NACCHO
National Association of County & City Health Officials
The National Connection for Local Public Health

[REPORT]
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Data Management Systems for Radiation Population Monitoring

Introduction

The National Association of County and City Health Officials (NACCHO), with support from the Radiation Studies Branch at the Centers for Disease Control and Prevention (CDC), helps to ensure that local health departments (LHDs) are connected to the most up-to-date and relevant radiation preparedness resources and information. Over the course of 2016–2017, NACCHO conducted a variety of research activities on data management systems for radiation population monitoring. NACCHO found that state and local health departments currently use some promising practices but still face challenges related to how radiation population monitoring data are collected, managed, shared, used, and reported.

This report highlights practices and resources to help state and local health departments develop strategies to manage radiation population monitoring data during radiation emergencies.

Overview

Radiological emergencies vary by size and type and can be caused by transportation accidents, nuclear power plant accidents, explosive radiological dispersal devices (dirty bombs), radiation exposure devices, and improvised nuclear devices. Following a large-scale radiation emergency, a large population across a broad geographic area may be impacted by radiation exposure or contamination. Depending on the event, these persons may be asked to shelter-in-place or evacuate the area to avoid radiation exposure or contamination. Many people not directly impacted may be concerned and may also seek radiation screening and decontamination services. As part of the response, impacted and neighboring jurisdictions may set up community reception centers (CRCs) to conduct large-scale population monitoring activities such as exposure screening, contamination screening, and decontamination services. Additional biomonitoring sampling activities and long-term surveillance may also occur after people leave CRCs to further assess levels of radiation contamination and to monitor health outcomes over an extended period of time.

Federal, state, tribal, territorial, and local public health agencies will play a significant role in radiation emergency response efforts. State and local public health responsibilities may include ensuring safe shelters for displaced populations, identifying exposed and contaminated persons, conducting or assisting with decontamination, conducting environmental sampling and monitoring, providing information to medical providers and the public, monitoring worker safety and health, and developing site-entry criteria and disease-control measures.[1] The Department of Health and Human Services will be responsible for coordinating federal population monitoring support, assisting state and local health departments with establishing health registries, performing lab analyses and dose reconstruction, and conducting long-term monitoring of the exposed population.[1]

There are currently a variety of systems, devices, and resources involved in collecting, managing, sharing, and using population monitoring data during a response. Many health departments will use paper forms to collect population monitoring data at CRCs. Typically, portal monitors and handheld survey meters are used at CRCs to generate population monitoring data,

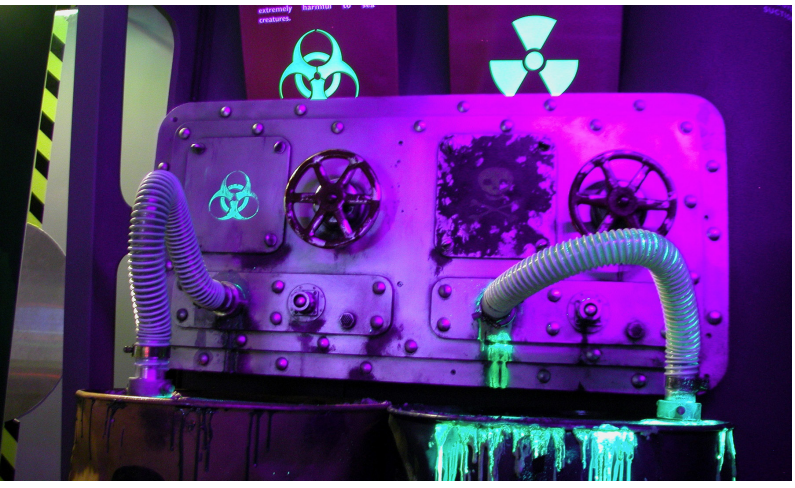
which are then used for triaging activities. Some states have established systems that can house CRC population monitoring data, but the majority do not yet have an electronic system for population monitoring data management. Additionally, protocols for sharing and using radiation data are not standardized from region to region and the reporting systems for sharing radiation population monitoring data among various levels of government are not always clearly defined.

Population Monitoring Promising Practices

Data Collection

Utilizing staff who perform radiation monitoring and measurement activities on a regular basis is a best practice when identifying persons to perform radiation data collection functions at response sites.[2] Persons with radiation expertise may come from radiation control programs, health physicist organizations, environmental health, hazardous materials teams, utility companies, poison control centers, emergency management, healthcare, and emergency medical services. Some health departments also conduct trainings for their volunteer organizations to expand the pool of persons able to perform population monitoring functions.

