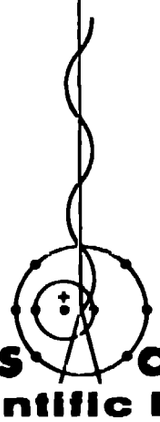
LA-UR-79-789

TITLE: MEASUREMENT CONTROL PROGRAM FOR IN-LINE NDA INSTRUMENTS

AUTHOR(S): William R. Severe and Charles C. Thomas, Jr.

SUBMITTED TO: Institute of Nuclear Materials Management
Twentieth Annual Meeting, July 1979

MASTER



los alamos
scientific laboratory
of the University of California
LOS ALAMOS, NEW MEXICO 87544

Form No. 836
St. No. 2629
1-75

UNITED STATES
ENERGY RESEARCH AND
DEVELOPMENT ADMINISTRATION
CONTRACT W-7405-ENG. 36

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MEASUREMENT CONTROL PROGRAM FOR IN-LINE NDA INSTRUMENTS

W. R. Severe* and C. C. Thomas, Jr.
University of California
Los Alamos Scientific Laboratory
P. O. Box 1663
Los Alamos, NM 87545
Phone: (505) 667-3378/FTS 843-3378

ABSTRACT

A measurement control program has been developed for the nondestructive assay (NDA) used in the Los Alamos Dynamic Material Control (DYMAC) system. The NDA instruments range in complexity from digital electronic balances to minicomputer based neutron and gamma-ray assay systems.

The measurement control program serves two major functions. The first provides on-line checks of instrument accuracy and precision. The second function provides the data base necessary for defining and monitoring the systematic and random errors associated with individual instruments. The mathematical aspects of the measurement control program will be presented and several specific examples of results will be discussed.

*Speaker

MEASUREMENT CONTROL PROGRAM FOR IN-LINE NDA INSTRUMENTS

W. R. Severe* and C. C. Thomas, Jr.
University of California
Los Alamos Scientific Laboratory
P. O. Box 1663
Los Alamos, NM 87545
Phone: (505) 667-3378/FTS 843-3378

The DYMAC measurement control program utilizes two types of checks to assure proper instrument performance. A response consistency check is made daily to verify that no changes have occurred in instrument response to working standards. Precision checks are made weekly to check for changes in instrument reproducibility and, for counting instruments, to detect non-random measurement fluctuations that might indicate electronics problems. The data generated by these performance checks are transmitted directly to the main DYMAC computer to be checked against control limits and stored in instrument history files for further use, such as in limit-of-error calculations. The control limits utilized are the 95% confidence interval warning limit and the 99% confidence interval action limit. Should an instrument check exceed the action limit or exceed the warning limit twice sequentially the DYMAC computer will not allow that instrument to be used for accountability measurements until appropriate corrective action has been taken.

The type of performance check used depends on the instrument being tested. DYMAC currently makes a separation between balances and counting instruments. The response consistency check for balances requires measurement of three standard weights which cover the normal operating range of the balance. A t-test compares the difference between the measured and standard values for each of the three levels to assure response consistent

with previous observations and to determine possible bias terms. Precision checks consist of replicate measurements of each standard weight which are used to estimate standard deviations for each level. These standard deviations are then compared with the past 15 weeks' pooled standard deviations using an F-test to monitor changes in balance reproducibility.

Counting instruments also use a t-test to check response consistency. In this case a plutonium standard is used and its expected response is compared with the measured response. Precision checks consist of two different tests that use the same set of 15 replicate measurements. The χ^2-test compares the counting statistic estimate of the variance with a variance estimate based on replication. The replicate data is then tested for randomness using a mean square successive difference test which can detect long term trends or rapid oscillations that might otherwise go unnoticed. The combination of these two tests has been very useful in detecting electronics problems in counting instruments.