends beyond the direct and indirect impacts of certain actions, but also to the impacts of inaction. In the case of waste, mere disposal (even if done correctly) may constitute a lost opportunity. To the extent waste can be mined efficiently and properly, policy makers will achieve a laudable result that furthers the aims of sustainability; namely, they could minimize (and in some cases eliminate) the need to exploit other natural resources. A promising illustration of this development is waste-to-energy.

Waste-to-energy (WTE) is a form of waste treatment that creates energy in the form of electricity and/or heat from a waste source. In this way, WTE facilitates the conservation of fossil fuels which would otherwise be used to generate electricity or heat. For example, one ton of combusted municipal solid waste reduces oil use by nearly 45 gallons and coal use by nearly 0.25 tons.[42] Moreover, WTE reduces greenhouse gas emissions, as one ton of municipal solid waste combusted (as opposed to landfilled) reduces emissions by 1.2 tons of carbon dioxide.[43] More generally, WTE conserves space required at landfills.[44]

WTE plants in Europe in particular have proved to be highly sustainable, with low emissions and efficient recovery of energy. Moreover, WTE plants are built and operated for moderate costs,

[42] MAKING ENERGY FROM WASTE, EARTH INSTITUTE NEWSLETTER FOR CROSS-CUTTING RESEARCH 4 (2005), *available at* http://www.seas.columbia.edu/earth/wtert/sofos/Making%20Energy%20from%20Waste%20Summer%202005.pdf.

[43] *Id.*

[44] *Id.*

and allow local governments a significant level of cost certainty compared to landfills. New York City, for example, has no landfills of its own and must rely on landfill operators in other states.[45] As the cost of landfilling increases, the cost of exporting the city's waste will impose a heavier burden on taxpayers.

There is also significant potential benefit in harnessing methane energy from existing landfills. Practical barriers currently exist, primarily linking landfills with large scale users of methane gas cost-effectively. Honeywell, in conjunction with DTE Energy, EPA, and the Virginia Department of Environmental Quality, constructed a 23 mile methane gas pipeline from a large landfill to Honeywell's Hopewell, Virginia caprolactam plant. This is the longest dedicated pipeline to move methane to a direct use customer. The pipeline has the potential to deliver a significant portion of Hopewell's natural gas needs. While this project has been an enormous success, we have struggled to duplicate this effort because of the distance of our other facilities from potential methane sources and the attendant high cost and complexity of building a connecting pipeline. Moreover, the tax benefits associated with methane use favor electricity producers and do not provide the same tax benefits to direct use customers. However, we predict that as energy and feedstock prices increase globally, the financial attractiveness and hence viability of these projects, and hopefully the attendant regulatory incentives, will increase not just here in the United States but globally as well.

III. REGULATORY IMPROVEMENTS

Thus far, we have discussed the potential application of a sustainability focus (coupled with cost-effectiveness and protectiveness) to substantive policies such as site cleanups and waste management policies. But a difficult procedural question remains: to what extent do our regulatory programs encourage or discourage the development of better, more sustainable practices? In our experience, the answer is generally not flattering. Redundant regulatory efforts, excessive transaction costs, and lack of flexibility, among other problems, all contribute to an inefficient regulatory system that discourages, rather than encourages,

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45 Press Release, Earth Institute at Columbia Univeristy, Columbia Study Finds a Solution to NYC Deficit in the Garbage (Feb. 22, 2002), *available at* http://www.earth.columbia.edu/news/story02_22_02.html.

innovative sustainable practices. Improving the overall regulatory process to incentivize and reward such actions would result in greater compliance, enhanced public-private partnerships, and better protection of the global environment. Here are two examples, although there are many more that could be discussed:

A. *Overlapping Remediation Programs Is Not Just Costly, It Is Also Wasteful of Natural Resources*

Today, it is not uncommon for a remediation sites to undergo multiple cleanups pursuant to different regulatory programs and under the direction of different agencies, or even different parts of the same agency. For example, a site remediation may have satisfied state regulators only to be subject to an additional cleanup by federal regulators.

Perhaps the most common example of multiple cleanups relates to the distinction between remediation and restoration. Pursuant to several federal and state laws, federal, state, territorial, and tribal governments may seek compensation for natural resources injured or destroyed when property becomes contaminated with certain pollutants, including hazardous substances and petroleum.[46] As a general rule, the compensation for natural resource damage (NRD) is intended to restore the natural environment to its prior condition and compensate the public for the interim lost use from the time of contamination until restoration.[47]

This NRD restoration concept is different than the remedial programs run by the U.S. EPA and the state governments. The main objective of the remedial programs is the protection of human health and the environment through the removal or isolation of contaminants. The main objective of the NRD restoration programs is to restore the ecological services lost because of the contaminants. While the remedy may have collateral ecological benefits, the principal focus is on removing or isolating contaminants, not restoring natural resources.

