Incident Command System Doctrine for Dam Owners

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Principal Investigator: Grant Sorensen

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REVISED TITLE

Incident Command System Guidance for Dam Owners

RESEARCH QUESTION

What is the proper role of the dam operating entity in an Incident Command System (ICS) organization during an on-site and off-site dam safety incident?

RESEARCH STRATEGY

The original research proposal was to review ICS doctrine put forth by the U.S. Department of Homeland Security and other practitioners and make recommendations for Dams Sector specific doctrine which implements ICS based on various tactical situations. The full research project was not funded. However, $15,000 of funding was provided to perform a scoping project instead. This paper was updated in December 2014 based on recently published research. This paper summarizes the results of the scoping project.

My hypothesis is that the effective utilization of ICS to manage dam safety incidents will improve accountably and employment of resources; improve communication and collaboration among responding agencies; improves efficiency of response through a standardized planning processes; reduces burden of responsibilities on Incident Commanders by a manageable span of control; reduces compromise or neglect of specific stakeholders legal authorities and priorities.

Specific questions to answer are:

1. Is there a Federal requirement that the Incident Command System (ICS) be used for managing dam safety incidents?

2. Is ICS the most effective structure for managing dam safety incidents vs. matrix teams or other management structures?

3. What advantages does the ICS system provide for emergency response at dams?

4. What are the various ICS organizational structure options for dam owners to use for responding to incidents at dams?

5. Which option provides the most cost effective span of control and is most inclusive of pertinent stakeholders in response to a dam safety incident?

6. Should ICS be used as the national management doctrine for incidents at high/significant hazard dams?

NEED AND BENEFIT

The following description from the Department of the Interior's Reduce Dam Safety Risk [RDSR] *Line of Business Modernization Blueprint* (July 26, 2009, Version 1.3, p. 16) describes the frequency and consequences of high flood releases and failures of dams on the populations at risk downstream from these facilities.

> Dams are high potential energy structures. If dams are not designed, constructed, operated, and maintained properly, natural events (such as floods and earthquakes) or the force of water under pressure can fail a dam.
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> When the water stored behind dams is released in a flood surge, it can cause massive loss of life and devastation. Some of the largest disasters in the U.S. have resulted from dam failures. In general, the potential for devastation is proportional to the height of the dam, the volume of the reservoir, the size of the failure breach, the rapidity of breach formation, and the depth/velocity of the failure flood wave. The number of people who lose their lives in a dam failure is dependent on their distance from the dam, the depth/velocity of the flood wave, and their ability to be warned and evacuated in advance of the flood.
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> In 1889, 2,209 lives were lost when the South Fork Dam failed upstream of Johnstown, Pennsylvania. In 1928, more than 500 lives were lost when the St. Frances Dam, California, failed. Between 1918 and 1958, 33 major U.S. dam failures caused 1,680 deaths. From 1959 to 1965, nine major dams failed worldwide. During the 1970s, the Buffalo Creek, Teton, and Kelly Barnes dam failures collectively cost 175 lives and more than $1 billion in losses.
>
> Dams continue to fail. Since 2000, there have been failures of Big Bay, Taum Sauk Upper Reservoir, Silver Lake and Ka Loko Dams. According to the National Performance of Dams Program, there were 29 dam failures in the years 2003 and 2004. 9 dam failures during the recent flooding in northern Colorado in 2013, including failure of Havana Ponds dam inside Rocky Mountain Arsenal National Wildlife Refuge, a near failure due to overtopping of Baseline Reservoir, a high-hazard dam in Boulder County and in 2013, high operational releases from Olympus Dam at the head of the Big Thompson Canyon in northeastern Colorado.

> The size of a dam and reservoir are only one factor in the number of lives lost in dam failures. The failure of small dams upstream of vulnerable populations also can lead to high loss of life as well.

DOI has experienced many dam safety problems, from the largest dam failure in U.S. history (Teton Dam) to dam performance anomalies. Incidents occur at a rate of about one per month. Since 1982, the BIA Safety of Dams Program has experienced 121 dam safety incidents (RDSR *Blueprint*, pp. 2, 26, 38 & 139).

