



RADIOACTIVITY IN SOLID WASTE

Regulations and Guidance for Dealing With Radioactivity in Solid Waste in Pennsylvania

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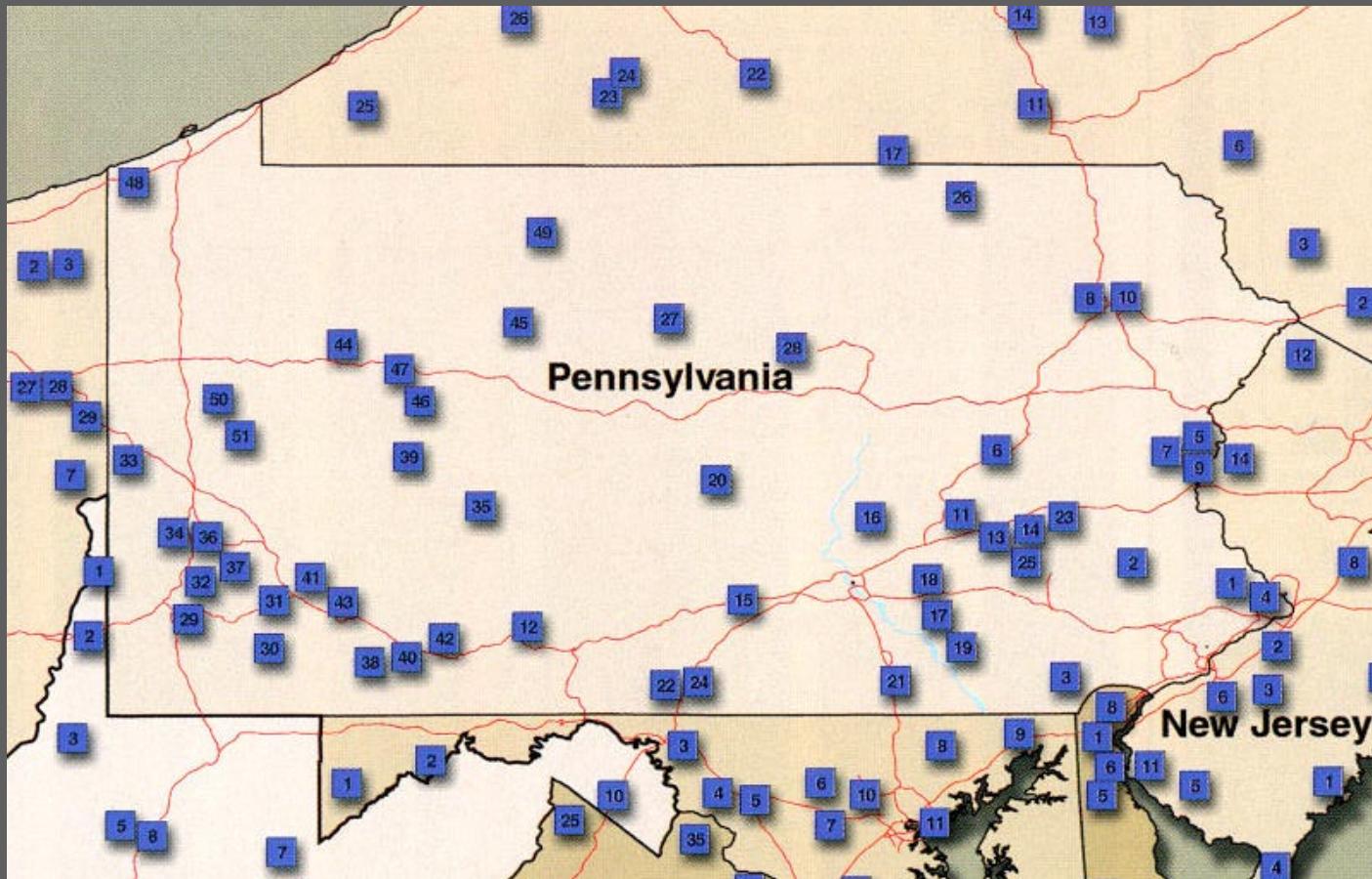
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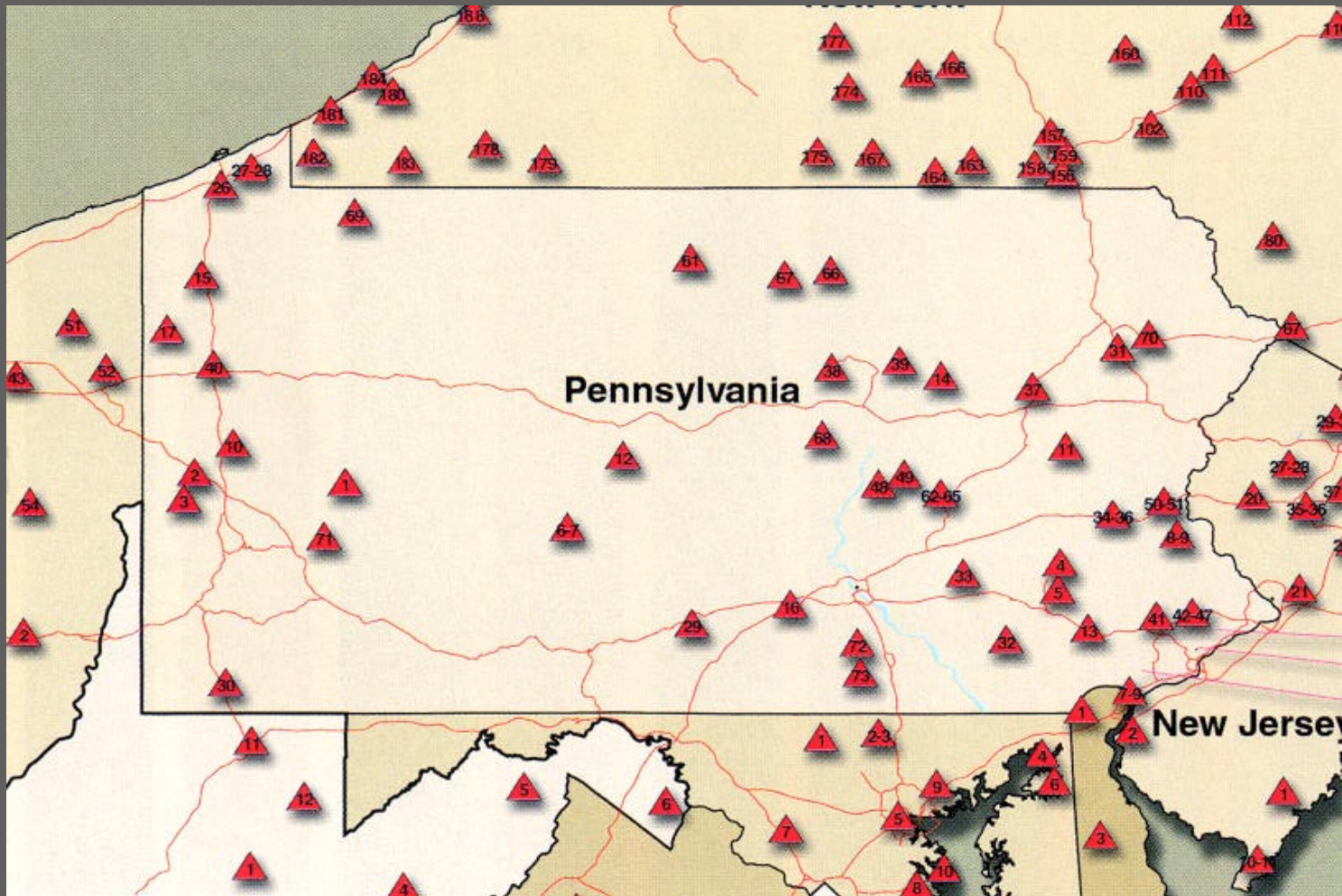
LANDFILLS

