MASTER

OAK RIDGE NATIONAL LABORATORY

Operated by
UNION CARBIDE NUCLEAR COMPANY
Division of Union Carbide Corporation

Post Office Box X
Oak Ridge, Tennessee

External Transmittal
Authorized

ORNL
CENTRAL FILES NUMBER

60-5-104

DATE: May 25, 1960
SUBJECT: High Current Saturation Characteristics of the ORNL
Compensated Ionization Chamber (Q-1045)
TO: Distribution
FROM: J. L. Kaufman

COPY NO. 95

ABSTRACT

The saturation characteristics of the ORNL Compensated Ionization Chamber Q-1045 have been measured with special regard to high current and voltage ranges. The chamber can be operated at currents up to 1 ma with a 2000 volt power supply.

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

- A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or
- B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

HIGH CURRENT SATURATION CHARACTERISTICS OF THE ORNL
COMPENSATED IONIZATION CHAMBER (Q-1045)

The saturation voltage and current characteristics of the ORNL compensated ionization chamber (Q-1045) have been measured with special regard to high voltage and current ranges. The chamber was sealed in an enclosure containing dry nitrogen at 15-20 psia.

The chamber was located with the center of its sensitive volume on the horizontal centerline of the BSR, 10.5 inches away from the core surface. This position was chosen so that the chamber current at full power would be of the order of one milliamperes with only a small gamma background error (5%) at a reactor power three decades lower.

The chamber was connected as shown in Figure 1. The output of the regulated high voltage power supplies was measured with a D'Arsonval microammeter (1/2% F.S. accuracy) with 1% precision resistors in series. High currents (10^{-5} ampere and up) were measured with a D'Arsonval microammeter and lower currents with a Leeds and Northrup μ ammeter (model 9836A).

The reactor was held at power levels between 1 KW and 1 MW and the chamber voltage was varied in 200-volt increments. The data are shown in Figure 2. The actual reactor power was 4% lower than the indicated power at 100 KW and 10% low at 1 MW due to the decreased neutron attenuation in the shielding caused by decreased water density at higher temperatures.

It can be seen from the curves in Figure 2 that the neutron-sensitive volume is well saturated for currents less than 100 μ a at any voltage above 600 volts. For high accuracy, the chamber should therefore be operated only at currents of 100 μ a and below with the standard power supply Q-995. The saturation voltage for 800 μ a is approximately 2000 volts. The inaccuracy at 400 μ a at 600 volts is about 20%. Since the chamber can easily withstand high potentials, there is no reason why it cannot be operated at 1 ma with a suitable power supply.

Thanks are due Mr. K. M. Henry and the staff at the Bulk Shielding Facility for their help in making the measurements.

SCHEMATIC DIAGRAM

FIG. 1

UNCLASSIFIED
ORNL-LR-DWG 48162

Fig. 2. Saturation Characteristics of ORNL, Compensated Ionization Chamber (Q-1045)

DISTRIBUTION

1 - 3. R. K. Abele	34-35. E. B. Johnson
4. R. G. Affel	36. W. H. Jordan
5. J. L. Anderson	37-62. J. L. Kaufman
6. A. E. G. Bates	63-64. J. D. Kington
7. C. J. Borkowski	65. F. C. Maienschein
8. T. E. Cole	66. J. E. Marks
9 -10. A. L. Colomb	67. W. F. Mruk
11-12. J. A. Cox	68. L. C. Oakes
13. S. J. Ditto	69. J. B. Ruble
14. E. P. Epler	70. R. T. Santoro
15. W. K. Etzel	71. R. S. Stone
16. F. P. Green	72. J. R. Tallackson
17. J. G. Gundlach	73. E. Vincens
18-27. S. H. Hanauer	74. C. S. Walker
28. C. S. Harrill	75. R. E. Wintenberg
29-30. K. M. Henry	76-77. K. W. West
31-32. L. B. Holland	78-79. Central Research Library
33. C. F. Holloway	80. Document Reference Section
	81-92. Laboratory Records
	93. M. J. Skinner
	94. ORNL-RC
	95-109. TISE, AEC