



Vanta Handheld XRF Safety Training

Best Practices for Safe Operation

Disclaimer

This course is for internal use only, which means that it is prohibited to pass this information on to any external party. Any comparison to competition has been written to the best of our knowledge at the date of publication. Please keep in mind that our competitors enhance their products as well, so their products might have changed in the meantime. Please take care when using competitor comparisons in your conversations with customers.

This training material does not constitute medical or legal advice and should not be relied upon as such. The training material should not be considered as a substitute for carefully reading all applicable labeling, including Instructional Manuals supplied with the devices and published, peer-reviewed articles concerning the topics presented.

Before using or selling any product, please thoroughly review the relevant user manual(s) for instructions, warnings and cautions.

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After this course you will be able to:

1. List those responsible for registration and safe use of the analyzer.
2. Discuss how radiation is used and emitted from the XRF analyzer.
3. Name the energy classifications.
4. Define the categories of radiation exposure
5. Recognize the forms of radiation.
6. Explain ALARA.
7. Describe proper use of the XRF analyzer in terms of radiation safety.

Thank you for purchasing an Olympus Vanta Handheld XRF Analyzer!

**Should you require any after sale Service or Technical Support,
please contact:**

<https://www.olympus-ims.com/en/vanta/>

Or

Our Olympus XRF Technical Support Group

(1) (877) 225-8380

ANI.TechnicalSupport@olympus-ossa.com

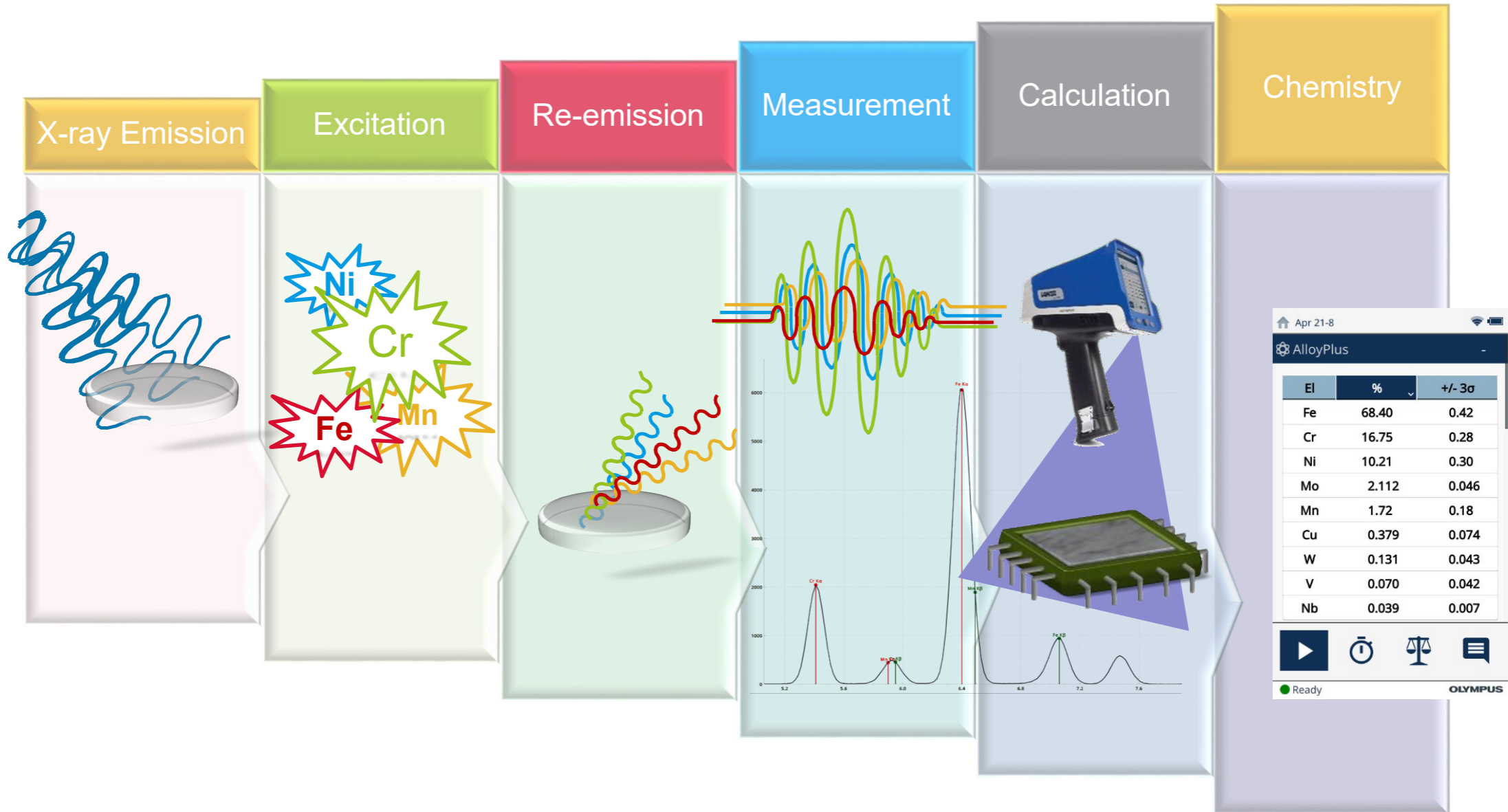
Safety!!

As the owner or operator of a hand-held, tube-based XRF device **you** are responsible for:

- understanding safety requirements
- implementing controls & training to ensure safe & responsible use.



XRF Testing Process



Apr 21-8

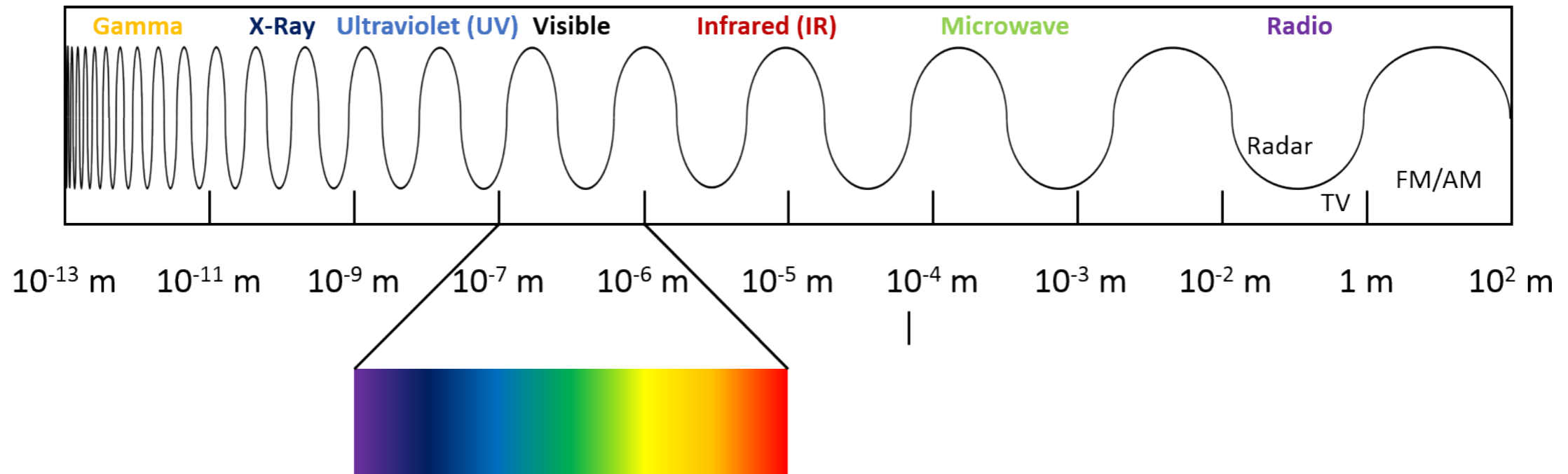
AlloyPlus

El	%	+/- 3σ
Fe	68.40	0.42
Cr	16.75	0.28
Ni	10.21	0.30
Mo	2.112	0.046
Mn	1.72	0.18
Cu	0.379	0.074
W	0.131	0.043
V	0.070	0.042
Nb	0.039	0.007

