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POTABLE WATER PRODUCTION AND DISTRIBUTION DURING HUMANITARIAN ASSISTANCE/DISASTER RELIEF SITUATIONS

PURPOSE

This document summarizes the processes used by civil authorities to obtain potable water treatment, distribution, and transportation equipment maintained by the Department of the Army (DA) and the Army National Guard (ARNG) during and subsequent to the onset of emergency/disaster circumstances.

BACKGROUND

A number of Humanitarian Assistance/Disaster Relief (HADR) events experienced in recent years have demonstrated the importance of potable water supplies and the tenuous nature of existing infrastructure and water quality. The potential impacts relative to public health are critical as well. Populations cannot survive more than a few days without water and certainly cannot initiate or endure the recovery process until such resources are rehabilitated or made available. Ideally, permanent water production facilities can be protected or quickly rehabilitated to provide reliable, safe water supplies. Commercially available supplies (i.e., bottled water) have been incorporated into many community and organizational emergency plans as an interim source. Unfortunately, transportation of such supplies into an affected region may be difficult; a limited amount of water may be available in many locations, and large numbers of people could be competing for these same resources. An organized rationing and distribution program for interim supplies (which is unlikely to be in place) could not sustain a population for very long. Another option used to provide a high quality water supply for interim periods has been to utilize assets developed for and used by the U.S. military. This document will delineate the basic methodologies used for U.S. states and territories, as well as HADR for autonomous, foreign governments to obtain such support from the DA and ARNG.

RECENT EXAMPLES

The spate of natural disasters in recent years has demonstrated the fragility of our critical infrastructure, and the potential public health impacts when resources such as potable water become compromised. In addition to direct public health effects associated with water availability and quality during an event, they also demonstrated difficulty in providing potable water to large populations to facilitate recovery and resumption of “normal” activity. Hurricanes Andrew, Katrina, Ike, Sandy, Harvey, Irma, and Maria are examples of natural events disrupting infrastructure and the provision of potable water supplies, as are recent earthquakes in Haiti, Mexico, South America, Japan, and New Zealand. The lack of access to potable water subsequent to these events hindered recovery and created conditions that promoted the spread of illness. Further, widespread flooding, such as along the Mississippi River during 1993 and 2016, adversely impacted the operation of many water systems supplying affected communities. Resources maintained by the Department of Defense (DOD) have been considered a viable option to provide assistance to civil authorities regarding interim potable water treatment and

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distribution. Mobile water purification systems have been developed to support deployed military personnel from all Services, as they can be used to create potable quality water from virtually any freshwater or saline source. In addition, mobile distribution and storage equipment has been fielded to facilitate the availability of potable water to personnel. Finally, mobile water tanks, of various sizes, have been developed to transport water supplies to isolated personnel located away from the water treatment or storage systems. Further, monitoring and assessment capabilities have been developed to evaluate these supplies and assure product water quality. Upon request, the military personnel assigned to this equipment can be deployed, under emergency circumstances, to service civilian populations.

The specific equipment utilized in response to requests for emergency water support will often depend on the needs of the regions requiring support and the units responding. Water treatment is most often provided using a Tactical Water Purification System (TWPS) operated by Active Duty (AD) or National Guard (NG) personnel. The TWPS consists of microfiltration membranes, high-pressure reverse osmosis membranes, and post-chlorination for disinfection. Activated carbon and mixed-bed ion exchange processes may be added to remove additional contamination (if necessary—e.g., toxic industrial chemicals or chemical, biological, radiological, nuclear (CBRN)). This equipment can provide 1500 gallons per hour (gph) from fresh or brackish water sources and approximately 1200 gph from saltwater sources. In addition, a number of NG units still maintain the older 600 gph and 3000 gph Reverse Osmosis Water Purification Units (ROWPUs). The ROWPUs possess a somewhat different filtration system and are being replaced by the newer TWPS within the AD. Potable water is stored in fabric tanks and distributed to designated communities from the production locations using Buffaloes (400 gal tanks), Hippos (2000-gal tanks), and the Camel II (800-900 gal portable water tanks). The transport vehicles and two personnel per vehicle must be requested along with the basic production and distribution equipment.

