The Status of State-level Radiation Emergency Preparedness and Response Capabilities, 2010

PREPARED BY

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DISCLAIMER

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Executive Summary

To reassess the national status related to radiation public health emergency preparedness capabilities at the state and local health department levels, the Council of State and Territorial Epidemiologists (CSTE) conducted a web-based survey in the summer of 2010, which was sent to state epidemiologists in all 50 states. States with nuclear power plants were instructed to consider their responses exclusive of capabilities and resources related to the plants given that the emergency response plans for nuclear power plants are specific and unique to the type of radiation emergency that would occur there. Thirty-eight (76%) states responded to the survey, including 26 of the 31 states with nuclear power plants. Results of this assessment indicate that in most measures of public health capacity and capability, states are poorly prepared to adequately respond to a major radiation emergency event.

Strengths at the state level include:

- The majority of states had a written radiation response plan, and most plans include a detailed section for communications issues during a radiation emergency.
- More than half of the states indicated that their relationship with federal partners is sufficient to provide resources for radiation emergencies, indicating the importance states placed on federal resources and expertise.

Weaknesses identified include:

- The 26 states with nuclear power plants had four times the available staff who could be called on to respond to a large radiation emergency than the 12 states without nuclear power plants (Average of 37 FTEs vs. nine FTEs)
- 70%-84% of responding states had completed little to no planning for public health surveillance to assess potential human health impacts of a radiation event.
- Less than half of the responding states had written plans to address exposure assessment, environmental sampling, human specimen collection and analysis, and human health assessment.
- Only 11% reported having sufficient resources to do public health surveillance and no more than 24% had sufficient resources for radiation exposure assessment.
- Resources for functions related to laboratory analysis were rated insufficient in most state health agencies.
- Although some resources were available in other state agencies to support radiation emergency response functions, less than 15% of the states reported that those resources were sufficient in any functional category.
- 53% states reported having a finalized written radiation emergency response plan; but generally less than half had detailed written operational plans for specific scenarios (range 15% to 53%).
- The average overall subjective radiation emergency preparedness “score” was 4.54 on a scale of 1 to 10 among the 37 states that provided a score. The average self-rating of the 25 states with nuclear power plants was higher than the rating of the 12 states without nuclear power plants (4.81 compared to 2.8).

Specific recommendations arising from this report include dissemination of best practices related to radiation response through CSTE, in collaboration with partner associations of the National Alliance for Radiation Readiness, including sharing of exercise templates; greater incorporation of radiation preparedness as a priority under an all-hazards approach; increased training and coordination opportunities for states with federal partners and experts; strategic planning for activities designed to provide collaboration between all types of CDC radiation preparedness personnel and states, and improved coordination with other Department of Human Services operating units such as the Office of the Assistant Secretary for Preparedness and Response (ASPR) on radiation preparedness related to service provision.

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Introduction

Public health preparedness activities have often focused on detection, identification, and response to the intentional release of microbial agents of human disease. Local and state health agencies are less experienced with non-microbial agents, such as chemical and radiologic threats. Nevertheless, these agencies are expected to be fully prepared for and capable of detecting, identifying, and responding to all of these divergent threats under an all-hazard approach to public health preparedness. To best understand the national public health capability for radiation emergency preparedness, an in-depth assessment of the current status of planning for radiation emergency preparedness is critical. Thus, the Council of State and Territorial Epidemiologists (CSTE) assessed state health departments to determine their current level of planning and preparedness.

Background

In 2003, CSTE conducted a national assessment of the status of planning for public health preparedness for chemical and radiation terrorism (*1*). Substantial gaps were identified in preparedness and response capabilities, and the results were used to inform continuing national efforts to improve preparedness and response capabilities. At that time, the nation was focused on issues related to terrorism only, and the assessment reflected that interest. Since then, "preparedness" planning has expanded to an "all-hazards" approach that includes readiness to respond not only to terrorism but to releases from unintentional technological incidents, natural disasters, and outbreaks of human diseases (such as pandemic influenza).

Emergency preparedness planning and response activities and capabilities related to radiation release incidents (both intentional and unintentional) represent a broadened focus for the Centers for Disease Control and Prevention (CDC), the Conference of Radiation Control Program Directors, the Association of State and Territorial Health Officials, the Association of Public Health Laboratories, the National Association of County and City Health Officials, and CSTE. These organizations and agencies have formed the National Alliance for Radiation Readiness (the Alliance) to increase awareness and understanding of the varied public health responsibilities related to radiation emergencies and to improve communication across the divergent communities responsible for preparedness and response.

A meeting of the Alliance in January 2010 to discuss issues of radiation emergency preparedness resulted in a clear sense of urgency to reassess the national status of radiation preparedness capabilities at the state and local health department levels. The Alliance concluded that the new assessment should be broadened beyond just radiologic terrorism to include unintentional and natural radiation releases that could harm human health. Because states that have nuclear power generating plants will have well-established and exercised radiation emergency response capabilities, characterizing capabilities independent of nuclear power plant operations is important. The CSTE assessment discussed in this document focuses on the capabilities reported by state public health agencies only. The findings of the assessment will be used to inform national partners and enable targeting of additional resources to improve the nation's overall preparedness and response capabilities regarding radiation emergencies.

Methods

Although the current assessment instrument was based on the 2003 CSTE chemical and radiologic terrorism assessment, the 2010 instrument addressed radiation emergencies only (Appendix 1). Additional questions and response categories were added to broaden the scope to include preparedness activities for all radiation emergencies, not just terrorism. Originally, a comparison of the 2003 and the 2010 data was planned, but the assessment instrument changed enough to make many direct comparisons difficult.

CSTE created a radiation emergency subcommittee composed of epidemiologists from four state health departments. The subcommittee, a CSTE staff member, and a consultant adapted the 2003 survey instrument into a new draft assessment. This draft was shared with the agencies and organizations of the Alliance, and the draft was further adapted. The instrument was pilot tested in three state health departments, and suggestions were incorporated into the final version. The assessment was adapted for electronic completion using Survey Monkey.

The questionnaire was divided into four categories: Radiation Emergency Preparedness and Response Capability: Planning and Resources; Radiation Emergency Staffing Levels in State Health Departments; Local Relationships; and Interagency Coordination on Radiation Emergency Preparedness and Response Activities. State Epidemiologists in all 50 states were asked to complete the assessment electronically using the best information they could obtain from their health agency. Because some State Epidemiologists do not have control over radiation emergency response, they were instructed to seek the input of the most qualified agency staff (from radiation, epidemiology and laboratory services, preparedness planning and response), collate the responses into a final form, and submit their responses electronically. The survey collected the names, titles, and agencies of individuals who contributed to the survey response in each state. All questions, unless otherwise noted, explicitly excluded capabilities directly related to nuclear power plant emergency response.

For planning activities, states were asked to rate their planning, resources, and relationships using a four- or five-choice rating system that ranged from none to sufficient number and level. Ratings of none and minimal were combined to reflect little or no capacity. For reporting level of state health agency preparedness to respond to a major radiation emergency incident, states chose a number on a scale of 0 (not prepared at all) to 10 (fully prepared).

CSTE analyzed data using SAS and calculated frequencies and descriptive statistics for aggregated data so that responses for individual states or territories are not identifiable. As part of this assessment, states were assured that CSTE would release only aggregate data and would not release state-specific information in any reports unless otherwise approved by the state(s).

Results

Thirty-eight (76%) states responded to the questionnaire, but not all responding states answered all questions. Responding states varied widely by size, population, region, and presence of an operating nuclear power plant within their borders. Of the 31 states with nuclear power plants, 26 (84%) responded to the assessment. Twelve (63%) of the 19 states without nuclear power plants completed the assessment.