Ready OLYMPUS

Electromagnetic Radiation & X-rays

- XRF = **X-Ray** **F**luorescence
- Note: Olympus also does XRD
 - XRD = X-Ray Diffraction
- Shorter wavelengths = Higher Energy (more damaging)



Types of Radiation

Non-ionizing

- Does not eject electrons from atoms
- Can cause burns
- Does not cause acute radiation poisoning

Ionizing

- Can eject electrons from atoms
- Can cause burns
- Can cause acute radiation poisoning

	Ionizing	Non-Ionizing
Particle	<p>alpha beta</p> <p>He²⁺ e⁻</p>	
Non-Particle	<p>X-rays gamma rays</p>	<p>UV, IR microwave</p>

Uses of X-ray Radiation



**Medical
Diagnostics**



**Medical
Therapeutics**



**Industrial
Analysis**



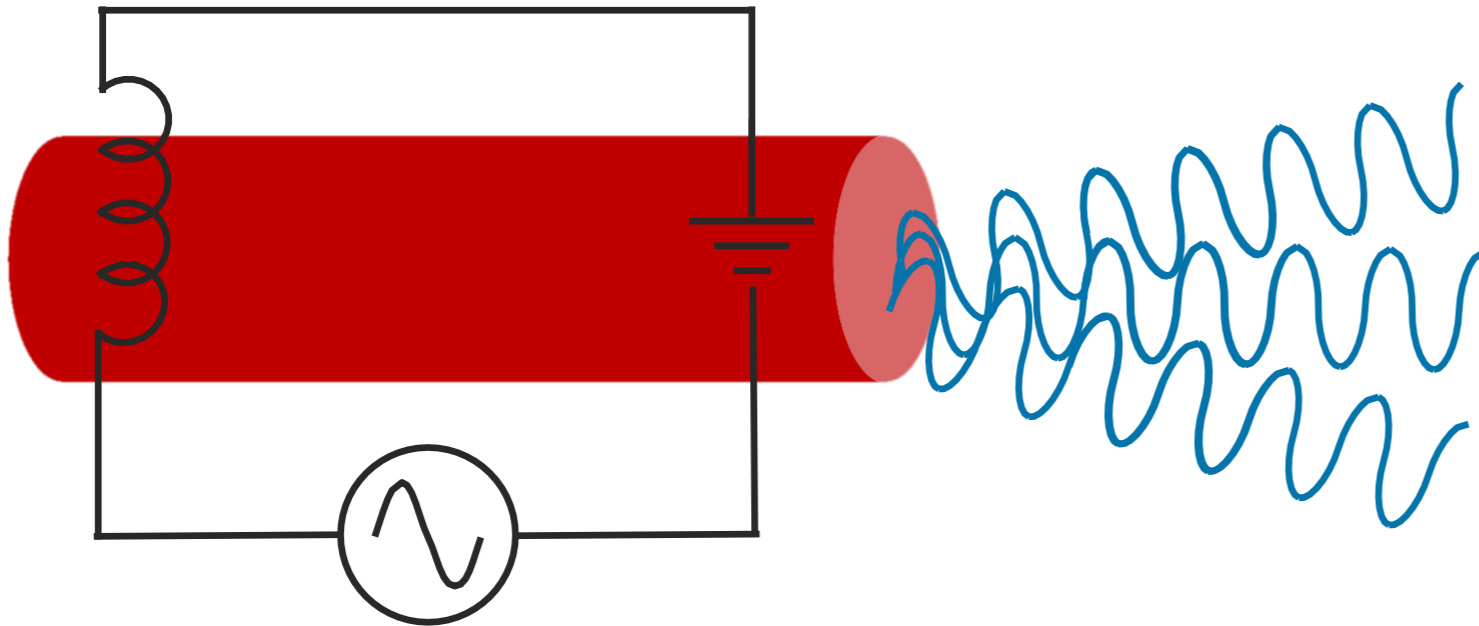
Medical X-rays are typically much more powerful than the X-rays from XRF.

Source: By Stillwaterising - Own work, CC0, <https://commons.wikimedia.org/w/index.php?curid=9686540>

Source: <https://www.cancer.gov/about-cancer/treatment/types/radiation-therapy/radiation-fact-sheet>

X-ray Emission (Primary X-rays)

- X-rays are generated electronically (w/ electricity)
- No radioactive material
- Non-particle radiation



