

A RADIATION DOSIMETER FOR FIRST RESPONDERS

Gordhan Patel

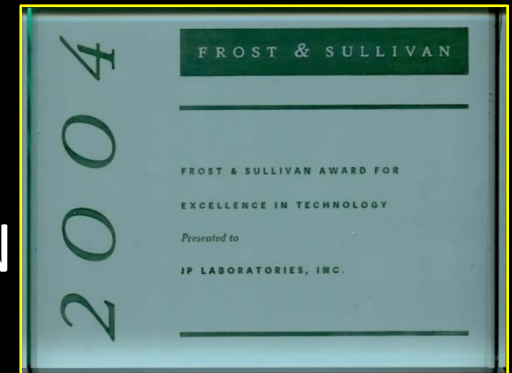
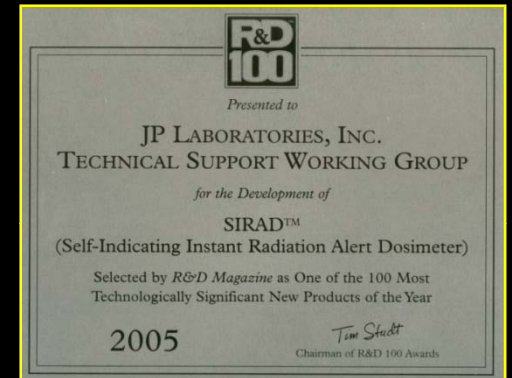
JP Laboratories, Inc., Middlesex, NJ

Fay Crowe

Crowe and Company, Summerville, SC

Yoichi Watanabe

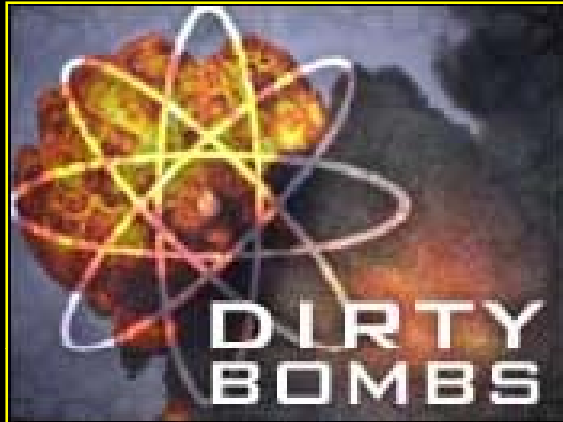
University of Minnesota, Minneapolis, MN



The 42nd Annual Midyear Meeting of the HPS
January 31 - February 3, 2009, San Antonio, TX

DIRTY BOMB & MAJOR CONCERNS

- In an event of a major radiological incident:



Chernobyl, 1986



Goiânia, Brazil, 1987

Affected people



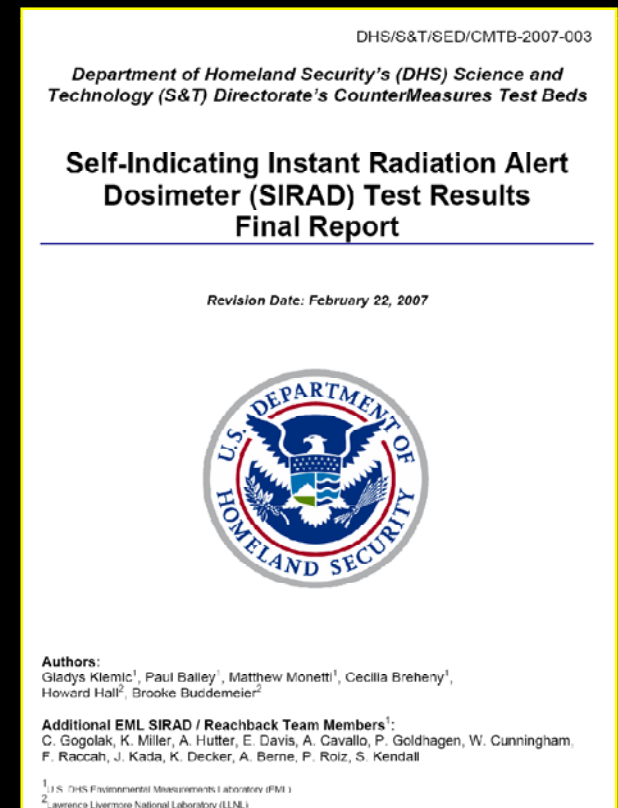
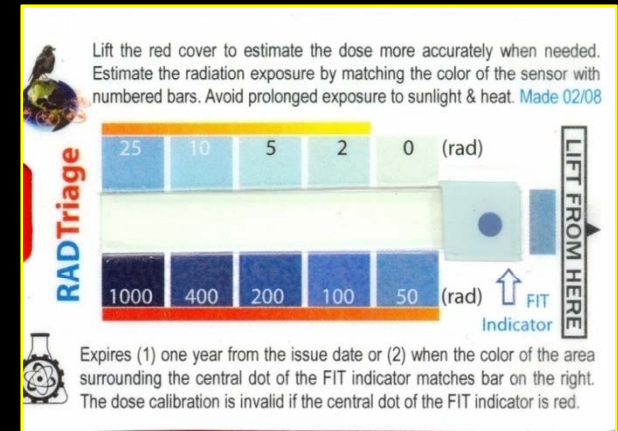
Panic