A. Planning and Resources Assessment

The extent of planning for human health effects of radiation was assessed for five types of surveillance: syndromic, clinician reporting, crisis phase epidemiology, recovery phase epidemiology, and other types of statistical surveillance (Table 1 in Appendix 2). Across all these types of surveillance, 70%–84% of states reported minimal or no planning completed on the potential human impacts of radiation.

States reported only slightly better planning for providing advice on exposure assessment and environmental sampling combined (42%–50% reporting none to minimal planning) and little planning to provide advice for biological sampling as well (14% have none and 60% have minimal). Seventy-four percent of states reported having minimal (53%) or no (21%) ability to conduct population-based exposure monitoring.

States reported little capacity for biological/clinical sampling collection, processing, and shipment. Thirty-one (82%) states reported no or minimal capacity to collect biological or clinical samples, and 28 (74%) indicated no or minimal capacity to process and ship samples for radioactivity analysis. Five (13%) states reported having any written or detailed operations plan for analyses of biological or clinical samples.

A greater percentage of states reported having a written plan or detailed operations plan for collecting (20 states [54%]), processing (17 [46%]), and shipping (14 [38%]) environmental samples and conducting (14 [38%]) radioactivity analysis. Likewise, 24%–27% of states reported having not begun incorporating these environmental sampling capabilities into their plans for radiation emergencies.

Planning for activities related to health assessment was generally poor. No or minimal health physics interpretation, predictions planning, and planning for medicine consultations were reported by 63%–70% of states. Sixteen (42%) states reported minimal or no planning to detect radiation contamination in first responders. Likewise, 25 (66%) reported minimal to no planning to provide health physics predictions on long-term health effects of radiation. Eight (21%) states reported planning for information technology/geographic information systems integration of radiation exposure data.

The majority of states reported having a written or detailed operations plan for communication issues during a radiation emergency. A total of 58%–68% of states reported having written plans or detailed operations plans for health alerts, risk communication, and public communication. Seventy-three percent reported written or detailed operations plans for potassium iodide or other radiation drug–dispensing activity. Half reported having written or detailed operations plans for worker safety/safety consultations.

A substantial number of states reported having inadequate resources within the state health department to maintain radiation emergency preparedness (responses include none, none dedicated, some dedicated [Table 2 in Appendix 2]). For syndromic surveillance and other kinds of statistical surveillance related to radiation incident, 35 (92%) states each reported insufficient resources to maintain preparedness; for surveillance through healthcare providers reporting, 31 (84%); for crisis-phase epidemiology and recovery-phase epidemiology, 33 (89%) each. Therefore, no more than 4 (11%) states reported having the necessary capability for any of the epidemiologic functions specifically associated with a radiation incident.

States similarly reported capacity to conduct exposure assessments as insufficient (choices were none, none dedicated, some dedicated) in a substantial proportion of states. A total of 76%–86% of states reported having few resources to provide advice for radiation exposure assessments, environmental

sampling, and biological/clinical sampling. Only three (8%) states reported adequate resources to conduct population-based exposure monitoring.

Handling environmental and biological samples for radiation analyses poses difficulties for state health departments. A total of 83%–89% reported insufficient resources to collect, process, and ship samples for, and conduct radioactivity analyses of, environmental samples. States reported similarly for biological/clinical samples, with 86%–92% reporting insufficient resources to collect, process, and ship samples for, and conduct, radiation analyses.

No more than four (11%) state health departments reported having sufficient resources to provide health physics interpretations, consultations upon reentry, predictions on long-term health effects, and medical consultations about radiation effects. Seven (19%) states reported sufficient resources for early detection of radiation contamination in first responders. A total of 74%–84% of states reported insufficient resources for the other public health functions, including worker health/safety consultations, health alerts, potassium iodide plans, risk communication, and community relations.

As expected, states reported limited epidemiologic resources for response to a radiation emergency in other state agencies (Table 3 in Appendix 2). A total of 67%–86% of states reported that agencies other than health departments had less than sufficient resources for exposure assessments, handling of environmental samples, handling of biological/clinical samples, health assessments, and other public health functions. Furthermore, up to nine (24%) states were uncertain about the resources that existed in other state agencies for radiation emergency preparedness.

Substantial resources and capacity for radiation emergency preparedness are located within a variety of federal agencies and are potentially available to states that have established relationships with these agencies (Table 4 in Appendix 2). Relationships regarding the functions of epidemiology and surveillance varied by specific function but were assessed as sufficient in 16%–27% of states.

Relationships with federal partners regarding exposure assessments, handling of environmental samples, health assessments, and other public health functions were reported as sufficient by 42%–65% of states. These responses were among the strongest reported in this part of the assessment. Relationships with federal partners to handle biological/clinical samples were weaker (33%–35%) for all four capabilities in this category.

B. Planning and Exercising

Twenty (53%) states reported having a finalized radiation written response plan. Four (20%) of these did not have a nuclear power plant.

The extent of planning conducted by state health departments may be influenced by the release type (unintentional vs. intentional) and environmental situation in which the release occurs (i.e., transportation, medical facility, mass gathering, major location, others). The questionnaire asked about the extent of planning (none or minimal vs. steps or detailed operation plan written) that state health agencies had conducted (Table 1). For unintentional releases, states were evenly distributed between the two planning categories. However, for unintentional transportation incidents on the nation's waterways, only six (15%) states reported having a written or detailed operations plan.

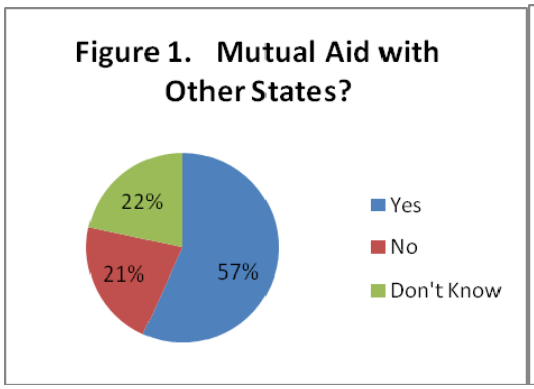
Half of the states reported having steps or detailed operation plans for a radiologic contamination dispersal device, the so-called "dirty bomb." For the remainder of the intentional scenarios, approximately one third of states (31%–35%) reported having steps or detailed operations plans.

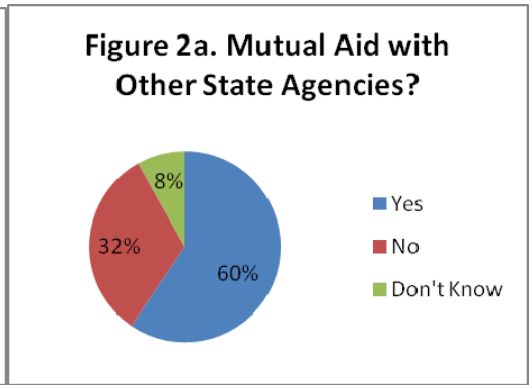
Table 1. Extent of State Health Department Planning for a Radiation Emergency, 2010 (n = 38 states)