“Isotope” Source

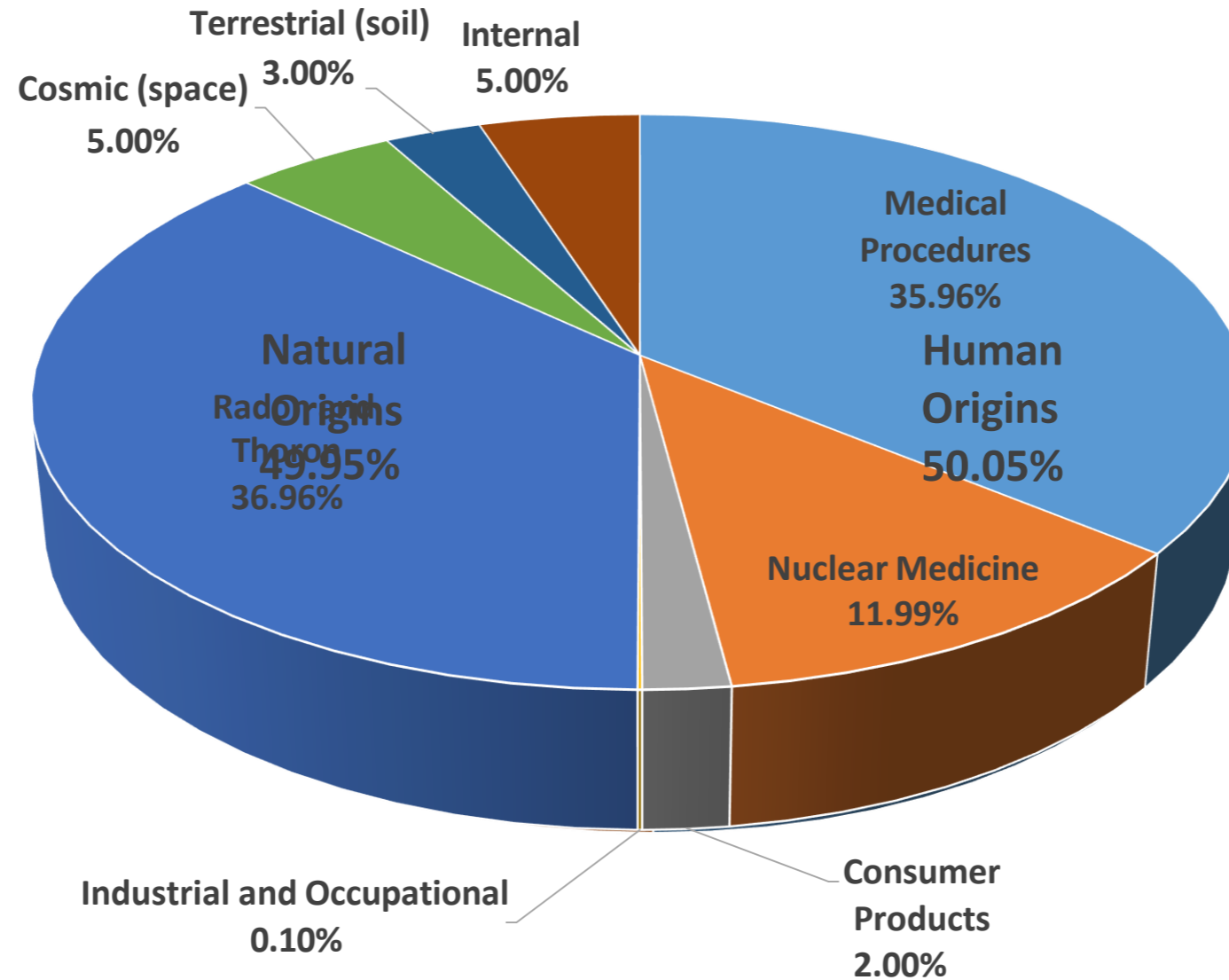


Radiation is everywhere



Sources of Radiation Exposure (in the US)

620 mRem, typical annual exposure



Radiation: How is it measured?

- REM = Roentgen Equivalent in Man
 - Primary unit of measure in the US
 - 1 REM = 1000 mREM (milliREM)
- RAD = Radiation Adsorbed Dose
- Sievert (Sv)
 - Primary unit of measure internationally
 - 1 Sv = 1000 mSv (milliSievert)
 - 1 mSv = 100 mREM

Active Monitoring and Typical Exposures

- Olympus employees who use XRF are actively monitored for radiation exposure
- All Olympus employees are **<20 mREM per year**

Activity	Exposure
Smoking	280 mREM per year
Mammogram	70 mREM
Dental X-ray	10 mREM per X-ray
Chest X-ray	8 mREM per X-ray
Drinking water	5 mREM per year
Cross country flight	5 mREM per trip

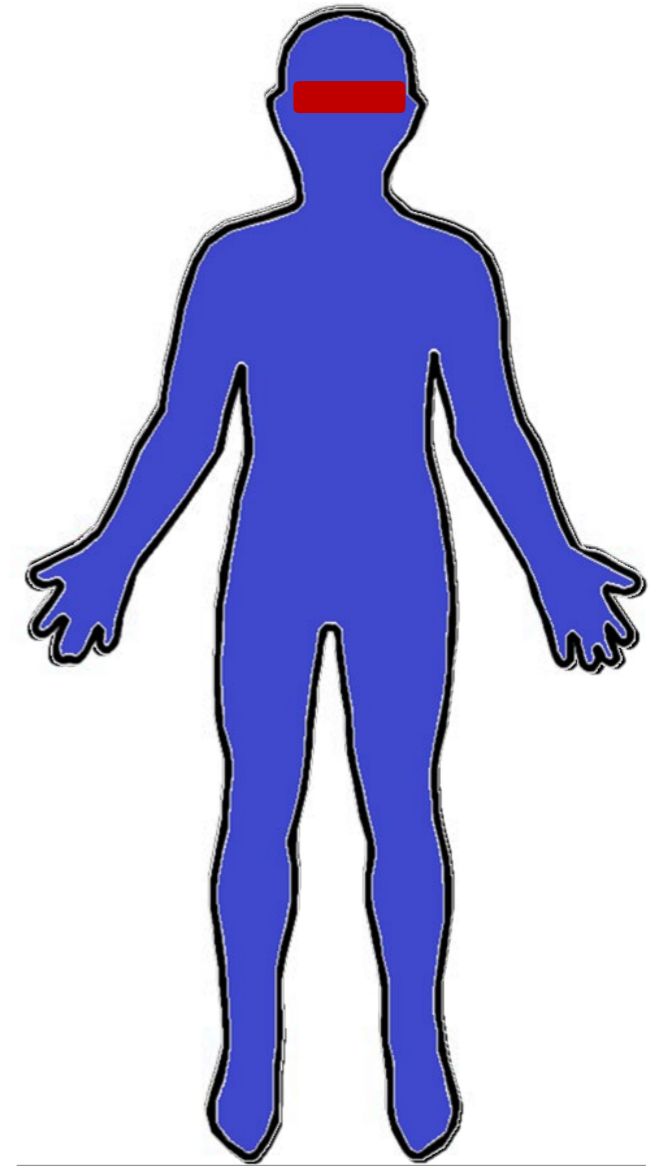
Source: <https://www.nrc.gov/about-nrc/radiation/around-us/doses-daily-lives.html>

