

Inside This Issue:

- Radiolabeling Red Blood Cells with Pyrophosphate
- NRC Regulatory Issue Summary 2005-24: Control of Radiation Dose To Visitors of Hospital Patients
- NeutroSpec® Supply Update
- Tc-99m Supply Update
- Ultratag® Supply Update
- Co-57 Dose Calibrator Source, and Radiation Safety Training Videos Rental

Radiolabeling Red Blood Cells with Pyrophosphate

As you well know, Ultratag RBC™ kit for labeling red blood cells has been in short supply for much of the last quarter of 2005 and new product will not be released until late January 2006. The alternative procedure for blood pool imaging utilizes pyrophosphate (PYP) as a source of stannous chloride. The PYP is first reconstituted with 3 mL preservative-free normal saline. A 1 to 3 mL portion of the reconstituted kit is then injected to accomplish “tinning” the red blood cells. Stannous chloride crosses the red blood cell membrane where it will react with Tc-99m sodium pertechnetate when it is injected, separately, thirty minutes later. Stannous ions that remain in the extracellular space are oxidized during this time. Sodium pertechnetate also crosses the red blood cell membrane and in the presence of stannous chloride is reduced and bound to hemoglobin.

The above technique is known as *in vivo* labeling of red blood cells. Modified *in vivo* labeling has been shown to increase labeling efficiency and improve blood pool to background ratios. Either ACD or heparin may be used as an anticoagulant for this technique. The patient dose of pyrophosphate is administered the same as the *in vivo* method. An intravenous line containing a 3-way stopcock is inserted into a large peripheral vein and kept with a continuous drip of preservative free normal saline. Thirty minutes after PYP administration, the infusion line and stopcock are cleared by withdrawing approximately 5 mL whole blood. Immediately following, approximately 5 mL whole blood are withdrawn into a syringe containing 1 mL preservative-free acid-citrate-dextrose (ACD) and 15 to 20 mCi Tc-99m sodium pertechnetate. The stopcock is then turned, residual blood is flushed from the intravenous line, and the normal saline flow is readjusted. The syringe is gently rotated to mix and allowed to incubate at room temperature prior to injection via the 3-way stopcock. If heparin is used as the anticoagulant, the infusion set is heparinized with a saline solution containing 5 to

10 units preservative-free heparin per mL. The infusion set should not be cleared with whole blood as the residual heparin is all that is needed for anticoagulation. Only 3 mL whole blood is withdrawn into the syringe containing 15 to 20 mCi Tc-99m sodium pertechnetate. Incubation time is 10 minutes.

If you have questions on this or any other procedure, please call and speak with a pharmacist any time.

NRC Regulatory Issue Summary 2005-24: Control of Radiation Dose to Visitors of Hospital Patients

Patients undergoing nuclear medicine procedures, diagnostic or therapeutic, as well as patients with brachytherapy implants, may be released from the hospital only if they meet certain conditions specified in NRC's regulations (10 CFR 35.75). Visitors to these patients during their confinement are considered to be members of the public, and are thus subject to the dose limits applicable to members of the public. These limits are 0.1rem (1millisievert) in a year or 0.002rem (0.02 millisievert) in any one hour, or 0.5rem (5 millisievert) in a year with prior NRC authorization (10 CFR 20.1301). The hospital's radiation protection staff are required to ensure that doses do not exceed these limits, and that all reasonable measures are taken to keep doses ALARA.

In many situations involving exposure of visitors in patient rooms, the visitors are not provided with radiation-monitoring devices, such as self-reading pocket dosimeters, to measure the doses they receive during the visits, nor is such monitoring required by regulation. This is adequate if it is prospectively determined that the doses to visitors, under the specific conditions of the case, are unlikely to exceed any limit or action level. Otherwise, the hospital radiation protection staff should either issue personnel-monitoring devices to the visitors or must rely on the radiation survey data routinely conducted in the patient's room to estimate and monitor visitor doses in real time. Under certain conditions, and

where adequate data are available, the doses received by the visitors may be calculated, but such calculations are complex, require a considerable amount of input data, and are normally performed only if it becomes necessary to undertake a retrospective dose assessment. The calculations are generally not suitable for controlling an ongoing exposure situation.

This summary discusses some of the measures that may be used to maintain control and minimize doses to visitors, and also discusses the types of information that may be needed if a retrospective dose assessment becomes necessary. In addition, it provides guidance on the use of radiation survey data to estimate visitor doses in those cases where visitors are not provided with personnel-monitoring devices.

To assist in maintaining compliance with regulatory requirements, and in assessing doses to visitors.

1) Mark the floor of the patient's room to designate areas with high exposure rates.

