THE ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D C 20301-1200

HEALTH AFFAIRS

MAR 2 0 2003

The Honorable John Warner
Chairman, Committee on Armed Services
United States Senate
Washington, DC 20510-6050

Dear Mr. Chairman

I am pleased to forward the report prescribed in Section 709 of the National Defense Authorization Act for Fiscal Year 2003 Section 709 requires the Secretary of Defense to report to Congress and the Secretary of Veterans Affairs (VA) how the Department of Defense (DoD) plans to review, declassify, and furnish the records necessary to provide benefits to veterans of Project 112, and to make periodic progress reports This package includes the plan and the first progress report

The enclosed report provides evidence that the DoD's Deployment Health Support Directorate has been diligently pursuing the work envisioned by the Act since the VA's need for information came to our attention in August 2000

Thank you for your continuing support of the military health system

Sincerely,

William Winkenwerder Jr.

William Winkenwerder, Jr , MD

Enclosure
As stated

cc
The Honorable Carl Levin
Ranking Democrat

PLAN FOR DISCLOSURE OF INFORMATION ON PROJECT 112 TO THE DEPARTMENT OF VETERANS AFFAIRS

February 6, 2003

I. **PURPOSE:** To articulate the Department of Defense (DOD) strategy for providing to the Department of Veterans Affairs (VA) the information required by section 709 of Public Law 107-314 and any additional information previously agreed to by the two departments.

II. **SCOPE:** Despite the definition in section 709(f) of the public law, this plan addresses the DOD's strategy to provide all available medically relevant information to the VA concerning the activities the Deseret Test Center conducted in support of Project 112 from the Center's inception in 1962 through its closure in 1973.

III. **DEFINITION:** Beginning in October 2000, DOD and VA representatives have met regularly to define specifically what information is "relevant to the provision of benefits"[1] to ensure DOD investigators would search for, locate and request declassification of all pertinent information. As a result, 'medically relevant information' for Project 112 has been mutually defined as:

A. The name and/or test number of all tests planned by the Deseret Test Center (DTC) in support of Project 112.

B. The inclusive test dates for each executed test.

C. The location, to include naval participating vessels, for each executed test.

D. Biological, chemical and riot control agents; radioactive materials; simulants, tracer materials; and decontaminants documented to have been used in executed tests.

E. Names, ranks, service numbers and any other available identifying information for military personnel known to have been assigned to participating naval vessels during active test periods.

F. Names, ranks, service numbers and any other available identifying information for military personnel whose presence at test locations during active test periods is documented in extant official or verifiable veteran-provided records.

IV. **INFORMATION ALREADY PROVIDED TO VA:** Since the initiation of this investigative effort predates the enactment of Public Law 107-314 by more than

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[1] *see* § 709 (a), P.L. 107-314.

two years, a substantial amount of declassified information has already been provided to the VA. Therefore, the first progress report required by section 709(e)(1) is being submitted concurrently with this Plan.

V. INVESTGATIVE PROCESS:

A. Determine the extent of the planned DTC operational testing program in support of Project 112. This investigation initially focused on providing information about three named tests (Autumn Gold, Copper Head, and Shady Grove) that fell under the umbrella name of "Project SHAD."[2] As the investigation progressed and more information was uncovered, the investigators determined that both land and sea based tests were being conducted by the DTC. Investigators determined that Project SHAD was part of a larger testing program supporting the Project 112 assessment. The investigation scope was ultimately defined as those operational testing activities planned and executed by the DTC, headquartered at Fort Douglas, Utah, in support of DOD Project 112.

B. Locate and review available classified and unclassified records on DTC activities.

1. Final test reports or other definitive records of the results of executed tests. Since test plans and other logistical documents were produced for most planned tests, the investigative team adopted the discovery of an extant final test report among official records as conclusive evidence that a given test was actually executed. Secondary evidence accepted as proof of a test's completion include a test's mention in DTC semi-annual reports and in documentation of annual test planning conferences where the previous year's completed test activity was reviewed. To determine or confirm the activities of a specific ship on specific dates, the investigators consult that ship's deck logs, which are archived at the National Archives in College Park, Maryland.

2. Definitive records of postponed and cancelled tests. The DTC semi-annual reports and the annual test planning conferences documentation provide charts of the deferral and cancellation of planned tests. By following the plans through the years, the investigative team deciphers and correlates shifting test numbering schemes as well as tracks the eventual fate of each planned test.

C. Request declassification and clearance for public release of available information deemed medically relevant that remains classified. The investigative team has established a process with the Department of the Army, the declassification authority for this information, which includes sensitivity to the equities of the Navy and the international community. Decisions on

[2] SHAD – Shipboard Hazard and Defense

what information is deemed medically relevant are made by the investigation team, based on agreement with the VA, and consultation with both DOD and VA physicians.

D. Using available unclassified personnel records and other administrative records, compile lists of military personnel who likely participated in Project 112 related testing activities.

1. Ship-Based Tests – Project SHAD. Ships' crew rosters from this time period are archived at the National Archives in College Park, Maryland. Once participating ships have been identified, the investigators' general practice is to use those rosters to compile lists of military personnel *assigned* to those ships during the entire period of the test. If, however, the investigators have identified each ship's specific participation dates during a test, the lists more closely reflect those who were *assigned* on the actual dates of the test. The investigators are aware of records that could assist in determining whether an individual was actually present during testing, but the VA has indicated that confirmation of assignment to the ship is sufficient.

2. Land-Based Tests. The investigators have had limited success in locating inclusive lists of personnel associated with the Project 112 land-based tests. During the team's work at Dugway Proving Ground, the investigators uncovered a number of commendation letters, country clearance requests, weekly reports, and personnel rosters from which they extracted identifying information for less than 100 military personnel not previously linked with the test program. The investigators did note, however, that many of the land-based tests were staffed predominantly by civilian and contractor employees based at Dugway.

3. Veteran Supplied Documentation. Throughout the course of the investigation, the VA has received claims from veterans containing personnel documents submitted to substantiate the claims. The VA provides the documents to DOD for verification. The investigators have accepted many of these veteran-supplied documents and use them to verify participation for each veteran named on the document, not just the veteran who submits it.

E. Interview individuals who conducted or participated in the DTC testing program. At various times during the course of the investigation, the investigators have consulted with selected individuals who planned and conducted the testing as well as participated in its actual execution.

VI. EXECUTION PLAN:

A. As of the date of this report, the DOD has identified that DTC planned 134 tests between 1962 and 1973.

1. Of these, 62 tests were confirmed to have been cancelled and copies of documents attesting to that have been posted on the Internet web site.

2. The status of 26 tests is still being investigated.

3. Of the 46 remaining tests known to have been executed, DOD has declassified and provided information to the VA and public on 42.

a. Information on two of the four remaining executed tests is pending release once declassification procedures are complete.

b. Although the remaining two tests are known to have been completed based on secondary sources, no final report has been located from which to extract specific details on them. The investigators continue to search for documentation associated with these two tests.

c. Participant information has been located, compiled and provided to the VA on 42 executed tests; 17 of 18 ship-based tests and 25 of 28 land-based tests.

B. The DTC was disestablished in 1973. Its classified records do not appear to have been formally archived. Therefore, the DOD has searched the classified holdings of the following major affiliated facilities to assemble the records used to provide the above information:

1. Soldier Biological and Chemical Command, Aberdeen Proving Ground, Maryland.

2. Dugway Proving Ground, Utah.

3. Naval Surface Warfare Center, Dahlgren Division, Dahlgren, Virginia.

4. U.S. Army Chemical Center and School, Fort Leonard Wood, Missouri.

C. The progress outlined above leaves the following tasks outstanding:

1. Locate any available records that detail the results of DTC Tests 68-71 (Folded Arrow) and 70-11. (Tests cited in A.3.b. above.)

2. Locate any available records to confirm whether DTC Tests 68-14 (Channel Crab), 69-74 (Prairie Carpet), 70-C, 70-D, 70-50 and 70-74, and

twenty DTC tests planned for fiscal years 1971 through 1974 were executed or cancelled. (Tests cited in A.2. above.)

3. Review and assess newly located records, requesting declassification and public release of medically relevant information as needed.

4. For the tests determined to have been executed, prepare fact sheets and compile participant rosters from available records and provide to the VA.

D. To accomplish the remaining tasks, the DOD will:

1. Query selected commands and activities, or their successors, known to have received DTC reports to determine if they have retained any of the documents being sought. Approximately twelve such organizations have been identified.

2. Directly query the organizations that requested those tests for which execution status is still unknown. Project 112 scientists have told the investigators that to save money toward the end of the DTC's existence, final test reports were not always published. Instead a letter report was sent directly to the requesting organization(s). If the test was executed, the investigators will ask that a copy of the final letter report be provided.

3. Conduct a detailed assessment of the relevant records of the Joint Staff maintained by the National Archives in both College Park and Suitland, Maryland. Project 112 was executed under the guidance of the Joint Chiefs of Staff. To ensure that all relevant documentation has been located, the Joint Staff files must be reviewed.

VII. **CONCLUSION OF EFFORT.** Upon the completion of the above tasks, the investigators believe that they will have exhausted all available and extant official information sources for Project 112. The DOD anticipates that the VA will continue to require assistance to verify information submitted by individual veterans and that interaction could expand the available knowledge base concerning Project 112. Therefore, while the coordinated research effort to accumulate and publish information on Project 112 will end with the completion of the above tasks, the DOD will continue to participate in the related activities described below.

VIII. ADDITIONAL RELATED ACTIVITIES:

A. Case Inquiries and Document Verification. The DOD recognizes that its Project 112 investigators have developed familiarity with both the circumstances of each executed test and their documentary histories, making them uniquely qualified to evaluate both a veteran's recollection of his experience and any documents he may submit to substantiate a claim.

Therefore, despite the formal conclusion of the Project 112 investigative effort, DOD will continue to provide timely response to VA inquiries on specific cases.

B. Medical Follow-up Agency's SHAD Veterans Study. The VA has contracted with the Institute of Medicine's Medical Follow-up Agency (MFUA) to conduct a health assessment of Project SHAD participants. Due to the DOD investigators' familiarity with the test program, DOD will provide assistance to the MFUA in conducting their study to determine if participation in Project SHAD is associated with long term health consequences.

Six Month Report to Congress as directed by PL107-314

A. Number of Records Reviewed. Attachment 1 lists those records reviewed by this office and retained for use by investigators. This list reflects approximately 20,000 pages reviewed by our investigators. Prior to the passage of Public Law 107-314, our investigators did not record records reviewed and not retained for investigator use. To date, we estimate that we have reviewed approximately 10,000 additional pages of records and determined the material was not germane to this investigation. As we continue the investigation, we will maintain a count of records both retained and rejected for future reporting.

B. Each test under Project 112 identified. Attachment 2 is a chart that lists all Project 112 tests identified since the initiation of this investigation. We have identified 134 tests that were planned by the Deseret Test Center. Those tests that were deferred/cancelled and those that have their status yet to be determined are marked accordingly on the chart.

C. For each test identified, list the test name, agents used, number of members of the armed forces and civilians who participated, and the extent of records and information to the VA under this section. Fact sheets were prepared for those tests identified as completed and for which final reports were available. Forty-two tests were identified as completed, and fact sheets were prepared identifying the test number and/or name, as well as agents used. Four tests are known to have been completed; however, no final reports have been located to identify the location, time, agents used, or participants. Investigators continue to search for this information. Attachment 3 lists the number of participants for each test. Many participants participated in more than one test; the total number of military participants identified to have participated in one or more tests is 5183. Attachments 4 through 48 are the Project 112 tests' fact sheets developed to date.

Document Title	# of pages	clas
"Strictly for the Birds": Science, the Military and the Smithsonian's Pacific Biological Survey Program, 1963-1970, extracted from the Journal of the History of Biology 34: 315-352, 2001.	37	UNCLAS
68-52 CLIFF ROSE Test Plan 7 October 1968	50	CONF
A Project Summit Report - Task Night Train Arctic Test Technology for Biological Weapons 31 July 1963	99	CONF
An Overview of the Deseret TestCenter Support and Technical Facilities, October 1972	89	FOUO
Annual Status Report of Joint Operational Activities, March 1971	30	SECRET
AUTUMN GOLD Test 63-2 Final Report May 1964	85	CONF
Bibliographic Data received from Dugway Proving Ground, UT technical library	326	UNCLAS
Bibliographic Data received from Edgewood technical library	102	UNCLAS
BIG JACK Phase A Final Report May 1964	198	CONF
BIG JACK Phase B Final Report May 1964	154	CONF
Biological and Chemical Ship Penetration 8 June 1965	14	CONF
Biological and Ship Penetration 8 June 1965	10	CONF
Brief Summary of DTC Bio Tests, 17 February 1977	22	SECRET
Chemical Weapons in Russia: History, Ecology, Politics.1994	72	UNCLAS
Chronological History of Ernest Harmon Air Force Base	7	UNCLAS
Comparison of Penetration During COPPER HEAD versus Penetration During HIGH LOW December 1965	10	CONF
Conference Briefs for the Fourth Annual Deseret Test Center Planning Conference, 8 March 1965	122	SECRET
Coordination Draft of Test 65-16 PINE RIDGE Final Report June 1967	84	SECRET
COPPER HEAD Special Exercise Report 23 March 1965	22	UNCLAS
COPPER HEAD Test Plan September 1964	71	CONF
Critique of DTC Biological Proposed Testing Outline Plans for Testing in Fiscal Year 1969, Volume I, 15 August 1967	43	CONF

Document Title	# of pages	clas
Critique of DTC Biological Proposed Testing Outline Plans for Testing in Fiscal Year 1969, Volume II, 15 August 1967	45	CONF
Deck Log Book, USS Carpenter (DD-825), June 1963	14	UNCLAS
Deck Log Book, USS Carpenter (DD-825), May 1963	47	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), April 1965	33	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), April 1966	40	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), August 1963	33	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), August 1965	51	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), August 1966	38	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), December 1963	37	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), December 1966	32	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), February 1963	33	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), February 1964	59	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), February 1965	49	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), February 1966	31	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), February 1967	30	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), January 1963	71	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), January 1964	63	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), January 1965	57	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), January 1966	33	UNCLAS

Document Title	# of pages	clas
Deck Log Book, USS George Eastman (YAG-39), January 1967	32	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), July 1966	33	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), June 1964	61	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), June 1966	31	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1963	63	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1964	63	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1965	36	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1966	47	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1967	32	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), March 1967	35	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), May 1964	64	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), May 1966	38	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), November 1963	21	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), November 1964	37	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), November 1965	31	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), November 1966	33	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), October 1963	35	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), October 1966	32	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), September 1965	54	UNCLAS
Deck Log Book, USS George Eastman (YAG-39), September 1966	34	UNCLAS

Document Title	# of pages	clas
Deck Log Book, USS Granville S. Hall (YAG-40), April 1964	13	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), April 1965	16	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), April 1967	39	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), April 1969	29	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), August 1964	1	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), August 1965	20	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), August 1966	47	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), December 1965	18	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), December 1966	17	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), February 1963	29	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), February 1964	34	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), February 1965	34	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), January 1963	5	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), January 1964	51	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), January 1965	12	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), July 1964	13	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), July 1966	42	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), June 1963	14	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), June 1964	9	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), June 1965	26	UNCLAS

Document Title	# of pages	clas
Deck Log Book, USS Granville S. Hall (YAG-40), June 1966	34	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), June 1967	33	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), June 1969	29	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), March 1963	63	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), March 1964	55	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), March 1965	36	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), May 1963	66	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), May 1964	36	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), May 1965	24	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), May 1966	39	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), May 1967	42	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), May 1969	41	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), November 1965	21	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), November 1966	31	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), October 1964	25	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), October 1966	40	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), September 1963	32	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), September 1964	6	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), September 1965	34	UNCLAS
Deck Log Book, USS Granville S. Hall (YAG-40), September 1966	55	UNCLAS

Document Title	# of pages	clas
Deck Log Book, USS Herbert J. Thomas (DD-833), February 1966	42	UNCLAS
Deck Log Book, USS Herbert J. Thomas (DD-833), January 1966	47	UNCLAS
Deck Log Book, USS Herbert J. Thomas (DD-833), March 1966	39	UNCLAS
Deck Log Book, USS Hoel (DDG-13), May 1963	35	UNCLAS
Deck Log Book, USS Navarro (APA-215), June 1963	20	UNCLAS
Deck Log Book, USS Navarro (APA-215), May 1963	67	UNCLAS
Deck Log Book, USS Power (DD-839), February 1965	43	UNCLAS
Deck Log Book, USS Power (DD-839), January 1965	48	UNCLAS
Deck Log Book, USS Tioga County (LST-1158), June 1963	23	UNCLAS
Deck Log Book, USS Tioga County (LST-1158), May 1963	73	UNCLAS
Deseret Test Center Final Report Test 63-1 EAGER BELLE Phase I (Revised) 30 June 1965	106	SECRET
Deseret Test Center in 1962, January 1963	28	CONF
Deseret Test Center Outline Plans for FY 75, February 1973	43	SECRET
Deseret Test Center Report DTC 64-342, Five Year Testing Program, Extracontinental Testing Program for Chemical and Biological Weapons and Defensive Systems, 1 April 1964	46	CONF
Deseret Test Center Requirements and Proposed Program for FY 74, November 1972	90	SECRET
Deseret Test Center Test Plan 63-2 Revision 1 AUTUMN GOLD April 1963	96	CONF
Deseret Test Center Test Plan DTCP 63-1 EAGER BELLE Phase II December 1962	57	CONF
Deseret Test Center Test Plan DTCP 63-4 BIG JACK November 1962	80	CONF
Deseret Test Center Test Plan DTCTP 63-1 EAGER BELLE Phase 1 October 1962	78	CONF
Deseret Test Center Test Plan Test 64-6 YELLOW LEAF 14 January 1964	66	CONF

Document Title	# of pages	clas
Deseret Test Center, Film Inventory	13	SECRET
Deseret Test Center, Outline Plans for FY 74, March 1972	102	SECRET
Deseret Test Center, Outline Plans for Testing in FY 64, 19 February 1963	59	CONF
Deseret Test Center, Outline Plans for Testing in FY 65, December 1963	90	CONF
Deseret Test Center, Outline Plans for Testing in FY 66, 16 December 1964	47	CONF
Deseret Test Center, Outline Plans for Testing in FY 66, Supplement I, 17 December 1964	35	CONF
Deseret Test Center, Outline Plans for Testing in FY 66, Supplement II, Janaury 1966	17	CONF
Deseret Test Center, Outline Plans for Testing in FY 67, December 1965	51	CONF
Deseret Test Center, Outline Plans for Testing in FY 67, Supplement I, December 1965	30	CONF
Deseret Test Center, Outline Plans for Testing in FY 67, Supplement II, February 1966	21	CONF
Deseret Test Center, Outline Plans for Testing in FY 68, January 1967	39	CONF
Deseret Test Center, Outline Plans for Testing in FY 68, Supplement 4, Janaury 1967	38	CONF
Deseret Test Center, Outline Plans for Testing in FY 68, Supplement I, January 1967	28	CONF
Deseret Test Center, Outline Plans for Testing in FY 68, Supplement II, January 1967	33	SECRET
Deseret Test Center, Outline Plans for Testing in FY 68, Supplement III, January 1967	30	CONF
Deseret Test Center, Outline Plans for Testing in FY 69, January 1968	56	SECRET
Deseret Test Center, Outline Plans for Testing in FY 69, Supplement I, Janaury 1968	41	SECRET
Deseret Test Center, Outline Plans for Testing in FY 69, Supplement II, January 1968	26	SECRET
Deseret Test Center, Outline Plans for Testing in FY 69, Tests for Special Consideration, Janaury 1968	29	SECRET
Deseret Test Center, Plans for Testing in FY 70, February 1969	74	SECRET

