

RADWASTE CARD: RADIONUCLIDE ACTIVITY ASSESSMENT

During a recent inspection by the Illinois Emergency management Agency, a violation was identified when personnel in a laboratory informed the inspectors that the laboratory had no method for determining the activity placed into the waste storage containers. ORS expects each investigator to develop a method that suits his or her own needs and doesn't endorse any one method over another. This article describes two methods that may be considered.

The total activity to declare on the rad-waste cards can be estimated by means of two different methods: the NCA (Non Corrected Activity) and the ECA (Empirically Corrected Activity). Both methods are conservative: they overestimate the true value of the total activity contained in the waste drum/jug at the time of the pick up. Both methods can be applied to both kinds of waste generated, solids and liquids, and to all radioisotopes used within Northwestern University.

NCA

For a given collecting period, the value of the total activity to declare, "A_{nc}" is the sum of the single total activities "A" listed on the inventory sheets as amounts of activity consigned to waste during that collecting period and for that specific radionuclide:

$$A_{nc} = \sum_{pinksheets} A$$

The collecting period is the interval of time between the delivery date of the empty container and the physical pick up date of the drum/jug. This method can be applied to all time lengths of collecting periods.

ECA

If the waste drum/jug is kept in the research laboratory for a number of days "g" for which is true the relationship $T_{1/2} \leq g \leq 2 \cdot T_{1/2}$ (where "T_{1/2}" is the radioisotope half-life measured in days) then the value of the total activity to declare on the rad-waste card, "A_{ec}", is estimated as follows:

$$A_{ec} = A_{nc} \cdot w(g) \cdot w(A_{nc}) \quad \left\{ \begin{array}{l} w(g) = e^{-0.0184 \cdot g} \\ w(A_{nc}) = -0.0039 \cdot A_{nc} + 1.2088 \end{array} \right.$$

Where:

- A_{ec} = Empirically Corrected Activity
- A_{nc} = Non Corrected Activity (estimated as in NCA method)
- w(g) = Correction due to the number of days relative to the collecting period
- w(A_{nc}) = Correction due to the disposed amount of non corrected activity

This method can be applied only when the collecting period satisfies the condition imposed on the number of days "g"; obviously, for H-3 and C-14 this condition is never satisfied.

In conclusion, while the NCA method can be always applied, the ECA method can be applied only in particular circumstances. However, even if the NCA can be considered more general, the ECA, when applicable, leads to a more accurate response in terms of overestimation of the true value of the activity effectively contained in waste drum/jug at the time of pick up.

Use this NUtrino as a training tool for new workers and required annual refresher training for current workers. Circulate it among the radiation workers in your group and have them sign and date the training form on the back. File it with your authorization and other radiation safety documents for review during regulatory inspections. Discuss it during laboratory meetings. You can find back issues at <http://www.research.northwestern.edu/research/ors/rad/nutrino/>.