Because of the different objectives and different agencies, sites are often subject to cleanup requirements twice—once to

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[46] *See* 42 U.S.C. § 9607 (2000).

[47] *See, e.g.*, U.S. ENVTL. PROT. AGENCY, NATURAL RESOURCE DAMAGES: A PRIMER (2007), http://www.epa.gov/superfund/programs/nrd/primer.htm (last visited Feb. 12, 2008).

address the remedy and then again to address the restoration. In many cases, if not most, the restoration occurs long after the remedy is implemented. The inefficiencies with this approach are enormous. An integrated remedial and restoration approach would allow responsible parties to weave restoration aspects into the remedy itself, thereby saving mobilization and other costs and avoiding duplicative, resource consuming construction projects. Also, since NRD calculations include compensation for past losses, the ability to conduct an early restoration will often result in lower damages. Finally, implementing distinct programs often leads to greater energy and resource impacts resulting from duplication of efforts (mobilization of equipment, redundant analyses, unnecessary staffing, etc). Thus, an integrated approach is more likely to be a sustainable approach.

Unfortunately, the remedial programs and NRD programs are usually run by different government agencies with different missions. At the federal level, for instance, the remedial program is run by the U.S. EPA. The NRD program is run by the applicable trustee agencies, including, for instance, the Department of Interior and the Department of Commerce. Because of this, true integration will be hard to achieve without radical rethinking of how we manage waste sites. However, in light of the cost inefficiencies and the imperative of sustainability, efforts should be made to streamline and combine site management programs in order to fully integrate all cleanup objectives.

A similar discontinuity exists in the overlap between the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and its state analogues and the citizen suit provisions of the Resource Conservation and Recovery Act (RCRA). The latter statute provides a right of action in federal district court to individuals and organizations that can demonstrate that the presence of a particular waste presents a risk of imminent and substantial endangerment.[48] It is not uncommon for a site that has been listed and is being managed under CERCLA or a state superfund program to be the subject of parallel RCRA litigation. This parallel litigation can skew the prioritization of remediation sites vis-à-vis one another. It also may lead to "one off" remedial decision-making by a federal judge in the court system, rather than by an expert agency. Decisions made in the RCRA civil suit

[48] 42 U.S.C. § 6901 et seq.

context are often less cost-effective—and not necessarily more protective—than those that would likely be made by a repeat player agency familiar with the science and technologies applicable to the various waste materials.

The above examples demonstrate the regulatory inefficiencies inherent in our current management of hazardous waste and other sites. This inefficiency results in lost opportunities to achieve faster, better, and more sustainable cleanups. Moreover, because different programs sometimes lead to multiple cleanups and multiple remobilizations, the increased energy use, transportation demands, and other resource needs associated with disjointed regulatory programs, while difficult to quantify, are not insignificant. The fix here is not simple but will require a concerted effort by state and federal regulatory agencies to do a much better job of coordinating efforts. In some cases, agencies will need to cede authority to another and focus on other priorities. Lastly, we may need to rethink whether legislation is required to force the consolidation of similar substantive programs so that there are fewer governmental entities overseeing the same or similar areas.

B. *Enforcement—An Expanded Role for SEPs Could Encourage Needed Innovation and Sustainable Technologies*

When a company or individual violates an environmental statute, the local, state or federal authority may seek monetary civil penalties. Supplemental environmental projects (SEPs) are beneficial environmental actions taken by a party to mitigate the applicable civil penalties from a violation of an environmental statute. SEPs have been encouraged and utilized by EPA for well over a decade.[49] The use of SEPs, however, remains limited and increasingly uncertain.[50] Because of the characterization of SEPs as a penalty mitigation, the legal status of SEPs is sometimes debated. Indeed, some commentators have argued that SEPs violate various federal statutes, such as the Miscellaneous Receipts

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[49] *See* Memorandum from Steven A. Herman, Assistant Administrator, Environmental Protection Agency, to Regional Administrators, Environmental Protection Agency (Apr. 10, 1998), *available at* http://www.epa.gov/Compliance/resources/policies/civil/seps/fnlsup-hermn-mem.pdf.

[50] *See, e.g.*, I.R.S. Off. Mem. on Government Settlements #1, LMSB-04-0507-042 (May 30, 2007); I.R.S. Tech. Adv. Mem. 2006-29030 (Mar. 31, 2006) (holding that SEPs are not tax deductible).

Act[51] which requires that all amounts "due and owing to the United States" be paid to the U.S. Treasury.[52]

The broader use of SEPs would be an important step toward wiser waste management practices. SEPs can, and should, be designed to achieve a reduction of waste generation and more sustainable waste handling practices, including with respect to recycling, energy use, air emissions, and water discharges. While a civil penalty paid to the U.S. Treasury will have no direct impact on the environment, a well-designed SEP would result in tangible and observable benefits. Moreover, SEPs encourage companies to adopt measures that go beyond compliance with existing regulations and therefore SEPs are drivers toward innovation and creativity.

