Comparison of retrospective dosimetry assays

	Time since exposure			Type of exposure			Approx. time (hrs) from receipt of sample to report of dose estimate (depends on incident size)	What damamge is agent/assay specific for?	Approximate dose range (Gy) for photon equivalent acute whole body exposure 24 hrs ago	Triage use	Automated analysis available now? (may change with more R and D)	Dose uncertainty analysis available	Standard-ization protocol (ISO document)
	Days	Months	Years	Acute	Protracted	Partial Body							
Dicentrics, full	√	√	no	√	√	√	55	IR	0.1-5	no	√	√	ISO 19238
Dicentrics, triage	√	√	no	√	√	no	52	IR	0.5-5	√	√	√	ISO 21243
PCC fragments	√	no	no	√	no	√	2, PCC fusion method	1 to > 20	0.2-20	√	Underway	no	
PCC rings	√	√	no	√	√	no	40, PCC chemically induced	IR	1 - > 20	√	Underway	no	
Micronuclei assay (cytokinesis-block micronucleus assay)	√	√	no	√	√	no	75	Genotoxins including IR	0.2-4	√	√	√	ISO pending, although scoring criteria have been published
FISH	√	√	√	√	√	no	120	IR	0.25-4	no	Underway	√	
GPA mutation asssays	no	√	√	√	no	no	3	Mutagens including IR	> 1	no	√	no	
HPRT mutation assays	√	√	no	√	no	no	400	Mutagens including IR	> 1	no	no	no	no
Gene expression	√	no	no	√	no	no	4/36, PCR/array analysis	Genotoxins including IR	> 0.1	√	√	no	no
EPR (teeth/bone)	√	√	√	√	√	no	1 - 48	IR	> 0.1	no	Underway	√	ISO, in preparation
EPR (p.b.)	√	no	no	√	no	√	1 - 48	IR	> 2	√	no	no	no
TL/OSL (bricks)	√	√	√	√	√	no	<24	IR	> 0.03	no	√	√	no
TL/OSL (p.b.)	√	√	no	√		no	<1	IR	> 0.01	√	√	no	no
Neutron activation	√	√	√	√	√	no	<24	Neutrons	> 0.0001	√	√	no	no

Hematology: CBC data	√	no	no	√	no	no	< 1; except in mass casualty setting	Wide range, including IR	> 1, sometimes assays may go lower	√	√	No for most tools, although some may report a probably dose range.	Routine diagnostics
γH2AX	√	no	no	√	no	√	3	Genotoxins including IR	0.5- > 8	√	√	no	no
C-reactive protein	√	no	no	√	no	no	1	Wide range, including IR	> 1	√	√	no	Routine diagnostics
Serum amylase	√	no	no	√	no	no	1	Wide range, including IR	>1	√	√	no	Routine diagnostics
Computational	√	√	√	√	√	√	<1	IR	0 to ∞	√	√	√	no

Table adapted from:

Ainsbury EA, Bakhanova E, Barquijero JF et al., Review of retrospective dosimetry techniques for external ionising radiation exposures, Table 1, Radiation Protection Dosimetry 2010 Dec 23, Epub ahead of print, doi: 10.1093/rpd/ncq499;

Notes:

- Some assays need to be performed in highly specialized laboratories and specifically calibrated to use for radiation biodosimetry. Most are not FDA-approved for radiation biodosimetry.
- The availability, clinical value, time to obtain a result, and time to communicate with clinicians for various assays will depend significantly on the size, nature, and location of a mass casualty incident.
- Even though some automation may exist, use of some of these assays with really large incidents may overwhelm the system.
- For clinical management of radiation injury, none of these tools is adequate as a stand-along tool. They should be used in conjunction with all clinical data and experienced clinical judgement.
- Some changes to a few of the cells in the original publication were made for updates and clarity for REMM users. Readers are encouraged to consult to original publication.

Abbreviations:

IR: ionizing radiation
ISO: international organization for standards http://www.iso.org/iso/home.html Consult specific ISO document, if available.
PCC: premature chromosome condensation
FISH: fluorescent in situ hybridization
GPA: Glycophorin A, a genetic technique
HPRT: hypoxanthine -guanine-phosphoribosyl transferase, a genetic technique
EPR: electron paramagnetic resonance
p.b.: personal belongings
TL: Thermoluminescence physical dosimeter
OSL: Optically Stimulated Luminescence physical dosimeter
γH2AX: protein biomarker
Computational: sophisticated software programs for "geographic dosimetry", using a victim's **time** at various site(s) during incident, precise **location**(s) , and any **shielding present** (e.g., from building materials where victim was located); used to calculate dose, based on modeling of radiation levels at various locations over time.