Standardization methodologies:
a dosimetry exercise for the NIAID-RERF project

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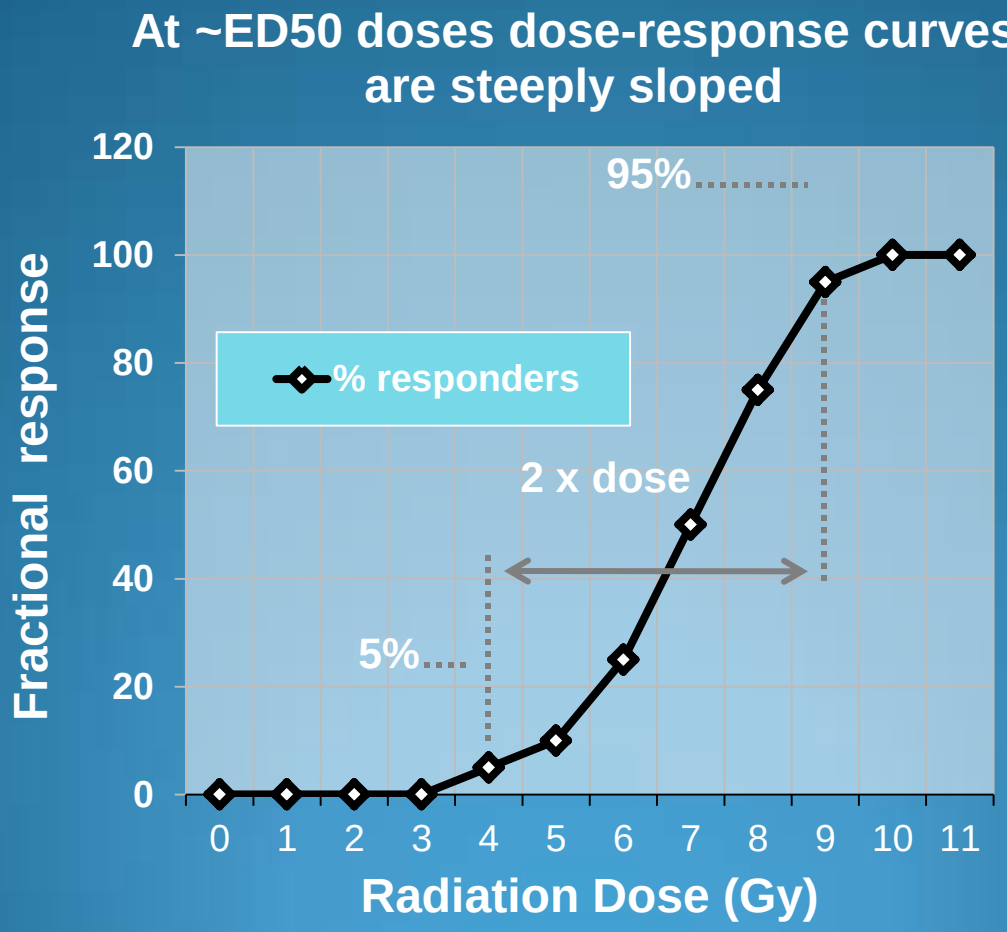
Introduction

- ✓ Multi-institutional NIAID-sponsored research project entitled “Studies of immunosenescence and other late effects of acute ionizing radiation exposures in atomic bomb survivors” initiated October 2009 and continues to date.
- ✓ Supplemental, supporting experimental radiation studies using small animal (mice) models are being conducted by a number of the collaborating researchers.
- ✓ Need to verify the accuracy of the radiation doses being delivered to experimental animals under test.
- ✓ Accuracy and reproducibility of such exposures are fundamental to the proper performance of radiobiologic investigations.

