

AMERICIUM-241

[²⁴¹Am]

PHYSICAL DATA

- Gamma Energy: 60 keV (36%)
(x-rays from Ba-137m) 18 keV (18%)
14 keV (13%)
- Beta Energy: no beta
- Alpha Energy: 5486 keV (85%)
5443 keV (13%)
5388 keV (1%)

- Physical Half-Life: 432.7 years
- Biological Half-Life: 50 years (bone)
- Effective Half-Life: 45 years (bone)

- Specific Activity: 3.43 Ci/gram 1.27 x 10¹¹ Bq/g
- Specific Gamma Constant: 3.14 x 10⁻¹ mR/hr/mCi 8.48 x 10⁻⁵ mSv/hr/MBq
(@ 1 meter)

RADIOLOGICAL DATA

- Radiological Toxicity Rating: Group 1 (very high)
- Critical Organ: Bone
- Routes of Intake: Ingestion, Inhalation, Puncture, Wound, Skin Absorption

- Committed Effective Dose Equivalent (CEDE): 3.64 x 10³ mrem/uCi (ingestion) 9.84 x 10² mSv/MBq (ingestion)
4.4 x 10⁵ mrem/uCi (inhalation) 1.2 x 10⁵ mSv/MBq (inhalation)
- Skin Contamination (7 mg/cm²): 7.4 x 10⁻² rem/hr/uCi/cm² 1.95 x 10⁻² mSv/h/kBq/cm²
(Kocher et al)

SHIELDING

- Half-Value Layer (HVL) for lead <0.04 inches <0.1 cm
HVL for steel 0.04 inches 0.1 cm
- Tenth-Value Layer (TVL) for lead <0.04 inches <0.1 cm
TVL for steel 0.12 inches 0.3 cm

- Maximum Alpha Range in Air: 1.6 inches 4 cm
- Maximum Alpha Range in Water/Tissue: 0.02 inches 0.06 cm

SURVEY INSTRUMENTATION

- A survey meter equipped with a G-M pancake or thin-window probe (with window thickness $< 0.2 \text{ mg/cm}^2$) is effective for detecting Am-241. Detection efficiency is between 5% (end window) and 25% (upper range pancake probe).
- A survey meter equipped with an alpha scintillation probe is suitable for detection of the Am-241. Typical efficiency is 25%-35%.
- Either a gamma counter or a liquid scintillation counter may be used to detect removable Am-241 contamination on wipe tests smears. The efficiency for a liquid scintillation counter can be 100% for detection of alphas.

RADIATION MONITORING DOSIMETERS

- Whole Body dosimeter: Required, unless a sealed source completely contained in an instrument.
- Finger dosimeter: Required for unsealed source.
- Whole body count may be required for suspected skin contamination or ingestion.

RADIOACTIVE WASTE

- Solids, liquids, scintillation vials, pathological materials, animal carcasses

REGULATORY COMPLIANCE INFORMATION

- | | | |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| • Derived Air Concentration (DAC): | $3 \times 10^{-12} \text{ uCi/cc}$
(occupational) | $1.1 \times 10^{-7} \text{ Bq/cc}$
(occupational) |
| • Annual Limit of Intake (ALI*):
*[1.0 ALI = 5,000 mrem CEDE] | $8 \times 10^{-1} \text{ uCi}$ (ingestion)
1 uCi
$6 \times 10^{-3} \text{ uCi}$ (inhalation)
$1 \times 10^{-2} \text{ uCi}$
(inhalation – bone surface) | $3.0 \times 10^4 \text{ Bq}$ (ingestion)
$3.7 \times 10^4 \text{ Bq}$
(ingestion – bone surface)
$2.2 \times 10^2 \text{ Bq}$ (inhalation)
$3.7 \times 10^2 \text{ Bq}$
(inhalation – bone surface) |
| • Effluent Release Limit: | $2 \times 10^{-14} \text{ uCi/cc}$ (air)
$2 \times 10^{-8} \text{ uCi/cc}$ (water) | $7.4 \times 10^{-10} \text{ Bq/cc}$ (air)
$7.4 \times 10^{-4} \text{ Bq/cc}$ (water) |

GENERAL RADIOLOGICAL SAFETY INFORMATION

- Often used in a “sealed source” (i.e., encapsulated sources). If the source is designed to release alphas and the activity is greater than or equal to 10 microcuries, the sealed source must be “leak tested” every 3 months. If the source is designed to release only gammas and the activity is greater than or equal to 100 microcuries, the sealed source must be “leak tested” every 6 months. The leak test methodology must be capable of

detecting the presence of 0.005 microcuries of removable contamination and must be taken at the nearest accessible location to the source.

- Laboratory coat and gloves must be worn when handling unsealed radioactive material. Monitor hands and change gloves frequently.
- Whole body and ring dosimeter must be worn when handling unsealed Am-241 or a sealed source that is not shielded and encased within the housing of an instrument.
- Unshielded Am-241 should be used in a well ventilated fume hood or a glove box.
- Shielding should be used to minimize exposure from Am-241.
- Store Am-241 in a shielded container.
- Remote handling tools should be used when handling Am-241.
- Practice procedures without radioactivity prior to performing the procedure with Am-241. Practice will improve dexterity and speed, along with providing opportunity to determine errors and practices that are not ALARA.
- After each use of unsealed Am-241 monitor self, work areas and floors using a survey meter equipped with a very thin walled G-M or an alpha.

Gamma exposure rate from 1 mCi point source - unshielded

<u>Distance</u>	<u>mR/hr</u>
1 cm	3140
5 cm	125.6
10 cm	31.4
100 cm	0.314

REFERENCES

Title 10 of the Code of Federal Regulations part 20

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