Guide for STP Trainees : Imaging with Ionising Radiation - Specialism

IPEM Institute of Physics and Engineering in Medicine

DOPS

		DOPS (Note that not all of the DOPS in the Learning Guide are listed)	Examples of evidence which may relate to this DOPS	Competencies which may share evidence with this DOPS
IIR DOPS		Prepare a phantom for SPECT QC	Discussion of radiation protection and practical skills	IIR-C-1,2,3,54
		Perform monthly QC on gamma camera according to Departmental procedures	Short report	IIR-C-2
		Process a renogram	Practical observations and analysis of results	IIR-C-5,6,8
		Perform a SPECT or SPECT/CT reconstruction	Practical observations/discussion of reconstruction parameters	IIR-C-5,6,8
		Perform quality control procedures on intraoperative probe	Short report	IIR-C-12, 13
		Monitor a patient in the therapy room	Analysis of measurements	IIR-C-33
		Decontamination of areas	Demonstration of dealing with radioactive spills. Decontamination of therapy room after treatment	IIR-C-34, 35, 54
		Perform a molybdenum breakthrough test and analyse the result	Practical observations and analysis of results.	IIR-C-42
		Perform a chemical purity test and analyse the result	Practical observations and analysis of results	IIR-C-42
		Elute a Tc-99m generator	Practical observations and analysis of results	IIR-C-42
		Perform a linearity measurement on a Radionuclide calibrator	Practical observations and analysis of results	IIR-C-43, 44
		Set up a radionuclide calibrator to measure I-123 using a copper filter	Practical observations and analysis of results	IIR-C-43, 44
		Monitor radioactive waste and dispose where appropriate. Keep records of storage and disposal	Practical observations and analysis of results	IIR-C-35, 57
		Test leakage of an X-ray tube	Practical observations and analysis of results	IIR-C-66
		Measure the image quality for a mammography unit using a variety of test objects	Practical observations and analysis of results	IIR-C-68
		Analyse and interpret data from a multislice CT phantom	Short report	IIR-C-71, 72

		Undertake a range of system administration tasks on a nuclear medicine or diagnostic radiology system	Practical observations	IIR-C-87

CbD

	Examples of possible subjects for CbD. Note that these are not prescribed within the Learning Guide	Examples of possible evidence	Competencies which may share evidence with this CbD
IIR CbD	Imaging clinical case studies	Discussion of particular imaging, e.g. brain imaging including any post processing and image analysis	IIR-C-5
	Non-imaging clinical case studies	Discuss clinical requirements of a non-imaging test, e.g., SeHCAT, including purpose, equipment necessary, results calculations and implications of results	IIR-C-19, 20
	Radionuclide therapy case study	Explain procedure to a patient and discuss possible post-treatment restrictions. Further discussion of practical issues surrounding MRT	IIR-C-30, 32
	Technetium generators	Short report showing understanding of Technetium generators. Discussion of issues surrounding Technetium generators	
	EPR waste limits	Discussion demonstrating understanding of different types of waste and limits. Analysis of aqueous waste limit trends	IIR-C-35, 57
	Local rules in a particular area	Write/critically appraise local rules and discuss	IIR-C-48, 49
	General requirements of quality assurance and commissioning on a range of equipment	Short reports on QA/commissioning of equipment	IIR-C-1, 2, 65, 66, 67, 68, 69, 70, 71, 72
	Reporting radiation incidents, including information on calculating doses and risks	Short report demonstrating example calculations	IIR-C-83, 84
	CT DRLs	Discussion of CT DRLs. Perform an audit or analyse audit results. Discuss radiation risks	IIR-C-80
	Radiation risk and effect variations in relation to the type of radiation, patient age, sex and pregnancy status, and the body part irradiated	Short report showing understanding of the principles. Discussion of risk and effect variations in relation to differing exposure circumstances	IIR-C-61, IIR-C-38, IIR-C-83 and 84
	Dose risk assessment as performed in MPE statement in IRAS forms (e.g. DR, radionuclide, hybrid imaging)	Dose risk assessment, letter of advice, discussion of outcome of assessment	IIR-C-83 and 84

