Preface

The use of risk assessment at DOE facilities

The U.S. Department of Energy (DOE) has generated and disposed of large volumes of hazardous and radioactive waste as a result of 50 years of nuclear weapons production. This waste has been placed in landfills, storage tanks, DOE buildings, holding ponds, and other locations. As a result, DOE is now faced with the problem of remediating its more than 7.000 hazardous waste sites. Environmental restoration requires the development of new remediation technologies, improved means and standards for estimating risks, and increased funding to meet stringent cleanup goals. Managing hazardous waste is a serious and complex problem that needs to be addressed by the public and by governmental agencies.

The use of risk assessment as a tool for hazardous waste management is becoming increasingly important and useful in a wide variety of applications. This issue of the *Journal of Hazardous Materials* is especially devoted to the use of risk assessment at DOE facilities in particular. Since risk assessment at DOE facilities is germane to the problem of hazardous waste, these papers are compiled as a forum for the presentation of issues concerning the use of risk and various applications of risk assessment. This issue represents a compilation of papers on a variety of issues, which include storage tank safety, worker risks, computer code estimation of human health risks, pump-and-treat technologies, institutional controls, and uncertainty analyses.

Radioactive wastes have long been stored in underground storage tanks at the DOE Hanford Site in Richland, Washington. Several safety issues have been raised about these wastes, and resolution of these issues is a top priority of DOE. Authors from the Hanford Site discuss the release of flammable vapors from both single- and double-shell tanks and the problem of organic chemicals and/or ferrocyanide ion-containing mixtures in single-shell tanks. An overview of the resolutions of safety issues being pursued at the Hanford Site is described by Babad et al.

Safety issues are a particular concern at DOE sites undergoing remediation activities where workers are directly involved in the treatment, remediation, or handling of waste. Risks to remediation workers are an important part of the entire scenario of risks at a given site. Authors from the Oak Ridge National Laboratory (ORNL) present a methodology that can be used to estimate worker risks from activities performed during site remediation. In a related analysis, radiation-induced fatal cancer risks and construction and transportation risks were estimated.

The unique settings and situations involved in site remediation often require the use of more complex risk assessment methods. Two of these methods are discussed in papers by Cheng and Yu and Droppo et al. Cheng and Yu discuss the use of the residual radiation (RESRAD) computer code to evaluate human health risks from radionuclides and hazardous chemicals, and Droppo et al. discuss the use of the Multimedia Environmental Pollutant Assessment System (MEPAS) for risk computation of environmental restoration activities. Used in conjunction with site data, computer codes such as these can simplify the risk assessment effort considerably.

Environmental restoration efforts continue to increase annually. Because these efforts pose potential risks of human exposure to contaminants, baseline risks at a contaminated site, risks during remediation, and residual risks remaining after remediation must be evaluated. Remediation technologies have a far-reaching effect on the risks during remediation. The more sophisticated remediation technologies become, presumably the more risk reduction will be achieved. Isherwood et al. discuss the effectiveness of the pump-and-treat technology for ground water restoration at the Lawrence Livermore National Laboratory. The authors' proposed approach to the pump-and-treat method boasts minimization of the cost and time needed to reach regulatory cleanup goals and maximization of contaminant removal.

Remediation technologies are just one way to reduce possible risks posed by contaminated DOE facilities. Another technique is the use of institutional controls to isolate the site from public access. Some of the major issues associated with the use of institutional controls at hazardous waste sites are discussed by White et al. In addition, the authors present the results of a baseline risk assessment for a waste area at ORNL. This study considers various applications of institutional controls and the risks of each.

Finally, Shevenell and Hoffman present the results of a study that ranks the human health risks of the waste area groupings at ORNL. The authors discuss a risk assessment issue that is pivotal and often controversial: uncertainty. Uncertainty analyses enabled the waste area groupings to be ranked in a more reliable manner than they otherwise would have been.

Although uncertainty continues to be one of risk assessment's major criticisms, continued scientific research and the development of more consistent risk-based standards will make risk assessments increasingly reliable. The current limitations of risk assessment do not negate its usefulness, relevance, or importance in the role of decision-making and the management of hazardous wastes at DOE facilities. As risk assessment continues to be refined, it will continue to gain recognition and be used in many applications, including risk-based prioritization of environmental problems, waste management, and environmental restoration of contaminated sites. While much remains to be learned about risk assessment and the issues surrounding this field of study, the material presented in this issue is intended to stimulate further research and encourage the formulation of opinions about some of the fundamental issues affecting the management of hazardous waste.

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