1. Objective

The objective of this document is to outline the steps that should be taken in the event that a Local Diagnostic Reference Level (LDRL) is exceeded, or consistently exceeded.

Guidance is provided on potential scenarios where

(i) an *individual* patient exposure exceeds the LDRL or
(ii) patient exposures *consistently exceeds* the LDRL.

This document relates to the IRMER Level 1 Employer's Procedures on DRLs, Assessment of patient dose and Optimisation.

N.B. Local staff should know the actions required of them in the event of a LDRL being exceeded; this knowledge may be tested during an IRMER inspection.

A flowchart of the process is shown in the Appendix.

2. Individual patient exposures exceeding the Local DRL

For radionuclide administrations, any situation whereby an individual patient exceeds the LDRL is more likely to arise from a proactive decision to administer a higher activity to that patient for pre-determined clinical reasons. Consequently, the increased administration will have been included in the justification and authorisation process. However, in X-ray exposures, an individual exposure exceeding the DRL is likely to have been determined retrospectively. In such cases, further action is required as detailed below.

Local staff (e.g. radiographers) are expected to have an awareness of the Local DRLs, know where to find the LDRL for a particular examination and know how to use them in practice. Staff should realise when the dose from an individual patient exposure (e.g. DAP, DLP) significantly exceeds the LDRL. For mammography, radiographers should be aware of action levels and procedure set out in HP-EXTU-FORM-018.

If an individual patient exposure exceeds the LDRL by a factor of 2 or more, the member of staff should consider the possible reasons for this (e.g. large patient, complex procedure…). The dose must be recorded as per local procedures, however it is not necessary to record the fact that this individual exposure exceeded the LDRL. If there is no reasonable explanation for the higher than expected dose, it should be mentioned to colleagues and a senior member of staff (e.g. modality lead), who may investigate further by analysing other patient dose data from the equipment or performing routine QA. The senior member of staff should make others aware if there is a potential issue with the equipment or protocol.

If the individual patient exposure exceeds the LDRL by a factor of 5 or more, it is recommended a local internal investigation is carried out in addition to the steps above. Patient exposures that exceed the local DRL by a factor of 10 or more should be reported to the MPE. (N.B. Interventional / cardiology procedures that exceed the local DRL by a factor of 10 or more are reportable to HIS.)

For both radionuclide administrations and X-ray exposures, if there is suspicion that the Local DRLs are being significantly exceeded on a frequent basis then a local audit patient dose audit should be carried out as discussed in Section 3.

3. Patient exposures consistently exceeding the Local DRL

If staff have concerns that a LDRL is being significantly exceeded on a frequent basis then a local audit should be carried out. If this indicates that the LDRL is being exceeded on a regular basis then this should be discussed with a Medical Physics Expert (MPE). The MPE may carry out a patient dose survey for the examination to determine how the mean and/or median dose compares to the LDRL, e.g. using IPEM Report 88 for guidance related to X-ray exposures.

Regarding X-ray exposures, IPEM Report 88 on the 'Establishment and Use of DRLs' states that an action should only be taken if a room mean dose is found to have *significantly* exceeded the DRL (i.e. where the mean or median dose is > 20% of LDRL **and** > 2 x the standard error of the mean). MPE advice is that this would be indicative of 'consistently' exceeding the DRL under IRMER17 Reg 6(7). In such cases the regulations require that a review be carried out to consider the possible reasons for this and to ensure corrective action is taken where appropriate.

Possible reasons for consistently exceeding the LDRL:

(i) Measurement methodology: For example, is the DAP meter / radionuclide calibrator accurately calibrated? Is the patient selection criteria satisfactory (i.e. within the recommended weight range)?

(ii) Equipment – there could be various differences in equipment, such as AEC settings, tube filtration, use of a grid and CR vs DR.

(iii) Case Mix: there could be differences in the case mix of individual rooms due to differences in, for example, patient cohort (such as paediatrics or elderly), complexity of procedure or room function (such as A&E vs general X-ray).

(iv) Technique: although departments should strive for standardisation, there may be situations where it is justified to have variations in technique.

Outcome of the review:

The MPE will provide feedback to the local department identifying:

- why the LDRL or NDRL has been exceeded (if known)
- any remedial measures that are recommended

The Image Optimisation Team (IOT) should discuss the outcome of the MPE review and advise the Employer on the appropriate corrective action(s) that should be taken. Recommended corrective actions may include:

- amend the LDRL, or establish a new LDRL for a specific room / case mix
- the equipment should be considered for replacement or put on the risk register
- QA / maintenance programmes should be reviewed
- Standard Operating Procedures (including technique and exposure factors) should be reviewed.

References:

1. Department of Health. Ionising Radiation (Medical Exposure) Regulations 2017, came into force on 6th February 2018
2. Institute of Physics and Engineering in Medicine (IPEM). Guidance on the Establishment and Use of Diagnostic Reference Levels for Medical X-Ray Examinations. IPEM report 88. IPEM, 2004.

Appendix: Flowchart showing the process to follow when the dose exceeds X-ray LDRL