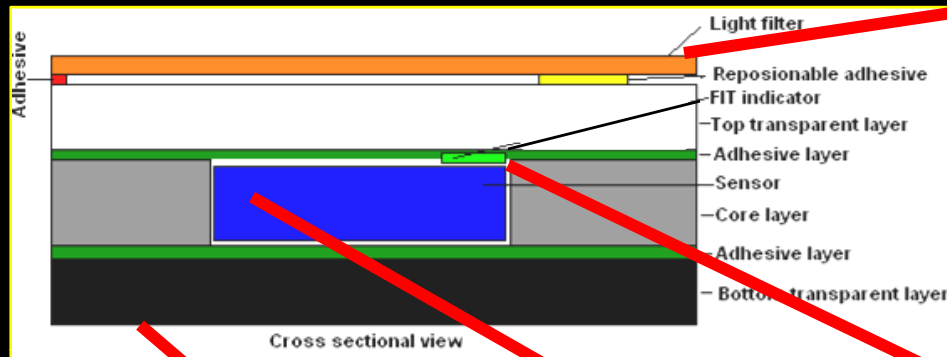
Worry

RADTriage™ - A RELIABLE DOSIMETER

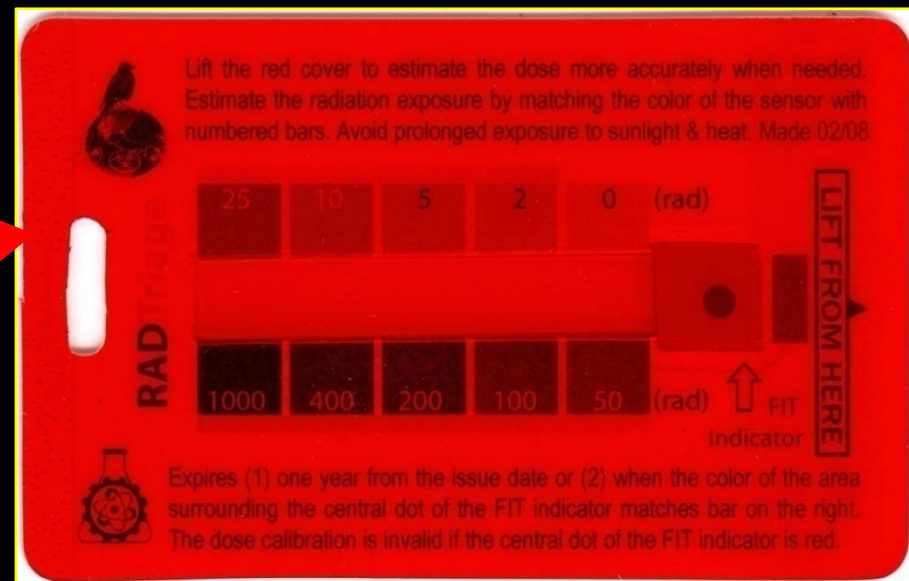
- RADTriage is a smart, reliable, color developing dosimeter designed for minimizing the panic & worry
- It is a second generation of SIRAD® (Self-Indicating Intant Radiation Alert Dosimeters) with improved sensor, a red protective filter and a revolutionary indicator (FIT™) for monitoring false signals, shelf life and tampering for the reliability
- The first generation of SIRAD® was field tested for 1 year by DHS with 800 first responders of NJ, NY & IL



