

Field Screening Equipment Information Document

Companion to Standardized Analytical Methods for
Environmental Restoration Following Homeland
Security Events (SAM) - Revision 5.0



SCIENCE

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Methods for Environmental Restoration
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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Disclaimer

Mention of trade names or commercial products in this document does not constitute endorsement or recommendation for use.

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Foreword

Following the events of September 11, 2001, EPA's mission was expanded to account for critical needs related to homeland security. Presidential Directives identified EPA as the primary federal agency responsible for the country's water supplies and for decontamination following a chemical, biological, and/or radiological (CBR) attack. To provide scientific and technical support to help EPA meet this expanded role, EPA's National Homeland Security Research Center (NHSRC) was established. The NHSRC research program is focused on conducting research and delivering products that improve the capability of the Agency to carry out its homeland security responsibilities.

One specific focus area of NHSRC's research is to support the Environmental Response Laboratory Network (ERLN), a nationwide association of federal, state, local, and commercial environmental laboratories, established by EPA. The ERLN can be deployed in response to a large-scale environmental disaster by providing consistent analytical capabilities, capacities, and quality data in a systematic, coordinated manner. Toward this end, NHSRC has worked with experts from across EPA and other federal agencies to develop a compendium of analytical methods to be used in support of remediation following national homeland security related incidents. For specific analytes that have been determined to be of concern during a homeland security related event, analytical methods have been chosen to measure levels of contamination in different environmental matrices. The results of these efforts have been published in EPA's *Standardized Analytical Methods for Environmental Restoration Following Homeland Security Events* (SAM), available at <http://www.epa.gov/sam>.

In identifying and selecting appropriate analytical methods to be used in such instances, a need became apparent to provide information regarding the capabilities of field equipment that is currently in use and could be applied for screening environmental samples and conditions prior to laboratory analysis. The information in this document addresses this need, in part, by **providing information regarding the capabilities of field screening equipment that is currently in use, for detecting chemical and radiochemical analytes listed in SAM**. Updates will be provided as new information is developed regarding field screening equipment and related capabilities.

NHSRC has made this publication available to assist in preparing for and recovering from disasters involving chemical, radiochemical, and biological contamination; it specifically represents an important next step in supporting the ERLN. We value your comments as we move toward the development of an efficient process to manage environmental samples and move EPA one step closer to achieving its homeland security mission and its overall mission of protecting human health and the environment while supporting sustainable solutions.

Gregory D. Sayles, Ph.D., Acting Director
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Table of Contents

ACKNOWLEDGEMENTS	ii
TABLE OF CONTENTS.....	IV
LIST OF TABLES	iv
ACRONYMS AND ABBREVIATIONS	v
1.0 BACKGROUND.....	1
2.0 SCOPE AND APPLICATION.....	1
3.0 EQUIPMENT	2
3.1 Field Screening Equipment for SAM Chemistry Analytes.....	2
3.2 Field Screening Equipment for SAM Radiochemistry Analytes.....	5
4.0 REFERENCES	7

List of Tables

Table 1a: Field Screening Equipment - Use in Detecting Chemistry Analytes Listed in SAM

Table 1b: Field Screening Equipment - Use in Detecting Radiochemistry Analytes Listed in SAM

Table 2a: SAM Chemistry Analytes - Detection using Field Screening Equipment

Table 2b: SAM Radiochemistry Analytes - Detection using Field Screening Equipment

Acronyms and Abbreviations

α	Alpha
β	Beta
γ	Gamma
BZ	Quinuclidinyl benzilate
°C	Degrees centigrade
CAS RN	Chemical Abstracts Service Registry Number
CDS	Civil Defense Simultest (Kit)
cfm	Cubic feet per minute
cm	Centimeter
cm ²	Square centimeter
cpm	Counts per minute
CSC	Computer Sciences Corporation
ED	Ethylchloroarsine
EPA	U.S. Environmental Protection Agency
eV	Electron volt
FID	Flame ionization detector
FPS	Flame photometric spectrometry
G-agent	Nerve agent
GA	Tabun
GB	Sarin
GD	Soman
GE	1-Methylethyl ester ethyl-phosphonofluoridic acid
GF	Cyclohexyl sarin
H-agent	Mustard/blister agent
HD	Mustard, sulfur/mustard gas
hr	Hour
HN-1	Mustard, nitrogen [bis(2-chloroethyl) ethylamine]
HN-2	Mustard, nitrogen [2,2'-dichloro-N-methyldiethylamine N,N-bis(2-chloroethyl) methylamine]
HN-3	Mustard, nitrogen [tris(2-chloroethyl) amine]
IMS	Ion mobility spectrophotometry
IR	Infrared
KeV	Kiloelectron volt
L	Liter
L-1	Lewisite 1
L-2	Lewisite 2
L-3	Lewisite 3
LCD	Liquid crystal display
LEL	Lower explosive limit
m ³	Cubic meter
MARLAP	Multi-Agency Radiological Laboratory Analytical Protocols Manual
MCA	Multi channel analyzer
µg	Microgram
µL	Microliter
µm	Micrometer
µR	Microroentgens
mg	Milligram
mR	Milliroentgens

mrem	Millirem
MeV	Megaelectron volt
min	Minute
mSv	Millisievert
mV	Millivolt
MVA	Mercury vapor analyzer
ng	Nanogram
NHSRC	National Homeland Security Research Center
nSv	Nanosievert
OSC	On-scene coordinator
PC	Personal computer
PID	Photoionization detector
ppb	Parts per billion
ppm	Parts per million
R	Roentgen
R-33	S-[2-(diethylamino)ethyl O-2 –methylpropyl ester (Russian VX)
rem	Roentgen equivalent in man
SAM	Standardized Analytical Methods for Environmental Restoration Following Homeland Security Events
SPM	Single point monitor
TEA	Triethanolamine
TIC	Toxic industrial chemical
V-agent	Nerve agent
VE	Phosphonothioic acid, ethyl-, S-(2-(diethylamino)ethyl) O-ethyl ester
VG	Phosphonothioic acid, S-(2-(diethylamino)ethyl) O,O-diethyl ester
VM	Phosphonothioic acid, methyl-, S-(2-(diethylamino)ethyl) O-ethyl ester
VOC	Volatile organic compound
VX	O-ethyl-S-(2-diisopropylaminoethyl) methyl phosphonothiolate
Z	Density value of composite composition

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*[Companion to Standardized Analytical Methods for Environmental Restoration
Following Homeland Security Events (SAM)]*

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1.0 Background

The U.S. Environmental Protection Agency (EPA) National Homeland Security Research Center (NHSRC) worked with experts from across EPA and its sister agencies since 2003 to develop a compendium of analytical methods to be used when responding to national homeland security related incidents. Analytical methods have been selected for chemical, radiochemical, pathogen, and biotoxin analytes of concern for the types of environmental sample matrices that are anticipated in such incidents. The results of these efforts have been published in several revisions of EPA's *Standard Analytical Methods for Environmental Restoration Following Homeland Security Events* (SAM), available at <http://www.epa.gov/sam>. NHSRC periodically reviews and updates the SAM document to address the needs of homeland security, reflect improvements in analytical methods and new technologies, and incorporate changes in target analytes.

During development of SAM, EPA recognized the need for a companion document to identify the capabilities of field equipment currently in use or being considered by EPA, to screen sites for the presence of the SAM analytes. This document is intended to address this need, in part, by providing information regarding the capabilities of field equipment currently being used or considered by EPA on-scene coordinators (OSC), for detecting chemical and radiochemical analytes listed in SAM. The document corresponds to Revision 5.0 of SAM and EPA's OSC equipment list as of September 1, 2009. As with SAM, NHSRC plans to update the information in this document periodically, to reflect changes to the analytes listed in SAM or to the equipment being used or considered by EPA OSCs.

2.0 Scope and Application

This document is intended to provide a general overview of information regarding field screening equipment that is currently in use by EPA, in terms of equipment capabilities for addressing the target chemical and radionuclide analytes and the environmental matrices included in SAM. The information in this document is intended for use by decision makers in preparing for and developing field screening site assessment activities. Detailed procedure(s) and/or instruction(s) regarding the use of specific equipment, as well as information regarding the relative toxicity, health risks, and environmental risks of the analytes, are outside the scope of this document. Users should refer to the appropriate instrument manufacturer, SAM, and/or other references listed in Section 4.0 and Tables 1a and 1b for further information on these topics.

NOTE: Information regarding the equipment listed in this document is provided in terms of equipment capabilities to address the analytes and sample types listed in SAM. Assumptions regarding whether analytes are of concern (i.e., will persist) in a particular sample type are based on how the analytes are listed in SAM. Analytes that are listed in this document as not a concern in a particular sample type reflect SAM workgroup decisions regarding analyte persistence.

There are four tables provided in this document. Information is compiled into two tables for each of two analyte categories (chemical and radiochemical) with emphasis on equipment capabilities (Tables 1a and 1b) and with emphasis on the analytes of concern (Tables 2a and 2b):

Tables 1a and 1b: Provide information regarding the screening equipment that can be used to indicate the presence/absence of chemical (Table 1a) and radiochemical (Table 1b) analytes listed in SAM. The information is sorted first by field screening equipment, followed by: (1) SAM analytes that can be detected by the equipment, (2) Chemical Abstracts Service Registry Number (CAS RN) of the analytes, and (3) environmental media that can be screened by the equipment for detection of the analytes.

Table 1a: Field Screening Equipment - Use in Detecting Chemistry Analytes Listed in SAM

Table 1b: Field Screening Equipment - Use in Detecting Radiochemistry Analytes Listed in SAM

Tables 2a and 2b: Provide information similar to the information provided in Tables 1a and 1b, but sort the information by SAM analyte, followed by (1) analyte CAS RNs, (2) field screening equipment that can be used to provide an indication of the presence/absence of the analyte, and (3) the type of environmental media that can be screened by the equipment.

Table 2a: SAM Chemistry Analytes - Detection using Field Screening Equipment

Table 2b: SAM Radiochemistry Analytes - Detection using Field Screening Equipment

3.0 Equipment

The information provided in this document corresponds to field screening equipment currently in use or being considered by EPA OSCs. This equipment is listed below, along with brief descriptions. Additional equipment information is provided in Tables 1a, 1b, 2a, and 2b. Where available, equipment performance information is provided throughout this document; this information, however, may not reflect specific project or site conditions. Prior to use, each piece of screening equipment should be evaluated for its ability to address site- or incident-specific goals.

NOTE: Analyte presence/absence determinations are highly dependent on equipment detection capabilities for the specific target analyte(s) or analyte class. Where available, equipment detection levels or ranges are included in Tables 1a and 1b. Site- or project-specific detection levels and plans will be needed to support site- or project-specific decision making, and will depend on the intended use of the field equipment.

3.1 Field Screening Equipment for SAM Chemistry Analytes

- **AP2C Chemical Agent Monitor** (Page 1a-1) – Portable, hand-held instrument that uses flame photometric spectrometry (FPS) to identify specific classes of nerve or mustard agent vapor in air. Responds to nerve and mustard agent vapors, including GA, GB, GD, GF, VX, and HD, through a series of lighted bars, with minimum detection limits of approximately 0.2 milligrams per cubic meter (mg/m³) for G-agents and 0.9 mg/m³ for H-agents.

- AP4C Chemical Agent Monitor (Page 1a-2) – Portable, hand-held instrument used to detect chemical agents in the form of vapor, aerosols, and dust. Responds to nerve, blister, and blood agent vapors, including GA, GB, GD, GF, lewisite, VX, and HD. The AP4C has extended capacity (compared to AP2C) to detect chemical warfare agents and toxic inorganic compounds in a simultaneous mode. There is no limitation in number of gases detected simultaneously by the AP4C. Detection time is within two seconds.
- APD2000® Chemical Agent Monitor (Page 1a-3) – Portable, hand-held instrument that uses ion mobility spectrometry (IMS) to identify the specific class of nerve agent or blister agent in air. Responds to nerve and blister agent vapors (GA, GB, GD, VX, HD, HN, and lewisite) through a relative number between 1 and 100, with minimum detection limits of approximately 0.025 mg/m³ for G-agents and 0.2 mg/m³ for H-agents.
- Draeger Civil Defense Simultest (CDS) Kit with Detection Tube Kits I and V (Page 1a-4) – Provides rapid identification of chemical agents using chemical reagents in calibrated detector tube sets. The Draeger CDS Kit includes both CDS Detection Tube Kits I and V, which are each designed to detect up to five separate chemical agents simultaneously in five minutes. Using both kits, a total of eight different chemical agents can be detected, with each detector tube having a sensitivity specific to one chemical. Compounds and minimum detection levels include the following: hydrocyanic acid (at 1 parts per million [ppm]); phosgene (at 0.2 ppm); lewisite (as organic arsenic compounds at 3 mg/m³ and as arsine at 0.1 ppm); N-mustard (as organic based nitrogen compounds at 1 mg/m³); S-mustard (as thioether at 1 mg/m³); nerve agents (as phosphoric acid esters at 0.025 ppm); cyanogen chloride (at 0.25 ppm); and chlorine (at 0.2 ppm). For additional detection capabilities, refer to full vendor listing of compatible detection tubes (i.e., Kits II, III, IV, etc.).
- Draeger MultiWarn (Page 1a-5) – Portable, hand-held, microprocessor-controlled instrument designed for monitoring up to four atmospheric gas hazards simultaneously. Combines electrochemical, catalytic oxidation, and infrared (IR) sensing technology to monitor for two different toxic gases (over 25 different toxic gas sensors are available), combustible gases (0 – 100% of lower explosive limit [LEL]), and oxygen levels (0 – 25%), using a membrane pump with a flow of 0.6 liters/minute that can draw gases from distances greater than 100 feet. Currently available toxic sensors include ammonia (0 – 300 ppm), nitric oxide (0 – 100 ppm), phosphine (0 – 10 ppm), hydrogen cyanide (0 – 50 ppm), chlorine (0 – 20 ppm), and nitric oxide (0 – 50 ppm).
- Draeger MultiWarn II (Page 1a-5) – Portable, hand-held, microprocessor-controlled instrument similar to Draeger MultiWarn with additional capabilities, including: (1) remote sampling pump is standard equipment and (2) optional internal datalogger.
- Draeger Polytron 7000 Series Detectors (Page 1a-6) – Single platform gas detector for toxic and oxygen gas measurement applications that can detect over 100 different gases. Modular design allows upgrading to higher specifications levels. Communication interfaces can be selected for different central control systems and software options. This instrument also can be equipped with a relay module.
- HazCat Chemical Identification System (Page 1a-7) – Chemical identification system used to identify hazardous characteristics (corrosive, water reactive, toxic, oxidizer, sulfide, flammable, and/or organic halide) and other properties of unknown materials. By

using simple field chemistry tests and following the HazCat charts, an unknown material can be segregated by hazard class and possibly identified. The HazCat kit uses gas detection tubes and is designed for rapid, on-site identification or categorization of many spilled or abandoned materials. Three HazCat kits are available: (1) KT1209, which is a basic kit without pump or detection tubes; (2) KT1206, which includes Draeger pump and detection tubes, and (3) KT1204, which includes Gastec pump and detection tubes. Kits KT1206 and KT1204 include ammonia, hydrogen cyanide, and phenol gas detection tubes. For additional detection capabilities, refer to full vendor listing of compatible detection tubes.

