Action Plan for Implementation of Peer Review Recommendations

SMDA-91.053

Safeguards Measurements

Duct Holdup Measurement Program

July 11, 1991

EG&G Rocky Flats, Inc.
P.O. Box 464
Golden, CO 80402-0464

Action Plan for Implementation of Peer Review Recommendations

INTRODUCTION

Task 1.6 of the Duct Remediation Program Plan (DR-PP-001) calls for an independent technical peer review of the EG&G Rocky Flays, Inc. (EG&G/RF) Safeguards Measurements Phase II NDA Holdup Measurements Program. To this end, members of the Safeguards Assay Group (N-1), Los Alamos National Laboratory, conducted an on-site review April 2,3, & 4, 1991. This technical review evaluated all aspects of holdup measurement methodology, to include detector set-up, detector calibration, data evaluation, measurement error evaluation, measurement error propagation, and measurement data reporting. The review committee members participated in both technical discussions of the measurement procedure and actual holdup measurements. Observations and recommendations proposed by the technical review committee are presented in a summary report, "EG&G Rocky Flats Duct Holdup Measurement Program: Major Observations and Recommendations of the Peer Review", Los Alamos National Laboratory, LA-UR-91-2104, and in the report, "Technical Peer Review of Rocky Flats Duct Holdup Measurement Program", Gregory A. Sheppard et.al., N-1-91-580 (Appendix A).

The review committee found the holdup measurement program to be technically sound, however, the LANL review committee proposes steps to improve the current holdup measurement program. These recommendations can be subdivided into three general topics; eliminate known biases, establish measurement uncertainty based on technical experience, and optimize use of far-field and contact measurements. A general discussion of these topics with specific recommendations is presented in the summary and review documents.

The first topic, "eliminate known biases", will be addressed in this plan in the form of a brief summary of the recommendations and the actions planned by EG&G/RF.

The second topic, "establish measurement uncertainty based on technical experience", will be addressed in a follow-on report. However, the implementation of actions outlined in this plan will increase the measurement accuracy and, therefore, decrease the measurement uncertainty.

The third topic, "optimize use of far-field and contact measurements", is carried out in part through implementation of the actions detailed in this plan. In addition, since some areas containing glovebox exhausts ducts are inaccessible from a far-field measurement standpoint (because of obstructions or interferences, i.e. gloveboxes, chainveyors, conduit, return air ducts, etc.), *"optimization of the use of far-field and contact measurements" is not* possible. However, far-field data and data obtained at duct contact have been compared since the Phase II program was implemented in November, 1989; these data comparisons will continue as accessibility and schedules allow. Lastly, a joint research and development effort should be instigated by LANL and EG&G/RF personnel with the purpose of optimizing future holdup measurements.

RECOMMENDATIONS AND IMPLEMENTATION

The reduction of measurement bias is a six part enhancement that calls for an adjustment in the detector-to-holdup calculation, the addition of a gamma-ray energy summation in the 500 to 580 keV spectral region, an integration of the unmodified point assay data, a uniform deposit calculation in specific locations, the implementation of an improved width model calculation, and a correction for material self-attenuation at specific locations. The uniform deposit calculation is a deterministic option which selects data treatment based upon statistical inference. The correction for material self-attenuation is only a concern where high material concentrations are identified.

RECOMMENDATION 3.3.C.1.a -- Adjustment in the Detector-to-Holdup Calculation

Adjust the detector-to-holdup distance by one pipe wall thickness. This will reduce D_T by 0.7 times the wall thickness, and increase D_B by the same factor.

The detector-to-holdup distance will be adjusted according to the pipe wall thickness.

The following information was not included in the peer review report but is a follow-on to Recommendation 3.3.C.1.a.

The initial pipe wall thicknesses and subsequent attenuation factors were based upon "schedule 10" pipe specifications, however, ultrasonic measurements indicate that not all ducts meet this particular specification. A majority of the duct wall thicknesses are less than that of "schedule 10".

In areas where ultrasonic measurements can be correlated to holdup measurements (ultrasonic measurements ongoing) detector-to-holdup distances and pipe wall attenuation factors will be based upon measured pipe thicknesses.

RECOMMENDATION 3.3.C.1.b -- Addition of Gamma-ray Energy Summation

Add an additional Region Of Interest (ROI) above the Pu ROI, between approximately 500 and 580 keV. Use this ROI to subtract continuum, of Compton-scattered, gamma rays from the Pu ROI in both background and assay spectra. This will reduce the bias resulting from the artificially elevated Pu peak count rates. Such action, however, will increase the number of count integrals that the assayist must record, and will require a modification of the calibration form, the data logging forms, and the software.