Competencies

Learning Outcome Subject	Code	Competency	Examples of evidence	Other competencies which may be demonstrated by this evidence
Radionuclide Imaging	IIR-C-1	Perform planar gamma camera commissioning tests and participate in the commissioning tests of Single-photon emission computed tomography (SPECT)/ Computed Tomography (CT) and Positron emission tomography (PET)/ (CT) scanners	• Report of commissioning tests on new system if appropriate • Repeat acceptance tests, comment on results and compare to those at acceptance	IIR-C-1,2,3,4
	IIR-C-2	Make comprehensive quantitative routine performance measurements on imaging equipment	• Evidence of participation in QC on gamma cameras, SPECT-CT, PET-CT (name on log, statement from supervisor etc.)	IIR-C-1,2,3,4
	IIR-C-3	Critically review quality assurance programmes for radionuclide imaging	• Review present QC programme and update to reflect equipment changes	IIR-C-1,2,3,4
	IIR-C-4	Instigate corrective action based on an evaluation of quality control results	•Evidence that trainee has taken an active part in assisting on the imaging rota and undertaking QC •Case report of corrective action taken when QC results have been outside acceptable limits e.g. acquire new uniformity correction	IIR-C-1,2,3,4
	IIR-C-5	Understand the wider clinical situation relevant to patients presenting to the modality	• Report on patients' pathway through the nuclear medicine department •Case reports for a selection of patient studies • Attend MDT and write a brief report	
	IIR-C-6	Develop and evaluate protocols for the optimal acquisition, processing and display of clinical images	• Review a selection of current scanning protocols (in terms of latest guidance, departmental requirements etc.) •Review and update scanning protocols for new equipment	IIR-C-6,7
	IIR-C-7	Write standard operating procedures for radionuclide imaging	•Write SoP for a new procedure	IIR-C-6,7
	IIR-C-8	Use sophisticated image analysis software to extract quantitative information and enhance diagnostic utility	• Become familiar with processing scans and provide evidence (e.g. name on log, statement from supervisor) • Case studies where complicated or unusual processing is required • Perform dosimetry for therapy patients using sequential imaging	
	IIR-C-9	Modify and develop image acquisition and analysis software	• Report on project work to develop software	
	IIR-C-10	Explain the cause and effect of a range of artefacts and of equipment performance limitations on the interpretation of clinical images	• Review of possible artefacts including bookwork (IAEA atlas), artefacts on CT, local experience	
	IIR-C-11	Participate in the clinical audit of radionuclide imaging in nuclear medicine	• Clinical audit report. Possible audits could be checking DRLs, audit of particular examinations (e.g. renograms, software/processing on different systems)	
	IIR-C-12	Make comprehensive quantitative performance measurements on non imaging equipment	• Report describing QC tests and commissioning tests on non-imaging equipment. This should include a review of the QA programme against current guidance Example equipment: Gamma counter, Calibrators, balance, contamination	IIR-C-12, 13, 14, 15
	IIR-C-13	Plan and perform commissioning tests on beta and gamma counters and gamma spectrometers		IIR-C-12, 13, 14, 15

Non-Imaging Radionuclide Tests	IIR-C-14	Critically review quality assurance programmes for the equipment used for non-imaging diagnostic tests	•Example equipment: Gamma counter, Calibrators, balance, contamination monitors, gamma probe	IIR-C-12, 13, 14, 15
	IIR-C-15	Instigate appropriate corrective action based on an evaluation of test results		IIR-C-12, 13, 14, 15
	IIR-C-16	Choose appropriate tissue – equivalent phantoms for quantitative in-vivo uptake measurements	• Report on optimisation of patient non-imaging test mini-project. To include test optimisation, SOP, phantom measurements, patient test results and clinical implications, issues with artefacts and the limitations of the tests • Examples: SeHCAT, GFR, Thyroid uptake	IIR-C-16, 17, 18, 19, 20, 21, 22
	IIR-C-17	Develop and critically evaluate the optimal acquisition and processing of data		IIR-C-16, 17, 18, 19, 20, 21, 22
	IIR-C-18	Write standard operating procedures (SOPs) for non-imaging tests		IIR-C-16, 17, 18, 19, 20, 21, 22
	IIR-C-19	Participate in a range of non-imaging in-vivo and in-vitro tests	• Short report on observations of non-imaging patient tests • Examples: SeHCAT, GFR, Thyroid uptake	IIR-C-16, 17, 18, 19, 20, 21, 22
	IIR-C-20	Generate results and assist in the interpretation of diagnostic tests, including the use of reference ranges	• Report on optimisation of patient non-imaging test mini-project. To include test optimisation, SOP, phantom measurements, patient test results and clinical implications, issues with artefacts and the limitations of the tests • Examples: SeHCAT, GFR, Thyroid uptake	IIR-C-16, 17, 18, 19, 20, 21, 22
	IIR-C-21	Explain the cause and effect of a range of artefacts, and of equipment performance limitations and patient related factors on the interpretation of results		IIR-C-16, 17, 18, 19, 20, 21, 22
	IIR-C-22	Advise on the clinical appropriateness of non-imaging diagnostic tests		IIR-C-16, 17, 18, 19, 20, 21, 22
	IIR-C-23	Perform clinical audit of non-imaging diagnostic nuclear medicine	• Short report on a clinical audit of a non-imaging patient test. • Examples: SeHCAT, GFR, Thyroid uptake	