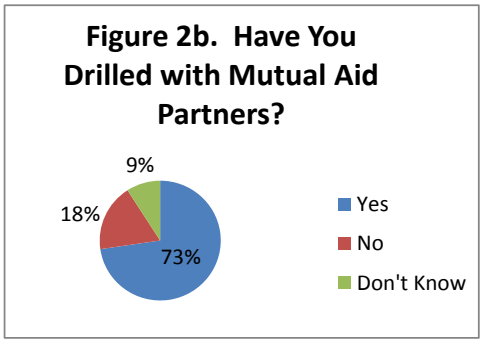
Radiation Incident Type	Extent of Planning	
	None or Minimal, No. (%)	Steps or Detailed Operations Plan Written, No. (%)
Unintentional incidents		
Transportation: roadway	18 (47)	20 (53)
Transportation: waterway	32 (85)	6 (15)
Hospital or medical	17 (45)	21 (55)
Fixed facility, not hospital or nuclear power plant	20 (54)	17 (46)
Intentional incidents		
Mass gatherings (e.g., Super Bowl)	23 (61)	15 (39)
Major location (e.g., Capitol building)	26 (68)	12 (32)
Explosive device, dispersal (i.e., dirty bomb)	20 (53)	18 (47)
Silent dispersal (i.e., intentional radiation material poisoning)	25 (66)	13 (34)
Nuclear detonation, including improvised nuclear device	26 (68)	12 (32)

Sixteen (80%) of the 20 states with a written plan reported having conducted a drill or exercise of the radiation plan. The most recent drill or exercise for these states occurred across the four time frames: within 6 months (six [38%] of states), longer than 6 months but less than 12 months ago (three [19%]), 1–2 years ago (five [31%]), and longer than 2 years ago (two [13%]).

Twenty-one (57%) states reported having mutual aid agreements for radiation emergency response with other states (Figure 1). Twenty-two (60%) reported having mutual aid for radiation emergency response with other state agencies (Figure 2a); 16 (73%) of these reported having drilled with their mutual aid partners (Figure 2b).







Thirty-seven (97%) states reported having an on-call duty officer system that provides 24/7 coverage and prompt response to a radiation emergency incident.

C. Staffing

An important measure of response capacity is the number of staff (full-time equivalents [FTE]) available to respond to a radiation emergency incident. States were asked to estimate the number of FTE in a variety of public health functions and to categorize them by funding source (Table 2a).

Table 2a. Average State Health Department Staffing for Radiation Emergency Response, 2010*

	Funding Source and No. FTE						
Staffing Area	CDC PHEP Funded	Other CDC Funded	State Funded	Redirected State Staff	Other Federal Funds	Total non-NPP FTE	NPP Funded
Planning	0.7	0.0	0.2	2.2	0.1	3.2	0.7
Epidemiology	0.1	0.0	0.0	4.8	0.2	5.1	0.0
Biomonitoring laboratory	0.0	0.1	0.0	0.6	0.1	0.8	0.0
Environmental laboratory	0.0	0.0	0.7	1.3	0.2	2.2	0.4
Radiation	0.2	0.0	1.0	9.1	0.7	11.0	1.0
Occupational health/Industrial hygiene	0.0	0.0	0.1	0.1	0.0	0.2	0.0
Risk communication	0.2	0.0	0.2	1.3	0.1	1.8	0.0
Sanitary engineering	0.0	0.0	0.0	0.2	0.0	0.2	0.0
Food science	0.0	0.0	0.2	0.7	0.2	1.1	0.0
Other	0.0	0.0	0.0	2.5	0.0	2.5	0.6
Total	1.2	0.1	2.4	22.8	1.6	28.3	2.7

*FTE, full-time equivalents; CDC, Centers for Disease Control and Prevention; PHEP, public health emergency preparedness; NPP, nuclear power plant.

The 38 states reported an average of 28 FTE that would be available to respond to a large-scale radiation emergency incident. Of these, 22.8 (81%) FTE are public health agency employees working in other areas who would be assigned or redirected to response activities. The 26 states that have a nuclear power plant within their borders have more than four times the available staffing to respond to a large-scale radiation emergency incident than do the 12 states without a nuclear power plant (37 FTE vs. nine FTE) (Table 2b).

Table 2b. Average Number of FTE for Radiation Emergency Response in States With and Without Nuclear Power Plants, 2010*

	Funding Source and No. FTE						
States	CDC PHEP Funded	Other CDC Funded	State Funded	Redirected State Staff	Other Federal Funds	Total non-NPP FTE	NPP Fund
With nuclear power plant (n = 26)	1.7	0.2	3.3	30.7	1.4	37.1	4.0
Without nuclear power plant (n = 12)	0.5	0.0	0.8	5.8	1.8	9.0	0

*CDC, Centers for Disease Control and Prevention; PHEP, public health emergency preparedness; FTE, full-time equivalents; NPP, nuclear power plant.

In many metropolitan areas, local health departments may have radiation emergency response personnel who would be a vital frontline resource. Nearly three-fourths or twenty-eight states reported that at least one of their local health departments had radiation emergency staff, and 23 (82%) reported knowing either all (10 [27%] states) or some (13 [34%] states) of these staff. Twenty-eight (74%) states reported providing training to local jurisdictions on any aspect of radiation emergency preparedness and response.

D. Interagency and Intraagency Coordination

States were asked to report on the level of coordination for radiation emergency preparedness and response activities between their agency and a variety of other agencies and institutions, with the level of coordination ranging from “no contact” to “exercise conducted” within the last 2 years (Table 3). In the assessment, states were asked to note whether they had written memoranda of understanding with any of the listed partner agencies or organizations.

Table 3. Level of Coordination with Response Partners for a Radiologic Emergency, 2010

	Level of Response, No. (%) States*			
Response Partners	No Contacts	Coordination Begun	Tabletop or Other Exercise Conducted in Last 2 Years	Memoranda of Understanding in Place
Regional FBI	8 (21)	15 (40)	15 (40)	3 (8)
State emergency management	3 (8)	11 (30)	21 (57)	9 (24)
State water regulator	11 (31)	13 (37)	9 (26)	5 (14)
State food regulator	6 (17)	17 (47)	12 (33)	5 (14)
State environmental health agency	0	16 (46)	16 (46)	6 (17)
State environmental agency	1 (3)	17 (45)	15 (40)	9 (24)
State agricultural agency	7 (19)	14 (38)	16 (43)	4 (11)
State hazardous waste regulator	9 (25)	10 (28)	12 (33)	8 (22)
Local health department	6 (16)	12 (32)	19 (50)	4 (11)
Nuclear power plant	4 (13)	3 (10)	23 (74)	11 (36)
Academic institution	12 (33)	13 (36)	7 (19)	7 (19)
Red Cross	13 (38)	7 (21)	13 (38)	4 (12)
US Department of Energy	9 (25)	7 (19)	19 (53)	4 (11)
US military forces	15 (42)	9 (25)	12 (33)	1 (3)
National Guard Civil Support Team	3 (8)	11 (29)	24 (63)	5 (13)
Poison control centers	12 (33)	16 (44)	5 (14)	4 (11)
State mental health department	15 (43)	8 (23)	10 (29)	3 (9)
State emergency management services agency	5 (14)	15 (40.5)	14 (38)	5 (14)
Native Americans/Alaskan Natives	20 (57)	12 (34)	4 (11)	1 (3)

*Percentages may not equal 100 because of rounding.

A fair amount of coordination has occurred with a wide variety of agencies and organizations. The majority of states have coordinated with the following partners for a radiation emergency: state emergency management agency, state environmental health agency, state environmental agency, nuclear power plant, and National Guard Civil Support Team. At least 15 (40%) states reported some level of coordination with their regional FBI, state food regulator, state environmental health agency,

state environmental agency, poison control centers, and state emergency management services agency. Likewise, at least 19 (50%) states reported having actually conducted a tabletop or other exercise with the following agencies in the last 2 years: state emergency management, local health department, nuclear power plant agency, US Department of Energy, and National Guard Civil Support Team. Also noteworthy is the general lack of any coordination with Native American/Alaska Native authorities (45%), academic institutions (55%), and state mental health department (52%).