- Jerome® 431/431 Mercury Vapor Analyzer (MVA) (Page 1a-8) – Portable, hand-held, microprocessor-controlled instrument using gold film technology to monitor for mercury vapor in air at levels from 0.003 to 0.999 mg/m³.
- M256A1 Chemical Agent Detector Kit (Page 1a-9) – Chemical agent detector kit that can detect chemical agents in vapor form, including nerve agents (G and V), blood agents, blister agents (H, HD, and CX), and lewisite. The kit gives qualitative results only, with detection limits ranging from µg/m³ levels for nerve agents to mg/m³ levels for blister and blood agents.
- M8 Paper (VGH ABC-M8 Chemical Agent Detector Paper) (Page 1a-10) – Detects nerve agents (G and V) and blister agents (H) in liquid form only. M8 paper is similar to litmus (i.e., pH) paper; the difference is that M8 paper is designed specifically to react to nerve agents and blister agents in liquid form. The paper gives qualitative results only; detection limits are unspecified.
- M9 Chemical Agent Detector Paper (Page 1a-11) – Reacts more rapidly than M8 paper and detects nerve agents (G and V) and blister agents (H) in liquid form only. Use with 100 microliter [µL] droplets of liquid, or larger; will not respond to chemical agents when wet. Chemical agent vapors also are not detected. The paper gives qualitative results only; detection limits are unspecified.
- MDA Scientific Single Point Monitor (SPM) (Page 1a-12) – Used for long-term monitoring of airborne concentrations of a known organic or inorganic gas for up to 30 days per Chemcassette® tape. Chemcassettes® use a dry reagent impregnated into a paper tape to collect and analyze air samples; when exposed to a target gas, a chemical reaction occurs resulting in a color change in direct proportion to the concentration of gas present. The instrument monitors the color intensity change and determines the gas concentration by comparison to a known, pre-programmed gas response. Detects a wide variety of compounds, with detection limits (generally in the parts per billion [ppb] range) and sample times depending on the compound. Available tapes include aliphatic amines, ammonia, diisocyanates, hydrides, hydrogen cyanide, hydrogen sulfide, chlorine dioxide, phosgene, hydrogen fluoride, sulfuric acid, and phosphine.
- MIE DataRAM™ (Page 1a-12) – Portable, hand-held, microprocessor-controlled instrument that measures the concentration of airborne particulate matter (aerosolized liquid or solid), as well as mean particle size. With appropriate particle discriminators, it provides measurements correlated with 10, 2.5, and 1.0 µm (PM₁₀, PM_{2.5}, PM_{1.0}), and respirable fractions, air temperature, and humidity. Covers a measurement range of 0.001 – 400 mg/m³. Uses a high-sensitivity nephelometric monitor with a light-scattering

sensing configuration optimized to measure airborne dust, smoke, fumes, and mist in industrial and ambient environments.

- MultiRAE Plus Multigas Monitor and Photoionization Detector (PID) (Page 1a-13) – Portable, hand-held, multi-gas monitor for continuous monitoring of toxic gases, oxygen, and combustible gases. Monitors organic vapors with a built-in PID (10.6 eV lamp standard), combustible gases/LEL with a catalytic bead sensor, oxygen concentration with an electrochemical sensor, and inorganic toxic compounds with up to two electrochemical sensors (numerous sensors are available). Examples of detection levels and currently installed sensors include the following: oxygen (0 – 30%); combustible gas (0 – 100% LEL); carbon monoxide (0 – 500 ppm); and hydrogen sulfide (0 – 100 ppm). In PID mode, the MultiRAE does not distinguish one type of chemical from another, but indicates the total concentration of all photoionizable compounds in the range of 0 to 2,000 ppm.
- RA-915+ MVA (Page 1a-14) – Portable, hand-held, atomic absorption spectrometer that can monitor for mercury vapor in air at levels from 2 nanograms per cubic meter (ng/m³) to 50 micrograms per cubic meter (µg/m³).
- TVA1000B Combined PID/Flame Ionization Detector (FID) Detector (Page 1a-15) – Portable, hand-held vapor analyzer that uses both a FID and PID. This instrument can detect total organic and some inorganic vapors in air down to ppm levels, but does not differentiate between compounds.

3.2 Field Screening Equipment for SAM Radiochemistry Analytes

- Ludlum Radiological Survey Meters – Ludlum rate meters with accompanying probes measure alpha, beta, and gamma radiation. The following Ludlum meters are included in this document:
 - *Ludlum Model 192 MicroR Radiation Meter* (Page 1b-1) – Used as a low-level gamma radiation surveying instrument. The detector used in the instrument is an internal 2-inch by 1-inch sodium-iodide scintillation counter. The detection range is 0 to 5,000 microroentgens per hour (µR/hr).
 - *Ludlum Model 2241-3 Survey Meter with Model 44-9, 43-90 or 44-2 Probe* (Page 1b-2) – The Model 2241-3 is a scaler/rate meter that can use different probes: the Model 44-9 probe detects alpha/beta/gamma contamination; the Model 43-90 probe is used for measuring alpha contamination; and the 44-2 probe is used to determine the presence of gamma-emitting contamination. The Model 2241-3 also has a scaler function to count radioactive disintegrations for a pre-selected time.
 - *Ludlum Model 15 Survey Meter* (Page 1b-2) – Used as a neutron counter by attaching the neutron probe beneath the instrument in a shielded chamber. The survey meter measures radiation in counts per minute (cpm) and has an effective operating range of 0 to 500,000 cpm. It is used predominantly as a neutron detection device; however, the auxiliary external Model 44-7 Geiger-Mueller probe will measure beta and gamma radiation.
 - *Ludlum Model 3030 Alpha/Beta Counter* (Page 1b-3) – Dual-channel counter for simultaneous alpha and beta radiation measurement of samples up to 2 inches in diameter and 0.4 inches thick. This instrument is primarily used for determining removable levels of radioactive contamination on wipes and airborne concentrations

collected on filters. The user-defined count times enable detection ranges from 0 to 999,999 cpm, with user-defined alarm levels.

- RADeCo Model H810AC High Volume Air (Page 1b-4) – Used for air sample collection coupled to the Ludlum Model 3030 alpha/beta counter. Typical maximum flow rates vary from 2.7 cubic feet per minute (cfm) to 11.8 cfm, depending on the cartridge and filter combination. Microprocessor-based unit does not use rotameter or mechanical time meter, increasing accuracy.
- Thermo-Eberline RO20E Ion Chamber (Page 1b-3) – Provides real-time monitoring of beta, gamma, and x-ray radiation with a portable ion chamber, which is vented to atmospheric pressure and specifically designed to have flat energy response into the x-ray region. The detector is compensated over the operational temperature range for output accuracy within 10%. The range of operation is 1 millirem per hour (mrem/hr) to 50 roentgen equivalent in man (rems) per hour. These instruments are usually used as a secondary survey device if high radiation fields have been indicated by a more sensitive survey instrument such as the Ludlum Model 192 MicroR Radiation Meter.
- Berkeley Nucleonics SAM 940™ Gamma Spectrometer (Page 1b-5) – Portable gamma and neutron radiation detector that identifies multiple radionuclides simultaneously. Identifies the radionuclide, category of the radionuclide (medical, industrial, or Special Nuclear Material), and calculates the isotope-specific dose rates, all within one second. Contains a 2-inch by 2-inch external sodium-iodide detector for greater sensitivity.
- Ludlum Model 239-1F Floor Monitor with 2350-1 Data Logger, 43-37-582 Gas Proportional Detector Coupled to Ludlum 2380-1 Data Logger (Page 1b-6) – Used for surface sample collection and detection of alpha, beta, and gamma emitters. Monitors floor contamination using a gas proportional detector (recommended gas P-10 [10% methane, 90% argon]). Flow meter is adjustable from 0 to 100 cubic centimeters per minute (cc/min) and has a threshold of 2 to 4 millivolts (mVs). Typical efficiencies are ~17% (alpha), ~ 25% (beta), and ~ <1% (gamma).
- Gamma Tracer and Base Station (Page 1b-7) – Uses Geiger-Müller tubes for detection of gamma emitters and integrates and stores up to 12,800 data points as time correlated dose rates (time cycles are user selectable). Provides real-time monitoring from either single or multiple units. Data from each unit can be downloaded into a local network using an embedded device serving as an IR transceiver.

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The following resources were used to prepare this document. Additional equipment vendor and manufacturer sources used for commercial product information are provided in Tables 1a and 1b.

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Table 1a: Field Screening Equipment - Use in Detecting Chemistry Analytes Listed in SAM

• Equipment detection levels, ranges, and units are cited as provided by the manufacturer and/or reference cited.

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
AP2C Chemical Agent Monitor Proengin Inc. 140 South University Drive, Suite F Plantation, FL 33324 http://www.proengin.com 1) Kovacs, T: 2006. "Developed Physical Detection-Possibilities of Chemical Agents." <i>Acta Polytechnica Hungarica</i> , 3(2): 133–141. <u>Matrix:</u> Air <u>Analytes:</u> 5 – 10 ppm (as G- and V-agents) 2) Fatah, A.A., Barrett, J.A., Arcilesi, R.D., Ewing, K.J., Lattin, C.H., and Helinski, M.S. June 2000. "Guide for the Selection of Chemical Agent and Toxic Industrial Material Detection Equipment for Emergency First Responders, v II." U.S. Department of Justice, National Institute of Justice. Washington, D.C. <u>Matrix:</u> Air <u>Analytes:</u> GA (13.3 µg/m ³ , 0.002 ppm); GB (11.5 µg/m ³ , 0.002 ppm); GD (7.45 µg/m ³ , 0.001 ppm); VX (656 µg/m ³ , 0.06 ppm); HD (6.51 µg/m ³ , 0.001 ppm) <u>Other:</u> Sulfur- and phosphorus-containing compounds may act as interferents 3) Rostker, B. Gulfink. July 1998. "Case Narrative Czech and French Reports of Possible Chemical Agent Detections, Tab D, Czech and French Detection Equipment." Gulfink, Department of Defense, Force Health Protection and Readiness, Department of Defense. <u>Matrix:</u> Air <u>Analytes:</u> GA (100 µg/m ³); GB (100 µg/m ³); GD (100 µg/m ³); GF (100 µg/m ³); HD (400 µg/m ³); VX (150 µg/m ³) 4) Longworth, T.L. and Ong, K.Y. May 2001. "Domestic Preparedness Program: Testing of Detectors Against Chemical Warfare Agents – Summary Report, UC AP2C Portable Chemical Contamination Control Monitor Collective Unit." Soldier and Biological Chemical Command, AMSSB-RRT, Aberdeen Proving Ground, MD. <u>Matrix:</u> Air <u>Analytes:</u> GA (30 µg/m ³ , 0.004 ppm); GB (20.0 µg/m ³ , 0.003 ppm); HD (930 µg/m ³ , 0.142 ppm)	Cyclohexyl sarin (GF)	329-99-7	Air
	1-Methylethyl ester ethylphosphonofluoridic acid (GE)	1189-87-3	Air
	Mustard, sulfur / Mustard gas (HD)	505-60-2	Air
	R-33 (VR) [methylphosphonothioic acid, S-[2-(diethylamino)ethyl O-2-methylpropyl ester]	159939-87-4	Air
	Sarin (GB)	107-44-8	Air
	Soman (GD)	96-64-0	Air
	Tabun (GA)	77-81-6	Air
	VE [phosphonothioic acid, ethyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21738-25-0	Air
	VG [phosphonothioic acid, S-(2-(diethylamino)ethyl) O,O-diethyl ester]	78-53-5	Air
	VM [phosphonothioic acid, methyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21770-86-5	Air
	VX [O-ethyl-S-(2-diisopropylaminoethyl)methyl-phosphonothiolate]	50782-69-9	Air

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
AP4C Chemical Agent Monitor Proengin Inc. 140 South University Drive, Suite F Plantation, FL 33324 http://www.proengin.com 1) U.S. EPA. <i>Technology Performance Summary: Proengin AP4C Handheld Detector for Toxic Industrial Chemicals.</i> Matrix: Air Analytes: Arsine (≤ 1 mg/m ³ , 0.3 ppm); hydrogen cyanide (≤ 18.7 mg/m ³ , 17 ppm); cyanogen chloride (≤ 1 mg/m ³ , 0.4 ppm); hydrogen sulfide (≤ 57.4 mg/m ³ , 41 ppm)	Ammonia	7664-41-7	Air
	Arsine	7784-42-1	Air
	BZ (Quinuclidinyl benzilate)	6581-06-2	Air
	Carbon disulfide	75-15-0	Air
	Cyanogen chloride	506-77-4	Air
	Cyclohexyl sarin (GF)	329-99-7	Air
	Hydrogen cyanide	74-90-8	Air
	Hydrogen sulfide	7783-06-4	Air
	1-Methylethyl ester ethylphosphonofluoridic acid (GE)	1189-87-3	Air
	Mustard, sulfur / Mustard gas (HD)	505-60-2	Air
	Phosphorus trichloride	7719-12-2	Air
	R-33 (VR) [methylphosphonothioic acid, S-[2-(diethylamino)ethyl O-2-methylpropyl ester]	159939-87-4	Air
	Sarin (GB)	107-44-8	Air
	Soman (GD)	96-64-0	Air
	Sulfur dioxide	7446-09-5	Air
	Tabun (GA)	77-81-6	Air
	VE [phosphonothioic acid, ethyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21738-25-0	Air
	VG [phosphonothioic acid, S-(2-(diethylamino)ethyl) O,O-diethyl ester]	78-53-5	Air
	VM [phosphonothioic acid, methyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21770-86-5	Air
	VX [O-ethyl-S-(2-diisopropylaminoethyl)methyl-phosphonothiolate]	50782-69-9	Air

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
APD 2000® Chemical Agent Monitor Smiths Detection 1601 North Kent Street #200 Arlington, VA 22209 http://www.smithsdetection.com 1) U.S. EPA. August 2009. <i>Technology Performance Summary: Smiths Detection APD 2000® Handheld Detector for Chemical Warfare Agents</i> . <u>Matrix:</u> Air <u>Analytes:</u> GB (>0.015 ppm); HD (<0.09 ppm) 2) Ong, K.Y., Longworth, T.L., and Barnhouse, J.L. August 2000. "Domestic Preparedness Program: Testing of APD2000 Chemical Warfare Agent Detector Against Chemical Warfare Agents Summary Report." Soldier and Biological Chemical Command, AMSSB-RRT, Aberdeen Proving Ground, MD <u>Matrix:</u> Air <u>Analytes:</u> HD (220 µg/m ³ , 0.033 ppm); GA (27.0 µg/m ³ , 0.004 ppm); GB (21.0 – 37.0 µg/m ³ , 0.004 – 0.006 ppm)	Lewisite 1 (L-1) [2-chlorovinylchloroarsine] (analyze for total arsenic)	541-25-3	Air
	Lewisite 2 (L-2) [bis(2-chlorovinyl)-chloroarsine] (analyze for total arsenic)	40334-69-8	Air
	Lewisite 3 (L-3) [tris(2-chlorovinyl)-arsine] (analyze for total arsenic)	40334-70-1	Air
	Mustard, sulfur / Mustard gas (HD)	505-60-2	Air
	Sarin (GB)	107-44-8	Air
	Soman (GD)	96-64-0	Air
	Tabun (GA)	77-81-6	Air
	VX [O-ethyl-S-(2-diisopropylaminoethyl)methylphosphonothiolate]	50782-69-9	Air
	Ammonia	7664-41-7	Air
	Arsine	7784-42-1	Air
Draeger Civil Defense Simutest (CDS) Kit with Detection Tube Kits I and V Draeger Safety Inc. 101 Technology Drive Pittsburg, PA 15275-1057 http://www.draeger.com 1) Civil Defense Kit Illustrated Accessory Guide http://www.skcgulfcoast.com/draeger/Draeger_CDS_Kit_Accessory_Guide.pdf (accessed August 26, 2009) <u>Other:</u> Complete CDS Kit includes 5 sets of tubes from Kit I and Kit V. Kits I and V can be used to replenish CDS kit. For additional detection capabilities, refer to full vendor listing of compatible detection tubes (i.e., Kits II, III, IV, etc.). 2) Civil Defense Simultest Kit http://www.afcintl.com/pdf/CDSKit.pdf (accessed August 26, 2009) <u>Matrix:</u> Air <u>Analytes:</u> Chlorine (0.2 – 30 ppm); cyanogen chloride (0.25 – 30 ppm); HD (1 mg/m ³ as thioethers) hydrogen cyanide (2 – 150 ppm); lewisite (3 mg/m ³ as arsenic); nitrogen mustards (1 mg/m ³ as basic nitrogen compounds); phosgene (0.25 – 15 ppm); G- and V-agents (0.05 ppm of phosphoric acid esters)	Chlorine	7782-50-5	Air
	Chloropicrin	76-06-2	Air
	Cyanogen chloride	506-77-4	Air
	Dichlorvos	62-73-7	Air
	Hydrogen cyanide	74-90-8	Air
	Hydrogen sulfide	7783-06-4	Air
	Lewisite 1 (L-1) [2-chlorovinylchloroarsine] (analyze for total arsenic)	541-25-3	Air
	Lewisite 2 (L-2) [bis(2-chlorovinyl)-chloroarsine] (analyze for total arsenic)	40334-69-8	Air
	Lewisite 3 (L-3) [tris(2-chlorovinyl)-arsine] (analyze for total arsenic)	40334-70-1	Air
	1-Methylethyl ester ethylphosphonofluoridic acid (GE)	1189-87-3	Air
	Mustard, nitrogen (HN-1) [bis(2-chloroethyl)ethylamine]	538-07-8	Air
	Mustard, nitrogen (HN-2) [2,2'-dichloro-N-methyldiethylamine N,N-bis(2-chloroethyl)methylamine]	51-75-2	Air

