

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION	
<i>Product Information</i>	
Product Name	Xenon Xe-133 Gas
Version	2.0
Active Substance	Xe-133 Gas
Synonyms	Xenon-133, Xe-133
Product Uses	This material is used as a medical imaging agent.
<i>Company Identification</i>	
Address	Lantheus Medical Imaging 331 Treble Cove Road Billerica, MA 01862 United States Of America 1-800-299-3431
Emergency Phone Number	CHEMTREC 1-800-424-9300. For all international transportation emergency call CHEMTREC at 1-703-527-3887. Collect calls accepted.

2. COMPOSITION INFORMATION ON INGREDIENTS		
Components	Concentration	CAS No.
<i>Hazardous Components</i>		
Xe-133 Gas	<0.1%	14932-42-4
<i>Other Ingredients</i>		
Carbon dioxide	95%	124-38-9
Xenon	5.0%	7440-63-3
Other Information: Xenon-133 is used as the radiopharmaceutical tracer. Gamma/X - 81 keV (38% abundance); 35 keV (7%); 31 keV (38%), Beta 346 keV max; 101 keV average (99% abundance). Gamma Constant: 0.103 mR/hr per mCi @ 1.0 meter [2.78E-5 mSv/hr per MBq @ 1.0 meter] ² . Half-life 5.2 days. The first half-value thickness of lead(Pb) is 0.04 mm (0.002 inches).		

3. HAZARDS IDENTIFICATION	
<i>Emergency Overview</i>	
Appearance	Colorless gas
Signal Word	Danger
Hazard Statements	Radioactive
Precautionary Measures	Avoid ingestion, inhalation, skin and eye contact. Care should be taken to minimize radiation exposure. Appropriate radiation shielding should be used. Keep material in a lead container. Avoid direct handling by using remote manipulation tools. Wash hands after handling to minimize exposure. Pregnant or nursing women should avoid exposure.
<i>Potential Health Effects</i>	
Eyes	Exposure to ionizing radiation may produce adverse effects.
Skin	Exposure to ionizing radiation may produce adverse effects.
Ingestion	Exposure to ionizing radiation may produce adverse effects.
Inhalation	Exposure to ionizing radiation may produce adverse effects..
Target Organs	Lung; bone; fatty tissue
Signs and Symptoms	Acute: diarrhoea, nausea, vomiting, abdominal pain, thirst, fever, difficulty sleeping, tremors, delirium, confusion,

Environmental Effects

convulsions, coma, death.
Chronic: Radioactive material: may cause cancer, adverse reproductive effects, embryo/fetal toxicity, hair loss, rash, skin effects, nail changes, pain, weakness, numbness, tingling, ataxia, constipation, vision changes, hallucinations.
Revert to section 12

4. FIRST AID MEASURES

Eye contact	Not applicable
Skin contact	Not applicable
Inhalation	Move to fresh air. Obtain medical attention.
Ingestion	Not applicable
Notes to Physicians	Xenon-133 gas is a radiopharmaceutical that is used to evaluate pulmonary function and cerebral blood flow, and for imaging the lungs. It is administered by inhalation from closed respirator systems and spirometers. Xenon-133 gas is a readily diffusible gas which is neither utilized nor produced by the body. Most of the Xenon-133 gas that enters the circulation from a single breath is returned to the lungs and exhaled after a single pass through the peripheral circulation. It is essentially an inert gas. Overexposure manifests as asphyxiation.
Medical Surveillance	A pre-placement physical examination and history for employees with potential exposure to this compound is recommended. Baseline testing would include: EKG, a blood test for liver function. Based on opportunity for exposure and duration of exposure a periodic follow-up examination may be considered. This exam should be overseen by a physician thoroughly knowledgeable about both the toxicity of this compound and the extent of work place exposure. It is recommended that the content be similar to the pre-placement exam. Employees who are pregnant, are breast-feeding, or who are concerned with other reproductive issues should be encouraged to consult with the occupational health physician monitoring worker's health.

5. FIRE-FIGHTING MEASURES

Flammable Properties	Material is non-flammable gas.
Extinguishing Media	Dry chemical, Water spray, Foam.
Protection of Firefighters	Specific hazards: Radioactive. Protective equipment: Use personal protective equipment. In the event of fire or leak, wear self-contained breathing apparatus. Hazardous Combustion Products: None
Other Information	Monitor and decontaminate protective clothing and equipment before reuse.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Evacuate affected rooms. Contact the company Radiation Safety Officer. Care should be taken to minimize radiation exposure. Handle as radioactive gas release. Refer to protective measures listed in sections 7 and 8. Use personal protective equipment. Depending on the nature of the spill (quantity and extent of release) a self-contained breathing apparatus may be needed.
Environmental Precautions	Minimize release to the environment.
Containment Methods	Seal leaking containers.
Cleanup Methods	Allow released gas to clear from the affected area through building ventilation.