Goals

- ***Elevate awareness*** of the project's investigators of the ***dosimetric requirement*** for quality radiobiologic investigation.
- ***Assuring radiation doses*** being delivered to experimental animals ***are consistent, with a minimal accuracy of 95%*** or better (or conversely, a maximum error of 5% or less)

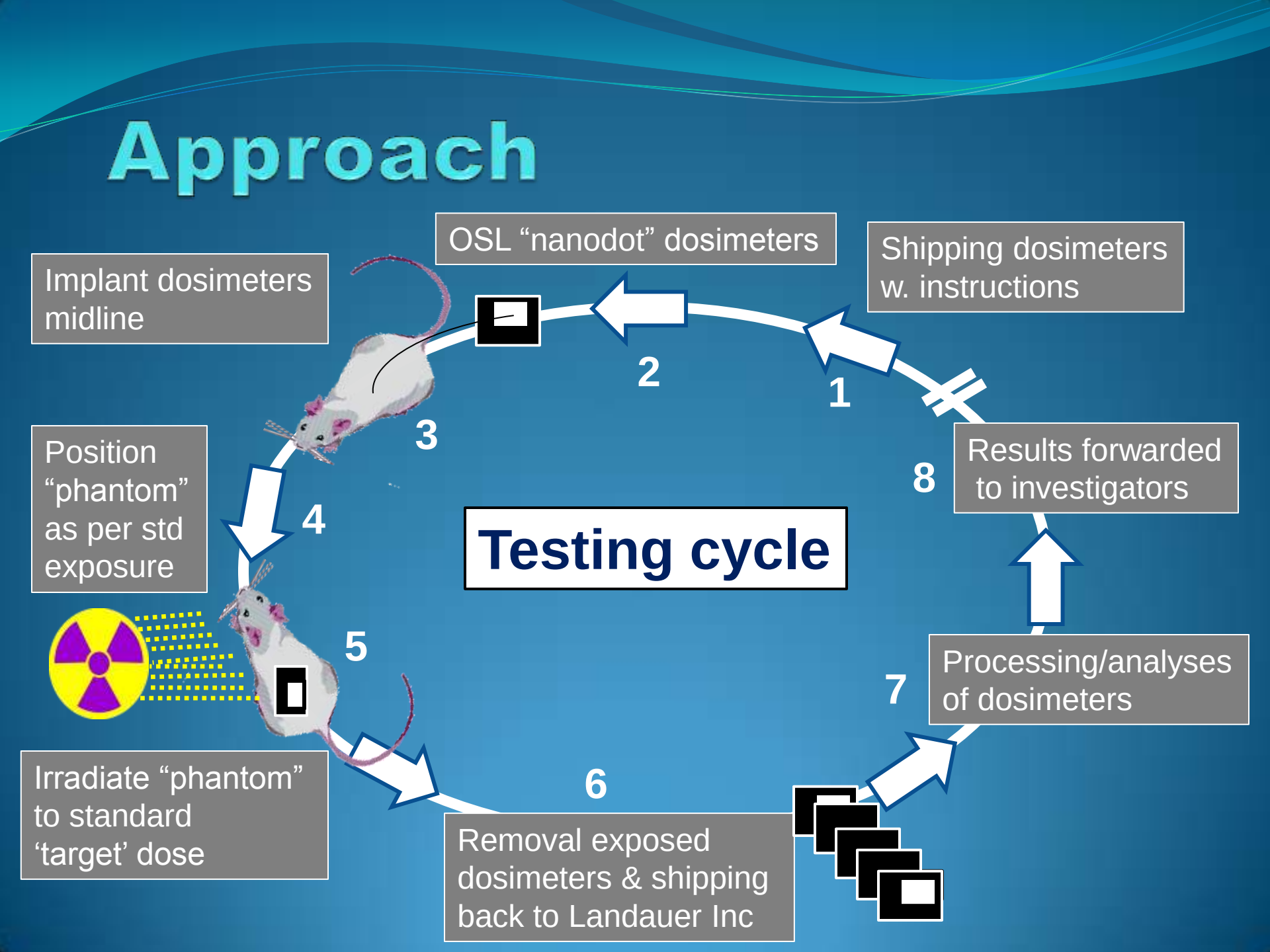
Why the need of a dosimetry exercise?



Basic approach

- ✓ Use of ***realistic phantoms*** (freshly sacrificed mouse carcass) w. ***midline embedded*** mini optical stimulated luminescence (OSL) ***nanodot dosimeters***
- ✓ Phantoms w. embedded dosimeters irradiated to set number of specific doses under simulated experimental conditions.
- ✓ Exposed dosimeters removed and shipped to Landauer Inc (Glenwood, IL) for ‘reading’ of doses.
- ✓ Exposure data sent back to investigators for review and analyses, and for possible adjustments to the exposure protocol.