Coordination among all planners and responders to a radiation emergency incident is critical to an effective response. State public health agencies were asked to report whether their radiation response team meets with other public health divisions (i.e., laboratory, epidemiology, others) to coordinate responses to radiation emergency incidents. Twenty-one (55%) states reported that their teams do meet with other parts of the health department; six (16%) states reported that they do not meet with other divisions of the health agency. Eleven (29%) of 21 states reported that the radiation response team is not part of the state health agency. Half of the states without a nuclear power plant reported that the radiation response team is not located within the state health agency. States with nuclear power plants were more likely to have the radiation response team within the public health agency (only 5 (19%) states did not have the response team located in the health agency).

The 21 states that reported holding coordination meetings with other divisions of the state health agency were asked about the timing of the most recent meeting. Twelve (57%) reported meeting within the last 6 months. Four (19%) states had met 6–12 months previously, and five (24%) most recently met more than one year ago.

States were asked whether they had developed planning and response protocols for gathering epidemiologic and exposure data and for providing coordinated guidance for large-scale radiation emergency incidents that would involve more than one county in the state. Nine (24%) states reported having developed protocols for gathering epidemiologic and exposure data. Most (25 [66%]) states had no such protocols, and 4 (11%) did not know. The responses for the 27 states with a nuclear power plant were similar to the aggregated total (20%, yes; 65%, no; 15%, don't know). For the 12 states without a nuclear power plant, four (33%) reported having established protocols for gathering epidemiologic and exposure data, and eight (67%) reported no such protocols.

Thirty-six states responded to the question about planning and response protocol for providing coordinated guidance for a large-scale radiation emergency incident. Of those, 11 (31%) reported having such protocols, and 22 (61%) did not; three (8%) states did not know whether they had such protocols. Responses for the 24 states with a nuclear power plant were similar to the aggregated totals (33%, yes; 58%, no; 8%, don't know). Of the 12 states without a nuclear power plant, three (25%) reported having coordination protocols. Eight (67%) states had no such protocols, and one (8%) did not know.

E. Overall Rating of Preparedness

For the 38 responding states, the average subjective preparedness score was 4.54 (on a scale of 1.0–10.0). Preparedness for the 25 (66%) states with a nuclear power plant was 4.76 and for the 12 (32%) without a nuclear power plant, 4.08. The average score for states that listed the state Radiation Control Program Director as a contributing respondent was 4.81 (n = 33) compared with states that did not 2.80 (n = 5).

Conclusions

Although results of the self-assessment are based on a modest response rate of 76% of state public health departments, the findings may be generalizable to the entire United States because the responding states are generally representative of the nation as a whole. Responding states were geographically large and small and included all regions, dense and sparse populations, and presence and absence of nuclear power plants.

The results of this assessment indicate that in almost every measure of public health capacity and capability, the public health system remains poorly prepared to adequately respond to a major radiation emergency incident. Capabilities are insufficient or inadequate throughout the sections that measure the extent of planning in state health departments, the resources in the state health department and other state agencies, and the extent of relationships with federal and other partners. In some cases, as many as 85% of states reported insufficient capacity in specific preparedness capabilities. With the transition from scenario-based preparedness planning to all-hazards and capabilities-oriented planning, it is unclear whether current levels of support from CDC indicate a likelihood of increased effort and capabilities directed toward the unique skills and training needed to improve radiation emergency preparedness among public health agencies.

The most fundamental step of preparedness—development of response plans—has not occurred in a major proportion (45%) of states. Without a comprehensive plan, states in which a radiation emergency occurs are likely to mount inefficient, ineffective, inappropriate, or tardy responses that could result in preventable loss of life. Similarly, few states have written protocols for epidemiologic or exposure data collection or for coordinated guidance. Without such protocols, collection of information will be uncoordinated, and important comparisons may be lost because critical information failed to be collected and analyzed.

Despite longstanding awareness of the threat of unintentional releases of radioactivity within our communities, generally less than half of the states have a written plan or detailed plan of operations for responding to such releases, with the exception of plans for roadway incidents. Preparedness is even less developed in regard to intentional releases, with approximately one third of states having a written or detailed operations plan. The exception to this performance is planning for response to a radioactive dispersal device (“dirty bomb”), for which nearly half of the states have written or detailed operations plans. This exception may reflect the interest and support of federal funding for terrorism that included dispersal devices as the prototypic radiation threat in U.S. communities.

Public health agency staffing to respond to a radiation emergency incident predominantly relies on redirecting state staff from their regular assignments to radiation emergency response activities. This approach has long been used within state and local public health departments. When an emergency occurs, staff are rotated in to assist in emergency response operations, but redirected staff may not have received adequate training to execute their assignments properly. The 2010 assessment did not inquire about the training of persons who would be redirected from their regular jobs during an emergency.

Few FTEs regularly work in radiation emergency response within state public health departments. The lack of a sizable cadre of radiation emergency workers is further highlighted when the states with and without nuclear power plants are separated. States with nuclear power plants estimate having four times as many staff available to them, either directly or through redirection, than do states without such plants. This capacity may result from long-term direction and assistance from state and federal agencies that regulate nuclear power plants. Even though having a nuclear power plant within a state

increases the risk for a radiation emergency and thus the need for response capacity, non–power plant radiation emergencies are possible everywhere, and lack of adequate response personnel in many states is of concern.

In a few areas of radiation preparedness, states seem to be doing reasonably well. All but one state reported having a 24/7 on-call duty officer system that can respond to an emergency. Most states that have mutual aid agreements with other state agencies have conducted exercises with them. These bright spots are few among the otherwise consistently inadequate preparation, staffing, and planning for a radiation emergency incident.

Some of the information obtained from states that responded to the assessment can be compared with information in the 2003 assessment. Unfortunately, most of those comparisons appear to indicate either the same poor level of preparedness and planning or a decline in capacity. In 2003, only 46% of states reported no or minimal planning for crisis-phase epidemiology, whereas 70% of states reported that in 2010. Ability to interpret health physics of an acute radiation incident was reported as none or minimal in 54% of states in 2003 and 73% in 2010. These observations clearly indicate a longstanding failure of state public health agencies to develop adequate planning and preparedness capacity to respond to any major radiation emergency.

The results from this assessment highlight the many aspects specific to radiation emergency response for which states are not adequately prepared, and it supports findings of earlier assessments (e.g., laboratory capabilities) (*2*). CDC has undertaken a number of activities to improve on this situation (*3*). Formation of the National Alliance for Radiation Readiness is an important step in improved coordination of public health's role in radiation emergency response. Based on the findings of this report, CSTE recommends the following activities, to be conducted by CDC and member organizations of the Alliance:

- Collect and disseminate best practices in state-based radiation response plans (excluding nuclear power plant plans) by coordinating with CSTE's "disaster epidemiology" (*4*) workgroup in the development of plans for radiation exposure public health surveillance.
- Explore with CDC how to best incorporate radiation preparedness as a priority under the new all-hazards guidance and appropriate capabilities development.
- Substantially increase training in radiation emergency response for public health personnel, including the emerging roles of the newly created Preparedness and Emergency Response Learning Centers
- Conduct strategic planning for activities that will increase collaboration between state public health personnel in CDC-funded preparedness and radiation protection personnel, including the health physicists, radiation equipment licensing and inspection personnel, who are often in the regulatory, rather than public health, area of health departments or who may not be in the health department at all.
- Develop exercise templates for non–nuclear power plant radiation release scenarios that would apply at the state and local health department levels (i.e., not huge but still impactful).
- Increase coordination with the Office of the Assistant Secretary for Preparedness and Response (ASPR) at the federal level and ASPR-funded state health department programs on aspects of radiation preparedness at the state and local levels that involve medical treatment, hospital surge, etc.
- Encourage local and state health departments to establish collaborations and connections with state, regional, and federal response partners who are versed in responding to incidents involving radiation (e.g., Civil Support Team of the state National Guard, regional response teams, Federal Emergency Management Agency, and Department of Energy radiation response teams).