7. HANDLING AND STORAGE	
Handling Precautions	Avoid exposure - obtain special instructions before use. Contact the company/institution Radiation Safety Officer. Care should be taken to minimize radiation exposure. Handling time should be kept to a minimum. Appropriate radiation shielding should be used. Use of syringe shields and tongs are recommended. Keep material in a lead container. Avoid direct handling by using remote manipulation tools. Obtain appropriate governmental licenses to possess and handle radioactive material. Keep away from heat and sources of ignition.
Storage Conditions	Store at controlled room temperature of 15 - 30°C. Storage and disposal of product should be controlled in a manner compliant with applicable governmental regulations pertaining to radionuclides. Store and handle in a designated area. Keep away from heat, sparks and flames.
Container Requirements	Store in sturdy containers appropriate to maintain the integrity of this material for its intended use.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION				
Exposure Limit(s)	NRC	ICRP/ACGIH	OSHA	NIOSH
Radionuclides	5 rem Whole Body (annual)	20 mSv Effective Dose, (annual)	2.0 mCi Annual Limit (NRC - 10 CFR 20)	---
	15 rem Lens of eye (annual)	150 mSv (lens of eye), Annual Equivalent Dose	0.000001 µCi/ml Derived Air Concentration (NRC - 10 CFR 20)	
	50 rem Skin of whole body (annual)	500 mSv (Skin), Annual Equivalent Dose	50 mSv Effective Dose, (annual)	
	50 rem Extremities (annual)	500 mSv (hands and feet), Annual Equivalent Dose	150 mSv (lens of eye), Annual Equivalent Dose	
	0.5 rem embryo/fetus	500 mSv (embryo/fetus), Equivalent Dose term of pregnancy	500 mSv (Skin), Annual Equivalent Dose	
		2 mSv (abdomen of pregnant woman over course of pregnancy)		
Xenon	---	---	---	---
Exposure Control Banding		Not available		
Lantheus MI Exposure Guidelines Summary		Not available		
Recommended Industrial Hygiene Monitoring Methods		Contact the Lantheus Medical Imaging Radiation Protection Office at 978-671-8672 or 8673.		
Engineering Controls and Ventilation		Use process enclosures, containment technology, or other engineering controls to keep airborne levels below recommended exposure limit.		
Respiratory Protection		Use and selection of respiratory protection is based upon engineering controls in use and potential for gas release. When engineering controls are not sufficient to control exposure to below the exposure limit, wear an approved		

	supplied air respirator.
Eye Protection	Chemical safety goggles and face shields are recommended. Note: Choice of eye protection may be influenced by the type of respirator which is selected.
Hand Protection	Impervious nitrile, rubber and latex gloves are recommended. Please note that employees who are allergic to natural rubber latex should use nitrile gloves.
Skin and Body Protection	Wear disposable coverall, polyethylene apron and sleeves, and shoe covers.
Hygiene	Wash hands and face before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

<i>Appearance</i>	
Physical State	Gas
Color	Colorless
Form	Not applicable
<i>Descriptive Properties</i>	
Molecular Weight	Not available
Odor	Odorless
Solubility, water	Soluble

9. STABILITY AND REACTIVITY

Chemical Stability	Stable under recommended storage conditions.
Conditions to Avoid	Heat, flames and sparks.
Incompatible Products	Not available
Hazardous Decomposition Products	Not available
Hazardous Reactions	Hazardous polymerization does not occur.

10. TOXICOLOGICAL INFORMATION

Routes of Entry	Inhalation
Eye Irritation	Not expected
Skin Irritation	Not expected
Respiratory Irritation	Not expected
Sensitization	Not expected
Acute Toxicity	Xenon/Carbon dioxide: asphyxiation if oxygen displaced. Carbon dioxide: In high concentrations causes rapid circulatory insufficiency.
Carcinogenicity	Ionizing radiation: exposure known to increase risk of cancer. Xenon/carbon dioxide: not listed by IARC, NTP, OSHA, ACGIH.
Reproductive/Developmental Toxicity	Ionizing radiation: exposure known to increase risk of reproductive and developmental effects.
Target Organs	Carbon dioxide: cardiovascular system.
Symptoms	Carbon dioxide: headache, nausea and vomiting, which may lead to unconsciousness.

11. ECOLOGICAL INFORMATION

Ecotoxicological Information (Aquatic)	Not available
Ecotoxicological Information (Terrestrial)	Not available
Chemical Fate	Not available. Hazardous component, Xe-133 will undergo radiological decay to Cs-133, a non-radioactive isotope of Cesium.

12. DISPOSAL CONSIDERATIONS

Advice on Disposal and Packaging	Segregate and label radioactive waste. Disposal should be in accordance with applicable regional, national, and local laws and regulations. Local regulations may be more stringent than regional or national requirements. This information presented only applies to the material as supplied.
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13. TRANSPORT INFORMATION*Transportation Classification for All Modes:*

The classification for transportation of radioactive materials will depend on the specific activity level of the material, type of isotope, as well as the quantity shipped. Specific site procedures should be followed for shipping radioactive materials or seek advice from your site radiation safety officer.

14. REGULATORY INFORMATION**United States of America**

OSHA Hazard Classification	No OSHA Hazards, Note: This regulation does not address hazards related to radioactivity
CERCLA/SARA RQ	Not listed.
313 Toxic Release Inventory. Listed Chemicals/Compounds	No components listed on the SARA 313 inventory.
TSCA Inventory	Not listed. Food, drug and cosmetic products are exempt from TSCA.
California Prop. 65	Carcinogen Radionuclides

International**Canada**

WHMIS	Finished medicinal products are exempt from classification and labeling requirements under the Canadian Hazardous Products Act and Controlled Products Regulations. Note: This regulation does not address hazards related to radioactivity.
DSL/NDSL	Xenon and carbon dioxide are listed. Xenon-133 is not listed.

Mexico

Mexico Classification	Health classification - Minimal hazard -0 - Substances that do not pose a hazard under emergency conditions other than that of ordinary combustible materials. Note: This regulation does not address hazards related to radioactivity.
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Europe

EINECS/ELINCS Number	Xenon: 231-172-7, Carbon Dioxide: 204-696-9
Other information	Medicinal product are exempt from classification and labeling requirements under EU Preparations Directive 1999/45/EC.

15. OTHER INFORMATION

MSDS preparation information

Prepared by	Environment, Health and Safety 1-978-671-8673
Prepared on	3/20/08

The information contained in this MSDS is believed to be accurate and represents the best information reasonably available at the time of preparation. However, we make no warranty, express or implied, with respect to such information. and we assume no liability from its use.