Xenon 133 (Xe-133)
Handling Precautions

*Half life: 5.245 days
Decay mode: Beta decay
Decays to Cesium 133 (Stable).

Provided as a gas: < 1% Xenon-133 gas
5% Carbon dioxide
95% Xenon gas

How shipped:

- 3 ml Glass vial in lead pipe with O-ring sealed lead cap
- 300 cm^3 SS cylinder with lead shielding

Activity:

- Glass vial: up to 20 mCi
- 300 cm^3 SS lead cylinder: up to 10 Ci

DAYS	0	0.2	0.4	0.6	0.8	1	1.2	1.4	1.6	1.8
0	1.000	0.974	0.949	0.924	0.900	0.876	0.853	0.831	0.809	0.788
1	0.876	0.853	0.831	0.809	0.788	0.768	0.748	0.728	0.709	0.691
2	0.768	0.748	0.728	0.709	0.691	0.673	0.655	0.638	0.621	0.605
4	0.589	0.574	0.559	0.544	0.530	0.516	0.503	0.490	0.477	0.465
6	0.453	0.441	0.429	0.418	0.407	0.397	0.386	0.376	0.366	0.357
8	0.347	0.338	0.330	0.321	0.313	0.304	0.296	0.289	0.281	0.274
10	0.267	0.260	0.253	0.246	0.240	0.234	0.228	0.222	0.216	0.210
12	0.205	0.199	0.194	0.189	0.184	0.179	0.175	0.170	0.166	0.161
14	0.157	0.153	0.149	0.145	0.141	0.138	0.134	0.131	0.127	0.124
16	0.121	0.118	0.114	0.111	0.109	0.106	0.103	0.100	0.098	0.095
18	0.093	0.090	0.088	0.086	0.083	0.081	0.079	0.077	0.075	0.073
20	0.071	0.069	0.067	0.066	0.064	0.062	0.061	0.059	0.058	0.056
22	0.055	0.053	0.052	0.050	0.049	0.048	0.047	0.045	0.044	0.043
24	0.042	0.041	0.040	0.039	0.038	0.037	0.036	0.035	0.034	0.033

***Radiations emitted:**

Radiation Types	Energy (keV)	Intensity (%)
Auger Electrons	3.55	49.7
Auger Electrons	25.5	5.6
Conversion Electrons	43.6	.33
Conversion Electrons	45.0	53.3
Conversion Electrons	75.3	8.1
Conversion Electrons	79.8	1.7
Conversion Electrons	80.8	0.47
Maximum Beta Energy	346	99.3
x-ray L	4.29	6.1
x-ray $K\alpha_2$	30.6	13.6
x-ray $K\alpha_1$	31.0	25.3
x-ray K_β	35	9.1
γ 1	79.6	0.217
γ 2	80.997	36.5

Unshielded exposure rate at 1 cm from a 1 mCi (37 MBq) point source ≈ 0.51 R/hr.
First half value layer for Pb shielding ≈ 0.002 inches (0.04 mm)
Tenth value layer for Pb shielding ≈ 0.015 inches (0.37 mm)

Occupational limits (from USNRC 10 CFR 20, Appendix B) for Submersion:

*Derived Air Concentration: 1E-4 uCi/ml (2E-7 MBq/ml)

The skin of the whole body (Shallow Dose Equivalent) is the critical organ for submersion in Xe-133. Extremity and whole body dosimeters should be worn to monitor dose from mCi quantities of Xenon 133.

Inhaled Xenon is rapidly exhaled. A few percent of inhaled Xenon may be dissolved in the blood and subsequently eliminated via breath with a biological half-life of a few minutes.

In areas where Xe-133 is used, determine the time period required for a complete turnovers (exhaust) of room air. In the event of a room air release allow a minimum of 10 air turnovers before re-entry into the area. The presence of Xe-133 gas can then be monitored using an open window exposure rate meter.

Xenon 133 should be handled and stored in a designated ventilated enclosures. Standard radiation safety precautions to minimize external exposure include the following:

1. Clearly label containers as containing radioactive material as appropriate.
2. Use 1/8 inch thick lead shielding when storing or handling.
3. Keep Xenon gas clean since various organic materials will absorb xenon. Many types of plastic and rubber should not be used to store Xe-133 since the gas will slowly diffuse through these materials.
4. Practice routine operations to improve dexterity and speed before using Xe-133
5. Use tools to indirectly handle unshielded sources.
6. Use closed systems and liquid nitrogen cooled charcoal traps to enhance containment of Xenon gas.
7. Exhaust effluent can be monitored by in-situ thin walled GM type detectors directly in the stack or by drawing exhaust effluent into a shielded vessel with a GM type detector. Detectors are attached to count rate meter and a scalar. System can be calibrated by releasing a known small quantity of gas into the system and observing the accumulated scalar count.

8. Use appropriate radiation detection instruments to measure exposure rates in work areas, and wear external dosimetry to measure dose when handling mCi (37MBq) quantities of activity.
9. Use shielding when handling activity, and minimize the time spent in radiation fields.
10. Prohibit eating, drinking, etc., in work areas.
11. Use protective clothing such as disposable gloves, lab coats, and safety glasses as secondary protection against personal contamination.
12. Use appropriate personal protective equipment; safety glasses, face shield, thermal gloves, and laboratory coat when handling liquid nitrogen.
13. Isolate wastes in sealed, labeled containers.

References:

*Kocher's Radioactive Decay Data Tables. Springfield National Technical Information Services. 1981. DOE/TC-11026