

## **CHAPTER 7: CONCLUSIONS AND FUTURE RESEARCH**

In summary, this effort has presented the first comprehensive analysis and estimation of benefits of Superfund (CERCLA and SARA) for the period 1980-2004. The building blocks of the effort are as follows. Chapter 1 provides an analytical framework that defines the approaches taken by Superfund and the benefits that are created by this framework, and situates the current study within the broader setting of policy analysis. Chapter 2 provides an over-arching literature review for the study, including reviews of similar efforts in the past. Chapter 3 describes Superfund responses (both removal and remedial actions) in some detail, quantifies them, and characterizes sites on the National Priorities List (NPL). Chapter 4 presents a monetary estimate of the benefits of remedial actions at NPL sites, based on changes in the property values of nearby homes—an important but incomplete measure of the total benefits of Superfund. Chapter 5 contains proposals for several effect-by-effect analyses of various health, ecological, and groundwater cleanup and protection benefits. This chapter is incomplete in the current version pending comments from the Science Advisory Board. Chapter 6 contains detailed descriptions of the benefits that are not quantified. This chapter includes a few thoughts on possible future research directions.

While data and methodological limitations prevent a complete estimate of the benefits of the Superfund program at this time, this study sheds some light on their nature and magnitude. It is clear that the Superfund program creates a broad array of benefits associated with protection of human health, welfare, and the environment, only some of which can be quantified. For the first 25 years of the Superfund program (1980-2004), the methods used in Chapter 4 yield an estimate of the present value in 1980 of benefits of Superfund in the range of \$63-\$100 billion (in year 2000\$, using a 3% discount rate). Converting these total present value estimates into annualized values yields \$3.6-\$5.9 billion per year, with a best point estimate of \$3.6 billion per year.

Several important directions for future research emerge from this study.

First, in order to understand how best to regulate and manage hazardous substances in the future, we must understand better the benefits of various approaches used in the past. This research might improve environmental regulation and management quality broadly across the country, affecting numerous federal, state, local, and private policies and practices.

Second, if a better understanding of the total benefits of the management of hazardous substances is desired, a better understanding of non-NPL responses, especially their typical risk mitigation profile, is required.

Third, improved understanding of the exposures resulting from uncontrolled releases of hazardous substances into the environment would be extremely helpful in estimating both the risks of these events and the benefits of mitigating them.

Fourth, a great deal is left to learn about the ecological benefits of Superfund, especially in regard to response actions. Given the size, scope, and variety of challenges presented by many sites currently being evaluated for response actions, research in this area is likely to be necessary in order to gain a better understanding of the true impact of the Superfund program.

Fifth, it is likely that the analysis presented here could be expanded to further analyze and account for heterogeneity among NPL sites, possibly improving the estimates developed in this study.

Sixth, and lastly, an important but missing component of a comprehensive appreciation of Superfund is a quantitative characterization of the subtler benefits, such as deterrence, international, and emergency preparedness, which are embedded in larger processes in the U.S. economy.

Research into these areas would likely prove useful for managing multiple challenges related to the mandate of the Superfund program, and might well inform other decisions about environmental regulation and management.