**Sufficient Accuracy Outline**

1. Introduction

    a. *Brief overview of "sufficient accuracy" and the purpose of the document*

*2.* Rule Requirements

    *a.* Per 42 CFR § 83.13 (c)(1)(i)*, Radiation doses can be reconstructed with sufficient accuracy if NIOSH has established that it has access to sufficient information to estimate the maximum radiation dose, for every type of cancer for which radiation doses are reconstructed, that could have been incurred in plausible circumstances by any member of the class or if NIOSH has established that it has access to sufficient information to estimate the radiation doses of members of the class more precisely than an estimate of the maximum radiation dose.*

3. Preliminary Steps to Evaluating Sufficient Accuracy
    a. Review work processes at the facility to establish exposure potential
        i. Evaluate the radioactive material source terms and/or the types of radiation generating devices employed
        ii. Determine the potential for internal and/or external exposures
    b. Identification of Exposed Population(s)
        i. If the potential for exposure existed, identify which workers (or groups of workers) were potentially exposed.
        ii. Determine if there is any potential for exposure variability within the exposed population(s).
    c. Apply hierarchical review (described below) using available data and/or information to determine if maximum radiation doses under plausible circumstances in each of the identified exposed population(s) can be reconstructed

*4. Hierarchical Review Used in the Evaluation of Sufficient Accuracy*
    *a. Personal Monitoring Data*
        i. If personal monitoring data are used to establish a maximum dose to unmonitored workers that incurred in plausible circumstances, it must be possible to demonstrate that the highest exposed workers were monitored. This can be done by showing that: 1) most of the exposed work force was monitored (e.g., uranium at Weldon Spring); 2) or that a large portion of a smaller potentially exposed group was monitored (Mound research quantity isotopes) and that the monitored group included the workers expected to receive the highest exposure.
        ii. The monitoring method must allow for either directly or indirectly measuring the exposure potential (i.e. uranium bioassay for uranium exposures). For analyses not directly connected to the nuclide (such as gross alpha), additional analyses must also provide a method of sorting out different exposures without the method resulting in "implausibly high" intake values for some isotopes. For example, gross alpha measurements in urine that were primarily caused by uranium intakes could not be assumed to be the result of thorium exposure if the resulting calculations produced unrealistically high thorium estimates.
        iii. Coworker models, which use personal monitoring data to reconstruct doses for unmonitored workers who were potentially exposed, must adequately reflect the exposures conditions of those workers. This includes accounting for potential stratification of exposures within the unmonitored worker population.

b. Air Monitoring Data (From white paper)
    i. Air monitoring information has a number of obstacles to overcome to demonstrate that it can be used to establish a maximum dose incurred in plausible circumstances. Not only do the samples collected have to represent the breathing zone during operations, but it also is necessary to understand which workers were exposed and for how long. This is often done in a bounding fashion by assuming all workers were in the highest airborne activity area 100% of the time. This practice can, however, lead to unrealistically high intake estimates. An example would be the decision made at Linde Ceramics that office workers' exposures could not be reconstructed by assuming continuous exposure to the high level air sample levels associated with decommissioning and decontamination activities.

c. Source Term Data (From white paper)
    i. Source term data can take many forms depending on its use. It can be used as a starting point for the use of surrogate data or as input to an exposure model.
    ii. Model
        1. Like air monitoring data, models must overcome the problem of producing unrealistically high estimates. The reason that models often provide unrealistic estimates is the tendency to conservatively estimate every parameter. By including conservatively high estimates of parameters such as building ventilation rate or respirable particle fractions, models can easily produce implausibly high exposure estimates.
        2. Besides the source term data necessary for a model, a number of assumptions are usually necessary and each of them must have an adequate basis to be scientifically defensible.
    iii. Surrogate Data
        1. To justify the use of surrogate data source term data is necessary. Also, the operations, engineering and administrative controls, material quantities must be similar. Again bounding data may be applied at times but this can cause unrealistically high values. The conditions required for the use of surrogate data are discussed in OCAS-IG-004.

5. Consideration of the Exposure Potential (added based on work group discussion)
    i. When dealing with exposures that produce low doses, there can be an allowance for greater uncertainty in application of upper bound estimates.
    ii. This is often applicable in the reconstruction of doses during residual contamination periods where the potential exposures are due to resuspension of radioactivity deposited on surfaces or in most cases from environmental doses.

6. References

Appendix A - Past Precedence

a. Identify how has "Sufficient Accuracy" been dealt with to date by describing the characteristics of previously evaluated SEC cases. This would be something similar to the table included at the

end of the January 2013 NIOSH report titled: *Review of Parameters Associated with Defining Sufficient Accuracy*