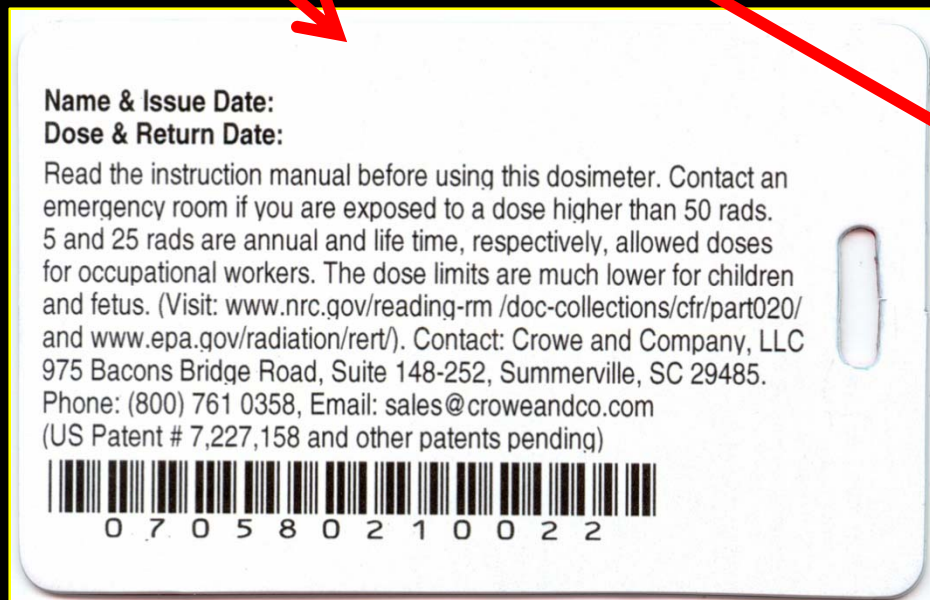
RADTriage™



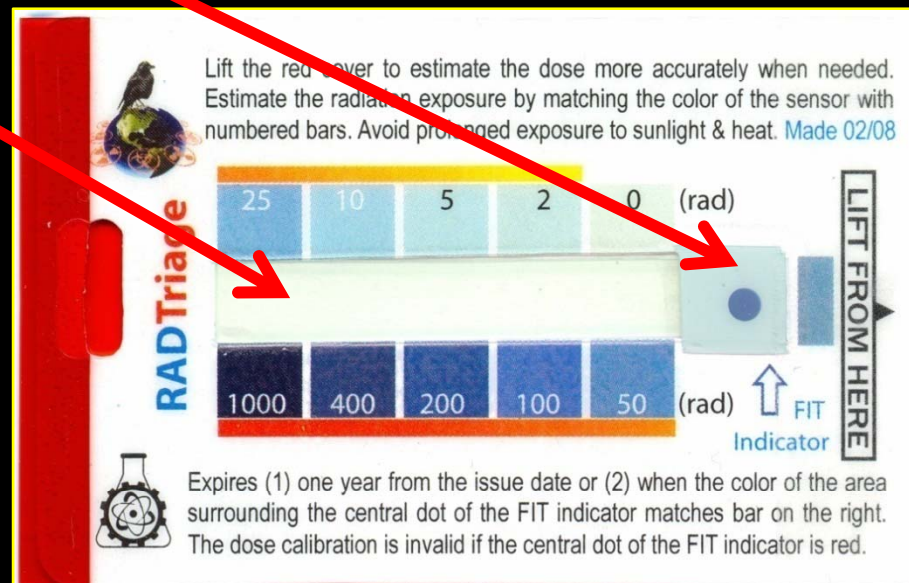
(a)



(c) Top view with red filter



(b) Back view



(d) Top view with red filter lifted



RADTriage

Lift the orange cover to estimate the dose more accurately when needed. Estimate the radiation exposure by matching the color of the sensor with numbered bars. Avoid prolonged exposure to sunlight & heat. Made 02/08



Expires (1) one year from the issue date or (2) when the color of the area surrounding the central dot of the FIT indicator matches bar on the right. The dose calibration is invalid if the central dot of the FIT indicator is red.

