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Standard Practice for Radiological Emergency Response[1]

This standard is issued under the fixed designation E2601; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

One of the legacies of the Oklahoma City bombing and the attacks of September 11, 2001 is recognition that terrorists use weapons of mass destruction (WMD). This awareness has changed the philosophy of emergency response across disciplines. Incident response is still based on accepted procedures and safe work practices developed over the years, but the new mission must include concerns that are specific to an intentional release of hazardous materials designed to kill or injure and cause destruction of property. This standard practice provides guidance for responding to incidents where radioactive materials might be used with that intent. The standard also applies guidance for general radiological emergency response. The purpose of the guidance is to save lives, minimize radiation dose, and move members of the public out of perceived danger areas.

This standard practice provides decision making considerations that jurisdictions can use to respond to incidents that involve radioactive materials. The standard practice provides a consistent set of practices that can be incorporated into the development, planning, training, and implementation of guidelines for radiological emergency response. The standard practice does not incorporate long-term recovery or mitigation considerations, nor does it include provisions for improvised nuclear device[2] (INDs) detonations or nuclear power plant (NPP) accidents. Jurisdictions using the standard practice shall incorporate their own procedures for notification and requests for assistance from specialized radiological response assets.

The following are key concepts associated with this standard practice:

The standard practice applies to the emergency phase of an event (0 to 24 h or until specialized resources arrive on scene if they are requested).

It adheres to a risk-based response; this means the guidance presented is intended to be coupled with the authority having jurisdiction's (AHJ's) understanding of local vulnerability and capability when developing its plans and guidance documents on the subject.

It is compliant with the National Incident Management System (NIMS) and uses Incident Command System (ICS) common terminology. Full compliance with NIMS is recognized as an essential part of emergency response planning. In developing this standard practice, every effort was made to ensure that all communications between organizational elements during an incident are presented in plain language according to NIMS 2007. In keeping with this NIMS requirement, key definitions and terms, using plain English, are incorporated.

It is not intended for large-scale nuclear scenarios (for example, IND), which may quickly exhaust the capabilities of local emergency responders.

The standard practice is not intended to prepare communities for nuclear power plant accidents. The state of preparedness for communities in close proximity to nuclear power plants far exceeds the minimum requirements and capabilities described in this standard practice.

TRACEM (Thermal, Radiological, Asphyxiant, Chemical, Etiological, Mechanical) issues were considered throughout. While response to radiological hazards is the focus of this standard practice, responders must consider all hazards during a response; it is possible that non-radiological hazards may present a greater danger at an incident.

The standard practice does not address airborne contamination levels of radioactive materials exposure. Equipment to determine this potential hazard is not widely available in emergency responder communities. Respiratory protection is required for emergency responders until a complete hazard identification assessment is complete.

1. Scope

1.1 This practice provides decision-making considerations for response to incidents that involve radioactive materials. It provides information and guidance for what to include in response planning, and what activities to conduct during a response. The scope of this standard practice does not explicitly consider response to INDs or nuclear power plant accidents.[3] It does not expressly address emergency response to contamination of food or water supplies.

1.2 This practice applies to those emergency response agencies that have a role in the response to a radiological incident, excluding an IND incident. It should be used in emergency services response such as law enforcement, fire department, and emergency medical response actions.

1.3 This practice assumes that implementation begins with the recognition of a radiological incident and ends when emergency response actions cease or the response is assumed by specialized regional, state, or federal response teams.

1.4 AHJs using this practice will identify hazards, develop a plan, acquire and track equipment, and provide training consistent with the descriptions provided in Section 6. AHJs not able to meet the requirements should refer to the United States (US) Department of Transportation (DOT) Emergency Response Guidebook (ERG) for guidance on how to manage radiological incidents (DOT, current version). This standard practice provides additional guidance and is not intended to replace the ERG, rather to supplement it (see Annex A1[4]).