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Deseret Test Center, Plans for Testing in FY 70, Supplement I, February 1969	75	SECRET
Deseret Test Center, Requirements and Proposed Programs for FY 73, October 1971	53	SECRET
Deseret Test Center, Semi-Annual Status Report, Current Activities to 15 February 1966	117	CONF
Deseret Test Center, Semi-Annual Status Report, Current Activities to 15 February 1967	96	SECRET
Deseret Test Center, Semi-Annual Status Report, Current Activities to 15 July 1966	140	SECRET
Deseret Test Center, Semi-Annual Status Report, Current Activities to 15 July 1968	45	SECRET
Dissemination and Evaluation of a Tracer Material Release (NIGHT TRAIN) Volume II Data Supplement 30 June 1964	298	UNCLAS
Dissemination and Evaluation of a Tracer Material Release COPPER HEAD April 1966	68	CONF
DTC Outline Plans for FY 73, March 1971	80	SECRET
DTC Program for FY 72, March 1971	73	SECRET
DTC Test 65-11 Final Report March 1968	108	CONF
DTC Test 66-1 DEVIL HOLE Phase II Final Report May 1968	183	CONF
DTC Test 66-13 Final Report March 1968	253	SECRET
DTC Test 66-2 (Phase I) Final Report June 1968	81	CONF
DTC Test 66-3 SWAMP OAK Final Report March 1968	132	CONF
DTC Test 66-4 GREEN MIST Final Report Volume I June 1969	37	CONF
DTC Test 66-4 GREEN MIST Final Report Volume II August 1970	165	CONF
DTC Test 66-8 Phase II Final Report May 1968	227	CONF
DTC Test 67-2 Final Report July 1968	137	CONF
DTC Test 67-7 Final Report May 1968	182	SECRET
DTC Test 67-8 Final Report December 1968	185	SECRET
DTC Test 68-10 Test Plan February 1968	31	CONF
DTC Test 68-12 Test Plan February 1968	25	CONF
DTC Test 68-13, Phases I, II, III and DTC Test 69-12 Final Report Volume I February 1972	73	SECRET

Document Title	# of pages	clas
DTC Test 68-13, Phases I, II, III and DTC Test 69-12 Final Report Volume II. Extent and Duration of Downwind Hazard for Chemical Agents GA and GD August 1972	53	SECRET
DTC Test 68-50 Final Report Volume I March 1969	36	SECRET
DTC Test 68-50 Final Report Volume II April 1969	194	SECRET
DTC Test 68-53 Phase I Final Report Volume II February 1971	241	UNCLAS
DTC Test 68-53 Phase I Final Volume I Report March 1971	152	UNCLAS
DTC Test 69-10 Final Report Volume I Coordination Draft October 1969	37	SECRET
DTC Test 69-10 Final Report Volume II April 1971	192	CONF
DTC Test 69-10 Test Plan April 1969	46	CONF
DTC Test 69-12 Phase I Test Plan May 1968	4	CONF
DTC Test 69-13 Test Plan April 1968	12	SECRET
DTC Test 69-14, Simulant Phase I, Test of MC-1 Bomb, Final Report, Volume I October 1972	67	UNCLAS
DTC Test 69-31 Final Report Volume I 29 May 1969	23	SECRET
DTC Test 69-31 Final Report Volume II 29 May 1969	69	CONF
DTC Test 69-31 Test Plan March 1968	33	SECRET
DTC Test 69-32 Final Report Volume I May 1970	38	SECRET
DTC Test 69-32 Final Report Volume II September 1970	167	SECRET
DTC Test 69-71 Test Plan, April 1968	33	CONF
DTC Test 69-75 Final Report Volume I June 1969	39	SECRET
DTC Test 69-75 Final Report Volume II June 1969	198	SECRET
DTC Test 70-73 Secondary Aerosol Study Final Report Volume I April 1972	23	UNCLAS
DTC Test 70-73 Test Plan July 1969	17	SECRET
DTCTP 64-6 (Revised) YELLOW LEAF Test Plan November 1964	64	CONF
EAGER BELLE Phase 2 Final Report March 1964	74	CONF
ELK HUNT Phase I Test 65-14 Test Plan 1964	56	UNCLAS
Employment of YAG 39 and YAG 40 in Support of Toxic Chemical Field Testing	52	UNCLAS
George Eastman, Dictionary of American Naval Fighting Ships	2	UNCLAS
History of the USS George Eastman (YAG-39)	3	UNCLAS

Document Title	# of pages	clas
History of the USS Tioga County (LST-1158) December 26, 1998	3	UNCLAS
History of USS Granville Hall (YAG-40) During Operation Redwing (1956)	2	UNCLAS
Independent Review of the Possible Health Hazards of the Large-Scale Release of Bacteria During the Dorset Defence Trials	39	UNCLAS
Information Security Guidance for NIGHT TRAIN DTCTP 54-5 31 October 1963	31	CONF
Installation Assessment of Gerstle River Test Site Records Evaluation Report No. 105 Volume 1, December 1976	58	UNCLAS
Investigative Report by Alaska Community Action on Toxics for Delta Junction, Alaska, The Nuclear Reactor at Fort Greely, May 2000	53	UNCLAS
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Logistical Support Plan Test Series 66-1 DEVIL HOLE II 31 May 1966	9	UNCLAS
Logistical Support Plan Test Series 66-10 PIN POINT 14 April 1966	7	UNCLAS
Logistical Support Plan Test Series 66-13 HALF NOTE 21 June 1966	10	UNCLAS
Logistical Support Plan Test Series 66-5 PURPLE SAGE 9 August 1965	7	UNCLAS
Logistical Support Plan Test Series 66-8 WEST SIDE II 25 August 1965	7	UNCLAS
Logistical Support Plan Test Series 67-7 RED CLOUD 29 August 1966	11	UNCLAS
MAGIC SWORD Test 65-4 Test Plan December 1964	17	CONF

Document Title	# of pages	clas
Meeting of the Dissemination & Field Testing Committee, Edgewood Arsenal CBR Advisory Council, 10-11 October 1963 at Edgewood Arsenal and Fort Detrick, Maryland, May 1964	105	SECRET
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Monthly Personnel Roster, Co B, 1st Bn, 8th Marines, 2d MARDIV, April 1969	58	UNCLAS
Monthly Personnel Roster, Co C, 1st Bn, 8th Marines, 2d MARDIV, April 1969	21	UNCLAS
Monthly Personnel Roster, Co C, 1st Bn, 8th Marines, 2d MARDIV, August 1969	58	UNCLAS
Monthly Personnel Roster, Co C, 1st Bn, 8th Marines, 2d MARDIV, June 1969	45	UNCLAS
Monthly Personnel Roster, Co C, 1st Bn, 8th Marines, 2d MARDIV, March 1969	15	UNCLAS

Document Title	# of pages	clas
Monthly Personnel Roster, Co C, 1st Bn, 8th Marines, 2d MARDIV, May 1969	32	UNCLAS
Monthly Personnel Roster, Headquarters & Service Co, 1st Bn, 8th Marines, 2d MARDIV, April 1969	69	UNCLAS
Monthly Personnel Roster, Headquarters & Service Co, 1st Bn, 8th Marines, 2d MARDIV, June 1969	11	UNCLAS
Monthly Personnel Roster, Headquarters & Service Co, 1st Bn, 8th Marines, 2d MARDIV, May 1969	73	UNCLAS
NAVSEA Shipboard Chemical and Biological Defense Bibliography and Assessment March 1997	76	UNCLAS
Navy BW/CW Information Requirements and Recommendations on Test Objectives Including Extraterritorial Test Requirements for FY 68/69, 11 March 1966	111	SECRET
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Project BIG TOM UL and OU Casualty Estimates	35	CONF
Project Deseret. Annual Historical Summary, 1 July 1962 - 30 June 1963	155	CONF
Project Deseret. Annual Historical Summary, 1 July 1963 - 30 June 1964	22	CONF
Project Deseret. Annual Historical Summary, 1 July 1964 - 30 June 1965	30	CONF
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Document Title	# of pages	clas
Project Deseret. Annual Historical Summary, 1 July 1968 - 30 June 1969	30	SECRET
Project Deseret. Annual Historical Summary, 1 July 1969 - 30 June 1970	62	CONF
Project NIGHT TRAIN Supplemental Analysis September 1965	153	CONF
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Proposed DTC FY-70 Test Plans, September 1968	181	SECRET
Quarterly Progress Report Phase III, B/DWS, Model DA-88, Covering Period May 1963 through July 1963, 31 July 1963	83	CONF
RED BEVA 1964	20	CONF
RED OAK I Data Analysis October 1967	91	CONF
Report No. 402-1-R26, 65-L-40 Data Analysis FLOWER DRUM Phase 1B Final Report June 1965	236	CONF
Report No. 402-2-R4(7) Data Analysis - FEARLESS JOHNNY Final Report July 1967	109	CONF
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Report of Proof Tests, LT Tug 2081 (Crew Training, Challenge and Decon of Target Ship)	113	CONF
Report of the Annual DTC CINCS/Services CB Coordination Conference (9th) held at Dugway Proving Ground, Utah, on 22-24 June 1971	104	CONF
Report of the Annual DTC CINCS/Services CB Coordination Conference 10th, held at Fort Douglas, Utah on April 1972	80	SECRET
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Secret Report Bibliography	16	SECRET
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Document Title	# of pages	clas
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Summary of Discussions and Agreements reached at the Fourth Annual Deseret Test Center Planning Conference, 21 October 1965	7	CONF
Summary Report of Fifth Annual Deseret Test Center Planning Conference, 23 September 1966	21	SECRET
Summary Report of the Porceedings of the Eighth Annual Deseret Test Center Planning Conference, 3 July 1969	34	SECRET
SUN DOWN 1967	11	CONF
TALL TIMBER Test 64-8 Test Plan December 1963	110	CONF
Task RED BEVA Part I, Source Strength Requirements for Biological Agent Dissemination Tests, 30 April 1963	35	SECRET
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Technical Note #8 Comments on Coordination Draft Test Plan of Test 66-6 SCARLET SAGE June 1965	14	UNCLAS
Test 64-2 FLOWER DRUM Phase I Final Report - Revised December 1965	75	CONF
Test 64-2 FLOWER DRUM Phase II Final Report - October 1965	122	CONF
Test 64-4 SHADY GROVE Final Report December 1965	362	SECRET
Test 64-4 SHADY GROVE Final Report June 1966	322	SECRET
Test 64-6 YELLOW LEAF Final Report October 1967	186	SECRET
Test 64-8 TALL TIMBER and Trial Groups A and B of Test 65-16 PINE RIDGE Final Report October 1967	143	CONF
Test 64-8 TALL TIMBER Test Plan - Revised December 1965	17	SECRET
Test 65-1 COPPER HEAD Final Report March 1966	95	CONF

Document Title	# of pages	clas
Test 65-1 COPPER HEAD Test Plan December 1964	33	CONF
Test 65-12 DEVIL HOLE December 1966	165	CONF
Test 65-12 DEVIL HOLE Phase 1 Test Plan January 1965	29	SECRET
Test 65-13 HIGH LOW Final Report July 1966	200	CONF
Test 65-14 ELK HUNT Phase I Final Report November 1965	173	CONF
Test 65-14 ELK HUNT Phase I Final Report Supplement December 1965	104	UNCLAS
Test 65-14 ELK HUNT Phase II Final Report September 1966	134	CONF
Test 65-16 PINE RIDGE Final Report November 1967	97	CONF
Test 65-17 FEARLESS JOHNNY Final Report November 1966	117	CONF
Test 65-17 FEARLESS JOHNNY Test Plan Addendum August 1965	25	CONF
Test 65-3 WEST SIDE Phase I Final Report June 1966	220	CONF
Test 65-4 MAGIC SWORD Final Report May 1966	113	CONF
Test 65-5 IRON CLAD Test Plan January 1965	25	SECRET
Test 65-6 BIG TOM Final Report January 1967	253	SECRET
Test 65-6 BIG TOM Test Plan Addendum March 1964	9	SECRET
Test 65-6 BIG TOM Test Plan December 1964	92	SECRET
Test 66-1 DEVIL HOLE Phase II Test Plan February 1966	32	CONF
Test 66-10 PIN POINT Final Report December 1966	127	UNCLAS
Test 66-13 HALF NOTE Test Plan Addendum July 1966	6	SECRET
Test 66-13 HALF NOTE Test Plan Amendment September 1966	5	CONF
Test 66-13 HALF NOTE Test Plan June 1966	18	CONF
Test 66-2 RED OAK Phase I Test Plan August 1966	13	CONF
Test 66-3 SWAMP OAK Test Plan July 1965	14	CONF
Test 66-4 GREEN MIST Test Plan Addendum October 1966	5	CONF
Test 66-4 GREEN MIST Test Plan December 1965	27	CONF

Document Title	# of pages	clas
Test 66-5 PURPLE SAGE Final Report January 1967	89	CONF
Test 66-6 SCARLET SAGE Final Report April 1967	110	SECRET
Test 66-8 WEST SIDE Phase II Test Plan August 1965	14	CONF
Test 67-12 SHARP NAIL Test Plan September 1966	11	SECRET
Test 67-2 DEW POINT Test Plan January 1967	9	CONF
Test 67-7 COINCIDENCE Test Plan July 1966	9	SECRET
Test 67-8 WATCH DOG Test Plan Addendum April 1967	6	SECRET
Test 67-8 WATCH DOG Test Plan February 1967	12	SECRET
Test 68-15 RED OAK Phase II Test Plan January 1967	47	CONF
US Army Activity in the US Biological Warfare Programs Volume I, 24 February 1977	39	UNCLAS
US Army Activity in the US Biological Warfare Programs Volume II, 25 February 1977	599	SECRET
US BW Agent Testing Using Human Subjects	22	UNCLAS
USS Berekely (DDG-15) Muster Rolls, Enlisted, 1966	196	UNCLAS
USS Berkeley (DDG-15) Muster Rolls, Enlisted, 1965	237	UNCLAS
USS Berkeley (DDG-15) Muster Rolls, Officers, 1965	31	UNCLAS
USS Berkeley (DDG-15) Muster Rolls, Officers, 1966	36	UNCLAS
USS Carpenter (DD-825) Muster Rolls, Officer and Enlisted, 1963	61	UNCLAS
USS Carpenter (DD-825) The Ship and Her History	5	UNCLAS
USS Fechteler (DD-870) Muster Rolls, Enlisted, 1965	187	UNCLAS
USS Fechteler (DD-870) Muster Rolls, Enlisted, 1966	214	UNCLAS
USS Fechteler (DD-870) Muster Rolls, Officer, 1965	28	UNCLAS
USS Fechteler (DD-870) Muster Rolls, Officer, 1966	26	UNCLAS
USS Fort Snelling (LSD-30) Muster Rolls, Enlisted, 1969	184	UNCLAS
USS Fort Snelling (LSD-30) Muster Rolls, Officer, 1969	30	UNCLAS

Document Title	# of pages	clas
USS George Eastman (YAG-39) Muster Rolls, Officer and Enlisted, 1963	120	UNCLAS
USS George Eastman (YAG-39) Muster Rolls, Officer and Enlisted, 1964	101	UNCLAS
USS George Eastman (YAG-39) Muster Rolls, Officer and Enlisted, 1965	103	UNCLAS
USS George Eastman (YAG-39) Muster Rolls, Officer and Enlisted, 1966	93	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Enlisted, 1967	61	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1963	115	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1964	104	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1965	104	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1966	94	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1968	104	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1969	33	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer and Enlisted, 1970	32	UNCLAS
USS Granville S. Hall (YAG-40) Muster Rolls, Officer, 1967	17	UNCLAS
USS Herbert J. Thomas (DD-833) Muster Rolls, Enlisted, July-August-September 1968	49	UNCLAS
USS Herbert J. Thomas (DD-833) Muster Rolls, Enlisted, May-June 1966	42	UNCLAS
USS Herbert J. Thomas (DD-833) Muster Rolls, Officer and Enlisted, January-February-March 1966	70	UNCLAS
USS Herbert J. Thomas (DD-833) Muster Rolls, Officer, 1968	16	UNCLAS
USS Herbet J. Thomas (DD-833)	2	UNCLAS
USS Hoel (DDG-13) Muster Rolls, Enlisted, 1963	65	UNCLAS
USS Hoel (DDG-13) Muster Rolls, Officer, 1963	15	UNCLAS
USS Hoel DDG-13 History	6	UNCLAS
USS Navarro (APA-215) Muster Rolls, Enlisted, 1963	68	UNCLAS

Document Title	# of pages	clas
USS Navarro (APA-215) Muster Rolls, Officer, 1963	21	UNCLAS
USS Navarro (APA-215), Dictionary of American Naval Fighting Ships	2	UNCLAS
USS Okanogan (APA-220) Muster Rolls, Enlisted, 1965	142	UNCLAS
USS Okanogan (APA-220) Muster Rolls, Enlisted, 1966	37	UNCLAS
USS Okanogan (APA-220) Muster Rolls, Officer, 1965	31	UNCLAS
USS Okanogan (APA-220) Muster Rolls, Officer, 1966	8	UNCLAS
USS Power (DD-839) 1965	3	UNCLAS
USS Power (DD-839) History	2	UNCLAS
USS Power (DD-839) Muster Rolls, Officer and Enlisted, 1965	54	UNCLAS
USS Tioga County (LST-1158) Muster Rolls, Officer and Enlisted, January-June 1963	43	UNCLAS
USS Wexford County (LST-1168) Muster Rolls, Enlisted, 1965	97	UNCLAS
USS Wexford County (LST-1168) Muster Rolls, Enlisted, 1966	106	UNCLAS
USS Wexford County (LST-1168) Muster Rolls, Officer, 1965	19	UNCLAS
USS Wexford County (LST-1168) Muster Rolls, Officer, 1966	20	UNCLAS
WEST SIDE Test 65-3 Test Plan August 1964	16	CONF
WHISTLE DOWN Final Report November 1963	322	CONF
YELLOW LEAF Test Analysis January 1967	173	CONF

FACT SHEET

Office of the
Assistant Secretary of Defense (Health Affairs)
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Version 10-31-2002

Deseret Test Center

Red Oak, Phase I

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purposes of Red Oak, Phase I were to determine the height-of-burst distributions of the 121A1 (155mm) chemical projectiles and the M55 (115mm) rocket warheads when fired into a jungle environment, and to determine the effects of fragmentation from bursting chemical munitions.

Red Oak, Phase I was conducted on the Island of Hawaii and in the Panama Canal Zone. Tests involving the M55 rocket warhead and the dissemination of Sarin nerve agent from the M121A1 projectile were conducted in the upper Waiakea Forest Reserve on the Island of Hawaii, southwest of Hilo.

Tests to determine fragmentation effects of artillery projectiles were conducted on the Pina Ridge near the Fort Sherman Military Reservation, Panama Canal Zone. These tests were not chemical weapons tests. Instead they used either standard artillery rounds or projectiles filled with an unspecified simulant.

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Deployment Health Support Directorate (DHSD) collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts this information provided on location, dates, units and/or ships, and substances involved in this exercise, which DHSD extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

Test Name	Red Oak, Phase I (DTC Test 66-2)
Testing Organization	US Army Deseret Test Center
Test Dates	April – May 1967
Test Location	Upper Waiakea Forest Reserve, Island of Hawaii Pina Ridge, near Fort Sherman Military Reservation, Panama Canal Zone
Test Operations	To evaluate the effectiveness of Sarin filled 155mm artillery projectiles and 115mm rocket warheads in a tropical jungle environment.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Munitions were statically detonated.
Agents	Sarin Nerve Agent (Hawaii)
Simulants and Tracers	Unspecified chemical agent simulant (Panama Canal Zone)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An

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	Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002] Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

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Special Assistant to the Under Secretary of Defense
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Version 01-17-2002

Project Shipboard Hazard and Defense (SHAD)

Scarlet Sage

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 primary purpose of the Scarlet Sage test was to evaluate the effectiveness of the experimental Shipboard Toxicological Operational Protection System (STOPS) against environmental attack of a BW tracer under operational situations.

The biological tracer was Bacillus subtilis var. niger (often referred to as Bacillus globigii [BG]). The STOPS destroyer, USS *Herbert J. Thomas* (DD-833), was challenged with aerosols of BG released from a continuous point source approximately 500 meters upwind of the ship.

Scarlet Sage tests were conducted in an operational area of the Pacific Ocean, off San Diego, California during the period February 9 through March 4, 1966.

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Special Assistant to the Under Secretary of Defense (Personnel and Readiness) for Gulf War Illnesses, Medical Readiness and Military Deployments collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts this information provided on location, dates, units and/or ships, and substances involved in this exercise, which the Special Assistant extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

Test Name	Scarlet Sage (Test 66-6)
Testing Organization	US Army Deseret Test Center
Test Dates	February 9 – March 4, 1966
Test Location	Testing was conducted in the Pacific Ocean, off San Diego, California.
Test Operations	To test the Shipboard Toxicological Operational Protective System (STOPS), a BW tracer was disseminated upwind of the ship.
Participating Services	Navy, plus Deseret personnel
Units and Ships Involved	USS *Herbert J. Thomas* (DD-833)
Dissemination Procedures	An aerosolized slurry of Bacillus subtilis var. niger (BG) was released from a point source located approximately 500 meters upwind of the target vessel.
Agents, Simulants, Tracers	Bacillus subtilis var. niger (BG).
Ancillary Testing	Not identified.
Decontamination	Not identified.
Potential Health Risks Associated with Agents, Simulants, Tracers	Bacillus subtilis var. niger (Bacillus globigii [BG]) The American Type Culture Center characterizes Bacillus subtilis var. niger as a BioSafety Level-1 (BSL-1) bacterium. The Centers for Disease Control and Prevention define BSL-1 as suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans. (Sources: American Type Culture Collection data sheet, http://phage.atcc.org [as of January 11, 2002] and *Biosafety in Microbiological and Biomedical Laboratories*, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention and National Institutes of Health, 4th ed., p. 17, April 1999, U.S. Government Printing Office, Washington)

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Office of the Special Assistant to the
Under Secretary of Defense (Personnel and Readiness)
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and Military Deployments

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Project Shipboard Hazard and Defense (SHAD)

Shady Grove

Project Shipboard Hazard and Defense (SHAD) was a program encompassing several tests undertaken in the 1960s to learn the vulnerabilities of US warships to an attack with chemical or biological warfare agents and develop procedures to respond to such an attack while maintaining a war-fighting capability.