If resources and time allow, the best practice for capturing external contamination data are conducting a whole-body screening using a Geiger-Muller pancake probe. The Radiation Emergency Medical Management and CDC websites provide detailed overviews for preparing radiation equipment, survey procedures, and measurement techniques for external contamination data collection. In the event that time or resources are limited, screening only the sites on the body most likely to be contaminated (i.e., the head, face, shoulders, and hands) is acceptable in lieu of whole-body screening.[1]



Urine samples are used to measure internal contamination. LHDs should develop a prioritization strategy for urine sample collection and analyses to assess internal contamination.

The CDC recommends that a registry be established as soon as possible following a radiation incident to facilitate both short-term medical follow-up and long-term health monitoring. In addition to collecting demographic information through CRC forms, it can be useful to assign unique identifiers, capture response roles (first responder, volunteer, general public), and assign triage categories (external contamination, internal contamination, external exposure only, neither contaminated nor exposed, or unknown).

Data Management

In the event of a radiation emergency, responding agencies will rely on data management systems to understand the size and scope of the incident. In many cases, local health departments will need to enter information collected in paper form during CRC operations into an electronic database, adding more time on the back end of operations. Regardless of when data are entered into the system, health departments will likely need to summarize collected data on a regular basis to maintain situational awareness and direct resources according to the needs of various response sites.

Responding agencies with electronic systems for real-time data collection at CRCs will need to ensure that patients' individual data are linked as they move through different stations within the system. This may be achieved by connectivity over a local area network, in the cloud, or through merging records by unique patient identifiers. Offline and online versions of databases may need to be considered depending on site-to-site variability in connection. Databases operating in a cloud environment offer the most user-friendly format for data management as there would likely be little need to perform merging steps for data collection activities at the CRC.

Some jurisdictions without population monitoring data management systems have discussed modifying existing disease surveillance systems for population monitoring. As part of planning, health departments should determine which software applications will allow for efficient data sharing between regional, state, and federal systems. Agencies may also need to have capabilities for incorporating population monitoring data for patient laboratory and assay results for internal contamination assessments.

Additionally, other response partners outside of state and local public health such as the federal government, emergency management, environmental health, the Red Cross, utility companies, and radiation control agencies may have existing

radiation data collection systems that may also provide utility for management of population monitoring data. Two systems available through the CDC and the Federal Emergency Management Agency (FEMA) will provide health departments with additional capabilities to manage radiation population monitoring data in the future. The first system is the CRC Epi Info™ Tool, which allows for the entry of population monitoring data into a database at each station as a person moves through a CRC. The second system is a population monitoring module within the RadResponder platform, which allows for the entry of aggregate CRC site data and other population monitoring data into the RadResponder application. Features of each of these two systems can be found in Table 1.