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
Draeger Civil Defense Simutest (CDS) Kit with Detection Tube Kits I and V (cont.) 3) Arnold, F. October 2006. "Measuring New Fumigants with Dräger-Tubes®." Ninth International Working Conference on Stored Product Protection, New Chemicals and Food Residues. Sao Paulo, Brazil. <u>Matrix:</u> Air <u>Analytes:</u> Chloropicrin (0.1 – 2 ppm); phosphine (0.01 – 1 and 0.1 – 4 ppm) 4) Department of Homeland Security. January 2007. "Guide for the Selection of Chemical Detection Equipment for Emergency First Responders," 3rd Ed. p. C-7. Department of Homeland Security. Washington, D.C. <u>Matrix:</u> Air <u>Analytes:</u> Arsine (0.1 ppm); chlorine (0.2 ppm); cyanogen chloride (0.25 ppmv); HD (1 mg/m3); hydrogen cyanide (1 ppm); lewisite (3 mg/m3); nitrogen mustard (1 mg/m3); phosgene (0.2 ppm); G- and V-agents (0.025 ppm as dichlorovos)	Mustard, nitrogen (HN-3) [tris(2-chloroethyl)amine]	555-77-1	Air
	Mustard, sulfur / Mustard gas (HD)	505-60-2	Air
	Phosgene	75-44-5	Air
	Phosphine	7803-51-2	Air
	R-33 (VR) [methylphosphonothioic acid, S-[2-(diethylamino)ethyl O-2-methylpropyl ester]	159939-87-4	Air
	Sarin (GB)	107-44-8	Air
	Soman (GD)	96-64-0	Air
	Sulfur dioxide	7446-09-5	Air
	Tabun (GA)	77-81-6	Air
	VE [phosphonothioic acid, ethyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21738-25-0	Air
	VG [phosphonothioic acid, S-(2-(diethylamino)ethyl) O,O-diethyl ester]	78-53-5	Air
	VM [phosphonothioic acid, methyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21770-86-5	Air
	VX [O-ethyl-S-(2-diisopropylaminoethyl)methyl-phosphonothiolate]	50782-69-9	Air
	Ammonia	7664-41-7	Air
	Arsine	7784-42-1	Air
Draeger MultiWarn Draeger Safety Inc. 101 Technology Drive Pittsburg, PA 15275-1057 http://www.draeger.com 1) Fatah, A.A., Barrett, J.A., Arcilesi, R.D., Ewing, K.J., Lattin, C.H., and Helinski, M.S. June 2000. "Guide for the Selection of Chemical Agent and Toxic Industrial Material Detection Equipment for Emergency First Responders, v II." U.S. Department of Justice, National Institute of Justice. Washington, D.C. <u>Matrix:</u> Air <u>Analytes:</u> Ammonia (0 – 300 ppm), arsine (0 – 10 ppm), chlorine (0 – 20 ppm), fluorine (0 – 20 ppm), hydrogen cyanide (0 – 50 ppm), hydrogen sulfide (0 – 100 ppm), methylamine (0 – 100 ppm), phosgene (0 – 3 ppm), sulfur dioxide (0 – 2000 ppm), phosphine (0 – 10 ppm), ethylene oxide (0 – 200 ppm), formaldehyde (0 – 200 ppm)	Chlorine	7782-50-5	Air
	Ethylene oxide	75-21-8	Air
	Formaldehyde	50-00-0	Air
	Hydrogen cyanide	74-90-8	Air
	Hydrogen sulfide	7783-06-4	Air
	Methylamine	74-89-5	Air
	Phosgene	75-44-5	Air
	Phosphine	7803-51-2	Air

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
Draeger MultiWarn II Draeger Safety Inc. 101 Technology Drive Pittsburg, PA 15275-1057 http://www.draeger.com 1) Draeger MultiWarn II Brochure http://www.skcgulfcoast.com/drager/Draeger_Multiwarn_Brochure.pdf (accessed August 25, 2009) <u>Matrix:</u> Air <u>Analytes:</u> Acrylonitrile (0 – 200 ppm); ammonia (0 – 300 ppm); arsine (0 – 10 ppm); chlorine (0 – 20 ppm); ethylene oxide (0 – 200 ppm); formaldehyde (0 – 200 ppm); hydrogen cyanide (0 – 50 ppm); hydrogen sulfide (0 – 1000 ppm); methylamine (0 – 100 ppm); phosphine (0 – 1000 ppm); propylene oxide (0 – 200 ppm); sulfur dioxide (0 – 50 ppm)	Acrylonitrile	107-13-1	Air
	Ammonia	7664-41-7	Air
	Arsine	7784-42-1	Air
	Chlorine	7782-50-5	Air
	Ethylene oxide	75-21-8	Air
	Formaldehyde	50-00-0	Air
	Hydrogen cyanide	74-90-8	Air
	Hydrogen sulfide	7783-06-4	Air
	Methylamine	74-89-5	Air
	Phosphine	7803-51-2	Air
	Propylene oxide	75-56-9	Air
	Sulfur dioxide	7446-09-5	Air
Draeger Polytron 7000 Series Detectors Draeger Safety Inc. 101 Technology Drive Pittsburg, PA 15275-1057 http://www.draeger.com 1) Drager 2008 List of Detectable Gases and Vapors http://www.draeger.com/media/10/01/10/10011004/gas_list_br_9046375_en.pdf (accessed August 25, 2009) <u>Matrix:</u> Air <u>Analytes:</u> Acrylonitrile (20 – 100 ppm); allyl alcohol (20 – 200 ppm); ammonia (50 – 1000 ppm); arsine (0.3 – 20 ppm); boron trifluoride (3 – 30 ppm); chlorine (1 – 50 ppm); 2-chloroethanol (30 – 100 ppm); 1,2 dichloroethane (30 ppm); ethylene oxide (20 – 200 ppm); hydrogen bromide (3 – 100 ppm); hydrogen chloride (3 – 100 ppm); hydrogen cyanide (10 – 50 ppm); hydrogen fluoride (3 – 30 ppm); hydrogen sulfide (10 – 1000 ppm); methyl hydrazine (1 – 3 ppm); methylamine (100 ppm); phosgene (0.1 – 1 ppm); phosphine (0.3 – 20 ppm); phosphorus trichloride (3 – 30 ppm); propylene oxide (20 – 200 ppm); sulfur dioxide (5 – 100 ppm); sulfur trioxide (30 ppm); TEA (100 ppm)	Acrylonitrile	107-13-1	Air
	Allyl alcohol	107-18-6	Air
	Ammonia	7664-41-7	Air
	Arsine	7784-42-1	Air
	Boron trifluoride	7637-07-2	Air
	Chlorine	7782-50-5	Air
	2-Chloroethanol	107-07-3	Air
	1,2 Dichloroethane	107-06-2	Air
	Ethylene oxide	75-21-8	Air
	Hydrogen bromide	10035-10-6	Air
	Hydrogen chloride	7647-01-0	Air
	Hydrogen cyanide	74-90-8	Air
	Hydrogen fluoride	7664-39-3	Air
	Hydrogen sulfide	7783-06-4	Air
	Methyl hydrazine	60-34-4	Air
	Methylamine	74-89-5	Air
	Phosgene	75-44-5	Air
	Phosphine	7803-51-2	Air
	Phosphorus trichloride	7719-12-2	Air
	Propylene oxide	75-56-9	Air
	Sulfur dioxide	7446-09-5	Air
	Sulfur trioxide	7446-11-9	Air
	Triethanolamine (TEA) (degradation product of HN-3)	102-71-6	Air

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
Draeger Warning Stations/Unit Sensor Bias Station	TBD	TBD	TBD
HazCat Chemical Identification System Haztech Systems™, Inc. P.O. Box 929 3919 Bootjack Lane Mariposa, CA 95338 http://www.hazcat.com/ 1) Hazcat Industrial Chemical Identification Systems™ User Guide http://www.hazcat.com/ (accessed August 25, 2009) <u>Matrix:</u> Air <u>Analytes:</u> Kits KT1204 and KT1206 come with ammonia, hydrogen cyanide, and phenol gas detection tubes (many other tubes available) <u>Other:</u> Three kits: 1) KT1209 basic kit without pump or detection tubes, 2) KT1206 with Draeger pump and detection tubes, and 3) KT1204 with Gastec pump and detection tubes 2) Department of Homeland Security. January 2007. "Guide for the Selection of Chemical Detection Equipment for Emergency First Responders," 3rd Ed. p. C-11. Department of Homeland Security. Washington, D.C. <u>Analytes:</u> GA (<0.5 ppm); GB (<0.13); HD (<40 mg); HN (<40 mg); VX (0.25 ppm)	Ammonia	7664-41-7	Air
	Ethylidichloroarsine (ED)	598-14-1	Water
			Air
			Solid
	Hydrogen cyanide	74-90-8	Air
	Lewisite 1 (L-1)	541-25-3	Water
	[2-chlorovinylidichloroarsine] (analyze for total arsenic)		Air
			Solid
	Lewisite 2 (L-2) [bis(2-chlorovinyl)-chloroarsine] (analyze for total arsenic)	40334-69-8	Water
			Air
			Solid
	Lewisite 3 (L-3) [tris(2-chlorovinyl)-arsine] (analyze for total arsenic)	40334-70-1	Water
			Air
			Solid
	Mustard, nitrogen (HN-1) [bis(2-chloroethyl)ethylamine]	538-07-8	Water
			Air
			Solid
	Mustard, nitrogen (HN-2) [2,2'-dichloro-N-methyldiethylamine N,N-bis(2-chloroethyl)methylamine]	51-75-2	Water
			Air
			Solid
	Mustard, nitrogen (HN-3) [tris(2-chloroethyl)amine]	555-77-1	Water
			Air
			Solid
	Mustard, sulfur / Mustard gas (HD)	505-60-2	Water
			Air
			Solid
	Phenol	108-95-2	Air
	Sarin (GB)	107-44-8	Water
			Air
			Solid
	Tabun (GA)	77-81-6	Water
			Air
			Solid
	VX [O-ethyl-S-(2-diisopropylaminoethyl)methylphosphonothiolate]	50782-69-9	Water
			Air
			Solid

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
Jerome® 411/431 Mercury Vapor Analyzer (MVA) Arizona Instrument 3375 North Delaware Street Chandler, AZ 85225 www.azic.com 1) University of British Columbia, School of Environmental Health Laboratory. Equipment. <u>Matrix:</u> Air <u>Analytes:</u> Hg (0.001 – 0.999 mg/m ³) 2) Jerome® 431-X Mercury Vapor Analyzer Manual http://www.equipcoservices.com/pdf/jerome431.pdf (accessed August 25, 2009) <u>Matrix:</u> Air <u>Analytes:</u> Hg (0.003 – 0.999 mg/m ³) <u>Other:</u> 431 model 3) Jerome® 411 Mercury Vapor Analyzer Manual http://www.equipcoservices.com/pdf/manuals/jerome411.pdf (accessed August 25, 2009) <u>Matrix:</u> Air <u>Analytes:</u> Hg (0.003 – 1.999 mg/m ³) <u>Other:</u> 411 model	Mercury, Total	7439-97-6	Air
	Mercuric chloride (analyze for total mercury)	7487-94-7	Air
	Methoxyethylmercuric acetate (analyze for total mercury)	151-38-2	Air
	Cyanogen chloride	506-77-4	Water
			Air
	Hydrogen cyanide	74-90-8	Air
M256A1 - Chemical Agent Detector Kit Anachemia Canada Inc. 255 Norman Lachine, Quebec, Canada H8R 1A3 1) Fatah, A.A., Barrett, J.A., Arcilesi, R.D., Ewing, K.J., Lattin, C.H., and Helinski, M.S. June 2000. "Guide for the Selection of Chemical Agent and Toxic Industrial Material Detection Equipment for Emergency First Responders, v II." U.S. Department of Justice, National Institute of Justice. Washington, D.C. <u>Matrix:</u> Air, liquid <u>Analytes:</u> Cyanogen chloride (7870 µg/m ³ , 3.13 ppm); GB: (4.58 µg/m ³ , 0.0008 ppm); GD: (14.9 µg/m ³ , 0.002 ppm); HD (2020 µg/m ³ , 0.31 ppm); hydrogen cyanide 7880 µg/m ³ , 7.13 ppm); lewisite (8480 µg/m ³ , 1 ppm); VX: (21.9 µg/m ³ , 0.002 ppm)	Lewisite 1 (L-1) [2-chlorovinylchloroarsine] (analyze for total arsenic)	541-25-3	Water
			Air
	Lewisite 2 (L-2) [bis(2-chlorovinyl)-chloroarsine] (analyze for total arsenic)	40334-69-8	Water
			Air
	Lewisite 3 (L-3) [tris(2-chlorovinyl)-arsine] (analyze for total arsenic)	40334-70-1	Water
			Air
	1-Methylethyl ester ethylphosphonofluoridic acid (GE)	1189-87-3	Water
			Air
	Mustard, sulfur / Mustard gas (HD)	505-60-2	Water
			Air
	R-33 (VR) [methylphosphonothioic acid, S-[2-(diethylamino)ethyl O-2-methylpropyl ester]	159939-87-4	Water
			Air

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
M256A1 - Chemical Agent Detector Kit (cont.) 2) National Research Council, Commission on Life Sciences, Committee on R&D Needs for Improving Civilian Medical Response to Chemical and Biological Terrorism Incidents. 1999. "Chemical and Biological Terrorism, Research and Development to Improve Civilian Medical Response." National Academy Press. Washington, D.C. <u>Analytes:</u> Cyanogen chloride (3000 µg/m ³ , 25 minutes); HD (20.0 µg/m ³); lewisite (2000 µg/m ³); G- and V-agents (5.0 µg/m ³ , 15 minutes) 3) Davis, G.L. December 2008. "CBRNE - Chemical Detection Equipment." eMedicine <u>Matrix:</u> Air <u>Analytes:</u> Hydrogen cyanide (1100 µg/m ³); HD (20.0 µg/m ³); G- and V-agents (5.0 µg/m ³) <u>Other:</u> Prone to false-positive results; has not been demonstrated to produce false-negative results in real situations.	Sarin (GB)	107-44-8	Water Air
	Soman (GD)	96-64-0	Water Air
	VE [phosphonothioic acid, ethyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21738-25-0	Water Air
	VG [phosphonothioic acid, S-(2-(diethylamino)ethyl) O,O-diethyl ester]	78-53-5	Water Air
	VM [phosphonothioic acid, methyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21770-86-5	Water Air
	VX [O-ethyl-S-(2-diisopropylaminoethyl)methyl-phosphonothiolate]	50782-69-9	Water Air
	Cyclohexyl sarin (GF)	329-99-7	Non-aqueous Liquid
	Lewisite 1 (L-1) [2-chlorovinylchloroarsine] (analyze for total arsenic)	541-25-3	Non-aqueous Liquid
	Lewisite 2 (L-2) [bis(2-chlorovinyl)-chloroarsine] (analyze for total arsenic)	40334-69-8	Non-aqueous Liquid
M8 Paper (VGH ABC-M8) Chemical Agent Detector Paper Truetech, Inc. 680 Elton Street Riverhead, NY 11301 (631) 727-8600 1) Longworth, T.L., Barnhouse, J.L., and Ong, K.Y. February 1999. "Testing of Commercially Available Detectors Against Chemical Warfare Agents: Summary Report." Soldier and Biological Chemical Command, AMSSB-RRT, Aberdeen Proving Ground, MD. <u>Other:</u> M8 paper is used to detect the presence of liquid V, G, and H chemical agents via direct contact of the paper with a suspected liquid. It cannot be used to detect agents in water or as aerosolized and does not detect vapors. 2) U.S. Army Soldier and Biological Chemical Command. October 2001. "M8 Chemical Agent Detector Paper." Soldier and Biological Chemical Command. Aberdeen Proving Ground, MD. <u>Matrix:</u> Non-aqueous Liquid <u>Analytes:</u> GA, GB, GD, GF, HD, and lewisite	Lewisite 3 (L-3) [tris(2-chlorovinyl)-arsine] (analyze for total arsenic)	40334-70-1	Non-aqueous Liquid
	Lewisite oxide (degradation product of lewisite)	1306-02-1	Non-aqueous Liquid
	Mustard, nitrogen (HN-1) [bis(2-chloroethyl)ethylamine]	538-07-8	Non-aqueous Liquid
	Mustard, nitrogen (HN-2) [2,2'-dichloro-N-methyl diethylamine N,N-bis(2-chloroethyl)methylamine]	51-75-2	Non-aqueous Liquid
	Mustard, nitrogen (HN-3) [tris(2-chloroethyl)amine]	555-77-1	Non-aqueous Liquid
	Mustard, sulfur / Mustard gas (HD)	505-60-2	Non-aqueous Liquid
	R-33 (VR) [methylphosphonothioic acid, S-[2-(diethylamino)ethyl O-2-methylpropyl ester]	159939-87-4	Non-aqueous Liquid
	Sarin (GB)	107-44-8	Non-aqueous Liquid

