Public Health England

University of Hertfordshire

US mass casualty decontamination provision: An online survey of current practice

Sarah Power, Charles Symons, Holly Carter & Richard Amlôt
Behavioural Science Team, Emergency Response Department
Health Protection and Medical Directorate, Public Health England, UK

Jo Larner, Hazem Matar & Rob Chilcott
Research Centre for Transdermal Drug Delivery and Toxicology
School of Pharmacy, University of Hertfordshire, UK

15th October 2014

Contents

Abstract

The University of Hertfordshire and Public Health England have collaborated on a Tier 1 Mass Casualty Decontamination research project on behalf of Health and Human Services' Biomedical Advances Research and Development Authority (BARDA). As part of this initiative, an online survey was conducted to explore current US Fire Departments' decontamination practices, and their preparedness for responding to incidents involving mass casualty decontamination.

A total of 68 responses were received from 35 cities within 21 US States. The majority of survey respondents had been involved in real-life incidents involving mass casualty decontamination. Details of response times to reach contaminated casualties, disrobing, approaches to decontamination, characteristics of the decontamination showering process, provision for special populations, and post-decontamination actions were elicited from survey respondents.

Although many US fire departments routinely use the "ladder-pipe system" (LPS) for conducting rapid, gross decontamination of casualties, a number of other methods are also employed. The survey revealed significant variability in LPS construction, such as the position and number of fire hoses used. The majority of US fire departments reported not having the capability to control the water temperature and water pressure when performing LPS decontamination, nor would they routinely add detergent to the shower water. Shower duration was also variable, ranging from 30secs to 10mins. Only sixty-four per cent of respondents stated they would instruct casualties to disrobe prior to showering, and a range of options were suggested for managing casualties refusing to disrobe and to meet the additional needs of vulnerable groups.

The survey highlights significant variability in the implementation of current decontamination guidance across US States. These inconsistencies are thought to reflect established 'perceived best-practice' and local adaptation of response plans to address practical and logistical constraints. The survey results highlight the need for evidence-based, national guidelines for conducting mass casualty decontamination in chemical emergencies.

Introduction

The use of chemical, biological, radiological and nuclear (CNRN) material and weapons remains a global threat (HM Government, 2010; Schneidmiller, 2012). Due to the adverse effects of chemical incidents, the US Government considers both deliberate and accidental release to be a serious threat to public health (Cibulsky & Ignacio, 2012; US Department of Health and Human Services, 2012). National or regional guidelines are in place in the US and many other countries for responding to mass casualty incidents arising from exposure to CBRN materials (Annelli, 2006; Baker, 2007).

If an incident involving a CBRN agent were to occur, one intervention which could be employed to minimise the impact on public health is emergency decontamination. Decontamination can be defined as the process of removing the hazardous contaminant on the external surfaces of the body in order to reduce exposure to the contaminant and minimise the risk of subsequent adverse health effects (Chilcott, 2014). Mass decontamination is described as “the emergency removal of contamination quickly from large numbers of victims” (Maniscalco & Christen, 2010). The decontamination of large numbers of casualties is currently most often performed by showering with water to remove contaminants from the skin surface (Matar et al, 2014).

Rapid physical removal of a hazardous agent is the most important aspect of decontamination, in order to reduce the impact of chemical contamination (Houston & Hendrickson, 2005; Amlôt et al, 2010). The act of disrobing (removal of clothing) is a highly effective method for removing hazardous contaminants from casualties and is suggested to be implemented at the earliest opportunity during incident response (Chilcott, 2014; Matar et al, 2010). It is important that casualties disrobe prior to showering, since failure to do so can facilitate increased transfer of any contaminant on to the skin (Chilcott, 2014). Disrobing should then followed by gross decontamination, which is commonly achieved using the “Ladder-Pipe System” (LPS), whereby two fire trucks shower casualties with large volumes of water under relatively low pressure (Lake et al, 2000; see Figure 1 overleaf). It is recommended that casualties walk slowly through the decontamination corridor with their heads back, and arms and legs extended, and that they occasionally turn 90 degrees (Lake, Schulze, & Gougelet, 2013). LPS decontamination may then be followed by secondary or technical decontamination in a specialised mass decontamination unit. The decision as to whether or not to carry out secondary decontamination will depend on the type of contaminant and the extent of the contamination (Lake et al, 2013).

Figure 1. Demonstration of the ladder pipe system (LPS) for mass casualty decontamination. Casualties are directed to walk through a high volume water mist generated by overhead and side fogging nozzles from two adjacent fire tenders.

The characteristics of the showering process have been shown to be important contributors to the effectiveness of decontamination. Recent research has shown that the optimal duration for shower-based decontamination is between 60 and 90 seconds and the recommended water temperature for decontamination is 35°C (Larner et al, 2010; Amlôt et al, 2011). Furthermore, the use of detergent has been recommended to optimise shower-based decontamination (Jones et al, 2010). Current decontamination guidance recommends that a high volume of water be delivered at a minimum of 60 pounds per square inch (PSI) to ensure that hazardous agents are removed (SBCCOM, 2000). Weather may also impact the manner in which a chemical agent will act in the environment and will therefore have an impact on decontamination requirements. For example, strong wind, heavy rain, or temperatures below freezing may reduce the effects of contamination (Maniscalco & Christen, 2010). Decontamination during cold or adverse weather may increase the risk of hypothermia, and the decontamination process may need to be adapted accordingly (e.g. implementing dry decontamination instead of wet decontamination) (Cibulsky & Ignacio, 2012). Following decontamination it is recommended that casualties be provided with temporary clothing, in order to provide warmth and restore modesty (Lake, Schulze, & Gougelet, 2013).

The needs of a diverse population and in particular vulnerable groups must be considered during the decontamination process. Following the attacks of September 11, 2001, the National Organisation on Disability launched the Emergency Preparedness Initiative to ensure that emergency managers and first responders address disability concerns, and that people with disabilities are included in all levels of emergency planning, response, and recovery (CBRNE). Guidance suggests that those with disabilities be allowed to retain any equipment which enables them to maintain independence and self-control (e.g. glasses, hearing aids etc) (Cibulsky & Ignacio, 2012). Carter et al (2012) have recently suggest that ambulatory casualties can to some extent be relied upon to assist those around them, including those with physical or cognitive impairments, children or elderly casualties, moving away from the source of contamination and initiating self-care decontamination procedures. However, an effective communication strategy to convey the importance of these steps will be essential as emergency responders help to manage contaminated casualties (Carter et al., 2013a, 2014).

This study explored decontamination practices and preparedness for chemical incidents in US fire departments via an online survey, in order to explore regional variations and consistency with current evidence and guidance for mass casualty decontamination. Survey questions related to: the response time to reach contaminated casualties, approaches to disrobing, the characteristics of the decontamination showering process, provision for special populations, and the management of casualties post-decontamination. The study informed an on-going collaborative research programme conducted by University of Hertfordshire and Public Health England on behalf of Health and Human Services' Biomedical Advances Research and Development Authority (BARDA), which is developing the evidence-base for effective emergency decontamination procedures (e.g. Matar et al, 2014).

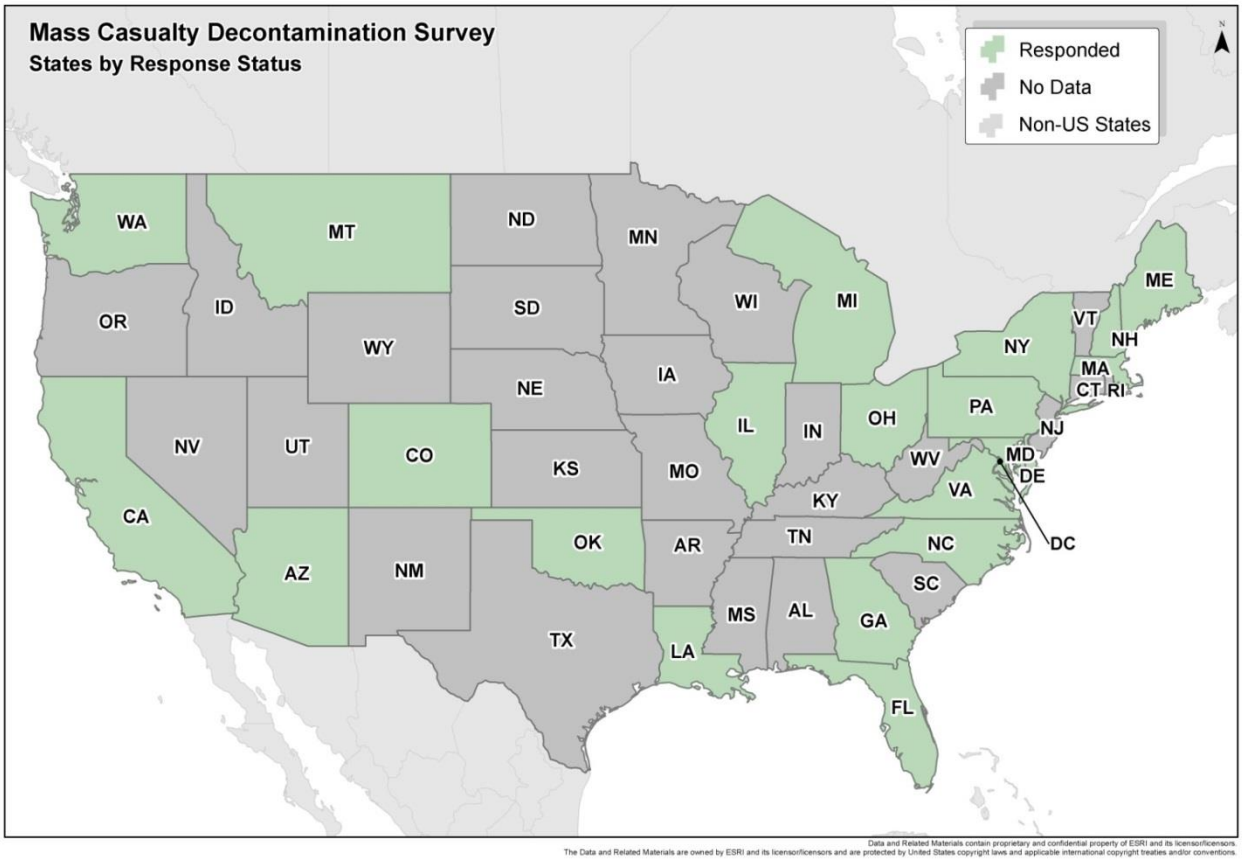

Figure 2: Survey respondents in the contiguous USA (Nb. no responses were received from Hawaii or Alaska).

Methodology

Participants

A total of 68 participants responded to the survey, however only 42 completed the questionnaire, with 26 participants skipping one or more questions. Of the 68 participants, 49 identified their location (see Figure 1) with at least one response coming from each of 21 different US States (see Table 2). A list of city of origin and the job role of respondents is included in Appendix 3. Fifty-two respondents disclosed their emergency response role. Eleven respondents indicated that they were directly involved in decontamination, CBRN, and/or HAZMAT on the operational level. Two respondents reported that they were responsible for producing guidance on the subject. Almost half of the respondents who attempted the survey (n=23) held leadership positions at the senior level, such as Director or Chief. At the time of responding, 38 respondents indicated that they had an active role within a fire department, whilst 7 respondents reported that they worked in a medical capacity.

Table 1: Number of survey respondents (total n = 49) by State (total no. of responding States = 21).