Approach


OSL “nanodot” dosimeters
Shipping dosimeters w. instructions
Implant dosimeters midline
2
1
3
Position “phantom” as per std exposure
8
Results forwarded to investigators
4
Testing cycle
5
7
Processing/analyses of dosimeters
Irradiate “phantom” to standard ‘target’ dose
6
Removal exposed dosimeters & shipping back to Landauer Inc

Basic approach (con't)

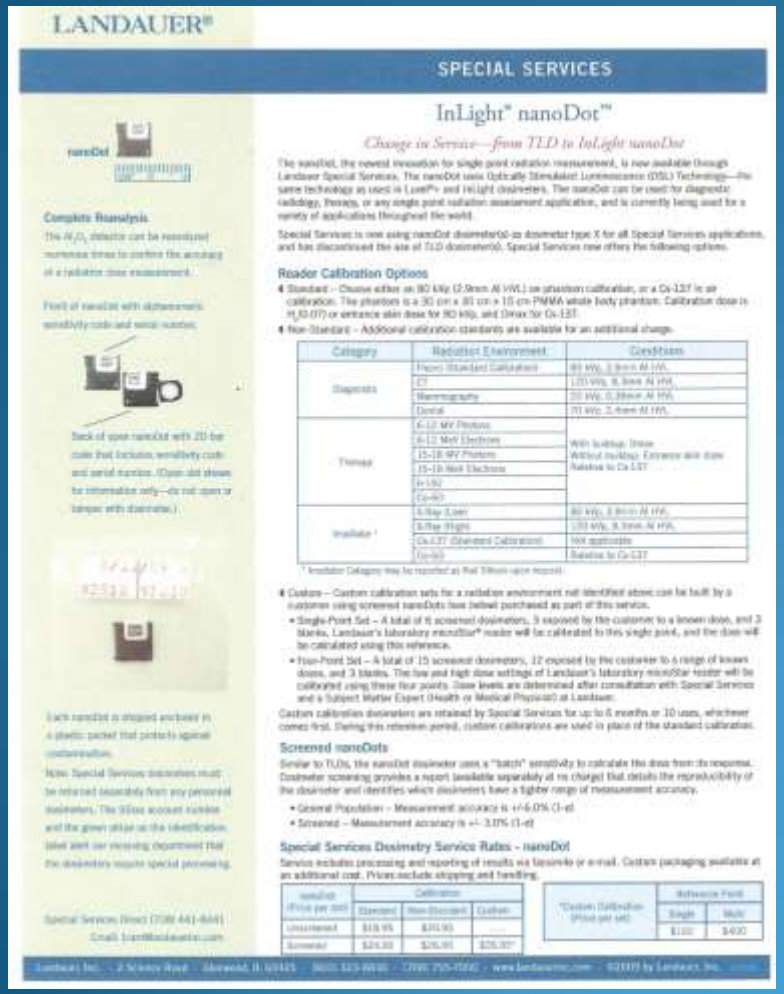
- ***Two guidance documents*** developed to assist investigators in this dosimetry exercise:

  i) ***Basic Instructions for using the 'Inlight nanoDot' radiation dosimeters***

  ii) ***Standard Operating Procedures (generic) for Experimental Radiation Exposures***

- ***Survey of IR exposure devices*****,** exposure protocols, and laboratory-specific capabilities

