

RADIOLOGICAL MONITORING EQUIPMENT

Tables 1. through 5., below, show instruments and instrument sets.

Table 1. Alpha Survey Instruments

Alpha Survey Instruments				
Instrument	Type	Scale	Indicator	Description
AN/PDR-56	Scintillation	0 to 1000K, 4 ranges	CPM/100cm ²	Small auxiliary probe provided for monitoring irregular objects. Mylar® probe face is very fragile; a puncture disables the instrument. Accompanying X-ray probe is calibrated for 17 kilo electron volt (keV) with associated meter scale from 0 to 10/m ² in four ranges.
AN/PDR-77	Scintillation	0 to 999K CPM Digital Auto Ranging	123cm ²	See the instrument sets in table AP7.T3.
ADM-300 (with alpha probe AP-100A)	Scintillation	0 to 1.2M CPM	CPM; microcuries per meter squared (μCi/m ²); dintegrations per minute (DPM) per 123 cm ²	Portable alpha probe with three units of alpha measurement possible. High-range.
PRM-5	Scintillation	0 to 500K, 4 ranges	CPM	Portable, high- and low-range instrument for detecting plutonium contamination by measuring associated X rays and low-energy gamma radiation. Effective in inclement weather and much less subject to damage during field use.
Ludlum Model 3 (See table AP7.T2., below)	Scintillation	0 to 400K	CPM	Portable, high- and low-range instrument. Similar in operation and function to the AN/PDR-60.
Ludlum Model 2220	Scintillation	0 to 500K, 4 ranges	CPM	Liquid crystal display and integral digital readout.

Table 2. Beta and Gamma Survey Instruments

Beta and Gamma Survey Instruments				
Instrument	Type	Scale	Indicator	Description
AN/VDR-2	GM	Digital Auto Ranging 0 to 9.99Gy/hr	Gy/hr	Portable beta and/or gamma survey instrument. Displays total accumulated dose or dose rate. (Replaces the AN/PDR-27 for Army applications.)
AN/PDQ-1	GM	1 Milliroentgen(mR) /h to 1000R/hr	R/hr	Uses ancillary probes; Detecting Head (DT)-680 for gamma/beta, DT-685 for beta probe interface, DT-681 for alpha, DT-682 for X ray, DT-683 for Neutron Indicator, DT-684 for Neutron, DT-686 for Radiography.
AN/PDQ-2	GM	1 mR/hr to 1000 R/hr	R/hr	Uses ancillary probes; DT-680 for gamma/beta, DT-685 for beta probe interface, DT-681 for alpha, DT-682 for X ray, DT-683 for Neutron Indicator, DT-684 for Neutron, DT-686 for Radiography.
AN/PDR – 78	Photo Multiplier	30 keV to 1.6 million electron volts (MeV)	Detector only. Uses an indicator light.	For underwater use to 300 feet.
Ludlum Model 3 (See table AP4.T1.)	GM	0 to 200 mR/hr	mR/hr	Portable high- and low-range analyzer similar to AN/PDR-60. Probe 44-6 uses a GM tube to detect beta and gamma. Probe 44-9 detects low-energy gamma, 0 to 200 mR/hr. Both the 44-9 and 44-6 are sensitive to photon and medium & high energy - particle radiations. The 44-9 has an active area of 15.5 cm ² and is sensitive to low-energy -and -particles because the entrance window is sufficiently thin, i.e. 1.7±0.3 mg/cm ² .
AN/PDR-27	GM	0 to 500; 4 ranges	mR/hr	Low-range; suitable for personnel monitoring for beta and/or gamma emitters only. Not useful for alpha emissions. May saturate and read 0 in high radiation fields above 1,000 R/hr.
AN/PDR-43	GM	0 to 500; 3 ranges	R/hr	High-range; does not saturate in high radiation area. Readings in gamma fields other than Co-60 may be inaccurate to greater than 20 percent.
Army, Navy/General Utility, RADIAC, Passive Detecting-13	1 GM tube. Pin Diode / Prompt Gammas	.01-999 1 – 999	cGy/hr	As a rate meter, it measures residual gamma radiation. As a tactical dosimeter, it measures prompt radiation and residual dose.