References

1. CSTE. A national assessment of the status of planning for public health preparedness for chemical and radiological contaminating terrorism. CSTE's findings and recommendations [cited Sept 12, 2010]. Atlanta: CSTE; 2004. Available at http://www.cste.org/dnn/LinkClick.aspx?fileticket=vtcs94oAGYE%3d&tabid=175&mid=716
2. Association of Public Health Laboratories. 2009 APHL All-Hazards Laboratory Preparedness Survey data. Silver Spring, MD: Association of Public Health Laboratories; 2010. Available at http://www.aphl.org/aphlprograms/ep/ahr/documents/aphlallhazwhitepaperepr.pdf
3. CDC Grand Rounds: Radiological and Nuclear Preparedness. MMWR 2010;59;1178–81.
4. Council of State and Territorial Epidemiologists. Disaster Epi Workshop. Available at http://www.cste.org/dnn/ProgramsandActivities/DisasterEpiWorkshop/tabid/404/Default.aspx

Appendix 1

Assessment tool

STATE PUBLIC HEALTH PREPAREDNESS AND RESPONSE CAPABILITIES TO RADIATION EMERGENCIES

BACKGROUND:

In 2003, CSTE conducted a national assessment of the status of planning for public health preparedness for chemical and radiation terrorism. Significant gaps in preparedness and response capabilities were identified and the results have been used to inform continuing national efforts to improve preparedness and response capabilities. Activities and capabilities related to *radiation emergency* preparedness and response are the focus of recent activity of the Centers for Disease Control and Prevention (CDC), the Conference of Radiation Control Program Directors (CRCPD), the Association of State and Territorial Health Officials (ASTHO), the Association of Public Health Laboratories (APHL), the National Association of County and City Health Officials (NACCHO), and CSTE. This "alliance" has worked to increase awareness and understanding of the varied responsibilities for preparing for radiation emergencies, as well as improving communication across the divergent communities with preparedness and response responsibilities. A more current assessment of the nation's capabilities to prepare and respond to radiation incidents (not just terrorism) is needed. To that end, CSTE has created this assessment to focus on radiation emergency incidents only (not related to nuclear power plant operations) and your information is needed to assess the current status and determine if capabilities have improved over the last 7 years.

INSTRUCTIONS:

Since the responsibility for radiation emergency preparedness and response is often dispersed among state health agencies, it will likely require collaboration to complete this assessment. CSTE asks that the State Epidemiologist should assume or assign the role of the "project leader" to assure that all questions get answered. We suggest printing out copies of the assessment for the various responders and collect, collate and report the findings electronically. Please coordinate the final submission so it represents the best information from the involved agencies in your state. You may use the comment field below each of the tables to add any additional information that is relevant to your state, but was not covered in the table.

CSTE will not release state-specific information in any reports unless otherwise requested of, and approved by the state(s).

Please do NOT include response or capability functions directly related to an existing nuclear power plant radiation safety plan unless specifically noted.

ASSESSMENT DUE DATE IS ON OR BEFORE August 27, 2010

If you have questions or difficulties in completing the online questionnaire please contact:

Erin Simms
CSTE National Office
Email: esimms@cste.org
Phone: (770)458-3811
Fax: (770)458-8516

The State Epidemiologist (or designee) is asked to complete any areas in which they are knowledgeable and to coordinate and collate responses from other staff to submit a single assessment response which is representative of your state's radiation and health response capabilities.

Primary respondent's contact information: State Epidemiologist or Designee	
Name	

Degree(s)	
Title	
Agency	
Address	
Address	
City	
State	
Zip	
Telephone	
Fax	
Email	

Please include names and contact information for other contributing respondents below:

Contributing respondent's contact information: ***Radiation Control Program Director (CRCPD Representative)***	
Name	
Degree(s)	
Title	
Agency	
Address	
Address	
City	
State	
Zip	
Telephone	
Fax	
Email	

Contributing respondent's contact information: Environmental Public Health Director or Designee	
Name	
Degree(s)	
Title	
Agency	
Address	
Address	
City	
State	
Zip	
Telephone	
Fax	
Email	

Contributing respondent's contact information: State Public Health Laboratory Director or Designee	
Name	
Degree(s)	
Title	
Agency	
Address	
Address	
City	
State	
Zip	
Telephone	
Fax	
Email	

Definition:

Radiation Emergency is the release of radioactive material that may pose a threat to the public health. This includes unintentional releases (transportation accidents, hospital or other fixed place releases), and intentional releases (covert or overt dispersal of radioactive material or detonation of a nuclear device).

Radiation Emergency Preparedness and Response Capability: Planning and Resources

1. In this table we have listed public health functions in the event of a radiation emergency. In the space provided in the tables below, select the phrase that best characterizes your state of planning to perform these functions and the resources available to do them with regard to radiation emergencies. **Please do NOT consider any nuclear power plant preparedness**.

Function	**Extent of Planning in State Health Dept.**	**Resources in State Health Department**	**Resources in other state agencies**	**Established relations with Federal Agencies**
	1. None 2. Minimal 3. Written plan 4. Detailed operations plan	1. None 2. None dedicated 3. Some dedicated 4. Sufficient # and level 5. Uncertain	1. None 2. None dedicated 3. Some dedicated 4. Sufficient # and level 5. Uncertain	1. None 2. Minimal 3.Sufficient # and level 4. Uncertain
Epidemiologic Functions: Potential Human Impacts of Radiation				
Syndromic Surveillance related to radiation incident.				
Other kind of Surveillance (e.g. poison control calls, pharmaceutical purchases, school absenteeism), not included above.				
Surveillance through astute healthcare providers reporting.				
Crisis phase epidemiology (e.g. documenting acute morbidity, outbreak style investigation)				
Recovery phase epidemiology (e.g. documenting delayed health effects, exposure registries)				
Exposure Assessment				
Advice regarding Radiation Exposure assessment				
Advice regarding Environmental Sampling				
Advice regarding Biological / Clinical Sampling				
Ability to conduct population-based exposure monitoring				
For Environmental Samples:				
Ability to collect for radioactivity analysis				
Ability to process for radioactivity analysis				
Ability to ship for radioactivity analysis				
Ability to conduct radioactivity analysis				
For Biological / Clinical Samples:				
Ability to collect for radiation analysis				
Ability to process for radiation analysis				
Ability to ship for radiation analysis				
Ability to conduct radiation analysis				

Function	Extent of Planning	Resources in State Health Department	Resources in other state agencies	Established relations with Federal Agencies
	1. None 2. Minimal 3. Written plan 4. Detailed operations plan	1. None 2. None dedicated 3. Some dedicated 4. Sufficient # and level 5. Uncertain	1. None 2. None dedicated 3. Some dedicated 4. Sufficient # and level 5. Uncertain	1. None 2. Minimal 3.Sufficient # and level 4. Uncertain
Health Assessment				
Health Physics Interpretation of Acute Incident – Radiation				
Health Physics Consultation on Reentry – Radiation				
Health Physics Predictions on Long Term Health Effects - Radiation				
Medicine Consults regarding radiation effects				
Early Detection of Radiation contamination in First Responders				
IT/GIS integration of radiation exposure data				
Other Public Health Functions				
Worker Health /Safety Consultation– Radiation				
Health Alerts/ Electronic Communication				
Potassium Iodide or other radiation prophylactic/therapeutic drug plan				
Risk Communication				
Community relations				

Comments RE Table 1: _____

2. Do you have a finalized written radiation response plan for your state or territorial public health agency, exclusive of your agency's section of the nuclear power plant emergency response plan?