REQUESTING ASSISTANCE

There exists several methods for affected civilian communities/states/territories/countries to request and obtain temporary support from the DOD (AD and NG) regarding the production, distribution, and monitoring of potable water supplies during HADR conditions. The appropriate approach to be used will depend upon several key criteria:

- The cause of the “emergency” situation
- The location of the situation
- Extent of the area/number of people impacted and requiring support
- Availability of alternative resources locally
- Availability of assets within DOD/NG
- Proposed duration of support requested
- Accessibility to requesting locales
- Security

EMERGENCY ASSISTANCE PROCESS

Emergency response actions always begin at the local level. First responders and support from the local governments are the first line of defense for any disaster or emergency situation. Should the extent or circumstances of the event exceed the capability of local resources, assistance may be requested/obtained from successive, broader-based levels of government or organization. For example, a local government may request assistance from a county or regional government if overwhelmed. Subsequently, assistance may be sought from the state or territorial government, which possess many varied resources under their jurisdiction. From the perspective of potable water production and distribution, one of the key assets available to the states are the NG. These units routinely are state-based assets that may be activated and assigned by the respective Governor or State Adjutant General (acting for the Governor). National Guard units may also be used as National assets, if federalized through Title 10 and working through the National Guard Bureau (NGB). Availability of water production, transport, and distribution equipment utilizing DOD (AD and NG) assets can occur, if needed, but involves a prescribed series of declarations and reviews, which will be summarized later in this text.

STATE NATIONAL GUARD RESPONSE

During recent years, a significant amount of water purification and distribution equipment and Quartermaster-trained operations personnel has been transferred to the NG for training and deployment. Numerous states now possess such capabilities within their ARNG and Air National Guard (ANG) units. Frequently, the ARNG units (if available) can respond to requests for emergency support at locations within, or nearby, their respective states where they transport equipment and personnel by land. A broader range of support requires the State Adjutant General or Governor to have the ANG provide air transport for ARNG resources. The ANG has developed pre-packaged Disaster Relief Beddown Sets, which include temporary billeting and laundry facilities, along with water production and distribution equipment. Since they control air transport capabilities, the ANG may provide support to a broader area. These systems are delivered as a packaged unit, and not all assets may be required or useful at a particular site.

Although NG resources are considered DOD assets, they fall under the control of the respective state where they are stationed and are activated at the request of their state’s Governor and/or Adjutant General. They can be activated and assigned anywhere within their particular state to provide emergency support. NG resources can be expanded to provide HADR anywhere at the request of the Governor/Adjutant General. A state’s emergency management authority plays a significant role in determining what resources are required, where they should be located, and how they interact. During emergency or disaster circumstances, the emergency management authority may be granted the authority to act for the Governor. Each state and U.S. territory has signed a mutual Emergency Management Assistance Compact (EMAC) stating their willingness to assist other signatories upon request. The EMAC also details how the State/Territory receiving assistance will be responsible to provide full reimbursement for all costs incurred by supporting state/territory NG units.

NG support provided within the state where assigned is relatively straightforward. The Governor may declare a state emergency situation and activate requisite elements (personnel and equipment) to address the situation. These assets may be located and tasked per the Governor's/Adjutant General's emergency authority's needs. This situation was observed during the recent response and recovery operations associated with Hurricanes Harvey in Texas and Irma in Florida. ARNG units in both states were deployed to assist during these emergency conditions, along with select units from neighboring states.

The request for assistance from NG units external to a particular State or Territory is more complex. The Governor and emergency management authorities must make a determination that the resources at hand do not sufficiently meet the needs of the population. Subsequent to Hurricane Maria, for example, the entire population of the territories of Puerto Rico and the U.S. Virgin Islands (USVI) (including NG personnel) were preoccupied trying to protect their homes and families and were not in a position to serve the needs of their territories. Water and power infrastructure was destroyed across the territories, and most of the water that was available was deemed unsafe to consume. Once it was determined that greater assistance was necessary, above that immediately identified by Federal Emergency Management Agency (FEMA)/DOD, efforts were initiated to request additional assistance from NG assets across the country. The process used to accomplish this follows:

1. The requesting Governor/emergency management authority identifies specifically the type of support/assistance they require. For example, in Puerto Rico and the USVI, this involved several additional water purification systems and the means to haul water to pre-determined distribution points for the populations.

2. These needs are delineated using an internet tool identified as the Joint Information Exchange Environment (JIEE), which is reviewed by all NG units and coordinating authorities at the NGB. Requests for Proposals (RFPs) to provide the requisite support are solicited from all ANG and ARNG units. The Adjutant General frequently is responsible for posting these requirements on the JIEE.