State	No. of respondents
Arizona (AZ)	1
California (CA)	6
Colorado (CO)	1
Delaware (DE)	1
Florida (FL)	4
Georgia (GA)	2
Illinois (IL)	1
Louisiana (LA)	1
Maine (ME)	1
Maryland (MD)	2
Massachusetts (MA)	1
Michigan (MI)	2
Montana (MT)	1
New Hampshire (NH)	1
New York (NY)	8
North Carolina (NC)	2
Ohio (OH)	1
Oklahoma (OK)	1
Pennsylvania (PA)	3
Virginia (VA)	3
Washington (WA)	6

Survey design

A 34 question online survey was created by researchers at Public Health England (PHE) and the University of Hertfordshire (UK) (See Appendix 1). The survey was reviewed and agreed by the project team, in consultation with BARDA representatives, before it was disseminated to emergency responders. The survey was hosted on SelectSurvey.Net, based on PHE servers in the UK. This allowed data to be stored in accordance with the UK Data Protection Act 1998.

Survey questions were designed to ensure clarity, brevity and avoid ambiguity to meet good practice in survey design. A combination of closed questions, multiple response, and open-ended response options were used to address a range of questions. Multiple response option questions were presented in a grid format, with the order of questions randomised within each grid to prevent response item ordering bias. Page conditions were used so that if, for example a respondent did not report instructing casualties to disrobe prior to decontamination, they would be directed to a subsequent survey page and would therefore not have to answer questions about disrobing. Respondents were able to skip questions if they had insufficient information to respond.

Survey respondents were asked to report their level of experience concerning mass decontamination, including: whether they had ever been involved in a CBRN incident, the number of real-life situations they had been involved in and the occurrence/ frequency of emergency preparedness drills and exercises. Three questions were asked to identify: the decontamination approach used by their fire department, hose configurations, and procedures during cold weather. Two questions addressed the act of disrobing casualties during an incident response. The survey asked five specific questions about the decontamination showering process relating to: the temperature of the water, the water pressure (in PSI) the duration of showering, whether detergent would be routinely added to shower water and whether casualties would walk through the decontamination corridor alone or in groups. Further questions in the survey sought to collect data in key areas including: the response time to reach contaminated casualties and the provision for vulnerable populations during mass decontamination.

Procedure

A covering letter (see Appendix 2) with a link to the online survey was circulated to members of the US InterAgency Board (IAB)[1]. The IAB is, "…a voluntary collaborative panel of emergency preparedness and response practitioners from a wide array of professional disciplines that represent all levels of government and the voluntary sector"[2] Through its activities, the IAB seeks to strengthen preparedness and response to CBRN incidents. The covering letter instructed recipients to share the letter and survey link with their colleagues. Informed consent from survey respondents was collected via a question on the first screen of the survey (see Appendix 1), following an introduction to the aims of the survey, the time commitment involved and information on the way in which their information would be processed and stored. At the end of the survey, respondents were provided with PHE contact details if they had any further questions or concerns or if they indicated that they would like to receive a copy of the final report.

[1] For more details see: https://iab.gov/AboutUs.aspx/
[2] Ibid.

Results

Experience of real incidents and exercises or drills

Twenty-seven out of 53 respondents (51%) said they had been involved in a real incident involving the decontamination of multiple casualties following a chemical, biological or radiological incident, whilst 26 respondents (49%) said they had not. Asked for the number of real incidents they had experienced, responses ranged from 1 to 100, with an average of 12 incidents per respondent. Thirty-three out of 54 respondents (61%) reported that they routinely carried out emergency preparedness drills or exercises for managing/treating casualties following a CBRN incident (Figure 3). Thirty-one respondents described how often these exercise/drills take place. Responses varied from regularly/monthly, to annually/every 2 years (See Appendix 3, Question 4). These respondents were then asked to specify how many mass-casualty decontamination drills they had participated in as part of their role. Response varied from 1 to 100 drills, with an average of 26 drills per respondent.

Response time to contaminated casualties

Twenty five respondents estimated the time between receiving a 911 call and the arrival of fire engines at the scene. The estimated response times during peak traffic ranged from 3 to 15 minutes, with an average estimated response time of 8.4 minutes. The estimated response times during non-peak traffic ranged from 3 to 10 minutes, with an average estimated response time of 5.7 minutes. Twenty five respondents estimated the time between arrival of fire engines at the scene and decontamination of the first casualty. The estimated time between arrival of fire engines and decontamination of the first casualty ranged from 2 to 20 minutes. Twenty eight respondents reported the time allowed between disrobing and beginning Tier 1 decontamination. The times ranged from 1 to 60 minutes, with the average time being 6.29 minutes.

Approaches to mass casualty decontamination and disrobing

Thirty-six respondents confirmed the ‘ladder-pipe system’ is the chosen approach for multiple casualties affected by a chemical incident (Appendix 3, Question 5). However, 21 respondents said this is was not the routine or preferred approach to mass casualty decontamination. A number of different or additional approaches were reported including: technical decontamination, reactive skin decontamination lotion (RSDL), multiple decontamination shower

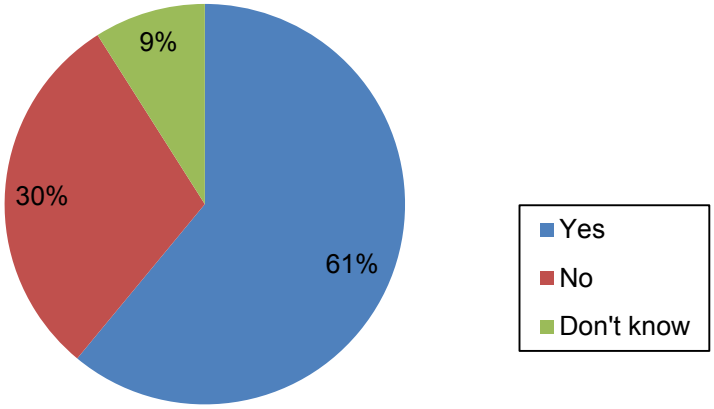

Figure 3: Does your fire department routinely carry out emergency decontamination drills for managing/treating casualties following a Chemical, Biological, or Radiological incident?

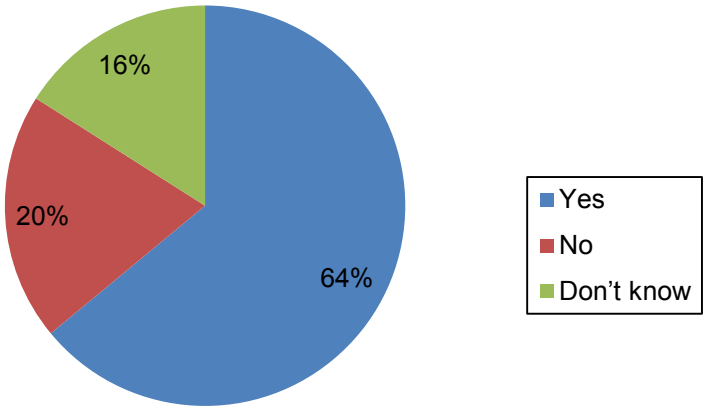

Figure 4: In a real-life chemical contamination incident, would you instruct casualties to remove their clothing (disrobe) prior to showering?

tents, and outdoor plumbing and fixtures around military hospitals to quickly set up mass decontamination lines for community and military support.

Twenty-eight out of 44 respondents (64%) reported that in a real incident involving a chemical contaminant, casualties would be instructed to disrobe prior to showering. Nine respondents (20%) said they would not follow this process, whilst 7 respondents (16%) said they didn't know what they would do with regards to disrobing casualties in a real incident (Figure 4). Respondents were also asked to specify at what point during the decontamination procedure they would ask casualties to disrobe. This open-ended question revealed that nearly half of the respondents (13 out of 28) said that the casualty would be asked to disrobe straight away/as

soon as possible. Eleven respondents said their response would be situation/incident dependent. Three respondents specified that casualties would be instructed to disrobe after gross decontamination. One respondent did not know the answer to this question.

Respondents were asked how they would respond if casualties were unwilling to disrobe. The question allowed respondents to select more than one option from several strategies (see Table 2). The most commonly selected procedure (n=18) was to 'offer a privacy corridor'. This was closely followed by 'explain the importance of disrobing in order to encourage them to disrobe' (n=15) and 'allow them to proceed through the decontamination procedure fully clothed' (n=14) (Table 2). The 7 respondents who selected 'Other' were asked to specify the alternative strategies they would use. Responses included: "several of the above", "situational", "separated into different refuge area (control until decontamination can be metered or quality assurance measures are verified)". One respondent stated that they would request that the casualties wear a disposable coverall suit if remaining on-site to reduce the risk of others becoming re-contaminated, while another respondent said that law enforcement may be used to forcibly prevent them from exiting the warm/hot zones until they comply with an appropriate decontamination.

Table 2: If casualties are unwilling to disrobe, how would you respond? (Nb. respondents could select as many options as applicable; * See text for 'Other' strategies).

Procedure	No. of times selected
1. Allow them to proceed through the decontamination procedure fully clothed	14
2. Refuse to decontaminate until the disrobe	1
3. Explain the importance of disrobing in order to encourage them to disrobe	15
4. Offer a 'privacy corridor'	18
5. Other*	7

Environmental considerations

Respondents were asked to identify how they would conduct decontamination during cold weather conditions. Eleven out of 25 respondents (44%) confirmed that they would employ the same system of tier 1 decontamination using hoses mounted to fire engines. Whilst 15 respondents (60%) identified other measures including: using tents with warm air and a warm

water supply, dry decontamination, protection from the cold environment such as taking control of buses, or nearby building lobby.

Characteristics of the LPS decontamination showering process

The web survey asked a number of questions related to the decontamination shower process itself. Respondents were asked to describe the hose and nozzle arrangement employed during decontamination showering and then to detail control over water temperature and pressure, shower duration, and instructions provided to casualties. Only 25 out of the 68 respondents were able to answer these questions, a feedback response of 37%.

Configuration of hoses/nozzles

With regard to the hose arrangement, options included side mounted to fire engine, suspended from overhead via attachment to an aerial ladder truck, use of both types or neither, or some other form of LPS (requested to be specified). The most common response from 19 of the 25 respondents (76%) was the use of both side mounted and overhead hoses. Two respondents (8%) indicated that only side mounted hoses were used whilst the remaining 7 respondents (28%) stated that some other configuration was used (See Appendix 3, Question 11).

The nozzle attachments determining the spray formation delivered to the casualties was addressed separately for the side mounted and overhead hoses. For the side mounting of hoses, the majority of respondents (16 out of 25, 64%) said that alternative nozzles were used although 4 respondents (16%) did confirm utilisation of the TurboMaster (See Appendix 3, Question 12). The remaining 5 respondents (20%) selected the ‘not applicable’ response. For the overhead location, the most frequent response (15 out of 25, 60%) was also for alternative nozzle models to be used (see Question 13). Two responders (8%) selected the Turbo Master, 1 responder (4%) selected the Hy-D whilst the remaining responders said the overhead nozzle type was ‘not applicable’.

Control of water temperature

The survey respondents were asked if they had the ability to control the temperature of the water used to shower casualties. The majority of the respondents (20 out of 25, 80%) said they were unable to control the temperature of the water. Only 3 respondents (12%) stated that temperature control was possible (Figure 5). For the respondents who said they were unable to control the water temperature there was a supplementary question regarding their knowledge of the approximate hydrant temperature on the coldest and hottest days of the year. Although only 20 respondents had selected ‘No’ to the previous question, there were 25 and 24 responses for

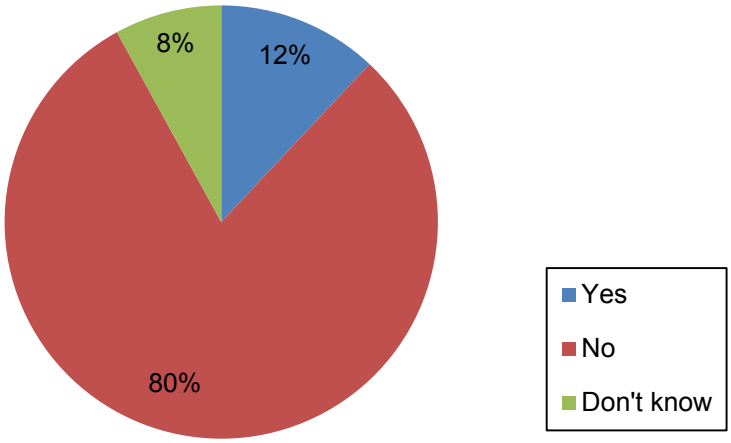

Figure 5: Are you able to control the temperature of the water?