51 MUNICIPAL, 47 PRIVATE, , 7 C&D

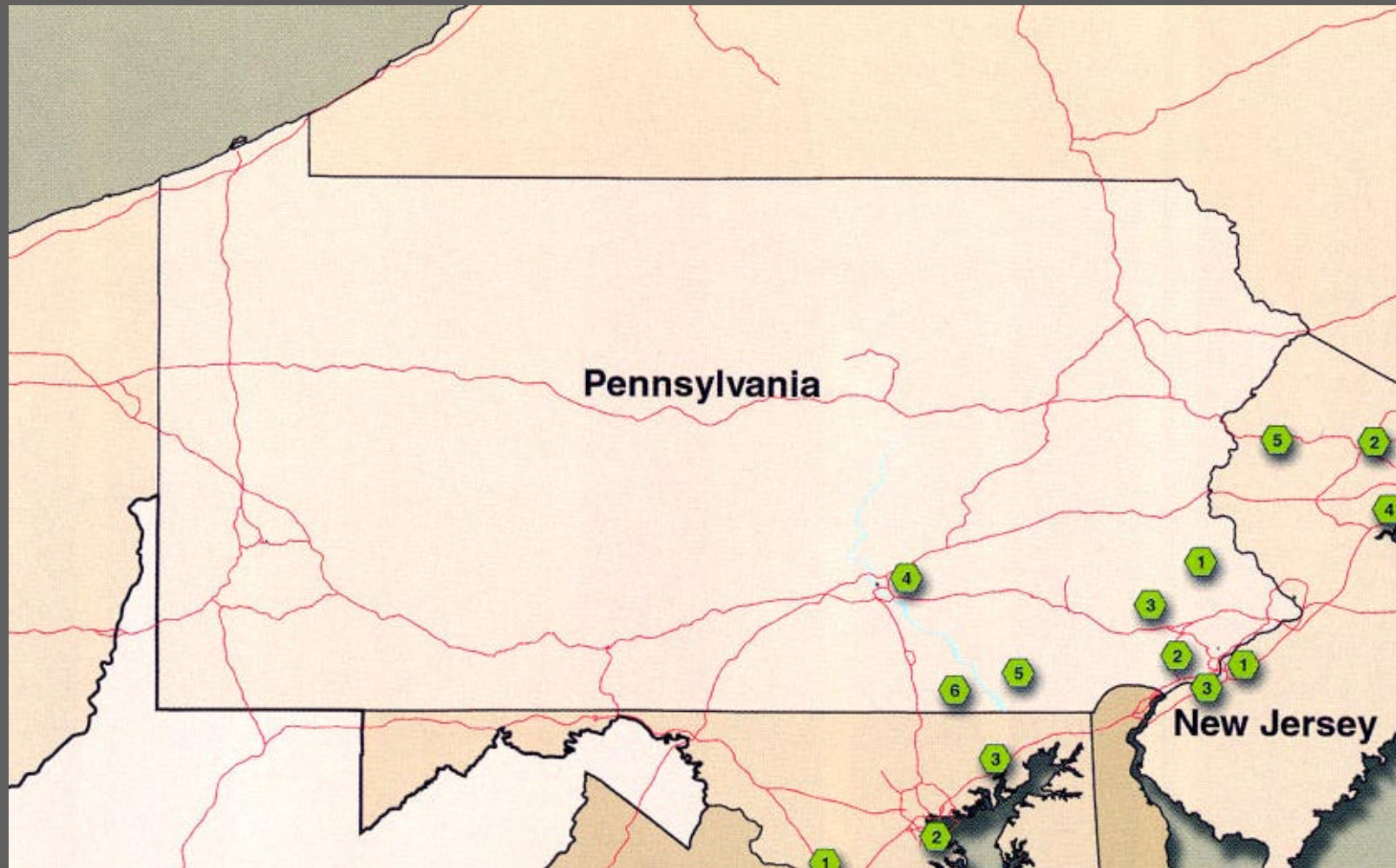


TRANSFER STATIONS & PROCESSING FAC.

TRANSFER-73, MEDICAL INCINERATORS-2,
COMPOSTING-8, OTHER-10



WASTE TO ENERGY FACILITIES - 6



Why do we need Regs and Guidance?

