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Managing hazards in place: The risks of residual risks

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A B S T R A C T

Managing hazards in place (MHP) is a policy instrument in environmental health that allows less than complete removal, abatement, or remediation of environmental hazards. The practice of minimizing exposure to hazards rather than removing them is widely recognized as part of the toolbox of environmental protection for human and ecosystem health. The concept of managing hazards in place is embedded in several environmental statutes and regulations in the US notably the waste management regulations, as well as in the Safe Drinking Water Act and the Clean Water Act. While this commentary focuses largely on applications of MHP in the US, this policy is also utilized by agencies in many other countries for managing hazardous waste sites, lead in housing and drinking water systems, and environmental contamination of rivers and estuaries.

The rationale for this concept is not difficult to understand: MHP policies can reduce the costs of meeting environmental goals; it can provide opportunities for access to resources that have been contaminated by past actions such as waste disposal, and it can enhance land and property values as well as tax revenues all of which are important to home owners and communities. The concerns related to this concept are also not difficult to understand: an incompletely abated or contained hazard may present future exposure risks to humans and environmental biota. Further, the compromise implicit in MHP is the assurance of indefinite oversight and monitoring to detect any releases. To that extent, MHP involves both sociology as well as toxicology and the exposure sciences. Because of the prevalence of managing hazards in place, this commentary suggests that evaluation of its performance is needed.

1. Background

Since its establishment in 1971, the mandate of the US EPA, to protect human health and the environment, has grown in complexity. Like many similar regulatory agencies, EPA's original mandates were focused on prevention of current and future risks by establishing frameworks for forward looking actions such as regulating chemicals and pesticides and protecting air and water quality under specific statutes. Several years after its founding, the agency's purview was extended to cover past actions and pre- existing hazards through the Toxic Substances Control Act and the hazardous waste statutes. In addition, issue-specific legislation related to lead, asbestos, and other hazards stretched EPA's responsibility to cover other environmental health hazards whose origins pre-dated the establishment of the agency. All of these legislative mandates have been met in large part by managing hazards in place (LeSage et al., 2007). Sjmiiar policies have been adopted in many countries, including Latin America, Japan, Australia, and the EU (reviewed extensively by Weber et al., 2008).

1.1. Objectives

This paper reviews the application of MHP policies to several types of environmental issues and the relative lack of information on long term success in preventing human exposures or ecosystem impacts. At present, there is very little guidance or limits on the application of this policy in terms of the nature of the hazard or its context. I conclude that to ensure public confidence in MPH and protect health and the environment it is important to develop criteria to judge the acceptability of MPH decisions and to ensure effective long term oversight of residual hazards.

2. Examples of managing hazards in place

2.1. Hazardous waste management

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), enacted in 1980, greatly increased the burdens on the EPA by mandating the management of past practices in hazardous waste disposal. The extent of this new responsibility was

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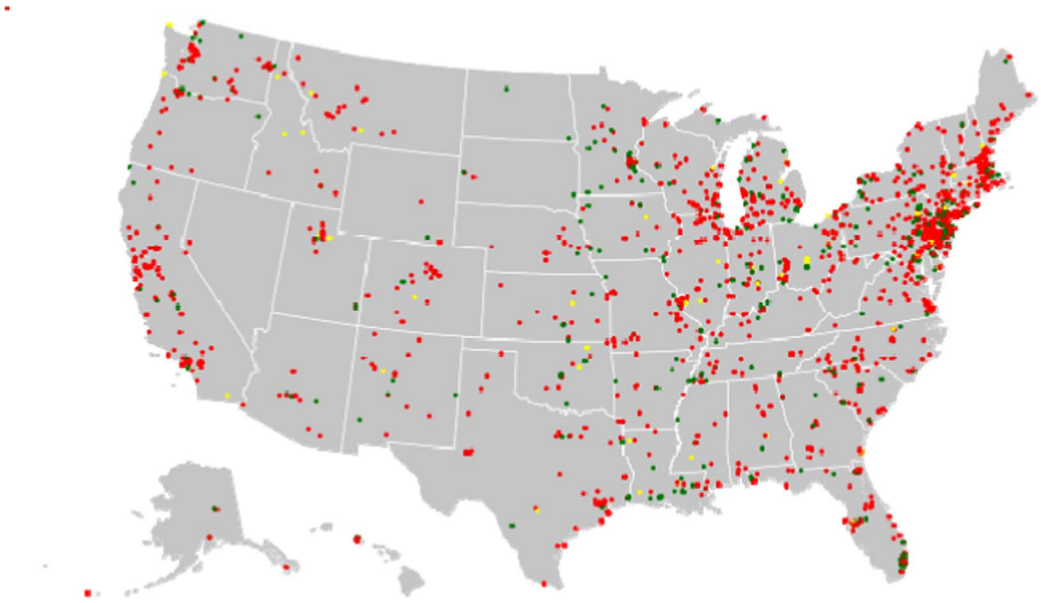