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
M8 Paper (VGH ABC-M8) Chemical Agent Detector Paper (cont.)	Soman (GD)	96-64-0	Non-aqueous Liquid
	Tabun (GA)	77-81-6	Non-aqueous Liquid
	VE [phosphonothioic acid, ethyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21738-25-0	Non-aqueous Liquid
	VG [phosphonothioic acid, S-(2-(diethylamino)ethyl) O,O-diethyl ester]	78-53-5	Non-aqueous Liquid
	VM [phosphonothioic acid, methyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21770-86-5	Non-aqueous Liquid
	VX [O-ethyl-S-(2-diisopropylaminoethyl) methyl phosphonothiolate]	50782-69-9	Non-aqueous Liquid
M9 Chemical Agent Detector Paper Truetech, Inc. 680 Elton Street Riverhead, NY 11301 (631) 727-8600 1) M9 Detection Paper Product Information http://www.aramsco.com/eserv/eclipse.ecl?PROCID=WEBPROC.WOE.AUTH&AUTOLOG&SEARCH=.6511 (accessed August 28, 2009) <u>Other:</u> M9 paper is used to detect the presence of liquid V, G, and H chemical agents via direct contact of the paper with a suspected liquid. Does not detect vapors. Can be purchased with or without adhesive backing in either a roll or booklet of sheets. 2) Chemical Agent Liquid Detector Paper - M-9 http://firstrespondernetwork.com/items/products/detection/detection-paper-kits/m9-c9-paper-091402-detail.htm (accessed August 29, 2009) <u>Other:</u> Can quickly determine the presence of G, V, or H agents in liquid	Cyclohexyl sarin (GF)	329-99-7	Non-aqueous Liquid
	Lewisite 1 (L-1) [2-chlorovinylchloroarsine] (analyze for total arsenic)	541-25-3	Non-aqueous Liquid
	Lewisite 2 (L-2) [bis(2-chlorovinyl)-chloroarsine] (analyze for total arsenic)	40334-69-8	Non-aqueous Liquid
	Lewisite 3 (L-3) [tris(2-chlorovinyl)-arsine] (analyze for total arsenic)	40334-70-1	Non-aqueous Liquid
	Lewisite oxide (degradation product of lewisite)	1306-02-1	Non-aqueous Liquid
	Mustard, nitrogen (HN-1) [bis(2-chloroethyl)ethylamine]	538-07-8	Non-aqueous Liquid
	Mustard, nitrogen (HN-2) [2,2'-dichloro-N-methyl diethylamine N,N-bis(2-chloroethyl)methylamine]	51-75-2	Non-aqueous Liquid
	Mustard, nitrogen (HN-3) [tris(2-chloroethyl)amine]	555-77-1	Non-aqueous Liquid
	Mustard, sulfur / Mustard gas (HD)	505-60-2	Non-aqueous Liquid
	R-33 (VR) [methylphosphonothioic acid, S-[2-(diethylamino)ethyl O-2-methylpropyl ester]	159939-87-4	Non-aqueous Liquid
	Sarin (GB)	107-44-8	Non-aqueous Liquid
	Soman (GD)	96-64-0	Non-aqueous Liquid
	Tabun (GA)	77-81-6	Non-aqueous Liquid

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
M9 Chemical Agent Detector Paper (cont.)	VE [phosphonothioic acid, ethyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21738-25-0	Non-aqueous Liquid
	VG [phosphonothioic acid, S-(2-(diethylamino)ethyl) O,O-diethyl ester]	78-53-5	Non-aqueous Liquid
	VM [phosphonothioic acid, methyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21770-86-5	Non-aqueous Liquid
	VX [O-ethyl-S-(2-diisopropylaminoethyl) methyl phosphonothiolate]	50782-69-9	Non-aqueous Liquid
MDA Scientific Single Point Monitor (SPM) with Data Recorder Honeywell Analytics Inc. 400 Sawgrass Corporate Parkway, Suite 100 Sunrise, FL 33325 www.honeywell.com 1) Honeywell MDA Scientific SPM http://www.equipcoservices.com/pdf/mdaspm.pdf (accessed August 28, 2009) <u>Matrix:</u> Air <u>Analytes:</u> Ammonia (2.6 – 75.0 ppm); arsine (15 – 150 ppb); chlorine (0.05 – 1.5 ppm); phosphine (32 – 900 ppb); hydrogen bromide (0.3 – 9.0 ppm); hydrogen chloride (0.5 – 15 ppm); hydrogen cyanide (1.1 – 30 ppm); hydrogen fluoride (0.6 – 9.0 ppm); hydrogen sulfide (1.1 – 30 ppm); <u>Other:</u> Gas sensitivity to ppb levels	Ammonia	7664-41-7	Air
	Arsine	7784-42-1	Air
	Chlorine	7782-50-5	Air
	Hydrogen bromide	10035-10-6	Air
	Hydrogen chloride	7647-01-0	Air
	Hydrogen cyanide	74-90-8	Air
	Hydrogen sulfide	7783-06-4	Air
	Phosphine	7803-51-2	Air
	Sulfur dioxide	7446-09-5	Air
MIE DataRam™ Thermo Electron Corporation Environmental Instruments 27 Forge Parkway Franklin, MA 02038 www.thermo.com/ih 1) Argus Hazco MIE Personal DataRAM Aerosol Monitor http://argus-hazco.com/air-section/air-monitoring/mie-personal-dataram.htm (accessed August 27, 2009) <u>Matrix:</u> Air <u>Analytes:</u> Asbestos particulates (0.001 – 399 mg/m ³) <u>Other:</u> Particle size range: 0.1 – 10 µm	Asbestos	1332-21-4	Air

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
MIE DataRam™ (cont.) 2) Personal DataRam™ Series Product Overview http://www.thermo.com/eThermo/CMA/PDFs/Product/productPDF_18492.pdf (accessed August 27, 2009) <u>Matrix:</u> Air <u>Analytes:</u> Asbestos particulates (0.001 - 400 mg/m ³) <u>Other:</u> Flow Rate Range: 1 - 10 L/min (external pump required) 3) University of British Columbia, School of Environmental Health Laboratory. Equipment <u>Matrix:</u> Air <u>Other:</u> Particle size range: 0.1 – 10 µm	Asbestos	1332-21-4	Air
MultiRAE Plus Multigas Monitor and Photoionization Detector (PID) RAE Systems 3775 North First Street San Jose, CA 95134 www.raesystems.com 1) Department of Homeland Security. January 2007. "Guide for the Selection of Chemical Detection Equipment for Emergency First Responders," 3rd Ed. p. C-113. Department of Homeland Security. Washington, D.C. <u>Matrix:</u> Air <u>Analytes:</u> Ammonia (1 – 50 ppm); arsine (0.2 – 2000 ppm); chlorine (0.1 – 50 ppm); GA (0.7 mg/m ³ , 0.1 ppm); GB (1.7 mg/m ³ , 0.3 ppm); GD (2.2 mg/m ³ , 0.3 ppm); GF (2 mg/m ³ , 0.3 ppm); HD (1.3 mg/m ³ , 0.2 ppm); HN-1 (1.4 mg/m ³ , 0.2 ppm); hydrogen cyanide (1.1 – 110 mg/m ³ , 100 ppm); hydrogen sulfide (1 – 100 ppm); L-1 (1.7 mg/m ³ , 0.2 ppm); phosphine (0.1 – 5 ppm); sulfur dioxide (0.1 – 20 ppm) 2) Fatah, A.A., Barrett, J.A., Arcilesi, R.D., Ewing, K.J., Lattin, C.H., and Helinski, M.S. June 2000. "Guide for the Selection of Chemical Agent and Toxic Industrial Material Detection Equipment for Emergency First Responders, v II." U.S. Department of Justice, National Institute of Justice. Washington, D.C. <u>Matrix:</u> Air <u>Analytes:</u> Ammonia (0 – 50 ppm); chlorine (0 – 10 ppm); hydrogen cyanide (0 – 100 ppm); hydrogen sulfide (0 – 100 ppm); phosphine (0 – 50 ppm); sulfur dioxide (0 – 100 ppm)	Ammonia	7664-41-7	Air
	Arsine	7784-42-1	Air
	Carbon disulfide	75-15-0	Air
	Chlorine	7782-50-5	Air
	Cyclohexyl sarin (GF)	329-99-7	Air
	Hydrogen cyanide	74-90-8	Air
	Hydrogen sulfide	7783-06-4	Air
	Lewisite 1 (L-1) [2-chlorovinylchloroarsine] (analyze for total arsenic)	541-25-3	Air
	Lewisite 2 (L-2) [bis(2-chlorovinyl)-chloroarsine] (analyze for total arsenic)	40334-69-8	Air
	Lewisite 3 (L-3) [tris(2-chlorovinyl)-arsine] (analyze for total arsenic)	40334-70-1	Air
	Mustard, nitrogen (HN-1) [bis(2-chloroethyl)ethylamine]	538-07-8	Air
	Mustard, sulfur / Mustard gas (HD)	505-60-2	Air

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
MultiRAE Plus Multigas Monitor and Photoionization Detector (PID) (cont.) 3) MultiRAE Plus One-to-Five Gas Monitor with VOC Detection http://www.raesystems.com/~raedocs/Data_Sheets/MultiRAE_Plus.pdf (accessed August 28, 2009) <u>Matrix:</u> Air <u>Analytes:</u> Chlorine (0 – 10 ppm); phosphine (0 – 5 ppm); and sulfur dioxide (0 – 20 ppm) at 0.1 ppm resolution. Ammonia (0 – 50 ppm); hydrogen cyanide (0 – 100 ppm); hydrogen sulfide (0 – 100 ppm); and VOCs (0 – 200 ppm) at 1.0 ppm resolution	Phosphine	7803-51-2	Air
	Sarin (GB)	107-44-8	Air
	Soman (GD)	96-64-0	Air
	Sulfur dioxide	7446-09-5	Air
	Tabun (GA)	77-81-6	Air
RA-915+ Mercury Vapor Analyzer (MVA) OhioLumex Co. 9263 Ravenna Rd, Unit A-3 Twinsburg, OH 44087 www.ohiolumex.com 1) Portable Zeeman Mercury Analyzer http://www.ohiolumex.com/download/Ra915_flyer.pdf (accessed August 26, 2009) <u>Matrix:</u> Air, water or solid <u>Analytes:</u> Hg (2.0 ng/m ³ [air], 0.5 ng/L [water], 0.5 µg/kg [solid]) <u>Other:</u> Measuring range 0.00001 – 0.1 mg/m ³ (air) 2) U.S. EPA. August 2001. "Measuring Elemental and Total Mercury Emissions." Environmental Technology Verification Program. <u>Matrix:</u> Water <u>Analytes:</u> Hg 1 – 8 µg/m ³ <u>Other:</u> Relative accuracy 58.2% for total mercury (levels: 7 – 8 µg/m ³); 50.2% for elemental mercury (levels: 6 – 7 µg/m ³); and 99% for oxidized mercury (levels: 1 – 1.5 µg/m ³)	Mercury, Total	7439-97-6	Water
			Air
			Solid
	Mercuric chloride (analyze for total mercury)	7487-94-7	Water
			Air
			Solid
	Methoxyethylmercuric acetate (analyze for total mercury)	151-38-2	Water
			Air
			Solid
TVA1000B Combined PID/FID Detector Thermo Electron Corporation Environmental Instruments 27 Forge Parkway Franklin, MA 02038 www.thermo.com/ih 1) Thermo Scientific TVA1000B Toxic Vapor Analyzer http://www.thermo.com/eThermo/CMA/PDFs/Product/productPDF_5619.pdf (accessed August 28, 2009) <u>Matrix:</u> Air <u>Other:</u> PID Dynamic range (0.5 – 2000 ppm); FID dynamic range (0.5 – 50000 ppm); PID linear range (0.5 – 500 ppm); FID linear range (0.5 – 10000 ppm)	Allyl alcohol	107-18-6	Air
	Ammonia	7664-41-7	Air
	Carbon disulfide	75-15-0	Air

Equipment (Testing Information)	SAM Analyte(s)	CAS RN	Media
TVA1000B Combined PID/FID Detector (cont.) 2) Longworth, T.L., Barnhouse, J.L., and Ong, K.Y. February 1999. "Testing of Commercially Available Detectors Against Chemical Warfare Agents: Summary Report." Soldier and Biological Chemical Command, AMSSB-RRT, Aberdeen Proving Ground, MD. <u>Matrix:</u> Air <u>Analytes:</u> HD (1.9 mg/m3, 0.29 ppm); GA (4.1 mg/m3, 0.61 ppm); GB (26 mg/m3, 4.46 ppm) 3) Feld Environmental Instruments http://www.equipcoservices.com/rentals/air-monitoring/flame-ionization-detectors.html (accessed August 28, 2009) <u>Matrix:</u> Air <u>Other:</u> PID Dynamic range (0.5 – 2000 ppm); FID dynamic range (0.5 – 50000 ppm); PID linear range (0.5 – 500 ppm); FID linear range (0.5 – 10000 ppm) 4) Fatah, A.A., Barrett, J.A., Arcilesi, R.D., Ewing, K.J., Lattin, C.H., and Helinski, M.S. June 2000. "Guide for the Selection of Chemical Agent and Toxic Industrial Material Detection Equipment for Emergency First Responders, v II." U.S. Department of Justice, National Institute of Justice. Washington, D.C. <u>Matrix:</u> Air <u>Analytes:</u> GA (0.61 ppm); HD (0.29 ppm) 5) Department of Homeland Security. January 2007. "Guide for the Selection of Chemical Detection Equipment for Emergency First Responders," 3rd Ed. p. C-235. Department of Homeland Security. Washington, D.C. <u>Analytes:</u> Allyl alcohol (10 ppm, PID & FID); ammonia (10 ppm, PID only); carbon disulfide (10 ppm, PID only); ethylene oxide (10 ppm, PID & FID); formaldehyde (10 ppm, PID & FID)	Ethylene oxide	75-21-8	Air
	Formaldehyde	50-00-0	Air
	Mustard, sulfur / Mustard gas (HD)	505-60-2	Air
	Sarin (GB)	107-44-8	Air
	Tabun (GA)	77-81-6	Air

Table 1b: Field Screening Equipment - Use in Detecting Radiochemistry Analytes Listed in SAM 5.0

The following assumptions/nuclear physics variables should be considered when assessing data from each instrument:

- It is assumed that standard health physics and radiation protection protocols are used consistently when comparing measurements. For example, all comparative radiation dose measurements are made at the same distance from the source term (at contact, one foot, etc.), all contamination measurements are consistent as to source to detector configuration, and the efficiency of the detector is well known to perform comparative readings from one detector system to another.
- It is assumed, for gamma spectroscopy measurements for comparative results, that the source configuration characteristics are well known to take into consideration the Z (density value of composite composition) of matrix, the Z of the container, expected homogeneity of the radioisotope in the sample matrix, and sample volume for self-absorption and gamma attenuation coefficients. For example, Am-241 measurements at the surface of an open steel container will give higher values because there is no steel to attenuate the low energy gamma vs. measuring the same container from the side through the steel.
- Minimum Detectable Activities, count rates, and/or dose rates are well established for each instrument prior to field utilization and re-evaluated to ambient backgrounds, in the field, to assess the instrument's capability to produce acceptable and usable data.
- If field measurements cannot determine presence/absence of a contaminant and samples have to be taken for laboratory analysis, ensure sample size is of sufficient quantity to enable the laboratory to meet presence/absence criteria (contact laboratory for sample size requirements prior to sampling).

