

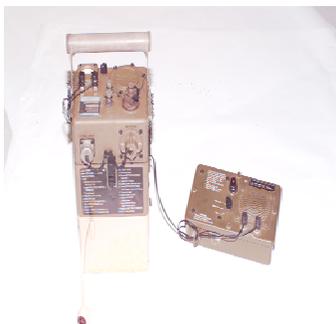


**INITIAL RADIATION SAFETY TRAINING
FOR
USERS OF M43A1, CAM/ICAM, AND ACADA**



This document can be used to satisfy the initial radiation safety training at the user level. This training pamphlet covers the basic information as required by NRC License Number 19-30563-01. Individuals not able to attend a formal training session can review this document and be provided the opportunity to ask questions of radiation safety personnel. Documentation of the individuals review must be maintained as record of training.

M43A1 Chemical Agent Automatic Alarm Detector Unit



The M43A1 Chemical Agent Automatic Alarm Detector Unit (CAD) contains a single source of Americium-241 (Am-241) of up to 300 microcuries (μCi). The CAD operates on the principle of molecular ion clustering. An air sample is drawn over the radiation source, which causes clustering of molecules with water and air. The air sample is drawn through a sensor cell, which is geometrically configured to allow passage only to clusters below a certain mass. The nerve agents cluster very rapidly whereas atmospheric agents do not. The molecules are impacted on a collector and an electrical signal is obtained when nerve agents are present.

The Am-241 source has passed rigorous environmental and accident situations without damage or leakage and is expected to remain intact during normal operating conditions. Small amounts of radioactive contamination have been detected in some CADs. Constant bombardment from the alpha particles emitted by the Am-241 has caused the gold-palladium cover in some of the detector modules to deteriorate. This deterioration is in the form of small cracks similar to "heat checking". In the most severe cases these cracks may penetrate the cover allowing moisture from the air to contact the Americium oxide causing it to plate out onto the outer surface of the cover. Continued use of the device will cause this contamination to migrate through the air path. The contamination is in the form of a powder found in the plastic tubing between the pump module and the cell module.

Owners and operators of this equipment have been alerted to take the following actions:

1. Ensure that all users are reminded that use of the 0.2 micron exit port air filter is mandatory when the CAD is used indoors.
2. Users are not authorized to perform any maintenance on the device.
3. If you see or suspect any damage to the device that might affect the detector cell module immediately place the device in double bags, seal and tag the bag then immediately contact your local RSO.

Biological Effects of Americium-241

The CAD contains Americium-241. Americium-241 primarily emits alpha and gamma radiation. The gamma radiation energy is very low, so an external dose could not be received unless large amounts of Am-241 are stored in one area and a person is in close contact with the material for most of a workday.

The high-energy alpha emission can present an internal radiation hazard if it is ingested. Am-241 is chemically analogous to calcium and can replace calcium in the body, especially in bone material. For this reason it is often referred to as a “bone seeker”. Once incorporated in the bone, the bone and surrounding tissue are constantly irradiated, which may potentially result in leukemia and malignancies.

Since Am-241 primarily emits alpha radiation, alpha detection equipment must be used to accurately assess contamination levels.

The Thermoluminescent Dosimeter (TLD) used to measure external radiation exposures, is not required for use of the CAD.

CHEMICAL AGENT MONITOR/IMPROVED CHEMICAL AGENT MONITOR



Ground forces use the Chemical Agent Monitor/Improved Chemical Agent Monitor (CAM/ICAM) to search and locate chemical agent contamination on personnel and equipment. The CAM/ICAM responds to nerve and blister agent vapors down to the lowest concentration that could have an immediate impact on personnel capabilities. The CAM/ICAM ionizes sample air using a 15 millicurie Nickel-63 (Ni-63) source.

