



# FACT SHEET

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Defense (Personnel and Readiness) for Gulf War Illnesses,  
Medical Readiness and Military Deployments

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## Project Shipboard Hazard and Defense (SHAD)

### Flower Drum, Phase I

Project Shipboard Hazard and Defense (SHAD) was part of the joint service chemical and biological warfare test program conducted during the 1960s. Project SHAD encompassed tests designed to identify US warships' vulnerabilities to attacks with chemical or biological warfare agents and to develop procedures to respond to such attacks while maintaining a war-fighting capability.

The purposes of the Flower Drum, Phase I test were to find a simulant to sarin nerve agent, to assess shipboard vulnerability to an enveloping vapor of toxic agent, and to establish comparative penetration properties for sarin nerve agent simulant and actual agent. The USS *George Eastman* (YAG-39) was exposed to candidate sarin nerve agent simulants as well as sarin nerve agent. The ship was enveloped by the test agent disseminated from a gas turbine mounted on the bow of the test ship and by simulated envelopment—direct injection of the test agent into the air supply system.

Trials of candidate simulants sulfur dioxide and methylacetoacetate were run to determine usability as a simulant for sarin nerve agent. Methylacetoacetate was selected and further subjected to comprehensive, comparative tests.

During sarin nerve agent dissemination, the disseminator crew wore M5 protective ensembles and all other personnel (those in the Safety Citadel) wore MK5, M7A1, or M17 protective masks. When dissemination ceased, all personnel whose duties required them to leave the Safety Citadel wore protective masks until the ship was cleared of nerve agent. During the dissemination period of the simulant trials, all personnel wore protective masks. During test periods, the only entrance to or exit from the Safety Citadel was through a decontamination tunnel consisting of a passageway that functioned as an air-sweep tunnel for the decontamination facility and also as one of two primary ventilation exhausts for the Safety Citadel. The passageway was divided into four sections by perforated doors; the doors restricted the rate of airflow and maintained the interior/exterior pressure differential. The decontamination tunnel was outfitted with a gas chamber to be used for a protective mask check, shower facilities (not used during the test of vapor agents), and

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FLOWER DRUM, PHASE I

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protective equipment and clothing removal facilities. All personnel worked in teams of two or more persons and all teams were checked in and out of the Safety Citadel.

Following the termination of sampling, a full aeration of the ship was accomplished. For the sarin nerve agent trials, aeration of the ship continued until the enzyme ticket test of the M15A1 Detector Kit indicated there was no nerve agent in the exhaust air. When negative results were obtained at the exhaust vents, properly protected personnel confirmed the absence of sarin nerve agent within each area—again using the enzyme ticket test of the M15A1 Detector Kit.

Flower Drum, Phase I, tests were conducted in the Pacific Ocean, off the coast of Hawaii, over the periods February through April and August through September 1964.

<b>Test Name</b>	Flower Drum, Phase I (Test 64-2)
<b>Testing Organization</b>	US Army Deseret Test Center
<b>Test Dates</b>	February through April and August through September 1964
<b>Test Location</b>	Testing was conducted in the Pacific Ocean, off the coast of Hawaii.
<b>Test Operations</b>	To find a simulant to sarin nerve agent, to assess shipboard vulnerability to an enveloping vapor of toxic agent, and to establish comparative penetration properties for sarin nerve agent simulant and agent.
<b>Participating Services</b>	US Navy, Deseret Test Center personnel
<b>Units and Ships Involved</b>	USS <i>George Eastman</i> (YAG-39) USS <i>Granville S. Hall</i> (YAG-40)
<b>Dissemination Procedures</b>	The ship was enveloped by test agent disseminated from a modified Model T-45M-2 MARS Portable Gas Turbine mounted on the bow of the test ship and by simulated envelopment—direct injection of test agent into the air supply system.
<b>Agents, Simulants, Tracers</b>	Sarin (GB) Sulfur dioxide (SO <sub>2</sub> ) Methylacetoacetate (MAA)

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<b>Ancillary Testing</b>	E41 V-G Agent Alarm System Hydrogen Flame Emission Detector (HYFED) Passive Long Path Infrared (LOPAIR) advance warning alarm
<b>Decontamination</b>	A decontamination tunnel was used during test periods.
<b>Potential Health Risks Associated with Agents, Simulants, Tracers</b>	<p><u>Sarin (GB)</u> Sarin gas is classified by the Centers for Disease Control and Prevention as a volatile and lethal nerve agent. Occupational Exposure limits are .0001mg/m<sup>3</sup>. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. Symptoms may occur within minutes depending on dose and include runny nose, watery eyes, drooling, tightness of the chest, difficulty breathing, dimness of vision, nausea, vomiting, cramps, loss of bladder/bowel control, twitching, jerking, staggering, confusion, drowsiness, coma, and death. Very little information is available regarding prolonged exposures to low levels and no information is available regarding potential carcinogenicity. Rapid decontamination is critical and administration of atropine every 5-10 minutes is necessary until symptoms are minimized. Complete recovery can take months and permanent damage to central nervous system is possible.</p> <p>(Source: <a href="http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp">http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp</a> [as of February 13, 2002]).</p> <p><u>Sulfur Dioxide (SO<sub>2</sub>)</u> Sulfur dioxide is a strong irritant of the lungs and throat. Internal exposure causes headache, dizziness, nausea, wheezing, and cough. External exposure causes severe irritation of eyes, nose, throat, and blisters on skin. Exposures to sulfur dioxide may lawfully range from 0 to 5 parts per million (ppm) of air. Exposure to 100 ppm of</p>

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	<p>sulfur dioxide is considered immediately dangerous to life and health. (Source: ATSDR Toxicological Profile for Sulfur Dioxide <a href="http://www.atsdr.cdc.gov/toxprofiles/tp116.html">www.atsdr.cdc.gov/toxprofiles/tp116.html</a> [as of February 13, 2002]).</p> <p>Methylacetoacetate (Synonyms: methyl acetoacetate, acetoacetic acid, methyl ester) Potential health effects consist of low to moderate eye, skin and respiratory tract irritation and possible gastrointestinal irritation with nausea, vomiting, and diarrhea. EPA does not consider methylacetoacetate to be a hazardous material. It is not a known carcinogen.</p> <p>(Sources: <a href="http://hazard.com/msds/tox/f/q4/q936.html">http://hazard.com/msds/tox/f/q4/q936.html</a> [as of January 28, 2002] and <a href="http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf">http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf</a>)</p>
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