Specification data sheet- OSL nanoDot dosimeters



LANDAUER®

SPECIAL SERVICES

InLight® nanoDot™

Change in Service—from TLD to InLight nanoDot

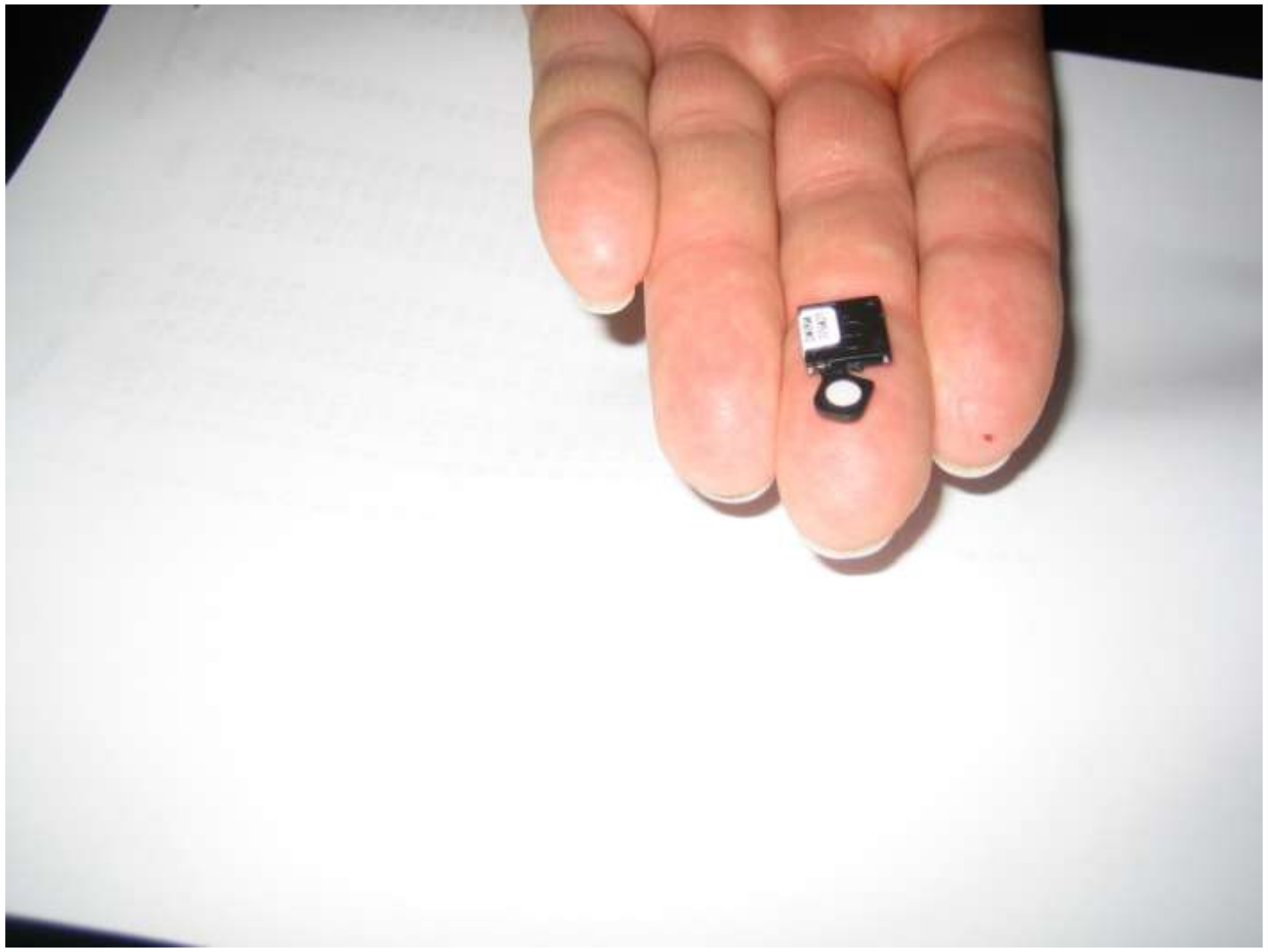
Reader Calibration Options

Screened nanoDots

Special Services Dosimetry Service Rates - nanoDot

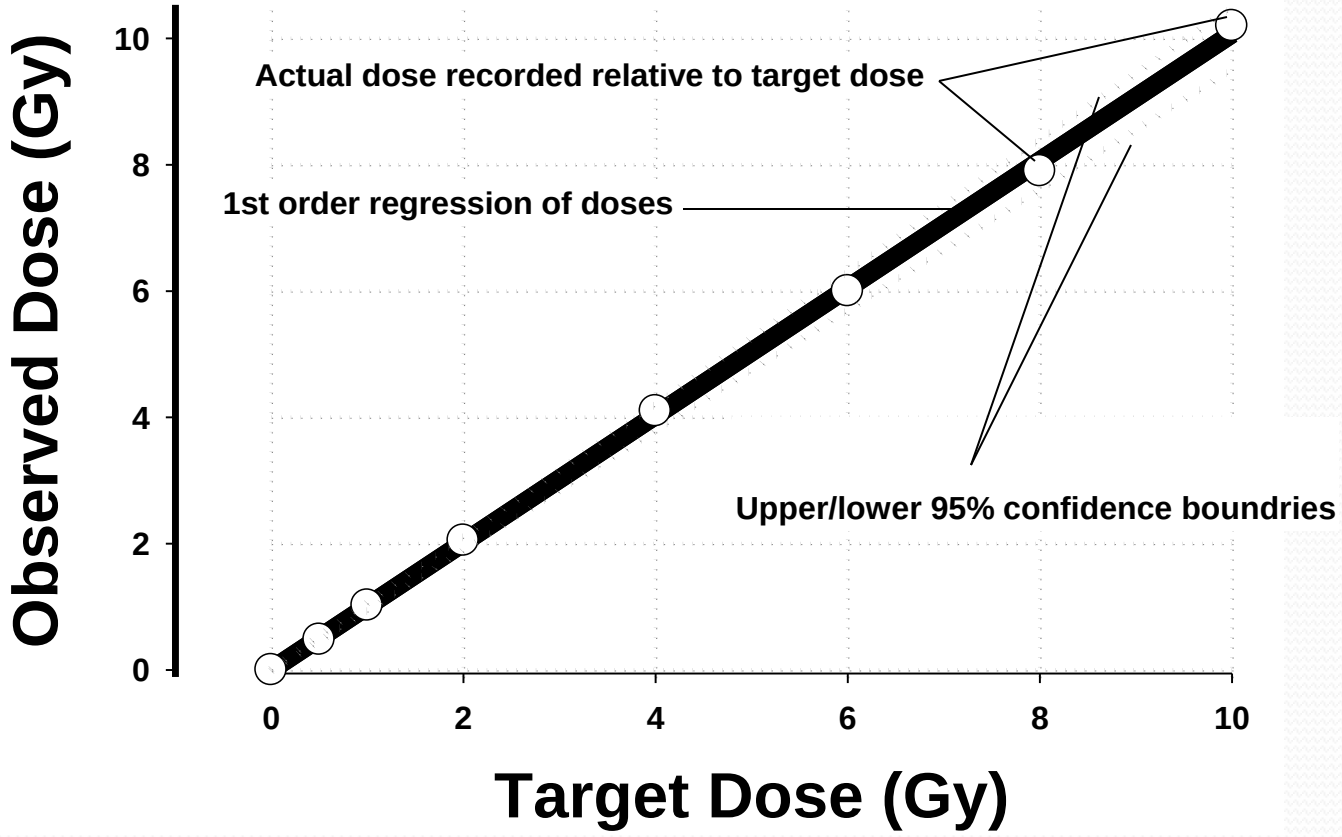
- ✓ In light nanoDot dosimeters- newest innovation for single point radiation measurements.
- ✓ nanoDot dosimeters (Al_2O_3) optically stimulated luminescence technology (OSL) .
- ✓OSL nanodots are currently being used for a variety of diagnostic radiological , therapeutic , and experimental purposes.
- ✓OSL nanoDots can be used for a broad range of ionizing radiation exposure intensities and qualities.
- ✓OSL nanoDots are cost effective, providing accurate, sensitive, and reliable dose estimates. (Landauer Inc is AALA accredited facility)

