The Field Deployable Hydrolysis System Site Layout

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FDHS Design Layout

The FDHS is designed for worldwide deployment with operational capability within 10 days of arriving on site location. A 20-week design and development phase was funded by DTRA in February 2013 and ECBC subject matter experts led the effort to construct a functional FDHS prototype with partnering organization, the Chemical Materials Activity. More than 50 ECBC employees accounted for 13,000 hours of work in order to meet the objective to produce an operational model in six months that could be transitioned from technology development into an advanced development program.

1. Breathing Air Compressor

Air supplied to operators inside the enclosure during Occupational Safety and Health Administration (OSHA) Level B operations is generated from a Breathing Air Compressor that is contained inside a 20-foot transportable container.

2. Personnel Decontamination Station (PDS)

Operators enter and exit the enclosure through the PDS. The General Purpose Structure includes dedicated air conditioning and provides support for operator decontamination. Personnel Protective Equipment (PPE) includes Tyvek coveralls, and OSHA Level C and OSHA Level B respiratory protection. Emergency response personnel onsite within the PDS will be prepared to enter the operations area in the event an upset condition occurs within the enclosure.

3. Chemical Agent Filtration System (CAFS)

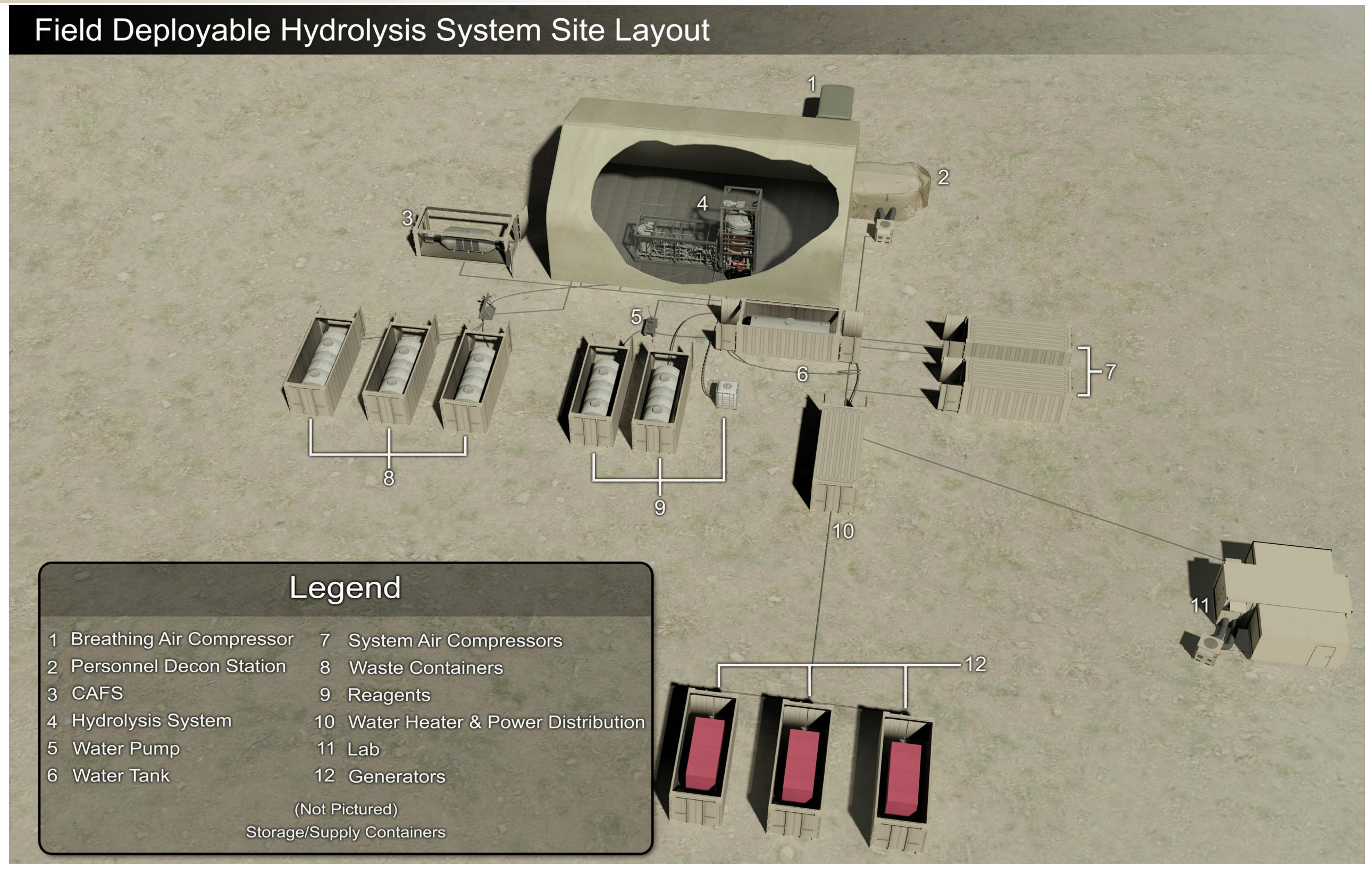
A 5,600-cfm chemical agent filtration system provides ventilation to the enclosure during operations. The system contains a pre-filter, High Efficiency Particulate Filter (HEPA), dual bed carbon filters and a secondary HEPA filter that provides air exchanges and hazardous chemical vapor removal from the enclosure prior to vapor release to the environment.