Shady Grove testing, conducted in the Pacific Ocean in 1965, was an extension of the Autumn Gold test series. The primary difference between Autumn Gold and Shady Grove is that in the latter tests actual agents were used in addition to simulants.

The crews who participated in Shady Grove were not test subjects, but test conductors. Participants should have been fully informed of the details of each test. Before testing began, all persons involved in Shady Grove should have received comprehensive biological and chemical agent training. Trial tests conducted before the actual test should have reinforced the training already received and ensured everyone involved knew their role in the test. The training program should have included training in these areas: using protective masks and clothing, medical training and immunizations, knowledge of chemical and biological agents and simulants, and knowledge of test procedures and processes. Under actual test conditions, test conductors should have worn appropriate nuclear, biological, and chemical (NBC) protective equipment and should have taken extensive safety precautions to prevent any adverse health effects from the testing.

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Test Name	Shady Grove (Test 64-4)
Testing Organization	US Army Deseret Test Center
Test Dates	January 22 through April 9, 1965
Test Location	Various open water locations of the Pacific Ocean
Test Operations	Target ship operated under three different readiness conditions: 1. Normal steaming conditions—full ventilation 2. Battle or near-battle condition 3. Chemical or biological attack expected
Participating Services	Navy, Marines, plus Deseret personnel
Units and Ships Involved	A. USS *Granville S. Hall* (YAG-40) B. Army light tugs 2080, 2081, 2085, 2086, and 2087, all staffed by USN personnel C. Marine Air Group 13, First Marine Brigade
Dissemination Procedures	Sprayed from A4B aircraft
Agents, Simulants, Tracers	Bacillus globigii (BG). Harmless to humans, BG is ubiquitous and easily found in samplings of wind-borne dust. BG is safely used in biological studies as a stand-in for pathogenic bacteria. BG is used as a biological tracer for anthrax because its particle size and dispersal characteristics are similar to those of anthrax. A household bleach and water solution easily kills BG. Coxiella burnetii (OU). Until the stockpile was destroyed in 1972, OU was part of the US biological weapons stockpile. OU causes Q fever in humans. Domestic animals (cattle, sheep, and goats), cats, wild animals, and ticks usually host OU. Humans become infected after contact with contaminated materials (feces, blood, placenta, etc.); inhaling contaminated dust or droplets; or ingesting contaminated food or raw (unpasteurized) milk. Symptoms of the disease include fever, headache, muscle pains, joint pain (arthralgia), and a dry, non-productive cough. Hepatitis or pneumonia also may develop during the early stages of the disease. In rare occurrences, Q fever can cause severe complications in the aortic heart valve (and subsequent endocarditis). Generally, victims recover even without treatment. However, complications, if they ensue, can be very serious and sometimes even life-threatening. (Sources: Mitretek Systems web site www.mitretek.org/mission/envene/biological/agents/rickettsia.html and Dr. Koop's web site http://www.drkoop.com/conditions/ency/

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Pasteurella tularensis (UL).	UL causes the infectious disease tularemia (rabbit fever, deer fly fever, Ohara's disease), most commonly in people who handle infected wild rabbits. Other infected animals, ticks, or contaminated food or water also transmit tularemia. The symptoms, high fever and severe constitutional distress, appear suddenly within 10 days of exposure. One (or more) ulcerating lesion develops at the site of infection, such as the arm, eye, or mouth. The regional lymph nodes enlarge, suppurate, and drain. Pneumonia, meningitis, or peritonitis may complicate the infection, whose mortality rate is about 6 percent. (Sources: Colorado State University, Environmental Health Services web site http://www.ehs.colostate.edu/biosafety/LARmanual/tular.htm and The Columbia Encyclopedia, 6th ed., New York: Columbia University Press, 2001, web site http://www.bartleby.com/65/tu/tularemi.html/.
Ancillary Testing	Aero 14-B spray tank
Decontamination	Not identified

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans' Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Office of the Special Assistant to the Under Secretary of Defense (Personnel and Readiness) for Gulf War Illnesses, Medical Readiness and Military Deployments (OSA) collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts the information provided on location, dates, units and/or ships, and substances involved in this exercise, which the OSA extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

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Deseret Test Center

Sun Down

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of Sun Down was to evaluate simulant and sarin-filled BLU-19/B23 bomblets in forested and open terrain with snow cover at temperatures between -18°C and -1°C.

Trials were conducted using BLU-19/B23 bomblets filled with methylacetoacetate, tiara, and sarin nerve agent. Bomblets filled with methylacetoacetate were both statically detonated under snow and projected into an open, snow-covered area to determine their depth of detonation in the snow. Bomblets filled with tiara were fired into a spruce forest to determine height of detonation. Five sarin-filled BLU-19/B23 bomblets were statically detonated.

Sun Down was conducted at the Gerstle River test site on Fort Greely, Alaska during February and April 1966.

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Deployment Health Support Directorate (DHSD) collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts this information provided on location, dates, units and/or ships, and substances involved in this exercise, which DHSD extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

Test Name	Sun Down (DTC Test 65-11)
Testing Organization	US Army Deseret Test Center
Test Dates	February, April 1966
Test Location	Gerstle River test site, Fort Greely, Alaska
Test Operations	To evaluate the simulant and sarin-filled BLU-19/B23 bomblet in forested and open terrain with snow cover at temperatures between -18°C and -1°C.
Participating Services	US Army, Desert Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Bomblets were statically detonated as well as projected into the open to determine depth and height of detonations.
Agents, Simulants, Tracers	Sarin Nerve Agent Methylacetoacetate Tiara
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Deployment Health Support Directorate (DHSD) collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts this information provided on location, dates, units and/or ships, and substances involved in this exercise, which DHSD extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

	Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.) Methylacetoacetate (MAA) This compound was used as a simulant. While acute exposure has been associated with irritation of skin, eyes, respiratory tract, and digestive tract, there is little or no evidence of long-term or late-developing health effects and it is not known to cause cancer in animal testing. (Sources: NLM TOXNET, Methyl acetoacetate 105-45-3, HSDB Human Health Effects and Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov.http://hazard.com/msds/tox/f/q4/q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf) Tiara is a luminescent gelatinous material. No further information is available on this substance.

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FACT SHEET

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Deseret Test Center

Swamp Oak

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The objective of Swamp Oak was to determine area-time-dosage relationships as a function of burst height and agent diffusion characteristics, within subarctic forested areas, for Sarin nerve agent-filled artillery munitions in temperatures ranging from -1°C to -18°C.

Sarin nerve agent-filled M121A1 (155mm) artillery shells were detonated statically and singly in a coniferous forest under winter conditions. To simulate an air burst, the shell was suspended using a cable, a hoist, and a special strap-steel sling.

Swamp Oak trials were conducted during March and April 1966 at the Gerstle River test site near Fort Greely, Alaska.

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Test Name	Swamp Oak (DTC Test 66-3)
Testing Organization	US Army Deseret Test Center
Test Dates	March - April 1966
Test Location	Gerstle River test site, near Fort Greely, Alaska
Test Operations	To determine time-area-dosage relationships as a function of burst height and agent diffusion characteristics, within subarctic forested areas, for Sarin nerve agent-filled artillery munitions in temperatures ranging from -1°C to -18°C.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Sarin nerve agent-filled M121A1 (155mm) artillery shells were statically and singly detonated in a coniferous forest under winter conditions.
Agents, Simulants, Tracers	Sarin Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association

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	between low-level sarin exposure and long-term health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002] Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Deployment Health Support Directorate (DHSD) collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts this information provided on location, dates, units and/or ships, and substances involved in this exercise, which DHSD extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

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Deseret Test Center

Tall Timber

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of Tall Timber was to test the effectiveness of the M138 bomblet filled with agent BZ in a tropical forested environment. BZ is a code name for an ester of benzilic acid. The chemical affects the human mind causing those contaminated to be unable to perform an assignment or have a reduced will to resist for a short period of time.

M138 bomblets filled with agent BZ were statically-ignited in a test area in the upper Waiakea Forest Reserve, southwest of Hilo, on the island of Hawaii during the period April through June 1966.

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Test Name	Tall Timber (DTC Test 64-8)
Testing Organization	US Army Deseret Test Center
Test Dates	April – June 1966
Test Location	Island of Hawaii
Test Operations	To test the effectiveness of the BZ-agent filled M138 bomblet in a tropical forested environment.
Participating Services	Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Statically-ignited M138 bomblets filled with agent BZ
Agents, Simulants, Tracers	Ester of benzilic acid (BZ)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Ester of benzilic acid (Agent BZ) This chemical is an incapacitating agent designed to cause stupor, confusion, and hallucinations when inhaled or absorbed through the skin. It is a white powder and may irritate the eyes, skin, and digestive and respiratory tracts, if inhaled or ingested. While some effects may last several days or weeks, long-term or late-developing health effects have not been documented and seem unlikely. (Source: Incapacitating Agents (chap. 5), in US Army Medical Research Institute of Chemical Defense, Medical Management of Chemical Casualties Handbook, 3rd edition, 1998; Ketchum JS, Sidell FR Incapacitating Agents (chap. 11), in ed. Zajtchuk R., Textbook of Military Medicine (part 1), Medical Aspects of Chemical and Biological

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	Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. http://www.fas.org/nuke/guide/russia/cbw/jptac008_194001.html [as of September 25, 2002].)

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FACT SHEET

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Version 10-09-2002

Deseret Test Center

Watch Dog

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The main purpose of Watch Dog was to obtain viability decay rates of *Francisella tularensis* (wet and dry forms), *Serratia marcesens*, and *Escherichia coli.* and stabilized *Francisella tularensis* animal infectivity data in a summer temperate environment. Six trials were conducted to measure the infectivity to monkeys in temperate environments using wet *Francisella tularensis*. The remaining trials determined biological decay rates for *Francisella tularensis* (wet and dry), *Serratia marcesens* and *Escherichia coli* in an environment considered analogous to the temperate humid areas of the northern hemisphere during the summer.

All of the Watch Dog trials were conducted in the area of Delta Creek in central Alaska near Fort Greely. The test was conducted in the summer of 1967.

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Test Name	Watch Dog (DTC Test 67-8)
Testing Organization	US Army Deseret Test Center
Test Dates	Summer 1967
Test Location	Delta Creek area of central Alaska, near Fort Greely
Test Operations	To obtain biological decay rates on *Francisella tularensis* (wet and dry form), *Escherichia coli*, and *Serratia marcesens* in a summer temperate environment.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Not Identified
Agents, Simulants, Tracers	*Bacillus globigii* *Serratia marcescens* *Escherichia coli* *Francisella tularensis* (wet) (TT) *Francisella tularensis* (dry) (ZZ)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-

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developing health effects would be very unlikely (except perhaps as a complication of the acute infection).

(Sources: Tuazon CU, Other Bacillus Species (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, Bacillus subtilis Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Serratia marcescens (SM)
This bacterial species can cause acute infections of the urinary tract, lung, bloodstream, and other body sites. These infections commonly occur in individuals whose health has already been compromised, and often in patients who are already hospitalized. Long-term or late-developing health effects would be very unlikely.

(Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2303.)

Escherichia coli, or *E. Coli* (EC)
This bacterial species is a common inhabitant of the digestive tract but can also cause acute infection, especially when it gains access to other body sites, like the urinary tract, lung, and bloodstream. Long-term or late-developing health effects of E. coli infection would be unlikely.

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Francisella tularensis (TT and ZZ)
Formerly identified as Pasteurella tularensis, this bacterial species can cause acute infection of the lung, bloodstream, and other body sites (tularemia), and is considered a potential biological warfare agent. While complications of the acute infection may be serious, even life threatening, long-term or late-developing health effects would be very unlikely.

(Sources: Cross, J. Thomas Jr., Penn, Robert L., Francisella tularensis (Tularemia) (chap. 216), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2393-2402; and Dennis DT, Inglesby TV, Henderson DA, et al. Tularemia as a biological weapon; medical and public health management. JAMA 2001;285(21):2763-73.)

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FACT SHEET

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Version 10-09-2002

Deseret Test Center

West Side, Phase I

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of West Side, Phase I was to evaluate the A/B 45Y-4 dry agent disseminator in a frigid environment. The A/B 45Y-4 was wing-mounted on an F-105D aircraft. Specifically, the objectives of the test were to evaluate the source strength, dissemination efficiency, and functional characteristics of the dry disseminator with the simulant *Bacillus globigii*, and to measure the diffusion of particulate biological aerosols disseminated by line source in a cold-weather test environment. To aid this investigation, two tracer materials – green and yellow zinc cadmium sulfide (FP) – were disseminated from a light aircraft under similar test conditions.

West Side, Phase I was conducted in the Tanana Valley of central Alaska, near Fort Greely, during the period January 8 through February 21, 1965.

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Test Name	West Side, Phase I (DTC Test 65-3)
Testing Organization	US Army Deseret Test Center
Test Dates	January 8 – February 21, 1965
Test Location	Tanana Valley of central Alaska near Fort Greely
Test Operations	To evaluate the A/B 45Y-4 dry agent disseminator in a frigid environment.
Participating Services	US Army, US Air Force, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Tracer material sprayed from an A/B 45Y 4 disseminator tank mounted on an F 105D aircraft.
Agents, Simulants, Tracers	*Bacillus globigii* Zinc Cadmium Sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).

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(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Zinc cadmium sulfide (ZCdS)
This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low.

(Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Version 10-09-2002

Deseret Test Center

West Side, Phase II

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of West Side, Phase II was to evaluate the area coverage capabilities of the A/B 45-Y-4/F-105 powdered agent dissemination system as used operationally over a northern open plains region during cold weather. Twelve trials were conducted in which both *Bacillus globigii* and zinc cadmium sulfide (FP) were simultaneously disseminated, each from separate, wing-mounted Y-4 disseminators on an F-105 aircraft. A second release of FP of a different fluorescent color was made by a contractor aircraft immediately after the dissemination run by the F-105. The contractor aircraft, a JHC-47, and EW-2 disseminator released FP both above and below the inversion top to measure its influence on aerosol travel.

The Canadian government permitted three flight paths for the dissemination of tracers. These flight paths and the corresponding trajectories of aerosol travel were selected to preclude travel of simulants and tracers over heavily populated areas, or over the inhabited areas of Suffield Experimental Station.

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West Side, Phase II was conducted in the Great Plains Region of central Canada, with the test area extending north and east from the Suffield Experimental Station, southern Alberta Province, and into southwestern Saskatchewan. The testing period extended from January 5 through March 7, 1965.

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Test Name	West Side, Phase II (DTC Test 66-8)
Testing Organization	US Army Deseret Test Center
Test Dates	January 5 – March 7, 1965
Test Location	Great Plains Region of Central Canada, north and east of the Suffield Experimental Station, southern Alberta Province, and into southwestern Saskatchewan
Test Operations	To evaluate the area coverage capability of an airborne dry agent dissemination system when operated in a frigid environment.
Participating Services	US Air Force, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Simulant and tracer material sprayed from an AB 45-Y4 powdered agent disseminator mounted on an F-105 aircraft. Tracer material was also disseminated above and below the inversion layer using an EW-2 disseminator mounted on a contractor-operated JHC-47 aircraft.
Agents, Simulants, Tracers	*Bacillus globigii* Zinc Cadmium Sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of

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	the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection). (Sources: Tuazon CU, Other Bacillus Species (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, Bacillus subtilis Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.) Zinc cadmium sulfide (ZCdS) This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low. (Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc

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	Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Version 10-09-2002

Deseret Test Center

Whistle Down

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

Whistle Down was primarily an investigation of the existence, nature, and extent of the hazard from Sarin nerve agent and VX nerve agent on environmental clothing, snow, and frozen ground.

Manikins dressed in arctic clothing and white camouflage overgarments were exposed downwind of the burst of Sarin-filled munitions as well as downwind of a detonated VX-filled M23 land mine.

Whistle Down was conducted at the Gerstle River test site, Fort Greely, Alaska, from December 1, 1962 to February 5, 1963.

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Test Name	Whistle Down (DTC Test 63-3)
Testing Organization	US Army Deseret Test Center
Test Dates	December 1, 1962 – February 5, 1963
Test Location	Gerstle River test site, Fort Greely, Alaska
Test Operations	To investigate the existence, nature, and extent of the hazard from Sarin and VX nerve agents on environmental clothing, snow, and frozen ground.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Sarin-filled M55 rockets and M121 155mm shells,and VX-filled M23 land mines were remotely detonated.
Agents, Simulants, Tracers	Sarin Nerve Agent, VX Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term

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health effects.

(Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]
Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

VX Nerve Agent – (Synonyms: Phosphonothioic acid, VX)
VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10 15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: constriction of pupils, headaches, runny nose, salivation, tightness in the chest, nausea, vomiting, anxiety, difficulty in thinking, muscle twitches, tremors, and weakness. With severe exposure, symptoms progress to convulsions and respiratory failure. There is little information available regarding the long-term human health effects of exposure to low doses of VX.

(Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002]
Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997.
SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002]

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	World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002] Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002])

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Version 10-31-2002

Deseret Test Center

Yellow Leaf

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The first objective of the Yellow Leaf test was to determine the effectiveness of the M143 bomblet when employed against targets in a jungle environment. The second objective was to determine mathematically, and based on data obtained from the Yellow Leaf test, the area coverage to be expected from the detonation of a US Navy MISTEYE I weapons system or a US Army SERGEANT M211 biological warhead over a jungle canopy. An additional objective was to gather information relative to the effects of precipitation on a biological aerosol moving under a jungle canopy.

Yellow Leaf, Phase A was conducted to measure height of burst characteristics for the M143 bomblet. Bomblets filled with tiara, a gelatinous simulant that fluoresces, were individually fired into jungle canopy. There were 185 Phase A trials conducted on the Fort Sherman Military Reservation, Panama Canal Zone and an additional 100 Phase A trials conducted on the Island of Hawaii. Phase B, conducted on the Island of Hawaii, consisted of 20 trials to measure cloud diffusion characteristics under a jungle canopy. The biological simulant *Bacillus globigii* was used as fill in the M143 bomblets detonated during the Phase B trials.

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Initial testing was conducted in February 1964 at the Fort Sherman Military Reservation, Panama Canal Zone. However, before Yellow Leaf trials could be completed, international considerations forced the Deseret Test Center to terminate the testing program at that location. To complete the program, a substitute jungle site was chosen on the Island of Hawaii. The remaining trials were conducted on the Island of Hawaii in the Olaa Forest, southwest of Hilo during April and May 1966.

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Test Name	Yellow Leaf (DTC Test 64-6)
Testing Organization	US Army Deseret Test Center
Test Dates	February 1964 (Panama Canal Zone) April – May 1966 (Hawaii)
Test Location	Fort Sherman Military Reservation, Panama Canal Zone (February 1964) Island of Hawaii (April – May 1966)
Test Operations	To measure burst height and cloud diffusion characteristics of the M143 bomblet when released into a jungle canopy.
Participating Services	Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	M143 bomblets statically detonated above jungle canopy.
Agents	Not used
Simulants and Tracers	*Bacillus globigii* (Hawaii) Tiara (Panama Canal Zone and Hawaii)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but

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always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).

(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Tiara is a luminescent gelatinous material. No further information is available on this substance.

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FACT SHEET

Office of the Special Assistant to the
Under Secretary of Defense (Personnel and Readiness)
for Gulf War Illnesses, Medical Readiness
and Military Deployments

For more information,
(703) 578-8500

Project Shipboard Hazard and Defense (SHAD)

Autumn Gold

Project Shipboard Hazard and Defense (SHAD) was a program encompassing several tests undertaken in the 1960s to learn the vulnerabilities of US warships to an attack with chemical or biological warfare agents and develop procedures to respond to such an attack while maintaining a war-fighting capability.