Equipment	Analyte(s)	CAS RN	Media
Ludlum Model 192 MicroR Radiation Meter Gamma Dose Rate Meter Ludlum Measurements, Inc. 501 Oak Street Sweetwater, TX 79556 http://www.ludlums.com/ <u>Matrix:</u> Water, Air, Soil/Sediment, Wipe <u>Analytes:</u> Gamma emitters (not analyte specific) <u>Other:</u> <ul style="list-style-type: none"> • 4 Ranges • Automatically adjusting alarm setting • Micro-processor based • Total counting range from 0 – 5,000 µR/hr • Indicated use is for low level (µR) gamma survey • Detector is 2" x 1" NaI TI scintillator • Sensitivity is typically 700 cpm/µR/hr (Cs-137 gamma) • Energy response is energy dependent • Meter dial are 0 – 5 µR/hr, battery test (others available) • Multipliers are x1, x10, x100, x1000 • Linearity reading is within ±10% of true value • Alarm is dual action and can be set at desired point 	γ NOTE: Gamma photons from all gamma emitter isotopes present are measured without isotopic identification.	NA	Water
			NOTE: Measurements should always be at the surface of the liquid. Never immerse the detector in the liquid.
			Air
			Soil / Sediment
			Wipe

Equipment	Analyte(s)	CAS RN	Media
Ludlum Model 2241-3 Survey Meter with: <ul style="list-style-type: none"> • Model 44-9 probe for alpha/beta/gamma • Model 43-90 probe for alpha • Model 44-2 probe for gamma Ludlum Measurements, Inc. 501 Oak Street Sweetwater, TX 79556 http://www.ludlums.com/ <p><u>Matrix:</u> Water, Air, Soil/Sediment, Wipe <u>Analytes:</u> Alpha, beta, and gamma emitters (not analyte specific) <u>Other:</u></p> <ul style="list-style-type: none"> • 6 Decade LCD Scaler with backlight • Logarithmic and linear rate meter with total counting range of 0 - 500,000 cpm • Audio divide • Single channel analyzer • Compatible detectors are the G-M, proportional, scintillation • Connectors are Series "C" (others available) • Audio is a built-in unimorph speaker with volume control • Audio divide is a thumb switch for 1, 10, or 100 events-per-click • Meter dial is 0 - 500 cpm; 50 - 500k cpm logarithmic scale (others available) • Multipliers are x1, x10, x100, x1000, and Log for logarithmic scale • Linearity reading is within $\pm 10\%$ of true value with detector connected • Digital display is a 6 digit LCD display with 0.5" (1.3 cm) digits • Digital ratemeter is a digital display of count rate • Scaler will allow for gross counting with range of 0 – 999999 counts when selector switch is in Scaler position (controlled by count and hold buttons) • Timer has selectable divisions of 0.1, 0.5, 1, 2, 5, 10 minutes or continuous NOTE: Concurrent use of scaler and digital ratemeter	α , β , and γ <p>NOTE: Alpha, beta, and gamma photons from all isotopes present are measured without isotopic identification.</p>	NA	Water <p>NOTE: Measurements should always be at the surface of the liquid. Never immerse the detector in the liquid. Gross alpha measurements of liquids are impractical.</p>
			Air
			Soil / Sediment
			Wipe
Ludlum Model 15 Survey Meter Ludlum Measurements, Inc. 501 Oak Street Sweetwater, TX 79556 http://www.ludlums.com/ <p><u>Matrix:</u> Water, Air, Soil/Sediment, Wipe <u>Analytes:</u> Alpha, beta, and gamma emitters (not analyte specific) <u>Other:</u></p> <ul style="list-style-type: none"> • End window G-M detector for alpha, beta, and gamma • He-3 proportional detector with moderator for neutrons • 4 ranges • Total counting range of 0 – 500,000 cpm • Indicated uses for fast and thermal neutron, alpha, beta-gamma survey • Detectors are controlled by selector switch 	α , β , and γ <p>NOTE: Alpha, beta, and gamma photons from all isotopes present are measured without isotopic identification.</p>	NA	Water <p>NOTE: Measurements should always be at the surface of the liquid. Never immerse the detector in the liquid. Gross alpha measurements of liquids are impractical.</p>
			Air

Equipment	Analyte(s)	CAS RN	Media
Ludlum Model 15 Survey Meter (cont.) <ul style="list-style-type: none"> • Neutron: Model 42-14H He-3 proportional detector with 3" (7.6 cm) diameter cadmium lined moderator for fast neutrons (remove detector from moderator for thermal neutrons) • Energy response: Count response is not linear throughout energy spectrum (0.025 – 12 MeV) • Sensitivity: Typically 60 cpm/mrem/hr (Am/Be fast neutrons) • Gamma rejection: Less than 10 cpm at 10 R/hr • Alpha/beta/gamma: Model 44-7 thin end window G-M detector (others available) • Window: 1.7 ± 0.3 mg/cm² mica • Window area: Active = 6.4 cm²; open = 5.2 cm² • Efficiency (4π geometry) is typically 2% C-14; 10% Sr-90/Y-90; 7% Pu-239 • Sensitivity is typically 2100 cpm/mR/hr (Cs-137 gamma) • Meter dial: 0 – 500 cpm, 0 – 2.5 kV, battery test (others available) • Multipliers: x1, x10, x100, x1000 	α, β, and γ NOTE: Alpha, beta, and gamma photons from all isotopes present are measured without isotopic identification.		Soil / Sediment
			Wipe
Thermo-Eberline RO20E Ion Chamber Thermo Eberline (Thermo Fisher Scientific) 27 Forge Parkway Franklin, MA 02038 www.thermo.com <u>Matrix:</u> Water, Air, Soil/Sediment, Wipe <u>Analytes:</u> Gamma emitters (not analyte specific) <u>Other:</u> <ul style="list-style-type: none"> • Indicated use is for gamma or X-ray exposure rate • Detector is an air filled ionization chamber vented to atmosphere • Range selections are 0 – 5, 0 – 50, 0 – 500 mR/hr/ 0 – 5, 0 – 50 R/h 	γ NOTE: Gamma photons from all gamma emitter isotopes present are measured without isotopic identification.	NA	Water NOTE: Measurements should always be at the surface of the liquid. Never immerse the detector in the liquid.
			Air
			Soil / Sediment
			Wipe
Ludlum Model 3030 Alpha/Beta Counter Ludlum Measurements, Inc. 501 Oak Street Sweetwater, TX 79556 http://www.ludlums.com/ <u>Matrix:</u> Water, Air, Soil/Sediment, Wipe <u>Analytes:</u> Alpha and beta emitters (not analyte specific) <u>Other:</u> <ul style="list-style-type: none"> • Dual Alpha/Beta Scaler • Maximum sample size is 2" x0.4" • Indicated use is for simultaneous alpha/beta sample counting • Detector is ZnS(Ag) adhered to plastic scintillation material • Tube is a 2" (5.1cm) diameter magnetically shielded photomultiplier 	α, β NOTE: Alpha, beta, and gamma photons from all isotopes present are measured without isotopic identification.	NA	Water NOTE: Measurements of liquids can be made with this instrument only if the liquid is taken to dryness in an appropriate counting planchet prior to counting.
			Air

Equipment	Analyte(s)	CAS RN	Media
Ludlum Model 3030 Alpha/Beta Counter (cont.) <ul style="list-style-type: none"> • Window is a 0.4 mg/cm² aluminized mylar • Active/open area is 20.3 cm² • Sample holder is brass housing with chrome-plated brass sample tray capable of holding 1" or 2" diameter samples • Efficiency (4pi geometry) is as follows: Alpha 37% Th-230; 39% U-238; 37% Pu-239; Beta 8% C-14; 27% Tc-99; 29% Cs-137; 26% Sr-90/Y-90 • Cross talk: Alpha to beta 10% or less; beta to alpha 1% or less • Background is as follows: Alpha – 3 cpm or less; beta/gamma – typically 50 cpm or less (10 µR/hr field), 80 cpm or less (25 µR/hr field) • Scalers are 2 each, 6 digit LCD displays with backlights providing a range of 0 – 999999 counts (started by count button) • Count timer is adjustable from 0.1 to 30 minutes (PC setting is user-defined via PC software) • High voltage is adjustable from 200 to 2500 volts; beta threshold – 4 mV; alpha – 120 mV • Beta window is 50mV 		NA	Soil / Sediment
			Wipe
RADeCo Model H810AC High Volume Air (Sample Collection) 509 Norwich Avenue Raftville, CT 06380 http://www.radecoinc.com/ <u>Matrix:</u> Air <u>Analytes:</u> NA <u>Other:</u> <ul style="list-style-type: none"> • LCD displays total elapsed time, flow rate, and total volume • Microprocessor based unit does not use rotometer or mechanical time meter, increasing accuracy • Battery-backed data memory stores data if power cut off • Tripod and carrying belt available • Typical maximum flow rates vary from 2.7 cfm to 11.8 cfm, dependent upon cartridge and filter combination 	NA	NA	Air NOTE: Air sample collection only; see Ludlum Model 3030 alpha/beta counter.

Equipment	Analyte(s)	CAS RN	Media
Berkeley Nucleonics SAM 940™ Gamma Spectrometer Berkeley Nucleonics Corporation 29 Kerner Boulevard San Rafael, CA 94901 http://www.berkeleynucleonics.com/ <u>Matrix:</u> Water, Air, Soil/Sediment, Wipe <u>Analytes:</u> Am-241, Cs-137, Co-60, Eu-154, I-125, I-131, Ir-192, Mo-99, Ra-226, Ru-103, U-235, U-238 <u>Other:</u> <ul style="list-style-type: none"> • Detection of these analytes requires use by an experienced operator • Operated primarily in Dose Rate (default mode). In any of its modes, an alarm (sample acquisition) can be stored, reviewed and qualitatively analyzed in a multi-channel analyzer. Each stored alarm can be printed or downloaded. • Four different modes of operation: <ul style="list-style-type: none"> – Dose rate, the default mode – Sigma – Spectra – Manual • Functions include nuclide identification, spectrum analysis, dose rate (rem/Sv) calculation, total dose display, source finding • Energy range is 18 KeV – 3 MeV • Basic SAM 940™ unit consists of: <ul style="list-style-type: none"> – Spectrometer electronics (controller) – Internal or external detector – A rechargeable battery pack (installed in the left side of the instrument) • Operates at temperature range of -20 to 50°C; automatic stabilization • Internal gamma detector (if present) is a 2" x 2" NaI detector; models with 6 LiI (SAM Defender GN) or LaBr (SAM Resolver) detectors available • Optional, detachable detectors: <ul style="list-style-type: none"> – 2" x 2" or 3" x 3" NaI, with or without neutron detector – LaBr detector 	γ	NA	Water
			Air
			Soil / Sediment
			Wipe
	Americium-241	14596-10-2	Water
			Air
			Soil / Sediment
			Wipe
	Cesium-137	10045-97-3	Water
			Air
			Soil / Sediment
			Wipe
	Cobalt-60	10198-40-0	Water
			Air
			Soil / Sediment
			Wipe
	Europium-154	15585-10-1	Water
			Air
			Soil / Sediment
			Wipe
	Iodine-125	8052-26-4	Water
			Air
			Soil / Sediment
			Wipe
	Iodine-131	10043-66-0	Water
			Air
			Soil / Sediment
			Wipe

Equipment	Analyte(s)	CAS RN	Media
Berkeley Nucleonics SAM 940™ Gamma Spectrometer (cont.)	Iridium-192	14694-69-0	Water
			Air
			Soil / Sediment
			Wipe
	Molybdenum-99	14119-15-4	Water
			Air
			Soil / Sediment
			Wipe
	Radium-226	13982-63-3	Water
			Air
			Wipe
			Soil / Sediment
	Ruthenium-103	13968-53-1	Water
			Air
			Wipe
			Soil / Sediment
	Ruthenium-106	13967-48-1	Water
			Air
			Wipe
			Soil / Sediment
	Selenium-75	14265-71-5	Water
			Air
			Wipe
			Soil / Sediment
	Uranium-235	15117-96-1	Water
			Air
			Wipe
			Soil / Sediment
	Uranium-238	7440-61-1	Water
			Air
			Wipe
			Soil / Sediment

Equipment	Analyte(s)	CAS RN	Media
Ludlum Model 239-1F Floor Monitor with 2350-1 Data Logger, 43-37-582 Gas Proportional Detector Coupled to Ludlum 2380-1 Data Logger Ludlum Measurements, Inc. 501 Oak Street Sweetwater, TX 79556 http://www.ludlums.com/ <u>Matrix:</u> Floor contamination monitor (possible adaptation for smooth, flat soil/sediment surfaces) <u>Analytes:</u> Alpha, beta, and gamma emitters	α , β , and γ	NA	Floor contamination monitor (possible adaptation for smooth, flat soil/sediment surfaces)
Ludlum Model 239-1F Floor Monitor with 2350-1 Data Logger, 43-37-582 Gas Proportional Detector Coupled to Ludlum 2380-1 Data Logger (cont.) <u>Other:</u> <ul style="list-style-type: none"> • Floor monitor detects alpha, beta, and gamma • Detector is gas proportional • Recommended counting gas is P-10 (10% methane, 90% argon) • Gas consumption is typically 50 cc/min; for gas recharge, will operate on static charge for 2 hours • Typically used with Matheson size 2 or Linde Q bottle size • Window is 0.8 mg/cm² aluminized mylar (window thicknesses of 0.4, 3.9, or 7.9 mg/cm² are available) • Active area is 584 cm² • Open area is 425 cm² • Efficiency (4pi) is 17% Pu-239; 25% Sr-90/Y-90; <1% gamma • Flow meter is adjustable from 0 to 100 cc/min • Detector operating voltage is typically: <ul style="list-style-type: none"> – 1000 – 1200 volts for alpha – 1600 – 1800 volts for beta and gamma • Threshold is typically 2 – 4 mV 	α , β , and γ	NA	Floor contamination monitor (possible adaptation for smooth, flat soil/sediment surfaces)
Gamma Tracer and Base Station Saphymo GmbH (formerly Genitron Instruments) Heerstrasse 149 D-60488 Frankfurt a.M., Germany http://www.genitron.de/ <u>Matrix:</u> Air <u>Analytes:</u> NA <u>Other:</u> <ul style="list-style-type: none"> • Detector is a 2X Geiger-Müller-tube at center of casing, parallel to longitudinal axis • Sensitivity is 2 x 150 impulses in 10 minutes at 100 nSv/h • Measuring range is 10 nSv/h – 10 mSv/h (measures dose rate) • 1-sigma-error is \pm 3% (at 100 nSv/h with 60-min measuring cycle) • Calibration error is \pm 6% calibrated with Cs-137 • Calibration radiation is 662 KeV (Cs-137) 	γ	NA	Air

Table 2a: SAM Chemistry Analytes - Detection using Field Screening Equipment

- Equipment detection levels, ranges, and units are cited as provided by the manufacturer and/or reference cited.
- Analytes listed as "not a concern" reflect their listing in *Standardized Analytical Methods for Environmental Restoration Following Homeland Security Events* (SAM).

