

Technical Decontamination Support Systems Assessment Report

March 2007

In order to provide emergency responders with information on currently available Technical Decontamination Support Systems (TDSS) components, the U.S. Department of Homeland Security's Center for Domestic Preparedness (CDP) conducted a comparative assessment of three TDSS components in October 2006, and provided findings in the Technical Decontamination Support Systems Assessment Report, which is available by request at <https://saver.fema.gov>.

Background

Technical decontamination of emergency responder reconnaissance and entry operations personnel is an essential element of hazardous materials (HAZMAT) and weapons of mass destruction (WMD) response. Technical decontamination commonly refers to the deliberate decontamination of responders wearing personal protective equipment (PPE). It may, however, also include the decontamination of emergency response equipment and evidence. Technical decontamination is performed with an emphasis on thorough agent removal or neutralization versus speed.

Assessment

Each assessed system was comprised of a water heater, a decontamination shower, and a water containment system (a containment pool and a containment bladder or drum). Table 1 lists the components used in each TDSS. Evaluators assessed the components while using them as part of a complete system. The assessment results are grouped by water heater, decontamination shower, and water containment system.

Assessment Results

Evaluators scored the TDSS components based on the evaluation criteria established by the TDSS focus group and prioritized within the five SAVER categories (capability, usability, affordability, deployability, and maintainability). The scoring system for each component was based on a 100 point scale and utilized the evaluation criteria weighting factors established by the focus group. The following sections provide a brief summary of the evaluator scoring and comments on each of the three TDSS components. Within each section, the components are listed from highest to lowest evaluator score. A complete breakdown of evaluator comments by individual criteria is included in the full *TDSS Assessment Report*.

Table 1: TDSS Components

System	Water Heater	Decontamination Shower	Containment Pool	Containment Bladder/Drum
	Reeves	Fend-All	Fend-All	Interstate

<p>1</p>	 <p>Reeves[®] EMS, LLC G2-I Decon Water Heater (#RDHW0004) <i>Photo courtesy of CDP</i></p>	 <p>Fend-All DeFend[®] Emergency Decon Shower (#32-001180) <i>Photo courtesy of CDP</i></p>	 <p>Fend-All DeFend[®] Decon Pool (#32-001182) <i>Photo courtesy of CDP</i></p>	 <p>Interstate Products, Inc. Replacement Bladder Tank (#RC-IPINPPT/100) <i>Photo courtesy of CDP</i></p>
<p>2</p>	<p>Zumro</p>  <p>Zumro[®], Inc. Propane Water Heater (#9908) <i>Photo courtesy of CDP</i></p>	<p>RMC</p>  <p>RMC Medical, Inc. Decon Shower (#HDS6012) <i>Photo Courtesy of CDP</i></p>	<p>RMC</p>  <p>RMC Medical, Inc. Decon Pool (#HDS) <i>Photo courtesy of CDP</i></p>	<p>ENPAC</p>  <p>ENPAC Corporation Poly-Overpack[®] Salvage Drum (#1237YW) <i>Photo courtesy of CDP</i></p>
<p>3</p>	<p>Compact 4000</p>  <p>First Line Technology, LLC Duel Facility Compact 4000 Water Heater (#DAV02000007) <i>Photo courtesy of CDP</i></p>	<p>DQE</p>  <p>DQE Standard Decon Shower (#HMK1101) <i>Photo courtesy of CDP</i></p>	<p>DQE</p>  <p>DQE Standard Decon Pool (#HM1050) <i>Photo courtesy of CDP</i></p>	<p>DQE</p>  <p>DQE Flexible Wastewater Tank (#HM150) <i>Photo courtesy of CDP</i></p>

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Water Heater Results

As shown in Table 2, the evaluator composite scores for the three assessed water heaters ranged from 67.7 to 66.1. The close scoring of the three water heaters and the evaluator comments indicated only slight differences in the water heater capabilities and performance observed during the assessment. An analysis of the evaluator scores and comments indicate that selection of the “best” water heater for a jurisdiction will be dependent upon the number of showers as well as the type of water supply and hoses planned for use with the TDSS.

Reeves

The Reeves water heater received the highest evaluator usability, deployability, and composite scores. Evaluators reported that the Reeves is capable of a 28 gallons per minute (gpm) flow rate. They also noted that the water heater can accept a water supply from a 1-1/2-inch commercial National Standard Thread (NST) building supply, standard hydrant, or a pumper truck with adequate pressure and flow (up to a maximum water pressure of 125 pounds per square inch [psi]). Evaluators commented that the 1-1/2-inch supply enables the Reeves to provide heated water to several decontamination showers simultaneously. Evaluators noted that the Reeves has two fresh water outlets and two decontamination solution outlets, which utilize 3/4-inch hoses with “quick connect” adapters.