The purpose of the Autumn Gold test program was to examine shipboard vulnerabilities and capabilities during a chemical or biological warfare agent attack. The test's primary objective was to determine the efficiency of shipboard protection systems such as detectors and decontaminants. The Autumn Gold test used a biological tracer.

According to the Autumn Gold test plan and final report, the crews who participated in the tests were not test subjects, but test conductors. Participants should have been fully informed of the details of each test. Before testing began, all persons involved in Autumn Gold should have received comprehensive biological and chemical agent training. Trial tests conducted before the actual test should have reinforced the training already received and ensured everyone involved knew their role in the test. The training program should have included training in the areas of using protective masks and clothing, medical training and immunizations, knowledge of chemical and biological agents and simulants, and knowledge of test procedures and processes. Under actual test conditions, test conductors should have worn appropriate nuclear, biological, and chemical (NBC) protective equipment and should have taken extensive safety precautions to prevent any adverse health effects from the testing.

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Test Name	Autumn Gold (Test 63-2)
Testing Organization	US Army Deseret Test Center
Test Dates	3-31 May, 1963
Test Location	Testing was conducted on the open sea approximately 60 miles west-southwest of Oahu in the Hawaiian Islands
Test Operations	Three phases simulating stages of combat preparedness. Each phase consisted of three trials: Phase A. Defense against chemical and biological attack Phase B. Battle or near-battle condition. Phase C. Wartime or battle steaming.
Participating Services	Navy, Marines, plus Deseret personnel
Units and Ships Involved	A. USS *Navarro* (APA-215) B. USS *Tioga County* (LST-1158) C. USS *Carpenter* (DD-825) D. USS *Hoel* (DDG-13) E. USS *Granville S. Hall* (YAG-40) F. Marine Air Group 13, First Marine Brigade
Dissemination Procedures	Sprayed from A4B aircraft.
Agents, Simulants, Tracers	Bacillus globigii (BG). Harmless to humans, BG is ubiquitous and found easily in samplings of wind-borne dust. BG is safely used in biological studies as a stand-in for pathogenic bacteria. BG is used as a biological tracer for anthrax because its particle size and dispersal characteristics are similar to those of anthrax. A household bleach-and-water solution easily kills BG.
Ancillary Testing	M-17 and Navy's Mark IV protective masks
Decontamination	Water wash-down system (salt water), fire hoses (salt water), air wash by forced ventilation

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Deseret Test Center
Project SHAD

Big Tom

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' and ashore installations' 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 purpose of Big Tom was to evaluate the feasibility of a biological attack against an island complex and to evaluate doctrine and tactics for delivery of such an attack.

Test personnel investigated the diffusion and downwind travel of biological simulant and tracer aerosols; estimated area coverage in both jungle and surrounding tropical terrain; investigated the degree of aerosol penetration of a jungle canopy, ventilation rate, and time resolution of aerosols; and, investigated the degree of penetration and aerosol time resolution of typical fortifications.

The test consisted of a series of aerial line-source trials during which a biological simulant, *Bacillus globigii*, was disseminated from a high performance aircraft. Both liquid and dry *Bacillus globigii* were used. Liquid *Bacillus globigii* was disseminated from an Aero 14B spray tank mounted on a US Navy A-4 aircraft. Dry *Bacillus globigii* was disseminated from an A/B Y45-4 spray tank mounted on a US Air Force F-105 aircraft. Aerosol sampling was done at various land-based stations.

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For this test, a contractor-flown Aero Commander aircraft also released two colors (yellow and green) of fluorescent particles of zinc cadmium sulfide (FP).

Big Tom was conducted on the island of Oahu, Hawaii and its surrounding waters and airspace during May and June 1965.

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Test Name	Big Tom (DTC Test 65-6)
Testing Organization	US Army Deseret Test Center
Test Dates	May – June 1965
Test Location	Oahu, Hawaii and surrounding waters and airspace
Test Operations	To evaluate the feasibility of a biological attack against an island complex and to evaluate doctrine and tactics for delivery of such an attack.
Participating Services	US Navy, US Marine Corps, US Air Force, Deseret Test Center personnel
Units and Ships Involved	USS *Granville Hall* (YAG-40)
Dissemination Procedures	Liquid *Bacillus globigii* was disseminated from an Aero 14B spray tank mounted on a US Navy A-4 aircraft; dry *Bacillus globigii* was disseminated from an A/B Y45-4 spray tank mounted on a US Air Force F-105 aircraft.
Agents, Simulants, Tracers	*Bacillus globigii* Zinc Cadmium Sulfide
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii (BG)* Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health

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Version 10-31-2002

Deseret Test Center

Big Jack, Phase A

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of the Big Jack, Phase A test was to measure penetration of a jungle canopy by biological and chemical agent simulants disseminated from an operational weapon system.

The Big Jack program was divided into two phases. In Phase A trials, *Bacillus globigii*, a simulant for biological warfare agents, was released and sampled. The dissemination systems used were the US Air Force A/B45Y-1 and the US Navy Aero 14B spray tanks. The tanks were mounted on Marine A-4 aircraft.

A meteorological study using zinc cadmium sulfide (FP) was conducted during Big Jack, Phase A, to compare penetration of the jungle canopy by FP and the biological tracer.

The Big Jack, Phase A test area was located near the Fort Sherman Military Reservation, Panama Canal Zone. Big Jack, Phase A tests were conducted from February 15 – March 15, 1963.

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Test Name	Big Jack, Phase A (DTC Test 63-4)
Testing Organization	US Army Deseret Test Center
Test Dates	February 15 – March 15, 1963
Test Location	Near Fort Sherman Military Reservation, Panama Canal Zone
Test Operations	To study the penetration of a jungle canopy by a biological aerosol generated by crosswind dissemination of a biological simulant from an elevated line source.
Participating Services	US Army, US Navy, US Air Force, Deseret Test Center personnel
Units and Ships Involved	VMA 225, Marine Aircraft Group 14
Dissemination Procedures	Sprayed from US Air Force A/B45Y-1 and US Navy Aero 14B spray tanks center mounted on Marine A-4 aircraft.
Agents	Not used
Simulants and Tracers	*Bacillus globigii* Zinc cadmium sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung,

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heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).

(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Zinc cadmium sulfide (ZCdS)

This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low.

(Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Office of the
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For more information
(703) 578 - 8500
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Version 10-31-2002

Deseret Test Center

Big Jack, Phase B

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of the Big Jack, Phase B test was to obtain information on the degree of penetration of jungle canopy by a chemical warfare agent simulant disseminated from an operational type weapon system.

The Big Jack program was divided into two phases. Phase B trials involved the release and sampling of tri (2-ethylhexyl) phosphate (TOF), a non-toxic simulant for VX nerve agent. The dissemination systems used were the US Navy Aero 14B and E40 spray tanks mounted on Marine A-4 aircraft

The Big Jack, Phase B test area was located on the Fort Sherman Military reservation, Panama Canal Zone. Big Jack, Phase B trials were conducted from February 15 - March 9, 1963.

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Test Name	Big Jack, Phase B (DTC Test 63-4)
Testing Organization	US Army Deseret Test Center
Test Dates	February 15 – March 9, 1963
Test Location	Near Fort Sherman Military Reservation, Panama Canal Zone
Test Operations	To investigate the penetration and dispersion of a simulant for VX nerve agent when released as an aerial spray over a jungle environment.
Participating Services	US Army, US Navy, US Air Force, Deseret Test Center personnel
Units and Ships Involved	VMA 225, Marine Aircraft Group 14
Dissemination Procedures	Sprayed from US Navy Aero 14B and E40 tanks mounted on Marine A-4 aircraft
Agents	Not used
Simulants and Tracers	tri (2-ethylhexyl) phosphate
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	trioctyl phosphate (tri (2-ethylhexyl) phosphate) (TOF) Used as a nontoxic simulant for VX nerve agent. TOF is a viscous, colorless or pale yellow liquid. It can irritate the eyes, skin, and respiratory tract on contact. It can cause cancer in some animal species, but this has not been demonstrated in humans. (Sources: NLM TOXNET, Trioctyl phosphate 1806-54-8 or Tri(2-ethylhexyl)phosphate 78-42-2, HSDB Human Health Effects and

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	Animal Toxicity Studies, available at *http://toxnet.nlm.nih.gov*. *http://physchem.ox.ac.uk/MSDS/TR/tris(2-ethylhexyl)phosphate.html* [as of September 25, 2002] and *http://www.ilo.org/public/english/protection/safework/cis/products/icsc/dtasht/_icsc09/icsc0968.pdf* [as of September 25, 2002]).

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Version 12-02-2002

Deseret Test Center

Cliff Rose

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The primary test objective of Cliff Rose (DTC Test 68-52) was to evaluate three CS weapon systems in tropical and semi-tropical environments: the BLU-52A/B chemical bomb; the CS2, XM28 helicopter sling-mounted dispenser; and, the XM-920 E-2 fuze and burster-bomb system. These CS weapon systems were all bulk-CS-filled terrain-denial systems and were evaluated in forest, open water (paddy), jungle, high grass, and open terrain, in terms of periods of denial to unmasked, walking test subjects, pattern sizes, and contamination density.

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For this test, ortho-chlorobenzylidene malontrile (CS2), a white crystalline powder riot-control agent, was dispersed by Air Force low and high speed tactical aircraft, burster devices, and a UH-1 type helicopter.

While the United States does not classify CS2 as a chemical warfare agent, Deseret Test Center managed Cliff Rose as a matter of convenience. Testing CS2 was not part of a chemical-biological warfare agent assessment.

Cliff Rose was conducted between September 22, 1967 – January 18, 1968 at Ft. Stewart, Georgia (Phase I) and at an unspecified location in the Panama Canal Zone (Phase II).

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Test Name	Cliff Rose (DTC Test 68-52)
Testing Organization	US Army Deseret Test Center
Test Dates	September 22, 1967 – January 18, 1968
Test Location	Ft. Stewart Georgia and the Panama Canal Zone
Test Operations	To evaluate three CS weapon systems in tropical and semi-tropical environments: the BLU-52A/B chemical bomb; the CS2, XM28 helicopter sling-mounted dispenser; and, the XM-920 E-2 fuze and burster-bomb system. CS2 was dispersed by Air Force low and high speed tactical aircraft, burster devices, and a UH-1 type helicopter.
Participating Services	US Army, US Air Force, and Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Three types of CS2 munitions, including the BLU-52A/B chemical bomb, the XM28 dispenser system, and the XM-920 E-2 fuze and burster system were tested.. The BLU-52A/B bombs were delivered by US Air Force low and high speed aircraft. The XM28 sling-mounted dispenser released CS2 from a UH-1 type helicopter.
Agents, Simulants, Tracers	Ortho-chlorobenzylidene malontrile (CS2)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	<u>CS2 Riot – Control Agent</u> CS2 is one of several chemicals commonly called "Tear Gas." CS2 is a white, crystalline powder and is dispersed into the air as either an aerosol or powder. The chemical name for CS2 is ortho chlorobenzylidene malononitrile. It is chemically

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identical to CS but differs in its physical characteristics. This chemical is an incapacitating/ riot-control agent that acts as a contact irritant on the exposed body surfaces (eyes and skin), and on the respiratory tract. Exposure to CS2 causes burning, irritation, tearing and pain in the eyes. Airway symptoms include burning, sneezing, coughing, shortness of breath and increased secretions, such as runny nose and increased salivation. High concentrations of CS2 can cause blistering of the skin. With commonly used concentrations, these effects are short-term and the potential for long-term health consequences is low.

(Sources: Riot-Control Agents (chap. 6), in US Army Medical Research Institute of Chemical Defense, Medical Management of Chemical Casualties Handbook, 3rd edition, 1998; Sidell FR, Riot Control Agents (chap. 12), in Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997, p. 310-6. http://www.metrokc.gov/health/hazard/riotcontrol.htm#cs [as of September 26, 2002] Cornell University, http://msds.pdc.cornell.edu/msds/siri/files/chl/chlfz.html [as of August 26, 2002]).

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FACT SHEET

Office of the Special Assistant to the
Under Secretary of Defense (Personnel and Readiness)
for Gulf War Illnesses, Medical Readiness
and Military Deployments

For more information,
(703) 578-8500

Project Shipboard Hazard and Defense (SHAD)

Copper Head

Project Shipboard Hazard and Defense (SHAD) was a program encompassing several tests undertaken in the 1960s to learn the vulnerabilities of US warships to an attack with chemical or biological warfare agents and develop procedures to respond to such an attack while maintaining a war-fighting capability.

Copper Head testing was similar to Autumn Gold testing in that the test used simulants only. The primary difference between Copper Head and Autumn Gold was Copper Head was designed to use simulants to learn biological agents' characteristics in frigid temperatures. Copper Head was conducted in international waters in the North Atlantic.

The crews who participated in Copper Head were not test subjects, but test conductors. Participants should have been fully informed of the details of each test. Before testing began, all persons involved in Copper Head should have received comprehensive biological and chemical agent training. Trial tests conducted before the actual test should have reinforced the training already received and ensured everyone involved knew their role in the test. The training program should have included training in these areas: using protective masks and clothing, medical training and immunizations, knowledge of chemical and biological agents and simulants, and knowledge of test procedures and processes. Under actual test conditions, test conductors should have worn appropriate nuclear, biological, and chemical (NBC) protective equipment and should have taken extensive safety precautions to prevent any adverse health effects from the testing.

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Test Name	Copper Head (Test 65-1)
Testing Organization	US Army Deseret Test Center
Test Dates	January 24 through February 25, 1965
Test Location	Atlantic Ocean, off the coast of Newfoundland, Canada
Test Operations	Target ship was operated under three different readiness conditions: A. Normal steaming conditions—full ventilation B. Battle or near-battle condition C. Chemical and biological attack expected
Participating Services	Navy, Marines, plus Deseret personnel
Units and Ships Involved	USS Power (DD-839)
Dissemination Procedures	Sprayed from A4B aircraft.
Agents, Simulants, and Tracers	Bacillus globigii (BG). Harmless to humans, BG is ubiquitous and easily found in samplings of wind-borne dust. BG is safely used in biological studies as a stand-in for pathogenic bacteria. BG is used as a biological tracer for anthrax because its particle size and dispersal characteristics are similar to those of anthrax. A household bleach and water solution easily kills BG. Zinc Cadmium Sulfide (FP – fluorescent particle). Zinc cadmium sulfide is a fine powder formed by heating zinc sulfide and cadmium sulfide together so that they fuse. It is not a biologic weapon, but it was used as a tracer to simulate the dispersion of biological weapons. During the 1950s and 1960s the U.S. Army sponsored a variety of tests in which particles of zinc cadmium sulfide were released in cities and towns in the United States. In the early 1990s, in response to health concerns among residents of those cities and towns, Congress asked the National Research Council to determine independently whether exposures to zinc cadmium sulfide had caused any adverse health effects. The Council's findings were that the amounts of zinc cadmium sulfide to which people were exposed were so small that adverse health effects were unlikely. Because zinc cadmium sulfide does not dissolve in water or fats, it is unlikely that it can enter someone's body through the skin or reach the bloodstream from air, food, or water that contains it. The main way for people to be exposed is by inhaling the particles. Most inhaled zinc cadmium sulfide particles would be exhaled almost immediately. Most of the

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	remaining particles would be cleared from the lungs by normal mechanisms that protect the lungs from other dust particles in the air. There have been no studies on the toxic effects of repeated exposure to zinc cadmium sulfide in humans. In experimental animals, large amounts of zinc cadmium sulfide placed in the lungs, skin, or eyes or fed to the animals produced little or no effects. No medical test is available to detect past exposure to zinc cadmium sulfide. Source: National Academy Press, Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, 1997.
Ancillary Testing	Aero 14-B spray tank
Decontamination	Exterior: Not documented. Interior: Betapropiolactone (b-Propiolactone). Modern uses for b-propiolactone include vaccines, enzymes, tissue grafts, and surgical instruments; to sterilize blood plasma, water, milk, and nutrient broth; and as a vapor-phase disinfectant in enclosed spaces. Its sporicidal action kills vegetative bacteria, pathogenic fungi, and viruses. The primary routes of potential human exposure to b-propiolactone are inhalation, ingestion, and dermal contact. There is evidence b-propiolactone is a carcinogen. However, the results of animal testing in mice, rats, hamsters, and guinea pigs are questionable due to a lack of controls in the study. An International Agency for Research on Cancer (IARC) working group reported no data are available to evaluate the carcinogenicity of b-propiolactone in humans. Source: Department of Health and Human Services, National Institutes of Health Web site: *http-server.niehs.nih.gov/htdocs/8_RoC/RAC/betaPropiolactone.html*.

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Version 10-09-2002

Deseret Test Center

Devil Hole, Phase I

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

Devil Hole, Phase I was conducted in temperate aspen and spruce forests to determine area-time-dosage information for Sarin nerve agent-filled artillery munitions (M121A1 155mm shells) and Sarin nerve agent –filled rocket warheads (M55 115 mm warheads.) Particulate simulants were used to study airflow patterns at the intersection of a spruce forest with open terrain. During the preliminary diffusion trials of the test, zinc cadmium sulfide (FP) was used as a particulate substitute for Sarin nerve agent. The fluorescent particles used in this test were of two colors, green and yellow.

Single static and single and multiple dynamic detonations were conducted with the M121A1 artillery shells. Testing of the M55 115mm rocket warhead was limited to single static detonations.

Safety equipment – such as protective clothing, protective masks, barriers, etc. – was used during the test as conditions dictated.

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All Devil Hole, Phase I trials were conducted in forested terrain at the Gerstle River test site in the vicinity of Fort Greely, Alaska during the summer of 1965.

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Test Name	Devil Hole, Phase I (DTC Test 65-12)
Testing Organization	US Army Deseret Test Center
Test Dates	Summer 1965
Test Location	Gerstle River test site, near Fort Greely, Alaska
Test Operations	To determine area-time-dosage information for Sarin nerve agent-filled artillery munitions and rocket warheads detonated in a temperate forested terrain.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Single static and single and multiple-round detonations of Sarin-filled M121A1 artillery shells and single static detonations of Sarin-filled M55 rocket warheads.
Agents, Simulants, Tracers	Sarin Nerve Agent Zinc Cadmium Sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An

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	Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.) Zinc cadmium sulfide (ZCdS) This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low. (Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Deseret Test Center

Devil Hole, Phase II

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

Devil Hole, Phase II was conducted in temperate aspen and spruce forested terrain to provide weapons effects information for artillery delivered VX nerve agent-filled shells. The munitions used were M121A1 (155m) and M426 (8-inch) artillery shells filled with VX nerve agent.

Munitions were statically detonated and M-109 self-propelled howitzers were also used to dynamically fire shells on the target. Manikins dressed in undyed cotton overgarments were used to estimate direct contamination of standing personnel in the area of a munition detonation. A three-quarter ton truck and an eight-by-ten foot tent wall were used to measure deposition on equipment.

Devil Hole, Phase II trials were conducted at the Gerstle River test site near Fort Greely, Alaska, from July through September 1966.

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Test Name	Devil Hole, Phase II (DTC Test 66-1)
Testing Organization	US Army Deseret Test Center
Test Dates	July – September 1966
Test Location	Gerstle River test site, near Fort Greely, Alaska
Test Operations	To provide weapons effects information for artillery delivered VX nerve agent-filled shells detonated in temperate, forested terrain.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Munitions were statically detonated and M-109 self-propelled howitzers were used to dynamically fire shells on the target.
Agents, Simulants, Tracers	VX Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	VX Nerve Agent – (Synonyms: Phosphonothioic acid, VX) VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: constriction of pupils, headaches, runny nose, salivation, tightness in the chest, nausea, vomiting, anxiety, difficulty in thinking, muscle twitches, tremors, and weakness. With severe exposure, symptoms progress to convulsions and respiratory failure. There is little information available regarding the

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	long-term human health effects of exposure to low doses of VX. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002]Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002]World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002] Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002]) [as of February 5, 2002])

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Deseret Test Center

Dew Point

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of Dew Point was to determine the effectiveness of Sarin nerve agent-filled BLU-19/B23 bomblets ejected from an SUU-13/A dispenser, and M139 bomblets dropped from a SADEYE dispenser in a temperate summer forest environment

The test area was situated in a heavy stand of deciduous aspen trees. A test grid was established in the aspen forest. Sarin nerve agent-filled M139 bomblets were used in Dew Point trials. The bomblets were individually statically detonated.

The test was conducted from June through July 1967 at the Gerstle River test site, near Fort Greely, Alaska.