3. NG units with the requested capabilities and equipment determine their availability and ability to coordinate travel to the required locations. Those units capable of meeting the requirements listed in the RFPs send a positive response to the requesting Adjutant General and the NGB. Authorities within the NGB assist with coordinating the NG response. The NGB Readiness and Plans office within the G3 maintains a listing of all available resources maintained by NG units. The G3 Current Operations Office may proactively reach out to some state NG units who have the equipment and personnel requested for support to inquire if they can/will provide assistance.

4. The NGB Operations and Logistics offices then assist responding state units with coordinating with requesting states/territories and programming transportation needs.

5. The NGB coordinates with State/Territory authorities to ensure that the appropriate equipment and personnel are sited where the requesting Governors/Adjutant Generals and emergency managers require such support and that there is no duplication of

effort or resources deployed.[Note: The emergency managers who are controlling the situation provide the active direction during the emergency action.]

6. Generally, NG units providing support can reach the locations of need via ground transportation. In the recent case involving Puerto Rico and the USVI subsequent to Hurricane Maria, however, NG resources were transported to the territories using military/ANG aircraft. Water production equipment and support personnel were transported to the designated locations, and treatment operations were initiated at the direction of emergency management authorities. Bulk water supplies were transported to localized distribution points identified by state/territory authorities using water trailers and trucks provided by the ARNG, where it was distributed to the population.

7. All NG assets must maintain a designated chain of command. Once an emergency is declared and support resources enter the picture, a Dual-Status Commander is identified. [Dual status commanders are authorized to command Federal responders, AD and state NG. This special authority enables them to effectively integrate the defense support operations and capabilities with government, civilian, and contracted operations that governors/emergency management authority's request.] These individuals are familiar with the locations impacted and the requisite resources within the state/territory affected.

8. All actions undertaken as part of the emergency response must comply with state/territory regulations. Generally, the local water authority/agency must approve all actions regarding the acquisition, treatment, and distribution of potable water. The local state/territory and/or municipal authorities will frequently sample the water supplies produced by NG or AD personnel responding to the emergency situation. In both Puerto Rico and the USVI, the territory water authority, in conjunction with their Public Health agencies, sampled and approved the waters produced as compliant with their standards and suitable for consumption. Unique requirements imposed by a state/territory must also be enforced. For example, the Texas Water Authority and Public Health Agency mandates that their offices not only approve the final water to be consumed, but they must also sample and approve the waters used as a source for the military water purification equipment. There is a specific limitation identified on the use of any waters influenced or resulting from flooding activities. Such requirements must be identified in advance, as this would impact the location of treatment equipment and the alteration of storage and water transportation requirements.

9. The Dual-Status Commander and state/territory emergency management authority will determine when the mission has been completed and when the NG resources may be redeployed. In the recent situation regarding Hurricane Maria, personnel were flown home via commercial air transport, and the equipment was returned to the continental United States via commercial ship, where it was met and driven back to its home base (i.e., using the most cost-expedient method available).

10. Invoices detailing all costs incurred by the NG units providing support will be submitted to the state/territory Adjutant General and Governor for reimbursement, per the EMAC agreement. These authorities will ensure that all reimbursements are completed.

FEDERAL ASSISTANCE

When the resources available at the local and State levels become exhausted or prove inadequate to support the population affected by an emergency or disaster situation, the Governor will request a disaster declaration from the President of the United States. The President, acting upon advice from the FEMA Administrator and Governor may approve such action and sign a “Presidential Disaster Declaration.” This declaration will include the area affected with a start date and an appointment of a Federal Coordinating Officer (FCO). This declaration will make Federal resources and agencies available to support the designated emergency. A State Coordinating Officer will submit a FEMA Resource Request Form to the FCO for resources requested that fall outside the capabilities of the State or Territory. If the FCO determines that DOD support would be the best solution, a Mission Assignment (MA) is processed through the Defense Coordinating Officer (DCO). The DCO validates the MA in conjunction with FEMA and coordinates with U.S. Army North (ARNORTH) prior to submission to U.S. Northern Command (NORTHCOM). NORTHCOM will review the MA and the capabilities required. If the requested capabilities fall under the Chairman of the Joint Chief of Staff Defense Support of Civil Authorities (DSCA) Standing Execution Order (EXORD), the NORTHCOM Commander will activate and deploy the unit(s). NORTHCOM will notify the Secretary of Defense (SECDEF) that the unit(s) have been activated. If the capability does not fall under the Standing EXORD, the MA is sent to the Joint Staff for review and validation. If approved, the request will be sent to the Office of the SECDEF to either approve or disapprove the MA.