4. Hydrolysis System

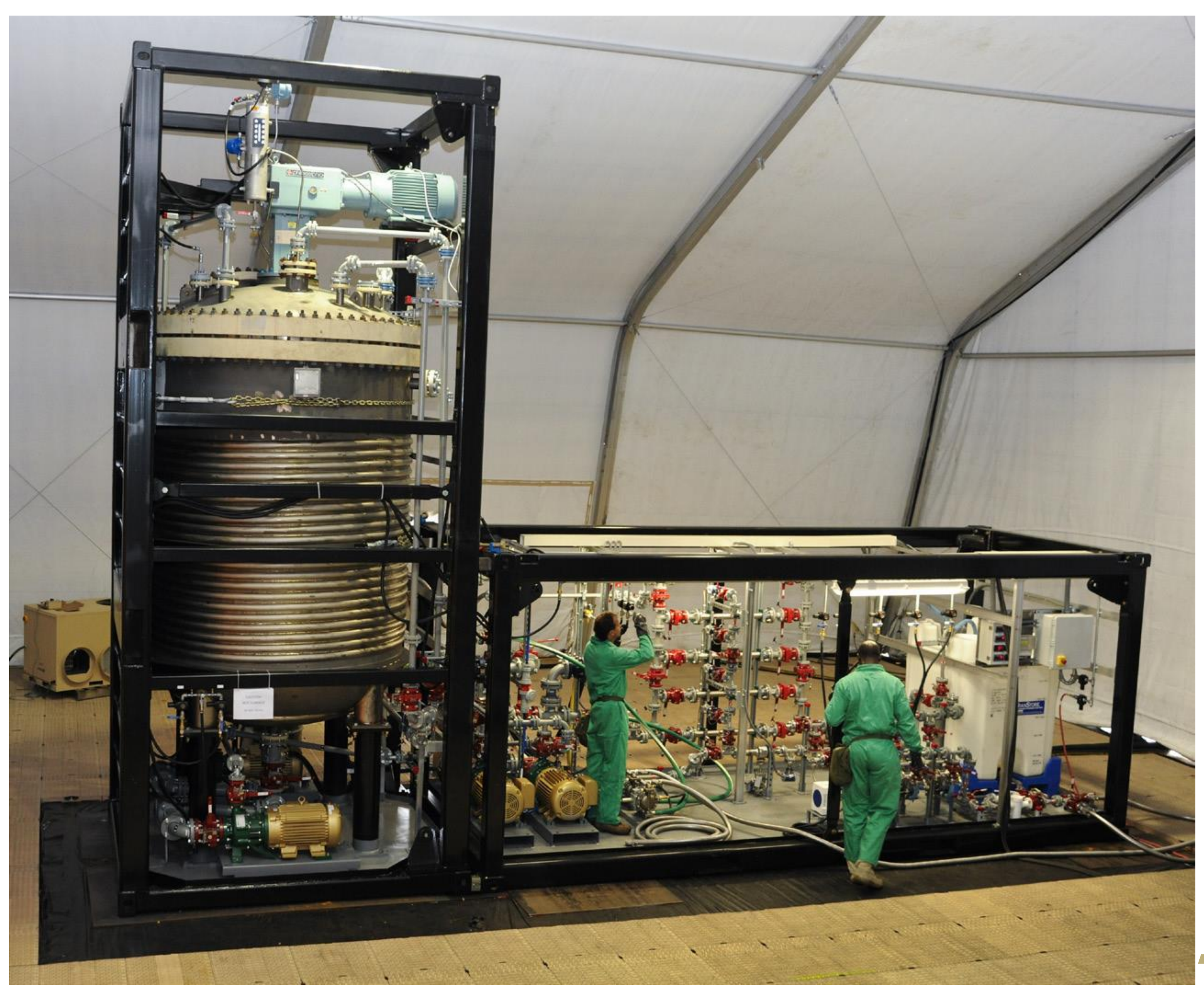
Process flows using the appropriate chemistry achieve 99.9 percent destruction. The titanium reactor has a 2,200-gallon capacity and throughput varies from five to 25 metric tons per day, depending on the material being treated. Flow, pressure and temperature gauges all remotely feed to the control panel, where the process can be monitored and pump flow rates adjusted. On-board agent storage can hold 330 gallons and is useful for consolidating material from several smaller containers. To increase throughput rates, multiple units can be co-located onsite, which also enables the sharing of security and other assets.