- ⇒ Permits say no “Radioactivity” at SW Facilities
- ⇒ Some SW Facilities have installed radiation / radioactive materials (RAM) monitors
- ⇒ Differences between monitors, policies, alarm set point, sensitivity, modes of use etc.
- ⇒ Alarms require response by facilities and BRP
- ⇒ RP staff responding to several alarms a week
- ⇒ A “quagmire” of national regulations and standards regarding the RAM involved

Why do we need Regs and Guidance?

- ⇒ Ensure the responses are appropriate from the public health & environmental standpoint
- ⇒ Alarms usually involve DEP/ RP program staff, and sometimes NRC or EPA staff
- ⇒ Most of the alarms result from radioactive material that has been disposed of legally [i.e., nuclear medicine (NM) procedures; RAM w/ $T_{1/2} < 65$ days]

Why do we need Regs and Guidance?

- ⇒ The entity with the source / radioactive material possession is responsible to act
- ⇒ Most of the alarms are of little or no radiological significance (i.e., RAM $T_{1/2} < 65$ d)
- ⇒ High costs of response if RAM > 65 d $T_{1/2}$
- ⇒ If classified as low-level rad. waste who pays?
- ⇒ Hauler or SW facility may have to pay if originator can't be identified

Why have facilities been installing monitors without mandate ?

- ⇒ To protect their image and legal interests
- ⇒ Permits prohibit accepting "radioactivity"
- ⇒ Cost of facility cleanup if contaminated
- ⇒ Concerned Citizens, Monitoring Groups
- ⇒ Concern for illegal disposal of LLRW

Why do we have this problem?

- ⇒ Almost everything in the world contains some radioactivity, mostly of natural origins; **but**
- ⇒ There is no accepted *legal* definition of what may be detectable as “radioactive,” but of such a low public dose impact (i.e., health risk) as having little need for regulatory control
- ⇒ Now SW facility permit holder will have to develop an “Action Plan” for radiation alarm response

Sources of Radioactivity - Medical Nuclear Medicine Procedures - 1

- ⇒ Short-lived NM radioisotopes w/ $T_{1/2} < 65$ days
- ⇒ NM Diagnostic or therapy procedures
- ⇒ No longer controlled to 30 mCi, use dose limit
- ⇒ Once inpatient, now dose based to determine if patient leaves facility
- ⇒ Excreta to sanitary sewer – biosolids with RAM, or contaminated household items in trash
- ⇒ While in facility, contaminated items are controlled, but may get in trash accidentally

Sources of Radioactivity - Medical Nuclear Medicine Procedures - 2

- ⇒ Commonly contaminated items in hospitals or medical clinics
 - Personal hygiene items
 - Cleaning wipes, paper towels
 - Newspapers, magazines
 - Dishes, tableware
 - Bedding
 - Anything else touched by patient
- ⇒ At home, much of above materials may get into trash

Sources of Radioactivity - Industry

- ⇒ Radium sources can be a major hazard
- ⇒ Discarded NRC General License (GL) RAM (e.g. static eliminators) and thickness gauges
- ⇒ Stolen or lost sources:
 - Well loggers
 - Moisture / density gauges
- ⇒ Some RAM are not gamma emitters & can't be detected by usual monitors (e.g., tritium EXIT signs)

Sources of Radioactivity - NORM

Naturally Occurring Radioactive Material

⇒ Primordial Radioactive Elements

- Present since earth was formed
- Very long half-lives (billions of years)
- Uranium, thorium, and decay products
- Potassium-40 (K-40)

⇒ Cosmogenic Radionuclides

- Formed continuously through interactions of cosmic rays with air, e.g., C-14, Be-7, H-3

Sources of Radiation

Items containing NORM or TENORM

- ⇒ Rocks
- ⇒ Minerals
- ⇒ Fertilizer
- ⇒ Gypsum
- ⇒ Sheet rock
- ⇒ Oil & gas brines and sludges
- ⇒ Coal fly ash
- ⇒ Coke slags
- ⇒ Metal processing slags
- ⇒ Media from water purification -Rn, Ra
- ⇒ Fire Bricks
- ⇒ Mineral Sands
- ⇒ Soils
- ⇒ Anything from earth