TABLE 1. CRC EPI INFO™ TOOL AND THE RADRESPONDER POPULATION MONITORING MODULE FEATURES

Features	CRC Epi Info™ Tool	RadResponder Population Monitoring Module
Developer	CDC Health Studies Branch	Chainbridge Technologies, in collaboration FEMA, Department of Energy's National Nuclear Security Administration, and the Environmental Protection Agency
Intended uses	The CRC Epi Info™ Tool can be used to collect, analyze, visualize, and transfer radiation population monitoring data collected from CRCs. Epi Info™ is an electronic database platform tool commonly used during outbreaks and for disease surveillance activities.	RadResponder is an electronic data management system that is primarily used for environmental radiological data management and visualization. The population monitoring module will additionally allow for the management and visualization of aggregate population monitoring data and CRC facility data.
Target audiences	Epi Info™ is mainly used by public health practitioners and researchers. The CRC Epi Info™ Tool can also be used by CRC staff at each CRC station.	The RadResponder population monitoring module will be used by LHDs responsible for establishing CRCs, state health departments, emergency management, incident command decision-makers, and federal partners.
Special features	• Database fields are based on data elements captured on paper CRC forms • Customizable dashboard can summarize statistics in real-time regarding population age, gender, contaminated persons, and other selected variables • Data can be imported and exported securely in a variety of formats • Capabilities to operate through a cloud-based server, over Wi-Fi, or without internet through local area networks • Can be used on Windows PCs, tablets, and other smart devices	• Data elements include information about CRC site capabilities, CRC operational status, and aggregate population information • Allows for real-time data analysis and visualization using mapping and tabular data display features • Data can be entered manually or uploaded automatically • Data export is available in a variety of formats • RadResponder is available for download and use on smart devices (Android, Windows, iOS) and accessible through the Web
Resources and training	A step-by-step user guide, tutorials, communities of practice, and frequently asked questions are available on CDC's website.	A comprehensive user guide, tutorial videos, job aids, one pagers, train-the-trainer materials, and frequently asked questions are available on the RadResponder website.
How to access	• Available for free • The CRC Epi Info™ Tool is projected to be released in mid-2017. Existing Epi Info™ resources are currently available at https://www.cdc.gov/epiinfo/index.html	• Available for free • The RadResponder population monitoring module is projected to be released in late 2017. The RadResponder application is currently available at https://www.radresponder.net/
Future work	The CRC Epi Info™ Tool will be tested as part of CRC full-scale exercises over the course of 2017–2018. Feedback from these exercises may be used to further refine and improve the CRC Epi Info Tool.	The RadResponder population monitoring module is currently under development and will be pilot tested over the course of 2017.

NACCHO in collaboration with the CDC, the Conference of Radiation Control Program Directors (CRCPD), FEMA, and Chainbridge Technologies* formed a workgroup to develop the RadResponder Population Monitoring Module Framework displayed in Figure 1. The framework includes the proposed data elements, concept of operations for using the module, module data display and visualization preferences, and desired outputs for use of the module. It is important to note the final version of the module (to be released in late 2017) may not include all of the features listed as of this writing since it is currently undergoing pilot testing prior to release.

Finally, there may be separate systems to conduct the long-term health surveillance of persons impacted by a radiation event. Determining which information fields are migrated over, who is responsible for managing this system (local, state, or federal agencies), and how these data are migrated from existing population monitoring data management systems will need to be determined.

Data Usage and Reporting

The collection of individual-level radiation data will serve two main purposes: (1) during CRC operations, population monitoring data will determine the appropriate course of action needed for each individual based on their level of radiation contamination and exposure history; and (2) following CRC operations, individual-level data will be used to direct patients to the appropriate follow-up healthcare services (if needed) and to monitor the short- and long-term health effects due to radiation contamination or exposure.

FIGURE 1. RADRESPONDER POPULATION MONITORING MODULE PROPOSED FRAMEWORK

- **Operational Facility Info**
  - » CRC Location & Date Opened
  - » Decon Availability
  - » Point of Contact Info
  - » Animal and Vehicle Services
  - » Aggregate Resources
- **Event Facility Info**
  - » Hours of Operations
  - » Facility Status
  - » Screening Criteria
  - » Specific Resources
- **Population Screened**
  - » Date/Time Range for Data
  - » External Contamination
  - » Internal Contamination
  - » Signs of ARS
  - » Referral Information

- User collects data on paper forms or database
- User compiles and aggregates collected data
- User opens RadResponder and creates an event and opens population monitoring module
- User enters CRC facility information
- User inputs aggregate data elements for each CRC

- Data visualization for all event users
- Unique CRC icons
- Displays data for multiple CRCs in regional event
- Filter available to display CRC operational status
- Data are location specific and is updated over response
- Cumulative data from each CRC and across entire event is available
- Data can be viewed on map or in tabular format
- Clicking on a CRC provides summary of information
- Dashboard dispalys overall event and CRC summaries

- Displays info for open response sites
- Displays screening criteria at each site
- Informs resource allocation & requests
- Informs public messaging
- Enhances cross-jurisdictional situation awareness
- Provides more rapid access to resources, services, and interventions
- Targets sites for follow-up health screenings and investigations

Aggregated population monitoring data will also provide useful information to both public health and other emergency response partners. At the CRC level, summarized data can help on-site management estimate overall site capacity, maintain situational awareness, project future needs, and direct and request resources. At the local, regional, and state levels, summarized population monitoring data can help aid in decision-making processes to direct resources, establish evacuation zones select response sites, craft public communications, and coordinate with healthcare and first responder agencies. Depending on the nature and type of the event, other state and federal agencies outside the public health realm may also request that specific radiation data be collected. State and local health departments must coordinate with other radiation response partners to determine their data collection needs so that they can effectively coordinate concurrent radiation data collection activities and reporting requirements within and across responding jurisdictions.