☐Yes ☐No ☐Don't Know

If yes, if your radiation response plan is available on the internet, please provide the URL
_____ (Enter NA if not available on web)

If yes, has your agency conducted a drill or exercise of your plan?

☐Yes ☐No ☐Don't Know

If yes, when was the latest drill or exercise? (Select One)

☐Within last 6 months ☐Longer than 6 months but less than 12 months ago

☐Between 1 and 2 years ago ☐Longer than 2 years ago

3. Which of the following radiation emergency scenarios have you *planned* for a *public health response*?
In the space provided, select the phrase that best characterizes your state of planning to perform these functions and the resources available to do them.

Release Type	**Extent of Planning**
Radiation Incidents	1. None 2. Minimal 3. Written plan 4. Detailed operations plan
Unintentional Incidents	
Transportation: Roadway	
Transportation: Waterway	
Hospital or Medical	
Fixed Facility (not hospital or nuclear power plant)	
Intentional Incidents	
Mass gatherings (e.g. Superbowl)	
Significant location (e.g. capitol building)	
Explosive device, dispersal (i.e. dirty bomb)	
Silent dispersal, (i.e. intentional radiation material poisoning)	
Nuclear detonation, including improvised nuclear device (IND)	

Comments RE Table 3: _____

4. Does your agency have a 24/7 on-call, duty officer system that would provide a prompt response to a radiation emergency incident?

☐Yes ☐No ☐Don't Know

5. Do you have mutual aid agreements for radiation emergency response with other states?

☐Yes ☐No ☐Don't Know

6. Do you have mutual aid agreements for radiation emergency response with other state agencies in your state?

☐Yes ☐No ☐Don't Know

If yes above, list the state agencies: _____

If yes above, have you ever drilled or exercised with those mutual aid partners?

☐Yes ☐No ☐Don't Know

Radiation Emergency FTE's in State Health Departments

7. Please denote the number of state health department FTEs (decimals are allowed) funded to spend all or part of their time on <u>radiation emergency preparedness and response activities other than power plant emergency preparedness, by funding source</u>. Please note: the last column refers to state health department FTEs funded by nuclear power plants but who may also work on non-power plant radiation emergency issues as well.

	CDC PHEP* Funded	Other CDC Funded	State Funded	Re-Directed State Staff**	Other Federal Funds	TOTAL FTEs	Nuclear Power Plant Funded
Planning							
Epidemiology							
Biomonitoring Laboratory							
Environmental Laboratory							
Radiation							
Occupational Health/ Industrial Hygiene							
Risk Communication							
Sanitary Engineering							
Food Science							
Other							
Total							

* CDC Public Health Emergency Preparedness funding

**Redirected state staff refers to employees who work in other areas of the department, but in the event of a radiation emergency would be directed to work on the response.

Comments RE Table 7 _____

Local Relationships

8. Do you (or your staff) know the lead contacts in each local health department for radiation public health response by name?

☐Yes, all of them. ☐Yes, some of them ☐No ☐None exist at local health department

9. Does your health department provide training to local jurisdictions on any aspect of radiation emergency preparedness and response?

☐Yes ☐No ☐Don't Know

Interagency Coordination on Radiation Emergency Preparedness and Response Activities

10. Please check the box that best describes the degree of coordination between state public health and the following agencies for radiation emergencies:

	No Contacts	Coordination Begun	Tabletop or other Exercise Conducted in the last 2 years	MOUs in Place
Regional FBI	☐	☐	☐	☐
State Emergency Management	☐	☐	☐	☐
State Water Regulator	☐	☐	☐	☐
State Food Regulator	☐	☐	☐	☐
State Environmental Health Agency	☐	☐	☐	☐
State Environmental Agency	☐	☐	☐	☐
State Agricultural Agency	☐	☐	☐	☐
State Hazardous Waste Regulator	☐	☐	☐	☐
Local Health Department	☐	☐	☐	☐
Nuclear Power Plant	☐	☐	☐	☐
Academic Institutions	☐	☐	☐	☐
Red Cross	☐	☐	☐	☐
US Department of Energy	☐	☐	☐	☐
US Military Forces	☐	☐	☐	☐

National Guard Civil Support Team	☐	☐	☐	☐
Poison Control Centers	☐	☐	☐	☐
State Mental Health Dept	☐	☐	☐	☐
State EMS Agency	☐	☐	☐	☐
Native Americans/Alaskan Natives	☐	☐	☐	☐
Other:	☐	☐	☐	☐

Comments RE Table 10

_____

11. Overall, how prepared is your state or territorial health agency to respond to a significant radiation emergency incident? *(On a scale of 0-10, with 0 being not prepared and 10 being fully prepared. Again, this does **not** include a nuclear power plant emergency)*

12. Is the role of the public health agency well-defined for the crisis and recovery phases in your plan? (Check those that apply. If neither apply, check Not Applicable)

☐Crisis Role well defined ☐Recovery Role well defined

13. Does the radiation response team in the public health agency meet with other public health divisions (Lab, Epidemiology, others) in order to coordinate responses to radiation emergency incidents?

☐Yes ☐No ☐Don't Know ☐Response team not in public health agency.

If Yes, have you met: ☐Within the last 6 months. ☐More than 6 months but less than 1 year ago

☐More than 1 year ago

14. Have you planned a clear planning and response protocol for gathering epidemiological and exposure data and providing coordinated guidance for a radiation incident involving more than one county in your state?

☐Yes ☐No ☐Don't Know

15. Any additional comments regarding any part of this assessment: _____

_____

_____

_____

THANK YOU FOR COMPLETING THIS ASSESSMENT! If you have any questions, please contact Erin Simms at esimms@cste.org.

Appendix 2

Tables of Planning Responses

Table 1. Extent of Planning in State Health Departments for Radiation Emergencies

