

## Phosphorous-33

1. Radioactive Material Identification
Common Names: Phosphorous-33
Atomic Number: 15
Chemical Form: Soluble
Chemical Symbol: P-33 or <sup>33</sup> P
Mass Number: 33 (18 neutrons)

2. Radiation Characteristics																									
Physical half-life: 25.4 days																									
Specific Activity (TBq/g): 305																									
<table border="1"> <thead> <tr> <th>Principle Emissions</th> <th>E<sub>Max</sub> (keV)</th> <th>E<sub>eff</sub> (keV)</th> <th>Dose Rate (μSv/h/GBq at 1m)</th> <th>Shielding Required</th> </tr> </thead> <tbody> <tr> <td>Beta* (β)</td> <td>249 (100%)</td> <td>85</td> <td>-</td> <td>≤3/8" Plexiglas, plastic, plywood (Recommended, not required)</td> </tr> <tr> <td>Gamma (γ) / X-rays</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>Alpha (α)</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>Neutron (n)</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table>	Principle Emissions	E <sub>Max</sub> (keV)	E <sub>eff</sub> (keV)	Dose Rate (μSv/h/GBq at 1m)	Shielding Required	Beta* (β)	249 (100%)	85	-	≤3/8" Plexiglas, plastic, plywood (Recommended, not required)	Gamma (γ) / X-rays	-	-	-	-	Alpha (α)	-	-	-	-	Neutron (n)	-	-	-	-
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Progeny: Sulfur-33, S-33																									

3. Detection and Measurement	
<b>Methods of detection (in order of preference):</b>	
1.	A radiation survey meter equipped with an energy-compensated Geiger Mueller pancake/frisker detector. (Ludlum)
2.	Ion chamber survey meter (Fluke)
3.	Liquid Scintillation Counting is to be used when conducting wipe tests for analyzing contamination.
<b>Dosimetry</b>	
Whole Body	<input checked="" type="checkbox"/> Skin <input type="checkbox"/> Extremity <input checked="" type="checkbox"/> Neutron <input type="checkbox"/>
Internal: In the event of loss of containment by the sealed source, all precautions should be taken to prevent inhalation or ingestion of the material. Urine bioassay is the most readily available method to assess intake.	
Critical Organ(s): Bone	
Annual Dose Limits: Non-radiation workers: 0.1 rem per year Radiation workers: 5 rem per year, 10 rem total over five years Pregnant radiation workers: 0.4 rem over the balance of the pregnancy	

4. Preventative Measures
Engineering Controls: Use shielding when handling P-32.
Personal Protective Equipment: For normal handling of unsealed sources only. Always wear disposable gloves, safety glasses, and whatever personal protective equipment and clothing appropriate to the material handled.
Special Storage Requirements: Store P-32 behind Plexiglas shielding, additional lead shielding may be necessary. Use tools to handle P-32 sources and contaminated objects; avoid direct hand contact.

5. Control Levels		
Oral Ingestion	Inhalation	
ALI (kBq)	ALI (kBq)	DAC (Bq/ml)
22,200	33,300	0.0000148 (All) 0.0000074 (Phosphates)
<b>Exemption Quantity (EQ):</b>	370,000	Bq

## 6. Non-radiological Hazards

Prolonged exposure to airborne particles may result in abdominal pain, nausea, and vomiting. Additional effects include lethargy, anemia, and dizziness. Could also lead to leukemia or other diseases/cancers.

OSHA Permissible Exposure Limit (PEL):  
0.1 mg/m<sup>3</sup>

## 7. Emergency Procedures

### Personal Decontamination Procedures

- Remove loose contamination. Use care to prevent the spread of contamination and be extra careful around wounds
- Wash contaminated areas. Use mild soap or detergent initially; use a mild abrasive soap for more persistent contamination
- Do not abrade skin, only blot dry

### Spill and Leak Control

- Alert everyone in the area
- Confine the problem or emergency (includes the use of absorbent material)
- Clear area
- Summon aid
- If a release of powdered or gaseous material, evacuate all personnel from room immediately and turn off any equipment that needs constant attention. Prevent others from entering the room.

### Damage to Sealed Radioactive Source Holder

- Evacuate the immediate vicinity around the source holder
- Place a barrier at a safe distance from the source holder (minimum 5 meters)
- Identify area as a radiation hazard
- Contact emergency number posted on local warning sign

### Suggested Emergency Protective Equipment

- Gloves
- Footwear Covers
- Safety Glasses
- Outer layer or easily removed protective clothing (as situation requires)