Analyte(s)	CAS RN	Media	Equipment	Comments
Acephate	30560-19-1	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Acrylamide	79-06-1	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Acrylonitrile	107-13-1	Water	–	Collect sample for laboratory analysis
		Air	<ul style="list-style-type: none"> • Draeger MultiWarn II • Draeger Polytron 7000 series 	<u>Draeger MultiWarn II</u> : 0 – 200 ppm <u>Draeger Polytron 7000 series</u> : 20 – 100 ppm
		Solid	–	Collect sample for laboratory analysis
Aldicarb (Temik)	116-06-3	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Aldicarb sulfone	1646-88-4	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Aldicarb sulfoxide	1646-87-3	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Allyl alcohol	107-18-6	Water	–	Collect sample for laboratory analysis
		Air	<ul style="list-style-type: none"> • Draeger Polytron 7000 series • TVA1000B 	<u>Draeger Polytron 7000 series</u> : 20 – 200 ppm <u>TVA1000B</u> : 10 ppm PID & FID
		Solid	–	Collect sample for laboratory analysis
4-Aminopyridine	504-24-5	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Ammonia	7664-41-7	Water	–	Collect sample for laboratory analysis
		Air	<ul style="list-style-type: none"> • AP4C • Draeger Civil Defense Kit • Draeger MultiWarn • Draeger MultiWarn II • Draeger Polytron 7000 series • HazCat Chemical Identification System • MDA Scientific SPM • MultiRAE Plus • TVA1000B 	<u>AP4C</u> : Not available <u>Draeger Civil Defense Kit</u> : 1740 – 6.97 x 10 ⁴ µg/m ³ (2.5 – 100 ppm); 3480 – 4.88 x 10 ⁵ µg/m ³ <u>Draeger MultiWarn</u> : 0 – 2.09 x 10 ⁵ µg/m ³ <u>Draeger MultiWarn II</u> : 0 – 300 ppm <u>Draeger Polytron 7000 series</u> : 50 – 1000 ppm <u>HazCat Chemical Identification System</u> : Not available <u>MDA Scientific SPM</u> : 2.6 – 75 ppm <u>MultiRAE Plus</u> : 1 – 50 ppm <u>TVA1000B</u> : 10 ppm PID only
		Solid	Not a concern	

Analyte(s)	CAS RN	Media	Equipment	Comments
Ammonium metavanadate (analyze for total vanadium)	7803-55-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Arsenic, total	7440-38-2	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Arsenic trioxide (analyze for total arsenic)	1327-53-3	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Arsine	7784-42-1	Water	–	Collect sample for laboratory analysis
		Air	<ul style="list-style-type: none"> • AP4C • Draeger Civil Defense Kit • Draeger MultiWarn • Draeger MultiWarn II • Draeger Polytron 7000 series • MDA Scientific SPM • MultiRAE Plus 	AP4C: $\leq 1 \text{ mg/m}^3$ (0.3 ppm) Draeger Civil Defense Kit: 0.1 ppm Draeger MultiWarn: $0 - 3.19 \times 10^4 \text{ } \mu\text{g/m}^3$ Draeger MultiWarn II: 0 – 10 ppm Draeger Polytron 7000 series: 0.3 – 20 ppm MDA Scientific SPM: 50 – 150 ppb MultiRAE Plus: 0.2 – 2000 ppm
		Solid	–	Collect sample for laboratory analysis
Asbestos	1332-21-4	Water	Not a concern	
		Air	• MIE DataRam™	Particulate detection range $0.001 - 400 \text{ mg/m}^3$; particle size range $0.1 - 10 \text{ } \mu\text{m}$; flow rate $1 - 10 \text{ L/min}$
		Solid	–	Collect sample for laboratory analysis
Boron trifluoride	7637-07-2	Water	Not a concern	
		Air	• Draeger Polytron 7000 series	3 – 20 ppm
		Solid	Not a concern	
Brodifacoum	56073-10-0	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Bromadiolone	28772-56-7	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
BZ (Quinuclidinyl benzilate)	6581-06-2	Water	–	Collect sample for laboratory analysis
		Air	• AP4C	AP4C: Not available
		Solid	–	Collect sample for laboratory analysis
Calcium arsenate (analyze as total arsenic)	7778-44-1	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Carbofuran (Furadan)	1563-66-2	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Carfentanil	59708-52-0	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis

Analyte(s)	CAS RN	Media	Equipment	Comments
Carbon disulfide	75-15-0	Water	–	Collect sample for laboratory analysis
		Air	• AP4C • MultiRAE Plus • TVA1000B	AP4C: Not available MultiRAE Plus: 0.1 – 2000 ppm TVA1000B: 10 ppm PID only
		Solid	–	Collect sample for laboratory analysis
Chlorfenvinphos	470-90-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Chlorine	7782-50-5	Water	–	Collect sample for laboratory analysis
		Air	• Draeger Civil Defense Kit • Draeger MultiWarn • Draeger MultiWarn II • Draeger Polytron 7000 series • MDA Scientific SPM • MultiRAE Plus	Draeger Civil Defense Kit: $58.0 - 8.70 \times 10^4 \mu\text{g}/\text{m}^3$ Draeger MultiWarn: $0 - 5.80 \times 10^4 \mu\text{g}/\text{m}^3$ Draeger MultiWarn II: 0 – 20 ppm Draeger Polytron 7000 series: 1 – 50 ppm MDA Scientific SPM: 0.05 – 1.5 ppm MultiRAE Plus: 0.1 – 50 ppm; 0 – 10 ppm
		Solid	Not a concern	
2-Chloroethanol	107-07-3	Water	–	Collect sample for laboratory analysis
		Air	• Draeger Polytron 7000 series	30 – 100 ppm
		Solid	–	Collect sample for laboratory analysis
3-Chloro-1,2-propanediol	96-24-2	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Chloropicrin	76-06-2	Water	–	Collect sample for laboratory analysis
		Air	• Draeger Civil Defense Kit	$6720 - 1.34 \times 10^4 \mu\text{g}/\text{m}^3$ (1 – 2 ppm)
		Solid	–	Collect sample for laboratory analysis
Chlorosarin	1445-76-7	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Chlorosoman	7040-57-5	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
2-Chlorovinylarsonous acid (CVAA) (degradation product of lewisite)	85090-33-1	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Chlorpyrifos	2921-88-2	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Chlorpyrifos oxon	5598-15-2	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Crimidine	535-89-7	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis

Analyte(s)	CAS RN	Media	Equipment	Comments
Cyanide, Amenable to chlorination	NA	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Cyanide, Total	57-12-5	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Cyanogen chloride	506-77-4	Water	• M256A1 Kit	3000 µg/m ³ in 25 min; 7870 µg/m ³ (3.13 ppm)
		Air	• AP4C • Draeger Civil Defense Kit • M256A1 Kit	AP4C: ≤1 mg/m ³ (0.4 ppm) Draeger Civil Defense Kit: 0.25 ppm M256A1: 3000 µg/m ³ in 25 min; 7870 µg/m ³ (3.13 ppm)
		Solid	–	Collect sample for laboratory analysis
Cyclohexyl sarin (GF)	329-99-7	Water	–	Collect sample for laboratory analysis
		Air	• AP2C • AP4C • Draeger Civil Defense Kit • MultiRAE Plus	AP2C: 100 µg/m ³ in 2 seconds AP4C: Not available Draeger Civil Defense Kit: 0.025 ppm (G and V-agents as dichlorovos); 0.05 ppm (G- and V-agents as phosphoric acid esters) MultiRAE Plus: 2 mg/m ³ (0.3 ppm)
		Non-aqueous Liquid	• M8 Paper • M9 Paper	M8: Not available M9: Not available
		Solid	–	Collect sample for laboratory analysis
1,2-Dichloroethane (degradation product of HD)	107-06-2	Water	–	Collect sample for laboratory analysis
		Air	• Draeger Polytron 7000 series	30 ppm
		Solid	–	Collect sample for laboratory analysis
Dichlorvos	62-73-7	Water	–	Collect sample for laboratory analysis
		Air	• Draeger Civil Defense Kit	Not available
		Solid	–	Collect sample for laboratory analysis
Dicrotophos	141-66-2	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Diesel Range Organics	NA	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Diisopropyl methylphosphonate (DIMP) (degradation product of GB)	1445-75-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Dimethylphosphite	868-85-9	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Dimethylphosphoramidic acid (degradation product of GA)	33876-51-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis

Analyte(s)	CAS RN	Media	Equipment	Comments
Diphacinone	82-66-6	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Disulfoton	298-04-4	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Disulfoton sulfoxide	2497-07-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
1,4-Dithiane (degradation product of HD)	505-29-3	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
EA2192 [Diisopropylaminoethyl methylthiolophosphonate] (hydrolysis product of VX)	73207-98-4	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Ethyl methylphosphonic acid (EMPA) (degradation product of VX)	1832-53-7	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Ethylchloroarsine (ED)	598-14-1	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
N-Ethyldiethanolamine (EDEA) (degradation product of HN-1)	139-87-7	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Ethylene oxide	75-21-8	Water	–	Collect sample for laboratory analysis
		Air	<ul style="list-style-type: none"> • Draeger MultiWarn • Draeger MultiWarn II • Draeger Polytron 7000 series • TVA1000B 	Draeger MultiWarn: 0 – 3.60 x 10 ⁵ µg/m ³ Draeger MultiWarn II: 0 – 200 ppm Draeger Polytron 7000 series: 20 – 200 ppm TVA1000B: 10 ppm PID & FID
		Solid	–	Collect sample for laboratory analysis
Fenamiphos	22224-92-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Fentanyl	437-38-7	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Fluoride	16984-48-8	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	Not a concern	
Fluoroacetamide	640-19-7	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis

Analyte(s)	CAS RN	Media	Equipment	Comments
Fluoroacetic acid and fluoroacetate salts (analyze for fluoroacetate ion)	NA	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
2-Fluoroethanol	371-62-0	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Formaldehyde	50-00-0	Water	–	Collect sample for laboratory analysis
		Air	• Draeger MultiWarn • Draeger MultiWarn II • TVA1000B	<u>Draeger MultiWarn</u> : 0 – 2.46 x 10 ⁵ µg/m ³ <u>Draeger MultiWarn II</u> : 0 – 200 ppm <u>TVA1000B</u> : 10 ppm PID & FID
		Solid	–	Collect sample for laboratory analysis
Gasoline Range Organics	NA	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Hexamethylenetriperoxidediamine (HMTD)	283-66-9	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Hydrogen bromide	10035-10-6	Water	Not a concern	
		Air	• Draeger Polytron 7000 series • MDA Scientific SPM	<u>Draeger Polytron 7000 series</u> : 3 – 100 ppm <u>MDA Scientific SPM</u> : 0.3 – 9.0 ppm
		Solid	Not a concern	
Hydrogen chloride	7647-01-0	Water	Not a concern	
		Air	• Draeger Polytron 7000 series • MDA Scientific SPM	<u>Draeger Polytron 7000 series</u> : 3 – 100 ppm <u>MDA Scientific SPM</u> : 0.5 – 15 ppm
		Solid	Not a concern	
Hydrogen cyanide	74-90-8	Water	Not a concern	
		Air	• AP4C • Draeger Civil Defense Kit • Draeger MultiWarn • Draeger MultiWarn II • Draeger Polytron 7000 series • HazCat Chemical Identification System • M256A1 Kit • MDA Scientific SPM • MultiRAE Plus	<u>AP4C</u> : ≤18.7 mg/m ³ (17 ppm) <u>Draeger Civil Defense Kit</u> : 1 ppm <u>Draeger MultiWarn</u> : 0 – 5.53 x 10 ⁴ µg/m ³ <u>Draeger MultiWarn II</u> : 0 – 50 ppm <u>Draeger Polytron 7000 series</u> : 10 – 50 ppm <u>HazCat Chemical Identification System</u> : Not available <u>M256A1 Kit</u> : 1100 µg/m ³ ; 7880 µg/m ³ (7.13 ppm); prone to false-positive results; has not been demonstrated to produce false-negative results in real situations <u>MDA Scientific SPM</u> : 1.1 – 30 ppm <u>MultiRAE Plus</u> : 1.1 – 110 mg/m ³ (0 – 100 ppm)
		Solid	Not a concern	

Analyte(s)	CAS RN	Media	Equipment	Comments
Hydrogen fluoride	7664-39-3	Water	Not a concern	
		Air	<ul style="list-style-type: none"> • Draeger Polytron 7000 series • MDA Scientific SPM 	<u>Draeger Polytron 7000 series</u> : 3 – 30 ppm <u>MDA Scientific SPM</u> : 0.6 – 9.0 ppm
		Solid	Not a concern	
Hydrogen sulfide	7783-06-4	Water	Not a concern	
		Air	<ul style="list-style-type: none"> • AP4C • Draeger Civil Defense Kit • Draeger MultiWarn • Draeger MultiWarn II • Draeger Polytron 7000 series • MDA Scientific SPM • MultiRAE Plus 	<u>AP4C</u> : $\leq 57.4 \text{ mg/m}^3$ (41 ppm) <u>Draeger Civil Defense Kit</u> : 878 – $8.36 \times 10^4 \text{ } \mu\text{g/m}^3$ (0.63 – 60 ppm); 6970 – $8.36 \times 10^5 \text{ } \mu\text{g/m}^3$ (5 – 600 ppm) <u>Draeger MultiWarn</u> : 0 – $1.39 \times 10^5 \text{ } \mu\text{g/m}^3$ <u>Draeger MultiWarn II</u> : 0 – 1000 ppm <u>Draeger Polytron 7000 series</u> : 10 – 1000 ppm <u>MDA Scientific SPM</u> : 1.1 – 30 ppm <u>MultiRAE Plus</u> : 1 – 100 ppm
		Solid	Not a concern	
Isopropyl methylphosphonic acid (IMPA) (degradation product of GB)	1832-54-8	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Kerosene	64742-81-0	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Lewisite 1 (L-1) [2-chlorovinylchloroarsine] (analyze for total arsenic)	541-25-3	Water	<ul style="list-style-type: none"> • HazCat Chemical Identification System • M256A1 Kit 	<u>HazCat Chemical Identification System</u> : Not available <u>M256A1 Kit</u> : $2000 \text{ } \mu\text{g/m}^3$; $8480 \text{ } \mu\text{g/m}^3$ (1 ppm); prone to false-positive results; has not been demonstrated to produce false-negative results in real situations
		Air	<ul style="list-style-type: none"> • APD2000® • Draeger Civil Defense Kit • HazCat Chemical Identification System • M256A1 Kit • MultiRAE Plus 	<u>APD2000®</u> : 200 ppb <u>Draeger Civil Defense Kit</u> : 3 mg/m^3 <u>HazCat Chemical Identification System</u> : Not available <u>M256A1 Kit</u> : $2000 \text{ } \mu\text{g/m}^3$; $8480 \text{ } \mu\text{g/m}^3$ (1 ppm); prone to false-positive results; has not been demonstrated to produce false-negative results in real situations <u>MultiRAE Plus</u> : 1.7 mg/m^3 (0.2 ppm)
		Non-aqueous Liquid	<ul style="list-style-type: none"> • M8 Paper • M9 Paper 	<u>M8</u> : Not available <u>M9</u> : Not available
		Solid	<ul style="list-style-type: none"> • HazCat Chemical Identification System • M256A1 Kit • MultiRAE Plus 	<u>HazCat Chemical Identification System</u> : Not available <u>M256A1 Kit</u> : Prone to false-positive results, but has not been demonstrated to produce false-negative results in real situations <u>MultiRAE Plus</u> : 1.7 mg/m^3 (0.2 ppm)