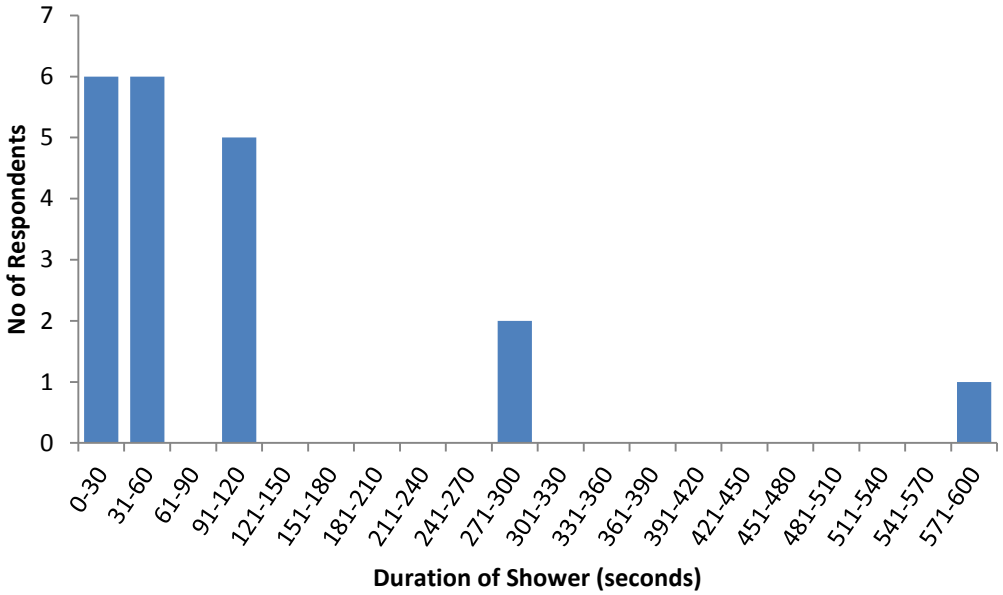

Figure 6: Approximately how long (in seconds) would each casualty spend in the shower? (Nb. if respondents provided a range, the upper value was used).

these two conditions, respectively. There were a total of ten estimations each, ranging from approx. 38 to 76°F and 50 to 79°F for the coldest and hottest days, respectively (See Appendix 3, Question 15).

Water pressure

The respondents were asked to estimate the water pressure used to decontaminate casualties. Twelve of 25 responses provided answers which ranged from between 30 to 150 PSI. One

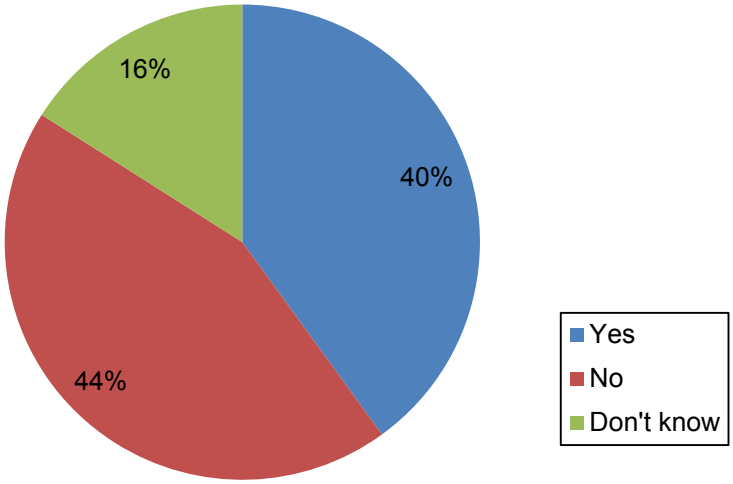

Figure 7: Are you able to add detergent to the water dispensed from the fire hoses during Ladder-Pipe (tier 1) decontamination?

respondent made reference to use of a 'Commonwealth SOP' and two indicated use of hydrant pressure without giving details. Factors such as satisfactory spray pattern, corridor length and adequate 'fog' were mentioned by a further three responders as influencing choice of water pressure. Nine respondents selected 'Don't know' as their answer.

Shower duration

The respondents were asked to specify how long they would let casualties spend in the shower. Twenty out of the 25 respondents gave numerical estimations of the length of the casualties' decontamination. These ranged from 5-10 seconds to 10 minutes; however, the responses suggested that the modal duration was between 30-60 seconds (12 out of 20 responses, 60%; Figure 6). Only 3 respondents indicated 5 minutes or longer. Three respondents provided text only answers stating that shower duration would depend on the nature (physical state, toxicity, CBR or N) of the contamination and also environmental factors. One respondent stated 'Not applicable' as an answer.

The use of detergent

Ten out of 25 respondents (40%) stated that they were unable to add detergent to the water dispensed from the fire hoses during Ladder-Pipe (tier 1) decontamination. A comparable 11 respondents (44%) said that they were able to carry out this process. Four respondents (16%) selected 'Don't know' (Figure 7).

Follow up questions explored the type and concentration of detergents if used. Out of 10 responses, 3 made reference to specific brands (Dawn, n=2; Johnson's Baby shampoo, n=1) whilst the remainder supplied generic information such as 'Class A foams' and 'dish soap'. The answer from another respondent was that the choice of 'locally procured detergents' would depend upon the 'perceived contaminant' but no examples were provided. Two responders stated they did not know which detergent was used and one expressly stated that it was possible but none were used. No indication of the concentration of detergent used was provided.

Management of casualties through the decontamination process

When asked whether they would instruct casualties to walk through the shower individually or in groups, 19 out of 25 respondents (76%) reported that they have no fixed rule for how casualties would walk through the shower. Five respondents (20%) reported that casualties would walk through the shower individually, and one respondent (4%) reported that they didn't know whether casualties would be asked to walk through the process individually or in groups.

Eight out of 25 respondents (32%) reported that they would use a bull horn or other type of PA system to direct casualties through the decontamination process. Seven out of 25 responders (28%) gave details of the instructions which they would provide to casualties during the decontamination process. The most commonly reported instructions included: asking casualties to walk slowly through the decontamination corridor, extend arms, and turn occasionally (See Appendix 3, Question 18).

Provision for vulnerable groups

Survey respondents were asked to elaborate their procedures for managing casualties with additional or special needs during mass decontamination, specifically the needs of vulnerable groups, including: managing dis-robe, children, non-ambulatory casualties and the use of supportive aids such as wheelchairs, prosthetic limbs and assistance animals. In response to the question, "How do you manage groups who are unable to undress/redress themselves due to physical and/or mental health conditions?" the most selected approach was to 'have a member of their team disrobe them and re-robe them at the other end' (See Table 3). The option 'allow them to proceed through the decontamination procedure fully clothed' was selected 11 times. 'Other' was selected 8 times in response to this question and those who selected this were asked to specify the alternative approach. These responses included: "depends on the situation", "any of the above may be applicable", "male and female hazardous materials technicians are available inside the decontamination tent to assist", and "generate a by-pass lane / privacy corridor and/or tarp the tent interior to create support space".

Table 3: How do you manage groups who are unable to undress/redress themselves due to physical and/or mental health conditions? (* See text for 'Other' strategies).

Procedure	No. of times selected
1. Allow them to proceed through the decontamination procedure fully clothed	11
2. Have a member of your team disrobe them and re-robe them at the other end	21
3. Request help from an able-bodied casualty to assist with the disrobe process	12
4. Other*	8

Table 4: What would you do if presented with casualties who are unable to walk (non-ambulatory) during the decontamination procedure? (* See text for 'Other' strategies).

Procedure	No. of times selected
1. Prioritize the decontamination of ambulatory over non-ambulatory casualties	12
2. Allocate a designated decontamination area and crew specifically to deal with non-ambulatory casualties	34
3. Send non-ambulatory casualties to hospital without decontamination	2
4. Other*	11

Respondents were asked if parents/guardians were allowed to carry young children through the decontamination procedure. Of 48 responses to this question, 41 responded 'yes', with only 7 respondents suggesting that this is not permitted. In addition, respondents were asked to identify their procedures for the management of non-ambulatory casualties during decontamination (Table 4). The most common option was to 'allocate a designated decontamination area and crew specifically to deal with non-ambulatory casualties' (n=32). 'Other' responses included: "dependent on agent", "level of exposure", "onset of symptoms", "available staff", "number of casualties requiring decontamination", "ask victims to assist and provide extra time in the decontamination shower area for the group to reduce contamination as

much as possible for all involved", and "assist non-ambulatory casualties with responders in PPE". Asked if they would allow those with physical impairments, to take supportive aids through the decontamination procedure, the majority of respondents indicated that guide dogs (74%), walking sticks (79%), wheelchairs (74%), prosthetic limbs (79%) and glasses (84%) were all permitted to pass through decontamination with casualties (See Appendix 3, Question 31).

Post-decontamination care

Twenty-two out of 28 respondents (79%) said they would provide temporary clothing packs to casualties following emergency decontamination. When asked whether the emergency department of a local hospital would be prepared to accept casualties who had only undergone decontamination through tier 1 decontamination using fire hoses, 16 of 25 respondents (64%) answered 'yes'. However, 7 respondents (28%) said the emergency department would only be prepared to accept casualties 'only after more thorough/technical decontamination'. Two respondents (8%) said they did not know the answer this question.

Discussion

The online survey described in this report describes a cross-section of current decontamination practices and preparedness for chemical incidents across 21 different US States. Responses to the survey indicate that decontamination practices differ significantly, suggesting that current protocols are not always consistent with current evidence and best-practice guidance. The survey focused on five different aspects of mass decontamination: response time to reach contaminated casualties; approaches to disrobing and decontamination; characteristics of the decontamination showering process; provision for special populations; and management of casualties post-decontamination. The results of the survey will now be discussed under each of these headings, and consistency with current evidence and guidance will be reviewed.

Response time to reach contaminated casualties

All respondents reported that they would reach contaminated casualties within 15 minutes of receiving a 911 call, and that response times could be as little as 3 minutes. However, there was wide variability in the length of time between fire engines arriving at the scene and the first casualty being decontaminated, with some respondents indicating that the first casualty would not be decontaminated until 20 minutes after the arrival of fire engines. This emphasises the need to quickly initiate disrobing of casualties, as this is an effective step which can be taken almost immediately after responders arrive at the scene (Chilcott, 2014).

Approaches to disrobing and decontamination

Most of the respondents stated that they would ask casualties to disrobe prior to showering, with just over half stating that they would ask casualties to disrobe as soon as possible. However, a minority (20%) of respondents stated that they would not ask casualties to disrobe prior to showering. Evidence suggests that disrobing is one of the most effective steps to reduce exposure to a contaminant, and that this should occur as soon as possible following potential contamination (Matar et al., 2010). While a large number of respondents acknowledged the importance of rapid disrobing, this was not universally recognised.

When asked what actions they would take if casualties were unwilling to disrobe, most respondents stated that they would either offer a privacy corridor or provide further explanation about the benefits of disrobing (or both). However, half of the respondents stated that they would allow casualties to proceed through the decontamination process fully clothed. Allowing

casualties to undergo decontamination whilst fully clothed could increase the transfer of contaminants through the clothing, leading to greater contamination of the skin (Chilcott, 2014).