2) Survey locations and frequencies should be planned to identify these changes in exposure rates as they occur, allowing timely action in controlling visitor activities.

3) In cases where it is anticipated that the dose to a visitor will approach a substantial fraction of the applicable limit, it is important to increase control of exposures to avoid exceeding that limit and contact the NRC if necessary.

4) Utilize pocket dosimeters if available.

5) Determine the probability of radioactive contamination in the patient's room on surfaces or in the air.

A detailed retrospective dose assessment should be considered whenever available information suggests that the dose to any person may have exceeded an applicable limit, and when there is insufficient reliable data to directly assign a dose to the exposed visitor.

To determine the relationship of the survey readings to visitor dose, NRC has made detailed calculations of the radiation fields around a patient lying on a hospital bed and containing radioactive material administration during nuclear medicine or brachytherapy procedures. The calculations estimated the relationship between the readings of a survey instrument, in R/hr, at specified locations around the bed, and the effective dose rate that would be received by a person present at that location. The details of this study were presented in **Health Physics Journal, Volume 89, Number 3, 2005.**

Based on these calculations, NRC will consider it acceptable to use the reading of a calibrated and correctly functioning survey meter, in R/hr, as directly indicating the effective dose rate to a visitor,

in centisievert per hour (cSv/hr, rem/hr), who may be present at the survey location. The surveys should be performed without the presence of the visitor, and the survey instrument should be held at some distance (e.g. at arm's length) from the body of the person performing the surveys. Failing to take these precautions will lead to high survey readings and will, in turn, cause the effective dose rate based on these readings to be overestimated. This is a result of backscatter from the person's body contributing to the survey reading. Assuming no internal exposures, the effective dose determined in this manner may be considered to be equal to the TEDE for purposes of showing compliance with applicable dose limits. If you have any questions, or for a complete copy of NRC Regulatory Issue Summary 2005-24: Control of Radiation Dose to Visitors of Hospital Patients, feel free to contact Radiopharmacy and we will be happy to help.

NeutroSpec® Supply Update

Mallinckrodt has issued a voluntary recall on NeutroSpec® effective December 19, 2005. They have given no time line for resuming production or reintroduction of NeutroSpec® to the market. We will keep you informed as the situation develops.

Tc-99m Supply Update

Mallinckrodt will not resume production of ⁹⁹Mo/^{99m}Tc generators until at least **March 31, 2006**. They are re-tooling their generator production line. After re-tooling is complete, they must re-validate their processes. The good news, however, is that Bristol-Meyers-Squibb has been able to meet current market demands for generators, and they anticipate being able to continue doing so.

Ultratag® Supply Update

We have just received news that, due to recent production problems, Mallinckrodt is not currently able to fill orders for UltraTag® kits. The expected release date for new product is **January 30, 2006**. Radiopharmacy last received an UltraTag® shipment from Mallinckrodt in late October. We were informed the second week of December that we (or anyone else in the US) can not expect another shipment until the end of January.

We are now completely out of vials of UltraTag®. We ask that you use an alternative to UltraTag® (i.e., PYP) when possible during the next 5-6 weeks.

Co-57 Dose Calibrator Source, and Radiation Safety Training Videos Rental

NRC and Agreement States require that radioisotope dose calibrators be tested for accuracy annually with at least two different sealed sources. One must have a principal photon energy between 100 and 500 keV. Because Co-57 has a photon energy close to Tc-99m it is a good choice for one of the two radionuclide sources. However, since the half life of Co-57 is only 270 days, your source must usually be replaced every three to four years. The NRC requires the source be at least 50 uCi. The cost of a 5 mCi dose calibrator source is more than \$700 including shipping. That makes the annual cost at least \$175 for the Co-57 source alone.

The Radiopharmacy would like to offer our customers who are purchasing their own Co-57 sources an option. You may "rent" a source from us for \$50. We always keep on hand a Co-57 dose calibrator source that is at least 50 uCi, and we are able to deliver and retrieve it with your normal deliveries. Simply give us a call if you are interested.

Radiation safety training for nuclear medicine support staff is an annual requirement, and for most an annual headache. Getting staff from nursing maintenance, housekeeping, etc., together all at once is practically impossible, and buying a \$300-\$500 training video is not a real attractive alternative.

Radiopharmacy has hopefully found a better solution. We have radiation safety videos that are available for your use. One is titled "Radiation Safety and Common Sense", and the other "Radiation Safety Training for Hospital Support Staff". Rental fee is \$50 per week per video. We anticipate most people need only one video for one week.

If you have questions about anything in the "Monthly Scan" don't hesitate to call us at (812) 421-1002 or (800) 755-5889 or visit us online at

www.radiopharmacy.com

