

Chromium - 51

Radiological Safety Guidance

Revision Date: 09/20/18

Physical Data

EMISSIONS	ENERGIES
Beta	No Betas Emitted from Cr-51
Gamma	320 keV (9.8% abundance)*
X-Ray Energy	5 keV (21.0% abundance)*

* Percent of disintegration resulting in this radiation being emitted

Specific Gamma Constant: 0.0234 millirem/hour per millicurie at 1.0 meter

Physical Half-Life	27.7 days
Biological Half-Life	616.0 days
Effective Half-Life	26.6 (whole body)
Specific Activity	92,442 curies/gram
Specific Activity (microspheres)	63.56 millicuries/gram

Shielding

- Use 1/4" - 1/2" lead shielding for chromium-51
- Maximum range in lead: 0.5"
- Maximum range in Plexiglass 22.0"

SHIELDING	THICKNESS
Half-Value Layer (lead)	0.17 cm = 0.07"
Half-Value Layer (concrete)	2.80 cm = 1.10"
Half-Value Layer (plexiglass)	4.80 cm = 1.90"
Tenth-Value Layer (lead)	0.55 cm = 0.22"
Tenth-Value Layer (concrete)	9.30 cm = 3.66"
Tenth-Value Layer (plexiglass)	17.20 cm = 6.80"

Volatility

Inherent Volatility (STP): Insignificant/Negligible

Exposure: Radiological Safety Information

Exposure Rates

Gamma (photon) exposure rates from an unshielded 1.0 mCi Cr-51 point source:

DISTANCE	MR/H
1.0 cm	160.0 mR/h
5.0 cm	6.4 mR/h
10.0 cm	1.6 mR/h
100.0 cm	0.01 mR/h

Regulatory Compliance Limits (10 CFR 20/Appendix B)

REGULATION	UNIT OF MEASURE	NOTES
Derived Air Concentration (DAC): Inhalation	<ul style="list-style-type: none">2.0E-5 uCi/mL (Class D)1.0E-5 uCi/mL (Class W)8.0E-6 uCi/mL (Class Y)	
Airborne Effluent Release Limit (Annual Average)	<ul style="list-style-type: none">6.0E-8 uCi/mL (Class D)3.0E-8 uCi/mL (Class W and Y)	Applicable to the assessment and control of dose to the public (10 CFR 20.1302). If this concentration was inhaled continuously for over one year the resulting TEDE would be 50 millirem
Unrestricted Area Removable Contamination Limit	1,000 dpm/100 cm ²	
Container Labeling Quantity (10 CFR 20.1905)	≥ 1 mCi	
Urinalysis	Not Required	However, may be requested in the event of a spill of Cr-51.
Whole Body Bioassay		May be requested in the event of a suspected intake of Cr-51 through ingestion, inhalation, skin absorption, or a wound.

Annual Limit on Intake (ALI)

- Ingestion: 40 millicuries (ingestion)
 - 1.0 ALI = 40 mCi (Cr-51/ingested) = 5,000 millirem CEDE (Whole Body)
- Inhalation
 - 20 millicuries (inhalation/Class W and Y)
 - 50 millicuries (inhalation/Class D/soluble)

Contamination

Radiological Data

Critical Organ	Lower Large Intestine (LLI)
Routes of Intake	<ul style="list-style-type: none">• Ingestion• Inhalation• Puncture• Wound• Skin Contamination (Absorption)
External and internal exposure and contamination are radiological concerns	<p>Committed Dose Equivalent (CDE): (gonad and lung)</p> <ul style="list-style-type: none">• 0.15 mrem/uCi (ingestion/gonad)• 1.41 mrem/uCi (inhalation/lung/Class W) <p>Committed Dose Equivalent (CDE): (Organ Doses)</p> <ul style="list-style-type: none">• 1.20 mrem/uCi (ingested/GI tract/LLI)• 0.22 mrem/uCi (inhaled/LLI Wall/Class D) <p>Committed Effective Dose Equivalent: (Whole Body Dose)</p> <ul style="list-style-type: none">• 0.125 mrem/uCi (ingestion)• 0.100 mrem/uCi (inhalation/Class D)• 0.250 mrem/uCi (inhalation/Class W)

Detect Contamination

Survey Instrumentation

- Survey meter equipped with a NaI scintillation probe is recommended.
- Survey meter equipped with a G-M pancake/frisker or standardized cylindrical probe is very inefficient for the detection of Cr-51 (very low counting efficiency).
- Smears or swabs counted in a liquid scintillation counter (indirect) are best for the detection of removable Cr-51 surface contamination.

Required Personal Radiation Monitoring

Dosimeters (Whole Body and Finger Tabs) when handling > 1.0 millicurie of Cr-51 at any one time.