Analyte(s)	CAS RN	Media	Equipment	Comments
Lewisite 2 (L-2) [bis(2-chlorovinyl)-chloroarsine] (analyze for total arsenic)	40334-69-8	Water	<ul style="list-style-type: none"> HazCat Chemical Identification System M256A1 Kit 	<u>HazCat Chemical Identification System</u> : Not available <u>M256A1 Kit</u> : Prone to false-positive results, but has not been demonstrated to produce false-negative results in real situations
		Air	<ul style="list-style-type: none"> APD2000® Draeger Civil Defense Kit HazCat Chemical Identification System M256A1 Kit MultiRAE Plus 	<u>APD2000®</u> : 200 ppb <u>Draeger Civil Defense Kit</u> : 3 mg/m ³ <u>HazCat Chemical Identification System</u> : Not available <u>M256A1 Kit</u> : Prone to false-positive results; has not been demonstrated to produce false-negative results in real situations <u>MultiRAE Plus</u> : 1.7 mg/m ³ (0.2 ppm)
		Non-aqueous Liquid	<ul style="list-style-type: none"> M8 Paper M9 Paper 	<u>M8</u> : Not available <u>M9</u> : Not available
		Solid	–	Collect sample for laboratory analysis
Lewisite 3 (L-3) [tris(2-chlorovinyl)-arsine] (analyze for total arsenic)	40334-70-1	Water	<ul style="list-style-type: none"> HazCat Chemical Identification System M256A1 Kit 	<u>HazCat Chemical Identification System</u> : Not available <u>M256A1 Kit</u> : Prone to false-positive results, but has not been demonstrated to produce false-negative results in real situations
		Air	<ul style="list-style-type: none"> APD2000® Draeger Civil Defense Kit HazCat Chemical Identification System M256A1 Kit MultiRAE Plus 	<u>APD2000®</u> : 200 ppb <u>Draeger Civil Defense Kit</u> : 3 mg/m ³ <u>HazCat Chemical Identification System</u> : Not available <u>M256A1 Kit</u> : Prone to false-positive results, but has not been demonstrated to produce false-negative results in real situations <u>MultiRAE Plus</u> : 1.7 mg/m ³ (0.2 ppm)
		Non-aqueous Liquid	<ul style="list-style-type: none"> M8 Paper M9 Paper 	<u>M8</u> : Not available <u>M9</u> : Not available
		Solid	<ul style="list-style-type: none"> HazCat Chemical Identification System 	Not available
Lewisite oxide (degradation product of Lewisite)	1306-02-1	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Non-aqueous Liquid	<ul style="list-style-type: none"> M8 Paper M9 Paper 	<u>M8</u> : Not available <u>M9</u> : Not available
		Solid	–	Collect sample for laboratory analysis
Mercuric chloride (analyze for total mercury)	7487-94-7	Water	<ul style="list-style-type: none"> RA-915+ MVA 	Not available
		Air	Not a concern	
		Solid	<ul style="list-style-type: none"> RA-915+ MVA 	Not available

Analyte(s)	CAS RN	Media	Equipment	Comments
Mercury, total	7439-97-6	Water	• RA-915+ MVA	0.5 ng/m ³ ; relative accuracy 50.2 – 58.2%
		Air	• Jerome® 411/431 MVA • RA-915+ MVA	Jerome® 411/431 MVA: Detection range of 1.00 – 999 µg/m ³ RA-915+ MVA: 2.0 ng/m ³ ; relative accuracy 50.2 – 58.2%
		Solid	• RA-915+ MVA	0.5 ng/m ³ ; relative accuracy 50.2 – 58.2%
Methamidophos	10265-92-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Methomyl	16752-77-5	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Methoxyethylmercuric acetate (analyze for total mercury)	151-38-2	Water	• RA-915+ MVA	Not available
		Air	• Jerome® 411/431 MVA • RA-915+ MVA	Jerome® 411/431 MVA: Not available RA-915+ MVA: Not available
		Solid	• RA-915+ MVA	Not available
Methyl acrylonitrile	126-98-7	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Methyl fluoroacetate (analyze for fluoroacetate ion)	453-18-9	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Methyl hydrazine	60-34-4	Water	–	Collect sample for laboratory analysis
		Air	• Draeger Polytron 7000 series	1 – 3 ppm
		Solid	–	Collect sample for laboratory analysis
Methyl isocyanate	624-83-9	Water	Not a concern	
		Air	–	Collect sample for laboratory analysis
		Solid	Not a concern	
Methyl paraoxon	950-35-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Methyl parathion	298-00-0	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Methylamine	74-89-5	Water	Not a concern	
		Air	• Draeger MultiWarn • Draeger MultiWarn II • Draeger Polytron 7000 series	Draeger MultiWarn: 0 – 1.27 x 10 ⁵ µg/m ³ Draeger MultiWarn II: 0 – 100 ppm Draeger Polytron 7000 series: 100 ppm
		Solid	Not a concern	
N-Methyldiethanolamine (MDEA) (degradation product of HN-2)	105-59-9	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis

Analyte(s)	CAS RN	Media	Equipment	Comments
1-Methylethyl ester ethylphosphonofluoridic acid (GE)	1189-87-3	Water	• M256A1 Kit	5.00 µg/m ³ in 15 minutes
		Air	• AP2C • AP4C • Draeger Civil Defense Kit • M256A1 Kit	AP2C: 5 – 10 ppm AP4C: Not available Draeger Civil Defense Kit: 0.025 ppm (G and V-agents as dichlorovos); 0.05 ppm (G- and V-agents as phosphoric acid esters) M256A1 Kit: 5.00 µg/m ³ in 15 minutes
		Non-aqueous Liquid	• M8 Paper • M9 Paper	M8: Not available M9: Not available
		Solid	–	Collect sample for laboratory analysis
Methylphosphonic acid (MPA) (degradation product of VX, GB, & GD)	993-13-5	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Mevinphos	7786-34-7	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Monocrotophos	6923-22-4	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Mustard, nitrogen (HN-1) [bis(2-chloroethyl)ethylamine]	538-07-8	Water	• HazCat Chemical Identification System	<40 mg
		Air	• Draeger Civil Defense Kit • HazCat Chemical Identification System • MultiRAE Plus	Draeger Civil Defense Kit: 1 mg/m ³ HazCat Chemical Identification System: <40 mg MultiRAE Plus: 1.4 mg/m ³ (0.2 ppm)
		Non-aqueous Liquid	• M8 Paper • M9 Paper	M8: Not available M9: Not available
		Solid	• HazCat Chemical Identification System	<40 mg
Mustard, nitrogen (HN-2) [2,2'-dichloro-N-methyl diethylamine N,N-bis(2-chloroethyl)methylamine]	51-75-2	Water	• HazCat Chemical Identification System	<40 mg
		Air	• Draeger Civil Defense Kit • HazCat Chemical Identification System	Draeger Civil Defense Kit: 1 mg/m ³ HazCat Chemical Identification System: <40 mg
		Non-aqueous Liquid	• M8 Paper • M9 Paper	M8: Not available M9: Not available
		Solid	• HazCat Chemical Identification System	<40 mg

Analyte(s)	CAS RN	Media	Equipment	Comments
Mustard, nitrogen (HN-3) [tris(2-chloroethyl) amine]	555-77-1	Water	• HazCat Chemical Identification System	<40 mg
		Air	• Draeger Civil Defense Kit • HazCat Chemical Identification System	Draeger Civil Defense Kit: 1 mg/m ³ HazCat Chemical Identification System: <40 mg
		Non-aqueous Liquid	• M8 Paper • M9 Paper	M8: Not available M9: Not available
		Solid	• HazCat Chemical Identification System	<40 mg
Mustard, sulfur / Mustard gas (HD)	505-60-2	Water	• HazCat Chemical Identification System • M256A1 Kit	HazCat Chemical Identification System: <40 mg M256A1 Kit: 20.0 µg/m ³ ; 2020 µg/m ³ (0.31 ppm); prone to false-positive results; has not been demonstrated to produce false-negative results in real situations
		Air	• AP2C • AP4C • APD2000® • Draeger Civil Defense Kit • HazCat Chemical Identification System • M256A1 Kit • MultiRAE Plus • TVA1000B	AP2C: 930 µg/m ³ (0.142 ppm) in 4 – 11 seconds; 6.51 µg/m ³ (0.001 ppm) in 2 seconds; sulfur- and phosphorus-containing compounds may act as interferents AP4C: Not available APD2000®: 220 µg/m ³ (0.033 ppm) Draeger Civil Defense Kit: 1 mg/m ³ HazCat Chemical Identification System: <40 mg M256A1 Kit: 20.0 µg/m ³ ; 2020 µg/m ³ (0.31 ppm); prone to false-positive results; has not been demonstrated to produce false-negative results in real situations MultiRAE Plus: 1.3 mg/m ³ (0.2 ppm) TVA1000B: 1900 µg/m ³ (0.29 ppm)
		Non-aqueous Liquid	• M8 Paper • M9 Paper	M8: Not available M9: Not available
		Solid	• HazCat Chemical Identification System	<40 mg
Nicotine compounds (analyze as nicotine)	54-11-5	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Organophosphate pesticides, NOS	NA	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis

Analyte(s)	CAS RN	Media	Equipment	Comments
Osmium tetroxide (analyze for total osmium)	20816-12-0	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Oxamyl	23135-22-0	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Paraquat	4685-14-7	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	Not a concern	
Paraoxon	311-45-5	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Parathion	56-38-2	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Pentaerythritol tetranitrate (PETN)	78-11-5	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Phencyclidine	77-10-1	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Phenol	108-95-2	Water	–	Collect sample for laboratory analysis
		Air	• HazCat Chemical Identification System	Not available
		Solid	–	Collect sample for laboratory analysis
Phorate	298-02-2	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Phorate sulfone	2588-04-7	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Phorate sulfoxide	2588-03-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Phosgene	75-44-5	Water	Not a concern	
		Air	• Draeger Civil Defense Kit • Draeger MultiWarn • Draeger Polytron 7000 series	Draeger Civil Defense Kit: $0.100 - 1.01 \times 10^5 \mu\text{g}/\text{m}^3$ Draeger MultiWarn: $0 - 1.21 \times 10^4 \mu\text{g}/\text{m}^3$ Draeger Polytron 7000 series: $0.1 - 1 \text{ ppm}$
		Solid	Not a concern	
Phosphamidon	13171-21-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis

Analyte(s)	CAS RN	Media	Equipment	Comments
Phosphine	7803-51-2	Water	Not a concern	
		Air	<ul style="list-style-type: none"> • Draeger Civil Defense Kit • Draeger MultiWarn • Draeger MultiWarn II • Draeger Polytron 7000 series • MDA Scientific SPM • MultiRAE Plus 	Draeger Civil Defense Kit: 13.9 – 1390 µg/m ³ Draeger MultiWarn: 0 – 1.39 x 10 ⁴ µg/m ³ Draeger MultiWarn II: 0 – 1000 ppm Draeger Polytron 7000 series: 0.3 – 20 ppm MDA Scientific SPM: 32 – 900 ppb MultiRAE Plus: 0.1 – 5 ppm; 0 – 50 ppm
		Solid	Not a concern	
Phosphorus trichloride	7719-12-2	Water	Not a concern	
		Air	<ul style="list-style-type: none"> • AP4C • Draeger Polytron 7000 series 	AP4C: Not available Draeger Polytron 7000 series: 3 – 30 ppm
		Solid	Not a concern	
Pinacolyl methyl phosphonic acid (PMPA) (degradation product of GD)	616-52-4	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Propylene oxide	75-56-9	Water	–	Collect sample for laboratory analysis
		Air	<ul style="list-style-type: none"> • Draeger MultiWarn II • Draeger Polytron 7000 series 	Draeger MultiWarn II: 0 – 200 ppm Draeger Polytron 7000 series: 20 – 200 ppm
		Solid	–	Collect sample for laboratory analysis
R-33 (VR) [methylphosphonothioic acid, S-[2-(diethylamino)ethyl O-2-methylpropyl ester]	159939-87-4	Water	• M256A1 Kit	5.00 µg/m ³ in 15 minutes
		Air	<ul style="list-style-type: none"> • AP2C • AP4C • Draeger Civil Defense Kit • M256A1 Kit 	AP2C: 5 – 10 ppm AP4C: Not available Draeger Civil Defense Kit: 0.025 ppm (G and V-agents as dichlorovos); 0.05 ppm (G- and V-agents as phosphoric acid esters) M256A1 Kit: 5.00 µg/m ³ in 15 minutes
		Non-aqueous Liquid	<ul style="list-style-type: none"> • M8 Paper • M9 Paper 	M8: Not available M9: Not available
		Solid	–	Collect sample for laboratory analysis
Sarin (GB)	107-44-8	Water	<ul style="list-style-type: none"> • HazCat Chemical Identification System • M256A1 Kit 	HazCat Chemical Identification System: <0.13 ppm M256A1 Kit: 5.00 µg/m ³ ; 4.58 µg/m ³ (0.0008 ppm); prone to false-positive results; has not been demonstrated to produce false-negative results in real situations
		Air	<ul style="list-style-type: none"> • AP2C • AP4C • APD2000® • Draeger Civil Defense Kit 	AP2C: 20.0 µg/m ³ (0.003 ppm) in 6 – 73 seconds; 11.5 µg/m ³ (0.002 ppm) in 2 seconds; 100 µg/m ³ in 2 seconds; sulfur- and phosphorus-containing compounds may act as interferents AP4C: Not available APD2000®: 21.0 µg/m ³ (0.004 ppm) Draeger Civil Defense Kit: 0.025 ppm (G and V-agents as dichlorovos); 0.05 ppm (G- and V-agents as phosphoric acid esters)

Analyte(s)	CAS RN	Media	Equipment	Comments
Sarin (GB) (cont.)	107-44-8	Air	<ul style="list-style-type: none"> HazCat Chemical Identification System M256A1 Kit MultiRAE Plus TVA1000B 	HazCat Chemical Identification System: <0.13 ppm M256A1 Kit: 5.00 µg/m ³ ; 4.58 µg/m ³ (0.0008 ppm); prone to false-positive results; has not been demonstrated to produce false-negative results in real situations MultiRAE Plus: 1.7 mg/m ³ (0.3 ppm) TVA1000B: 26 mg/m ³ (4.46 ppm)
		Non-aqueous Liquid	<ul style="list-style-type: none"> M8 Paper M9 Paper 	M8: Not available M9: Not available
		Solid	HazCat Chemical Identification System	<0.13 ppm
Semivolatile Organic Compounds, NOS	NA	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Sodium arsenite (analyze for total arsenic)	7784-46-5	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Sodium azide (analyze as azide ion)	26628-22-8	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Soman (GD)	96-64-0	Water	M256A1 Kit	5.00 µg/m ³ ; 14.9 µg/m ³ (0.002 ppm); prone to false-positive results; has not been demonstrated to produce false-negative results in real situations
		Air	<ul style="list-style-type: none"> AP2C AP4C APD2000® Draeger Civil Defense Kit M256A1 Kit MultiRAE Plus 	AP2C: 7.45 – 100 µg/m ³ ; sulfur- and phosphorus-containing compounds may act as interferents AP4C: Not available APD2000®: 15 ppb Draeger Civil Defense Kit: 0.025 ppm (G and V-agents as dichlorovos); 0.05 ppm (G- and V-agents as phosphoric acid esters) M256A1 Kit: 5.00 µg/m ³ ; 14.9 µg/m ³ (0.002 ppm); prone to false-positive results; has not been demonstrated to produce false-negative results in real situations MultiRAE Plus: 2.2 mg/m ³ (0.3 ppm)
		Non-aqueous Liquid	<ul style="list-style-type: none"> M8 Paper M9 Paper 	M8: Not available M9: Not available
		Solid	–	Collect sample for laboratory analysis
Strychnine	57-24-9	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis

Analyte(s)	CAS RN	Media	Equipment	Comments
Sulfur dioxide	7446-09-5	Water	Not a concern	
		Air	<ul style="list-style-type: none"> • AP4C • Draeger Civil Defense Kit • Draeger MultiWarn II • Draeger Polytron 7000 series • MultiRAE Plus 	AP4C: Not available Draeger Civil Defense Kit: 1310 – 6.55 x 10 ⁴ µg/m ³ (0.5 – 25 ppm) Draeger MultiWarn II: 0 – 50 ppm Draeger Polytron 7000 series: 5 – 100 ppm MultiRAE Plus: 0.1 – 20 ppm; 0 – 100 ppm; 0 – 20 ppm
		Solid	Not a concern	
Sulfur trioxide	7446-11-9	Water	Not a concern	
		Air	• Draeger Polytron 7000 series	30 ppm
		Solid	Not a concern	
Tabun (GA)	77-81-6	Water	<ul style="list-style-type: none"> • HazCat Chemical Identification System • M256A1 Kit 	HazCat Chemical Identification System: <0.5 ppm M256A1 Kit: 5.0 µg/m ³ in 15 minutes
		Air	<ul style="list-style-type: none"> • AP2C • AP4C • APD2000® • Draeger Civil Defense Kit • HazCat Chemical Identification System • M256A1 Kit • MultiRAE Plus • TVA1000B 	AP2C: 13.3 – 100 µg/m ³ ; sulfur- and phosphorus-containing compounds may act as interferents AP4C: Not available APD2000®: 27.0 µg/m ³ (0.004 ppm) Draeger Civil Defense Kit: 0.025 ppm (G and V-agents as dichlorovos); 0.05 ppm (G- and V-agents as phosphoric acid esters) HazCat Chemical Identification System: <0.5 ppm M256A1 Kit: 5.0 µg/m ³ in 15 minutes MultiRAE Plus: 0.7 mg/m ³ (0.1 ppm) TVA1000B: 4.10 mg/m ³ (0.61 ppm)
		Non-aqueous Liquid	<ul style="list-style-type: none"> • M8 Paper • M9 Paper 	M8: Not available M9: Not available
		Solid	• HazCat Chemical Identification System	<0.5 ppm
Tetraethyl pyrophosphate	107-49-3	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Tetramethylenedisulfotetramine	80-12-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Thallium sulfate (analyze for total thallium)	7446-18-6	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
Thiodiglycol (TDG) (degradation product of HD)	111-48-8	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis

Analyte(s)	CAS RN	Media	Equipment	Comments
Thiofanox	39196-18-4	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
1,4-Thioxane (degradation product of HD)	15980-15-1	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Titanium tetrachloride (analyze for total titanium)	7550-45-0	Water	Not a concern	
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Triethanolamine (TEA) (degradation product of HN-3)	102-71-6	Water	–	Collect sample for laboratory analysis
		Air	• Draeger Polytron 7000 series	100 ppm
		Solid	–	Collect sample for laboratory analysis
Trimethyl phosphite	121-45-9	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	Water	–	Collect sample for laboratory analysis
		Air	Not a concern	
		Solid	–	Collect sample for laboratory analysis
Vanadium pentoxide (analyze for total vanadium)	1314-62-1	Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis
VE [phosphonothioic acid, ethyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21738-25-0	Water	• M256A1 Kit	5.0 µg/m ³ in 15 minutes
		Air	• AP2C • AP4C • Draeger Civil Defense Kit • M256A1 Kit	AP2C: Nerve gases (G-agents/V-agents) 10 – 5 ppm AP4C: Not available Draeger Civil Defense Kit: 0.025 ppm (G and V-agents as dichlorovos); 0.05 ppm (G- and V-agents as phosphoric acid esters) M256A1 Kit: 5.0 µg/m ³ in 15 minutes
		Non-aqueous Liquid	• M8 Paper • M9 Paper	M8: Not available M9: Not available
		Solid	–	Collect sample for laboratory analysis
VG [phosphonothioic acid, S-(2-(diethylamino)ethyl) O,O-diethyl ester]	78-53-5	Water	• M256A1 Kit	5.0 µg/m ³ in 15 minutes
		Air	• AP2C • AP4C • Draeger Civil Defense Kit • M256A1 Kit	AP2C: Nerve gases (G-agents/V-agents) 10 – 5 ppm AP4C: Not available Draeger Civil Defense Kit: 0.025 ppm (G and V-agents as dichlorovos); 0.05 ppm (G- and V-agents as phosphoric acid esters) M256A1 Kit: 5.0 µg/m ³ in 15 minutes

Analyte(s)	CAS RN	Media	Equipment	Comments
VG [phosphonothioic acid, S-(2 (diethylamino)ethyl) O,O-diethyl ester] (cont.)	78-53-5	Non-aqueous	• M8 Paper	M8: Not available
		Liquid	• M9 Paper	M9: Not available
		Solid	–	Collect sample for laboratory analysis
VM [phosphonothioic acid, methyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21770-86-5	Water	• M256A1 Kit	5.0 µg/m ³ in 15 minutes
		Air	• AP2C • AP4C • Draeger Civil Defense Kit • M256A1 Kit	AP2C: Nerve gases (G-agents/V-agents) 10 – 5 ppm AP4C: Not available Draeger Civil Defense Kit: 0.025 ppm (G and V-agents as dichlorovos); 0.05 ppm (G- and V-agents as phosphoric acid esters) M256A1 Kit: 5.0 µg/m ³ in 15 minutes
		Non-aqueous	• M8 Paper	M8: Not available
		Liquid	• M9 Paper	M9: Not available
VX [O-ethyl-S-(2-diisopropylaminoethyl) methyl phosphonothiolate]	50782-69-9	Solid	–	Collect sample for laboratory analysis
		Water	• HazCat Chemical Identification System • M256A1 Kit	• HazCat Chemical Identification System: 0.25 ppm M256A1 Kit: 5.00 µg/m ³ ; 21.9 µg/m ³ (0.002 ppm); prone to false-positive results; has not been demonstrated to produce false-negative results in real situations
		Air	• AP2C • AP4C • APD2000® • Draeger Civil Defense Kit • HazCat Chemical Identification System • M256A1 Kit	AP2C: 656 µg/m ³ (0.06 ppm) in 2 seconds; 150 µg/m ³ in 2 seconds; sulfur- and phosphorus-containing compounds may act as interferents AP4C: Not available APD2000®: 4 ppb Draeger Civil Defense Kit: 0.025 ppm (G and V-agents as dichlorovos); 0.05 ppm (G- and V-agents as phosphoric acid esters) HazCat Chemical Identification System: 0.25 ppm M256A1 Kit: 5.00 µg/m ³ ; 21.9 µg/m ³ (0.002 ppm); prone to false-positive results; has not been demonstrated to produce false-negative results in real situations
		Non-aqueous	• M8 Paper	M8: Not available
		Liquid	• M9 Paper	M9: Not available
White phosphorus	12185-10-3	Solid	• HazCat Chemical Identification System	0.25 ppm
		Water	–	Collect sample for laboratory analysis
		Air	–	Collect sample for laboratory analysis
		Solid	–	Collect sample for laboratory analysis

Table 2b: SAM Radiochemistry Analytes - Detection using Field Screening Equipment

The following assumptions/nuclear physics variables should be considered when assessing data from each instrument:

- It is assumed that standard health physics and radiation protection protocols are used consistently when comparing measurements. For example, all comparative radiation dose measurements are made at the same distance from the source term (at contact, one foot, etc.), all contamination measurements are consistent as to source to detector configuration, and the efficiency of the detector is well known to perform comparative readings from one detector system to another.
- It is assumed, for gamma spectroscopy measurements for comparative results, that the source configuration characteristics are well known to take into consideration the Z (density value of composite composition) of matrix, the Z of the container, expected homogeneity of the radioisotope in the sample matrix, and sample volume for self-absorption and gamma attenuation coefficients. For example, Am-241 measurements at the surface of an open steel container will give higher values because there is no steel to attenuate the low energy gamma vs. measuring the same container from the side through the steel.
- Minimum Detectable Activities, count rates, and/or dose rates are well established for each instrument prior to field utilization and re-evaluated to ambient backgrounds, in the field, to assess the instrument's capability to produce acceptable and usable data.
- If field measurements cannot determine presence/absence of a contaminant and samples have to be taken for laboratory analysis, ensure sample size is of sufficient quantity to enable the laboratory to meet presence/absence criteria (contact laboratory for sample size requirements prior to sampling).

Analyte(s)	Decay Products / Radiations	CAS RN	Media	Equipment
Gross Alpha NOTE: All alpha particles present are measured without isotopic identification.	α	NA	Water	NOTE: Water samples cannot be directly read for gross alpha; samples may be dried and analyzed using the Ludlum Model 3030 Alpha/Beta Counter.
			Air Filters	<ul style="list-style-type: none"> • Ludlum Model 3030 Alpha/Beta Counter with RAdCo Model H810AC • Ludlum Model 15 Survey Meter • Ludlum Model 2241-3 Survey Meter
			Wipe	<ul style="list-style-type: none"> • Ludlum Model 3030 Alpha/Beta Counter • Ludlum Model 15 Survey Meter • Ludlum Model 2241-3 Survey Meter
			Soil / Sediment	<ul style="list-style-type: none"> • Ludlum Model 2241-3 with Model 44-9 or 43-90 probe • Ludlum Model 3030 Alpha/Beta Counter • Ludlum Model 15 Survey Meter
Gross Beta NOTE: All beta-gamma particles present are measured without isotopic identification.	β	NA	Water	NOTE: These detectors should not be immersed. Measurements should be taken at the water surface. <ul style="list-style-type: none"> • Ludlum Model 2241-3 Survey Meter with Model 44-9 probe • Ludlum Model 15 Survey Meter • Ludlum Model 3030 Alpha/Beta Counter
			Air Filters	<ul style="list-style-type: none"> • Ludlum Model 3030 Alpha/Beta Counter with RAdCo Model H810AC • Ludlum Model 15 Survey Meter • Ludlum Model 2241-3 Survey Meter
			Wipe	<ul style="list-style-type: none"> • Ludlum Model 3030 Alpha/Beta Counter • Ludlum Model 15 Survey Meter • Ludlum Model 2241-3 Survey Meter
			Soil / Sediment	<ul style="list-style-type: none"> • Ludlum Model 2241-3 w/ Model 44-9 probe • Ludlum Model 15 Survey Meter • Ludlum Model 3030 Alpha/Beta Counter

Analyte(s)	Decay Products / Radiations	CAS RN	Media	Equipment
Gamma NOTE: Except for the Berkeley Nucleonics SAM 940™, which can identify specific isotopes, all equipment listed will detect gamma photons from all gamma emitter isotopes present without isotopic identification.	γ	NA	Water	NOTE: These detectors should not be immersed. Measurements should be taken at the water surface. • Ludlum Model 192 MicroR Radiation Meter • Ludlum Model 2241-3 w/ Model 44-9 or 44-2 probe • Ludlum Model 15 Survey Meter • Thermo-Eberline RO-20E Ion Chamber • Berkeley Nucleonics SAM 940™
			Air Filters	• Ludlum Model 192 MicroR Radiation Meter • Ludlum Model 2241-3 w/ Model 44-9 or 44-2 probe • Ludlum Model 15 Survey Meter • Thermo-Eberline RO-20E Ion Chamber • Berkeley Nucleonics SAM 940™ • Gamma Tracer and Base Station
			Wipe	• Berkeley Nucleonics SAM 940™ • Ludlum Model 192 MicroR Radiation Meter • Ludlum Model 2241-3 Survey Meter • Thermo-Eberline RO-20E Ion Chamber
			Soil / Sediment	• Ludlum Model 192 MicroR Radiation Meter • Ludlum Model 2241-3 w/ Model 44-9 or 44-2 probe • Ludlum Model 15 Survey Meter • Thermo-Eberline RO-20E Ion Chamber • Berkeley Nucleonics SAM 940™
Americium-241	α, γ	14596-10-2	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
Californium-252	α, γ	13981-17-4	Water	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Air Filters	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Wipe	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Soil / Sediment	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.

Analyte(s)	Decay Products / Radiations	CAS RN	Media	Equipment
Cesium-137	β, γ	10045-97-3	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
Cobalt-60	β, γ	10198-40-0	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
Curium-244	α, γ	13981-15-2	Water	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Air Filters	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Wipe	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Soil / Sediment	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
Europium-154	β, γ	15585-10-1	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
Iodine-125	γ	8052-26-4	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
Iodine-131	β, γ	10043-66-0	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy

Analyte(s)	Decay Products / Radiations	CAS RN	Media	Equipment
Iridium-192	β, γ	14694-69-0	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
Molybdenum-99	γ	14119-15-4	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
Plutonium-238	α, γ	13981-16-3	Water	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Air Filters	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Wipe	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Soil / Sediment	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
Plutonium-239	α, γ	15117-48-3	Water	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Air Filters	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Wipe	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Soil / Sediment	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.

Analyte(s)	Decay Products / Radiations	CAS RN	Media	Equipment
Polonium-210	α, γ	13981-52-7	Water	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Air Filters	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Wipe	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
			Soil / Sediment	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis.
Radium-226	α, γ	13982-63-3	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy U-235 is an interferent. Field equipment screening will likely require a long counting time to address low gamma yield fraction.
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy U-235 is an interferent. Field equipment screening will likely require a long counting time to address low gamma yield fraction.
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy U-235 is an interferent. Field equipment screening will likely require a long counting time to address low gamma yield fraction.
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy U-235 is an interferent. Field equipment screening will likely require a long counting time to address low gamma yield fraction.
Ruthenium-103	β, γ	13968-53-1	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
Ruthenium-106	β, γ	13967-48-1	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
Selenium-75	γ	14265-71-5	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy

Analyte(s)	Decay Products / Radiations	CAS RN	Media	Equipment
Strontium-90	β	10098-97-2	Water	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
			Air Filters	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
			Wipe	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
			Soil / Sediment	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
Technetium-99	β	14133-76-7	Water	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
			Air Filters	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
			Wipe	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
			Soil / Sediment	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
Tritium (Hydrogen-3)	β	10028-17-8	Water	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
			Air Filters	Not Applicable
			Wipe	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
			Soil / Sediment	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
Uranium-234	α	13966-29-5	Water	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
			Air Filters	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
			Wipe	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.
			Soil / Sediment	Field equipment is not available to determine presence/absence of this isotope. Collect sample for laboratory analysis.

Analyte(s)	Decay Products / Radiations	CAS RN	Media	Equipment
Uranium-235	α, γ	15117-96-1	Water	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy may be used to determine presence/absence of this isotope at 185.7 keV. However, if Ra-226 is also suspected to be present at 186.2 keV in the gamma spectrum, then collect sample for laboratory analysis by alpha spectroscopy.
			Air Filters	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy may be used to determine presence/absence of this isotope at 185.7 keV. However, if Ra-226 is also suspected to be present at 186.2 keV in the gamma spectrum, then collect sample for laboratory analysis by alpha spectroscopy.
			Wipe	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy may be used to determine presence/absence of this isotope at 185.7 keV. However, if Ra-226 is also suspected to be present at 186.2 keV in the gamma spectrum, then collect sample for laboratory analysis by alpha spectroscopy.
			Soil / Sediment	Berkeley Nucleonics SAM 940™ - Gamma Spectroscopy may be used to determine presence/absence of this isotope at 185.7 keV. However, if Ra-226 is also suspected to be present at 186.2 keV in the gamma spectrum, then collect sample for laboratory analysis by alpha spectroscopy.
Uranium-238	α, γ	7440-61-1	Water	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis. However, U-238 progeny (Pa-234m) may be used as a surrogate if it is assumed to be in secular equilibrium with U-238. In this case, Berkeley Nucleonics SAM 940™ should be used.
			Air Filters	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis. However, U-238 progeny (Pa-234m) may be used as a surrogate if it is assumed to be in secular equilibrium with U-238. In this case, Berkeley Nucleonics SAM 940™ should be used.
			Wipe	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis. However, U-238 progeny (Pa-234m) may be used as a surrogate if it is assumed to be in secular equilibrium with U-238. In this case, Berkeley Nucleonics SAM 940™ should be used.
			Soil / Sediment	Field equipment is not available to determine presence/absence of this isotope due to low gamma yield fraction for gamma spectroscopy. Collect sample for laboratory analysis. However, U-238 progeny (Pa-234m) may be used as a surrogate if it is assumed to be in secular equilibrium with U-238. In this case, Berkeley Nucleonics SAM 940™ should be used.

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