

PHOSPHORUS-32 [³²P]

PHYSICAL DATA

- Beta energy:
1.709 MeV (maximum)
0.690 MeV (average, 100% abundance)
- Physical half-life:
14.3 days
- Biological half-life:
1155 days
- Effective half-life:
14.1 days (bone) /13.5 days (whole body)
- Specific activity:
285,000 Ci/gm
- Maximum range in air:
610 cm = 240 inches = 20 feet
- Maximum range in water/tissue:
0.76 cm = 1/3 inch
- Maximum range in plexiglas/lucite/plastic:
0.61 cm = 3/8 inch
- Half-Value Layer (HVL):
2.00 mm (water/tissue)

RADIOLOGICAL DATA

- Critical organ (biological destination) (soluble forms): Bone
- Critical organs (insoluble forms or non-transportable ³²P compounds): Lung (inhalation) and G.I. tract/lower large intestine (ingestion)
- Routes of intake: Ingestion, inhalation, puncture, wound, skin contamination (absorption)
- External and internal exposure from ³²P
- Bone receives approximately 20% of the dose ingested or inhaled for soluble ³²P compounds.

- Tissues with rapid cellular turnover rates show higher retention due to concentration of phosphorous in the nucleoproteins.
- ^{32}P is eliminated from the body primarily via urine.

SHIELDING

- $\leq 3/8$ inch thick plexiglas/acrylic/lucite/plastic/wood
- Do not use lead foil or sheets! Penetrating Bremsstrahlung x-ray will be produced!
- Use lead sheets or foil to shield Bremsstrahlung x-rays only **after** low density plexiglas/acrylic/lucite/wood shielding.

SURVEY INSTRUMENTATION

- GM survey meter and a pancake probe.
- Low-energy NaI probe is used **only to detect Bremsstrahlung x-rays**.
- Liquid scintillation counter (indirect counting) may be used to detect removable surface contamination of ^{32}P on smears or wipes.

DOSE RATES

(from unshielded 1.0 mCi isotropic point source)

<u>Distance</u>	<u>Rads/hr</u>
1.00 cm	348
15.24 cm	1.49
10.00 ft	0.0015

- 780,000 mrad/hr at surface of 1.0 mCi ^{32}P in 1 ml liquid.
- 26,000 mrad/hr at mouth of open vial containing 1.0 ml ^{32}P in 1.0 ml liquid.

GENERAL PRECAUTIONS

- Because it is a bone seeker, special precautions must be taken to minimize any chance of introducing into the body.
- Airborne contamination can be generated through drying (dust), rapid boiling, or expelling solutions through syringe needles and pipette tips, due to aerosols.
- Personnel radiation monitors (whole body and finger rings) are **required** when handling greater than 1.0 mCi of ^{32}P at any time.

- Never work directly over an open container; avoid direct eye exposure from penetrating ^{32}P beta particles.
- Always wear a lab coat and disposable gloves when handling ^{32}P .
- Monitor personnel work areas and floors using a GM survey meter equipped with a pancake (beta) probe, for surface contamination.
- Monitor for removable surface contamination by smearing, or wiping where ^{32}P is used.
- Use low-density (low atomic number) shielding material to shield ^{32}P and reduce the generation of Bremsstrahlung x-rays. The following materials are low atomic number materials: Plexiglas, acrylic, lucite, plastic, wood, or water.
- Do NOT use lead foil, lead sheets, or other high density materials (metals) to shield ^{32}P directly. Materials with atomic number higher than that of aluminum ($Z = 13$) should NOT be used. Penetrating Bremsstrahlung x-rays will be generated in lead and other high density shielding material.
- Safety glasses or goggles are recommended when working with ^{32}P .
- Typical GM survey meter with pancake probe efficiency is greater than or equal to 45%. Typical liquid scintillation counter counting efficiency for ^{32}P (full window/maximum) greater than or equal to 85%.
- Typical detection limit of ^{32}P in urine specimens using a liquid scintillation counter = 1.1×10^{-7} uCi/ml.

- **POST-USE**

- After handling P-32,
 - Use the Geiger Counter to check your hands, shoes, clothing, work bench, floor, centrifuges, and water baths for contamination.
 - If any contamination is found on your shoes and/or clothing, contact the RSO. You will likely have to remove it temporarily until the radiation decays to background.
 - If any contamination is found on your hands, wash thoroughly with soap and water. This will usually be sufficient to remove the surface contamination. If it does not, contact the RSO for assistance.
 - If any contamination is found on the work bench, floor, or lab equipment, use a commercial radiation contamination remover (i.e. Count Off) with paper towels to clean up the equipment. Place the towels in the radioactive waste receptacle.
 - If contamination cannot be removed, place a "radiation" label on the equipment indicating that it is P-32, maximum dpm found, and the date you measured the level.

- If contamination cannot be removed from the floor, contact the RSO to obtain shielding materials.
- Inform your fellow lab workers if any unremovable contamination is found.
- Check the normal trash container to make sure no radioactive waste has been accidentally placed there.
- Store the waste temporarily in plexiglass containers or other containers which are sufficient to absorb P-32's beta particles.
- Wash your hands thoroughly after using P-32.