The majority of respondents stated that they would employ the LPS method of decontamination, as recommended in current guidance (e.g. Lake et al., 2000; 2013). The most common hose configuration for LPS was to use hoses mounted to the side of fire engines, as well as a hose suspended from a ladder attached to an aerial truck. The type of nozzle attachments generating the shower spray was shown to vary amongst responders with no clear indication of preferred models or spray pattern. The majority of respondents recognised that it might be necessary to adapt LPS decontamination systems during cold weather, with suggested adaptations including using tents with warm air and warm water, or carrying out dry decontamination instead. However, a substantial minority (44%) stated that they would carry out the same method of decontamination during cold or adverse weather. This is of concern, as guidance suggests that in cold environments, it might be necessary to avoid water-based decontamination, to minimise the likelihood of cold weather injuries (Cibulsky & Ignacio, 2012).

Characteristics of the decontamination showering process

The majority of respondents (80%) stated that they were unable to control the temperature of the water used for decontamination. Estimates of likely hydrant temperature at coldest and hottest times of the year also varied widely from 30-76°F (winter) to 50-79°C (summer). It is likely, however, that this is reflective of the climatic differences between the respondent States. There were a wide range of different pressures (30-150 PSI) quoted as used for decontamination but over half or the responders were unclear as to the pressure employed. Approximately a quarter of respondents stated that the pressure they would use would be around or below 60 PSI, the minimum recommended water pressure for decontamination (SBCCOM, 2000). The majority of participants were either unable to add detergent to the water dispensed from fire hoses, or did not know if this was possible, and were therefore unable to comply with the recommendation of decontaminating casualties using detergent (Jones et al., 2010). The selection of detergent appears to be limited to those household brands most likely to be readily available but if used, there was no consensus as to appropriate concentration suitable for decontamination of casualties.

Respondents reported a wide range in shower duration, ranging from 5 seconds to 10 minutes. The modal shower duration was shown to be between 30-60 seconds slightly below the recommended shower duration of 60 and 90 seconds identified in controlled studies of emergency decontamination (Larner et al., 2010; Amlôt et al., 2011). Although 40% of

respondents reported that the shower duration they would use would be outside of this range, the majority of respondents (85%) reported durations of within 120 seconds.

Only a quarter of respondents reported that they would provide instructions to casualties about how to progress through the decontamination process. Where details of specific instructions were given, these included asking participants to walk slowly through the decontamination corridor, turn occasionally, and extend arms; these instructions were therefore broadly in-line with recommended showering procedures (e.g. Lake, Schulze, & Gougelet, 2013). However, the majority of respondents did not describe any specific instructions that they would provide to casualties during the decontamination process.

Provision for vulnerable populations

When asked how they would manage the decontamination of casualties who were unable to undress/re-dress themselves due to physical or mental health conditions, the majority of respondents stated that they would ask a member of their team to help the casualty to disrobe and rerobe. This was also selected as the most common way to manage non-ambulant casualties through the decontamination process. However, depending on the number of casualties with these additional needs, these actions could put strain on responder resources, and may not be practical. Another option, selected by 43% of respondents, would be to ask an able-bodied casualty to assist the non-ambulant casualty in disrobing and rerobing. Research suggests that casualties may be willing to help others during decontamination, provided they have received effective communication from responders about the importance of undergoing decontamination (Carter et al., 2012, 2013a, 2014), and this may offer an efficient method of enabling less ambulant casualties to disrobe and rerobe, given limited responder resources. A similar number of respondents also stated that they would allow those who were unable to disrobe to go through the shower fully clothed; as noted above, this could increase the amount of contaminant reaching the casualty's skin (Chilcott, 2014).

The majority of respondents stated that they would allow various different types of service equipment (including guide dogs, walking sticks, wheelchairs, prosthetic limbs, and glasses) to be taken through the decontamination shower. This is in-line with recommendations in decontamination guidance (e.g. Cibulsky & Ignacio, 2012). Only a small minority stated that they would not allow this equipment to go through the decontamination shower. Whilst allowing service equipment to be taken through the shower is likely to enable casualties to progress through the process more independently, consideration should be given to equipment which cannot go through the showering process (e.g. some types of prosthetic limbs). Guidance

suggests that in such cases, casualties should be decontaminated as non-ambulant casualties (Cibulsky & Ignacio, 2012).

Management of casualties post-decontamination

Most respondents reported that they would provide temporary clothing packs to casualties following decontamination. This is in-line with guidance which suggests that temporary clothing packs should be provided for warmth, and to restore modesty, following decontamination (Lake, Schulze, & Gougelet, 2013). Only a small minority (14%) of responders stated that they would not provide temporary clothing packs following decontamination.

Implications

Overall, the decontamination procedures used varied substantially between different survey respondents. In certain aspects, such as initiating disrobe as quickly as possible, employing an LPS method of decontamination, and provision of rerobe packs to casualties following decontamination, responses were broadly in-line with guidance and evidence for decontamination. However, in several aspects of decontamination, most notably characteristics of the decontamination shower (e.g. shower duration, shower temperature, and shower pressure) responses varied widely and were often not consistent with current guidance. Failure to adhere to recommended decontamination processes could result in casualties receiving less than effective decontamination, and possibly experiencing more adverse effects or injury. The variability in the responses presented here suggests that there is a need to ensure that decontamination guidance documents are consistent across US States, and updated routinely with the developing evidence-base in this area.

References

Amlôt, R., Larner, J., Matar, H., Jones, D.R, Carter, H., Turner, E.A., Price, S.C., & Chilcott, R.P. (2010). Comparative analysis of showering protocols for mass-casualty decontamination, *Prehospital Disaster Medicine*. *25*(5), 435.

Annelli, J. F. (2006). The national incident management system: a multi-agency approach to emergency response in the United States of America. *Revue scientifique et technique (International Office of Epizootics)*, *25*(1), 223-231.

Baker, D. J. (2007). The management of casualties following toxic agent release: The approach adopted in France. In T. T Marrs., R. I Maynard & F. R Sidell (Eds.), *Chemical warfare agents: toxicology and treatment* (pp.261-275). Chichester: John Wiley & Sons, Ltd.

Carter, H. Drury, J., Rubin G. J., Williams, R., & Amlôt, R. (2012). Public experiences of mass casualty decontamination. *Biosecurity and Bioterrorism: Biodefence Strategy, Practice, and Science*, *10*(3), 280-289.

Carter, H., Drury, J., Rubin, G. J., Williams, R., Amlôt, R. (2013). The effect of communication during mass decontamination, *Disaster prevention and management*, *22*(2), 132-147.

Carter, H., Drury, J., Amlôt, R., Rubin, G. J., Williams, R. (2014). Effective responder communication improves efficiency and psychological outcomes in a mass decontamination field experiment: implications for public behaviour in the event of a chemical incident. *PloS one*, *9*(3), e89846.

Chilcott, R. P. (2014). Managing mass casualties and decontamination. *Environment international*, *72*, 37-45.

Houston, M., & Henderickson, R. G. (2005). Decontamination. *Critical care clinics, 21*(4), 653-672.

HM Government (2010) *The United Kingdom's strategy for countering chemical, biological, radiological and nuclear (CBRN) terrorism*. London: HM Government.

Lake, W. A., Fedele, P. D., & Marshall, S. M. (2000). *Guidelines for mass casualty decontamination during a terrorist chemical agent incident*. US Army Soldier and Biological Chemical Command.

Lake, W., Divarco, S., Schulze, P., Gougelet, R. (2013). *Guidelines for Mass Casualty Decontamination During a HAZMAT/Weapon of Mass Destruction Incident. Volumes 1 and 2 (Update)*. Army Chemical Biological Radiological Nuclear School Fort Leonard Wood MO.

Jones, D. R., Larner, J., Price, S. C., Chilcott, R. P. (2010). Optimisation of mass casualty decontamination procedures< i> in vitro</i>, *Toxicology*, *278*(3), 363-364.

Larner, J., Jones, D. R., Price, S. C., Chilcott, R. P. (2010). Modified static diffusion cells for decontamination modelling, *Toxicology*, *278*(3), 351-352.

Maniscalco, P., Christen Jr, H. T. (2010). *Homeland security: principles and practice of terrorism response*. Canada: Jones & Bartlett Learning.

Matar, H., Larner, J., Kansagra, S., Atkinson, K.L., Skamarauskas, J.T., Amlot, R., Chilcott, R.P. (2014). "Design and characterisation of a novel in vitro skin diffusion cell system for assessing mass casualty decontamination systems, *Toxicology in Vitro, 28*(4), 492-501.

Matar, H, Price, S.C., Chilcott, R.P. (2010). Temporal effects of disrobing on the skin absorption of chemical warfare agents and CW agents simulants, *Toxicology*, *278*(3), 344-345.

U.S Army Soldier and Biological Chemical Command (SBCCOM). (2000). *Guidelines for Mass Casualty Decontamination during a Terrorist Chemical Agent Incident*. Aberdeen Proving Ground, MD: US. Army Soldier and Biological Chemical Command.

Appendix 1 – online survey questions

Tier 1 Mass Casualty Decontamination Survey

Researchers at the University of Hertfordshire and Public Health England are working on a Tier 1 Mass Casualty Decontamination research project on behalf of the Department of Health and Human Services' Biomedical Advanced Research and Development Authority (BARDA).Given your position within the Fire Department; we would like to ask you some questions about Mass Casualty Decontamination. Completion of this survey should take no longer than 20 minutes. Your identity will remain anonymous. Your responses may be cited in both academic and government publications. Please tick the box if you consent to your responses being used in such a way. If you do not consent, simply close the survey.

<Consent question here>

---

1) In which state and city is your Fire Department located?
   State: <Text>
   City: <Text>

2) What is your role in the Fire Department?
   <Text>

3) Have you ever been involved in a real-life incident involving the decontamination of multiple casualties following a Chemical, Biological, or Radiological incident?
   <Yes / no / don't know>

   How many real-life mass decontamination situations have you experienced?
   <Text>

4) Does your Fire Department routinely carry out emergency decontamination drills for managing/treating casualties following a Chemical, Biological, or Radiological incident?
   <Yes / No >

   - If yes how often do these exercise/tests take place (state 'Don't know' if unknown)?
     <Text>

   - How many mass casualty decontamination drills have you participated in as part of your role in the Fire Department?
     <Text>

   - How many real-life mass decontamination situations have you experienced?
     <Text>

5) If multiple casualties were affected by a chemical incident during warm temperatures, would you deploy a system of tier 1 decontamination using hoses mounted to fire engines (often referred to as the 'Ladder Pipe System')?

<Yes* / No>

- If 'No', what would be your primary method of decontamination?
  <Text>

6) What is the estimated time between the 911 call and the arrival of fire engines on scene:
   - During peak traffic
     <Text>
   - During off-peak traffic
     <Text>

7) What is the estimated time between the arrival of fire engines on scene and the first casualty being decontaminated?
   <Text>

8) Approximately how long would each casualty spend in the shower?
   <Text>

9) Do you instruct casualties on how to walk through the shower?
   <Yes / No / Don't Know>
   - If 'Yes', how do you instruct casualties to walk through the shower?
     <Text>

10) Would casualties normally walk through the shower corridor individually or in groups?
    <Individually / Groups / No fixed rule / Don't know>

11) Which of these hose configurations do you use as part of tier 1 decontamination:
    <Hoses mounted to the sides of fire engines>
    <Hose suspended from a ladder attached to an aerial truck>
    <Both of the above>
    <None of the above>
    <Other, please specify>

12) Which spray nozzle(s) do you use for the hoses mounted to the sides of the fire engines (if applicable)?
    <Turbo Master>
    <Bresnan Distributer>
    <Hy-D>

<Other - Please specify>
<Not Applicable>

13) Which model of spray nozzle(s) do you use for the hoses mounted to the overhead ladder suspended from the aerial truck (if applicable)?
<Turbo Master>
<Bresnan Distributer>
<Hy-D>
<Other - Please specify>
<Not Applicable<

14) What water pressure do you use for decontaminating casualties? (State 'Don't know' if unknown)
<Text>

15) Are you able to control the temperature of the water?
<Yes / No / Don't know
- If 'Yes', what temperature do you set the water to? <Text>

- If 'No', do you know the approximate hydrant temperature on
- The coldest day of the year: <text>
- The hottest day of the year: <text>

16) To your knowledge, would the Emergency Department of a hospital in your area be prepared to accept casualties who have only undergone decontamination through tier 1 decontamination using fire hoses?
<Yes / No / only after more thorough/technical decontamination / Don't Know>

17) If multiple casualties were affected by a chemical incident during **cold temperatures**, would you deploy this same system of tier 1 decontamination using hoses mounted to fire engines?
<Yes / No
- If 'No', which contingency measure of decontamination would you use instead?