Sources of Radiation

Consumer Products - 1

- ⇒ Self luminous items
 - Timepieces (tritium, radium, promethium)
 - Gauges for aircraft etc (same as timepieces)
 - Tritium "EXIT" signs (hydrogen-3)
- ⇒ Smoke detectors (Am-241)
- ⇒ Pottery [and glass] used natural uranium compounds for color in glazes
- ⇒ Gas lantern mantles (thorium)

Sources of Radiation

Consumer Products - 2

- ⇒ Optical lenses - cameras, glasses, binoculars, telescopes, etc. (thorium)
- ⇒ Welding rods (thorium)
- ⇒ (Old) Dental porcelain (uranium)
- ⇒ Gold recovered from radon seeds used for interstitial therapy (Pb-210)
- ⇒ Fertilizers (uranium, radium, K-40)
- ⇒ Lite salt or road salt (KCl), or other potassium compounds (K-40)

Objectives of Regs and Guidance

- ⇒ To protect environment, public and workers from unnecessary exposure
- ⇒ To protect SW Facility property from RAM contamination and costly decontamination
- ⇒ To help prevent unlawful disposal of controlled RAM
- ⇒ To assist facility operators in complying with revised regulations and permits
- ⇒ To conserve DEP resources by reducing unnecessary response activity

SW Regulations – Basic Limitations

The following radioactive material controlled under specific or general license or order authorized by any federal, state or other government agency shall not be processed at the facility, unless specifically exempted from disposal restrictions by an applicable Pennsylvania or federal statute or regulation:

- ⇒ NARM
- ⇒ Byproduct material
- ⇒ Source material
- ⇒ Special nuclear material
- ⇒ Transuranic radioactive material
- ⇒ Low-level radioactive waste

SW Regulations – Basic Limitations

The following radioactive material shall not be disposed/processed at the facility, unless approved in writing by the department and the disposal/processing does not endanger the health and safety of the public and the environment:

- ⇒ Short lived radioactive material from a patient having undergone a medical procedure
- ⇒ TENORM
- ⇒ Consumer products containing radioactive material

The limitations in subsections () and () shall not apply to radioactive material as found in the undisturbed natural environment of the commonwealth.

Guidance General

Definitions (RAM, NARM, NORM, TENORM, etc.)

- ⇒ Background; reg drivers, sources, past events
- ⇒ General Considerations
 - Personnel Training
 - Monitoring and detection of radiation
 - Awareness of items containing RAM
 - Initial response to detection
 - Notifications; internal/external (DEP)
 - Characterization
 - Disposition; reject, dispose/process onsite
 - Record keeping

Guidance Action Plans

- ⇒ Approved Action Plan, can have a disposal option for NM RAM, TENORM and consumer products
- ⇒ Plan summary posted for facility personnel
- ⇒ Facility personnel trained to plan
- ⇒ Proper response if alarm exceeded
- ⇒ Customer and waste hauler awareness
- ⇒ Ensure that at least one trained person on duty

Guidance

Action Levels

- ⇒ Below average background + 10 mR h⁻¹

NO ACTION REQUIRED -

Treat waste in normal manner

ACTION LEVEL 1

- ⇒ Above average background + 10 mR h⁻¹ shall cause an alarm; 10 mR h⁻¹ limit on instrument background

ACTION LEVEL 2

- ⇒ Above 2 mR h⁻¹ in vehicle cab, 50 mR h⁻¹ any other surface, or contamination – notify DEP/BRP and isolate waste or vehicle

Guidance

Detection and Initial Response - 1

- ⇒ System must alarm with 10 mR h^{-1} radiation field at detector element, with Cs-137
- ⇒ Must detect 50 KeV and above gamma rays
- ⇒ Alarm set at no higher than average instrument background + 10 mR h^{-1} (maximize sensitivity, minimize false alarms)
- ⇒ Background is instrument response AT THAT LOCATION; may need to shield to 10 mR h^{-1}
- ⇒ If wastes exceeds alarm set point, test again
- ⇒ Still above alarm set point – survey truck