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Test Name	Dew Point (DTC Test 67-2)
Testing Organization	US Army Deseret Test Center
Test Dates	June – July 1967
Test Location	Gerstle River test site, near Fort Greely, Alaska
Test Operations	To determine the effectiveness of Sarin nerve agent-filled BLU-19/B23 bomblets ejected from an SUU-13/A dispenser, and M139 bomblets dropped from a SADEYE dispenser in a temperate summer forest environment.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Single bomblets were statically detonated.
Agents, Simulants, Tracers	Sarin Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term

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	health effects. (Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002] Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

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FACT SHEET

Special Assistant to the Under Secretary of
Defense (Personnel and Readiness) for Gulf War Illnesses,
Medical Readiness and Military Deployments

For more information,
(703) 578-8500

Project Shipboard Hazard and Defense (SHAD)

DTC Test 68-50

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 purpose of Deseret Test Center (DTC) Test 68-50 was to determine the potential casualty area and associated casualty levels for the F-4/AB45Y-4/PG2 weapon system. The weapon system disseminated an aerosol over a 40-50 kilometer downwind grid, encompassing a segment of the Eniwetok Atoll and an array of five Army light tugs.

The agent employed in this test was staphylococcal enterotoxin, Type B, a toxin produced by certain strains of the common bacterium known as Staphylococcus aureus. A two percent concentration of uranine dye (sodium fluorescein) was incorporated into the staphylococcal enterotoxin, during the drying cycle at the production plant. The dye served as a tracer for the agent. Bacillus subtilis var. niger (BG) was also used as a tracer of the agent aerosols.

The USS *Granville S. Hall* (YAG-40) was assigned to DTC Test 68-50, along with five Army light tugs. Aircraft assigned to the 4533rd Tactical Test Squadron, 33rd Tactical Fighter Wing, disseminated agent and tracers during the test.

DTC Test 68-50 was conducted at Eniwetok Atoll, Marshall Islands during September and October 1968.

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Test Name	DTC Test 68-50
Testing Organization	US Army Deseret Test Center
Test Dates	September and October 1968
Test Location	Testing was conducted at Eniwetok Atoll, Marshall Islands.
Test Operations	The F-4/AB45Y-4/PG2 weapon system disseminated an aerosol over a 40-50 kilometer downwind grid, encompassing a segment of the Eniwetok Atoll and an array of five light tugs.
Participating Services	Army, Navy, Air Force, Deseret personnel
Units and Ships Involved	USS *Granville S. Hall* (YAG-40) Five Army light tugs 4533rd Tactical Test Squadron, 33rd Tactical Fighter Wing (F-4E aircraft)
Dissemination Procedures	Aerial-delivered aerosolized agent and agent tracers
Agents, Simulants, Tracers	Staphylococcal enterotoxin, Type B Bacillus subtilis var. niger (BG) Uranine dye (sodium fluorescein)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Bacillus subtilis var. niger (Bacillus globigii [BG]) The American Type Culture Center characterizes Bacillus subtilis var. niger as a BioSafety Level-1 (BSL-1) bacterium. The Centers for Disease Control and Prevention define BSL-1 as suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans. (Sources: American Type Culture Collection data sheet, http://www.atcc.org/ [as of January 11, 2002]. *Biosafety in Microbiological and Biomedical Laboratories*, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention and National Institutes of Health, 4th ed., p. 17, April 1999, U.S. Government Printing Office, Washington).

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	Staphylococcal enterotoxin, Type B (PG2) Produced by Staphylococcus aureus strains. It may be aerosolized or used to sabotage food supplies causing food poisoning. Symptoms are present within three to twelve hours after aerosol exposure and are characterized by fever, chills, headache, myalgia and nonproductive cough. Some may develop shortness of breath and retrosternal chest pain. Fever may last two to five days, and cough may persist for up to four weeks. Swallowing staphylococcal enterotoxin may also cause nausea, vomiting, and diarrhea. staphylococcal enterotoxin is not generally thought of as a lethal agent; however, it may incapacitate soldiers for one to two weeks. Military protective masks are effective against exposure. Treatment is limited to supportive care through ventilation and fluid management. The incapacitating dose is 30 mg/ person by inhalation. (Source: Medical NBC Website, http://www.nbc-med.org/ others/Default.html [as of April 2, 2002.] Uranine dye (sodium fluorescein) used as a tracer can cause a mild reaction in about one in ten people exposed. Exposure to dye dust through breathing or skin contact can result in adverse health effects such as asthma, eczema, and severe allergic reactions. http://www.cdc.gov/niosh/hc13.html

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Deseret Test Center

DTC Test 68-53

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The primary test objective of DTC Test 68-53 was to establish safety distances downwind of CS2 drop zones. A secondary objective required the determination of agent deposition patterns, percent of agent recovery, and airborne agent particle size in defining direct assault effects such as those related to rescue missions.

Five types of CS2 munitions, including the BLU-52A/B, Mk77, Mk20, and XM925 bombs and the XM28 dispenser system, were tested in flat, open terrain. The BLU-52A/B bombs were delivered by A-4/Skyhawk aircraft. The Mk77 and Mk20 bombs were deployed in pairs fromA-4/Skyhawk aircraft. The XM925 drum was tested statically and in dynamic drops from a CH47 helicopter. Bag submunitions were released from an XM28 dispenser carried by a UH-1B helicopter.

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While the United States does not classify CS2 as a chemical warfare agent, Deseret Test Center managed DTC Test 68-53 as a matter of convenience. Testing CS2 was not part of a chemical-biological warfare agent assessment.

DTC Test 68-53 was conducted during the period April to December 1969 at Dugway Proving Ground, Utah.

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Test Name	DTC Test 68-53
Testing Organization	US Army Deseret Test Center
Test Dates	April – December 1969
Test Location	Dugway Proving Ground, Utah
Test Operations	DTC Test 68-53 established safety distances downwind of CS2 riot control agent drop zones. The test also determined agent deposition patterns, percent of agent recovery, and airborne agent particle size in defining direct assault effects such as those related to rescue missions.
Participating Services	Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Five types of CS2 munitions, including the BLU-52A/B, Mk77, Mk20, and XM925 bombs and the XM28 dispenser system, were tested in flat, open terrain. The BLU-52A/B bombs were delivered by A-4/Skyhawk aircraft. The Mk77 and Mk20 bombs were deployed in pairs fromA-4/Skyhawk aircraft. The XM925 drum was tested statically and in dynamic drops from a CH47 helicopter. Bag submunitions were released from an XM28 dispenser carried by a UH-1B helicopter.
Agents, Simulants, Tracers	Ortho-chlorobenzylidene malontrile (CS2)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	CS2 Riot–Control Agent CS2 is one of several chemicals commonly called "Tear Gas." CS2 is a white, crystalline powder and is dispersed into the air as either an aerosol or powder. The chemical name for CS2 is ortho-chlorobenzylidene

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malononitrile. It is chemically identical to CS but differs in its physical characteristics. This chemical is an incapacitating/riot-control agent that acts as a contact irritant on the exposed body surfaces (eyes and skin), and on the respiratory tract. Exposure to CS2 causes burning, irritation, tearing and pain in the eyes. Airway symptoms include burning, sneezing, coughing, shortness of breath and increased secretions, such as runny nose and increased salivation. High concentrations of CS2 can cause blistering of the skin. With commonly used concentrations, these effects are short-term and the potential for long-term health consequences is low.

(Sources: Riot-Control Agents (chap. 6), in US Army Medical Research Institute of Chemical Defense, Medical Management of Chemical Casualties Handbook, 3rd edition, 1998; Sidell FR, Riot Control Agents (chap. 12), in Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997, p. 310-6. http://www.metrokc.gov/health/hazard/riotcontrol.htm#cs [as of September 26, 2002]Cornell University, http://msds.pdc.cornell.edu/msds/siri/files/chl/chlfz.html [as of August 26, 2002]).

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Deseret Test Center
Project SHAD

DTC Test 69-10

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

In DTC Test 69-10, units of a US Marine Corps Ready Group were subjected to a simulated chemical agent spray attack while engaged in an amphibious assault. The purpose of the test was to determine the operational effects of a persistent, toxic, chemical agent spray attack on US amphibious forces. The objectives of the test were to assess the performance degradation of troops wearing protective clothing and to illustrate the effectiveness of existing chemical weapons. Contamination of ships and equipment supporting the landing was also assessed.

The test was conducted in two parts: aerial spray attacks against Battalion Landing Team (Minus), BLT(-), and company sized USMC amphibious landing forces; and, an aerial spray attack against the primary control ship of an amphibious assault force. During all trials, sampling was conducted on exposed personnel, and their clothing, to determine if they were contaminated with the simulant. Performance of the troops, the landing craft crews, and the

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ship's crew was evaluated with regard to the response of personnel to the attack and their subsequent ability to operate in a simulated toxic environment.

Missions flown by Marine A-4 aircraft carrying Aero 14B spray tanks delivered trioctyl phosphate (tri [2-ethylhexyl] phosphate) to simulate VX nerve agent. The USS *Fort Snelling* (LSD-30) was the target ship for the ship trial.

DTC Test 69-10 was conducted in May 1969 on the beaches of Vieques island, six miles east of Puerto Rico.

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Test Name	DTC Test 69-10
Testing Organization	US Army Deseret Test Center
Test Dates	May 1969
Test Location	Vieques island, six miles east of Puerto Rico
Test Operations	To determine the operational effects of a persistent, toxic, chemical agent spray attack on US amphibious forces.
Participating Services	US Navy, US Marine Corps, Deseret Test Center personnel
Units and Ships Involved	Landing Force Carib 1-69/BLT 1/8 (attached and supporting personnel from 2d Marine Division)VMA-324, MAG-32, 2d Marine Aircraft Wing USS *Fort Snelling* (LSD-30)
Dissemination Procedures	Sprayed from Marine A-4 aircraft equipped with Aero 14B spray tanks.
Agents, Simulants, Tracers	Tri (2-ethylhexyl) phosphate
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Trioctyl phosphate (tri(2-ethylhexyl) phosphate) (TOF) Used as a nontoxic simulant for VX nerve agent. TOF is a viscous, colorless or pale yellow liquid. It can irritate the eyes, skin, and respiratory tract on contact. It can cause cancer in some animal species, but this has not been demonstrated in humans.

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	(Sources: NLM TOXNET, Trioctyl phosphate 1806-54-8 or Tris(2-ethylhexyl)phosphate 78-42-2, HSDB Human Health Effects and Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov. http://physchem.ox.ac.uk/MSDS/TR/tris(2-ethylhexyl)phosphate.html [as of September 25, 2002] and http://www.ilo.org/public/english/protection/safework/cis/products/icsc/dtasht/icsc09/icsc0968.pdf [as of September 25, 2002]).

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Deployment Health Support Directorate (DHSD) collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts this information provided on location, dates, units and/or ships, and substances involved in this exercise, which DHSD extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

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Deseret Test Center

DTC Test 69-12

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

In 1967 and 1968, Deseret Test Center Test conducted DTC Test 68-13 (Rapid Tan I, II, III) jointly with the United Kingdom and Canada. Rapid Tan was designed to investigate the extent and duration of hazard following a Tabun, Soman or V nerve agent attack. DTC Test 69-12 was planned as a more sophisticated test than Rapid Tan. DTC Test 69-12 was originally scheduled for conduct near Fort Greely, Alaska; however, the test site was moved to Edgewood Arsenal, Maryland. Only three trials (of 54 scheduled) were completed prior to the imposition of open-air toxic test restrictions and the suspension of the test.

The three completed DTC Test 69-12 trials were conducted at Edgewood Arsenal, Maryland during the spring of 1969.

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Test Name	DTC Test 69-12
Testing Organization	US Army Deseret Test Center
Test Dates	Spring 1969
Test Location	Edgewood Arsenal, Maryland
Test Operations	To determine rate of evaporation of Tabun, Sarin, Soman, and VX as a function of contamination density, drop size, and terrain cover under a variety of meteorological conditions in a temperate environment.
Participating Services	Deseret Test Center Personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Not identified
Agents, Simulants, Tracers	Sarin Nerve Agent Soman Nerve Agent Tabun Nerve Agent VX Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of

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Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects.

(Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

Soman Nerve Agent (GD)
Soman is a colorless liquid, which gives off an odor of rotting fruit when vaporizing. The vapor is colorless. Soman is a persistent agent that can easily remain in a particular area for a day or longer, depending on the atmospheric conditions. Acute health effects associated with exposure to soman include a runny nose, tightness in the chest, constriction of the pupils, difficulty in breathing, coma, and death. There is little information available regarding the long-term human health effects of exposure to soman.

(Source: http://www.sbccom.army.mil/services/edu/soman.htm Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997.)

Tabun Nerve Agent (GA)
Tabun is an amber, non-persistent liquid, which gives off little odor when vaporizing. The vapor is colorless. When exposed to tabun, the symptoms a victim will experience include a runny nose, tightness in the chest, constriction of the pupils, difficulty breathing,

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and nausea. Ultimately the victim will become comatose and will suffocate as a consequence of convulsive spasms. Tabun is mainly absorbed through the skin; however, vapors can also be hazardous. If a person does not receive an immediately lethal dose, death will occur after approximately 20 minutes. Those receiving a less than lethal dose who do not receive immediate medical care may suffer permanent neurological damage. There is little information available regarding the long-term human health effects of exposure to low doses of tabun.

(Source: http://www.sbccom.army.mil/services/edu/tabun.htm Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997.

VX Nerve Agent – (Synonyms: Phosphonothioic acid, VX)
VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: constriction of pupils, headaches, runny nose, salivation, tightness in the chest, nausea, vomiting, anxiety, difficulty in thinking, muscle twitches, tremors, and weakness. With severe exposure, symptoms progress to convulsions and respiratory failure. There is little information available regarding the long-term human health effects of exposure to low doses of VX.

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	(Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002] Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002] World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002] Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002]).

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Office of the
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Version 10-09-2002

Deseret Test Center

DTC Test 69-14

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of DTC Test 69-14 was to determine the hazards associated with inadvertent release of the MC-1 bomb during takeoff and landing, as well as the hazards resulting from bomb damage caused by hostile fire. The secondary objective was to determine the adequacy of leak suppressant and disposal procedures for damaged MC-1 bombs.

Simulant and/or water-filled 750 pound MC-1 bombs with or without bursters were used in the test. The simulant used was di (2-ethylhexyl) phthalate (DEHP.)

DTC Test 69-14 was conducted between July and November 1971 at Dugway Proving Ground, Utah.

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Test Name	DTC Test 69-14
Testing Organization	US Army Deseret Test Center
Test Dates	July – November 1971
Test Location	Dugway Proving Ground, Utah
Test Operations	DTC Test 69-14 consisted of 26 trials. Eighteen bullet-impact trials and eight simulated inadvertent releases were conducted. The primary test objective was to determine the hazards associated with inadvertent release of the MC-1 bomb during takeoff and landing and to determine the adequacy of leak suppressant and disposal procedures for damaged MC-1 bombs.
Participating Services	US Army, US Air Force, and Deseret Test Center Personnel
Units and Ships Involved	F-4 aircraft with MC-1 bombs
Dissemination Procedures	In the simulated inadvertent release trials, an MC-1 bomb was released from an F-4 aircraft. All bombs were equipped with the MAU-91 tail fin mounted "lo-drag" display. Six releases were made over a dry lake bed. These were followed by releases over concrete. For the bullet-impact trials, bombs were again filled with water and equipped with the central burster. Both water-filled and simulant-filled bombs were subjected to 50- and 30-caliber fire, 20mm armor piercing incendiary fire and 20mm high explosive incendiary fire.
Agents, Simulants, Tracers	Di (2-ethylhexyl) phthalate (DEHP)
Ancillary Testing	Not identified
Decontamination	Not identified

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Potential Health Risks Associated with Agents, Simulants, Tracers	Di (2-ethylhexyl) phthalate (DEHP) This chemical is commonly present in flexible plastics and therefore widespread in the environment and of some concern for the general population. While low level exposures have not been shown to cause serious health effects, acute exposure to high levels of this chemical can cause irritation of the skin, eyes, and respiratory tract. DEHP has caused cancer in some animal testing, but the relevance of this testing to cancer in humans is uncertain. (Sources: DHHS PHS ATSDR ToxFAQs, Di(2-ethylhexyl)phthalate #117-81-7, April 1993, and Toxicological Profile for Di(2-ethylhexyl)phthalate (DEHP), draft for public comment, September 2000, both available at http://www.atsdr.cdc.gov as of October 1, 2002. Also WHO International Agency for Research on Cancer (IARC) Monographs on the Evaluation of Carcinogenic Risks to Humans (vol. 77, Some Industrial Chemicals updated February 23, 2000), available at http://193.51.164.11/htdocs/announcements/vol77.htm as of October 4, 2002.)

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Version 10-09-2002

Deseret Test Center
Project SHAD

DTC Test 69-31

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 primary purpose of DTC Test 69-31 was to evaluate the continued effectiveness of the Shipboard Toxicological Operational Protection System (STOPS) of the USS *Herbert J. Thomas* (DD-833). The ship was challenged by five chemical vapor attacks using methylacetoacetate, a simulant for Sarin nerve agent. An additional 11 attacks were conducted in which the USS *Herbert J. Thomas* was enveloped with the nonpathogenic biological aerosol, *Bacillus globigii* (BG).

A MARS generator mounted on the bow of the ship was used to disseminate methylacetoacetate; PCF "swift boats" were used to disseminate BG during simulated biological warfare agent attacks.

DTC Test 69-31 trials were conducted in the Pacific Ocean, off the coast of San Diego, California, during the period August 19 - September 4, 1968.

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Test Name	DTC Test 69-31
Testing Organization	US Army Deseret Test Center
Test Dates	August 19 – September 4, 1968
Test Location	Testing was conducted in the Pacific Ocean, off the coast of San Diego, California
Test Operations	To test the Shipboard Toxicological Operational Protective System (STOPS) using methylacetoacetate, a simulant for Sarin nerve agent (GB) and *Bacillus globigii*, a nonpathogenic biological aerosol.
Participating Services	US Navy, Deseret Test Center personnel
Units and Ships Involved	USS *Herbert J. Thomas* (DD-833)
Dissemination Procedures	MARS generator to disseminate MAAPCF "swift boats" for BG dissemination
Agents, Simulants, Tracers	*Bacillus globigii* (BG) Methylacetoacetate
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-

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developing health effects would be very unlikely (except perhaps as a complication of the acute infection).

(Sources: Tuazon CU, Other Bacillus Species (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, Bacillus subtilis Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Methylacetoacetate (MAA)
This compound was used as a simulant. While acute exposure has been associated with irritation of skin, eyes, respiratory tract, and digestive tract, there is little or no evidence of long-term or late-developing health effects and it is not known to cause cancer in animal testing.

(Sources: NLM TOXNET, Methyl acetoacetate 105-45-3, HSDB Human Health Effects and Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov. http://hazard.com/msds/tox/f/q4/q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf)

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FACT SHEET

Special Assistant to the Under Secretary of
Defense (Personnel and Readiness) for Gulf War Illnesses,
Medical Readiness and Military Deployments

For more information,
(703) 578-8500

Project Shipboard Hazard and Defense (SHAD)

DTC Test 69-32

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 purpose of Deseret Test Center (DTC) Test 69-32 was to examine the effect of solar radiation on the viability of aerosolized Serratia marcescens and Escherichia coli after being aerially disseminated in a temperate marine environment during time periods about sunrise and sunset.

Twenty-seven field trials were conducted (14 Serratia marcescens and 13 Escherichia coli). Releases were made from two Aero 14B spray tanks wing-mounted on an A-4C aircraft. Bacillus subtilis var. niger (BG) with fluorescent tracer suspension was released from one tank while either Serratia marcescens or Escherichia coli was simultaneously released from the other. Calcofluor was added to the BG as the physical fluorescent tracer. All trials were conducted using ten percent calcofluor added to the BG.

The USS *Granville S. Hall* (YAG-40), along with five Army light tugs, was assigned to provide surface support to DTC Test 69-32. The five tugs, each converted to serve as an ocean-going sampling platform and laboratory, were employed as target vessels. Agent and tracer dissemination by A-4C aircraft commenced 1.6 kilometers downwind of the primary laboratory ship (YAG-40) and continued downwind for approximately 3.2 kilometers beyond the last sampling support tug.

DTC Test 69-32 was conducted at sea southwest of the Hawaiian Islands during the period April 30 to June 28, 1969.