Radionuclide Therapies	IIR-C-24	Generate or critically review the design of suitable equipment and facilities for patient therapies	• Report/presentation on the design of the equipment, rooms and facilities for patient therapies including suggested changes/improvements • Short Review of the risk assessment available for the room/procedure	
	IIR-C-25	Advise on the appropriateness of requests for the administration of radionuclide therapy	• Written confirmation of discussion on appropriateness of therapies for different patient circumstances • Write an individual patient risk assessment for a patient with difficult social/clinical circumstances	
	IIR-C-26	Prepare or critically review a radiation risk assessment for the administration of a particular form of radionuclide therapy	• Risk assessment for room/procedure • Risk assessment for individual patient	IIR-C-24, 25
	IIR-C-27	Write or critically review standard operating procedures for the administration of particular form(s) of radionuclide therapy, incorporating the results of the risk assessment	• SOP for therapy based on previously written risk assessment • Short report reviewing current SOPs and if any alterations are necessary due to risk assessments	
	IIR-C-28	Perform a tailored radiation risk assessment and instructions for those in contact with an individual radionuclide therapy outpatient	• Radiation risk assessment for staff, family, friend or work colleagues for radionuclide therapy outpatient • Example: for benign thyroid disease	IIR-C-30, 31, 32, 33
	IIR-C-29	Prepare or review written instructions for staff on the management of inpatients receiving a particular radionuclide therapy, and give advice to staff in accordance	• Instructions for staff for radionuclide inpatient therapies • Short report reviewing current staff instructions and if any alterations are necessary • Presentation detailing instructions to be presented to ward staff	IIR-C-53
	IIR-C-30	Actively contribute to the administration of a range of radionuclide therapies, including at least iodine-131 for thyroid cancer and benign thyroid disease	• Written confirmation of active contribution to radionuclide therapies	IIR-C-30, 31, 32, 33
	IIR-C-31	Assist and advise medical practitioners in the administration of non-oral radionuclide therapies, e.g. by intravenous infusion	• Written confirmation of active contribution to radionuclide therapies given by intravenous infusion • Written confirmation of discussion on appropriateness of therapies (administered via intravenous infusion) for different patient circumstances • Example therapies: ^{90}Y-Dotatate, ^{177}Lu-Dotatate, ^{131}I-mIBG, ^{223}Ra-dichloride	IIR-C-30, 31, 32, 33
	IIR-C-32	Advise patients and their carers on appropriate post-therapy behavioural restrictions	• Written confirmation of active contribution on providing patients/carers on post-therapy restrictions including ^{131}I and one other radionuclide	IIR-C-30, 31, 32, 33, 52
	IIR-C-33	Actively participate in the monitoring of inpatients to determine effective half-life and/or residual activity and managing the criteria for release of inpatients based on the results of this monitoring.	• Written confirmation of active monitoring of inpatients • Spreadsheet showing activity and effective half-life calculations • Short report detailing case study	IIR-C-30, 31, 32, 33, 37
	IIR-C-34	Perform contamination monitoring and decontamination of a treatment room post radionuclide therapy administration	• Written confirmation of active participation in decontamination procedures • Short report describing decontamination procedures	IIR-C-35
	IIR-C-35	Record, store and dispose of radioactive waste produced as a result of radionuclide therapy	• Written confirmation of active participation in waste disposal • Short report describing waste disposal procedures	IIR-C-34, 57

