Monitoring Radiation Dose: A New IHE Profile

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Many radiology sites have recently re-iterated their commitment to monitoring the radiation dose delivered to their patients. It is not uncommon for concrete action to then falter when faced with the challenge of finding a way to do so in a way that is effective but not overly burdensome.

Integrating the Healthcare Enterprise (IHE - www.ihe.net) is an initiative of professional societies to collaborate with industry and coordinate standards-based solutions to problems that span multiple vendors systems.

The new **IHE Radiation Exposure Monitoring (REM) Profile** facilitates the collection and distribution of the estimated patient radiation exposure information resulting from imaging procedures.

In the vast majority of medical procedures involving radiation, the potential diagnostic or interventional benefit to the patients' health far outweighs the potential risk, but the trade-off should not be overlooked. Technological mechanisms can automate and facilitate a deliberate evaluation of that trade-off.

Many regulations and guidelines (such as the European directive Euratom 97/43 and the American College of Radiology Dose Whitepaper) express the need for facilities to monitor radiation dose estimates for procedures they perform and keep procedure doses As Low As Reasonably Achievable (ALARA). Such efforts are easier, and more likely to occur regularly, when dose estimates are provided electronically

The IHE REM Profile provides an **implementation guide for vendors**. It documents how to support dose reporting using existing standards (DICOM SR Dose Reports). By following this guide and participating in IHE Connectathons, vendors can release products that will interoperate to provide an exposure monitoring pipeline.

Imaging modalities are required to export radiation exposure details in a standard format. **Radiation reporting systems** can periodically query these "dose objects" from an **archive**, or receive them directly from modalities. The reporting system is expected to perform relevant dose QA analysis and produce related reports. Dose reports can also be submitted to **centralized registries** such as might be run by professional societies or national accreditation groups.

The Profile addresses **CT, angiography, fluoroscopy, mammography, CR, DR, and plain X-ray**. It does not yet address nuclear medicine (PET or SPECT), radiotherapy, or implanted seeds.

Dose details are recorded for each **irradiation event**, defined as one continuous irradiation applied to a patient. A CT scanogram and the associated helical scan are two separate events, as are two different presses of the fluoro pedal. Typically, one dose object is created at the end of

each procedure step performed on the modality. That object collects all irradiation events from the procedure step and adds summary dose index values. The details include patient demographics, study information, imaging technique and geometry and typical dose metrics like CT Dose Index (CTDIvol), Dose Length Product (DLP), Dose Area Product (DAP), Average Glandular Dose (AGD) and Dose @ Reference Point. For a more complete content specification of the dose report objects, refer to the tables in CP-874 below.

Because the profile clearly defines what vendors have to do to claim compliance, the IHE REM Profile provides an **effective shorthand for sites to use in purchase specifications**. Sites with programs to monitor radiation exposure should review the IHE REM Profile for applicability to their goals, and consider requiring compliance with the profile in future purchases and upgrades using language such as "The **system shall support the IHE REM Profile** as the Acquisition Modality actor." Vendors can respond with their IHE Integration Statement.

Vendors who have implemented one or more of the actors in an IHE Profile provide a formal declaration of that support by publishing an **IHE Integration Statement** for a specific version of a specific product. Purchasers may also want to ask prospective vendors if they have tested their implementation at an IHE Connectathon testing event. IHE does not mandate participation in an **IHE Connectathon**, but the cross-testing with partner systems make it a useful litmus test.

Finally, **IHE Profiles provide sites with a deployment model**, mapping out the components of a solution they can use for planning. In the case of the IHE REM Profile, it is important to recognize that the profile addresses the efficient collection and distribution of dose information. It is, however, just a tool. The **policies and procedures for radiation safety and dose management remain, appropriately, the responsibility of the site**. The Profile removes data collection and management burdens but it is up to the site to put the information to use. Site physicists and radiologists should work with their dose reporting system vendor to discuss how best to analyze the data and format the reports so as to meet the needs of their dose management policy and plans. In the future, the registry features of the Profile may allow sites to compare their dose levels for various procedures with those of similar sites or national recommended dose levels.

       For more details on the IHE REM Profile:
IHE REM Profile Summary: http://wiki.ihe.net/index.php?title=Radiation_Exposure_Monitoring
IHE REM Profile Document: http://www.ihe.net/Technical_Framework/index.cfm#radiology
                       (find the link to Radiation Exposure Monitoring)

       For more details on elements of the DICOM Standard on which REM is directly based:
X-Ray Radiation Dose SR object: ftp://medical.nema.org/medical/dicom/2008/08_03pu.pdf
Templates TID 10000 thru 10005: ftp://medical.nema.org/medical/dicom/2008/08_16pu.pdf
CP-874 Final Text*:   ftp://medical.nema.org/medical/dicom/final/cp874_ft.pdf

*As part of creating the IHE REM Profile, several modifications were made to the SR Templates. Those modifications are now official and can be found in CP-874 (which will be incorporated in the 2010 Publication of DICOM).