

HE Detection								
Technology	Information Detected/Determined	Key Limitations (shielding issues, possible size restraints, etc.)	Approximate Measurement Time Scales	Equipment Availability (TRL)/for Simple Scenario (TRL)	IB Needed (TRL?)	Applicable Dismantlement Steps (1–14)	Comments	Related Technology Paper
Raman Explosive Identification System	Spectroscopic technique to observe vibrational, rotational, and other low-frequency modes of a molecular system; when compared to known spectra can be used to confirm presence and identification of HE.	Depends on HE stored in a semi-transparent container; would not likely work with a sturdy wooden container.	15 minutes	Readily in use today (9) / for dismantlement (5)	Yes (1)	12, 14	It is assumed that no active methods will be permitted with an assembled NED due to safety/security concerns. The sealed nature of the NED limit applicability of this technique on a NED in a container. Works for both bulk and trace detection	HE4: Raman Explosive Identification System
NQR-explosive Identification System	Spectroscopic technique where select nuclei are excited using radio waves, where the response is observed; when compared to known spectra can be used to confirm presence and identification of HE	Likely works with a variety of containers but not metal.	1 hour	Readily in use today (8) / for dismantlement (3)	Yes(1)	10, 12, 14	It is assumed that no active methods will be permitted with an assembled NED due to safety/security concerns. The sealed nature of the NED limit applicability of this technique on a NED in a container. Works best for bulk detection.	HE3: NQR Explosive Identification System
Fast Neutron Interrogation System	Measures gamma emissions in response to excitation by neutron bombardment; resulting spectra observed can be used to confirm presence and identification of HE; also can be used to image material	Needs compositional information ahead of time; is container composition dependent.	10 minutes	Readily in use today (9) / for dismantlement (5)	Yes (1)	10, 12, 14	It is assumed that no active methods will be permitted with an assembled NED due to safety/security concerns. Operator needs to be shielded from the neutron source.	HE2: Fast Neutron Interrogation System for HE Identification
Active Neutron Techniques	Detect gamma emissions in response to bombardment with thermal neutrons	Neutron source usually needs to be 10–30m away from personnel.	2–10 minutes	Readily in use today (9)	Yes	10, 12, 14	It is assumed that no active methods will be permitted with an assembled NED due to safety/security concerns. Detection of gamma emissions may be used to indicate presence of explosives (N, H) [example PINS].	HE2: Fast Neutron Interrogation System for HE Identification
Compton Backscattering Cameras	Active x-ray technique to determine shape and number of components	Battery operated; can't be used with thick metal containers.	Seconds to minutes	Commercially available (9) / for dismantlement (7)	Yes (1)	10, 12, 14	It is assumed that no active methods will be permitted with an assembled NED due to safety/security concerns. Minor health and safety issues (x-ray source).	HE5: X-ray Backscattering Imaging
Nuclear Resonance Fluorescence	Gamma-ray spectrum, isotope information, C/N and C/O ratios for explosives determination, potential for SNM mass determination.	Hydrogen is the only element that can't be detected. In the transmission configuration, the measurement is aided by a "witness or detection" foil that consists of the isotope of interest.	10 minutes	Commercially available (9) / for dismantlement (7)	Yes (1)	10, 12, 14	It is assumed that no active methods will be permitted with an assembled NED due to safety/security concerns. There will be a radiation safety concern. Relatively large physical footprint	HE/NM1: Nuclear Resonance Fluorescence
X-ray Computed Tomography	3D volumetric information, shape, location, effective atomic number, density, mass, material type. The technology can identify objects that are surrounded (hidden) by other objects.	Will not penetrate through materials with a high density thickness.	Seconds to 10 minutes	Commercially available (9) / for dismantlement (7)	Yes (1)	10, 12, 14	It is assumed that no active methods will be permitted with an assembled NED due to safety/security concerns. Designed to be used within a concrete bunker and do pose a radiation hazard if used outside of these conditions.	HE1: X-ray Computed Tomography
Passive Gamma Detection	Detect C, N, O, H that could be indicative of HE.	Only applicable to Pu device before separation of SNM and HE.		Not readily used for this application today	No	Steps 2, 4, 6, 8	Not a direct indication of HE but only of C, N, O, H. Severe constraints likely for any use in Step 8; not applicable for actual dismantlement operation (physical separation of components).	NM2: High Resolution Gamma-ray Spectroscopy (HRGS)
Swipe Sampling	Detects trace amounts of explosive	Dismantlement facilities will have trace amounts of HE all over the facility and in empty containers.		Commercially available (9)	No	None	Not recommended	N/A

Notes:

- (1) No technology identified for monitoring storage of large numbers of containers. Some technologies could be modified into portal monitors, but use dependent on scenario.
- (2) Disposition = burning or blowing up