Evaluators reported that the Reeves is easy to set up, start, and operate, even while wearing Class 3 PPE. Evaluators complimented the Reeves’ rugged metal construction and design. They pointed out that the Reeves was the only assessed water heater with a built-in decontamination tank, but they noted that the green colored fuel tank and red colored decontamination solution tank may create some confusion.

Zumro

The Zumro water heater received the highest evaluator affordability and maintainability scores. Evaluators reported that the Zumro is capable of a 3.7 gpm flow rate with a minimum flow rate of .5 gpm. They also noted that the water heater has one 3/4-inch water inlet, one cold water outlet, and one hot water outlet. All of the Zumro connections use standard garden hose fittings. Evaluators stated that the Zumro manufacturer recommended a maximum water pressure of 150 psi. Evaluators noted that the fittings were easy to use, but several stated that it was difficult to tighten the hose fittings because the case opening around the connections was too small.

Evaluators pointed out that the Zumro was the only assessed water heater that did not require electricity for operation. Evaluators commented that the Zumro is not thermostat-controlled and does not have a temperature gauge. Instead, they reported that the unit has a three-position gas control slide, which produces a temperature rise of 33°, 45°, or 90°F. Evaluators reported that the Zumro is easy to set up and operate, but could be difficult to start due to the small pilot light window. The aluminum casing and internal housing appeared to be rugged and durable, but evaluators expressed concerns about the durability of the pilot light igniter, plastic temperature slide, and plastic water control valves.

Table 2: Water Heater Assessment Results

Water Heater	Capability Score	Usability Score	Affordability Score	Deployability Score	Maintainability Score	Composite Score

	(.30 Overall Weighting)	(.15 Overall Weighting)	(.05 Overall Weighting)	(.20 Overall Weighting)	(.30 Overall Weighting)	
Reeves	20.5	10.4	3.4	14.6	18.8	67.7
Zumro	19.9	9.8	3.6	14.2	19.3	66.8
Compact 4000	20.6	9.8	3.1	14.5	18.1	66.1

Compact 4000

The Compact 4000 water heater received the highest evaluator capability score. Evaluators reported that the Compact 4000 is capable of an 11 gpm flow rate with a minimum flow rate of 4 gpm. Evaluators noted that the Compact 4000's water inlet connection uses a pressure-reducing valve, which allows the unit to accept a water supply from a fire hydrant, pumper truck, or other sources such as a regular garden hose.

Evaluators noted that the Compact 4000 has an internal thermostat that is preset to 95°F, and the user is unable to change the thermostat settings. Evaluators noted that the temperature gauge was difficult to use because it displays temperature readings in Celsius. Evaluators reported that the Compact 4000 is easy to set up, start and operate, even while wearing Class 3 PPE. Evaluators commented favorably on the Compact 4000's rugged metal construction and design, except for the Gerry can, which provides fuel to the unit. Evaluators noted that the Compact 4000 was the only assessed water heater that includes an exhaust chimney. Evaluators pointed out that the Compact 4000 is also capable of producing heated air.

Decontamination Shower Results

Evaluator scoring and comments indicated significant differences in the decontamination shower capabilities and performance observed during the assessment—most notably in the capability and usability criteria. An analysis of the decontamination shower scores and comments revealed that evaluators considered effective spray coverage, water efficiency, and shower construction to be the most important decontamination shower selection considerations. Evaluator decontamination shower scoring is presented in Table 3.

DQE

The DQE decontamination shower received the highest evaluator capability, usability, affordability, maintainability, and composite scores. Evaluators reported that the six adjustable DQE shower heads provided a consistent, encompassing spray. The spray completely covered the evaluators from multiple directions during the assessment rotations, and the accessory spray nozzle allowed the evaluators to rinse the bottom of boots and other difficult-to-reach areas. In addition to the excellent spray coverage, the evaluators pointed out that the shower was very water efficient. Evaluators stated that the polyvinyl chloride (PVC) pipe frame was rugged and well-constructed, and the color-coded quick-connect pipe connectors made setup and takedown quick and easy.