When reporting data, health departments must ensure that sharing of population monitoring data adheres to the standards of the Health Insurance Portability and Accountability Act (HIPAA) and other privacy laws. In some cases, there may also be other local concerns with sharing certain information even if information is de-identified.

State and Local Promising Practices

NACCHO identified the following state and local promising practices during the course of its research:

- The Los Angeles County Department of Public Health's standard operating guide contains radiation survey procedures, guidance on collecting information during the registration process, prioritization strategies, and forms for capturing contamination measurements.[3]
- The New York City Department of Health and Mental Hygiene developed forms to record equipment information, resource assignments, triage criteria, and individual and property contamination information as well as radiation safety and control guidance for responders.[4]
- The Florida Department of Health developed a database that collects contact, health, and exposure data into a registry for all potentially contaminated first responders, public health workers, hospital staff, and victims.[5]
- Numerous state health departments have the potential capacity to capture, aggregate, track, and share population monitoring data by modifying BioSense/ESSENCE systems, state-level syndromic surveillance systems, or CASPER surveys.[6]

Fukushima Daiichi Nuclear Disaster: International and National Population Monitoring Activities

Following the Fukushima disaster in 2011, officials in Japan aggregated and reported collected CRC population monitoring data about external contamination on a daily basis to Fukushima Prefecture headquarters. For long-term health surveillance, data from returned paper-based surveys and follow-up medical services were being compiled in a central database. Internal contamination data collected in the first four months following the disaster was also collated with the long-term database records.[7] In the United States, the CDC and U.S. Customs and Border Protection (CBP) implemented a screening and tracking system for all individuals returning to the United States with detectable external contamination.[8] Paper forms were developed for epidemiological follow-up by state health departments for those with detectable contamination. Despite CBP detecting only three returning travelers with external contamination, this event helped formulate a screening protocol should a similar international radiation event occur again.

Success Story: Kansas Department of Health and Environment (KDHE)

KDHE has developed a Radiation Response Volunteer Corps (RRVC) through funding received by CRCPD. This funding allowed KDHE to develop regional training materials, operations guides, and job aides for radiation professionals. In 2012, KDHE conducted the Amber Waves Full-Scale CRC Exercise, engaging LHD staff and RRVC members and their pets to serve as victims, volunteer citizens, and CRC staff. KDHE performed screening and decontamination processes for humans and animals and used paper forms to collect data at each CRC station. KDHE plans to utilize EpiTrax (a KDHE state-based disease surveillance system) for data management following CRC operations. EpiTrax will allow for easy sharing of data among health departments that use the system. However, LHDs should consider access requirements when using EpiTrax for onsite CRC data entry because administrative processes to add new members may be cumbersome, require off-site action, and delay data-entry operations.

Success Story: Tennessee Department of Health (TNDOH) Southeast Region

The Southeast region of Tennessee has several counties that fall within the 10-mile emergency planning zone of two nuclear power plants. TNDOH takes a multi-jurisdictional, regional approach to radiation emergency planning and planning based on FEMA National Radiation Emergency Preparedness guidance. The Southeast Tennessee region developed field operations guides that include step-by-step instructions for setting up handheld monitors, conducting contamination screening, doing inventory, and setting up CRCs. In February 2017, the Southeast Tennessee Health Department conducted a functional CRC exercise in which over 40 volunteers underwent simulated screening and decontamination processes. TNDOH is planning to do a full-scale CRC exercise in 2018 to evaluate the use of the CRC Epi Info™ Tool and the RadResponder Population Monitoring Module.

Success Story: New York State Department of Health (NYSDOH)

In New York State, seven NREP counties surrounding nuclear power plants have CRC plans that rely on paper-based systems for data collection. Other counties further away from the plants are at various stages of plan development and can utilize the New York State Countermeasure Data Management System (CDMS) for data collection. CDMS can perform population monitoring data collection, management, and reporting functions for CRC operations. CDMS has a pre-registration feature that enables the public to enter data online in advance of on-site arrival to reduce data collection burden at CRCs. CDMS can also be used at points of dispensing (PODs) and is regularly used by NYSDOH staff for routine disease surveillance activities. In 2009, two non-nuclear counties exercised their CRC plan utilizing NYSDOH staff to conduct screening and decontamination and having county health department staff serve in other roles. The exercise identified that local staff need additional training on the CDMS CRC system as planning work advances in New York State.