1.5 *This standard practice does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard practice to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *Referenced Standards and Documents:*

ANSI N42.33 American National Standard for Portable Radiation Detection Instrumentation for Homeland Security[5]

ANSI N42.32 American National Standard Performance Criteria for Alarming Personal Radiation Detectors for Homeland Security[5]

ANSI N42.49A American National Standard for Performance Criteria for Alarming Electronic Personal Emergency Radiation Detectors (PERDs) for Exposure Control[5]

CDC 2007 Population Monitoring in Radiation Emergencies: A Guide for State and Local Public Health Planners[6]

CRCPD 2006 Radiological Dispersal Device (RDD)—First Responder's Guide, the First 12 Hours[7]

CTOS 2014 WMD Definitions for Use in the DHS Course Materials Developed by CTOS[8]

29 CFR 1910 Occupational Safety and Health Standards[9]

49 CFR 173 Shippers General Requirements for Shipments and Packages[9]

DOT, current version, Emergency Response Guidelines (ERG)[10]

EPA 400-R-92-001 Manual of Protective Action Guides and Protective Actions for Nuclear Incidents[11]

EPA PAG Manual Protective Actions Guides and Planning Guidance for Radiological Incidents, 2013 (Draft for Interim Use and Public Comment)[11]

EPA-402-F-07-008 Communicating Radiation Risks, Office of Radiation and Indoor Air[11]

FEMA 2008 Application of Protective Action Guides for Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents[12]

Homeland Security Act of 2002 [13]

IAEA 2006 Manual for First Responders to a Radiological Emergency[14]

ICRP Publication 96 Protecting People against Radiation Exposure in the Event of a Radiological Attack, 96[15]

NCRP Commentary No. 19 Key Elements of Preparing Emergency Responders for Nuclear and Radiological Terrorism[16]

NCRP Report No. 138 Management of Terrorist Events Involving Radioactive Material[16]

NCRP Report No. 116 Limitation of Exposure to Ionizing Radiation[16]

NCRP Report No. 165 Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers[16]

NFPA 472 Standard for Professional Competence of Responders to Hazardous Materials Incidents[17]

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[1] This practice is under the jurisdiction of ASTM Committee E54 on Homeland Security Applications and is the direct responsibility of Subcommittee E54.02 on Emergency Preparedness, Training, and Procedures.

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[2] An improvised nuclear device is defined as follows: A device incorporating fissile materials designed or constructed outside of an official government agency and that has, or appears to have, or is claimed to have the capability to produce a nuclear explosion. It also may be a nuclear weapon that is no longer in the custody of competent authority or custodian, or has been modified from its designated firing sequence, or it may have been assembled from illegally obtained nuclear weapons components or special nuclear materials.

[3] Local response to nuclear facilities incidents should follow nuclear facility plans, especially in accordance to ingestion pathway zone actions, such as distribution of potassium iodine.

[4] Annex A1 material is labeled to complement the standard practice section numbers and can be found at the end of the standard before the appendices. The annex provides additional information for responder consideration.

[5] Available from http://standards.ieee.org/getN42/.

[6] For access to document, go to http://www.bt.cdc.gov/radiation/pdf/population-monitoring-guide.pdf.

[7] For access to document, go to http://www.crcpd.org/publications.asp#RDD.

[8] For access to document, go to www.ctosnnsa.org.

[9] For access to document, go to www.access.gpo.gov.

[10] Available from http://hazmat.dot.gov/pubs/erg/gydebook.htm.

[11] Available from www.epa.gov.

[12] Available from http://edocket.access.gpo.gov/2008/E8-17645.htm.

[13] For access to document, go to http://www.whitehouse.gov/deptofhomeland/bill/hsl-bill.pdf.

[14] For access to document, go to http://www-pub.iaea.org/MTCD/publications/PDF/EPR_FirstResponder_web.pdf.

[15] For access to description and site for ordering, go to http://www.elsevier.com/wps/find/bookdescription (cws_home/707248/description#description).

[16] Available from www.ncrponline.org.

[17] Available from www.nfpa.org.