Source: <https://www.nrc.gov/about-nrc/radiation/rad-health-effects.html>

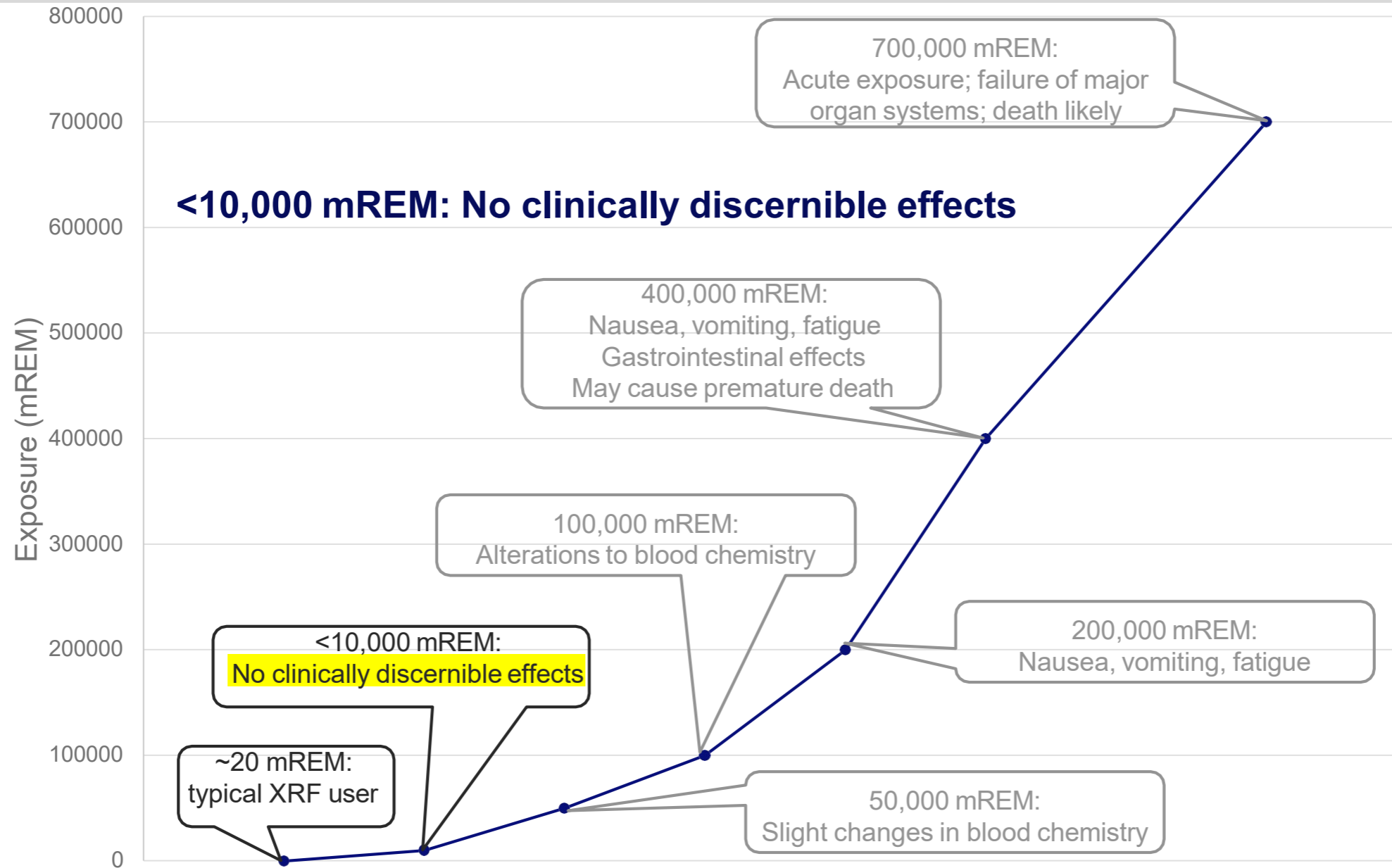
Occupational Limits (in US)

- Maximum Permissible Limits from
 - National Council on Radiation Protection (USA)
 - International Commission on Radiological Protection
 - Nuclear Regulatory Commission (USA)
 - State of Massachusetts (Local Example)
 - Health & Human Resources -Dept of Public Health

Portion of Exposure	Limit (mREM/yr)
Hands & Feet	50,000
Eyes (lens)	15,000
Skin	50,000
Thyroid	50,000
Whole Body	5,000



Biological Effects of Radiation Exposure



Source: <https://www.nrc.gov/about-nrc/radiation/health-effects/rad-exposure-cancer.html>

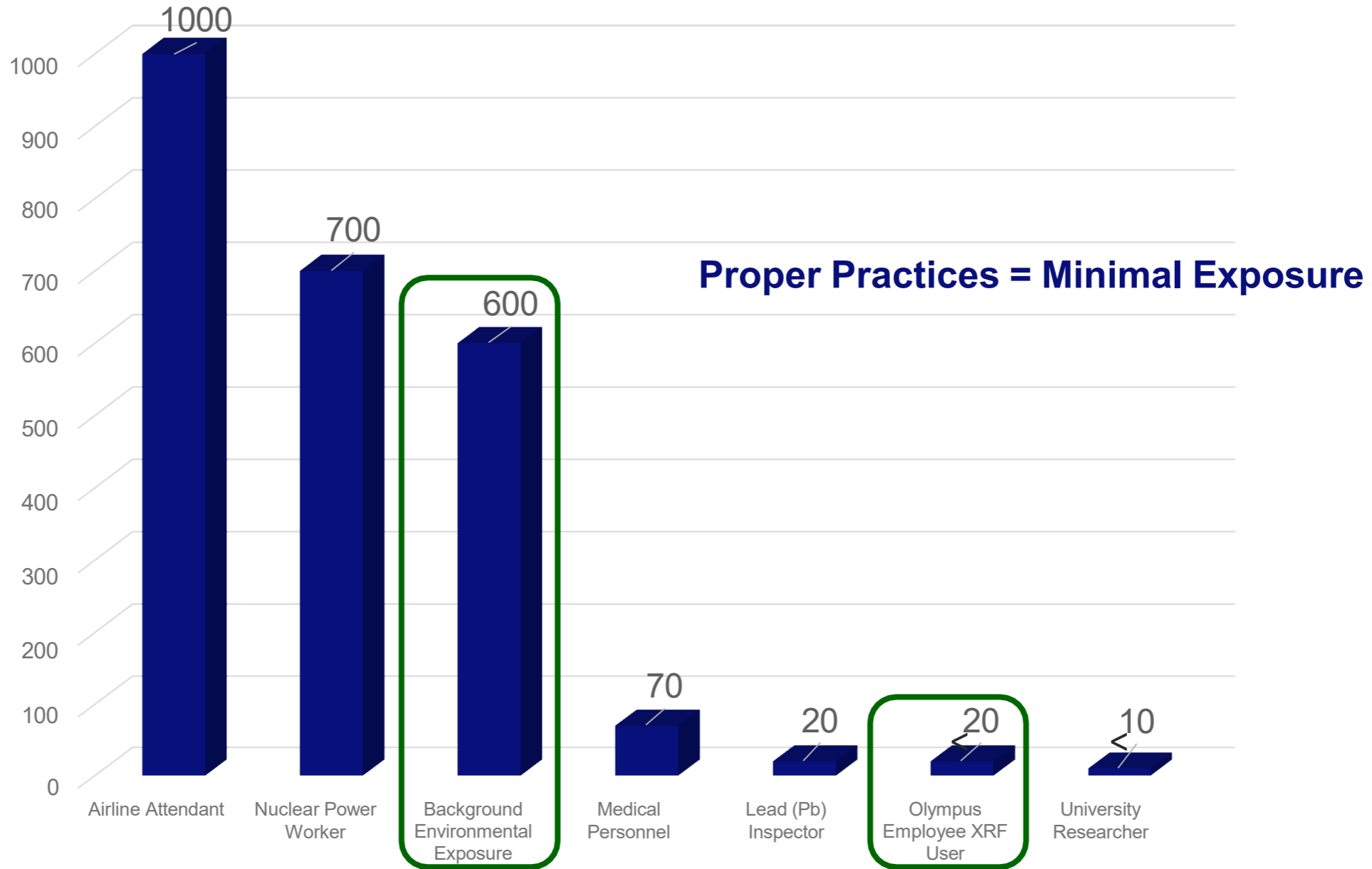
Radiation Profile

- Radiation exposure measured at the trigger is indistinguishable from the amount of general, background exposure
- <0.1 mREM/hr
- Let's assume:
 - Continuous testing for 10 hrs/day
 - Testing 5 days/week, 50 wks/yr
- Occupational limit for the hand is 50,000 mREM/yr
- Typical exposure is 0.5% of regulatory limit