EFFECT OF DOSE

TRIAGING ABILITY:

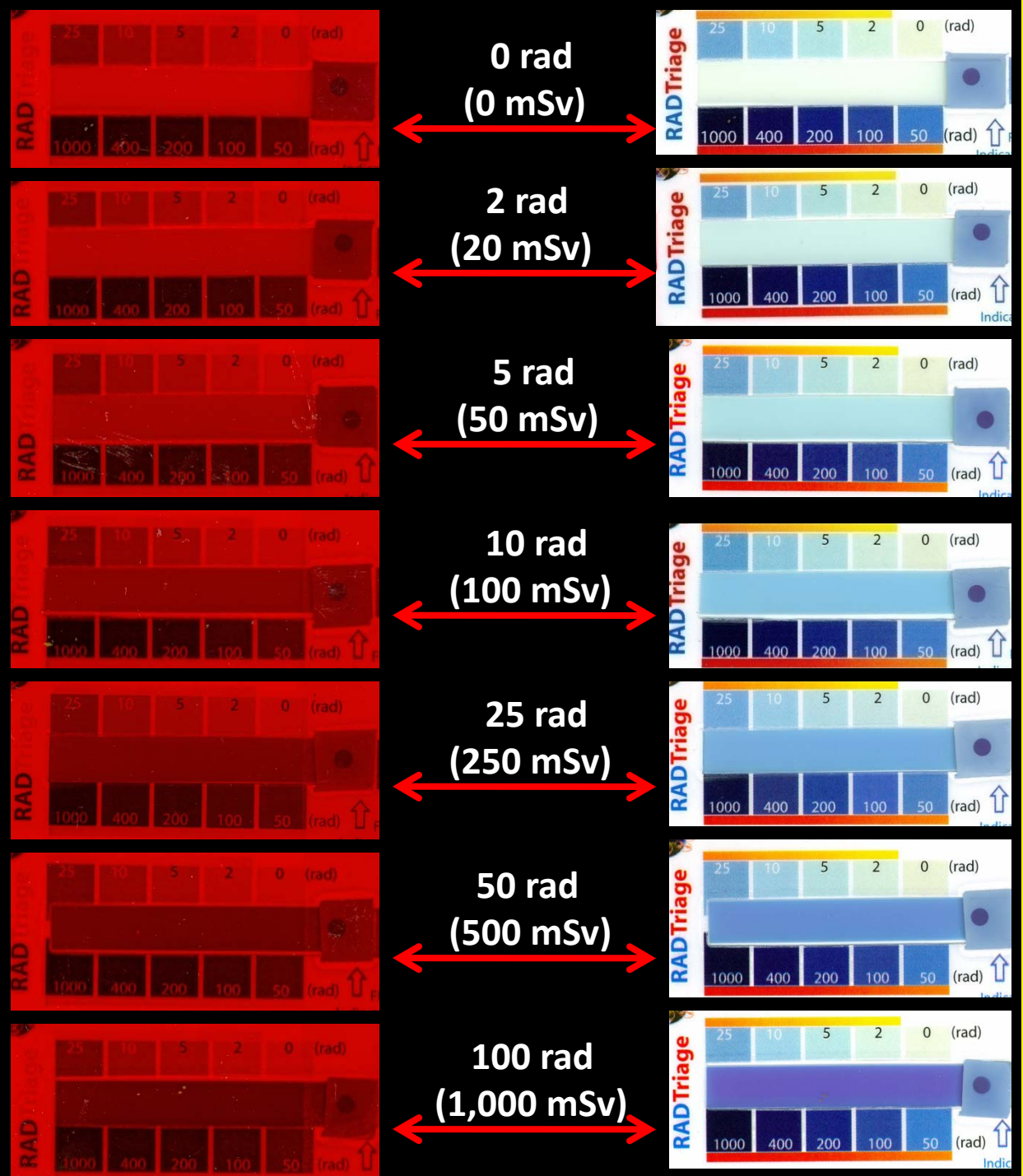
- 5 rad/250 mSv & 25 rad/5000 mSv
- >50 rad/500 mSv Medical treatment