Here is a recent real-world example of the promise of SEPs and the problem with our current regime. In response to an alleged civil violation of an environmental statute, a company agreed not only to correct the underlying problem but also to pay a penalty in the amount of the economic benefit from the violation, which was modest. In addition, the company proposed a novel SEP to EPA that would have been in lieu of the remainder of the civil penalty. The SEP would have required the company to undertake a rigorous experiment to test a new technology for on-site regeneration of carbon, which is commonly used at Superfund sites to cleanup certain types of contamination. If successful, the technology could have significant environmental benefits since the current practice is to ship spent carbon offsite for treatment, and the associated environmental costs (including carbon dioxide emissions) with off-site regeneration are huge. Moreover, the promising technology was based upon an EPA patent! Notwithstanding the collective promise of this new approach, the technology to date has not been further developed because the incentive to do so for a single site is not present. In sum, this should have been a perfect SEP—it would further develop a technology that would potentially massively reduce the indirect environmental costs of site cleanups. The company would enjoy no financial benefit since the cost of the

[51] 31 U.S.C. § 3302(b) (2000).

[52] *See, e.g.*, *Hearing and Markup on H.R. 3754, Authorizing Supplemental Environmental Projects to Incent Reduction of Diesel Emissions, Before H. Subcomm. on Energy and Air Quality*, 110th Cong. (2008) (statement of Rep. Boucher) (noting EPA conclusion that continuation of SEP's violates the Miscellaneous Receipts Act).

pilot study was the same as the penalty. Finally, the proposed SEP clearly met all of the existing guidelines for SEPs. Nonetheless, EPA rejected the proposal. EPA's rationale was that SEPs are receiving increased scrutiny from EPA headquarters and there was no appetite for fighting an uphill bureaucratic battle.

In order to fully achieve the sustainability promise of SEPs, then, a legislative fix is required. Here's one possible legislative solution: modify the civil penalty regime for environmental statutes so that civil penalties can be entirely paid through SEPs, except to the extent that the violation is deemed willful and to the extent necessary to recoup any economic benefit from the violation. If the violation resulted from willful conduct, then the violator would not be able to offset the penalty though a SEP.

A SEP policy such as this is an overall positive. Regulators would be able to see real environmental results from their enforcement efforts. Companies would have the same incentive to comply with the law since the monetary consequences of noncompliance would still exceed the economic benefit of the violation. Moreover, in cases where the violation resulted from willful conduct, there would be no opportunity for a SEP offset. And, most importantly, a more robust SEP policy would lead to creative, sustainable projects that would not otherwise be required by the environmental laws.

CONCLUSION

This article provides a few illustrations of a management framework that considers not only direct environmental impacts and cost effectiveness when making waste management decisions, but also indirect environmental impacts. We call this third criteria sustainability. Sustainability looks broadly at the spatial and temporal impacts associated with our products, our waste handling procedures, and our cleanup sites. We believe that this three-pronged approach could dramatically improve waste management decisions as outlined in the examples above. Of course, this framework is broadly applicable and should also apply to numerous other aspects of resource and waste management.[53]

[53] Consider for example, the question of nuclear waste. While the issue is complex and difficult, it should be evaluated not only in terms of protection to human health and the environment, but also in terms of larger sustainability objectives. According to a recent McKinsey report, increased reliance on nuclear

Finally, we submit that there is something significant we do not yet know about current environmental behavior and norms that will one day prove harmful. A few possibilities include nanoparticles, endocrine disrupters, or even some of the alternative energy sources currently being explored. Given our increasing ability to measure impacts and our expanding notion of up-stream and down-stream sustainability, it is a near-certainty that some activities currently presumed to be safe and effective will one day be viewed as inappropriate. Whatever the phenomenon, the lesson to be learned is that we are imperfect and evolving and will always have unpredictable impacts on our environment. Ultimately, we must be mindful of this lesson and be proactive about evaluating and reducing our footprint in the world. This is a burden that most often will fall on those engaged in production and other tangible physical activities. However, this forward looking perspective is also a critical component of a wiser waste management policy.

power has the potential to reduce annual greenhouse gas emissions by about 70 million metric tons or more. MCKINSEY & CO., REDUCING U.S. GREENHOUSE GAS EMISSIONS: HOW MUCH AT WHAT COST? 59 (2007), *available at* http://www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf. This massive savings in emissions would result from only a modest increase in the use of nuclear power from 20 percent in 2005 to 24 percent in 2030. *Id.* at 28. Perhaps most impressively, at $9/ton, nuclear power represents one of the more cost effective options for greenhouse gas abatement in the energy sector. By comparison, the use of solar photovoltiac ($29/ton), clean coal ($44/ton), and wind ($20/ton) are all significantly more expensive. *Id.* at 59.