An additional γ-ray peak region of interest will be incorporated into the measurements recording program and the instrumentation software. Appropriate changes will be made in the analysis program to utilize this new data for the assessment of the Compton-continuum in both background and assay spectra.

RECOMMENDATION 3.10.C.4 -- Integration of Unmodified Point Assay Data

We recommend integrating the unmodified point assay data over the length of a duct or major duct section to minimize the cumulative positive bias effect of propagating the Critical Level. If the point assays were computed at each measurement location using the net count rates, without changing the signs, then the integration of mass per unit length over the length of the duct would result in a more realistic value.

The reduction of the systematic error component for individual measurements enables summations to be performed using unmodified point assay data. This data utilization option minimizes the propagated error which is introduced when individual point applications are summed using the minimum detectable level criteria. The unmodified point assay data will be integrated over each length of duct measured.

RECOMMENDATION 3.3.C.2 -- Uniform Deposit Calculation in Specific Locations

Before testing C_T/C_B to determine which of the three deposit width options should be exercised, propagate the random error associated with that quantity in order to determine its statistical significance. If the ratio is not statistically less than unity, and there are no other data to support an alternative approach, then we recommend averaging the top and bottom count rates and assuming a uniform deposit that completely covers the duct's inside surface.

The statistical evaluation of material deposition ratios is already an integral part of the holdup measurement program. The utilization of this data to determine the uniformity of deposit calculation will be initiated. In measurement areas where the measured count ratio is ≥ 1 it will be assumed that the material deposit is a uniform distribution about the entire interior of the measured surface.

Associated with the uniform deposition calculation an alternative net count value will be calculated for the individual measurement points. Where a uniform deposit is located, the count rates measured at the top (above duct) and bottom (below duct) assay positions are each a factor of two high. This "double count rate" is a result of the γ-rays emitted from the upper and lower surfaces of the duct. For this reason, the top and bottom count rates will be averaged and then divided by a factor of two to determine the measurement value.

RECOMMENDATION 3.3.C.1.c -- Implementation of Improved Width Model Calculation

Where contact measurements are used, the width model should be improved to more effectively handle the deposit geometry and the detector response. The existing body of data can be reanalyzed using the new model.

A new width model, developed by the LANL Safeguards Assay Group (N-1) and RFP personnel, will be incorporated into the holdup measurements analysis software (See figure 1).

RECOMMENDATION 3.3.C.3 -- Correction for Material Self-Attenuation at Specific Locations

Experience has shown that most point assays (mass per unit length) are low enough that there is little reason for concern that they have been underestimated due to self-attenuation within the holdup deposit. We recommend, however, that a flag be set in the software whenever a point assay is high enough that self-attenuation could be a factor, and that an appropriate correction be applied.

This "flag" has been realized through an administrative review of the raw data. This review is an integral part of the data analysis process and will continue. This negates the need for a "flag" in the software.

SUMMARY

Data collection and analysis alternatives are designed to promote a better understanding of the systematic error component and thereby improve the overall measurement accuracy. The previously described actions are designed to reduce the measurement bias, but have the spin-off benefit of facilitating quantification of measurement uncertainty. The proposed contact measurement improvements, itemized in the previous paragraph, will improve measurement accuracy.

These actions will in part help to reduce the positive biases that have been in the results since inception of the Phase II program. At the same time, some of the measurement locations will result in a higher holdup value reported. These increases are due to the additional interior pipe surface area at measurement locations determined to have a circumferential deposit. These increases and decreases in the analysis at each measurement location will result in both higher and lower gram totals with an anticipated maximum of +/- 30% for different duct sections. The end result will be a more accurate reflection of the holdup plutonium in the ducts.

The following data are an example.

Measurement Location	Duct Length (Ft)	Present Data Analysis (Grams)	New Data Analysis (Grams)
Bldg. 707, Module A, South	174	203	213
Bldg. 707, Module C, South	137	40	42
Bldg. 707, Module J, Inert	119	82	86

The actions involving analysis software changes are complete. The new analysis software will be implemented following approval of this plan. All subsequent data will be analyzed with the new software. All areas where measurements are complete (FINAL, PRE-RESUMPTION) will be re-analyzed using the new software. A phased approach will be taken for this process. Data that is directly related to the resumption of Building 707(FINAL, PRE-RESUMPTION) will be re-analyzed first. Additional re-analysis will be performed on data used in before- and after-remediation comparisons. In all other areas, only the most recent measurement data will be re-analyzed. Following completion of Building 707, data from other buildings will be re-analyzed in a phased approach (i.e 771, 559, 776, etc.). For clarification, results that reflect the new analysis, will be marked appropriately.

These actions will effect many facets of the duct holdup measurement and duct remediation data reporting systems (i.e. flow path diagrams, final reports etc.) and will take a considerable amount of effort to carry out these changes.