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Test Name	DTC Test 69-32
Testing Organization	US Army Deseret Test Center
Test Dates	April 30 – June 28, 1969
Test Location	Testing was conducted at sea southwest of the Hawaiian Islands.
Test Operations	To examine the effect of solar radiation on the viability of aerosolized Serratia marcescens and Escherichia coli after being aerially disseminated in a temperate marine environment during time periods about sunrise and sunset.
Participating Services	Army, Navy, Air Force, Deseret personnel
Units and Ships Involved	USS *Granville S. Hall* (YAG-40) Five Army light tugs VC-1 (previously designated VU-1, Utility Squadron One) the Blue Aiis (Blue Warriors) Squadron, stationed at Barbers Point, Hawaii, provided a Navy A-4C as a disseminator aircraft. Patrol Squadron Six (PATRON SIX), Fleet Air Wing Two, provided two P3V *Orion* aircraft as airborne command posts.
Dissemination Procedures	Releases were made from two Aero 14B spray tanks wing mounted on an A-4C aircraft. Bacillus subtilis var. niger (BG) with fluorescent tracer suspension (calcofluor) was released from one tank while either Serratia marcescens or Escherichia coli was simultaneously released from the other.
Agents, Simulants, Tracers	Serratia marcescens Escherichia coli Bacillus subtilis var. niger (BG) Calcofluor (fluorescent brightner 28)
Ancillary Testing	Not identified
Decontamination	Not identified

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Potential Health Risks Associated with Agents, Simulants, Tracers	Serratia marcescens In 1969 Serratia marcescens was recognized as having a limited pathogenic capability and its use as a bacterial marker for studying the dissemination of bacterial aerosols was discontinued. It is an opportunistic pathogen, causing infections of the endocardium, blood, wounds, and urinary and respiratory tracts. (Source: U.S. Army Activity in the U.S. Biological Warfare Programs, Volume II, Appendix E, p. E-6, p. E-7, February 24, 1977; Miller-Keane Medical Dictionary, 2000, http://my.webmd.com/content/asset/miller_keane_30189 [as of January 9, 2002]). Escherichia coli (Synonym: E. Coli) E. coli is one of the most common bacteria in man's environment. Most animals and humans have it in their digestive systems, where it does no harm. E. coli can cause severe stomach cramps, diarrhea, bloody stools, and kidney failure. Some who are exposed to E. coli may experience mild irritation of the stomach and intestines that goes away without treatment, while for others the bacteria can be deadly. (Source: http://my.webmd.com/content/article/3606.464 [as of January 9, 2002]). Bacillus subtilis var. niger (Bacillus globigii [BG]) The American Type Culture Center characterizes Bacillus subtilis var. niger as a BioSafety Level-1 (BSL-1) bacterium. The Centers for Disease Control and Prevention define BSL-1 as suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans. (Sources: American Type Culture Collection data sheet, http://www.atcc.org/ [as of January 11, 2002]. *Biosafety in Microbiological and Biomedical*

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	Laboratories, US Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention and National Institutes of Health, 4th ed., p. 17, April 1999, U.S. Government Printing Office, Washington). Calcofluor (fluorescent brightener 28, Calcofluor White ST) Used as a fluorescent tracer with BG. $C_{40}H_{42}N_{12}Na_2O_{10}S_2$. Testing on laboratory animals indicates calcofluor may cause mild eye irritation. (Source: http://hazard.com/msds/tox/f/q127/q679.html [as of April 30, 2002])

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Version 10-09-2002

Deseret Test Center

DTC Test 69-75

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The objective of Deseret Test Center (DTC) Test 69-75 was to investigate the effectiveness of the F-4/A/B 45Y-2/TX weapon system to reduce wheat crop yields in selected geographic areas. The objective was subdivided into other tasks: determine the downwind travel of agent TX released from the A/B 45Y-2 spray tank; estimate the yield reduction and loss of wheat crops attacked by this weapon system; study the effectiveness of killed TX as a simulant for agent TX; and, evaluate the adequacy to predict downwind dosages of TX.

TX is the agent symbol for the fungus *Puccinia graminis var. tritici*, commonly known as stem rust of wheat. Killed TX is defined as spores killed by a gaseous mixture of ethylene oxide. Dead spores are those that have died as a result of causes other than intentional killing.

Four killed TX trials and seven live agent trials were conducted. All trials were conducted in the vicinity of Yeehaw Junction, Florida, from October 31 to December 1, 1968.

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Test Name	DTC Test 69-75
Testing Organization	US Army Deseret Test Center
Test Dates	October 31 – December 1, 1968
Test Location	In the vicinity of Yeehaw Junction, Florida
Test Operations	To investigate the effectiveness of the F-4/A/B 45Y-2/TX weapon system to reduce wheat crop yields in selected geographic areas.
Participating Services	US Air Force, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	TX was sprayed from an A/B 45Y-2 spray tank mounted on an F-4 aircraft.
Agents, Simulants, Tracers	*Puccinia graminis var. tritici* (TX)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Puccinia graminis tritici* (TX) This fungal species is toxic to plants, and therefore was considered a potential biological warfare agent directed against agricultural crops. It is not ordinarily considered to have either short-term or long-term human health effects. (Sources: Zajtchuk R., ed., Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997, p. 60, 460. Also http://www.cbwinfo.com/Biological/PlantPath/PG.html as of October 4, 2002.)

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Version 10-09-2002

Deseret Test Center

DTC Test 70-73

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purpose of DTC Test 70-73 was to examine potential secondary aerosol hazards to friendly troops following a biological agent attack. A secondary aerosol is defined as bacterial, toxic, or viral particles resuspended in the air after once settling from a primary aerosol attack or after the biological agent has been intentionally deposited on surfaces.

The types of biological attack simulated in this study were (a) a liquid filled bomblet point source, (b) an aerial liquid spray line source, and (c) a surface deposition with dry biological spores. *Bacillus globigii* (BG) was used in these trials. Liquid BG was dispersed by an explosive test fixture or by a vehicle mounted generator. The dry form of BG was manually deposited with a gravity test fixture at an area designated for road deposit trials. Zinc cadmium sulfide (FP) was disseminated with the BG.

DTC Test 70-73 was conducted between July and December 1970 at Dugway Proving Ground, Utah.

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Deployment Health Support Directorate (DHSD) collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts this information provided on location, dates, units and/or ships, and substances involved in this exercise, which DHSD extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

Test Name	DTC Test 70-73
Testing Organization	US Army Deseret Test Center
Test Dates	July – December 1970
Test Location	Dugway Proving Ground, Utah
Test Operations	DTC Test 70-73 examined potential secondary aerosol hazards to friendly troops following a biological agent attack. The types of biological attack simulated in this study were (a) a liquid filled bomblet point source, (b) an aerial liquid spray line source, and (c) a surface deposition with dry biological spores.
Participating Services	Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Liquid BG was dispersed by an explosive test fixture or by a vehicle mounted generator. Dry BG was manually deposited with a gravity test fixture at an area designated for road deposit trials. Zinc cadmium sulfide (FP) was disseminated with the BG.
Agents, Simulants, Tracers	*Bacillus globigii* (BG) Zinc cadmium sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease. They have been associated with acute infections of

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	the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection). (Sources: Tuazon CU, Other Bacillus Species (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, Bacillus subtilis Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.) Zinc cadmium sulfide (ZCdS) This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low.

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	(Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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FACT SHEET

Special Assistant to the Under Secretary of Defense
(Personnel and Readiness)for Gulf War Illnesses,
Medical Readiness and Military Deployments

For more information,
(703) 578-8500

Version 01-17-2002

Project Shipboard Hazard and Defense (SHAD)

Eager Belle, 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 primary purpose of the Eager Belle, Phase I test was to evaluate the effectiveness of selected protective devices in preventing penetration of a naval ship by a biological aerosol. An additional objective was to compare the efficiency of the M-17 and the Mark V protective masks against a biological aerosol. The USS *George Eastman* (YAG-39) was exposed to a biological tracer disseminated from a point source installed on a tugboat.

The biological tracer was Bacillus subtilis var. niger (often referred to as Bacillus globigii [BG]). For each trial, BG was aerosolized from an E-2 biological disseminator mounted on the stern of a tugboat. The BG was disseminated over a 10-minute period, during which 16 to 18 liters of agent were aerosolized. The USS *George Eastman* (YAG-39) maintained a distance of approximately 500 yards astern the tugboat. Fog oil was disseminated from an M3A3 pulse-jet mechanical smoke generator, prior to and concurrently with the BG, to provide a visible tracer to assist the captain of YAG-39 in remaining within the aerosol cloud.

Eager Belle, Phase I tests were conducted in an area of the Pacific Ocean west of Oahu, Hawaii within 40 miles of latitude 21? 30′ N, 158? 40′ W during the months of January and March 1963.

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Test Name	Eager Belle, Phase I (Test 63-1)
Testing Organization	US Army Deseret Test Center
Test Dates	January, March 1963
Test Location	Testing was conducted in the Pacific Ocean, west of Oahu, Hawaii.
Test Operations	To evaluate the effectiveness of selected protective devices in preventing penetration of a naval ship by a biological aerosol.
Participating Services	Navy, plus Deseret personnel
Units and Ships Involved	USS *George Eastman* (YAG-39)
Dissemination Procedures	Biological tracer released from an E-2 biological disseminator
Agents, Simulants, Tracers	Bacillus subtilis var. niger (Bacillus globigii [BG]).
Ancillary Testing	Mk V and M17 protective masks
Decontamination	Not identified.
Potential Health Risks Associated with Agents, Simulants, Tracers	Bacillus subtilis var. niger (Bacillus globigii [BG]) The American Type Culture Center characterizes Bacillus subtilis var. niger as a BioSafety Level-1 (BSL-1) bacterium. The Centers for Disease Control and Prevention define BSL-1 as suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans. (Sources: American Type Culture Collection data sheet, http://phage.atcc.org [as of January 11, 2002] and *Biosafety in Microbiological and Biomedical Laboratories*, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention and National Institutes of Health, 4th ed., p. 17, April 1999, U.S. Government Printing Office, Washington)

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans' Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Office of the Special Assistant to the Under Secretary of Defense (Personnel and Readiness) for Gulf War Illnesses, Medical Readiness and Military Deployments (OSA) collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts the information provided on location, dates, units and/or ships, and substances involved in this exercise, which the OSA extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

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Special Assistant to the Under Secretary of Defense
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Version 01-17-2002

Project Shipboard Hazard and Defense (SHAD)

Eager Belle, Phase II

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 primary purpose of the Eager Belle, Phase II test was to study the downwind travel of biological aerosols. The primary test objectives were to relate biological cloud travel to predicted cloud travel based on prediction models for prevailing conditions; to obtain additional information on weapon system performance over the open sea under meteorological conditions encountered; and, to obtain information to assist in the design and execution of future trials. A secondary objective was to provide information on the performance of a particle-sized analyzer under environmental conditions.

Bacillus subtilis var. niger (often referred to as Bacillus globigii [BG]), a biological tracer, was released as a line source generated by Aero 14B spray tanks mounted on A-4 series jet attack aircraft. The ships which operated in Eager Belle, Phase II were the USS *George Eastman* (YAG-39), the USS *Carpenter* (DD-825), the USS *Navarro* (APA-215), and the USS *Tioga County* (LST-1185). The USS *Granville S. Hall* (YAG-40) and an EC-121 aircraft maintained operational control of testing.

Eager Belle, Phase II tests were conducted in an area of the Pacific Ocean approximately 175 miles west of Oahu, Hawaii within 100 miles radius of latitude 19? 30´ N, 160? 00´ W during the months of February, March, and June 1963.

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Special Assistant to the Under Secretary of Defense (Personnel and Readiness) for Gulf War Illnesses, Medical Readiness and Military Deployments collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts this information provided on location, dates, units and/or ships, and substances involved in this exercise, which the Special Assistant extracted from classified DoD

Test Name	Eager Belle, Phase II (Test 63-1)
Testing Organization	US Army Deseret Test Center
Test Dates	February, March, June 1963
Test Location	Testing was conducted in the Pacific Ocean, west of Oahu, Hawaii.
Test Operations	To study the downwind travel of biological aerosols.
Participating Services	Navy, plus Deseret personnel
Units and Ships Involved	• USS *George Eastman* (YAG-39) • USS *Granville S. Hall* (YAG-40) • USS *Carpenter* (DD-825) • USS *Navarro* (APA-215) • USS *Tioga County* (LST-1185)
Dissemination Procedures	Biological tracer released as a line source generated by Aero 14B spray tanks mounted on A-4 series jet attack aircraft.
Agents, Simulants, Tracers	Bacillus globigii (Bacillus subtilis var. niger [BG]).
Ancillary Testing	Particle-sized analyzer under development
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Bacillus subtilis var. niger (Bacillus globigii [BG]) The American Type Culture Center characterizes Bacillus subtilis var. niger as a BioSafety Level-1 (BSL-1) bacterium. The Centers for Disease Control and Prevention define BSL-1 as suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans. (Sources: American Type Culture Collection data sheet, http://phage.atcc.org [as of January 11, 2002] and *Biosafety in Microbiological and Biomedical Laboratories*, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention and National Institutes of Health, 4th ed., p. 17, April 1999, U.S. Government Printing Office, Washington)

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Office of the
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(703) 578 - 8500
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Version 10-09-2002

Deseret Test Center

Elk Hunt, Phase I

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The Elk Hunt, Phase I tests were designed to determine the amount of either standard or modified VX nerve agent picked up on the clothing of personnel traversing various types of contaminated terrain. The tests examined the length of time a barrier is effective in producing casualties. Elk Hunt, Phase I also compared pickup of agent when M23 mines filled with standard and modified VX nerve agent were detonated under water and under ground.

In Elk Hunt, Phase I, standard or modified VX nerve agent was disseminated from M23 mines detonated under ground in three types of terrain – shrubbery, wooded, and ground covered in rye grass – and under water. Personnel, assuming various tactical positions, traversed the contaminated test grids at specified times and the amount of VX picked up on their clothing was measured. Personnel wore complete, impermeable, butyl-rubber outfits and M9A1 masks.

Twenty trials were conducted in the vicinity of Fort Greely, Alaska from July 3 through August 15, 1964.

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Deployment Health Support Directorate (DHSD) collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts this information provided on location, dates, units and/or ships, and substances involved in this exercise, which DHSD extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

Test Name	Elk Hunt, Phase I (DTC Test 65-14)
Testing Organization	US Army Deseret Test Center
Test Dates	July 3 – August 15, 1964
Test Location	Fort Greely, Alaska
Test Operations	To determine the amount of either standard or modified VX nerve agent picked up on the clothing of personnel traversing various types of contaminated terrain. To determine the length of time a barrier is effective in producing casualties. To compare pickup of agent when M23 mines filled with standard and modified VX are detonated under ground and under water.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Selected personnel assigned to HHC, 171st Infantry Brigade, 15th Artillery Battalion, 40th Armor Battalion, 4th Battalion, 9th Infantry, 1st Battalion, 47th Infantry, 538th Ordnance Company (Direct Support)
Dissemination Procedures	Standard or modified VX was disseminated from M23 mines detonated under ground and under water.
Agents, Simulants, Tracers	VX Nerve Agent Modified VX Nerve Agent (one percent polyisobutyl-methacrylate added as thickener)
Ancillary Testing	Not identified
Decontamination	Not identified

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Potential Health Risks Associated with Agents, Simulants, Tracers	VX Nerve Agent – (Synonyms: Phosphonothioic acid, VX) VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: constriction of pupils, headaches, runny nose, salivation, tightness in the chest, nausea, vomiting, anxiety, difficulty in thinking, muscle twitches, tremors, and weakness. With severe exposure, symptoms progress to convulsions and respiratory failure. There is little information available regarding the long-term human health effects of exposure to low doses of VX. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002]Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002] World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002] Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002])

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Deployment Health Support Directorate (DHSD) collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts this information provided on location, dates, units and/or ships, and substances involved in this exercise, which DHSD extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

FACT SHEET

Office of the
Assistant Secretary of Defense (Health Affairs)
Deployment Health Support Directorate

For more information
(703) 578 - 8500
(800) 497 - 6261

Version 10-09-2002

Deseret Test Center

Elk Hunt, Phase II

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The Elk Hunt, Phase II tests were designed to determine the amount of VX nerve agent picked up on the clothing of personnel traversing breached paths through contaminated areas and M23 minefields; the amount of VX nerve agent deposited on the surface of vehicles traversing VX-contaminated areas or under which an M23 mine had been detonated; the amount of VX nerve agent deposited on the clothing of personnel actively or passively contacting contaminated vehicles; vehicle decontamination by wet steam, high-pressure cold water hosing, and wallow pit; and, the amount of VX vapor rising from VX-contaminated areas.

Thirty-five trials were conducted near Fort Greely, Alaska, between June 7 and July 27, 1965. Five trials were conducted by the Canadian government in conjunction with the Deseret Test Center trials. Chemical Research and Development Laboratories, Edgewood Arsenal, Maryland, performed 11 additional vehicle decontamination trials from October 27 to December 17, 1965.

Personnel who participated in Elk Hunt, Phase II wore complete, impermeable butyl-rubber outfits and M9A1 masks.

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Test Name	Elk Hunt, Phase II (DTC Test 65-14)
Testing Organization	US Army Deseret Test Center
Test Dates	June 7 – July 27, 1965 October 27 – December 17, 1965
Test Location	Fort Greely, Alaska Edgewood Arsenal, Maryland Canada
Test Operations	To determine the amount of standard VX nerve agent picked up on the clothing of personnel traversing paths formed by the breaching of minefields and areas contaminated by detonated M23 mines. Tests were made to determine the amount of VX nerve agent picked up by personnel contacting contaminated vehicles.
Participating Services	US Army, Deseret test personnel
Units and Ships Involved	Selected personnel assigned to HHC, 171st Infantry Brigade, 15th Artillery Battalion, 40th Armor Battalion, 4th Battalion, 9th Infantry1st Battalion, 47th Infantry, 538th Ordnance Company (Direct Support)
Dissemination Procedures	Standard VX was disseminated from M23 mines buried with pressure plates flush with the ground.
Agents, Simulants, Tracers	VX Nerve Agent
Ancillary Testing	Not identified
Decontamination	Wet steam, high-pressure cold water hosing, and wallow pit for decontaminating vehicles

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Potential Health Risks Associated with Agents, Simulants, Tracers	VX Nerve Agent – Lethal Nerve Agent (Synonyms: Phosphonothioic acid, VX): VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: miosis (constriction of pupils) and visual effects, headaches and pressure sensation, runny nose and nasal congestion, salivation, tightness in the chest, nausea, vomiting, giddiness, anxiety, difficulty in thinking, difficulty sleeping, nightmares, muscle twitches, tremors, weakness, abdominal cramps, diarrhea, involuntary urination and defecation. With severe exposure symptoms progress to convulsions and respiratory failure. The permissible airborne exposure concentration for VX nerve agent in any 8-hour work shift can be found in Department of the Army Pamphlet 40-8. To date, however, the Occupational Safety and Health Administration has not promulgated a permissible exposure concentration for VX nerve agent. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002].SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002].World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002]. Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve

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	Agents GA, GB, GD, and VX, http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002]).

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Special Assistant to the Under Secretary of
Defense (Personnel and Readiness) for Gulf War Illnesses,
Medical Readiness and Military Deployments

For more information,
(703) 578-8500

Project Shipboard Hazard and Defense (SHAD)

Fearless Johnny

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 Fearless Johnny test were to evaluate the magnitude of interior and exterior contamination from an aerial-delivered chemical weapon system using a simulant for VX nerve agent; demonstrate the effectiveness of the shipboard water washdown system for decontamination and as a protective measure against an aerial spray of VX nerve agent; and, evaluate the operational impact of gross VX nerve agent contamination on a US Navy ship.

VX nerve agent and the VX nerve agent simulant, diethylphthlate, mixed with 0.1 percent of the fluorescent dye DF-504, were used during Fearless Johnny testing.

The USS *George Eastman* (YAG-39) was the test subject vessel for all trials of the test program. The USS *Granville S. Hall* (YAG-40) was assigned to Fearless Johnny as an escort and laboratory support vessel. Two light tugs provided a capability to transfer test samples between the USS *George Eastman* and the support vessels.

The Fearless Johnny trials were conducted at sea, southwest of Honolulu, Hawaii, during August and September 1965. Disseminating aircraft were stationed at an auxiliary airfield on the Island of Kauai.

