Radionuclide Safety Data Sheet

PHYSICAL DATA

Radionuclide:	Phosphorous-32 (P-32)
Decay Mode:	Beta (100% abundance)
Beta Energy:	1710 keV (maximum); 694 keV (average)
Physical Half-Life:	14.3 days
Biological Half-Life:	1155 days (Bone)/ 257 days (Whole Body)
Effective Half-Life:	14.1 days (Bone)/13.5 days (Whole Body)
Specific Activity:	285,518 curies / gram
Maximum Beta Range in Air:	610 cm = 20 feet
Maximum Beta Range in Water/Tissue:	0.76 cm = 1/3” - Energy > 795 keV can penetrate lens of the eye (0.3 cm) - Energy > 70 keV required to penetrate dead layer of skin; 95% of P-32 particles penetrate dead layer (0.007 cm)
Maximum Beta Range in Lucite/Plastic:	0.61 cm = 3/8”

RADIOLOGICAL DATA

Critical Organ:	Bone (soluble P-32), Lung (inhalation) and GI Tract/LLI (ingestion for insoluble forms and non-transportable P-32 compounds
Routes of Intake:	Ingestion, Inhalation, Puncture, Skin Contamination (Absorption)
Exposure Concerns:	Internal & external exposure and contamination
Committed Dose Equivalent (CDE):	Inhalation: 95 mrem/uCi (Lung) Ingestion: 30 mrem/uCi (Marrow)
Committed Effective Dose Equivalent (CEDE):	Inhalation: 16 mrem/uCi Ingestion: 8.8 mrem/uCi
Annual Limit on Intake (ALI):	600 uCi (ingestion / all compounds) 900 uCi (inhalation / except phosphates) 400 uCi (inhalation / phosphates) (1 ALI = 5,000 mrem CEDE)

SKIN CONTAMINATION:

VERY HIGH LOCALIZED DOSE IF P-32 CONTAMINATION REMAINS ON SKIN

Skin Contamination Dose Rate (0.007 cm tissue depth): 7030 mrem/hour per 1 uCi/cm^2

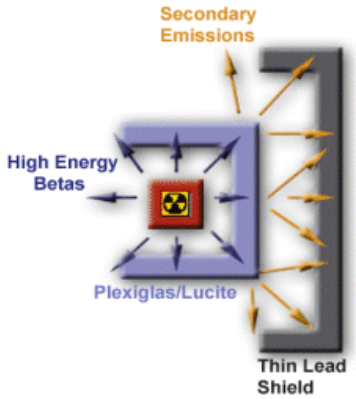
SURVEY INSTRUMENTATION:

P-32 can be detected with a survey meter equipped with a GM probe (pancake probe preferable)
Counting efficiency of P-32 with GM survey meters is about 25%
Low energy NaI probe should be used only to detect bremsstrahlung x-rays
Wipes/smears should be counted on a liquid scintillation counter to detect P-32 contamination. Counting efficiency on a Perkin Elmer liquid scintillation counter is approximately 98%.

SHIELDING/LABELING

Shielding : > 3/8" thick plexiglass, acrylic, Lucite, plastic or wood will completely shield P-32
Do NOT shield soley with lead because bremsstrahlung x-rays will be produced with P-32 high energy beta particles
May use lead AFTER the low Z material (e.g., Lucite, plastic) if Bremsstrahlung radiation is present

Labeling: Container with $\geq$ 10 uCi must be labeled "Caution, Radioactive Material"



PERSONAL RADIATION MONITORING DOSIMETERS

Personnel dosimetry (whole body & ring badges) are required in working with millicurie amounts of P-32

BIOASSAY REQURIEMENTS

Not normally required. Notify Radiation Safety if an intake of P-32 is suspected

DOSIMETRY

The bone is the critical organ for intake of transportable compounds of P-32 (bones receives about 20% of dose ingested). Phosphorus metabolism is complex; 30% is rapidly eliminated from the body, 40% possesses a 19-day biological half-life, and the remaining 30% is reduced by radioactive decay. If ingested, 60% of P-32 is excreted in the first 24 hours; only about 1% is excreted after the 2nd or 3rd day. The lung and large intestine are the critical organs for inhalation and indigestion, respectively, of non-transportable P-32 compounds. The high energy beta emissions can present a substantial skin dose hazard. For example, 1 uCi of P-32 on a 1 cm^2 area of bare skin can produce a dose rate of 7 to 8 rem/hr to the skin. Multi millicurie quantities of P-32 can produce a significant secondary radiation (bremsstrahlung x-rays) presenting an external exposure hazard.

RADIOACTIVE WASTE

Isolate waste from other radionuclides in clearly labeled containers.
Sanitary sewer disposal limit is 100 uCi in any one day via a designated "hot" sink provided it is readily soluble, dispersible in water, and contains no hazardous materials. A sewer log must be maintained.

GENERAL RADIOLOGICAL SAFETY INFORMATION (P-32)

(Permission from University of Michigan Radiation Safety Office)

- Inherent Volatility (STP): Insignificant / Negligible; P-32 is not volatile, even when heated, and can be ignored as an airborne contaminant unless aerosolized.
- White vinegar can be an effective decontamination solvent for this nuclide in most forms.
- P-32 is used as a tracer to study phosphorus-containing processes (nucleotide biochemistry).
- Skin (0.007 cm) & lens of the eye (0.3 cm) are primary dose concerns.
- Skin contamination (skin dose), lens of the eye dose, ingestion, inhalation, puncture, absorption through skin, and area contamination are primary radiological concerns.
- Drying can cause airborne P-32 dust contamination.
- Rapid boiling can cause airborne P-32 contamination.
- Expelling P-32 solutions through syringe needles and pipette tips can generate airborne aerosols.
- Never work directly over an open container of P-32. Avoid direct eye exposure from penetrating P-32 beta particles.
- Always wear a lab coat and disposable gloves when handling P-32.
- Monitor your hands, shoes, lab coat, work areas, and floors using a survey meter equipped with a thin-window G-M probe for gross contamination. Preferably, use a sensitive G-M pancake / frisker probe (15.5 cm^2 monitoring area).
- Monitor for removable surface contamination by smearing, swiping, swabbing, or wipe testing where P-32 is used. Count smears or swabs in a liquid scintillation counter (LSC).
- Use low-atomic (low Z) shielding material to shield P-32 and reduce the generation of bremsstrahlung x-rays. The following materials are low Z materials: plexiglass, acrylic, lucite, plastic, wood, or water.
- DO NOT use only lead foil, lead sheets, or other high-density (high atomic number) materials to shield P-32 directly. Penetrating bremsstrahlung x-rays will be generated in lead and other high density shielding material May use lead AFTER the low Z material (e.g., Lucite, plastic) if Bremsstrahlung radiation is present..
- Percent of incident P-32 betas converted to bremsstrahlung x-rays: 4.8% (lead), 0.5% (lucite), and 0.3% (wood).
- Safety glasses or goggles are recommended when working with multi millicurie amounts of P-32.