5. Water Pump/6. Water Tank

A 4,000-gallon water tank circulates water to system heaters. Water that is brought to the site is pumped into the water tank using a portable pump cart.



The transportable FDHS is a self-sufficient system that includes power generators and a laboratory that is fully capable out of the box, needing only consumable materials such as water, reagents and fuel to operate. It can be set-up within 10 days and is equipped with redundant critical systems that ensure maximum system availability. Once onsite a crew of 15 trained personnel, including SME support, is needed each shift for 24/7 operational capability.



7. System Air Compressors

A compressor air system provides plant air to power pumps on the hydrolysis skid, flush out system piping and ventilate the reactor, agent storage tanks and waste containers.

8. Waste Containers

The FDHS neutralization process generates waste in volumes of five to 14 times the volume of chemical warfare material treated. As many as five waste containers rated for high temperatures are used for interim storage of effluent, which will be pumped from the interim containers after it has cooled. This hazardous waste can then be commercially disposed of in accordance with host-nation environmental laws.

9. Reagents

Water, sodium hydroxide (NaOH) and sodium hypochlorite (NaOCl) are required for neutralization of chemical warfare material and decontamination of system components. The FDHS uses mixing and heating to facilitate chemical reactions with the reagents, which optimize throughput with a destruction efficiency of 99.9 percent.

10. Water Heater & Power Distribution

An onsite 20-foot container is divided into two parts that house the power distribution on one side of the container and water heaters on the other side. The heaters are designed to heat the water up to 90 degrees Celsius for HD processing, and are sized to heat water quickly in order to begin processing the next batch of agent after the three-hour treatment cycle.

11. Lab

An onsite laboratory designed within a 20-foot expandable structure allows for standard transportation. The laboratory includes an environmental control unit, sample handling and storage capability, analytical systems suite and data management. This mobile lab is equipped with a ventilated glove box and fume hood for sample handling and preparation, as well as analytical instruments such as gas chromatograph/mass spectrometers and infrared spectrometers that are used to analyze liquid samples. This suite of equipment was specifically selected and developed to provide confirmation of the identification of the agent material prior to processing, and verification of destruction in the effluent.

12. Generators

Three 300 kW commercial generators provide electricity to the site. An automatic transfer switch ensures the site maintains power in the event of an outage of one of the generators. The power is distributed to systems throughout the site with cables specifically configured to allow for quick set-up.

13. Storage/Supply Containers (Not Pictured)

All system components are designed to fit in 20-foot storage containers for transportation.

THE ECBC TEAM

Throughout the design process, ECBC's Research and Technology Directorate analyzed multiple reagents at varying concentrations and mixing ratios to determine the correct chemistry to achieve 99.9 percent destruction. The Center's Chemical Biological Application and Risk Reduction (CBARR) Business Unit worked with the CMA team to draw on past hydrolysis experience to design the appropriate process flows. In addition, the CBARR team managed the procurement, fabrication, system assembly and site set-up. ECBC's Advanced Design and Manufacturing (ADM) Division within the Engineering Directorate developed models of the skid layout and ancillary equipment, and conducted engineering analyses that included vibration effects during transport.

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