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Test Name	Fearless Johnny (Test 65-17)
Testing Organization	US Army Deseret Test Center
Test Dates	August and September 1965
Test Location	Testing was conducted at sea southwest of Honolulu, Hawaii.
Test Operations	The test subject vessel, the USS *George Eastman* (YAG 39), was challenged by VX nerve agent or its simulant, diethylphthlate, to evaluate the magnitude of exterior and interior contamination levels under three material readiness conditions, demonstrate the effectiveness of the shipboard water washdown system, and evaluate the operational impact of gross VX nerve agent contamination on a US Navy ship.
Participating Services	Navy, plus Deseret personnel
Units and Ships Involved	USS *George Eastman* (YAG-39) USS *Granville S. Hall* (YAG-40) Two light tugs (not further identified). VC-1 (previously designated VU-1, Utility Squadron One) the Blue Aiis (Blue Warriors) Squadron provided a Navy A4-B as a disseminator aircraft. Patrol Squadron Six (PATRON SIX), Fleet Air Wing Two, provided two P2V *Neptune* aircraft as airborne command posts and to provide surveillance in the operating area.
Dissemination Procedures	Aerial-delivered aerosolized agent and agent simulant.
Agents, Simulants, Tracers	VX nerve agent Diethylphthlate mixed with 0.1 percent of fluorescent dye DF-504.
Ancillary Testing	Not identified
Decontamination	Water washdown system

The Department of Defense (DoD) is providing this information, at the request of the Department of Veterans Affairs (VA), to assist the VA in providing healthcare services to qualified veterans and to assist veterans in establishing service connection for disability claims. The Special Assistant to the Under Secretary of Defense (Personnel and Readiness) for Gulf War Illnesses, Medical Readiness and Military Deployments collected this information from multiple sources and requested that the military services declassify it to allow its public distribution. The VA accepts this information provided on location, dates, units and/or ships, and substances involved in this exercise, which the Special Assistant extracted from classified DoD records, and will provide it to individual veterans as necessary, but the VA cannot verify its accuracy.

Potential Health Risks Associated with Agents, Simulants, Tracers	VX Nerve Agent – Lethal Nerve Agent (Synonyms: Phosphonothioic acid, VX): VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: miosis (constriction of pupils) and visual effects, headaches and pressure sensation, runny nose and nasal congestion, salivation, tightness in the chest, nausea, vomiting, giddiness, anxiety, difficulty in thinking, difficulty sleeping, nightmares, muscle twitches, tremors, weakness, abdominal cramps, diarrhea, involuntary urination and defecation. With severe exposure symptoms progress to convulsions and respiratory failure. The permissible airborne exposure concentration for VX nerve agent in any 8-hour work shift can be found in Department of the Army Pamphlet 40-8. To date, however, the Occupational Safety and Health Administration has not promulgated a permissible exposure concentration for VX nerve agent. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002]. *SBCCOM Online*, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002]. World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002]. Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX, http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002]).

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	Diethylphthlate (Synonyms: diethyl ester 2, Benzenedicarboxylic acid). Short-term exposure to diethylphthlate vapors can irritate the nose and throat. If splashed in the eyes, diethylphthlate can cause considerable eye pain but no, or slight, reversible damage. The Environmental Protection Agency places this substance in category D - not classifiable as a human carcinogen. Diethylphthlate is only very slowly absorbed through the skin; however, ingestion in high concentrations can cause gastrointestinal irritation, or hypotension. Diethylphthlate has been used routinely as an insect repellent since World War II. It is also used in cosmetics and aspirin. (Sources: New Jersey Department of Health and Senior Services, http://www.state.nj.us/health/eoh/rtkweb/0707.pdf [as of January 25, 2002]. National Institute for Occupational Safety and Health [NISOH] *International Chemical Safety Cards* http://www.cdc.gov/niosh/ipcsneng/neng0258.html [as of January 25, 2002]. Agency for Toxic Substances and Disease Registry, National Toxicology Program, http://ntp-server.niehs.nih.gov/htdocs/Chem_H&S/NTP_Chem8/Radian84-66-2.html [as of January 25, 2002].

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FACT SHEET

Special Assistant to the Under Secretary of
Defense (Personnel and Readiness) for Gulf War Illnesses,
Medical Readiness and Military Deployments

For more information,
(703) 578-8500

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 cham-

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ber to be used for a protective mask check, shower facilities (not used during the test of vapor agents), and 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.

Test Name	Flower Drum, Phase I (Test 64-2)
Testing Organization	US Army Deseret Test Center
Test Dates	February through April and August through September 1964
Test Location	Testing was conducted in the Pacific Ocean, off the coast of Hawaii.
Test Operations	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.
Participating Services	Navy, plus Deseret personnel
Units and Ships Involved	USS *George Eastman* (YAG-39) USS *Granville S. Hall* (YAG-40)
Dissemination Procedures	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.
Agents, Simulants, Tracers	Sarin nerve agent Sulfur dioxide Methylacetoacetate

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Ancillary Testing	E41 V-G Agent Alarm System Hydrogen Flame Emission Detector (HYFED) Passive Long Path Infrared (LOPAIR) advance warning alarm
Decontamination	A decontamination tunnel was used during test periods.
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent 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^3. 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. (Source: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]). Sulfur Dioxide 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

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	air. Exposure to 100 ppm of sulfur dioxide is considered immediately dangerous to life and health. (Source: ATSDR Toxicological Profile for Sulfur Dioxide www.atsdr.cdc.gov/toxprofiles/tp116.html [as of February 13, 2002]). 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. (Sources: http://hazard.com/msds/tox/f/q4/q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf

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FACT SHEET

Special Assistant to the Under Secretary of
Defense (Personnel and Readiness) for Gulf War Illnesses,
Medical Readiness and Military Deployments

For more information,
(703) 578-8500

Project Shipboard Hazard and Defense (SHAD)

Flower Drum, Phase II

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 primary purpose of the Flower Drum, Phase II, test was to determine the effectiveness of a shipboard water washdown system as a protective and decontaminant measure against simulated aerial delivery of VX nerve agent spray.

The US Navy Covered Lighter (Barge), YFN-811, was used as the platform for the test. During the test trials, the barge was towed by the US Navy Tug, ATF 105. It was towed approximately one kilometer behind the tug. A spray device on the barge disseminated agent or simulant onto the barge during tests.

A dyed liquid containing approximately 90 percent VX nerve agent (by weight) was used in this program. To assist in taking radiometric measurements of contamination, radioactive "tagged VX nerve agent" molecules containing a radioactive isotope, Phosphorous 32, were included in the agent. In addition to VX nerve agent, a simulant, Bis (2 ethyl-hexyl) hydrogen phosphite was used in this test.

Flower Drum, Phase II, tests were conducted at sea during November and December 1964, off the coast of Hawaii.

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Test Name	Flower Drum, Phase II (Test 64-2)
Testing Organization	US Army Deseret Test Center
Test Dates	November and December 1964
Test Location	Testing was conducted in the Pacific Ocean, off the coast of Hawaii.
Test Operations	To determine the effectiveness of a shipboard water washdown system as a protective and decontaminant measure against simulated aerial delivery of VX nerve agent spray.
Participating Services	Navy, plus Deseret personnel
Units and Ships Involved	US Navy Covered Lighter (Barge), YFN-811 US Navy Tug, ATF-105
Dissemination Procedures	A dyed liquid containing approximately 90 percent VX nerve agent (by weight) was sprayed onto the barge. To assist in taking radiometric measurements of contamination, radioactive "tagged VX nerve agent" molecules containing a radioactive isotope, Phosphorous 32, were included in the agent.
Agents, Simulants, Tracers	VX nerve agent VX nerve agent containing radioactive isotope, Phosphorous 32 Bis (2 ethyl-hexyl) hydrogen phosphite
Ancillary Testing	Not identified
Decontamination	Water washdown system
Potential Health Risks Associated with Agents, Simulants, Tracers	VX Nerve Agent – Lethal Nerve Agent (Synonyms: Phosphonothioic acid, VX): VX is an extremely lethal nerve agent. It is an oily liquid that is clear, odorless and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: miosis (constriction of pupils) and visual effects, headaches and pressure sensation, runny nose and nasal congestion, salivation, tightness in the chest, nausea, vomiting, giddiness, anxiety,

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	difficulty in thinking, difficulty sleeping, nightmares, muscle twitches, tremors, weakness, abdominal cramps, diarrhea, involuntary urination and defecation. With severe exposure symptoms progress to convulsions and respiratory failure. The permissible airborne exposure concentration for VX nerve agent in any 8-hour work shift can be found in Department of the Army Pamphlet 40-8. To date, however, the Occupational Safety and Health Administration has not promulgated a permissible exposure concentration for VX nerve agent. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002]. *SBCCOM Online*, Edgewood Chemical Biological Center [ECBC], http://www.sbccom.apgea.army.mil/RDA/msds/vx.htm [as of April 2, 2002]. Department of Sustainable Development and Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002]). Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX, http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002]). Phosphorous 32 Phosphorous 32 is one of the highest energy beta-emitting radionuclides commonly used in biomedical research. In general Phosphorous 32 does not pose a severe threat from ingestion or inhalation. High energy betas from Phosphorous 32 pose an external (skin and lens of the eye) dose hazard, as well as a potential internal hazard. Radiogenic health effects (primarily cancer) are observed in humans only at doses in excess of 10 rem delivered at high dose rates. Below this dose, estimation of adverse health effects is speculative. Exposure can contribute to development of cancer.

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	(Sources: Environmental Protection Agency, http://www.epa.gov/radiation/heast/docs/heast2_table_4-d2_0401.pdf. [as of February 28, 2002], Harvard University, http://www.uos.harvard.edu/ehs/radsafety/gui_p32.shtml.[as of February 28, 2002] Cornell University, http://msds.pdc.cornell.edu/msds/siri/msds/h/q428/q236.html [as of February 28, 2002]. Office of Radiation, Chemical and Biological Safety, MSU. http://www.orcbs.msu.edu/radiation/radsaf.html [as of February 28, 2002] University of California, Davis, http://ehs.ucdavis.edu/hp/shi/haz_sh.html [as of February 28, 12002]. University of Iowa, http://www.uiowa.edu/~hpo/facts/P32.htm [as of February 28, 2002]). Bis (2 ethyl-hexyl) hydrogen phosphite May be harmful by inhalation, ingestion, or skin absorption. Vapor or mist can be irritating to the eyes, mucous membranes, and upper respiratory tract. It can also cause skin irritation. It is not carcinogenic and there are no chronic exposure hazards. (Source: Cornell University, http://msds.pdc.cornell.edu/msds/siri/msds/h/q324/q431.html [as of February 28, 2002]).

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FACT SHEET

Office of the
Assistant Secretary of Defense (Health Affairs)
Deployment Health Support Directorate

For more information
(703) 578 - 8500
(800) 497 - 6261

Version 10-09-2002

Deseret Test Center

Green Mist

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The primary purpose of Green Mist was to estimate the effective dosage area coverage that could be expected if sarin nerve agent-filled M139 bomblets were disseminated from four different weapons systems over a rain forest canopy.

Trials were conducted using sarin nerve agent and the simulant methylacetoacetate.

Green Mist was conducted on the island of Hawaii during the period of March 25 through April 24, 1967.

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Test Name	Green Mist (DTC Test 66-4)
Testing Organization	US Army Deseret Test Center
Test Dates	March 25 – April 24, 1967
Test Location	Island of Hawaii
Test Operations	To determine the average dosage in a mountain rain forest of four chemical weapon systems employing the M139 sarin nerve agent bomblet.
Participating Services	Deseret Test Center
Units and Ships Involved	Not identified
Dissemination Procedures	M139 sarin nerve agent-filled bomblets were statically detonated at several heights below the canopy.
Agents, Simulants, Tracers	Sarin Nerve Agent Methylacetoacetate
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association

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between low-level sarin exposure and long-term health effects.

(Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

Methylacetoacetate (MAA)
This compound was used as a simulant. While acute exposure has been associated with irritation of skin, eyes, respiratory tract, and digestive tract, there is little or no evidence of long-term or late-developing health effects and it is not known to cause cancer in animal testing.

(Sources: NLM TOXNET, Methylacetoacetate 105-45-3, HSDB Human Health Effects and Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov.http://hazard.com/msds/tox/f/q4/q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf)

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FACT SHEET

Office of the
Assistant Secretary of Defense (Health Affairs)
Deployment Health Support Directorate

For more information
(703) 578 - 8500
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Version 10-09-2002

Deseret Test Center
Project SHAD

Half Note

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 purpose of the Half Note test was to determine biological decay rates of vegetative nonpathogens in a marine environment and to compare the field decay rates with chamber decay rates when conducted under similar conditions. Trials included the release of *Escherichia coli* or *Serratia marcescens* with *Bacillus globigii.*

In each trial, a slurry of *Bacillus globigii* and one of the two other organisms were released from Aero 14B spray tanks, wing-mounted on an A-4 aircraft. During each trial, the USS *George Eastman* (YAG-39) and five Army light tugs would traverse upwind attempting to remain in the aerosol cloud for several hours. In addition, the USS *Granville S. Hall* (YAG-40) took complete surface observations, every half-hour during the trials.

Calcofluor, a fluorescent tracer, was used as a tool for determining cloud arrival and departure. For this test, a contractor released and sampled a stable inorganic tracer, zinc cadmium sulfide (FP), type 3206 green.

Half Note tests were conducted in the Pacific Ocean off the coast of Hawaii, approximately 80 nautical miles south-southwest of Oahu from August 18 – September 30, 1966.

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Test Name	Half Note (DTC Test 66-13)
Testing Organization	US Army Deseret Test Center
Test Dates	August 18 – September 30 1966
Test Location	In the Pacific Ocean off the coast of Hawaii, Approximately 80 nautical miles south-southwest of Oahu
Test Operations	To determine biological decay rates of *Escherichia coli* and *Serratia marcescens* in a marine environment.
Participating Services	US Navy, Deseret Test Center personnel
Units and Ships Involved	USS *George Eastman* (YAG-39) USS *Granville S. Hall* (YAG-40) Army light tugs 2080, 2081, 2085, 2086, and 2087, all staffed by USN personnel
Dissemination Procedures	Sprayed from A-4 aircraft equipped with Aero 14B spray tanks.
Agents, Simulants, Tracers	*Bacillus globigii* *Serratia marcescens* *Escherichia coli* Calcofluor (fluorescent brightner 28) Zinc cadmium sulfide (FP)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Bacillus globigii (BG) Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease.

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They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).

(Sources: Tuazon CU, Other Bacillus Species (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, Bacillus subtilis Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Serratia marcescens (SM)
This bacterial species can cause acute infections of the urinary tract, lung, bloodstream, and other body sites. These infections commonly occur in individuals whose health has already been compromised, and often in patients who are already hospitalized. Long-term or late-developing health effects would be very unlikely.

(Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2303.)

Escherichia coli, or *E. Coli* (EC)
This bacterial species is a common inhabitant of the digestive tract but can also cause acute infection, especially when it gains access to other body sites,

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like the urinary tract, lung, and bloodstream. Long-term or late-developing health effects of E. coli infection would be unlikely.

(Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2299-301.)

Calcofluor (fluorescent brightener 28, Calcofluor White ST)
Used as a fluorescent tracer with Bacillus globigii. Chemical formula is C40H42N12Na2O10S2. This chemical has been used as a medical laboratory stain and as a whitening agent in detergents. It can cause eye irritation in animal testing, but there is limited evidence for or against human health effects.

(Source: http://hazard.com/msds/tox/f/q127/q679.html [as of April 30, 2002]NLM TOXNET, Cellufluor 4193-55-9, available at http://toxnet.nlm.nih.gov)

Zinc cadmium sulfide (ZCdS)
This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area

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	was low. (Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Version 10-09-2002

Deseret Test Center
Project SHAD

High Low

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 primary purpose of the High Low test was to assess the vulnerability of ships to an enveloping cloud of toxic G-series nerve agent. The test had two primary objectives. Objective one was to investigate the penetration of a simulant for the nerve agent Sarin (GB) into four types of naval ships operating at sea. Objective two was to estimate the penetration of Sarin into the four types of operational naval ships by evaluating the results of Objective one in conjunction with the Sarin/Sarin-simulant relationship established in Flower Drum, Phase I (DTC Test 64-2.) This was done mathematically, no Sarin was used in this test.

Methylacetoacetate was used to simulate Sarin nerve agent. The simulant was disseminated from a modified Model T-45M-2 MARS Portable Gas Turbine located on the bow of the test ship. All personnel (ships' crews and civilian test personnel) were instructed in the use of protective masks, and masks were worn by personnel directly exposed to significant quantities of methylacetoacetate.

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The ships which operated in High Low were the USS *Berkely* (DDG-15), the USS *Fechteler* (DD-870), the USS *Okanogan* (APA-220), and the USS *Wexford County* (LST-1168).

High Low tests were conducted in the Pacific Ocean off the coast of San Diego, California, during the period January 11 through February 26, 1966.

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Test Name	High Low (DTC Test 65-13)
Testing Organization	US Army Deseret Test Center
Test Dates	January 11 – February 26, 1966
Test Location	Testing was conducted in the Pacific Ocean, off the coast of San Diego, California
Test Operations	To assess the vulnerability of ships to an enveloping cloud of toxic G-series nerve agent.
Participating Services	U.S. Navy, Deseret Test Center personnel
Units and Ships Involved	USS *Berkely* (DDG-15) USS *Fechteler* (DD-87) USS *Okanogan* (APA-220) USS *Wexford County* (LST-1168)
Dissemination Procedures	Agent cloud was generated by dissemination from a modified Model T-45M-2 MARS Portable Gas Turbine located on the bow of the test ship.
Agents, Simulants, Tracers	Methylacetoacetate
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Methylacetoacetate (MAA) This compound was used as a simulant. While acute exposure has been associated with irritation of skin, eyes, respiratory tract, and digestive tract, there is little or no evidence of long-term or late-developing health effects and it is not known to cause cancer in animal testing. (Sources: NLM TOXNET, Methyl acetoacetate 105-45-3, HSDB Human Health Effects and Animal Toxicity Studies, available at http://toxnet.nlm.nih.gov. http://hazard.com/msds/tox/f/q4/

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	q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf)

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Deseret Test Center
Project SHAD

Magic Sword

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' and ashore installations' 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 purpose of Magic Sword was to study the feasibility of an offshore release of *Aedes aegypti* mosquitoes and to obtain information on mosquito biting habits, mosquito trap technology, and operational and logistical problems associated with the delivery of mosquitoes to remote sites.

The *Aedes aegypti* mosquito is a main vector for various infectious diseases, including dengue and yellow fevers.

Uninfected mosquitoes were released from the USS *George Eastman* (YAG-39), off the coast of Baker Island and traps were placed on the island as part of the test. As part of an onshore biting study, volunteers were placed at specific locations and a designated number of vectors were released centrally. Volunteers recorded the number of bites received.

A thermal fog generator was used to eradicate the mosquito population on the island at the conclusion of the test. Mosquitoes were eradicated aboard ship through a combination of high heat and insecticide.

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The trials for Magic Sword were conducted in the Pacific Ocean, on or in the vicinity of Baker Island, during May 1965.

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Test Name	Magic Sword (DTC Test 65-4)
Testing Organization	US Army Deseret Test Center
Test Dates	May 1965
Test Location	In the Pacific Ocean, on or in the vicinity of Baker Island
Test Operations	To study the feasibility of an offshore release of *Aedes aegypti* mosquitoes and to obtain information on mosquito biting habits, mosquito trap technology, and operational and logistical problems associated with the delivery of mosquitoes to remote sites.
Participating Services	US Navy, Deseret Test Center personnel
Units and Ships Involved	USS *George Eastman* (YAG-39)
Dissemination Procedures	Mosquitoes were released from the USS *George Eastman* near the coast of Baker Island.
Agents, Simulants, Tracers	Uninfected *Aedes aegypti* (mosquitoes).
Ancillary Testing	Not identified.
Decontamination	A thermal fog generator was used o eradicate the mosquito population on the island at the conclusion of the test. Mosquitoes were eradicated aboard ship through a combination of high heat and insecticide.
Potential Health Risks Associated with Agents, Simulants, Tracers	*Aedes aegypti* mosquitoes *Aedes aegypti* mosquitoes used in this test were not infected. Health effects at the time would be the usual swelling and irritation associated with mosquito bites. No long-term or latent effects would be expected.

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Version 10-09-2002

Deseret Test Center

Night Train

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The primary purpose of Night Train was to study the penetration of an arctic inversion by a biological aerosol cloud. A secondary purpose was to study the downwind travel and diffusion of this cloud when disseminated into different arctic meteorological regimes.

A total of 14 trials were conducted in which the biological simulant *Bacillus globigii* was released from an A/B45Y-1 spray tank carried on an F-105 or F-100 aircraft. Four trials were surface trials in which dry *Bacillus globigii* was disseminated from the rear of a moving, M116 Personnel Carrier. In addition, biological release was accompanied by the release of two colors (yellow and green) of fluorescent particles of zinc cadmium sulfide. The fluorescent particles were released from contractor-flown aircraft. The yellow fluorescent particles were disseminated from an Aero Commander aircraft; the green fluorescent particles from a Cessna 180.

Night Train was conducted in the vicinity of Fort Greely, Alaska during the period November 30, 1963 to January 8, 1964.