CHECKLIST OF PLANNING CONSIDERATIONS FOR POPULATION MONITORING DATA MANAGEMENT

- ☐ Conduct trainings on basic radiation preparedness and population monitoring
- ☐ Engage radiation subject matter experts (e.g., radiation control staff, health physicists, radiation emergency preparedness staff) and epidemiologists throughout the planning process
- ☐ Leverage existing preparedness planning work and Public Health Emergency Preparedness Grant requirements to conduct radiation preparedness planning activities
- ☐ Identify the information collection needs, including minimum data requirements from individuals, daily reporting requirements, and intended data usages
- ☐ Determine data sharing procedures among different levels of government and partner agencies
- ☐ Understand the HIPAA regulations for sharing of individual-level data among agencies
- ☐ Define data collection needs for pets, service animals, and personal possessions
- ☐ Define the capacity for internal contamination assessment and lab testing and determine how lab results will be incorporated into other population monitoring records
- ☐ Explore integration of new technologies such as the CRC Epi Info™ Tool and RadResponder
- ☐ Understand the software and hardware needs of onsite and off-site data collection and entry
- ☐ Investigate the use of existing disease surveillance systems for data management and long-term surveillance
- ☐ Define the roles of the local and state health departments and the procedures and systems for long-term surveillance
- ☐ Build radiation response capacity through radiation training for volunteers and response partners
- ☐ Incorporate population monitoring data management objectives as part of exercises

Conclusion

Summary of Gaps

NACCHO identified the following gaps in radiation population monitoring planning at the state and local levels during its research:

- Many health departments do not have electronic systems specifically identified to manage population monitoring data.
- Protocols for sharing and reporting data are not well-defined at the local, state, and federal levels.
- Responsibilities and plans for long-term surveillance are not well-defined for radiation emergencies.
- Minimum data elements, screening criteria, and aggregate data elements are not standardized.

Recommendations

To address the gaps listed above, NACCHO recommends the following action items be addressed by federal, state, and local radiation response stakeholders:

- Develop a minimum set of data elements to be collected for population monitoring and investigate a tiered approach to collection of additional data based on demands of the event and the operational capacity of the responding agencies.
- Pilot and evaluate new population monitoring data management systems at the state and local level to identify potential strengths and areas for improvement.
- Establish procedures and guidelines for state and local health departments to use when sharing aggregated population monitoring data.
- Conduct and participate in local, state, and federal population monitoring exercises that test data collection and information sharing capabilities.
- Increase the level of training on population monitoring, radiation data collection and management, and other basic radiation preparedness topics by including specific requirements in funding agreements and widely promoting available products and offerings.
- Engage state and local response partners in the process of developing guidance and protocols to ensure products meet the needs of the end users.

Next Steps

NACCHO will continue working with partners at the CDC, FEMA, CRCPD, and the state and local level over the next year to develop and evaluate new population monitoring systems. NACCHO also plans to develop resources to help incorporate population monitoring data management systems into planning and exercises and will continue to promote the usage of these systems as they get released.

Population Monitoring Resources

Topic	Resources
Population Monitoring Guidance	• Population Monitoring in Radiation Emergencies: A Guide for State and Local Public Health Planners, Second Edition, April 2014 [document]
Radiation Basics	• Radiation Basics Made Simple [online training]
Community Reception Center Resources	• Community Reception Center Overview [video] • Virtual Community Reception Center [training tool] • RealOpt CRC [website, video, and model] • CRC Simulation Tool for Evaluation and Planning [website] • CRC Drill Toolkit [exercise toolkit]
Other Radiation Preparedness Resources	• A Guide to Operating Public Shelters in a Radiation Emergency, First Edition, February 2015 [document] • Screening People for External Contamination: How to Use Hand-held Radiation Survey Equipment [video] • Use of Radiation Detection, Measuring, and Imaging Instruments to Assess Internal Contamination from Intakes of Radionuclides [webpage]
Resource Clearinghouses	• NACCHO Radiation Toolkit [website] • CDC Radiation Emergency Training and Education Resources [webpage] • National Alliance for Radiation Readiness [website] • National Library of Medicine – Radiation Emergency Medical Management [website] • Radiation Response Volunteer Corps [website]

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