The principle of detection is based on ion mobility spectrometry. Outside air is drawn in through the sampling probe across a membrane. Air molecules are swept over the membrane and permeate into the detector cell where the air molecules are ionized by the Ni-63 source as they pass through the drift tube module. The molecular ions are propelled through the drift tube module by their attraction to the shutter grid. An electrostatic field is established around the drift tube by applying a 1000-volt DC potential to the space rings. The polarity of the applied voltage is such that ions are repelled from the wall of the tube and remain suspended in flight until they impact upon the faraday plate. When ions from organic vapors are present and are collected at this plate there is an exchange of charge and a current is detected. The current is averaged and displayed on the Light Emitting Diode (LED) readout. The LED indicates the relative concentrations of agent or simulator present.

AUTOMATIC CHEMICAL AGENT DETECTOR ALARM (ACADA)



Developed as a replacement for the M43A1, the ACADA uses the same detection principle as the CAM/ICAM and coincidentally uses the same radioactive material. The detector cell module actually contains two drift tube modules each containing up to 15 millicuries for a total of 30 millicuries.

Biological Effects of Nickel-63

Nickel-63 is used in many portable and laboratory analysis equipment as a source of ionization. Nickel-63 is a common source due to its low energy beta radiation, short decay chain and fairly long half-life. The beta energy of the Ni-63 is too low to penetrate the dead layers of skin, therefore it is considered to be an internal hazard only. The amount of Ni-63 intake determines how much biological hazard exists. Efforts should be taken to prevent ingestion, inhalation, or absorption through broken skin. Released Ni-63 may cause contamination of personnel clothing, work areas, and the air. Treating Ni-63 sources with special care and ensuring they are not damaged is the best protection against contamination or exposure. **Intact drift tube modules pose no radiological hazard to the user.**

Both the CAM/ICAM and the ACADA have been designed to ensure that the operator does not come into contact with the radioactive source component. There is no user level maintenance allowed on either of these pieces of equipment that involves the radioactive source module.

STORAGE REQUIREMENTS:

User level requirements for the storage of chemical agent detection devices containing radioactive material were developed mainly to ensure security of the radioactive material. Storage areas will be located in areas free from the dangers of flooding and outside the danger radius of explosives and flammables. Storage areas shall be secured from access by unauthorized personnel and shall have the following postings:

1. Nuclear Regulatory Commission Form 3
2. Section 206 of the Energy Reorganization Act
3. Either posting of, or a notice where they can be reviewed:
 - a. Title 10 Code of Federal Regulations Parts 19, 20, and 21

- b. Applicable NRC License and Conditions
- c. Standing Operating Procedures

ACCOUNTABILITY AND LEAK TESTS

Commodities containing radioactive material must be physically inventoried at a minimum of once per year. A record of such inventory should contain, the item being inventoried to include the detector/monitor serial number, cell module serial number, and physical location of the device (i.e. building and room number).

Additionally, the CAM/ICAM and the M43A1 are required to be leak tested on an annual basis. The leak test frequency for the ACADA, as stated in the NRC source registration, is only when the source assembly is removed or replaced during maintenance, currently not authorized below the depot level.

EMERGENCY PROCEDURES

When incidents occur involving any of the listed detection devices where the integrity of the source is in question, the following emergency procedures shall be followed:

1. If a device shows indications of being damaged or you suspect contamination you should:
 - a. Isolate the area
 - b. Double bag and tag the item as "Damaged Nickel-63 or Americium-241 Device – Do not open"
 - c. Contact your local Radiation Safety Officer.
2. If a device is lost or stolen you should:
 - a. Contact your local Radiation Safety Officer
 - b. Conduct thorough search of all areas where the device could have been.
 - c. Initiate report of survey process through chain-of-command.

NOTE: Loss of any of these devices is reportable to the Nuclear Regulatory Commission under Title 10 Code of Federal Regulations Part 20.2201(a)(i). All losses or suspected losses shall be reported to the U.S. Army Soldier and Biological Chemical Command Radiation Safety Office as soon as the loss is discovered. The report of loss is initially performed telephonically with a documented follow-up. Any questions about radiation safety issues related to these devices can be addressed to the following address:

U.S. Army Soldier and Biological Chemical Command
ATTN: AMSSB-RCB-RS
5183 Blackhawk Road
Aberdeen Proving Ground, MD 21010-5424
(410) 436-7118/2287 (DSN: 584)
email: license@sbccom-brhd.apgea.army.mil