Fig. 1. US Superfund sites, as of 2013. As of November 2016, there were 1337 Superfund sites on the National Priorities List in the United States the vast majority of which have not been completely cleaned up. A total of 392 have been deleted from the NPL list on the grounds that no significant risks remain ⟨https://www.epa.gov/superfund/npl-site-totals-status-and-milestone⟩.

largely unanticipated as assessment of past waste disposal practices uncovered thousands of highly contaminated areas, designated as Superfund sites, throughout the US. As shown in Fig. 1 below, Superfund sites in the US are located in a variety of places, including urban areas.

It was soon clear that complete cleanups were beyond the means or willingness of responsible parties to pay and the "superfund" (funded by a tax on industry) was not adequately funded to fill the gaps. As a consequence, most of the original actions at these sites after removal of discarded drums and other waste containers focused on preventing human contact with contaminated materials. This was accomplished essentially by removing them from further use by relocating communities, fencing contaminated areas, and applying encapsulation controls. In addition to the costs of these actions, political and economic pressures came from communities to be able to sustainably reuse some of these sites as part of urban redevelopment. These factors drove the development of the brownfields program starting in 1995 (Eckerd, 2011). In the words of the EPA:

> A brownfield is a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. It is estimated that there are more than 450,000 brownfields in the U.S. Cleaning up and reinvesting in these properties increases local tax bases, facilitates job growth, utilizes existing infrastructure, takes development pressures off of undeveloped, open land, and both improves and protects the environment ⟨https://www.epa.gov/brownfields/brownfield-overview-and-definition⟩.

The program is now guided by a separate statute, the Small Business Liability Relief and Brownfields Revitalization Act of 2002, which has become one of the most extensive applications of the policy of managing hazards in place in the US.

Typical control measures employed at brownfields sites include removal of waste containers, capping contaminated areas with "clean fill" and phytoremediation to reduce surficial soil concentrations. The implementation of these steps follows the criteria used to evaluate risks of the site during the prioritization process for designation as a national priority site. These criteria focus on two pathways of release: leaching into groundwater and volatilization into air (Ofungwu and Eget, 2006).

Remarkably, there are few studies on the actual performance of preventing releases and exposures at brownfields sites, making it difficult to evaluate the overall success of the program. A query to EPA (personal communication, February 23, 2017, with Amanda Sutton, EPA Office of Brownfields and Land Revitalization Communications, elicited this response:

> Thank you for following up with contacting the EPA Brownfields program. The EPA has not conducted national studies regarding exposures from proximity to brownfields or studies about the extent of risk posed by sites assessed and cleaned using EPA funds or other local or state processes.
>
> You may wish to contact state cleanup programs or developers that have conducted risk assessments as part of their cleanup decision making process.
>
> We would be interested to learn of your results if you move forward with this research.

Contact with state agencies as well as a limited literature search of several of these Superfund sites on the National Priority List (NP), as discussed below, did not yield any information on this topic aside from modeling analyses without empirical confirmation. In some cases, investigative reports have revealed brownfields sites where interventions have deteriorated over time, particularly those that have been turned into parks. In other cases, the sites have been delisted without much information as to the final closure conditions and no further follow up. For example, the last primary lead smelter in the US, at Herculaeneum MO, closed in 2013 after being listed on the NPL and paying a bargain charge of $65 million for environmental management. Fig. 2 shows the smelter complex and waste pile at the facility at the time of closure. This site and other mining sites in the same region of Missouri are now largely unfenced and still incompletely remediated. Parts of the area have been designated as the Missouri Mines State Historical Center and many have become *de facto* playgrounds for dirt bikes and other activities that destroy the integrity of any attempts at covering lead waste or "chat" piles left on site (Fig. 2).

Herculanaeum follows the example of Doe Run, the large lead smelter complex in Kellogg, Idaho, which was also designated a Superfund site on the NPL. Its owner closed the plant by blowing it up in 1996 and declared bankruptcy to avoid pension obligations and any Superfund costs. After investing hundreds of millions of dollars from the Superfund for repeated cleanups following repeated flooding, the EPA acceded to the request by the Governor of Idaho to remove the site from the NPL. It has been converted into a recreation area. There has been no ongoing systematic monitoring of lead contamination at the site and