RELIABILITY:

FIT™ Indicator

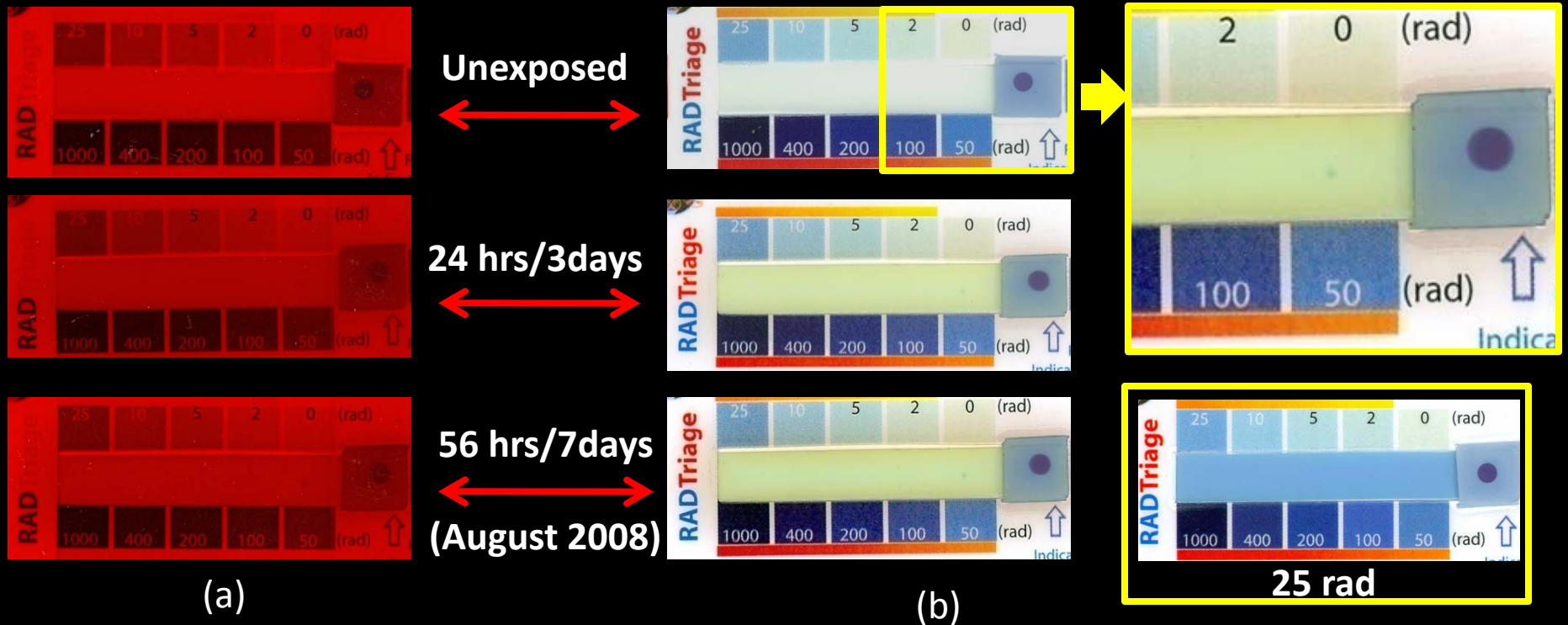
Monitors:

- False signals
- Inactive-active
- Tampering & Time-temp. (shelf-life)