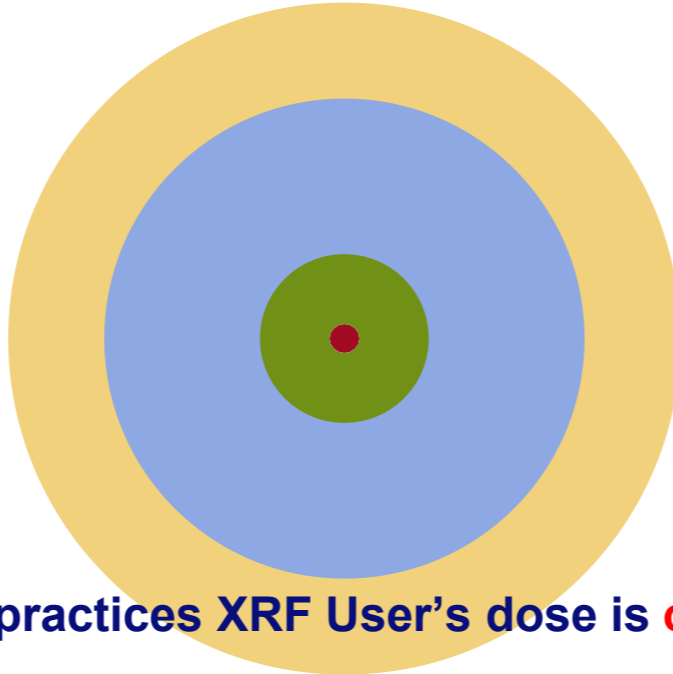
$$\frac{0.1 \text{ mREM}}{\text{hr}} \left(\frac{10 \text{ hours}}{\text{day}} \right) \left(\frac{5 \text{ days}}{\text{week}} \right) \left(\frac{50 \text{ weeks}}{\text{year}} \right) = 250 \text{ mREM/yr}$$

Typical Occupational Exposures



So far we covered:

- There is no known harm at $< 10,000$ mR/yr
- Permissible whole-body exposure is set at $< 5,000$ mR/yr
- Typical exposure from everyday life is ~ 620 mREM/yr
- Olympus's monitoring program shows XRF user is < 20 mREM/yr



With proper practices XRF User's dose is **over 50 times**
less exposure than an airline attendant.

So what are proper practices?

Safety Features



**Proximity Detector
(software-based)**

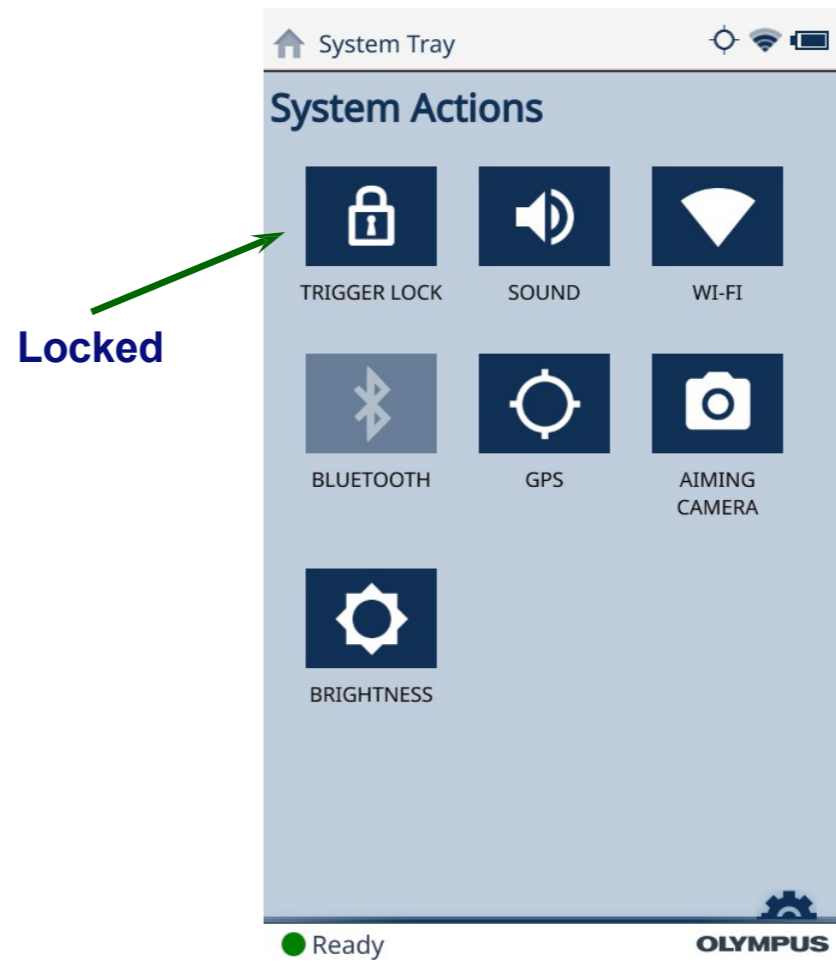
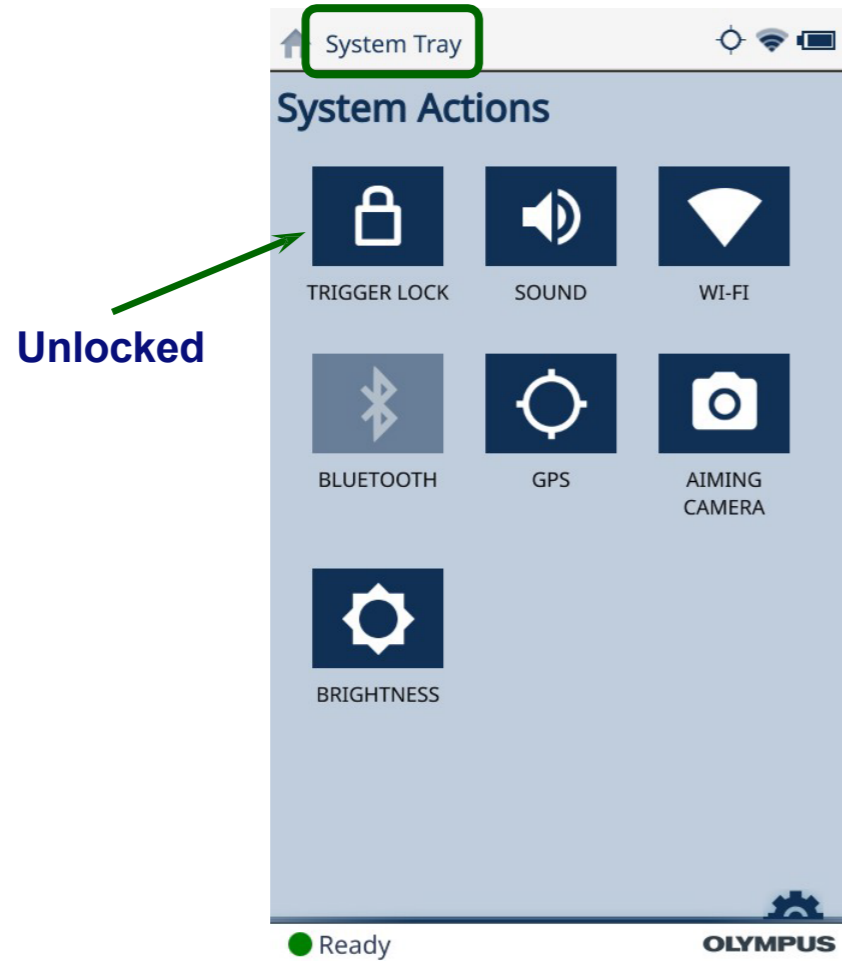
**Radiation
Warning Lights**