Table 3: Decontamination Shower Assessment Results

Shower	Capability Score	Usability Score	Affordability Score	Deployability Score	Maintainability Score	Composite Score
	(.30 Overall)	(.25 Overall)	(.15 Overall)	(.20 Overall)	(.15 Overall)	

	Weighting)	Weighting)	Weighting)	Weighting)	Weighting)	
DQE	25.0	14.8	11.2	14.2	10.7	75.9
RMC	18.5	14.2	10.0	14.6	10.4	67.7
Fend-All	19.8	11.6	9.2	15.0	9.5	65.1

RMC

Evaluators noted that the RMC's large shower openings provided adequate coverage for full decontamination. Water streaming out of the holes, however, did not provide as much coverage area as the spray created by the DQE shower heads or the Fend-All spray openings. Because holes are only drilled in two of the four overhead pipe frame sections, the evaluators were required to turn around more and stay in the shower longer for complete coverage. As a result, the shower appeared to require more water to provide adequate coverage than the other assessed models. Evaluators reported that the RMC shower does not have an accessory spray nozzle for difficult-to-reach areas. Evaluators liked the color-coded connectors, but they pointed out that it was easy to set up the base incorrectly.

Fend-All

The Fend-All decontamination shower received the highest evaluator deployability scores. Evaluators agreed, however, that the Fend-All shower did not provide adequate coverage for full decontamination. The shower provided spray coverage from the top and sides of the shower, but the spray was not wide enough to provide good coverage. Evaluators noted that Fend-All offers an optional accessory spray wand for difficult-to-reach areas, which may help the shower. Evaluators stated that the self-inflating shower was easily set up by one person. They, however, expressed concerns about the shower's durability—especially the flexible pipe joints.

Water Containment System Results

An analysis of the water containment scores and comments revealed that evaluators considered water capacity and rugged construction to be the most important water containment system component selection considerations. Evaluator water containment system scoring is presented in Table 4.

DQE/DQE

The DQE pool and DQE bladder received the highest evaluator scores in all five SAVER categories. Evaluators stated that the DQE pool was easy for one person to set up. They pointed out, however, that the collapsible frame had numerous pinch points. Evaluators also noted that the pool was large enough to capture shower overspray and its capacity was adequate for most technical decontamination operations. During the assessment, the evaluators filled the pool over half full. Neither the pool liner nor the frame showed signs of straining. The evaluators complimented the rugged construction of the shower and the 150-gallon DQE bladder. They pointed out, however, that the location of the drain valve made draining the bladder difficult.

Table 4: Water Contamination System Assessment Results

Water Containment	Capability Score	Usability Score	Affordability Score	Deployability Score	Maintainability Score	Composite Score
	(.30	(.25				

	Overall Weighting)	Overall Weighting)	(.10 Overall Weighting)	(.25 Overall Weighting)	(.10 Overall Weighting)	
DQE/DQE	23.1	18.6	7.2	19.9	7.3	76.1
Fend-All/Interstate	22.4	16.8	6.7	19.5	7.1	72.5
RMC/ENPAC	21.4	17.1	6.4	18.9	7.1	70.9

Fend-All/Interstate

Evaluators reported that the Fend-All pool was easy to set up, but the frame has several pinch points. During the assessment, the evaluators filled the pool over half full. Neither the pool liner nor the frame showed signs of straining. While the pool's water capacity was adequate for most technical decontamination operations, evaluators stated that the pool was not large enough to capture shower overspray. The evaluators also expressed concerns about the pool's durability. Evaluators commented favorably on the rugged construction of the Interstate bladder, but they noted that the fill and drain valve locations were difficult to reach once the bladder was full.

RMC/ENPAC

Evaluators stated that the RMC pool was economical, easy to set up, and easy to store. They were concerned, however, that the cardboard pool walls were not sturdy enough to adequately contain the pool's stated capacity. When the evaluators filled the pool over half full during the assessment, the cardboard walls began to show signs of straining. While the evaluators were impressed with the drum's rugged construction and its potential for storage, they expressed a preference for the larger capacity and more compact bladders.

Conclusion

The evaluator comments and scoring indicated that all of the assessed TDSS components would enable emergency responders to successfully complete technical decontamination operations while wearing Class 3 PPE. The evaluators' observations on key TDSS component selection considerations contained in the full report, should provide local jurisdictions a helpful resource for the selection of TDSS equipment which best meets their specific needs.

All reports in the series, as well as reports on other technologies, are available on the SAVER website (<https://saver.fema.gov>).