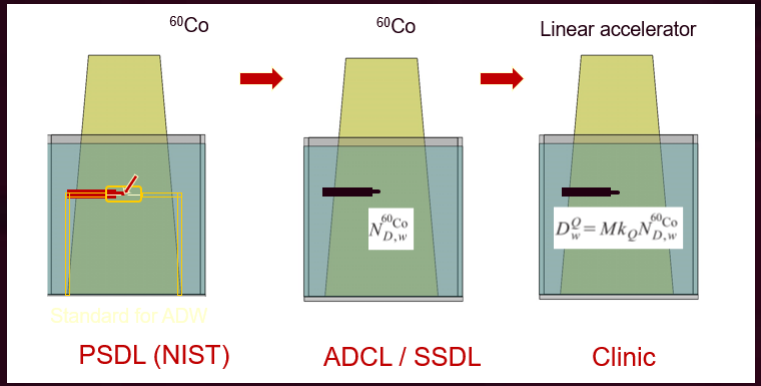


# Session: ADCL Calibrations – More than Just a Number


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2020 Improving Health QUALITY. Increasing Global IMPACT.
JULY 12–16 VIRTUAL EASTERN TIME (GMT-4)
JOINT AAPM | COMP MEETING

# What is an ADCL?

- Accredited Dosimetry Calibration Laboratory (the SSDL equivalent in North America but different…)
- Accredited by the AAPM
- Provides calibrations to users for instruments and radioactive sources for dosimetry in radiotherapy and diagnostic imaging
- Currently three ADCLs:
  - **University of Wisconsin (Madison)**
  - **K&S Associates (Nashville)**
  - **MD Anderson Cancer Center (Houston)**

# SSDLs vs ADCLs

- ADCLs
  - Provide everything that an SSDL would provide, PLUS
    - Independent of instrument manufacturers
    - Provide technical support to AAPM members
    - Proficiency Tests

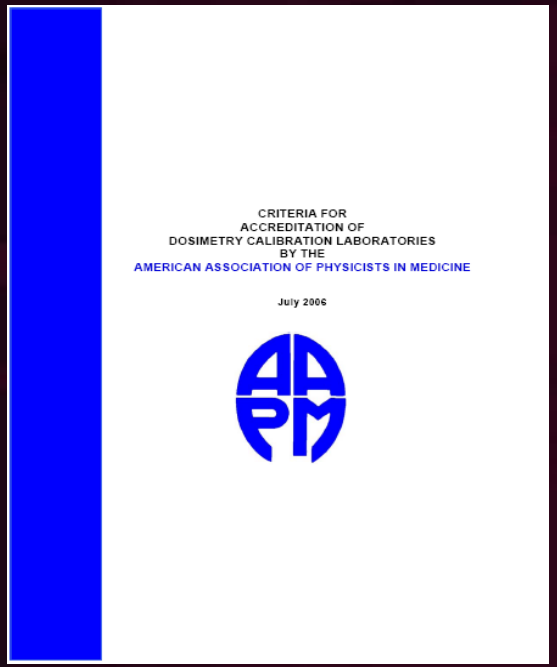
- The result: ADCLs provide unbiased and knowledgeable resources for instrument purchases and guidance

# AAPM CLA

- Main forum for discussion of issues relating to calibration of ion chambers and brachytherapy sources
- An assembly of metrology experts

Side note: Possible restructuring in the AAPM may involve the transition to a “Metrology” subcommittee.

# What does the CLA do?




- Develops criteria
- Recommends (to AAPM BOD) accreditation for ADCL laboratories
- Carries out assessment visits
- Monitors performance
- Makes recommendations
- Highly technical in nature

# What the CLA doesn't do?

- Does not set prices
- Does not recommend any one ADCL over another
- Does not distinguish between commercial and academic organizations
- Does not try to "spread the business around"

# What the ADCLs will not do?

- Does not calibrate solid state radiation detectors
  - Solid state diagnostic instruments
  - Diodes for radiation therapy
  - Scintillators
  - TLDs
  - Diamond detectors
  - OSLDs
- Pulsed charge or AC current electrometer scales
- System calibrations for therapy ion chambers with supplied electrometers

# Why not diodes?

- Not a reference dosimeter (according to the TG51 addendum)
  - Temperature dependencies (among other things) affect the calibration
  - Energy dependence ($k_Q$ values) not available