EFFECT OF PROLONGED SUNLIGHT

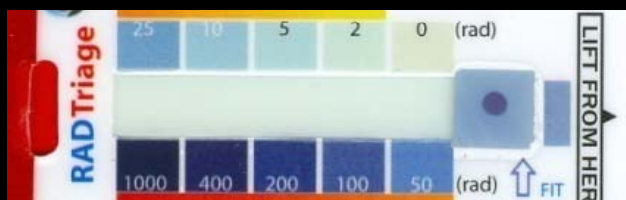
- Under the normal circumstances and if used as per instructions, the sensor of RADTriage will not give false signals



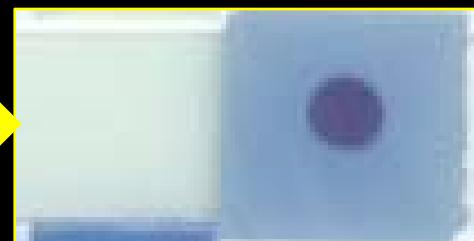
MONITORING TAMPERING



(a) Unexposed



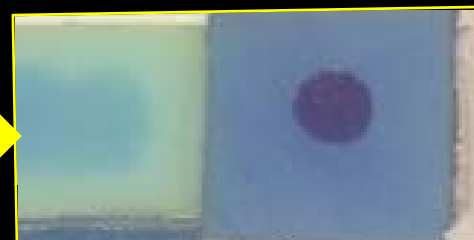
(d) Unexposed



(b) 16 hrs direct sunlight
without the red filter



(e) 16 hrs direct sunlight
without the red filter



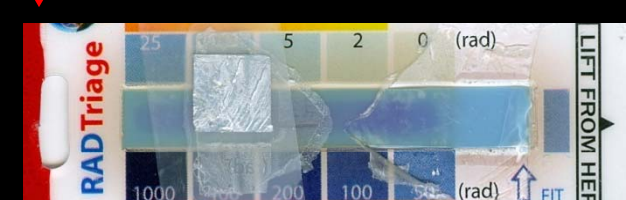
25 rad



(f) 16 hrs sunlight + 25 rad



(c) Top clear film peeled

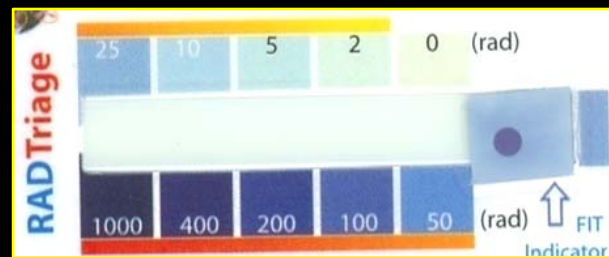
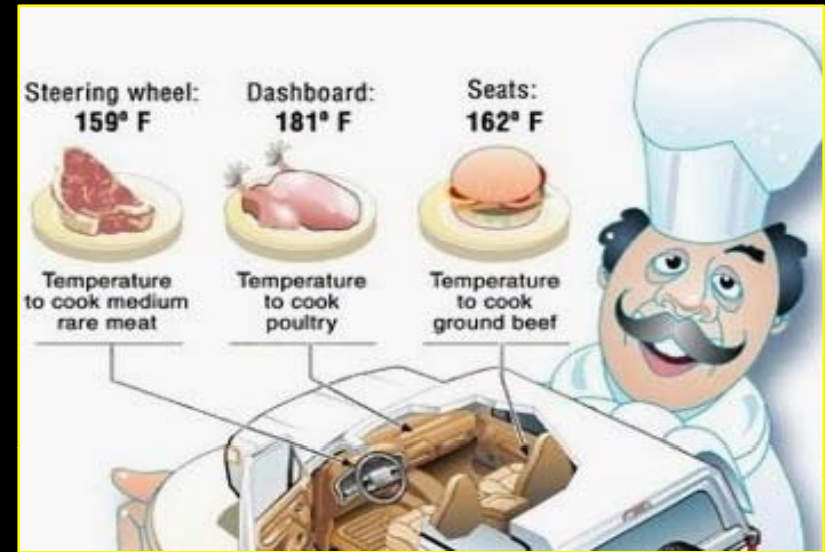