18) In a real-life chemical contamination scenario, would you instruct casualties to remove their clothing (disrobe) prior to showering?
<Yes* / No / Only Partially* (e.g. only their outer layers of clothing) / Don't Know>

19) At what point during the decontamination procedure would you ask casualties to disrobe?
<Text>

20) If casualties are unwilling to undress, how would you respond?
<Allow them to proceed through the decontamination procedure fully clothed>
<Refuse to decontaminate them until they disrobe>
<Explain the importance of disrobing in order to encourage them to disrobe>
<Offer a 'privacy corridor'>
<Other – please specify…>

21) How do you manage groups who are unable to undress/redress themselves, for whatever reason?
<Allow them to proceed through the decontamination procedure fully clothed>
<Have a member of your team disrobe them and re-robe them at the other end>
<Request help from an able-bodied casualty to assist with the disrobe process>
<Other – please specify…>

22) If casualties are required to disrobe, how much time do you allow between disrobing and decontamination for Tier 1 decontamination?

<Text>

23) Do you provide temporary clothing packs?
<Yes / No>

24) What do you do with casualties' personal effects (e.g. phones and wallets) during the decontamination procedure?
<Text>

25) Are parents/guardians allowed to carry young children through the decontamination procedure?
<Yes / No>

26) What would you do if presented with casualties who are unable to walk (non-ambulatory) during the decontamination procedure?
<Prioritize the decontamination of ambulatory over non-ambulatory casualties>
<Allocate a designated decontamination area and crew specifically to deal with non-ambulatory casualties>
<Send non-ambulatory casualties to hospital without decontamination>
<Other – Please specify…>

27) Are people with physical impairments permitted to take their guide dogs / walking sticks / wheelchairs / glasses through the decontamination corridor with them?
<Yes / No / Don't know>

28) Are you able to add detergent to the water dispensed from the fire hoses during Ladder-Pipe (tier 1) decontamination?
<Yes / No / Don't know>

29) Would you use detergent for tier 1 decontamination?
<Yes / No / Don't know>

30) Please state the brand(s) of detergents which you would use during a decontamination procedure
<Text>

31) Please state the concentration of detergent which you would use, e.g. 0.5%
<Text>

Closing statement

Thank you for helping us progress with this research project

Would you be willing to send us a copy of your Department's mass casualty decontamination protocol?

Please e-mail the protocol to richard.amlot@phe.gov.uk

Would you be willing to participate in an interview to discuss aspects of mass casualty decontamination?

Please provide your email and telephone number so that we can contact you.
E-mail:
Telephone Number:

Appendix 2 – letter of invitation

Biomedical Advance Research & Development Authority
200 Independence Ave. SE
Washington, DC
20024
www.phe.gov

Emergency Response Department
Health Protection Directorate
Public Health England
Porton Down
Salisbury, Wiltshire, SP4 0JG
T +44 (0)1980 612917
F +44 (0)1980 612968
www.gov.uk/phe

1st February 2014

Dear Emergency Responder,

The office of the Assistant Secretary for Preparedness and Response at the U.S. Department of Health & Human Services through a contract with Hertfordshire University and Public Health England are working to understand decontamination science more clearly. As part of that process we would like you to participate in a survey in an online survey on Mass Casualty Decontamination.

We would like to ask you to complete an online survey concerning mass casualty decontamination procedures. The survey can be accessed at the following address:

http://www.hpa-surveys.org.uk/TakeSurvey.aspx?SurveyID=MCD

This survey is being conducted by researchers at Public Health England and the University of Hertfordshire (UK), who are working on a project on behalf of the Biomedical Advanced Research and Development Authority (BARDA), a Division of the Office of the Assistant Secretary for Preparedness and Response in the Department of Health and Human Services.

The project, entitled ***Advanced Studies of Mass Casualty Decontamination***, will examine and test key aspects of Mass Casualty Decontamination (MCD) in order to generate new guidance for Emergency Responders. The project seeks to enhance optimal safety and efficiency of MCD across all States. For more information about the project, please see the following links:

http://www.phe.gov/Preparedness/news/Pages/barda-patientdecon-120912.aspx

http://www.nature.com/news/uk-rolls-out-terror-attack-plan-1.14696?WT.mc_id=FBK_NatureNews

By completing this survey, you will help to inform the research activities undertaken as part of this project. The survey should take no longer than 20 minutes to complete and all responses will be handled in the strictest confidence. If you would also be willing to discuss mass decontamination procedures with us in a short telephone interview, please contact me directly or get in touch using the contact details at the end of the survey. If you have any questions, please feel free to contact us.

Thank you in advance for your help.

Scientific Programme Leader, Behavioural Science
richard.amlot@phe.gov.uk
behaviouralscience@phe.gov.uk

Appendix 3 – full survey results

Question 1 *- In which state and city is your Fire Department located? (49 out of 68 respondents reported their state. 46 out of 68 respondents reported their city).*

US State	**Response Total**
Arizona (AZ)	1
California (CA)	6
Colorado (CO)	1
Delaware (DE)	1
Florida (FL)	4
Georgia (GA)	2
Illinois (IL)	1
Louisiana (LA)	1
Maine (ME)	1
Maryland (MD)	2
Massachusetts (MA)	1
Michigan (MI)	2
Montana (MT)	1
New Hampshire (NH)	1
New York (NY)	8
North Carolina (NC)	2
Ohio (OH)	1
Oklahoma (OK)	1
Pennsylvania (PA)	3
Virginia (VA)	3
Washington (WA)	6
Total respondents (For this Question)	**49**
(Skipped this Question)	19

US City	**Response Total**
Albany (NY)	1
Atlanta (GA)	2
Avon (MT)	1
Charlotte (NC)	1
Charlottesville (VA)	1
Chicago (IL)	1

DeWitt (NY)	1
Durham (NC)	1
Fairfax (VA)	2
Gaithersburg (MD)	1
Grand Rapids (MI)	1
Huntingdon (PA)	1
Irvine (CA)	1
La Conner (WA)	1
Lancaster (PA)	1
Los Angeles (CA)	3
Montgomery (MD)	1
New York (NY)	5
Orlando (FL)	1
Park County (CO)	1
Phoenix (AZ)	1
Pittsbrugh (PA)	1
Planation (FL)	1
Sacramento (CA)	1
San Diego (CA) – Naval Base	1
Sarasota (FL)	1
Seattle (WA)	2
Shreveport (LA)	1
Symyrna (DE)	1
Toledo (OH)	1
Troy (MI)	1
Tulsa (OK)	1
Washington (WA)	4
Waterboro (ME)	1
Total Respondents (For this Question)	**46**
(skipped this Question)	22

Question 2 *- What is your role in the Fire Department? (52 out of 68 respondents answered this question).*

Response ID	Role
108681	Medical advisor.
157513	United States (US) Army Public Health Command, subordinate organization under the US Army Office of the Surgeon General and US Army Medical Command. Prepare written Army medical policy for decontamination of personnel (Soldiers, civilians, dependants, contractors, etc.). Work with functional Army and DOD elements responsible for performance of decontamination operations to identify decontamination media, methods, detection, emergency first aid, medical treatment, transport, etc.
157514	No role. On order advisor/consultant
157516	Associate Medical Director/Division Medical Director/Field response/Quality Assurance for medical care provided by medical personnel.
157517	Support and/or lead to disasters.
157518	Liaison.
157524	7+ years WMD training and Operations Level support to WMD incident. Currently assigned to RAD/Nuclear detection program.
157540	Special Operations Commander – Retired.
157541	Hazmat Technician / Training.
157543	Lieutenant and Hazmat Supervisor.
157564	State-wide Hazardous Materials Response Team.
157565	Acting Lt.
157567	Deputy Fire Chief.
157570	Deputy Fire Chief.
157573	Battalion Chief - Commander of the Haz Mat and Decontamination Task Forces and the Joint Hazard Assessment Teams. In addition, Regional Coordinator and Training Master for Haz Mat, CBRNE and Special Operations.
157574	Haz Mat Medical.
157587	Retired - Captain of Hazardous Materials Company #1.
157592	Program Manager.
157596	Assistant Chief.
157603	EMS Chief.
157605	Director.
157606	Battalion Fire Chief.
157648	Fire fighter/EMT.
157697	None.
157732	Battalion Chief, fire suppression, training, etc.
157765	Chief.
157767	Past Chief currently State Emergency Management Director.
157768	Park County Fire Marshall is the elected Sheriff (Chief Law Enforcement Officer). My role with the Sheriff's Office is a "deputy sheriff" (general law

	enforcement, patrol, index drivers, assaults, theft, gangs, drugs, search and rescue, traffic control, clandestine drug labs, etc.
157776	Captain - Communications/Special Operations.
158413	Medical Director.
158477	Law Enforcement - first responder.
158627	Assistant Chief of a shift with responsibilities over Special Operations. This includes technical and mass decontamination.
158713	Safety officer.
158718	Fire fighter.
158719	Fire Battalion Chief - Retired Hazardous Materials Coordinator Line Battalion Chief responsible for all emergency and non-emergency operations of between 5 and 10 Fire Stations.
159221	First line supervisor Lieutenant.
159509	Law enforcement.
159575	Doctrine and Guidance.
159580	Station Captain and Decontamination Team Leader of the Seattle Fire Dept. Decontamination Team.
159870	Assistant Fire Chief, Chief of Special Operations, ret.
175420	I am retired.
175439	Medical.
175446	Labour union. Health, Safety and Medicine. Now retired.
175461	Station Commander and paramedic.
175468	I am the Deputy Commander for a Civil Support Team. I am not nor am I affiliated with a Fire Department. This fact may very well impact my participation in this survey.
175487	I am neither a fire fighter nor am I currently involved in decontamination.
175493	Fire fighter / driver operator.
175633	Bomb Tech / Render safe any RDD's etc.
175705	Chief.
175713	I am a Sgt with Troy Police Department and the Team Leader for the Oakland County Hazmat Unit.
179897	Military subject matter expert.
Total Respondents (For this Question)	**52**
(Skipped this question)	16

Question 3 *- Have you ever been involved in a real-life incident involving the decontamination of multiple casualties following a Chemical, Biological, or Radiological incident? (53 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Yes	27	51%
No	26	49%
Don't know	0	0%
Total Respondents (For this Question)	**53**	**100%**
(Skipped this question)	15	

How many real-life mass decontamination situations have you experienced? (26 out of 68 respondents answered this question).

Response ID	**Number of situations**
108681	10
157516	2
157517	10
157540	1 -chlorine
157543	2
157564	2
157567	15
157570	5
157573	The key is the definition of 'mass' (greater than 7? 15? or an overwhelming number for the on scene resources that dictates a procedural change to accomplish the primary objectives. I have experienced at least 40 or more incidents involving more than 10.
157574	40+
157587	10+
157596	3
157603	At least 18 over a 34 year period.
157606	4
157767	4
157768	20+
158413	Approximately 5.
158627	6
158719	5

159580	1
159870	2
175420	4
175487	One actual and several exercises.
175493	2
175705	2
Total Respondents (For this Question)	**25**
(Skipped this question)	43

Question 4 *- Does your Fire Department routinely carry out emergency decontamination drills for managing/treating casualties following a Chemical, Biological, or Radiological incident? (54 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Yes	33	61%
No	16	30%
Don't know	5	9%
Total Respondents (For this Question)	**54**	**100%**
(Skipped this question)	14	

How often do these exercises/tests take place? (29 out of 68 respondents answered this question).