ARNORTH is the Army component of NORTHCOM to provide command and control of DOD Homeland Defense efforts and to coordinate DSCA. In a time of major disaster, such as the hurricanes in 2005 and 2017, ARNORTH became the Joint Forces Land Component Command (JFLCC) for NORTHCOM to command and control those deployed units in support of the DSCA mission. ARNORTH/JFLCC was also responsible to set the theater for the DSCA mission and set the priorities within the time-phased force deployment list. During operations they were also involved in reviewing any additional military capabilities requested/required through the request for Forces process. Like most major DSCA operations, ARNORTH/JFLCC worked closely with the other Services on the DSCA response since capabilities were not only required from the Army but from the other military services.

Subsequent to the widespread devastation caused by Hurricane Maria in 2017 and the declaration of a National Emergency by the Federal Government, the DOD was requested to provide assistance in producing and distributing potable water during recovery operations. Elements from Fort Carson, Colorado and Fort Bragg (XVIII Airborne Corps), North Carolina proceeded to Puerto Rico to provide the requested assistance. Personnel and equipment were deployed to establish water production points at four locations across the territory to service key military and civilian communities. Potable water was transferred to portable water trailers and transported to pre-designated locations, where it was distributed to the local populations. All

military assets remained under the command of an AD Sustainment Brigade from Fort Carson, located onsite.

Military Preventive Medicine units provide public health support to U.S. and Coalition Forces, especially in deployed settings; these units should be considered when planning response efforts and determining resources necessary for emergency circumstances. Sampling equipment and methodologies utilized in Technical Bulletin, Medical 577 (TB MED 577, Sanitary Control and Surveillance of Field Water Supplies, May 2010) should be useful during HADR operations. Preventive Medicine/Public Health personnel have played important roles during past emergency incidents—including Hurricane Katrina in 2005, the 2010 Operation Unified Response in Haiti, the 2011 Operation Tomodachi in Japan, Hurricane Sandy in 2012, and Hurricane Harvey and Maria in 2017. These personnel are trained and equipped to provide a basic assessment of water quality on-site and will coordinate advanced water testing as required. Personnel skills and capabilities are enhanced through the performance of routine water supply system monitoring wherever they are stationed (fixed or field operations) and the updating and calibration of equipment. They can also access the U.S. Army Medical Command (MEDCOM)/U.S. Army Public Health Center (APHC) and the Army Medical Material Agency for reach-back support during emergency response. Further, APHC can provide Specialized MEDCOM Response Capabilities—Public Health teams for emergency operations worldwide. These teams can provide consultative support, as well as surveillance guidance and equipment, for public health issues in addition to water surveillance (e.g., soil, air, and vectors). Furthermore, APHC can provide comprehensive laboratory services for sample analysis and assessment and is the Army's custodian of the Defense Occupational and Environmental Health Readiness System (DOEHRS) to record and archive data.

HADR ABROAD

It is not unusual to see video of international groups rendering aid/assistance to a country that has experienced some catastrophic natural disaster. Among them have been numerous organizations from within the United States. However, it is rare to observe DOD, or any nation's Uniformed Service, involved in such relief efforts. It has proven to be unsettling to most indigenous populations to see military personnel from other nations acting with purpose within their borders. [Note: A notable exception to this occurred after the major earthquake in Haiti several years ago, where the devastation and relative isolation required significant military involvement for transport of personnel, supplies, and equipment and the Tomodachi Japan earthquake/tsunami response.] It is preferred to avoid any appearance of military action or invasion. Items such as water support are not normally requested from other nations. Local assets and contractors are primarily relied upon to recover infrastructure. This minimizes the need for financial reimbursement from the requesting nation and assists the local economy. Foreign nations generally only request DOD air transport, except under extreme circumstances.

The devastation caused by Hurricanes Irma and Maria in the Caribbean created a temporary need for external support to produce and distribute potable water. DOD resources were requested and deployed to these locations for HADR to assist during response and recovery operations. All such requests for countries and territories not associated with the United States must be forwarded through the U.S. Department of State, via the local embassy or the U.S.

Agency for International Development (USAID). The process used to present a request for international support follows:

1. The Host/requesting Nation initiates an official request for support to the embassy or USAID, specifying the type of support needed.