NIMS 2007 Draft revised NIMS for interim use[18]
NRF 2008 [19]
NIST 2006a Results of Test and Evaluation of Commercially Available Survey Meters for the Department of Homeland Security—Round 2[20]
NIST 2006b Results of Test and Evaluation of Commercially Available Personal Radiation Detectors (PRDs) and Radiation Pagers for the Department of Homeland Security—Round 2[20]
NIST 2005a Results of Test and Evaluation of Commercially Available Survey Meters for the Department of Homeland Security[20]
NIST 2005b Results of Test and Evaluation of Commercially Available Personal Radiation Detectors (PRDs) and Radiation Pagers for the Department of Homeland Security[20]
NUREG-0654/FEMA-REP-1, Rev. 1 Addenda Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, Final Report[21]
NUREG-0654/FEMA-REP-1 Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants[21]

3. Terminology

3.1 *Definitions:*

3.1.1 *authority having jurisdiction (AHJ)*—the organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure. **NFPA 472**

3.1.2 *ALARA (as low as reasonably achievable)*—a principle of radiation protection philosophy that requires that exposures to ionizing radiation should be kept as low as reasonably achievable, economic and social factors being taken into account; the ALARA principle is satisfied when the expenditure of further resources would be unwarranted by the reduction in exposure that would be achieved. **NCRP Report No. 165**

3.1.3 *committed effective dose equivalent (CEDE)*— committed effective dose equivalent is the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues.

3.1.4 *decision points*—predefined exposure rates or doses at which a decision-maker must determine a path forward to maximize responder safety and public protection.

3.1.5 *decontamination*—(*1*) the removal of radionuclide contaminants from surfaces (for example, skin) by cleaning and washing (NCRP Report No. 165); (*2*) the physical or chemical process of reducing and preventing the spread of contaminants from people, animals, the environment, or equipment involved at hazardous materials/weapons of mass destruction (WMD) incidents (2013 Edition NFPA 472 3.3.17).

3.1.6 *defensive operation(s)*—emergency response measures taken from a safe distance (for example, outside the hot zone) to prevent or limit radiation exposure or the spread of hazardous material; life-safety operations are not a concern if defensive operations are the only operations supporting the response.

3.1.7 *dose*—radiation absorbed by an individual's body; general term used to denote mean absorbed dose, equivalent dose, effective dose, or effective equivalent dose, and to denote dose received or committed dose; see Total Effective Dose Equivalent (TEDE). **CRCPD 2006**

3.1.8 *dosimeter*—a small portable instrument (such as a film badge, thermoluminescent dosimeter, or pocket dosimeter) used to measure and record the total accumulated personal dose of ionizing radiation. **U.S. NRC Glossary**

3.1.9 *emergency decontamination*—the physical process of immediately reducing contamination of individuals in potentially life-threatening situations with or without the formal establishment of a decontamination corridor. A goal of emergency decontamination is reducing dose to a lower level; however it may not be possible to completely eliminate contamination.

3.1.10 *emergency operations center (EOC)*—the physical location at which the coordination of information and resources to support incident management activities normally takes place. An EOC may be a temporary facility or in a permanently established location in a jurisdiction. **NIMS 2007**

3.1.11 *emergency responder*—emergency response providers include federal, state, and local government, fire, law enforcement, emergency medical, and related personnel, agencies, and authorities. **Homeland Security Act of 2002**

3.1.12 *emergency response*—the performance of actions to mitigate the consequences of an emergency for human health and safety, quality of life, the environment and property. It may also provide a basis for the resumption of normal social and economic activity. **IAEA 2006**

3.1.13 *evacuation*—organized, phased, and supervised withdrawal, dispersal, or removal of civilians from dangerous or potentially dangerous areas, and their reception and care in safe areas. **NIMS 2007**

3.1.14 *high exposure rate*—exposure rate beyond which emergency response is not recommended for rescue operations unless the incident commander (IC) determines it can be carefully controlled for a short duration for priority operations such as life-saving, and the emergency responder is informed of the hazards and consents to performing the operation(s); the recommendation of this standard practice is for a high exposure rate less than or equal to 100 R/h (1 Sv/h). For the purposes of this standard practice, the term "high dose rate" is equivalent to "high exposure rate."

3.1.15 *hot zone*—the control zone immediately surrounding a hazardous materials incident, which extends far enough to prevent adverse effects from hazardous materials releases to personnel outside the zone. **NFPA 472**

3.1.16 *hot line*—the line of demarcation that may become a decision point to control the hot zone; for a radiological response, the hot line shall correspond to a previously established exposure rate (for example, the low exposure rate) or

[18] For access to document, go to www.fema.gov.
[19] For access to document, go to www.dhs.gov.
[20] For permission to access document, go to https://www.rkb.us/.
[21] For access to document, go to www.nrc.gov.