	IIR-C-36	Participate in clinical audit of radionuclide therapy	• Audit report • Examples: patient experience questionnaire, administered activities, patient discharge levels	
	IIR-C-37	Actively participate in acquisition of imaging data and/or data from radiation detectors/monitors	• Written confirmation of active monitoring of inpatients • Spreadsheet showing activity and effective half-life calculations • Short report detailing case study including any imaging performed	IIR-C-32, 33
	IIR-C-38	Actively participate in calculating absorbed radiation doses to target and non-target tissues for therapy protocols guided by patient-specific dosimetry	• Report/spreadsheet with organ dosimetry calculations • Attend dosimetry training if not performed at current centre	
Radiopharmacy	IIR-C-39	Advise colleagues on the use of radiopharmaceuticals	• Presentation to peers on the use of radiopharmaceuticals • Short report on the production of radiopharmaceutical including guidance	
	IIR-C-40	Access sources of information on the design requirements for the production of radiopharmaceuticals	• Summary of requirements including relevant guidance • Table showing information sources e.g. GMP, MHRA, National and International guidance	
	IIR-C-41	Critically review environmental and personal monitoring including which tests are performed and frequency of testing	• Review environmental and personal monitoring procedures •Present audit of environmental/personal monitoring and comment on results	
	IIR-C-42	Comply with relevant quality assurance requirements associated with radiopharmaceuticals	• Results of Quality assurance tests on radiopharmaceuticals and evidence of sign-off for patient use • Details of quality system used in radiopharmacy, possibly in the form of a table listing requirements	
	IIR-C-43	Perform commissioning tests on radionuclide calibrators	• Report of commissioning tests performed in accordance with NPL guidance	IIR-C-43, 44
	IIR-C-44	Perform periodic quality control tests on radionuclide calibrators and recommend procedures for optimisation of measurements	• Review of calibrator QC protocols • Results of QC tests, including daily QC, monthly QC and linearity	IIR-C-43, 44
	IIR-C-45	Use radionuclide calibrators for the measurement of therapeutic activities of radionuclides	•Evidence of participation in measurement of therapeutic radiopharmaceuticals (e.g. name on log, statement from supervisor) • Therapy case studies	
	IIR-C-46	Review compliance of radiopharmacy procedures against relevant radiation regulations and guidance	• Table linking procedures with relevant regulations and guidance • Report of RPA/RWA audit of Radiopharmacy	

Radiation Protection	IIR-C-47	Undertake risk assessment for a range of radiation facilities and a range of radiation hazards, to include external and internal, low energy and high energy, X-ray, gamma, beta and positron	• Risk assessments covering external and internal, low energy and high energy, X-ray, gamma, beta and positron	
	IIR-C-48	Write local rules for a diagnostic imaging area, including contingency planning	• Local rules for a new facility or new protocol • Short review of current local rules	
	IIR-C-49	Write local rules for nuclear medicine facilities and services, including contingency planning	• Local rules for a new facility or new protocol • Short review of current local rules	
	IIR-C-50	Critically appraise IRMER procedures for a radiation facility.	• Review IR(ME)R documentation • Perform IR(ME)R audit	IIR-C-50, 58, 59
	IIR-C-51	Review the results of whole body and extremity radiation dose monitoring of staff and take remedial action as appropriate	• Short report of an audit of hand and foot monitoring • Short report reviewing badge results detailing any actions taken	
	IIR-C-52	Give advice to diagnostic and therapy patients on the precautions that they should follow on their return home, with particular regard to the safety of children, unborn foetuses and breast-fed infants	• Written confirmation of active contribution on providing patients/carers on post-therapy restrictions including 131I and one other radionuclide • Written confirmation of active contribution on providing patient restrictions to diagnostic patients	IIR-C-32
	IIR-C-53	Give radiation safety advice to a range of healthcare staff in connection with nuclear medicine patients	.• Instructions for staff for radionuclide inpatient therapies • Short report reviewing current staff instructions and if any alterations are necessary • Presentation detailing instructions to be presented to staff	IIR-C-29
	IIR-C-54	Deal with a spillage of liquid radioactive material and perform subsequent decontamination measures	• Written confirmation of practical skills in dealing with a spillage	DOP
	IIR-C-55	Calibrate contamination monitors for measuring the surface activity of a range of radionuclides, including technetium-99m, iodine-131 and pure beta emitter	• Report/spreadsheet showing procedure and results from contamination monitor calibrations and regular QC • Critical appraisal of QC procedures for monitoring equipment	IIR-C-56
	IIR-C-56	Manage a quality assurance programme for radiation monitors	• Report/spreadsheet showing procedure and results from contamination monitor calibrations and regular QC • Critical appraisal of QC procedures for monitoring equipment	IIR-C-55
	IIR-C-57	Participate in the management of the storage, disposal and record keeping of radioactive waste	• Written confirmation of active participation in waste disposal • Short report describing waste disposal procedures	IIR-C-35
	IIR-C-58	Perform radiation protection audits for nuclear medicine	•Participate in and prepare reports for IRR, EPR, IR(ME)R audits	IIR-C-50, 58, 59
	IIR-C-59	Critically review policies and procedures for regulatory compliance	• Short report reviewing policies related to e.g., IRR, EPR, IR(ME)R - this can be done as part of the audit process or preparation for an inspection	IIR-C-50, 58, 59