Response ID	**Number of exercises/tests**
157513	Depending on organization and situation exercises could be conducted annually
157516	Semi-annual
157517	Multiple times a year
157518	Every other year
157540	1 per year
157543	Annually
157565	Once a year
157567	Every 1-2 years
157573	Required annual review for all field fire-fighters; the Haz Mat /Decon Task Forces are required quarterly exercise and annual recertification
157574	Annually
157587	2 - 3 times per year

157592	Annually
157596	Yearly
157605	At least annually
157648	2-3 times per year
157697	Annually
157732	Annually
157767	Semi annually
157776	Annually
158719	Once a quarter
158866	Regularly based on the number of units involved requires frequent drills
159221	There are many test/exercises that these skills of the members up to full functional exercise that test the overall plan.
159575	Every month with multiple events
159580	At least once a month. During the Summer months, more frequently.
175420	Yearly
175468	6-8 times a year for individual unit level casualties
175487	I am not sure, they perform table top, functional, and full scale
175713	Every couple years
179897	Annually
Total Respondents (For this Question)	**29**
(Skipped this question)	39

How many mass casualty decontamination drills have you participated in as part of your role in the Fire Department? (30 out of 68 respondents answered this question).

Response ID	**Number of drills**
157513	More than a half dozen.
157516	4-5
157517	As part of public health many. If an incident is bio public health has the lead not fire
157518	2
157540	Dozens
157543	Several a Year
157565	1
157567	5

157573	Greater than 50
157574	20+
157587	12+
157592	6+
157596	10
157603	Many over the course of my career probably greater than 75
157605	11
157648	2 times per year
157697	Several
157732	15-20
157765	Annually
157767	Annual
157776	3-4
158719	Several
158866	Dozens
159221	Numerous too many to remember
159580	Too numerous to remember.
175420	over 20
175468	Approx. 15
175487	Several
175713	Fire department none. Hazmat Team at least 6
179897	1
Total Respondents (For this Question)	**30**
(Skipped this question)	38

Question 5 *- If multiple casualties were affected by a chemical incident, would you deploy a system of tier 1 decontamination whereby a high volume of water is sprayed from fire engines, which are positioned to create a corridor through which potentially contaminated casualties can pass (often referred to as the 'Ladder Pipe System'), similar to that displayed in the photograph above? (51 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Yes	36	71%
No – please specify your primary method of decontamination the box below • The ladder pipe system is one means. Other temporary and permanent engineered piping systems have been used and planned. For example,	21	41%

around military hospitals outdoor plumbing and fixtures exist to quickly set up mass patient decon lines (including temporary structures for gender privacy and protection from extreme ambient environment. These efforts support joint military and community emergency support agreements as well as potential military base events. • Depends on the contaminant. If it is water-reactive water will not be used. • Yes and No, We do not use the ladder company only engine company and place the second set of personnel off the second engine towards other objectives. So a mass decon is two engines 28 (we found that after 28 feet the patterns are not as continuous - this is different for different makes of apparatus) feet apart no pressure volume only. ;Yes • With exception of cold weather seasons. Yes • Yes! Based on the number of victims, the level of contamination, and their status, we would likely use a hand line to spray water while setting up an Aerial Ladder platform to spray a high volume of water downward. • Be advised the LAFD has four Haz Mat Task Forces and six Technical Decon Task Forces geographically disbursed with in the city. The cited tier 1 is an option taught to all field companies but based on the urgency or numbers of victims can be considered a first wash or back up to more developed procedures or specialized resources. Yes • NOTE: We have assigned engine companies who are trained in delivering this capability. Yes • We would normally deploy multiple decon shower tents as needed in series to manage the patient load. This configuration is not ruled out but it would be a strategic option of last selection. Additionally depending on the product the patients were exposed to we could deploy RSDL packages to the patients for self-application after doffing their clothes to reduce the intervention interval to the shower. • We have a decontamination trailer • We do not have any set plans - it is possible that the above referenced system may be used, but not necessarily. Park County is 2,211 square miles (5,726 km2) with a population of 16,000. The population is concentrated into two towns. Resources are very limited. • A decontamination trailer • Remove clothes, spray with hand lines. • I am not able to answer this question • The NGB decontamination is accomplished by a line that runs through tents or a decontamination trailer. • This is not a ladder pipe system, a true ladder pipe system uses three ladder pipes raised to 7o degrees, the ladder nozzle set at max flow and 30 degrees angled from the surface to achieve flow and time requirements as an industrial hygienist decon shower would require. This system was utilized and tested during the 96 Olympics. the system in the above picture is and impinging water dispersal and will do little more than spread the contamination from person to person, the water flow must be downward as the standards call for in the decontamination industrial shower. The system above is easy to setup for fire-fighters, but non-functional for operational use as a decontamination shower for masses of people. • I am not a fire fighter, but having exercised with the local departments, I know that they use a variety of configurations for mass decontamination. Yes • Don’t know • Hand lines		

• Depends on the circumstance. If there were obvious signs and symptoms of a chemical attack we would possibly do this. There are other situations where the facility may have a locker room with showers that may be used. Depending on the situation, we might knock off sprinkler heads while they were exiting the facility. Or if we have time, we have several mass deacon systems utilizing tents and trailers.Yes • We would employ Technical Decontamination as a means of decontamination.		
Total Respondents (For this Question)	**51**	**100%**
(Skipped this question)	17	

Question 6 *- What is the estimated time (in minutes) between the 911 call and the arrival of the fire engines on scene? (25 out of 68 respondents answered this question for 'during slow response'. 24 out of 68 respondents answered this question for 'during fast response').*

Response ID	**During slow response (e.g. peak traffic)**	**During fast response (e.g. Off-peak traffic)**
108681	7 minutes	4 minutes
157514	Incident dependent	Incident dependent
157516	10 minutes	3.5 minutes
157541	Don't know	Don't know
157570	8-10 minutes	5-7 minutes
157574	6 minutes	4 minutes and below
157587	3-4 minutes or less	No answer
157596	8 minutes	4 minutes
157605	15 minutes	6 minutes
157606	8 minutes	12 minutes
157732	8 minutes	5 minutes
157765	12 minutes	8 minutes
157767	10-15 minutes	5-10 minutes
157776	3.5-4 minutes	5 minutes
158413	8-10 minutes	4-6 minutes
158713	10 minutes	6 minutes
158719	8 minutes	5 minutes
158866	6 minutes	4 minutes
159124	10 minutes	6 minutes
159221	4 minutes	4 minutes
159580	4.5 minutes	4.5 minutes
175420	5-6 minutes	4 minutes
175461	8 minutes	4 minutes
175468	N/A	N/A
175493	10 minutes	5 minutes
Total Respondents (For this Question)	**25**	**24**
(Skipped this question)	43	44

Question 7 *- What is the estimated time (in seconds) between the arrival of fire engines on scene and the first casualty being decontaminated? (25 out of 68 respondents answered this question).*

Response ID	Estimated time (in seconds)
108681	360
157514	Incident dependent
157516	600
157541	Don't know
157570	120
157574	N/A
157587	300
157596	900
157605	120
157606	30
157732	300
157765	240
157767	180- 240 (depending on water supply)
157776	120
158413	300
158713	900
158719	90
158866	300
159124	1200
159221	Once recognized an emergency Devon can be established within a couple of minutes
159580	200
175420	600
175461	180
175468	N/A
175493	20
Total Respondents (For this Question)	**25**
(Skipped this question)	43

Question 8 *- Approximately how long (in seconds) would each casualty spend in the shower?* (*25 out of 68 respondents answered this question).*

Response ID	Estimated time (in seconds)
108681	120
157514	120
157516	300
157541	5 - 10
157570	30
157574	120
157587	Plan is to gross deacon. The time depends upon the incident, outside temp, severity of the contamination/exposure, and a series of other multiple fact
157596	120

157605	20
157606	60
157732	45-60
157765	Depends
157767	Based on product & effect on citizen
158719	60
158413	15-30
158713	60
158719	60
158866	30
159124	300
159221	The depends on the product and chemical properties I.e. Chemical vs. rad, gas vs. liquid
159580	300-600
175420	120
175461	30
175468	N/A
175493	30-60
Total Respondents (For this Question)	**25**
(Skipped this question)	43

Question 9 *- How do you instruct casualties to walk through the shower? (25 out of 68 respondents answered this question).*

Response ID	
108681	bull horn with simple instructions provided
157514	Per SOP
157516	directed by FD personnel, by hand signals and directed by barriers
157541	verbal/ loud speaker
157570	With FFs directing them
157574	PA, Bull horn or Face to Face using voice mitters through SCBA
157587	using personnel to direct and use the herd mentality, seal off other means of avoiding the shower corridor
157596	Verbal and hand signals if ambulatory
157605	Walk in with hands in the air, eyes/mouth closed, elbows bent (approx. 90 degrees) - slowly turn 2 times - exit
157606	We would instruct them to strip and rinse, then to rinse until all visible chemical was off their skin
157732	slowly with arms extended
157765	Slowly
157767	Based on product - avoid touching eyes, ears, and throat. Make sure all skin surfaces have been exposed for dilution
157776	Utilizing a PA system (apparatus radio/PA) and/or a bull-horn
158413	remove outer layer of clothes, walk through water stream, turn and flush thoroughly
158713	slowly one by one
158719	PA systems from apparatus
158866	PA system on apparatus, use of personnel in PPE to guide
159124	FF at beginning of line

159221	Once again depends on what type of product and properties
159580	Remove all exterior garments (except underwear). With your hands, scrub your hair, body, underarms and groin areas vigorously
175420	Bull horn, pa system
175461	Walk through water stream
175468	Loud Speaker/Vehicle PA System
175493	Single line w/ directions on each move provided from rescue worker giving a step by step coordinated method
Total Respondents (For this Question)	25
(Skipped this question)	43

Question 10 *- Would casualties normally walk through the shower corridor individually or in groups? (25 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Individually	5	20%
Groups	0	0%
No fixed rule	19	76%
Don't know	1	4%
Total Respondents (For this Question)	**25**	**100%**
(Skipped this question)	43	

Question 11 *- Which of these hose configurations do you use as part of tier 1 decontamination? (25 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Hoses mounted to the sides of fire engines	2	8%
Hose suspended from a ladder attached to an aerial truck	0	0%
Both of the above	19	76%
None of the above	0	0%
Other, please specify • Don't know • Fixed Ladder pipe with fog tip. Large volume fog nozzle on pump discharges • Opposing engines with fog Nozzles attached to truck outlet and Fixed Ladder above as available ;Both of the above • Ladder Pipe Assembly, Opposing Engines with open 1 1/2 gates and nozzles attached, 1 1/2 hose lines operated by Fire fighters or a combination of any or all above. • Can use hoses on side of the fire engines, but training usually have nozzles	7	28%

attached directly to discharge piping without hose. Nozzles are fog type and are on a wide enough patterns to cover normal height persons. • CFD has precut Hydrant caps which can be a Fire hydrant. Both of the above • Fixed Ladder pipe with fog tip. Large volume fog nozzle on pump discharges		
Total Respondents (For this Question)	**25**	**100%**
(Skipped this question)	43	