2. The USAID's Office of U.S. Foreign Disaster Assistance (OFDA), as the lead Federal coordinator for the U.S. Government's disaster response overseas, first makes a determination on whether or not DOD-unique capabilities are required. If so, OFDA submits an Executive Secretariat Memo to the Office of the Secretary of Defense (OSD) requesting the DOD assistance needed.

3. OSD then passes the Memo/request to the Joint Chiefs of Staff, who tasks the appropriate Geographical Combatant Command (GCC) (e.g., U.S. Africa Command (AFRICOM), U.S. European Command (EUCOM), U.S. Northern Command (NORTHCOM), U.S. Pacific Command (PACOM)—depending on the location).

4. A Mission Tasking Matrix is developed, which delineates the detail of the request—who is asking for support, what they are asking for, where the support is needed, and so forth.

5. The GCC, through U.S. Forces Command (FORSCOM), determines available Forces and equipment; the tasking is sent through the Command to the units identified to support the request.

The OFDA consults with representatives from the Host/requesting Nation to determine where the equipment should be deployed and what population(s) is (are) to be serviced. The OFDA authorities also determine when the mission is complete and when the units can redeploy. All costs incurred throughout this assistance mission will be reimbursed by the host/requesting Nation.

WATER QUALITY AND PROTECTION OF PUBLIC HEALTH

The water purification equipment utilized by AD and NG Forces can produce potable water from most fresh, brackish, and saline water sources. Trained operators provide monitoring and maintenance to ensure proper operation of the equipment. It is critical that such actions are continued throughout the operational cycle. Proper filter media, chemicals, and membranes must be supplied to facilitate operational sustainment. Such support must be programmed prior to deployment. Similarly, fuel for vehicles transporting equipment and generators supporting the water purification systems, lights, pumps, and so forth, should be addressed during project planning.

Establishing potable water purification systems for DSCA operations must be coordinated with local environmental and public health authorities prior to activation of disaster assistance. All local/country standards must be met, requiring significant interaction and coordination, and in many cases pre-approval by local health officials before water is treated and distributed.

Preventive Medicine personnel should be prepared to perform water quality oversight according to TB MED 577 (Sanitary Control and Surveillance of Field Water Supplies, May 2010).

Water quality to ensure that equipment is operating properly and as designed is generally the responsibility of the equipment operators. Basic operational monitoring provided hourly by the purification system operators includes free available chlorine residual, total dissolved solids, turbidity, and system pressures. Currently, available equipment has been designed and tested to provide potable water quality from most available water sources. Water quality, from a health perspective, is often performed by Preventive Medicine or Public Health personnel. However, these personnel are generally not deployed with the water purification or distribution systems during emergency situations (although they will often be present as Medical Detachments or as a Specialized MEDCOM Response Capability for Public Health (SMRC-PH) team). As previously stated, Preventive Medicine/Public Health may work with local health agencies in support of protecting the general public; however, their primary mission is to mitigate and document health risks to deployed Service members. In doing so, thought must be given to how best to surveil environmental exposures to ensure the health of Service personnel and the public consuming the water supplies. Exposure pathways, the link between the threat and the exposure to that threat by the Service member, must be considered prior to initiating onsite water quality sampling and analysis. Exposure, for example, may be in the form of immersion in flood waters, dermal contact during showering, and consumption during brushing teeth and/or drinking. Once the exposure pathway is defined, Preventive Medicine/Public Health should perform field tests appropriate for the exposure to document acute threats. Selection of which analyses to perform will depend on it the water is raw or treated and may include pH, total dissolved solids, turbidity, free chlorine residual, and total coliform/*Escherichia coli*.

Fielded military equipment sets, kits, and outfits, such as the Water Quality Analysis Set-Preventive Medicine (WQAS-PM), are designed to provide these capabilities. While the WQAS-PM provides a capability, it is only relevant if the analytical instruments are maintained and reagents are available. Periodic maintenance of the instruments, re-familiarization with their operation, and maintaining valid reagents is critical since notification of deployment is too late to order supplies. More detailed water quality analysis can be performed using APHC Advanced Water Test kits, which contain numerous sample bottles to be filled on-site and shipped back to APHC. These kits document chronic health risks of both raw and treated waters. Contact APHC at usarmy.apg.medcom-aphc.list.desp-request@mail.mil prior to deployment to coordinate advanced water testing; refer to TB MED 577 for additional guidance regarding water quality surveillance.

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