	IIR-C-60	Collect data for the calculation of estimated absorbed, equivalent and effective doses to patients, and effective doses to staff and the public	•Personal dosimetry report • Patient dose audit	
	IIR-C-61	Calculate estimated radiation dose and radiation risk where relevant in relation to a particular incident	•Radiation dose incident report e.g. skin dose	

Diagnostic Radiology Equipment Performance	IIR-C-62	Decide on appropriate tests to apply to the assessment of the measuring device to ensure that it is performing according to its specified standard	•Cross calibration work instruction •Familiarisation with manufacturers recommendations and instructions for measuring device if appropriate	
	IIR-C-63	Undertake and/or arrange for tests to be carried out in an environment, and with facilities, that are appropriate and traceable to national standards	•Cross calibration of equipment ○ Arrange to send of to laboratory for assessment (e.g. NPL, Manufacturer etc.) ○ Check to ensure laboratory is suitable (evidence of traceability to primary standard etc.) OR ○ Follow department procedure to perform cross calibration of dosemeter	
	IIR-C-64	Obtain and interpret the results of tests and calibrations and report on the performance on the equipment	•DAP meter tests. QC reports. Cross calibrations. Service report hand-over	
	IIR-C-65	Safely operate and perform routine quality assurance measurements on simple X-ray equipment for quality assurance (e.g. dental, mobile and general radiography), using a range of image detector technologies	•Be observed to safely operate a range of equipment •Perform Quality assurance measurements on range of simple equipment •Write reports of results of QA tests for a range of simple X-ray equipment	
	IIR-C-66	Perform commissioning and acceptance tests on simple X-ray equipment and detectors	•Be observed performing commissioning and acceptance tests on simple X-ray equipment and Detectors •Commissioning reports and explanatory info	
	IIR-C-67	Safely operate and perform routine quality assurance measurements on mammography equipment	•Be observed performing routine QA measurements for Mammo •Report of QA findings	
	IIR-C-68	Perform commissioning and acceptance tests on mammography equipment	•Be observed performing commissioning and acceptance tests •Commissioning reports and explanatory info	
	IIR-C-69	Safely operate fluoroscopy systems and perform appropriate routine quality assurance measurements	•Be observed performing routine QA measurements for fluoroscopy systems •Report of QA findings	
	IIR-C-70	Perform commissioning and acceptance tests on fluoroscopy equipment	•Be observed performing commissioning and acceptance tests •Commissioning reports and explanatory info	
	IIR-C-71	Safely operate CT systems and perform appropriate routine quality assurance measurements	•Be observed performing routine QA measurements for CT systems •Report of QA findings	
	IIR-C-72	Perform commissioning and acceptance tests on CT X-ray equipment	•Be observed performing commissioning and acceptance tests •Commissioning reports and explanatory info	
	IIR-C-73	Devise test schedule for a diagnostic imaging system new to the trainee	•Critically appraise a test schedule for a diagnostic imaging system new to the trainee •Read appropriate guidance and reports •Write a test schedule	