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Test Name	Night Train (DTC Test 64-5)
Testing Organization	US Army Deseret Test Center
Test Dates	November 30, 1963 – January 8, 1964
Test Location	Near Fort Greely, Alaska
Test Operations	To obtain data on the downwind travel of a biological agent simulant under arctic conditions, when disseminated from the A/B 45Y-1 wet biological spray tank mounted on an operational aircraft and when sprayed from a tracked vehicle mounted dissemination device.
Participating Services	US Army, US Air Force, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Biological simulant *Bacillus globigii* was released from an A/B45Y-1 spray tank carried on an F-105 or F-100 aircraft. In surface trials, *Bacillus globigii* was disseminated from the rear of a moving, tracked vehicle. Fluorescent particles were released from contractor-flown aircraft (Aero Commander - yellow particles and Cessna 180 - green particles).
Agents, Simulants, Tracers	*Bacillus globigii,* Zinc Cadmium Sulfide
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii* (BG) Now considered to be *Bacillus subtilis var. niger,* a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the

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environment, and are uncommon causes of disease. They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).

(Sources: Tuazon CU, *Other Bacillus Species* (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, *Bacillus subtilis* Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Zinc cadmium sulfide (ZCdS)
This compound was aerosolized as a tracer material for the dispersion of biological warfare agents because it had similar properties. There has been little scientific study on the toxicity of this compound when inhaled. A National Research Council (NRC) committee focused on the cadmium component as potentially most toxic. While higher concentrations and more prolonged exposures to cadmium are associated with the development of lung cancer, the concentrations and durations of exposure in the Army's tests were substantially lower. The NRC committee concluded that the risk of adverse health effects to populations in the area was low.

(Sources: National Research Council (National Academies), Toxicologic Assessment of the Army's

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	Zinc Cadmium Sulfide Dispersion Tests, and Toxicologic Assessment of the Army's Zinc Cadmium Sulfide Dispersion Tests: Answers to Commonly Asked Questions, National Academy Press, Washington DC, 1997, both available at http://www.nap.edu as of October 1, 2002.)

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Deseret Test Center

Pin Point

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center (DTC) was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purposes of Pin Point were to evaluate the riot-control-agent CS-dispensing, man- portable E8 launcher and the aerially-delivered CBU-19/A and CBU-30/A munitions for area-coverage-time-dosage relationships in a tropical jungle environment. The reactions to CS of unmasked, volunteer personnel operating in the impact area and the persistency of the agent were also evaluated.

Ortho-chlorobenzylidene malonotrile (CS), a white crystalline powder riot-control agent, was used for the Pin Point tests. CS was dispersed by a counterinsurgency-type aircraft (A-1E/Skyraider) using CBU-30/A and CBU-19/A munitions as well as by using an E8 man portable launcher.

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While the United States does not classify CS as a chemical warfare agent, Deseret Test Center managed Pin Point as a matter of convenience. Testing CS delivery methods was not part of a chemical-biological warfare agent assessment.

Pin Point trials were conducted in 1966 in a tropical jungle type environment.

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Test Name	Pin Point (Test 66-10)
Testing Organization	US Army Deseret Test Center
Test Dates	1966 (specific dates not identified in the final report.)
Test Location	Tropical jungle environment (specific location not identified in final report.)
Test Operations	The riot-control-agent CS-dispensing, man portable E8 launcher, and the aerially delivered CBU-19/A and CBU-30/A munitions were operationally evaluated for area-coverage-time-dosage relationships in a tropical jungle environment. Reactions of unmasked, volunteer personnel operating in the impact area were evaluated as well as the persistency of the agent.
Participating Services	Deseret Test Center personnel, US Army, US Air Force, US Marine Corps
Units and Ships Involved	Counterinsurgency type aircraft (A 1E/Skyraider)
Dissemination Procedures	CS-filled submunitions were released from single and double dynamic drops of the CBU-19/A munition, CBU-30/A munition and from the firing of the E8 launcher.
Agents	CS Riot-Control Agent
Simulants and Tracers	Not identified
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	CS Riot – Control Agent CS is one of several chemicals commonly called "Tear Gas." CS is a white, crystalline powder and is dispersed into the air as either an aerosol or powder.

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	The chemical name for CS is ortho-chlorobenzylidene malononitrile. It is chemically identical to CS2 but differs in its physical characteristics. This chemical is an incapacitating/riot-control agent that acts as a contact irritant on the exposed body surfaces (eyes and skin), and on the respiratory tract. Exposure to CS causes burning, irritation, tearing and pain in the eyes. Airway symptoms include burning, sneezing, cough, shortness of breath and increased secretions, such as runny nose and increased salivation. High concentrations of CS can cause blistering of the skin. With commonly used concentrations, these effects are short-term and the potential for long-term health consequences is low. (Sources: Riot-Control Agents (chap. 6), in US Army Medical Research Institute of Chemical Defense, Medical Management of Chemical Casualties Handbook, 3rd edition, 1998; Sidell FR, Riot Control Agents (chap. 12), in Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997, p. 310-6. *http://www.metrokc.gov/health/hazard/riotcontrol.htm#cs* [as of September 26, 2002] and Cornell University, *http://msds.pdc.cornell.edu/msds/siri/files/chl/chlfz.html* [as of August 26, 2002]).

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Deseret Test Center

Pine Ridge

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

The purposes of Pine Ridge were to ascertain the percentage of BLU-19/B23 and BLU-20/B23 bomblets that function and to determine their dissemination points in or below a jungle canopy; to determine area-time-dosage and diffusion characteristics of agent BZ and Sarin nerve agent when disseminated from single bomblets; and, to estimate the effective area coverage that could be expected if agent BZ and Sarin nerve agent were disseminated from single or multiple SUU-13/A dispenser loads. A secondary objective was to determine any peculiar handling, storage, or safety requirements associated with BLU-19/B23 or BLU-20/B23 bomblets.

BZ is a code name for an ester of benzilic acid. The chemical affects the human mind causing those contaminated to be unable to perform an assignment or have a reduced will to resist for a short period of time. Sarin is a volatile and lethal nerve agent.

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Sarin filled BLU-19/B23 and BZ filled BLU-20/B23 bomblets were detonated in test areas in the upper Waiakea Forest Reserve and in the Olaa Forest Preserve, southwest of Hilo, on the island of Hawaii in May and June 1966.

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Test Name	Pine Ridge (DTC Test 65-16)
Testing Organization	US Army Deseret Test Center
Test Dates	May – June 1966
Test Location	Island of Hawaii
Test Operations	To evaluate the effectiveness of the BLU-19/B23 Sarin-filled bomblet and the BLU20/B23 agent BZ-filled bomblet in a tropical rain forest.
Participating Services	US Air Force, US Navy, US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Bomblets were projected with an airgun to determine burst height and static detonations were used for area-time-dosage determinations.
Agents, Simulants, Tracers	Ester of benzilic acid (BZ) Sarin Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Ester of benzilic acid (Agent BZ) This chemical is an incapacitating agent designed to cause stupor, confusion, and hallucinations when inhaled or absorbed through the skin. It is a white powder and may irritate the eyes, skin, and digestive and respiratory tracts, if inhaled or ingested. While some effects may last several days or weeks, long-term or late-developing health effects have not been documented and seem unlikely. (Source: Incapacitating Agents (chap. 5), in US Army Medical Research Institute of Chemical Defense, Medical Management of Chemical

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Casualties Handbook, 3rd edition, 1998; Ketchum JS, Sidell FR Incapacitating Agents (chap. 11), in ed. Zajtchuk R., Textbook of Military Medicine (part 1), Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. http://www.fas.org/nuke/guide/russia/cbw/jptac008_194001.html [as of September 25, 2002].)

Sarin Nerve Agent (GB)
Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects.

(Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002]Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

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FACT SHEET

Special Assistant to the Under Secretary of
Defense (Personnel and Readiness) for Gulf War Illnesses,
Medical Readiness and Military Deployments

For more information,
(703) 578-8500

Project Shipboard Hazard and Defense (SHAD)

Purple Sage

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 primary purpose of the Purple Sage test was to evaluate the effectiveness of the experimental Shipboard Toxicological Operational Protection System (STOPS) against environmental attack with a gaseous chemical warfare agent under operational situations. An additional objective was to evaluate the effect that the wearing of protective masks (MK5 or M17) for a four-hour period had on the operational efficiency of a ship's crew.

The chemical warfare test agent was methylacetoacetate, a sarin nerve agent simulant. The STOPS-equipped destroyer, USS *Herbert J. Thomas* (DD-833), was enveloped by a test agent cloud generated by release of methylacetoacetate through a turbine disseminator located on the bow of the ship.

Purple Sage tests were conducted in an operational area of the Pacific Ocean, off San Diego, California, during the period January 5 through February 3, 1966.

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Test Name	Purple Sage (Test 66-5)
Testing Organization	US Army Deseret Test Center
Test Dates	January 5 - February 3, 1966
Test Location	Testing was conducted in the Pacific Ocean, off San Diego, California.
Test Operations	To test the Shipboard Toxicological Operational Protective System (STOPS), a test agent was released through a turbine disseminator located on the bow of the ship.
Participating Services	Navy, plus Deseret personnel
Units and Ships Involved	USS *Herbert J. Thomas* (DD-833)
Dissemination Procedures	Test agent was released through a turbine disseminator.
Agents, Simulants, Tracers	Methylacetoacetate
Ancillary Testing	MK5 and M17 protective masks
Decontamination	Not identified
Potential Health Risks, Associated with Agents, Simulants, Tracers	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 methlyacetoacetate to be a hazardous material. It is not a known carcinogen. (Sources: http://hazard.com/msds/tox/f/q4/q936.html [as of January 28, 2002] and http://www.hbcollege/chem/lab/organic/gilbert3e/resources/studenttools/dl/e_mmsds.pdf

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Version 10-09-2002

Deseret Test Center

Rapid Tan I, II, III

Shortly after President Kennedy's inauguration in 1961, the Secretary of Defense, Robert McNamara, directed that a total review of the U.S. military be undertaken. The study consisted of 150 separate projects. The chemical and biological warfare review was known as Project 112. As part of the Project 112 review, the Joint Chiefs of Staff convened a working committee that recommended a research, testing, and development program for chemical and biological weapons. To oversee this program, the Deseret Test Center was established at Fort Douglas, Utah, in 1962. Both land-based and ship-based tests were conducted during the period 1962 – 1973. The Deseret Test Center closed in 1973.

Deseret Test Center Test 68-13 (Rapid Tan I, II, III) was a joint U.S., U.K., and Canadian program designed to investigate the extent and duration of hazard following a Tabun, Soman or V nerve agent attack. Phases I and III trials involving agents Tabun, Sarin, Soman and VX spray in both open grassland and wooded terrain were conducted at the Chemical Defence Establishment, Porton Down, England. Both Tabun and Soman spray and munition (Soman-filled) trials (Phase II) were conducted at the Suffield Defence Research Establishment, Ralston, Canada.

The purpose of the Rapid Tan I, II, III tests was to obtain rate-of-vapor return data for agents Tabun and Soman when sprayed on different terrain types in a summer (temperate) environment. Sarin and VX trials were also conducted to strengthen confidence in the Tabun and Soman data by allowing comparisons of data from Sarin and VX munition tests conducted in the same environment.

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The weapons systems germane to this test were explosive munitions (Soman-filled), aircraft spray, rain-type munitions (using both Tabun and Soman), and massive bombs (Tabun- and Soman-filled).

DTC Test 68-13 trials were conducted during three time periods: July – August 1967; May – June 1968; and, August – September 1968.

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Test Name	Rapid Tan I, II, III (DTC Test 68-13)
Testing Organization	US Army Deseret Test Center
Test Dates	Jul – Aug 1967; May – Jun 1968; Aug – Sep 1968
Test Location	Chemical Defence Establishment, Porton Down, England (Phases I and III) Suffield Defence Research Establishment, Ralston, Canada (Phase II)
Test Operations	To determine rate of evaporation of Tabun, Sarin, Soman, and VX as a function of contamination density, drop size, and terrain cover under a variety of meteorological conditions in a temperate environment.
Participating Services	Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	Agent was disseminated using 155mm Howitzer shells (Soman-filled) and a crop sprayer to simulate agent dissemination from aircraft, rain type munitions, and massive bomb dissemination.
Agents, Simulants, Tracers	Sarin Nerve Agent Soman Nerve Agent Tabun Nerve Agent VX Nerve Agent
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	Sarin Nerve Agent (GB) Sarin gas is a volatile and lethal nerve agent. It can enter the body by inhalation, ingestion, through the eyes, and to a lesser extent through the skin. After exposure to a sufficient dose, human symptoms may occur within minutes and include runny nose, watery

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eyes, difficulty breathing, dimness of vision, confusion, drowsiness, coma, and death. Very little information is available regarding long-term health effects following exposures to low levels that do not cause acute symptoms. No information is available regarding potential carcinogenicity. An Institute of Medicine committee concluded that there was insufficient evidence for or against an association between low-level sarin exposure and long-term health effects.

(Sources: http://www.bt.cdc.gov/Agent/Nerve/Sarin/Sarin.asp [as of February 13, 2002] Institute of Medicine (National Academies), Gulf War and Health (vol.1): Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines. National Academy Press, Washington DC, 2000.)

Soman Nerve Agent (GD)
Soman is a colorless liquid, which gives off an odor of rotting fruit when vaporizing. The vapor is colorless. Soman is a persistent agent that can easily remain in a particular area for a day or longer, depending on the atmospheric conditions. Acute health effects associated with exposure to soman include a runny nose, tightness in the chest, constriction of the pupils, difficulty in breathing, coma, and death. There is little information available regarding the long-term human health effects of exposure to soman.

(Source: http://www.sbccom.army.mil/services/edu/soman.htm Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997.)

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Tabun Nerve Agent (GA)
Tabun is an amber, non-persistent liquid, which gives off little odor when vaporizing. The vapor is colorless. When exposed to tabun, the symptoms a victim will experience include a runny nose, tightness in the chest, constriction of the pupils, difficulty breathing, and nausea. Ultimately the victim will become comatose and will suffocate as a consequence of convulsive spasms. Tabun is mainly absorbed through the skin; however, vapors can also be hazardous. If a person does not receive an immediately lethal dose, death will occur after approximately 20 minutes. Those receiving a less than lethal dose who do not receive immediate medical care may suffer permanent neurological damage. There is little information available regarding the long-term human health effects of exposure to low doses of tabun.

(Source: http://www.sbccom.army.mil/services/edu/tabun.htm Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997.

VX Nerve Agent – (Synonyms: Phosphonothioic acid, VX)
VX nerve agent is extremely lethal. It is an oily liquid that is clear, odorless, and tasteless. Death usually occurs within 10-15 minutes after absorption of a fatal dosage. VX nerve agent is one of the most toxic substances ever synthesized. Symptoms of overexposure may occur within minutes or hours, depending upon the dose. They include: constriction of pupils, headaches, runny nose, salivation, tightness in the chest, nausea, vomiting, anxiety, difficulty in thinking, muscle twitches, tremors, and weakness. With severe exposure, symptoms

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	progress to convulsions and respiratory failure. There is little information available regarding the long-term human health effects of exposure to low doses of VX. (Sources: Centers for Disease Control and Prevention http://www.bt.cdc.gov/Agent/Nerve/VX/ctc0006.asp [as of January 25, 2002]Zajtchuk R (ed.), Textbook of Military Medicine (part 1, Medical Aspects of Chemical and Biological Warfare, 1997), Office of the Army Surgeon General, Washington DC, 1997. SBCCOM Online, Edgewood Chemical Biological Center http://in1.apgea.army.mil:80/RDA/msds/vx.htm [as of April 2, 2002] World Health Organization, Department of Sustainable Development & Environmental Protection, http://209.61.192.180/phe/factsheet_5.htm [as of April 2, 2002] Department of the Army Pamphlet 40-8: Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX http://books.army.mil:80/cgi-bin/bookmgr/BOOKS/P40_8/CCONTENTS [as of February 5, 2002])

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Deseret Test Center

Red Cloud

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The main purpose of Red Cloud was to obtain biological decay rate and animal infectivity data on aerosols of *Francisella tularensis* (wet and dry forms) disseminated in a frigid field environment. Measurements of the infectivity to monkeys were made at extremely low ambient temperatures; determinations were also made for biological decay rates of *Francisella tularensis* (wet and dry), *Serratia marcesens* and *Escherichia coli.*

M143 bomblets were projected from a tower-mounted gun into a wintertime spruce forest simulating an operational drop. E26 and M32 dissemination devices were also used to disseminate aerosols for biological decay rate measurements. The liquid biologicals *Francisella tularensis*, *Serratia marcescens*, and *Escherichia coli* were released from E26 disseminators as an intermix with *Bacillus globigii.* Sampling crews were stationed in pressurized safety citadels at predetermined intervals, downwind of the agent release line to facilitate immediate assay of samples in an area free of background contamination.

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Prior to conducting Red Cloud in the Tanana Valley, the Deseret Test Center had conducted a Special Study, Alaska, which was a preliminary field effort with vegetative, nonpathogenic bacteria to prepare for future tests with pathogenic vegetative bacteria at the Alaskan site. A DTC advisory committee concurred in the proposed method of pathogen testing, subject to certain restrictions on agent dissemination. These restrictions limited the amount of agent dissemination for each field trial to preclude possible travel of agent pathogens over inhabited areas of the valley.

Testing began in late November 1966 and was completed in mid-February 1967. All of the field trials were conducted in the Tanana Valley of central Alaska, near Fort Greely.

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Test Name	Red Cloud (DTC Test 67-7)
Testing Organization	US Army Deseret Test Center
Test Dates	November 1966 – February 1967
Test Location	Tanana Valley of central Alaska, near Fort Greely
Test Operations	To obtain biological decay rates on *Francisella tularensis* (wet and dry form), *Escherichia coli*, and *Serratia marcesens* in a sub-zero overland environment.
Participating Services	US Army, Deseret Test Center personnel
Units and Ships Involved	Not identified
Dissemination Procedures	M143 bomblets were projected from a tower-mounted gun into a wintertime spruce forest simulating an operational drop. E26 and M32 dissemination devices were also used to disseminate aerosols for biological decay rate measurements.
Agents, Simulants, Tracers	*Bacillus globigii* *Serratia marcescens* *Escherichia coli* *Francisella tularensis* (wet) (TT) *Francisella tularensis* (dry) (ZZ)
Ancillary Testing	Not identified
Decontamination	Not identified
Potential Health Risks Associated with Agents, Simulants, Tracers	*Bacillus globigii (BG)* Now considered to be *Bacillus subtilis var. niger*, a close relative of *Bacillus subtilis*, this bacterial species was used as a simulant and considered harmless to healthy individuals. *Bacillus subtilis* and similar *Bacillus* species are common in the environment, and are uncommon causes of disease.

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They have been associated with acute infections of the ear, meninges (brain lining), urinary tract, lung, heart valve, bloodstream, and other body sites, but always or nearly always in individuals whose health has already been compromised. Long-term or late-developing health effects would be very unlikely (except perhaps as a complication of the acute infection).

(Sources: Tuazon CU, Other Bacillus Species (chap. 197), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2220-6; US Environmental Protection Agency, Bacillus subtilis Final Risk Assessment, February 1997, available at http://www.epa.gov as of October 4, 2002.)

Serratia marcescens (SM)
This bacterial species can cause acute infections of the urinary tract, lung, bloodstream, and other body sites. These infections commonly occur in individuals whose health has already been compromised, and often in patients who are already hospitalized. Long-term or late-developing health effects would be very unlikely.

(Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2303.)

Escherichia coli, or *E. Coli* (EC)
This bacterial species is a common inhabitant of the digestive tract but can also cause acute infection, especially when it gains access to other body sites, like the urinary tract, lung, and bloodstream. Long-

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term or late-developing health effects of *E. coli* infection would be unlikely.

(Source: Eisenstein, Barry I., Zaleznik, Dori F., Enterobacteriaceae (chap. 206), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2299-301.)

Francisella tularensis (TT and ZZ)
Formerly identified as *Pasteurella tularensis*, this bacterial species can cause acute infection of the lung, bloodstream, and other body sites (tularemia), and is considered a potential biological warfare agent. While complications of the acute infection may be serious, even life threatening, long-term or late-developing health effects would be very unlikely.

(Sources: Cross, J. Thomas Jr., Penn, Robert L., Francisella tularensis (Tularemia) (chap. 216), in Principles and Practice of Infectious Diseases, 5th edition (vol. 2), ed., Mandell GL, Bennett JE, Dolin R, Churchill Livingstone, Philadelphia, 2000, p. 2393-2402; and Dennis DT, Inglesby TV, Henderson DA, et al. Tularemia as a biological weapon; medical and public health management. JAMA 2001;285(21):2763-73.)

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