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Introducing the Joint AAPM/IROC Houston Ionization Chamber Registry to Host TG-51 Reference Dosimetry Data

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Motivation

AAPM's TG-51 protocol[1], its Addenda[2,3] and guidance on implementation[4] are followed to calibrate external treatment devices (linacs), thereby fulfilling a critical aspect of radiation therapy treatments.

The quantity of interest, absorbed dose to water, D_w^Q, is based on the reading, M, measured with a calibrated ionization chamber in the beam with quality Q

$$D_w^Q = M k_Q N_{D,w}^{60\mathrm{Co}}.$$

Chamber calibrations are traceable to national standards for absorbed dose in a cobalt-60 beam and the beam quality conversion factor, k_Q, is required to convert the calibration coefficient, $N_{D,w}^{60\mathrm{Co}}$, for cobalt-60 to that for the beam Q of interest.

Historically these crucial data have been provided in reports published by AAPM[1-3] but **it can take several years for these reports to be updated.** Meanwhile, new chambers are developed, and shortcomings are identified with older chamber designs. New treatment technologies are also developed that require additional data or modified formalisms.

The AAPM established the Working Group on the Ionization Chamber Registry (WGICR) to develop a web-based Ionization Chamber Registry that:

- provides a central source for accepted k_Q data,
- reduces confusion across reports, worksheets, and revisions,
- enables timely updates, additions, and removal of outdated data.

The Registry unifies two key functions:

1. Compilation of published data
Curated, quality-controlled k_Q data for AAPM dosimetry protocols.

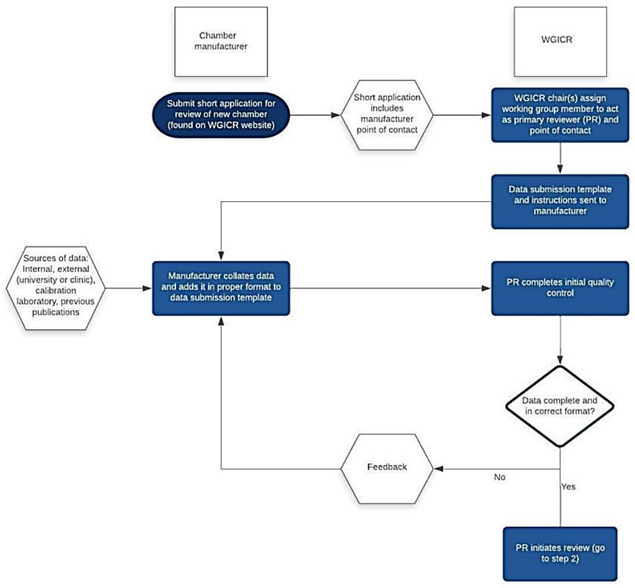
2. Dissemination of new detector data
A transparent process for validating and publishing k_Q data for new chambers, with the same scientific rigour as TG-51. **ICR data supersede corresponding published values.**

Methodology

To establish the ICR **a series of documents were developed** to describe the policies governing the Registry, provide specifications chambers must meet to be included on the ICR, and facilitate data submission and review:

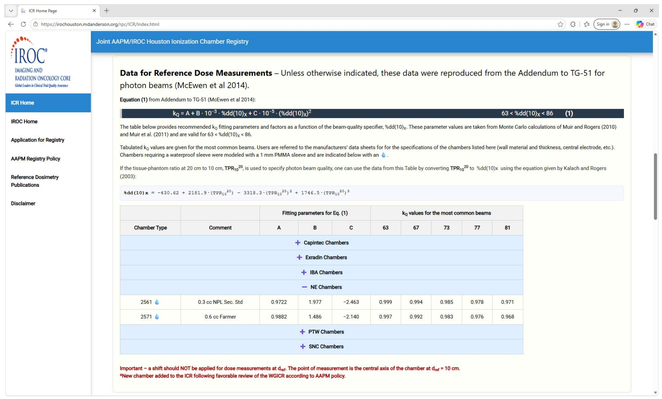
NAME	ACRONYM	APPENDIX	FILE FORMAT	DESCRIPTION
AAPM WGICR Policy Document	AP	NA	PDF	Describes the process
Reference Chamber Specifications	RCS	1	PDF	Requirements for a chamber to be included in the ICR
Initial Submission Form	ISF	2	Word	Initiates the ICR process; includes manufacturer contact info and chamber details
Maintenance of Registry Status Form	MRS	3	Word	For manufacturers to report changes to manufacturing or chamber design
Warning Letter to Manufacturers (Template)	WL	4	Word	Warns manufacturers that a chamber may be removed from the ICR
Test Data Submission Template	TDS	5	Excel	For manufacturers to submit chamber data
Review Form Template	TRF	6	Excel	Used by reviewers during evaluation
Confidentiality Form	CF	7	Word	Signed by reviewers to ensure confidentiality of data
Generic MC Models	GMM	8	PDF	Describes models to demonstrate accuracy of calculated kQ factors

The AAPM policy document, AP 146-A, **describes the process** for data submission and review for new chambers, and on-going review on a 3-year basis for chambers on the registry. Flowcharts are provided for each step. An example flowchart showing the procedure for ICR data submission and initiation of the review process:



Meaning

The ICR policy was **approved and adopted** by the AAPM in July 2025. The web site, hosted by IROC Houston, **went live** in December 2025:



Existing chamber types recommended in the Addenda to TG-51 were included in the Registry **without further review**. Two new chamber types have gone through the full review process and vote by the WGICR to be added to the Registry.

Presently the ICR includes data for high-energy photon and electron beams, with **planned expansion** to protons, brachytherapy well chambers, MR-linacs, and small fields.

Discussions with the IAEA aim to incorporate TRS-398[5] data on the ICR and **broaden international dosimetry standardization.**

Beyond data compilation, the ICR enables:
Continuous quality control through mandatory ongoing review,
Updates following chamber manufacturing changes,
Withdrawal of chambers that no longer meet reference-class specifications.

As a **single authoritative source** for k_Q data, the ICR supports consistent reference dosimetry practices, reduces the need for frequent protocol revisions, and **improves confidence** in clinical implementation, audits, and multi-institutional trials.

References:

1. Almond PR, et al. *Med. Phys.* 1999;26 (9):1847–1870.
2. McEwen M, et al. *Med. Phys.* 2014;41 (4):041501.
3. Muir B, et al. *Med. Phys.* 2024;51 (9):5840–5857.
4. Muir B, et al. *Med. Phys.* 2022;49 (11):6739-6764.
5. International Atomic Energy Agency. Technical Reports Series No. 398, Rev. 1. Vienna: IAEA; 2024.

Learn more about the Joint AAPM/IROC Houston Ionization Chamber Registry.

https://irochouston.mdanderson.org/