Epidemiologic Function	None, No. (%)	Minimal, No. (%)	Written Plan, No. (%)	Detailed Operations Plan, No. (%)
Potential Human Impacts of Radiation				
Syndromic surveillance related to radiation incident	13 (34.2)	18 (47.4)	4 (10.5)	3 (7.9)
Other kind of surveillance (e.g., poison control calls, pharmaceutical purchases, school absenteeism), not included above	8 (21.1)	20 (52.6)	6 (15.8)	4 (10.5)
Surveillance through astute healthcare providers reporting	12 (32.4)	19 (51.4)	3 (8.1)	3 (8.1)
Crisis-phase epidemiology (e.g., documenting acute morbidity, outbreak-style investigation)	7 (18.9)	19 (51.4)	5 (13.5)	6 (16.2)
Recovery-phase epidemiology (e.g., documenting delayed health effects, exposure registries)	10 (27.0)	21 (56.8)	3 (8.1)	3 (8.1)
Exposure Assessment				
Advice for radiation exposure assessment	2 (5.3)	14 (36.8)	13 (34.2)	9 (23.7)
Advice regarding environmental sampling	6 (15.8)	13 (34.2)	11 (28.9)	8 (21.1)
Advice regarding biological/clinical sampling	5 (13.5)	22 (59.5)	7 (18.9)	3 (8.1)
Ability to conduct population-based exposure monitoring	8 (21.1)	20 (52.6)	8 (21.1)	2 (5.3)
For Environmental Samples				
Ability to collect for radioactivity analysis	10 (27.0)	7 (18.9)	9 (24.3)	11 (29.7)
Ability to process for radioactivity analysis	9 (24.3)	11 (29.7)	9 (24.3)	8 (21.6)
Ability to ship for radioactivity analysis	10 (27.0)	13 (35.1)	9 (24.3)	5 (13.5)
Ability to conduct radioactivity analysis	10 (27.0)	13 (35.1)	5 (13.5)	9 (24.3)
For Biological/Clinical Samples				
Ability to collect for radioactivity analysis	10 (26.3)	21 (55.3)	4 (10.5)	3 (7.9)
Ability to process for radioactivity analysis	14 (37.8)	14 (37.8)	5 (13.5)	4 (10.8)
Ability to ship for radioactivity analysis	10 (26.3)	18 (47.4)	6 (15.8)	4 (10.5)
Ability to conduct radioactivity analysis	17 (45.9)	15 (40.5)	3 (8.1)	2 (5.4)
Health Assessment				
Health physics interpretation of acute incident—radiation	7 (18.4)	17 (44.7)	9 (23.7)	5 (13.2)
Health physics consultation on reentry—radiation	11 (28.9)	7 (18.4)	15 (39.5)	5 (13.2)
Health physics predictions on long-term health effects—radiation	13 (34.2)	12 (31.6)	8 (21.1)	5 (13.2)
Medicine consults regarding radiation effects	9 (24.3)	17 (45.9)	8 (21.6)	3 (8.1)
Early detection of radiation contamination in first responders	6 (15.8)	10 (26.3)	12 (31.6)	10 (26.3)
IT/GIS integration of radiation exposure data	11 (28.9)	19 (50.0)	7 (18.4)	1 (2.6)
Other Public Health Functions				
Worker health/safety consultation—radiation	5 (13.2)	14 (36.8)	16 (42.1)	3 (7.9)
Health alerts/electronic communication	3 (7.9)	9 (23.7)	16 (42.1)	10 (26.3)
Potassium iodide or other radiation	2 (5.4)	8 (21.6)	19 (51.4)	8 (21.6)

prophylactic/therapeutic drug plan				
Risk communication	3 (7.9)	10 (26.3)	18 (47.4)	7 (18.4)
Community relations/public communications	3 (7.9)	13 (34.2)	16 (42.1)	6 (15.8)

Table 2. Resources Available in State Health Departments for Radiation Emergencies

Epidemiologic Function	None, No. (%)	None Dedicated, No. (%)	Some Dedicated, No. (%)	Sufficient # and Level, No. (%)	Uncertain, No. (%)
Potential Human Impacts of Radiation					
Syndromic surveillance related to radiation incident.	3 (7.9)	17 (44.7)	15 (39.5)	2 (5.3)	1 (2.6)
Other kind of surveillance (e.g., poison control calls, pharmaceutical purchases, school absenteeism), not included above.	2 (5.3)	19 (50.0)	14 (36.8)	2 (5.3)	1 (2.6)
Surveillance through astute healthcare providers reporting	5 (13.5)	13 (35.1)	13 (35.1)	4 (10.8)	2 (5.4)
Crisis-phase epidemiology (e.g., documenting acute morbidity, outbreak-style investigation)	3 (8.1)	15 (40.5)	15 (40.5)	2 (5.4)	2 (5.4)
Recovery-phase epidemiology (e.g., documenting delayed health effects, exposure registries)	6 (16.2)	17 (45.9)	10 (27.0)	2 (5.4)	2 (5.4)
Exposure Assessment					
Advice for radiation exposure assessment	1 (2.6)	11 (28.9)	17 (44.7)	9 (23.7)	0
Advice regarding environmental sampling	3 (8.1)	9 (24.3)	17 (45.9)	8 (21.6)	0
Advice regarding biological/clinical sampling	4 (10.8)	15 (40.5)	13 (35.1)	4 (10.8)	1 (2.7)
Ability to conduct population-based exposure monitoring	5 (13.5)	16 (43.2)	13 (35.1)	3 (8.1)	0
For Environmental Samples					
Ability to collect for radioactivity analysis	6 (16.7)	6 (16.7)	19 (52.8)	4 (11.1)	1 (2.8)
Ability to process for radioactivity analysis	6 (16.7)	7 (19.4)	18 (50.0)	4 (11.1)	1 (2.8)
Ability to ship for radioactivity analysis	6 (16.7)	9 (25.0)	17 (47.2)	3 (8.3)	1 (2.8)
Ability to conduct radioactivity analysis	8 (22.2)	5 (13.9)	17 (47.2)	5 (13.9)	1 (2.8)
For Biological/Clinical Samples					
Ability to collect for radioactivity analysis	7 (18.4)	20 (52.6)	8 (21.1)	2 (5.3)	1 (2.6)
Ability to process for radioactivity analysis	11 (29.7)	12 (32.4)	9 (24.3)	4 (10.8)	1 (2.7)
Ability to ship for radioactivity analysis	8 (21.1)	17 (44.7)	8 (21.1)	4 (10.5)	1 (2.6)
Ability to conduct radioactivity analysis	13 (35.1)	13 (35.1)	7 (18.9)	3 (8.1)	1 (2.7)
Health Assessment					
Health physics interpretation of acute incident—radiation	5 (13.2)	14 (36.8)	15 (39.5)	4 (10.5)	0

Health physics consultation on reentry—radiation	5 (13.2)	12 (31.6)	17 (44.7)	4 (10.5)	0
Health physics predictions on long-term health effects—radiation	6 (15.8)	13 (34.2)	15 (39.5)	2 (5.3)	2 (5.3)
Medicine consults regarding radiation effects	6 (15.8)	20 (52.6)	8 (21.1)	3 (7.9)	1 (2.6)
Early detection of radiation contamination in first responders	5 (13.5)	15 (40.5)	10 (27.0)	7 (18.9)	0
IT/GIS integration of radiation exposure data	10 (26.3)	16 (42.1)	9 (23.7)	2 (5.3)	1 (2.6)
Other Public Health Functions					
Worker health/safety consultation—radiation	2 (5.3)	13 (34.2)	17 (44.7)	5 (13.2)	1 (2.6)
Health alerts/electronic communication	0	10 (26.3)	18 (47.4)	10 (26.3)	0
Potassium iodide or other radiation prophylactic/therapeutic drug plan	1 (2.6)	10 (26.3)	20 (52.6)	7 (18.4)	0
Risk communication	0	10 (26.3)	22 (57.9)	6 (15.8)	0
Community relations/public communications	1 (2.6)	11 (28.9)	20 (52.6)	6 (15.8)	0