Radiation Label

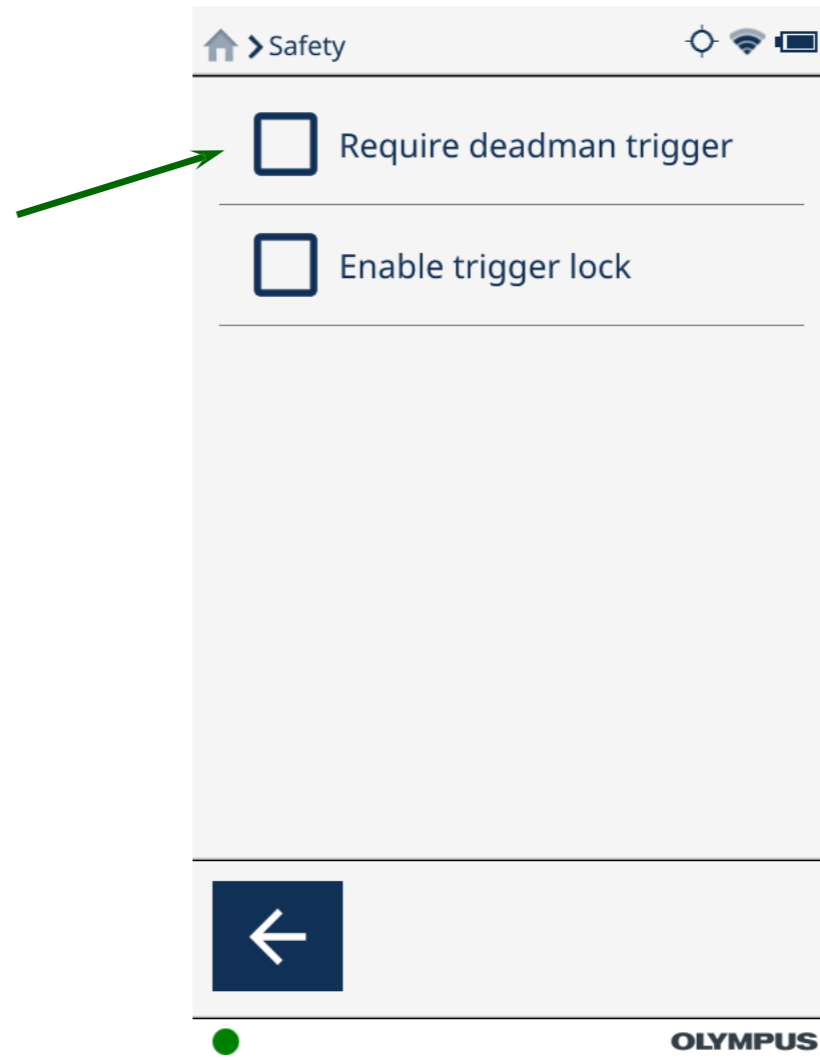
**Optional
"Deadman" Trigger**

**Trigger Lock
(software-based)**

Safety Settings: Trigger Lock

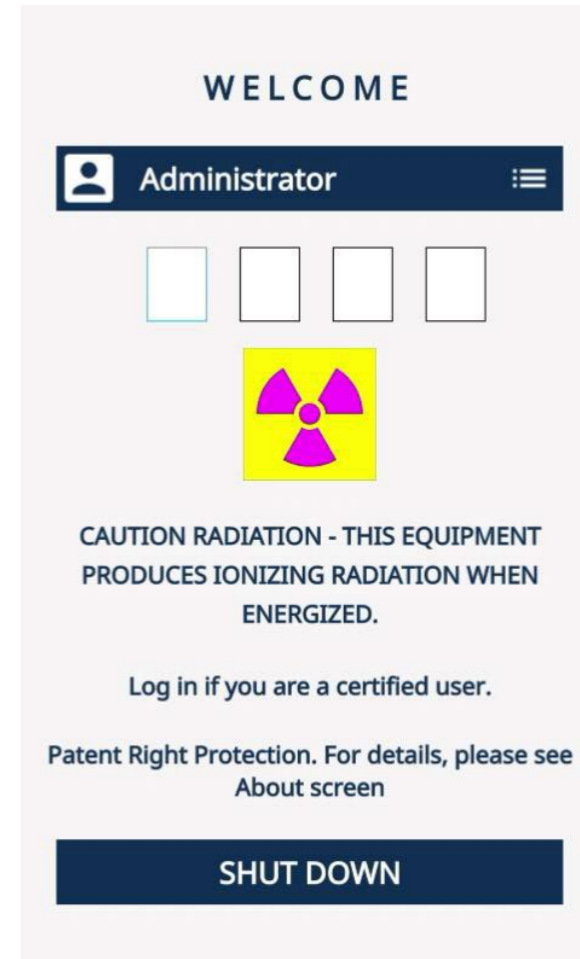


Safety Settings: Deadman Trigger



Safety Settings: Login Password Protected

- Only trained and authorized users should be allowed to operate the instrument

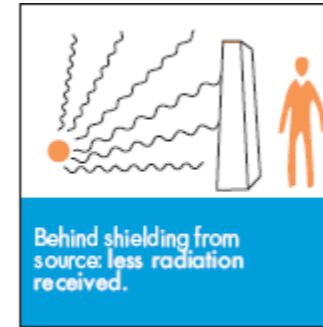
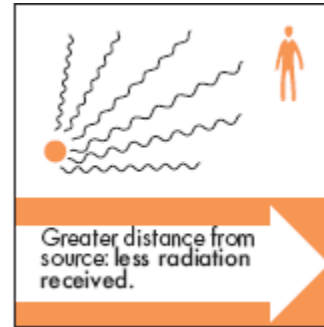
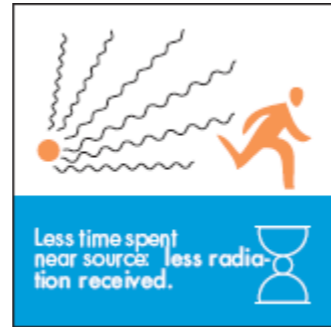


Approach to Radiation Safety: *ALARA*

- Practice *ALARA*: Keep radiation exposure “As Low As Reasonably Achievable”

- Three main approaches:

- Time
- Distant
- Shielding



- Time:

- **Less time = less radiation exposure**
- Never test longer than required
- No X-rays are emitted when a test is not being actively taken



Distance: Stay behind the analyzer

- X-rays travel in a (nearly) straight line, out the front of the analyzer.
Therefore:
 - Never use your hand (or other part of your body) to hold a sample in front of the analyzer
 - Never point the analyzer at yourself or others
- X-rays can be scattered from the sample
 - Keep your hand (and other body parts) away from the snout