(g) Top clear film peeled

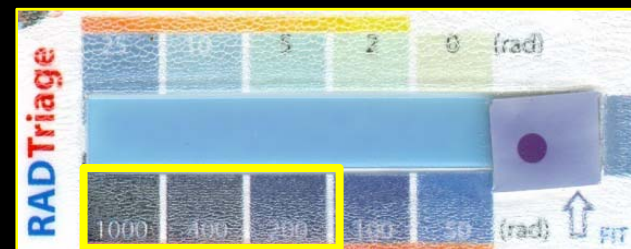


MAXIMUM OPERATING TEMPERATURE

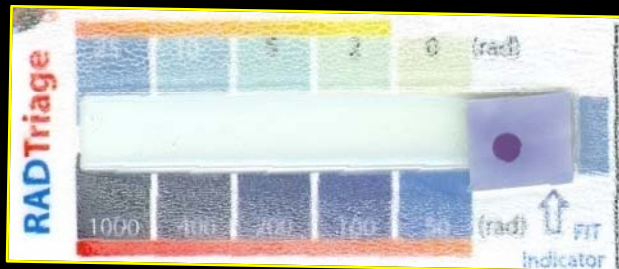
- A few laundry cycles of washing and drying (below 80°C) has a negligible effect.
- It is unaffected by humidity and water.



(a) Before annealing



(c) 90°C, 8 hours + 25 rad



(b) 90°C, 8 hours



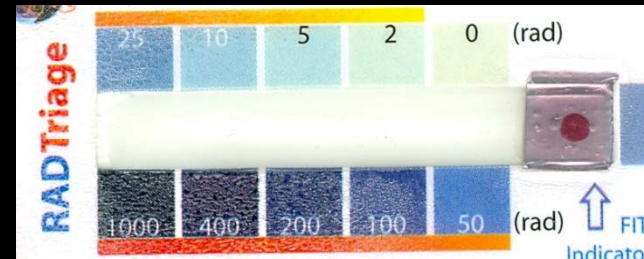
(d) Selected area enlarged

EFFECT OF ABNORMAL TEMPERATURE

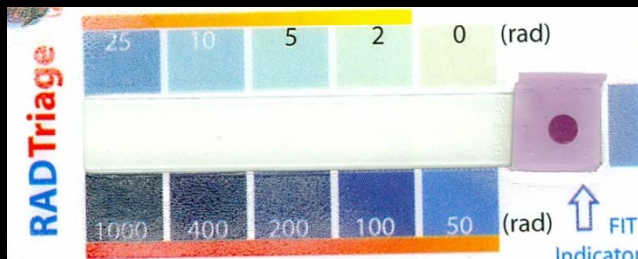
Depending upon temperature, time of annealing and rate of cooling to room temperature, the sensor becomes inactive above 100°C . The results can be archived by heating the sensor at 140°C and cooling rapidly to room temperature



(a) Control



(c) 120°C



(b) 100°C



(d) 140°C

OTHER EFFECTS & PARAMETERS

- **Shelf life:** ~1 year at 25°C
 - ~5-10 years in a freezer (stockpiled)
 - Less than 1 year at higher temperatures
- **Dose rate:** Negligible
- **Uncertainty:** $\pm 20\%$ visually, $\pm 10\%$ spectroscopy
- **Response time:** Instant, 95% within a minute
- **Energy:** Negligible above ~200 keV
 - slight attenuation at lower energy
- **Temperature of radiation:** Small ($\sim 0.1\%/^{\circ}\text{C}$ between -10°C - 60°C)

A TECHNOLOGICAL GAP: THERE WAS A NEED & NO DOSIMETER FOR FIRST RESPONDERS & PUBLIC WHIS IS:

- Instant, Self-indicating, User friendly
- Inexpensive, Reliable, Light weight, Wearable
- Monitors 1-1,000 rads with triaging ability
- Always ready without a power source
- Practically non-destructible, Stockpileable
- One year shelf life, unaffected by normal ambient conditions, Archivable
- User in control: monitor dose & false signals

RADTriage™ has these and many other desired properties and fills that technological gap

ACKNOWLEDGEMENT

- Technical Support Working Groups
- Department of Homeland Security
- Department of Justice
- Department of State
- Department of Defense (Navy)
- Department of HHS (NCI)