Guidance

Monitoring Equipment

- ⇒ Recommends that facilities have suggested types of monitoring devices
 - Fixed portal monitors
 - Hand-held instrument and 2 probes (NaI and “pancake” G-M) for dose rate and contamination
 - Portable MCA
- ⇒ Annual calibration
- ⇒ Daily performance source checks if used
- ⇒ Staff training on field use and maintenance

Guidance

Detection & Initial Response

- ⇒ Facility situation specific Action Plan
- ⇒ Initial measurements below Action Level 2, $T_{1/2} < 65$ days and patient excreta, facility may have DEP blanket approval for disposal option
- ⇒ If $> 2 \text{ mR h}^{-1}$ cab and/or $> 50 \text{ mR h}^{-1}$ on surface, or removable contamination- isolate and call DEP/BRP
- ⇒ DO NOT send driver back on road until proper action determined, and DOT Exemption obtained from DEP/BRP
- ⇒ If waste rejected, DEP will want to know destination to notify other state agencies

Guidance

Characterization

- ⇒ Identification of radioisotope – use portable MCA for gamma spectroscopy
- ⇒ $T_{1/2} < 65$ days and NM RAM, see guidance
- ⇒ $T_{1/2} > 65$ days, see guidance
- ⇒ May have to unload or hold in Designated Area
 - Isolate vehicle, bag, or container
 - STOP, isolate vehicle from people, call DEP if Action Level 2 exceeded

Guidance

Determining Origin

- ⇒ Ask driver where the shipment came from
- ⇒ Record information required by SW regs
- ⇒ Identification on containers or bags. Look for anything with radiation labels while unloading. Any printed material where radiation is localized.
- ⇒ Assistance from DEP/BRP, NRC and/or EPA

Guidance - Disposition

- ⇒ Dispose of NM RAM with half life less than 65 days (Determined by DEP not to endanger health and safety of site staff, public and environment)
- ⇒ Small quantity TENORM and consumer products can be pre-approved too
- ⇒ Expect most facilities will want blanket approval of DEP in Action Plan, or
- ⇒ DEP HP managers can approve case by case

OR

- ⇒ Return to point of origin (with DOT Exemption manifest from DEP/BRP)

Guidance – Disposal Option

Examples of RAM from patients

<u>Isotope</u>	<u>T-1/2</u>
Tc-99m	6 hr
Tl-201	3.0 days
Ga-67	3.3 days
I-131*	8 days

* About 75% of alarms to date

Guidance - Disposal Option

NORM or TENORM

- ⇒ TENORM, surface gamma dose rate $< 50 \text{ mR h}^{-1}$ @ 5 cm, combined radium activity $< 5.0 \text{ pCi/g}$, and $< \text{one cubic meter}$ – facility can dispose / process with DEP approval
- ⇒ Higher with BRP Director approval if pathways analysis demonstrates annual dose to maximum exposed person is less than 10 mrem a^{-1} air, 4 mrem a^{-1} DW, 25 mrem yr^{-1} for total all exposure pathways

Guidance - Disposition

$T_{1/2} > 65$ days, except NORM / TENORM

- ⇒ Above ACTION LEVEL 1 - Reject and return to point of origin (with DOT Exemption Form from BRP), or arrange for proper recovery and disposal
- ⇒ Above ACTION LEVEL 2 - Respond in consultation with DEP/BRP, and/or U.S. NRC or EPA

Guidance

Records & Notification

⇒ Daily Operational Records

- Date/time/location
- Brief Narrative
- Any info on origin
- Isotope ID if known
- Name, address, tel.# of hauler/ supplier/driver ID
- Final deposition (dispose/reject)

⇒ DEP Notification

- For DOT Exemption
- For disposal NM RAM w/ $T_{1/2} < 65$ days
- Immediate if Action Level 2 exceeded
- Annual report of detected RAM

Guidance APPENDICES

- ⇒ DEP contact tel.# for notification, by region
- ⇒ RAM activities for released patients
- ⇒ Guidelines for Monitoring Equipment
- ⇒ Guidelines for Action Plans
- ⇒ Background information on RAM in Solid Waste
- ⇒ Radiation Protection Fundamentals (rev.)