Dam incidents include increasing seepage, sand boils, sinkholes, significant piezometer changes, slides, cracks, floods, spillway erosion, major outlet works deterioration, uncontrolled release of the reservoir, major crest erosion, major or extensive animal burrowing, major vegetation problems, and threats from dams owned by others upstream. (RDSR Blue Print, p. 68).

RESEARCH QUESTIONS

The initial answers to the research questions presented at the beginning of this report, based on this Scoping Level research project, are listed below.

1. Is there a Federal requirement that the Incident Command System (ICS) be used for managing dam safety incidents?

Yes, on February 28, 2003, President George W. Bush issued Homeland Security Presidential Directive 5 (HSPD 5) which states: "To prevent, prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies, the United States Government shall establish a single, comprehensive approach to domestic incident management. The objective of the United States Government is to ensure that all levels of government across the Nation have the capability to work efficiently and effectively together, using a national approach to domestic incident management" (Bush, 2003, p. 1). This directive not only to governmental organizations across the United States but includes the private sector and nongovernmental organizations as well. The Department of the Interior requires compliance with the standards developed by the National Incident Management System, of which ICS is one element, in planning, preparing, responding and recovering from emergencies (900 DM 1, 2006, p. 5.) Use of ICS is also required when responding to incidents involving hazardous materials (OSHA, Rule 29 CFR 1910.120). "As of 2004, all organizations in the United States are expected to utilize ICS to structure their interorganizational efforts for all response efforts regardless of the incident's cause, size, or complexity" (Jensen and Waugh, March 2014, p. 9).

2. Is ICS the most effective structure for managing dam safety incidents vs. matrix teams or other management structures?

It appears that there is no documented research describing specific incident management systems specifically related to dam safety. While ICS has been used by emergency responders for nearly four decades, there has not been much scientific research on the effectiveness of the system. In a recently published paper, there were only 14 scholarly, peer-reviewed journal articles reporting

the findings of empirical research on ICS in the United States" (Jensen and Waugh, March 2014, p. 12).

3. What advantages does the ICS system provide for emergency response at dams?

The Federal Emergency Management Agency describes the advantages of ICS for domestic incident management as:

> The ICS is a management system designed to enable effective and efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure, designed to enable effective and efficient domestic incident management. A basic premise of ICS is that it is widely applicable. It is used to organize both near-term and long-term field-level operations for a broad spectrum of emergencies, from small to complex incidents, both natural and manmade. ICS is used by all levels of government—Federal, State, local, and tribal—as well as by many private-sector and nongovernmental organizations. ICS is also applicable across disciplines. It is normally structured to facilitate activities in five major functional areas: command, operations, planning, logistics, and finance and administration (FEMA, May 2008).

4. What are the various ICS organizational structure options for dam owners to use for responding to incidents at dams?

While there is a number of reference documents and job aids that describe various ICS organizational structure for responding to incidents (Intermediate (300) and Advanced (400) ICS training manuals, FEMA, October 2013; Informed, 2008; Deal, et al, 2010, 2011) there were not any readily available published documents outlining the attributes of the description of the various tactical ICS organizations structures that are described in the reference documents or job aids. Additional research should look into publications describing the use of ICS by the on-site and off-site emergency responders to incidents at nuclear power plants, chemical production facilities and petroleum refineries.

In 2004, the USDA Natural Resources Conservation Service (NRCS) and the Association of State Dam Safety Officials (ASDSO) launched a joint effort to develop a sample EAP for earthen high hazard dams (ASDSO, September 2007). The sample plan identifies the local Sheriff as the Incident Commander. This may work well for the non-federal dams, but it does not address the issues of dams on lands of exclusive federal jurisdiction. It implies that the County Sheriff, designated as the Incident Commander, will direct the operations at the dam as well as in the non-federal as well as possibly federal lands impacted by the flood waters from the dam. This raises the question of what happens when the Incident Commander directs operations at the dam that are contrary to the desired operations by the dam owner. For example, the Incident Commander wants the dam to withhold releases from the controlled spillway for an additional six hours in order to complete a downstream evacuation while the Emergency Action Plan and/or Standing Operating Procedures identifies spillway releases are to be made at the current time based on the rate of rise curve before the dam overtops. What instructions will

prevail? What about a designated flood control facility with a flood control regulation? The current NCRS/ASDSO template does not include a provision for a Unified Command as outlined in FEMA and other reference documents as a possible ICS organizational for this type of incident.

