Australian Government
Australian Radiation Protection and Nuclear Safety Agency

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Australian Clinical Dosimetry Service

Level II Audit – Fact Sheet

Definition

The Level II audit offered by the ACDS investigates the accuracy with which a Radiation Oncology Facility delivers dose to selected points and planes within a 'slab' geometry phantom. This is an audit of the beam model within a treatment planning system (TPS), where the phantom CT is supplied to the Facility for treatment planning and delivery. Dosimetry measurements are made in a custom phantom of CIRS plastic water and lung equivalent material, using a 2D ionisation chamber array (PTW Octavius 1500MR) as a primary detector and supporting measurements with Farmer type ionisation chambers (PTW 30013). For every audit the 2D array is calibrated (on the Linac being examined) against a Farmer type ionisation chamber which is traceable to the primary standard at ARPANSA. An onsite calibration quality control check is performed via comparison with data obtained on the ARPANSA Linacs prior to the audit measurements.

Audit Coverage

One Level II Audit is performed at a facility as part of the four-year ACDS audit program. For organisations with matched beam models and centralised planning, the Level II audit plans can be completed once and delivered at multiple facilities. The Level II audit is also available for a new radiotherapy TPS.

Audit Scope

The Level II audit includes several modalities and energies. The facility can choose to complete as many options in the audit as deemed necessary for their clinical practice (see Table 1). Measurements are performed on a single representative Linac of each Linac class type, at each facility. If the facility operates different Linac class types (e.g. a Conventional Linac and a Halcyon), the Level II audit will be offered for both systems.

Table 1. Summary of options available for the Level II audit

Modality	Conventional Linac	Halcyon	Ethos
3DCRT#	6X, 10X, 18X, 6FFF, 10FFF	6FFF	
IMRT	6X, 10X, 6FFF, 10FFF	6FFF	
VMAT	6X, 10X, 6FFF, 10FFF	6FFF	

A subset of 3DCRT cases are measured as reference beams for the complex treatment modalities and specialist treatment machines.

CPD

For Radiation Therapists participating in the audit, ASMIRT CPD hours are claimable at a rate of 8 hours for treatment planning and 3 hours for treatment delivery.

Radiation Oncology Medical Physicists participating in the audit may claim 5 ACPSEM CPD points and 1 Optional Reflective point.

Certificates will be issued with the audit report.

Dose reporting

The ACDS acknowledges that treatment planning systems can report dose as dose-to-water or dose-to-tissue (where the TPS is modelling the phantom as a mixture of muscle and soft tissue by default). The audit is performed in a water equivalent phantom. AAPM TG-329 has identified the mass energy absorption coefficient ratio and the stopping power ratio of muscle/water to be approximately 0.99. The D_{tissue}/D_{water} correction and the audit outcome are tailored according to the algorithm that was used by the facility to report dose.

Audit Outcomes

Outcomes are attained for each modality the facility chooses to include in the audit. Measurement results that are reported but not scored include supporting measurements, repeated measurements, alternative scoring options and deliveries restricted from clinical use. Outcome thresholds for all available audits are outlined in Table 2.

An outcome for an individual case is determined from the measured 2D dose map using the dose variation between the facility stated dose (planned dose) and the ACDS measured dose. The ACDS assesses the global gamma pass rate using measurements from detectors that fall completely within 80% of the projected field size at the measurement plane.

Table 2. Scoring criteria for the Level II audit

Modality	Metric	Pass (Optimal Level)	Pass (Action Level)	Out of Tolerance
3DCRT	Local dose variation	≤ 3.3%	> 3.3% and ≤ 5%	> 5%
IMRT & VMAT	Gamma criteria	γ≤1 at 3%/3mm for ≥95% points	γ≤1 at 3%/3mm for ≥90% and <95% points	γ≤1 at 3%/3mm <90% points

Outcome Reporting

An individual report is created for each facility audited and is specific to the beam model(s) audited. A formal report will be sent to the Facility within approximately 30 working days of the audit. This timeline will extend if additional information or follow up of non-optimal audit results are required.

Out of Tolerance results are promptly communicated to the Chief Physicist and reviewed by the Clinical Advisory Group. Data collected is held confidentially by the ACDS and its oversight groups. Publicly reported outcomes are randomised and de-identified. Data collected is held confidentially by the ACDS and its oversight groups. Publicly reported outcomes are de-identified and randomised.

The Australia and New Zealand (ANZ) Dataset is comprised of an extensive number of data points and information collected while developing, executing, and analysing ACDS audits. This comparative data is available for benchmarking the Facility's audit results against measured audit data and will be included in the formal report.

General Audit Procedures

- Scheduling of the audit is confirmed 3-6 months prior to the audit date.
- The data required for planning is sent ~6 weeks prior to the on-site audit. Plans are completed on the phantom CT datasets available for download on the ACDS website.
- Planning is completed according to 'ARPANSA-WI-2001 LII Instructions'. Planning data should be returned to the ACDS 1-2 weeks prior to the on-site audit, for ACDS to review. Planning for Level II may be completed by a suitably experienced physicist or radiation therapist.
- At minimum, the Facility should book staff and equipment for 12 hours of treatment planning time and 5 hours of treatment delivery time. Additional planning and linac time will be required, as the number of beam models is increased. The ACDS suggests an onsite audit start time no later than 1pm.
- The Facility must ensure that a physics representative is available for the duration of the audit to provide supplemental information and to deliver reference beams in Service mode and/or the planned treatment. If preferred a radiation therapist may deliver the planned treatment. The phantom is set up for each treatment delivery by the ACDS auditors.
- Audit measurements are typically completed in R&V Clinical QA mode to allow multiple deliveries. For the IMRT and VMAT modalities, the facility must confirm the plans are deliverable and pass all QA measures employed by the facility for clinical IMRT plans, including patient specific QA.
- A comparison of ACDS versus Facility temperature and ambient air pressure measurements will be performed.