# The “Value” in Your Calibration Report

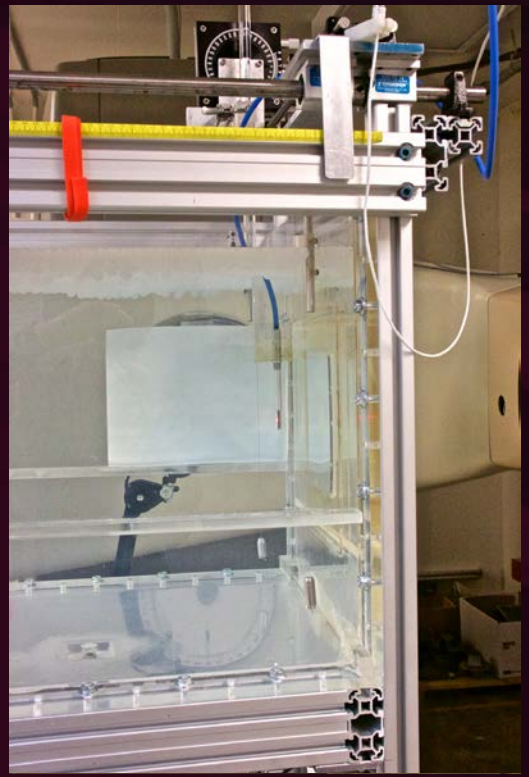
- Financial
  - The ADCLs receive no financial support from the AAPM.
  - It requires huge efforts to calibrate a dosimetry instrument with the necessary uncertainties to treat patients safely.
  - Calibration staff are highly trained technical experts
  - Constant intercomparisons
  - QA testing
  - Redundant checks and more redundancy checks
  - Administrative overhead
  - Licensed for various high-activity radionuclides

# The “Value” in Your Calibration Report

- The Calibration Coefficient
  - If its new equipment, we compare with an average of other chamber models
  - If it is a repeat calibration, and it was in our lab, we have agreement thresholds
    - Example for Co-60 ADW is 0.6%, which is the AAPM mandated ADCL uncertainty component
    - Varies for calibration type
  - Physicist contacted if outside of thresholds

# $^{60}$Co Calibrations

- Resin beads to reduce evaporation
- Horizontal beam line
- Replacement technique
- Plumb bob lines
- Thermometer & barometer



# Electrometer Calibrations

- Charge calibration
  - NIST-traceable calibrated capacitor
  - NIST-traceable voltage source
- Current calibration
  - NIST-traceable calibrated current source
- No pulsed-mode calibrations available due to lack of NIST standard
  - Same for all ADCLs

# Practical Considerations

- Its not just a number
  - Your calibration coefficients give an indication of the response of your equipment.
  - The $N_{D,W}$ is the largest component of the uncertainty in TG-51 measurements (McEwen et al 2014)
  - Be a scientist, not a technologist.
  - Look for trends, outliers, and anything that just doesn't make sense
- An ADCL is not meant to be a repair shop
  - If you think your equipment is malfunctioning, contact the manufacturer
- ADCL staff is there to answer questions at any time
- UWADCL has a booth at AAPM to see what's new and answer questions

# Manufacturer Calibrations

- Many manufacturers will offer NIST-traceable (or other PSDL-traceable) calibrations
- If it's a U.S. company, these will not be an SSDL or ADCL.
- If it's a European company, it may be traceable to another PSDL (NPL, PTB, etc.)
- What assurance do you have that these values are accurate?
- Issues without the AAPM infrastructure in place
  1) No routine round-robin testing
  2) No AAPM credentialing / site visits by experts
  3) May not be legally acceptable

# Linac-based Calibrations?

- Has been debated in the Medical Physics Journal
- The pros:
  - Beam-quality factors ($k_Q$) for a physicist's chamber can be measured, which is appealing
- The cons:
  - Instabilities of commercial medical linac platforms adds uncertainty
  - Beam quality of customer's linac not necessarily the same as the ADCL or NIST linac. Need multiple data points for a proper calibration
  - $K_Q$ uncertainties are low, 0.3% agreement between experimental and measurements across NE2571 chambers by Muir et al in 2010

# Conclusions

- The world of calibration laboratories is complex, but well serving
- North America maintains its own system of ADCLs, which are accredited by the AAPM CLA subcommittee
- The ADCLs are there to serve their customers and members of the AAPM