	IIR-C-74	Instigate corrective action based on an evaluation of safety performance results	•Advice attached to a safety report •Follow-up quality assurance tests etc. as appropriate to determine effectiveness of corrective action ○Subsequent follow up reports/e-mails etc.	
	IIR-C-75	Critically review safety performance programmes and make recommendations if appropriate	•Review programmes and compare to guidance	
	IIR-C-76	Devise and undertake a critical examination for complex equipment, for example a cardiac intervention suite or CT scanner	•Participate in a critical examination for complex equipment or paper exercise if appropriate •Produce critical exam report	
Diagnostic Radiology: Image Optimisation and Patient Dose Measurement	IIR-C-77	Review and critically appraise the patient dose measurement framework	A report describing the methodology for a type of patient dose measurement (e.g. skin dose calculation for interventional x-ray, foetal dose calculation, or patient dose calculation). The report should include, assessment of errors in the calculations	
	IIR-C-78	Review and analyse methods for assessment of image quality in a range of diagnostics radiology equipment, including computed radiography, digital radiography, CT and image intensifier systems	A report considering the various ways in which image quality can be assessed. The report may describe in brief how to perform a test but should focus on demonstrating an understanding of the purpose of each test, and how the results may correlate with clinical image quality. Ideally test object tests, quantitative image quality metrics, and assessments of clinical images quality should be considered	
	IIR-C-79	Undertake measurements to assess image quality in a range of diagnostics radiology equipment, including computed radiography, digital radiography, CT and image intensifier systems, and interpret results in the context of the clinical use.	• Reports from routine QC testing or commissioning of each type of equipment • Report describing an optimisation project including assessment of image quality	
	IIR-C-80	Undertake measurements to assess the patient dose in the equipment settings used to assess image quality above and advise on appropriate diagnostic reference levels	Review of dose audit on specific procedure and review protocols and image quality	IIR-C-79,81 and 82
	IIR-C-81	Review and develop parameters for assessing clinical image quality with clinical staff	Report describing an optimisation project including assessment of image quality.	IIR-C79 80 and-82
	IIR-C-82	Review the outcome of image quality and patient dose measurements in a range of systems and recommend optimisation strategies. Assess by simulation or measurement the effect of the optimisation suggested	Report describing an optimisation project including assessment of image quality.	IIR-C79 80 and-81
	IIR-C-83	Calculate organ dose and effective dose for a range of investigations	A selection of patient dose reports, expected to include effective dose calculation following an incident, foetal dose calculation, skin dose calculation, and a research ethics report	IIR-C-84

	IIR-C-84	Calculate radiation risks and communicate them effectively to various staff groups and the patient	• A selection of reports from dose investigations with some description of the risks • Slides from a talk given in which radiation risk was considered	IIR-C-83

Information and Communication Technology	IIR-C-85	Critically appraise the information governance and operational management requirements for departmental systems	• Document covering the general requirements and ISO standards & legislation, and how these are applied within the department	
	IIR-C-86	Write procedures for the operational management of a clinical computer system	• Evidence of written work instructions for a computer system.	
	IIR-C-87	Undertake a range of system administration tasks on a nuclear medicine or diagnostic radiology system	• Written confirmation of performance of admin tasks. • Short report detailing admin tasks performed and their importance	
	IIR-C-88	Critically appraise the ICT infrastructure requirements for a diagnostic imaging service	•Document discussing the legislation & standards, security, back up, and imaging requirements	
	IIR-C-89	Discuss the interconnectivity requirements of DICOM	• Short document on DICOM	
	IIR-C-90	Write a user specification for the requirements of a novel image processing application	• Report detailing novel image processing application, including user specification, details of the development and implementation, audit, and instructions for use • Written confirmation of training provided • PowerPoint presentation of training provided These can be covered as part of a mini project or an MSc project	IIR-C-90, 91, 92, 93
	IIR-C-91	Develop a novel image processing application		IIR-C-90, 91, 92, 93
	IIR-C-92	Develop and implement a verification and validation plan for a novel image processing application. Release application software for clinical use. Audit use in clinical environment		IIR-C-90, 91, 92, 93
	IIR-C-93	Write user and technical documentation in support of a novel image processing application. Provide user training		IIR-C-90, 91, 92, 93