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TECHNICAL  
R E P O R T

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Review of Literature  
Related to Exposures and  
Health Effects at Structural  
Collapse Events

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Prepared for the National Institute for Occupational Safety and Health



RAND INFRASTRUCTURE, SAFETY, AND ENVIRONMENT

The research described in this report was conducted under the auspices of the Safety and Justice Program within RAND Infrastructure, Safety, and Environment (ISE), a division of the RAND Corporation, and the RAND Science and Technology Policy Institute (S&TPI), a federally funded research and development center sponsored by the National Science Foundation, for the National Institute for Occupational Safety and Health.

**Library of Congress Cataloging-in-Publication Data**

Review of literature related to exposures and health effects at structural collapse events / Elizabeth M. Sloss ...  
[et al].

p. cm.

“TR-309.”

Includes bibliographical references.

ISBN 0-8330-3875-3 (pbk. : alk. paper)

1. Hazardous substances—Health aspects. 2. Chemicals—Health aspects. 3. Environmentally induced diseases. 4. Toxicology. 5. Building failures—Health aspects. 6. Structural failures—Health aspects. 7. Emergency medical personnel—Health and hygiene. 8. Protective clothing—Standards.

[DNLM: 1. Hazardous Substances. 2. Emergencies. 3. Environmental Exposure. WA 670 R454 2005]

I. Sloss, Elizabeth M. II. Rand Corporation. III. Title.

RA1219.3.R48 2005

363.17'9—dc22

2005030032

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Published 2005 by the RAND Corporation

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## Summary

As part of the development of guidelines for personal protective equipment (PPE) for emergency responders, the RAND Corporation assembled information on acute and chronic health effects that might result from working in a structural collapse environment. The rationale for describing the human health risks associated with the post-collapse environment is to better understand the possible consequences of inadequate PPE at the site of a structural collapse.

In the months following the collapse of the World Trade Center (WTC) on September 11, 2001, several federal agencies monitored the air, dust, and water at the collapse site and in the surrounding areas. The air and dust sampled by these agencies were tested for hundreds of substances. Analyses of the dust and smoke aerosol that settled in the areas adjacent to the WTC after its collapse indicated that it was composed of a complicated mixture of pulverized building material and combustion by-products. The topics for the health effect summaries included in this report were selected by focusing on these two components of the mixture. Individual substances were selected that (1) had well-documented adverse health effects, (2) were likely to be present in other structural collapse environments, and (3) represented the full range of hazardous exposures in the structural collapse environment.

The report summarizes data on injuries among emergency responders available from incidents of structural collapse. It also reviews the possible health effects of substances likely to be found in the pulverized building materials, including asbestos, particulate matter, silica, synthetic vitreous fibers, and metals (arsenic, cadmium, chromium, lead, and mercury). Finally, the report describes the possible health effects of several combustion by-products, including benzene, dioxins, polychlorinated biphenyls, and polycyclic aromatic hydrocarbons. For each substance, information is summarized related to the following topics:

- identity, properties, and uses
- possible routes of exposure
- evidence for health effects from human studies
- occupational exposure limits
- carcinogenicity status.

Information about human health effects in these summaries is based primarily on published reviews.