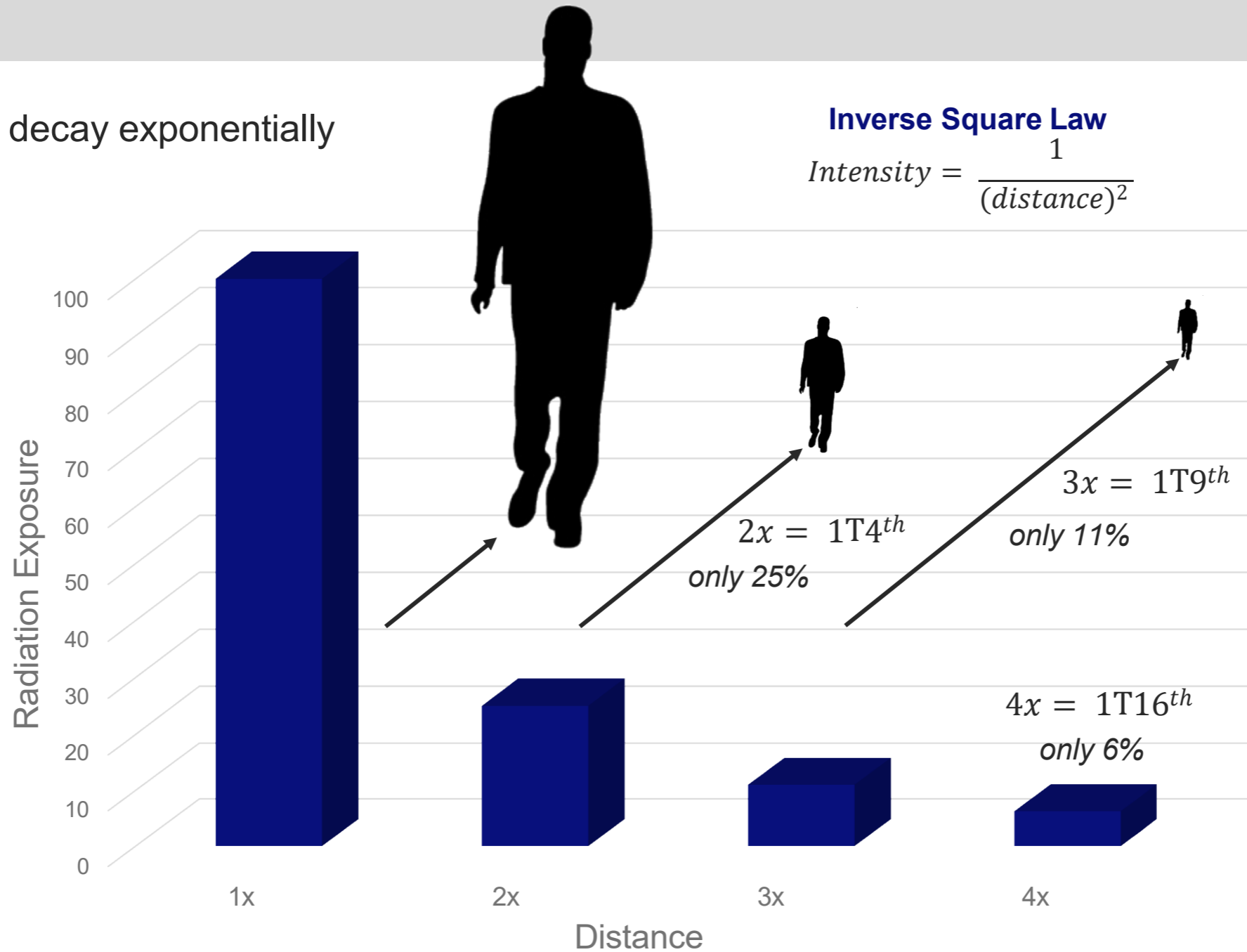
Distance: Stay behind the analyzer

- X-rays can penetrate through low-density materials
 - Do not test in a way that lower extremities would be exposed (e.g., through a table)



Distance

- X-rays decay exponentially



Three meters (3 m) is generally considered a safe distance for non-operators in order to eliminate inadvertent exposure from radiation.

Practical Testing Tips

- The instrument detector is fragile; don't poke anything in the window.
- When the warning lights are flashing X-rays are being emitted.
- Keep the instrument as close as possible to the sample, ideally in direct contact.
- Never point the instrument at anyone when the lights are flashing.
- Watch for radiation zones and warning signs.



Radiation Detection - Dosimetry

- Several commercial companies offer radiation monitoring services
- Some states require dosimetry programs (fixed term or ongoing)
- Badges are for whole body exposure
- Rings are for hand exposure (wear on trigger finger)

Company	Location	Telephone
AEIL	Houston, Texas	1-713-790-9719
Sierra Dosimetry	Escondido, CA	1-866-897-8707
Global Dosimetry Solutions	Irvine, California	1-800-251-3331 (toll free US/CAN)
Landauer	Glenwood, Illinois	1-708-755-7000
Landauer, Inc.	Oxford, England	44 1865 373008
Nagase Landauer, ltd.	Japan	81 33-666-4300
LCIE Landauer	Paris, France	33 1 40 95 62 90
Landauer	Beijing, China	86 10 6221 5635



- Read the User's Manual before operating
- Chapter 1 covers safety

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Vanta Family
X-Ray Fluorescence Analyzer
User's Manual

Models:
Vanta M Series
Vanta C Series
Vanta L Series

International edition

DMTA-10072-01EN — Rev. B
July 2016

This instruction manual contains essential information on how to use this Olympus product safely and effectively. Before using this product, thoroughly review this instruction manual. Use the product as instructed. Keep this instruction manual in a safe, accessible location.

DMTA-10072-01EN, Rev. B, July 2016

1. Safety Information

This chapter contains important safety information for using the Vanta XRF analyzer.

1.1 Radiation Safety Information

IMPORTANT

Always make operational safety your highest priority. Heed all warning labels and messages.

The Vanta XRF analyzer is a secure and dependable instrument when used according to Olympus recommended testing techniques and safety procedures. However, the Vanta produces ionizing radiation, and as such, it should only be used by individuals trained in correct operating techniques and authorized to use X-ray producing devices.

The radiation detected on any outside surface (excluding the Prolene or Kapton window area) is below limits for an unrestricted area.