As a general practice, many dam owners assign a representative from their organization to the respective downstream county emergency operations center to provide technical information about the facility and its operations during an incident. Often mislabeled as "Liaisons," they most often serve the role as a "Technical Specialist" or less often that of an "Agency Representative" at the EOC and generally not as a member of a Unified Command involved in setting the priorities and objectives for managing the incident, even though it is their facility that instigated the incident.

In the current Intermediate ICS training (ICS 300), DHS proposes that the dam owners automatically jump to a Unified Command structure with the local sheriff's department in managing a safety of dams incident. The course does not explain how a single incident command structure can be used by a dam owner organization to manage their incident before jumping to a Unified Command with the downstream public safety agencies when the incident grows and causes downstream consequences. In addition, the course does not describe in detail how Complex Incident, Branch Tactical or an Area Command type of organization can be used, based on the geographic size of the incident, number of jurisdictions involved in the response or population at risk both upstream and downstream of the incident, as well as strengths and challenges of each organizational structure based on an emerging incident.

5. Which option provides the most cost effective span of control and is most inclusive of pertinent stakeholders in response to a dam safety incident?

Given the limited resources of this Scoping Project and the small amount of literature available this question remains to be answered in a future research project.

6. Should ICS be used as the national management doctrine for incidents at high/significant hazard dams?

Based on HSPD 5, yes, it is required. According to the NRCS/ASCSO EAP template "The activation of an EAP also utilizes the National Incident Management System (NIMS). The *Federal Guidelines for Emergency Action Planning for Dams* states: "It is recommended that dam owners coordinate with appropriate emergency management authorities in an effort to incorporate ICS and NIMS concepts and structures into the EAP (FEMA, July 2013, p. I-3).

"None of the existing empirical research on ICS has stated that the theory underlying ICS is a flawed or that the desire to see ICS work is unfounded. Instead, research has suggested ICS has not been, and is not currently, consistently used or equally effective in all events and contexts in the United States" (Jensen and Waugh, March 2014, p. 12).

"Regardless, the ICS research suggests it is critical that all participating individuals accept, or buy-into, use of the system (Bigley & Roberts, 2001; Buck et al., 2006; Granillo, Renger, Wakelee, & Burgess, 2010)" (Jessica Jensen and William L. Waugh Jr., March 2014, p. 9).

"Arnold, O'Brien, Walsh, Ersoy, and Rodoplu (2001) suggest that participating individuals must have been exposed to the system prior to participating in a response for the system to work. Yet, exposure is too abstract a notion by itself. The ICS research suggests that the individuals involved in response must understand ICS (Branum et al., 2010; Buck et al., 2006; Crichton, Lauche, & Flin, 2005; Granillo et al., 2010; Lutz & Lindell, 2008; Moynihan, 2009a, p. 904), have had significant training in the system (Branum et al., 2010; Buck et al., 2006; Crichton et al., 2005; Granillo et al., 2010; Lutz & Lindell, 2008;Moynihan, 2009a, p. 903), and significant experience with ICS through exercises and/or previous response efforts (Branum et al., 2010; Buck et al., 2006; Crichton et al., 2005; Granillo et al; 2010; Lutz & Lindell, 2008; Moynihan, 2009a, p. 903) for the system to be most useful" (Jensen and Waugh, March 2014, p. 9).

"It seems that significance of training and experience has at least three important dimensions – frequency, depth, and specificity. The individual training and experience of participants in the system are likely to contribute positively to ICS' usefulness when it has been periodic and when there has been little time between when individuals were trained and when they attempt to use the system in response (Lutz & Lindell, 2008). Furthermore, individuals are likely to influence the usefulness of ICS positively when they have had a combination of general ICS training as well as training related to the domain of their organization within the system and their specific role (Branum et al., 2010). And, with respect to depth of training, there is nothing in the research that suggests that all types of exercises are not important; yet, the research does suggest that individual experience gained through full-scale exercises and in response to real world events is particularly relevant to ICS' overall usefulness (McLennan, Holgate, Omodie, & Wearing, 2006). Finally, it seems critical that individuals participating in the system have technical knowledge related to the type of hazard event they encounter and the resources necessary to meet the needs of the event (Branum et al., 2010; Buck et al., 2006; Crichton et al., 2005). This technical knowledge presumably would result from a combination of training and experience related to specific events – as opposed to just ICS" (ibid).