Question 12 *- Which spray nozzle(s) do you use for the hoses mounted to the sides of the fire engines (if applicable)? (25 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Turbo Master	4	16%
Bresnan Distributor	0	0%
Hy-D	0	0%
Not applicable	5	20%
Other, please specify • Don't know • Don't know • Fog nozzle configuration • Task Force Tip in 60 degree fog • Varies • Various fog nozzles • Select-o-matic fog nozzle • For us Akron Fog Nozzles - others inventory specific • Task Force, and/or Elkhart • Multiple manufacturers; solid fog pattern • We carry a few different nozzles on our Engines. • I do not know • Several types • TFT... Task Force Tip • Fog nozzle (TFT) • Fog or blitz nozzle	16	64%
Total Respondents (For this Question)	**25**	**100%**
(Skipped this question)	43	

Question 13 *- Which model of spray nozzle(s) do you use for the hoses mounted to the overhead ladder suspended from the aerial truck (if applicable)? (25 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Turbo Master	2	8%

Bresnan Distributor	0	0%
Hy-D	1	4%
Not applicable	7	28%
Other, please specify • Don't know • Fog nozzle configuration • Task Force Tip • Task Force Tips • Various fog nozzles • Fog nozzle • Akron Fog Nozzles • Task Force, and/or Elkhart • Multiple manufacturers; solid fog pattern • Same as above • I do not know • Fog high volume low pressure • Same • Fog nozzle (TFT) • Akron FOG 50 PSI	15	60%
Total Respondents (For this Question)	**25**	**100%**
(Skipped this question)	43	

Question 14 *- What water pressure (in PSI) do you use for decontaminating casualties? (25 out of 68 respondents answered this question).*

Response ID	**PSI**
108681	Don't know
157514	Per commonwealth SOP
157516	Don't know /spray low pressure
157541	Don't know
157570	50 PSI
157574	Don't know
157587	Unsure
157596	100 PSI
157605	60 PSI
157606	Less than 80 psi or enough to form a good pattern
157732	100 PSI
157765	30 PSI
157767	Dependent upon length & width of corridor 60 - 75 lbs.
157776	Don't know
158413	hydrant pressure to sufficient PSI to maintain solid fog pattern

158713	Don't know
158719	50 – 150 PSI
158866	Hydrant pressure or gated down
159124	50-60
159221	Don't know
159580	Hydrant pressure
175420	Usually 38 PSI
175461	50-100 PSI
175468	Don't know
175493	50 ish
Total Respondents (For this Question)	**25**
(Skipped this question)	43

Question 15 *- Are you able to control the temperature of the water? (25 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
No	20	80%
Don't know	2	8%
Yes – at what temperature (in Farenheit) do you set the water?	3	12%
Total Respondents (For this Question)	**25**	**100%**
(Skipped this question)	43	

Do you know the approximate hydrant temperature (in Farenheit) on the coldest day of the year and the hottest day of the year? (25 out of 68 respondents answered the question for 'the coldest day of the year' and 24 out of 68 respondents answered the question for 'the coldest day of the year').

Response ID	**The coldest day of the year**	**The hottest day of the year**
108681	Don't know	Don't know
157514	Incident dependent	Incident dependent
157516	40	75
157541	Don't know	No answer
157570	56	60
157574	45	60
157587	Coldest	Cold
157596	52	52

157605	Don't know	Don't know
157606	Don't know	Don't know
157732	76	79
157765	42	56
157767	Don't know	Don't know
157776	45	50
158413	60s	70s
158713	38	65
158719	No	No
158866	Don't know	Don't know
159124	No	No
159221	No but it is cold	No but it is cold
159580	Don't know	Don't know
175420	Unknown	Unknown
175461	Don't know	Don't know
175468	Don't know	Don't know
175493	Upper 30's	60's
Total Respondents (For this Question)	**25**	**24**
(Skipped this question)	43	44

Question 16 *- To your knowledge, would the Emergency Department of a hospital in your area be prepared to accept casualties who have only undergone decontamination through tier 1 decontamination using fire hoses? (25 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Yes	16	64%
No	0	0%
Only after more thorough/technical decontamination	7	28%
Don't know	2	8%
Total Respondents (For this Question)	**25**	**100%**
(Skipped this question)	43	

Question 17 *- If multiple casualties were affected by a chemical incident during cold temperatures and other adverse weather conditions, would you deploy this same system of tier 1 decontamination using hoses mounted to*

fire engines? Respondents were able to select more than 1 answer. (25 out of 68 respondents answered this question).

	Response Total	Response Percent
Yes	11	44%
No – which contingency measure of decontamination would you use instead? • Tents with warm air and warm water supply • Dry decontamination. • Decontamination tents and trailers • Tent, fixed facilities and Mobile facilities with heated water • Define cold temperatures? If freezing, the dispersal would be less of a problem. Generally we would look for alternatives if the temp is above freezing to ~60 degrees. That could be indoor locations or multiple decon shower trucks with controllable water temperatures • Define what is meant by cold • We have portable expandable shelters than can be used at decon line exit for reheating/redressing. This extends the time needed to decon, thus dry partial decon (undressing, lint rollers, etc.) may be used or partially used as a diversion option for wet decon. • We would switch to tent systems • Based on product & exposure • mass decontamination unit, but takes much longer to set up • If the contamination was life threatening and we would then take control of city buses that are heated to manage exposure or take control of a nearby building with a large lobby area. • Maybe • If necessary to save their lives but we would need to then protect them from the cold environment I.e bus, building lobby, etc;Yes • The department would initiate Tier 2 decontamination procedures with heated water. • Regional & state haz mat teams with formal decontamination shelters and water heaters.	14	60%
Total Respondents (For this Question)	**25**	**100%**

(Skipped this question)	43	

Question 18 *- Can you briefly explain what happens to casualties after they have walked through the decontamination shower? (25 out of 68 respondents answered this question).*

Response ID	
108681	Triage area to assess for immediate medical needs
157514	They proceed to a technical decontamination set of stations. Within a prescribed distance from the Ladder Pipe Decontamination Station
157516	Dressed, medical assessment and treatment as clinically indicated. Transport to medical facilities if symptomatic
157541	Don't know
157570	They are triaged for signs and symptoms
157574	Stripped down appropriately, garments given then Triage as necessary and available
157587	If needed they will but they are met by EMS personnel that triage and perform appropriate procedures
157596	Into tent or structure and provided with disposable clothing and blankets
157605	If screening is available (appropriate metering resources are not always on site quickly,) post screening for off-gassing / remaining radioactive contamination occurs. If negative, redress and exit. If positive, secondary more technical decontamination will be set up with self-service soap/water scrub down areas. Once re-washed, metering is repeated. Cycle repeats if necessary
157606	They would be given redress kits, triaged and sent to a Casualty Collection Point or transported to the Hospital
157732	Depends on exposure. most will not have additional decontamination
157765	Transported
157767	Further decontamination via a trailer system
157776	Our department has a mass-decontamination unit that provides heated showers, detergent/bleach mixing; Tyvek-type suits to change into, garbage bags for clothing/personal items, etc. The walk-through tier 1 decontamination serves as an 'initial' gross decontamination (...and a delay tactic...) until the more thorough mass-decontamination unit can be set up
158413	Wet clothing removed, clothing bagged and labelled using triage tag tear-off, triage, entered into multi-casualty branch, dried and examined
158713	Transport to ER decontamination
158719	They go into technical decontamination
158866	We provide disposable garments with zip lock bags for personal items, bar codes are included for tracking, the people are then guided to a safe staging area for further triage, (possible PD questioning). We use

	as in #19, either city buses for heat in winter or AC in summer heat, or take control of a building to house the decontaminated people in for the triage, interviews, and release as determined by unified response team
159124	Depends on the threat
159221	Depending on the product we would monitor to make sure the decon was effective (I.e. Radiation,) and/or they would then be triaged. They may be released transported or held at a casualty collection point
159580	After Tier 1 decontamination, they casualties proceed to Tier 2 decontamination which includes removal of all clothing, heated water and neutralizing solution if needed
175420	Further decontamination will be performed
175461	Once established those requiring additional decontamination would be further decontamination based upon the chemical, if known
175468	Don't Know
175493	Final removal of clothing to sterile scrubs suit or gown
Total Respondents (For this Question)	**25**
(Skipped this question)	43

Question 19*- Are you able to add detergent to the water dispensed from the fire hoses during Ladder-Pipe (tier 1) decontamination? (25 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Yes	10	40%
No	11	44%
Don't know	4	16%
Total Respondents (For this Question)	**25**	**100%**
(Skipped this question)	43	

Question 20 *- Please state the brand(s) of detergent which you would use during a decontamination procedure. (10 out of 68 respondents answered this question).*

Response ID	**Brand of Detergent**
157587	Locally procured detergents. There are various types depending upon the perceived contaminant.
157605	Dawn dish detergent - ultra concentrated.
157732	None - we are able but we don't.
157765	Class A Foam.
157767	Unknown.
158413	Class A Foam, mild dishwashing detergent can be entered via an educator but is not a standard of

	practice. Detergent would be used in a second phase, more technical decontamination is necessary or at hospital-based decontamination.
158719	Dish soap.
158866	I don't know at this time.
175420	Johnson baby shampoo.
175461	Dawn.
Total Respondents (For this Question)	10
(skipped this question)	58

Question 21 *- Please state the concentration of detergent which you would use. (2 out of 68 respondents answered this question).*

Response ID	**Concentration of detergent**
175420	Johnson's baby shampoo
175461	Batch mixed in the tank
Total Respondents (For this Question)	2
(skipped this question)	66

Question 22 *- In a real-life chemical contamination scenario, would you instruct casualties to remove their clothing (disrobe) prior to showering? (44 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Yes	28	64%
No	9	20%
Don't know	7	16%
Total Respondents (For this Question)	**44**	**100%**
(skipped this question)	24	

Question 23 *- At what point during the decontamination procedure would you ask casualties to disrobe? (28 out of 68 respondents answered this question).*

Response ID	
108681	First step
157513	Situational. For workers dealing with known contaminants disrobing may be part of entering the decontamination line. For patients approaching a medical treatment facility disrobing may be directed if an alarm goes off or visible signs of chemical contamination is seen.

157514	Incident dependent.
157516	Upon entering privacy area, not for street decontamination
157517	Depends on the contaminant. There is not a one-size fits all contaminant response.
157567	Once formal decontamination is set up (for us, formal decontamination consists of one or more tented decontamination shower structures that include water recovery basins).
157570	Before entering
157573	Field Commanders are taught key symptoms drive the incident. If immediate public action is necessary (for chemical - not bio, rad) then an immediate disrobing of outer clothing followed by a 'wet decon' and then sheltered into a safe refuge area. The key is situational awareness and communication with the Haz Mat Squads and JHAT en route.
157574	Depends on Chemical, exposure, symptoms and temperature as well as other considerations
157587	Question 24 needs to have a comment section. Disrobing prior to gross deacon showering is dependent upon the contaminant. If the contaminant is going to do more exposure by disrobing through inhalation then the clothes stay on. The opposite is also true.
157596	Outer clothing only before they go thru wet decontamination
157603	If ambulatory as soon as they were in the decontamination casualty collection area. If non ambulatory responders may decide the doff clothing prior to moving depending on clinical needs of treatment. RSDL could be used as an interim neutralization solution to facilitate early decontamination intervention while treating patient and waiting to access shower line.
157605	When it is either apparent that the chemical is likely to be persistent on clothing, where further spread of dilute contamination would be exceptionally detrimental, or where the risks are unclear.
157606	At the beginning before entering the shower
157648	Upon entry into the decontamination process.
157697	In the tent before decontamination
157765	Before entering
157776	During primary decontamination if possible, but certainly before secondary decontamination.
158413	Outer layer of clothes prior to entry into water stream, then more layers once hands-on and more private care can be initiated
158627	Once it has been identified as a working incident
158718	As soon as possible
159221	Timing depends on chemical & physical properties. With a liquid we may ask them to disrobe after a gross wash while with a solid we would prefer to have them disrobe ASAP prior to a gross wash.
159575	During the first stage of triage. At the front of the decontamination lines
159580	The outer layers are removed during Tier 1 decontamination and all clothing is removed during Tier 2.