Landauer's In light-nanoDot dosimeters

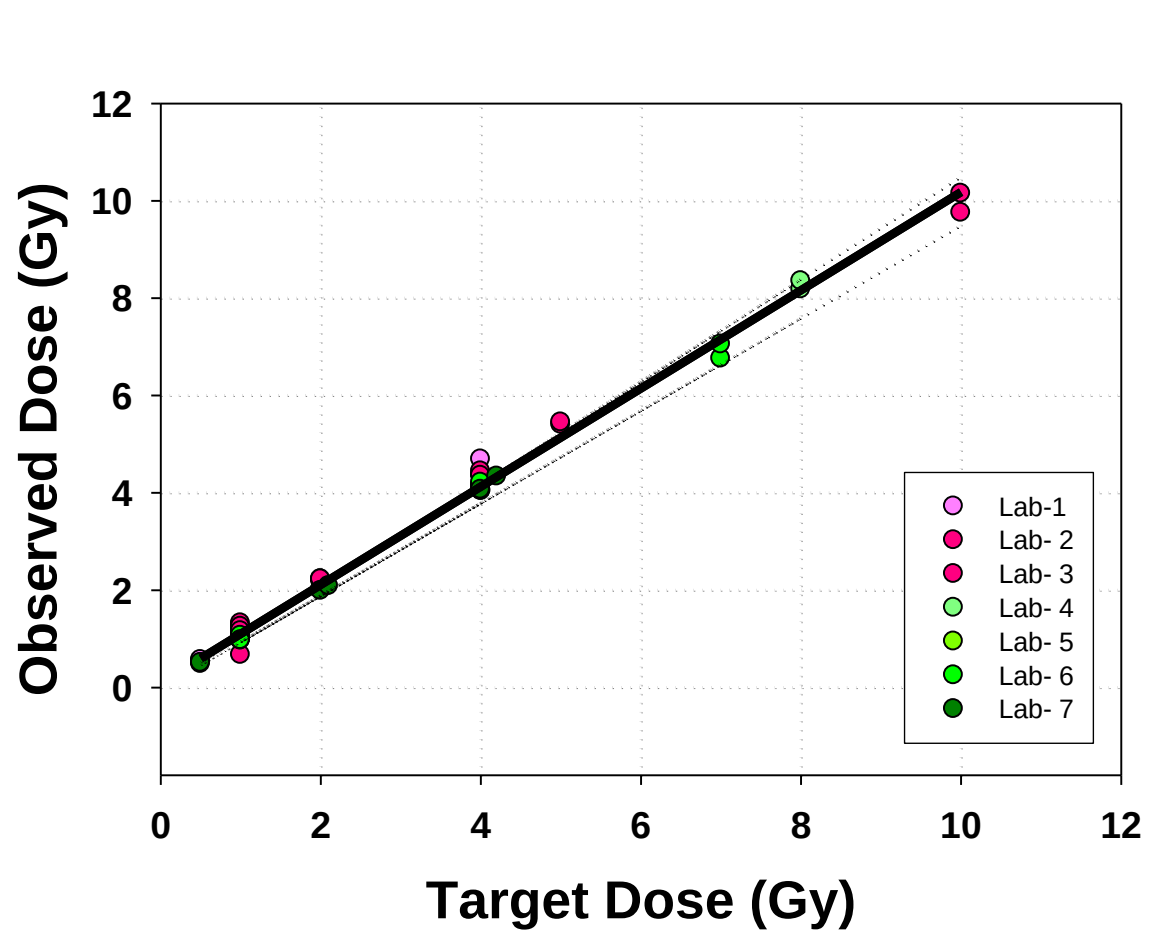


Exposure reader- OSL nanoDots

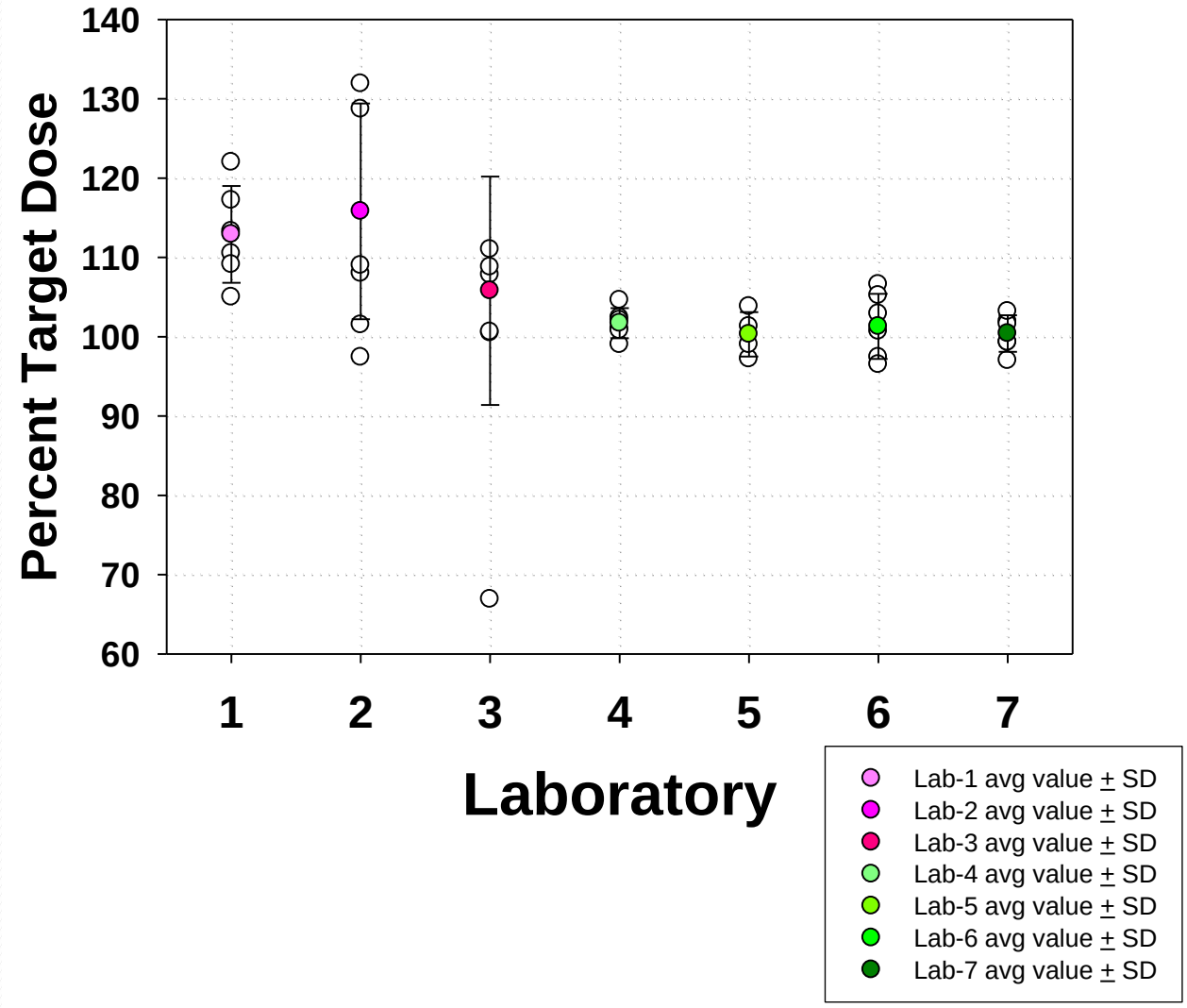
Goal: Maximum error of ≤ 5% for specific doses over a given range of exposures



Results


Observed Dose (Gy)
Target Dose (Gy)
0
2
4
6
8
10
12
Lab-1
Lab- 2
Lab- 3
Lab- 4
Lab- 5
Lab- 6
Lab- 7

Results


Percent Target Dose
140
130
120
110
100
90
80
70
60
1
2
3
4
5
6
7
Laboratory
Lab-1 avg value ± SD
Lab-2 avg value ± SD
Lab-3 avg value ± SD
Lab-4 avg value ± SD
Lab-5 avg value ± SD
Lab-6 avg value ± SD
Lab-7 avg value ± SD

Results

Lab #	Rad type	Survey	Testing-initiated	Testing-completed	Est dose <5% error	Comment
1	X-ray	Yes	Yes	No	No	Retesting required
2	X-ray	Yes	Yes	No	No	Retesting required
3	X-ray	Yes	Yes	No	No	Retesting required
4	137Cs	Yes	Yes	Yes	Yes	Passed test
5	137Cs	Yes	Yes	Yes	Yes	Passed test
6	137Cs	Yes	Yes	Yes	Yes	Passed test
7	60Co	Yes	yes	Yes	Yes	Passed test

~57% (4/7) labs passed

Summary

- ✓A review of exposure protocols has been initiated, along with a ‘dosimetry exercise’ that employs the use of OSL dosimetry technology.
- ✓All seven labs doing animal-based studies are participating; 7/7 labs have completed an initial survey of planned exposures; All labs have begun the ‘dosimeter exercise; and 4 of 7 labs have successfully completed the exercise.
- ✓It is anticipated that all participating labs will have completed the ‘dosimetry exercise’ and will be compliant by this calendar year, 2011.

Acknowledgment

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