Table 2. Beta and Gamma Survey Instruments, continued

ADM-300A	GM	Gamma: 10 to 10,000	μ R/hr R/hr	Portable beta and/or gamma survey instrument (with beta probe-100 or beta gamma probe (BGP)-100). Built in beta gamma detection and monitoring capability without additional probes. High-range. BGP-100 may be up to 300 feet from the ADM-300. Saturation level of 100,000 R/hr.
		Beta: 10 to 5	μ R/hr R/hr	

Table 3. Instrument Sets

Instrument Sets	
Instrument	Description
AN/PDR-77 RADIAC Set	The AN/PDR-77 shall accept a maximum of eight different probes. Each probe is automatically recognized and has unique calibration information stored in non-volatile memory. The AN/PDR-77 comes with three probes. A 123cm ² Zinc Sulfide (ZnS) alpha probe, a two Geiger tube beta and/or gamma probe, and a 5-inch Sodium Iodide (NaI) low-energy X ray probe able to measure and find surface contamination levels of Plutonium and Americium (Am)-241 in μ Ci/m ² . An accessory kit is available that contains a GM pancake probe and a 1" x 1.5" NaI micro-R probe.
Violinist III - FIDLER Instrument Set	Includes the FIDLER, high-voltage power supply, pre-amplifier, and the Violinist III. The Violinist III consists of a battery operated 256-channel analyzer and a pre-programmed microprocessor. When calibrated appropriately, it measures and determines surface contamination levels of Plutonium and Am-241 in μ Ci/m ² .
Ranger	Includes the FIDLER (Field Instrument for the Detection of Low-Energy Radiation), a positioning determining system (GPS) , and a hand-held data collection platform (4096 MCA and PDA). The FIDLER is specifically designed to detect the low-energy (17- and 60- keV) photons associated with plutonium and americium. The system can be used as a stand-alone data collection unit (storing data on internal compact-flash cards) or as a system consisting of a base station and mobile field units. The mobile units send FIDLER radiation data along with the positional data to the base station for subsequent graphical display. The surface radiation ground deposition values are displayed in near real time. Ranging is typically limited to near line of sight, roughly about 5 miles, but dense vegetation, buildings, and hills can affect the signal. The current system can also use various other low-resolution gamma detectors coupled to the MCA unit allowing for identification and determination of surface contamination from numerous radionuclides.
Berkeley Nucleonic Corp SAM-935	The SAM-935, as equipped for AF units, have an external 2 x 2 NaI(Tl) detector with a multi-channel analyzer capable of isotope identification based on discrete energy photon emissions.

Table 4. Tritium Survey Instruments

Tritium Survey Instruments			
Instrument	Scale	Indicator	Description
T-446	0 to 10	Microcuries per cubic meter ($\mu\text{Ci}/\text{m}^3$)	Portable, automatic scale switching, trickle charger for Nickel Cadmium F-sized cells. With adapter kit, has urinalysis capability with 5-minute response. Filters particulate to .3 microns; not sensitive to smoke and paint fumes.
AN/PDR-73	0 to 10K; four ranges	$\mu\text{Ci}/\text{m}^3$	Portable air monitor comprising radiacmeter Intensity Measuring (IM)-245/Portable Detector Radiation, designed to detect gaseous radioactive contamination in the ambient air. The instrument is capable of continuous air sampling and is calibrated to read directly the level of tritium. Powered by twelve internal rechargeable "C" cell batteries or by 115 Alternating Current Volt, 60 Hz when in continuous use.
AN/PDR-74	0 to 100K; three ranges	$\mu\text{Ci}/\text{m}^3$	The portable RADIAC set contains an IM-246 air monitor to detect gases. Calibrated in terms of tritium activity but may be used to monitor other radio gases. Powered by "D" cell batteries. Alarm sounds at preset meter reading.

Table 5. Dosimeters

Dosimeters	
Instrument	Capability and Limitations
Self-Reading Ionization Chamber Dosimeter	Reusable device for measuring exposure to X rays and gamma radiation. May provide false positive readings due to charge leakage and sensitivity to mechanical shock.
Non-Self-Reading Ionization Chamber Dosimeter	Reusable device for measuring exposure to X rays and gamma radiation. May provide false positive readings due to charge leakage and sensitivity to mechanical shock. Requires separate reading device.
Film Badge	Provides measurement and permanent record of beta and gamma doses over a wide dosage range. Special neutron films are available. 10 percent dose accuracy depending on quality control (QC) during development. Sensitive to light, humidity, aging, and exposure to X rays. Delay between exposure and dose reading due to processing time.
Thermo-Luminescent Dosimeter (TLD)	Measures gamma radiation dose equivalents up to 10,000 rem. Accurate to within a factor of two when the energy of the neutrons is unknown. After long periods of exposure, damaged or bent cards delay processing, static electric discharge causes spurious readings, and temperatures greater than 115°F reduce sensitivity. Delay between exposure and dose reading due to central processing of TLDs.
Electronic Personal Dosimeter	Detects and measures gamma, beta, and X-ray radiation. Most have an audible alarm as well as a digital readout. There are many models available on the market. Specifications vary from system to system.