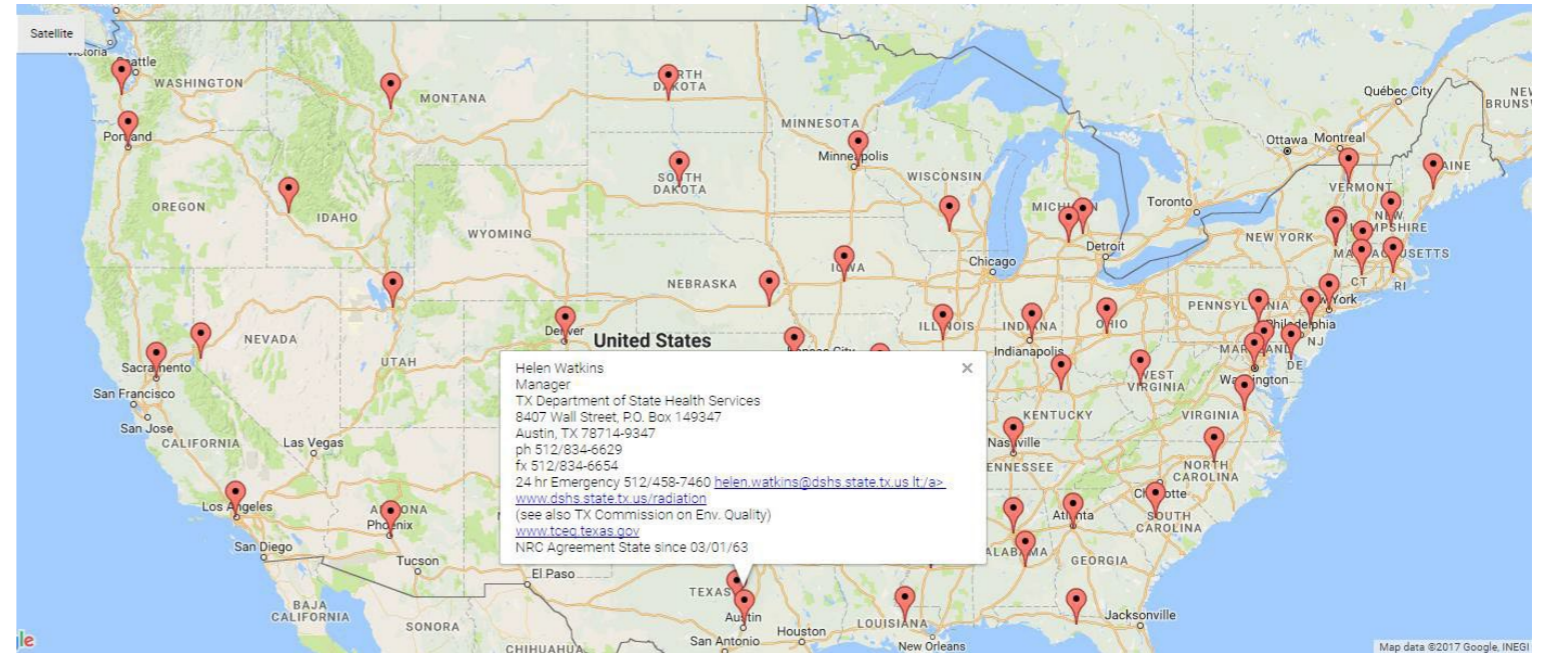


WARNING

X-ray tubes in the Vanta XRF analyzer can emit ionizing radiation. Prolonged exposure can cause serious illness or injury. It is the responsibility of Olympus customers to follow the operating instructions and safety recommendations in this manual and good radiation control practices.


Regulations & Registration

- X-ray regulations vary a lot based upon location
- In the US, state governments are the primary regulatory body
 - Levels of paperwork can vary
 - Cost structure can vary
 - Dosimetry requirements vary
 - Training requirements vary
- For more information:
 - <http://www.crcpd.org/mpage/Map>



Local Regulations & Control: Questions to Ask

- Local Contact?
- Inspections?
- Monitoring Requirements?
- Registration and Licensing
- Cost?
- Must Register by when?



TEXAS DEPARTMENT OF STATE HEALTH SERVICES

P.O. Box 149347
 Austin, Texas 78714-9347
 1-888-963-7111
 TTY: 1-800-735-2989
www.dshs.state.tx.us

DAVID L. LAKEY, M.D.
 COMMISSIONER

CONFIRMATION OF SCHEDULED INDUSTRIAL X-RAY INSPECTION

NAME: _____ Company _____ REGISTRATION NUMBER: _____

DATE OF INSPECTION: 7/12/2011 TIME: 10:00 a.m.

Registrant's contact Person (or person who confirmed inspection): _____ Name _____

PLEASE NOTE:

- Approximately 10 minutes must be allowed for an exit summation at the end of the inspection. This should be with the Radiation Safety Officer (RSO) or with the highest level of management available.

PLEASE HAVE THE FOLLOWING RECORDS AVAILABLE FOR REVIEW PRIOR TO THE INSPECTION:

- Current Certificate of Registration
- 25 TAC §289 "The Rules" – Applicable regulations are listed on your Certificate of Registration. Via office internet you may print a hard copy or you may demonstrate online access availability at <http://www.dshs.state.tx.us/radiation/rules.shtm>
- Operating and Safety Procedures – unique to your facility and signed by all operators and your RSO. A guide is available at <http://www.dshs.state.tx.us/radiation/regguide.shtm>
- Notices of Violation - and your Response Letters to each notice if applicable
- Evaluation of protective devices – (lead aprons, etc.) This is required yearly and must be documented in writing
- Training records – records for all employees that operate the radiation equipment
- Personnel monitoring and area surveys – records of radiation badge reports, if applicable
- Records of annual surveys – if applicable
- Receipt of Purchase – or FDA 2579 (pink copy) Report of Assembly. Transfer or Disposal for all units if applicable.
- Inventory of X-ray units – The annual inventory must be created and maintained by you. It must include the manufacturer's name, model number, serial number and room number for each x-ray unit
- Notice to Employees - sign must be posted. It is available at <http://www.dshs.state.tx.us/radiation/pdf/Files/Rules/203-1.pdf>
- Warning labels – on each radiation unit
- Interlock checks – checked and documented annually
- Records of annual surveys – if applicable

It may be helpful to review 25 T.A.C. §289.228

If you have any questions, please contact me at:
 STATE INSPECTOR: Gabrielle Howard (713) 767 – 3267
 DSHS RCP Form: X-RayInspConf#3 e-mail: gabrielle.howard@dshs.state.tx.us
 Updated 01/05/09 An Equal Employment Opportunity Employer and Provider

Example Registration Form

Review: Proper Practices = Minimal Exposure

- Don't point the analyzer at anyone.
- Don't hold samples in your hand.
- Stay behind the analyzer at all times.
- Pay attention to radiation signs, labels and lights.
- Always control access to the analyzer.

Review

- The owner of the XRF is responsible for:
 - Complying with all local regulations
 - Implementing proper usage controls

Review:

- Responsibility for X-ray Safety
- Use of X-rays for Materials Identification
- Types of Radiation
 - Ionizing vs. Non-Ionizing
 - Particle vs. Non-Particle
 - X-rays & Electromagnetic Radiation
- X-ray Technology
 - Uses of X-ray Technology
 - Generation of X-rays
- X-ray Exposure
 - Sources of X-ray exposure
 - Measurement of X-ray exposure
 - Relative levels of X-ray exposure
 - Regulatory limits
 - Biological effects
 - Exposure from XRF operation
- Safety Features of XRF Analyzer
 - Safety Features & Interlocks
 - Software Safety Settings
 - Authorized Users & Lockout
- Culture of Safety
 - ALARA: As Low As Reasonably Achievable
 - Time, Distance, & Shielding
 - Safe Practices
 - Dosimetry
 - Safety Knowledge & User's Manual
- Radiation Regulations
 - Regulatory Authority
 - Registration
- Review

THERE IS A QUIZ FOLLOWING THIS TRAINING. YOU MUST PASS WITH 80% OR BETTER TO RECEIVE CREDIT FOR THIS CLASS.

[Click here to start the quiz](#)

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