PDR 70-1113

GENERAL ELECTRIC

NUCLEAR ENERGY
PRODUCTS DIVISION

WILMINGTON MANUFACTURING
DEPARTMENT

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March 20, 1980

Director
Office of Nuclear Material Safety & Safeguards
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. James G. Partlow, Chief
Material Control Licensing Branch

Dear Sir:

References: (1) Letter, A. L. Kaplan to J. G. Partlow, 7/24/79
(2) Telephone conversations, C. M. Vaughan & E. J. McAlpine, 3/18/80

Subject: MODIFICATION #4 TO APPLICATION AMENDMENT S-8, PHYSICAL INVENTORY OF UO_2 PELLETS & CERTAIN CONTAINERS OF SNM

With respect to the amendment application referenced above and the recent telephone conversations with E. J. McAlpine of your staff related to that application, attached is the information that Mr. McAlpine requested.

General Electric personnel would be pleased to discuss this matter further with you and members of your staff as you may deem necessary.

Very truly yours,

GENERAL ELECTRIC COMPANY

Arthur L. Kaplan

Arthur L. Kaplan, Manager
Licensing & Compliance Audits
M/C J26

ALK:bmw

Attachment

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GE EXEMPT

add'l info

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FURTHER EXPLANATION OF SAM II CALIBRATION

1.0 REFERENCES

1. A. L. Kaplan to J. G. Partlow, "Modification 3* to Application Amendment S-8 Physical Inventory of UO_2 Pellets and Certain Containers of SNM", July 24, 1979.

2. Telephone conversations of March 18, 1980, C. Vaughan and E. McAlpine.

2.0 CALIBRATION

The referenced submittal of July 24, 1979 contained a Section 6 describing the Age Compensated SAM II. The equation:

$$\% E = A \times Ch\ 1 - B \times Ch\ 2$$

defines the calibration function for "old material" (non age compensated). Old material is defined as material over 90 days since conversion, the time required for the daughter products to attain equilibrium.

Calibration constants for A and B are determined using the "old standards". Old standards consist of 11 cans of UO_2 powder with certified enrichments spanning the range of 0.77% U-235 to 3.80% U-235. A and B are determined from responses of three five-minute counts on a high standard (i.e., 380) and a low standard (i.e., 0.77). Simultaneous equations:

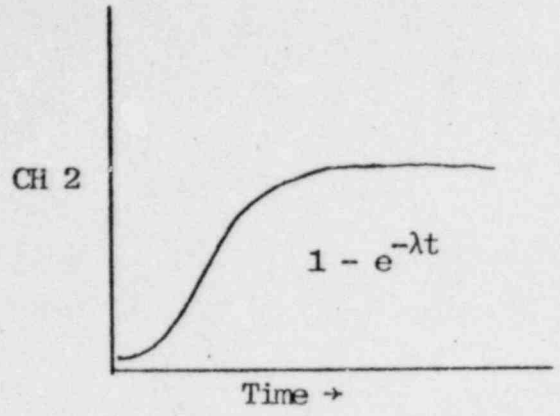
$$\text{High Standard Value} = A \cdot CH\ 1 - B \cdot CH\ 2$$
$$\text{Low Standard Value} = A \cdot CH\ 1 - B \cdot CH\ 2$$

are solved for the values of A and B. The calibration is then verified using a mid range standard.

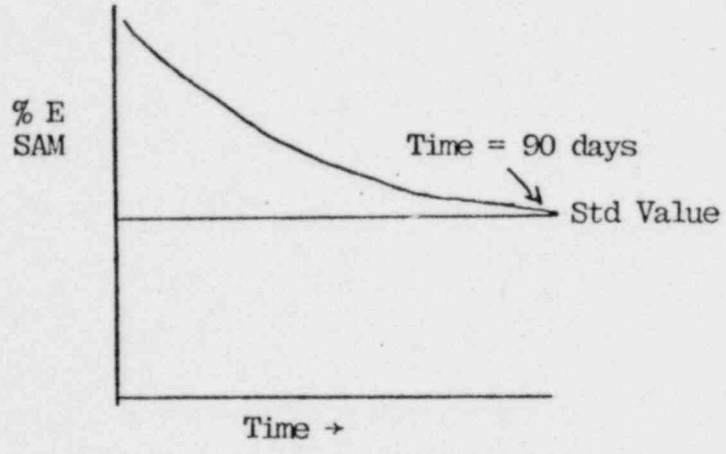
Age compensation constants are also determined as a part of each calibration. These constants were defined in the referenced submitted by the equation:

$$R = a \times CH\ 2 + b$$

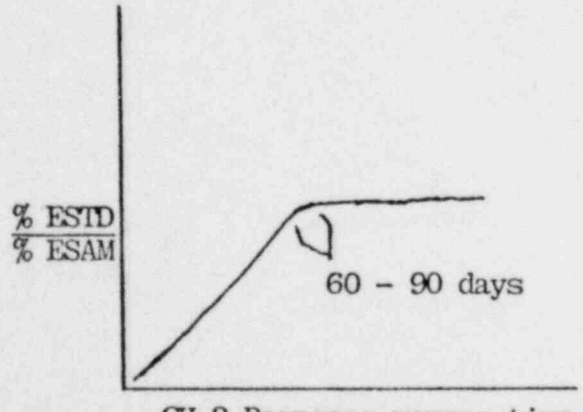
CH 1 contains the response of U-235 plus the interference. CH 2 contains the interference. Age compensation is required because the interfering daughter products begin at very low levels after conversion and grow to equilibrium values within about 90 days. The CH 2 response has the following form:



as defined in basic physics. As a result of the daughter product growth, the non age compensated SAM II response will be of the following form:



Therefore, a good way to look at the age compensation phenomenon is as follows:



CH 2 Response versus time

The age compensation constants are determined from three five-minute counts of an old standard and a can of new material (1 week old) which is accurately characterized by lab measurements. A linear least squares program is used to determine a and b. The appropriateness of these values is checked with a middle age standard.

Calibration checks using the old standards are performed during each shift of operation. If the calibration check is outside the control limit of 0.02% U-235 or if changes occur which could effect the instrument, a recalibration is performed.

Calibration checks using old standards have been determined to be adequate to control the age compensated measurement system. This is justified because the calibration actually confirms by measurement the basic responses dictated by physics. The only variable is the instrumentation and it is the same instrumentation which determines A, B, a, b. Therefore, once the instrument is calibrated all constants either remain in calibration as verified by the check standards or loose calibration as evidenced by drift outside the 0.02% U-235 control limit.

CMV
3/18/80

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