

**XENON Xe 133 GAS
FOR DIAGNOSTIC USE**

DESCRIPTION: XENON Xe 133 Gas is supplied in a mixture of xenon gas (5%) in carbon dioxide (95%). It is contained within septum sealed glass vials and is suitable for inhalation in the diagnostic evaluation of pulmonary function and imaging, as well as assessment of cerebral blood flow. Xenon Xe 133 Gas is reactor-produced as a by-product of Uranium U235 fission. Each vial contains the labeled amount of Xenon Xe 133 radioactivity at the time of calibration. The contents of the vial are in gaseous form, contain no preservatives and are ready for use.

Xenon Xe 133 is chemically and physiologically related to elemental Xenon, a non-radioactive monoatomic gas which is physiologically inert except for anesthetic progenies at high doses.

PHYSICAL CHARACTERISTICS: Xenon Xe 133 decays by beta and gamma emissions with a half-life of 5.245 days. Significant radiations which are emitted by the nuclide are listed in Table 1.

Table 1. Principal Radiation Emission Data from Xenon-133

Radiation	Mean Energy (KeV)	Mean % per Disintegration
Beta-2	100.6	99.3
Ce-K-2	45.0	53.3
Ce-L-2	75.3	8.1
Ce-M-2 "	79.8	1.7
Gamma-2	81.0	36.5
K ₂ X-ray	30.6	13.6
K ₁ X-ray	31.0	25.3
K ₁ X-ray	35.0	9.1

Kocher, David C. "Radioactive Decay Data Tables," DOE/TIC-11026 p. 138. 1981.

EXTERNAL RADIATION: The specific gamma ray constant for Xenon Xe 133 is 3.6 microcoulombs/Kg-MBq-hr (0.51 R/hr-mCi) at 1 cm. The first half value thickness of lead is 0.0035cm. A range of values for the relative attenuation of the radiation emitted by this radionuclide that results from the interposition of various thicknesses of Pb is shown in Table 2. For example, the use of 0.20cm of Po will decrease the external radiation exposure by a factor of 1.000.

Table 2. Radiation Attenuation by Lead Shielding

cm of Pb	Radiation Attenuation Factor
0.0035	0.5
0.037	10 ⁻¹
0.12	10 ⁻²
0.20	10 ⁻³
0.29	10 ⁻⁴

To correct for physical decay of this radionuclide the fractions that remain at selected time intervals after the time of calibration are shown in Table 3.

Table 3. Xenon Xe 133 Physical Decay Chart (Half Life 5.245 days)

Day	Fraction Remaining	Day	Fraction Remaining
0*	1.000	8	.349
1	.877	9	.302
2	.768	10	.268
3	.674	11	.235
4	.591	12	.206
5	.518	13	.181
6	.452	14	.157
7	.398		

* Calibration Day

CLINICAL PHARMACOLOGY: Xenon Xe 133 is a readily diffusible gas which is neither utilized nor produced by the body. It passes through cell membranes and freely exchanges between blood and tissue. It tends to concentrate more in body fat than in blood, plasma, water or protein solutions. In the concentrations used for diagnostic purposes it is physiologically inactive. Inhaled Xenon Xe 133 Gas will enter the alveolar wall and enter the pulmonary venous circulation via the capillaries. Most of the Xenon Xe 133 that enters the circulation from a single breath is returned to the lungs and exhaled after a single pass through the peripheral circulation.

INDICATIONS AND USAGE: Inhalation of Xenon Xe 133 Gas has proved valuable for the evaluation of pulmonary function and for imaging the lungs. It may also be applied to assessment of cerebral flow.

CONTRAINDICATIONS: None known.

WARNINGS: Xenon Xe 133 Gas delivery systems, i.e., respirators or spirometers and associated tubing assemblies must be leakproof to avoid loss of radioactivity into the environs not specifically protected by exhaust systems. Xenon Xe 133 adheres to some plastics and rubber and should not be allowed to stand in tubing or respirator containers. The unrecognized loss of radioactivity from the dose for administration may render the study non-diagnostic.