Table 3. Resources Available in Other State Agencies for Radiation Emergencies

Epidemiologic Function	None, No. (%)	None Dedicated, No. (%)	Some Dedicated, No. (%)	Sufficient # and Level, No. (%)	Uncertain, No. (%)
Potential Human Impacts of Radiation					
Syndromic surveillance related to radiation incident	16 (42.1)	8 (21.1)	7 (18.4)	1 (2.6)	6 (15.8)
Other kind of surveillance (e.g., poison control calls, pharmaceutical purchases, school absenteeism), not included above	14 (36.8)	6 (15.8)	8 (21.1)	2 (5.3)	8 (21.1)
Surveillance through astute healthcare providers reporting	14 (37.8)	7 (18.9)	5 (13.5)	2 (5.4)	9 (24.3)
Crisis-phase epidemiology (e.g., documenting acute morbidity, outbreak-style investigation)	16 (43.2)	9 (24.3)	4 (10.8)	1 (2.7)	7 (18.9)
Recovery-phase epidemiology (e.g., documenting delayed health effects, exposure registries)	17 (45.9)	7 (18.9)	3 (8.1)	1 (2.7)	9 (24.3)
Exposure Assessment					
Advice for radiation exposure assessment	3 (8.1)	7 (18.9)	16 (43.2)	6 (16.2)	5 (13.5)
Advice regarding environmental sampling	3 (8.1)	8 (21.6)	17 (45.9)	5 (13.5)	4 (10.8)
Advice regarding biological/clinical sampling	8 (22.2)	9 (25.0)	11 (30.6)	3 (8.3)	5 (13.9)
Ability to conduct population-based exposure monitoring	4 (11.1)	9 (25.0)	12 (33.3)	4 (11.1)	7 (19.4)
For Environmental Samples					
Ability to collect for radioactivity analysis	2 (5.7)	7 (20.0)	19 (54.3)	3 (8.6)	4 (11.4)
Ability to process for radioactivity analysis	7 (20.0)	5 (14.3)	13 (37.1)	4 (11.4)	6 (17.1)
Ability to ship for radioactivity analysis	4 (11.4)	8 (22.9)	12 (34.3)	4 (11.4)	7 (20.0)
Ability to conduct radioactivity analysis	9 (25.7)	6 (17.1)	11 (31.4)	4 (11.4)	5 (14.3)
For Biological/Clinical Samples:					
Ability to collect for radioactivity analysis	14 (37.8)	6 (16.2)	8 (21.6)	3 (8.1)	6 (16.2)
Ability to process for radioactivity analysis	15 (40.5)	6 (16.2)	7 (18.9)	3 (8.1)	6 (16.2)
Ability to ship for radioactivity analysis	15 (40.5)	6 (16.2)	7 (18.9)	3 (8.1)	6 (16.2)
Ability to conduct radioactivity analysis	15 (40.5)	7 (18.9)	6 (16.2)	3 (8.1)	6 (16.2)
Health Assessment					
Health physics interpretation of acute incident—radiation	8 (21.6)	10 (27.0)	9 (24.3)	5 (13.5)	5 (13.5)
Health physics consultation on reentry—radiation	7 (18.9)	11 (29.7)	11 (29.7)	4 (10.8)	4 (10.8)
Health physics predictions on long-term health effects—radiation	7 (18.9)	14 (37.8)	8 (21.6)	4 (10.8)	4 (10.8)

Medicine consults regarding radiation effects	13 (35.1)	12 (32.4)	4 (10.8)	3 (8.1)	5 (13.5)
Early detection of radiation contamination in first responders	6 (16.2)	5 (13.5)	17 (45.9)	7 (18.9)	2 (5.4)
IT/GIS integration of radiation exposure data	5 (13.5)	7 (18.9)	14 (37.8)	4 (10.8)	7 (18.9)
Other Public Health Functions					
Worker health/safety consultation—radiation	4 (11.1)	10 (27.8)	15 (41.7)	3 (8.3)	4 (11.1)
Health alerts/electronic communication	4 (11.1)	6 (16.7)	14 (38.9)	5 (13.9)	7 (19.4)
Potassium iodide or other radiation prophylactic/therapeutic drug plan	7 (19.4)	9 (25.0)	15 (41.7)	2 (5.6)	3 (8.3)
Risk communication	2 (5.6)	6 (16.7)	18 (50.0)	6 (16.7)	4 (11.1)
Community relations/public communications	1 (2.9)	5 (14.3)	21 (60.0)	4 (11.4)	4 (11.4)

Table 4. State Health Department Relationships Established with Federal Agencies for Radiation Emergencies

Epidemiologic Function	None, No. (%)	Some, No. (%)	Sufficient # and Level, No. (%)	Uncertain, No. (%)
Potential Human Impacts of Radiation				
Syndromic surveillance related to radiation incident	9 (23.7)	18 (47.4)	6 (15.8)	5 (13.2)
Other kind of surveillance (e.g., poison control calls, pharmaceutical purchases, school absenteeism), not included above	10 (26.3)	15 (39.5)	8 (21.1)	5 (13.2)
Surveillance through astute healthcare providers reporting	12 (32.4)	8 (21.6)	10 (27.0)	7 (18.9)
Crisis-phase epidemiology (e.g., documenting acute morbidity, outbreak-style investigation)	10 (27.0)	10 (27.0)	10 (27.0)	7 (18.9)
Recovery-phase epidemiology (e.g., documenting delayed health effects, exposure registries)	11 (29.7)	10 (27.0)	9 (24.3)	7 (18.9)
Exposure Assessment				
Advice for radiation exposure assessment	3 (7.9)	9 (23.7)	23 (60.5)	3 (7.9)
Advice regarding environmental sampling	3 (7.9)	8 (21.1)	24 (63.2)	3 (7.9)
Advice regarding biological/clinical sampling	2 (5.4)	13 (35.1)	18 (48.6)	4 (10.8)
Ability to conduct population-based exposure monitoring	4 (10.5)	10 (26.3)	16 (42.1)	8 (21.1)
For Environmental Samples				
Ability to collect for radioactivity analysis	2 (5.4)	6 (16.2)	24 (64.9)	5 (13.5)
Ability to process for radioactivity analysis	2 (5.4)	8 (21.6)	21 (56.8)	6 (16.2)
Ability to ship for radioactivity analysis	1 (2.7)	11 (29.7)	18 (48.6)	7 (18.9)
Ability to conduct radioactivity analysis	1 (2.7)	9 (24.3)	21 (56.8)	6 (16.2)
For Biological/Clinical Samples				
Ability to collect for radioactivity analysis	7 (18.9)	11 (29.7)	13 (35.1)	6 (16.2)
Ability to process for radioactivity analysis	6 (16.7)	12 (33.3)	12 (33.3)	6 (16.7)
Ability to ship for radioactivity analysis	7 (18.9)	11 (29.7)	13 (35.1)	6 (16.2)
Ability to conduct radioactivity analysis	6 (16.7)	12 (33.3)	12 (33.3)	6 (16.7)
Health Assessment				
Health physics interpretation of acute incident—radiation	1 (2.6)	8 (21.1)	24 (63.2)	5 (13.2)
Health physics consultation on reentry—radiation	1 (2.6)	9 (23.7)	23 (60.5)	5 (13.2)
Health physics predictions on long–term health effects—radiation	3 (7.9)	8 (21.1)	22 (57.9)	5 (13.2)
Medicine consults regarding radiation effects	3 (7.9)	10 (26.3)	20 (52.6)	5 (13.2)
Early detection of radiation contamination in first responders	4 (10.5)	10 (26.3)	17 (44.7)	7 (18.4)
IT/GIS integration of radiation exposure data	5 (13.2)	7 (18.4)	17 (44.7)	9 (23.7)
Other Public Health Functions				
Worker health/safety consultation—radiation	1 (2.6)	10 (26.3)	21 (55.3)	6 (15.8)
Health alerts/electronic communication	2 (5.3)	8 (21.1)	19 (50.0)	9 (23.7)
Potassium iodide or other radiation	0	12 (31.6)	21 (55.3)	5 (13.2)

prophylactic/therapeutic drug plan				
Risk communication	2 (5.3)	7 (18.4)	22 (57.9)	7 (18.4)
Community relations/public communications	4 (10.5)	9 (23.7)	18 (47.4)	7 (18.4)