159870	As soon as we get on the scene and make contact. Should the air temp be low we will provide buses as shelter in the exclusion zone as well as the support zone.
175420	After gross
175633	Don't know
179897	Prior to entering showers/water exposure
Total respondents (For this Question)	**28**
(Skipped this question)	40

Question 24 *- If casualties are unwilling to disrobe, how would you respond? (Respondents were able to select more than 1 answer. 28 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Allow them to proceed through the decontamination procedure fully clothed	14	50%
Refuse to decontaminate them until they disrobe	1	4%
Explain the importance of disrobing in order to encourage them to disrobe	15	54%
Offer a 'privacy corridor'	18	64%
Other, please specify • Again, depends on the situation. • May be released if informed consent given and a release is signed, explain the importance of disrobing in order to encourage them to disrobe, offer a 'privacy corridor'. • Victims designated for mass decontamination that do not disrobe after encouragement (usually not an issue) are separated into different refuge area (control until decontamination can be metered or quality assurance measures are verified). Allow them to proceed through the decontamination procedure fully clothed. Explain the importance of disrobing in order to encourage them to disrobe. Offer a 'privacy corridor'. • All contingencies are covered. Allow them to proceed through the decontamination procedure fully clothed. Explain the importance of disrobing in order to encourage them to disrobe. Offer a 'privacy corridor'. • Request that they wear a disposable coverall suit if remaining on-site to reduce the risk of others becoming re-contaminated. In an extreme case (weaponized anthrax, etc.) Law	7	25%

enforcement may be used to forcibly prevent them from exiting the warm/hot zones as they prevent a grave risk to others in violation of state laws until they comply with an appropriate decontamination. This would require high-level executive authority to act upon (isolation/quarantine authorities of the Governor.). Allow them to proceed through the decontamination procedure fully clothed. Explain the importance of disrobing in order to encourage them to disrobe. Offer a 'privacy corridor'. • We would use several of the above mentioned options. • Never had this happen, they were most uncomfortable with the material on them and their clothes, they came out quite willing. On the bio side we have had the outer shell removed, then put them in a tyvex suit and sent people home to shower and follow up with their physician.		
Total respondents (For this Question)	**28**	
(Skipped this question)	40	

Question 25 *- How do you manage groups who are unable to undress/redress themselves due to physical and/or mental health conditions? Respondents were able to select more than 1 answer. (28 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Allow them to proceed through the decontamination procedure fully clothed	11	39%
Have a member of your team disrobe them and re-robe them at the other end	21	75%
Request help from an able-bodied casualty to assist with the disrobe process	12	43%
Other, please specify • Depends on the situation any of the above may be applicable. • Male and female haz mat techs are available inside the decontamination tent to assist. Have a member of your team disrobe them and re-robe them at the other end. • 2 minutes or less - Incident driven; goal is disrobing station is adjacent to first wash corridor (question #28 not able to enter). Allow them to proceed through the decontamination procedure fully clothed. Have a member of your team disrobe them and re-robe them at the	8	29%

other end. • Anything that will help the procedure and forward the objective to gross decontamination the contaminated victims. Allow them to proceed through the decontamination procedure fully clothed. Have a member of your team disrobe them and re-robe them at the other end. Request help from an able-bodied casualty to assist with the disrobe process. • Varies by victim and prevailing circumstances. Clearly this is expedited as much as possible. Have a member of your team disrobe them and re-robe them at the other end. Request help from an able-bodied casualty to assist with the disrobe process. • Generate a by-pass lane / privacy corridor and/or tarp the tent interior to create support space. Allow them to proceed through the decontamination procedure fully clothed. Have a member of your team disrobe them and re-robe them at the other end. Request help from an able-bodied casualty to assist with the disrobe process. • We would use several of the options above plus other tactics. • Special needs patients must always be assisted by directions or direct intervention. Have a member of your team disrobe them and re-robe them at the other end. Request help from an able-bodied casualty to assist with the disrobe process.		
Total Respondents (For this Question)	**28**	
(Skipped this question)	40	

Question 26 *- How many minutes do you allow between disrobing and Tier 1 decontamination? (28 out of 68 respondents answered this question).*

Response ID	Time (in minutes)
108681	1 minute
157513	1 minute
157514	15 minutes
157516	0 minutes
157517	0 minutes
157567	30 minutes
157570	2 minutes
157573	2 minutes

157574	5 minutes
157587	5 minutes
157596	10 minutes
157603	0 minutes
157605	2 minutes
157606	1 minute
157648	1 minute
157697	60 minutes
157765	2 minutes
157776	1 minute
158413	1 minute
158627	2 minutes
158718	20 minutes
159221	4 minutes
159575	2 minutes
159580	1 minute
159870	0 minutes
175420	4 minutes
175633	3 minutes
179897	1 minute
Total Respondents (For this Question)	**28**
(Skipped this question)	40

Question 27 *- Do you provide temporary clothing packs? (28 out of 68 respondents answered this question).*

	Response Total	**Response Percent**
Yes	22	79%
No	4	14%
Don't know	2	7%
Total Respondents (For this Question)	**28**	**100%**
(Skipped this question)	40	

Question 28 *- What do you do with casualties' personal effects (e.g. phones and wallets) during the Tier 1 decontamination procedure? (43 out of 68 respondents answered this question).*

Response ID	
108681	Sealed bag and scanner bar with wrist band
157513	Place in bag and tag with ID information. Personal items may be monitored for contamination before being released

157514	Bagged per Commonwealth SOP
157516	Individual bagging
157517	They are placed in a bag and properly identified and stores. All personal effects e.g. clothes, phones, are potential evidence
157540	We have decontamination bags for the walking casualties
157541	Bag them
157543	All personal items are collected and bagged. All patients receive a bar code to identify their belongings
157567	Bag, seal and label them
157570	Collect and place in bio bags
157573	Efforts are made to provide for a recovery process BUT if this is a mass decontamination (>20) past practices are personal effects (purse or wallet) in a personal bag (ID per victim via wristband or triage tag) and all other clothing are gathered later in large bags for analysis and NOT given back
157574	Dependents on substance, plan is for cataloguing and tracking for evidentiary
157587	Collect in a zip lock bag and either give to victims or keep them safe for retrieval later
157592	Would try to bag and ID
157596	Bagged and tagged and carry with them
157603	They are subjected to a logistical decontamination if applicable, and turned over to law enforcement representatives for accounting, safe keeping, and possible evidence. If it is the latter they may be bagged and tagged as contaminated with Law Enforcement address the issue later while dealing with chain of custody issues
157605	Using Stat Band Triage wristlets, we bag valuables and put a triage tag barcode sticker on the bag for later sorting. Clothing is bagged and destroyed
157606	Collect in a pile, in some scenarios we may be able to individually bag these items
157648	Placed in separate bag for inventory and decontamination before returning
157697	Bag them
157732	Good question
157765	Place in marked bags
157767	Bag & Tag
157768	Regarding the last question on disrobing, I selected a random answer since none of the provided answers were appropriate, and the system would not let me proceed unless I selected one of the answers provided. I'm not familiar with the term Tier I decontamination
157776	Have patients place them in a garbage bag, to be dealt with later

158413	Bag and tag
158627	Save them in personal pack
158713	Bio bags
158413	Bag and tag
159124	Depends on the severity of the threat (life safety)
159221	This question doesn't provide enough info to determine what we would do. What is the product (chemical, bio rad), what is the physical state (solid liquid gas)
159575	Tag them and bag them
159580	Store them in a plastic bag
159870	Bag them in the exclusion zone
175420	Collect and bag if possible worst case place in drum
175461	Patients requiring ambulance transport would be transported with belongings, others would be responsible for their own belongings or if left would be collected as evidence
175468	Bagged & Tagged
175487	It would depend upon whether the agent is known or not, the top of agent, the environment, and ambient temperature, and other factors
175493	Separate bagging if possible. Contaminated clothing is usually bagged then personal effects bagged but kept together as they are tied together. Incident specific of course
175633	Unknown
175705	Collect in bags if possible
175713	We have a procedure where the personnel affects are collected and decontaminated. PS: The previous questions too vague. If people are contaminated and the chemical is either making them sick or causing some kind of burning, they will have their clothes off long before we get there. The circumstance dictates the method that is being used
179897	Personal effects would go into a contamination bin & would only be decontaminated if needed for criminal investigation purposes
Total Respondents (For this Question)	**43**
(skipped this question)	25

Question 29 *- Are parents/guardians allowed to carry young children through the decontamination procedure? (43 out of 68 respondents answered this question).*

	Response Total
Yes	41

No- How do young children get through the LPS (Tier 1) decontamination corridor if parents/guardians are not permitted to carry them? • Again, depends on the contaminant and the situation. These closes questions are not appropriate. • The answer to #31 would depend on the scenario. Therefore, neither of the provided answers are appropriate since the one excludes the other. However, I was forced to select one of the answers.	2
Total Respondents (For this Question)	**43**
(skipped this question)	25

Question 30 *- What would you do if presented with casualties who are unable to walk (non-ambulatory) during the decontamination procedure? Respondents were able to select more than 1 answer. (43 out of 68 respondents answered this question).*

	Response Total
Prioritize the decontamination of ambulatory over non-ambulatory casualties	12
Allocate a designated decontamination area and crew specifically to deal with non-ambulatory casualties	34
Send non-ambulatory casualties to hospital without decontamination	2
Other, please specify • Do not know. • All the above depends on the location and time to assemble team. If near hospital the Occupational and Physical therapists trained in decontamination would assist. • Depends on the chemical - the only one that is of concern are the organophosphates - all others can be decontamination effectively • Decontamination would give regular progress reports stating their conditions, actions, and needs... the Incident Commander would respond appropriately. Prioritize the decontamination of ambulatory over non-ambulatory casualties. Allocate a designated decontamination area and crew specifically to deal with non-ambulatory casualties • Ask victims to assist and provide extra time in the decontamination shower area for the group to reduce contamination as much as possible for all involved.. Allocate a designated decontamination area and crew specifically to deal with non-ambulatory casualties • Assist non-ambulatory casualties with responders in PPE. Allocate a designated decontamination area and crew specifically to deal with non-ambulatory casualties. • Decontamination tent has rollers for back board. • This survey approaches decontamination as though we preform mass decontamination the same way every time. There are numerous factors that need to be considered before I.e. What product (chemical, biological, radiation) the chemical & physical properties (solid, liquid, gas) hazards (corrosive, irritant). Environment & weather, number of victims (ambulatory vs. non ambulatory). Prioritize the decontamination of ambulatory over non-ambulatory casualties. Allocate a designated decontamination area and crew specifically to deal with non-ambulatory casualties. Send non-ambulatory casualties to hospital without decontamination. • We have two lines; one for each. Allocate a designated decontamination area and crew specifically to deal with non-ambulatory casualties.	11

• Again, it would be dependent upon a variety of factors. Agent, level of exposure, onset of symptoms, available staff, and number of casualties requiring decontamination. • We have procedures in place to cover non-ambulatory victims PS: the below questions again is to gauge. Those items would be allowed only if decontaminated and is a necessity for proper decontamination. Allocate a designated decontamination area and crew specifically to deal with non-ambulatory casualties.	
Total Respondents (For this Question)	**43**
(skipped this question)	25

Question 31 *- Are people with physical impairments permitted to take the following through the decontamination procedure? (43 out of 68 respondents answered this question).*

	Yes	**No**	**Don't know**	**Response total**
Guide dogs	32	2	9	43
Walking sticks	34	4	5	43
Wheelchairs	32	6	5	43
Prosthetic limbs	34	3	6	43
Glasses	36	3	4	43
Total Respondents (For this Question)				43
(skipped this question)				25