PRECAUTIONS:

General

Xenon Xe 133, as well as other radioactive drugs, must be handled with care and appropriate safety measures should be used to minimize radiation exposure to clinical personnel. Also care should be taken to minimize radiation exposure to patients consistent with proper patient management.

Exhaled Xenon Xe 133 gas should be controlled in a manner that is in compliance with the appropriate regulations of the government agency authorized to license the use of radionuclides.

Radiopharmaceuticals should be used only by physicians who are qualified by training and experience in the safe use and handling of radionuclides and whose experience and training have been approved by the appropriate government agency authorized to license the use of radionuclides.

Carcinogenesis, Mutagenesis, Impairment of Fertility

No long term animal studies have been performed to evaluate carcinogenic potential or whether Xenon Xe 133 affects fertility in males or females.

Pregnancy Category C

Animal reproductive studies have not been conducted with Xenon Xe 133 Gas. It is also not known whether Xenon Xe 133 Gas can cause fetal harm when administered to a pregnant woman or can affect reproduction capacity. Xenon Xe 133 Gas should be given to a pregnant woman only if clearly needed. Ideally, examination using radiopharmaceuticals, especially those elective in nature in a woman of childbearing capability, should be performed during the first few (approximately 10) days following the onset of menses.

Nursing Mothers

It is not known whether Xenon Xe 133 is excreted in human milk. Many drugs are excreted in human milk, therefore formula feedings should be substituted for breast feeding, because of the potential for adverse reactions in nursing infants.

Pediatric Use

Safety and effectiveness in children below the age of 18 have not been established.

ADVERSE REACTIONS: Adverse reactions related to the use of this agent have not been reported to date.

DOSAGE AND ADMINISTRATION: Xenon Xe 133 gas is administered by inhalation from closed respirator systems or spirometers.

The suggested activity range employed (or inhalation by the average adult patient (70kg) is:

Pulmonary function including imaging: 74-111 GMBq (2-30m0) in 3 liters of air.

Cerebral blood flow: 370-1110MBq (10-30mCi) in 3 liters of air.

The patient dose should be measured by a suitable radioactivity calibration system immediately prior to administration.

RADIATION DOSIMETRY: The estimated absorbed radiation doses² to an average patient (70kg) for pulmonary perfusion and cerebral blood flow studies from a maximum dose of 1110 MBq (30mCi) of Xenon Xe 133 in 3 liters of air are shown in Table 4.

Table 4. Radiation Doses

	Effective Half –Time	Lungs *	Brain	Whole Body
			mGy/110 MBq (rads/30 mCi)	
Pulmonary Perfusion	2 minutes	2.5 (0.25)	0.014 (0.0014)	0.0027 (0.0027)
Cerebral Blood Flow	5 minutes	6.3 (0.63)	0.035 (0.0035)	0.068 (0.0068)

*99% of activity is in lungs.

²Method of Calculation: A Schema for Absorbed-Dose Calculation for Biologically Distributed Radionuclides. Supplement No. 1. MIRP pamphlet No.1. J.Nuc;.Med.p.7(1968).

HOW SUPPLIED: The Xenon Xe 133 gas is supplied as part of the Calidose™ system consisting of 3ml unit dose vials and the Calidose dispenser for shielded dispensing.

Normally vials containing either 370-740 MBq (10 or 20 mCi)/vial packed up to 5 vials per shield tube. are supplied. Vial sets containing up to 3700 MBq (100mCi)/vial are available. Store at room temperature (15-30°C).

The U.S. Nuclear Regulatory Commission has approved this prepared radiopharmaceutical for distribution to persons licensed to use byproduct material pursuant to § 35.200 of 10 CFR Part 35, to persons who hold an equivalent license issued by an Agreement State, and, outside the United States, to persons authorized by the appropriate authority.

The contents of the vial are radioactive. Adequate shielding and handling precautions must be maintained.

Du Pont Radiopharmaceutical Division

The Du Pont Merk Pharmaceutical Co.
331 Treble Cove Rd., Billerica, MA. USA 01862
For Ordering Tel. Toll Free 800-225-1572
(For Massachusetts & International. Call 508-667-9531)
All Other Business 800-362-2668