

PHOSPHORUS-32

[³²P]

Physical and Radiological Data

Physical half-life:	14.3 days
Effective half-life:	14.1 days (bone), 13.5 days (whole body)
High-energy beta emitter:	1.71 MeV (max), 0.690 MeV (average)
Maximum range in air:	20 feet = 6.1 meters
Maximum range in tissue/water:	1/3 inch = 0.76 cm
Maximum range in plexiglas:	3/8 inch = 0.61 cm
Critical organ:	Bone

Special Concerns

- ◆ Bremsstrahlung x-rays.
Penetrating Bremsstrahlung x-rays will be produced if high-density materials (i.e. lead, foil) are directly used to shield ³²P. These high-density materials may be added to the exterior of a low-density shield (plexiglas) but should not be used alone.
- ◆ Radiation exposures from dry ³²P.
³²P in solution is slightly shielded by the liquid itself, whereas dry ³²P emits unshielded particles (max range in water=1/3 inch vs. max range in air=20ft). Therefore, any process involving dry ³²P (i.e. blots, paper chromatography) should be done with frequent monitoring of exposure levels because the radiation exposure rate from dry ³²P is much higher than that of ³²P in solution.

Shielding

- ◆ Low-density materials should be used to shield ³²P. Plexiglas (lucite) is the most highly recommended, but acrylic, plastic, wood and water will also work.
- ◆ High-density materials, materials with an atomic number higher than that of aluminum, should NOT be used directly. Bremsstrahlung x-rays will be generated in these materials unless low density shielding first blocks the emitted particles.

- ◆ Shields should be thick enough to provide adequate protection from beta particles. Plexiglas of 3/8 to 1/2 inch is usually sufficient. If more than 1 mCi will be handled, at least 1/2 inch thickness is recommended.

General Safety Precautions

- ◆ All persons handling ^{32}P must wear a whole body dosimeter and ring badge. Ring badges should be worn on the hand which is most used for handling vials, pipettes, etc.
- ◆ All persons handling ^{32}P must wear a lab coat and disposable gloves. Safety glasses are recommended.
- ◆ Do not work directly over an open vial or container of ^{32}P .
- ◆ Do not pipette ^{32}P by mouth.
- ◆ Pipettes should be committed solely to ^{32}P use and clearly labeled.
- ◆ Always use shields in areas of work, storage, and waste storage. Frequently monitor exposure levels in front of the shield to be sure the protection is adequate.
- ◆ Always have a radiation detection instrument in operation when handling ^{32}P . Check the batteries before beginning. A single sheet of plastic wrap should be kept around the detection window to avoid contaminating it.
- ◆ Frequently monitor gloves, work area, floor, and shoes for contamination.

Contamination

A radiation level greater than or equal to three times background is considered contamination. Here are some tips on what to do when contamination is found.

- ◆ If contamination is found on your hands/skin:
Do not touch anything, this may spread contamination to door handles, etc. Wash thoroughly with non-abrasive soap and water, *blot* dry. Do not rub or abrade skin. Contact the RSO if this does not remove the contamination. Monitor areas that may have been touched.
- ◆ If contamination is found on your shoes/clothing:
Do not walk around in contaminated shoes. Contaminated clothing will need to be removed, but some shoes may be decontaminated with a commercial contamination remover. Survey the area and floor to determine the extent of contamination. Contact the RSO.

- ◆ If contamination is found on the floor:
Immediately mark off the area and prevent anyone from walking near the contamination. Use a commercial decontaminant (i.e. Radiacwash) and paper towels to clean the area. Swipe the paper towels only once across the area and discard (in radioactive waste). To use a sweeping motion would only spread the contamination. Be sure to monitor shoes. Contact the RSO.
- ◆ If contamination is found on the countertop, lab equipment, etc:
Use a commercial decontaminant and paper towels to clean the area. Place equipment in a shielded area if contamination cannot be removed.

Decay Table

DAYS	DECAY FRACTION	% ACTIVITY REMAINING
0	0.100	100
2	0.908	90.8
4	0.824	82.4
6	0.748	74.8
8	0.678	67.8
10	0.616	61.6
12	0.559	55.9
14	0.507	50.7
16	0.460	46.0
18	0.418	41.8
20	0.379	37.9
22	0.344	34.4
24	0.312	31.2
26	0.283	28.3
28	0.257	25.7
30	0.233	23.3
143 (10 HALF LIVES)	0.001	00.1

Specific Activity

The following formula can be used to calculate specific activity after the assay date:

$$\text{Specific Activity} = \frac{\text{Decay Fraction}}{\frac{1}{\text{Specific Activity on Assay Date}} - \frac{(1 - \text{Decay Fraction})}{\text{Theoretical Specific Activity}}}$$

Where Theoretical Specific Activity = 9120