CONCLUSIONS

Based on HSPD 5, all incidents at dams are to be managed using the National Incident Management System, which includes the Incident Command System. It appears from this scoping project that additional research is needed to define the best applications for integrating ICS with the dam owners and the affected public safety agencies emergency response operations. To support the integration, an analysis of ways to integrate these concepts into the planning, exercising and training programs should also be studied further. This is supported by comments from a recent research paper that made similar conclusions: "Going forward, it is critical that more research on ICS implementation and effectiveness be conducted pre- and per-response and in a variety of organizational, geographic, national, and event settings before we can confidently assert conclusions regarding the system's potential (Jensen and Waugh, March 2014, p. 12). "It will fall to future researchers to investigate a range of topics related to ICS. For instance, more needs to be known about how the system is implemented day-to-day and in incidents of varying

size, scope and complexity (e.g., extent of use, appropriateness of use given the situation) and by whom. Moreover, research needs to explore the extent to which ICS is effective in addressing common response problems" (Jensen and Waugh, March 2014, p. 13).

BIBLIOGRAPHY

Cole Dana. *The Incident Command System: A 25-Year Evaluation by California Practitioners*. February 2000

Deal, Tim, et al. *All Hazard Field Guide: A Responder's Handbook Using the National Incident Management System's Incident Command System*. June 25, 2011.

Deal, Tim, et al. *Beyond Initial Response—2nd Edition: Using The National Incident Management System Incident Command System*. April 5, 2012.

Federal Emergency Management Agency, *Federal Guidelines for Emergency Action Planning for Dams-FEMA64).* July 2013.

Federal Emergency Management Agency. *Incident Command System Training*. May 2008.

Federal Emergency Management Agency. *ICS-300: Intermediate ICS for Expanding Incidents, Instructor Guide*. October 2013.

Federal Emergency Management Agency. *ICS-400: Advanced ICS Command and General Staff - Complex Incidents, Instructor Guide*. October 2013.

Franco, et al. *Evaluating the Impact of Improvisation on the Incident Command System: A Modified Single Case Study using the DDD Simulator*. Proceedings of the 6th International ISCRAM Conference – Gothenburg, Sweden, May 2009. J. Landgren and S. Jul, eds.

Homeland Security Presidential Directive 5 (HSPD-5). 28 February 2003.

Informed ©. *NIMS Incident Command System Field Guide*. 2008

Jensen, Jessica and William L. Waugh Jr. The United States' Experience with the Incident Command System: What We Think We Know and What We Need to Know More About. *Journal of Contingencies and Crisis Management*, Volume 22 Number 1 March 2014, pp. 5-17.

Moynihan, Donald P. The Network Governance of Crisis Response: Case Studies of Incident Command Systems. *Journal of Public Administration Research and Theory*, pp. 895-915. 2009

Mottern, Lee A. *HSPD-5: Its Context and The Law*. 26 June 2010.

United States Department of Agriculture, Natural Resources Conservation Service/Association of State Dam Safety Officials. *NRCS/ASDSO Sample EAP documents for earthen high hazard dams, Developing Emergency Action Plans Using the NRCS Sample EAP "Fillable Form" Template*. 2004.

U.S. Department of Agriculture, Natural Resources Conservation Service, Electronic Directives System. *National Operation & Maintenance Manual, Part 500, Subpart F – Emergency Action Plan*. September 2007.

U.S. Department of Agriculture, Natural Resources Conservation Service, Electronic Directives System. *National Operation & Maintenance Manual, Part 500, Subpart G – Operation and Maintenance, 500.66 Sample Emergency Action Plan*. September 2007.

U.S. Department of the Interior. Departmental Manual, Series: Emergency Management, Part 900: Emergency Management Program, Chapter 1: Policy, Functions, and Responsibilities. January 4, 2006.

U.S. Department of the Interior. Reduce Dam Safety Risk [RDSR] *Line of Business Modernization Blueprint* (Version 1.3). July 26, 2009.