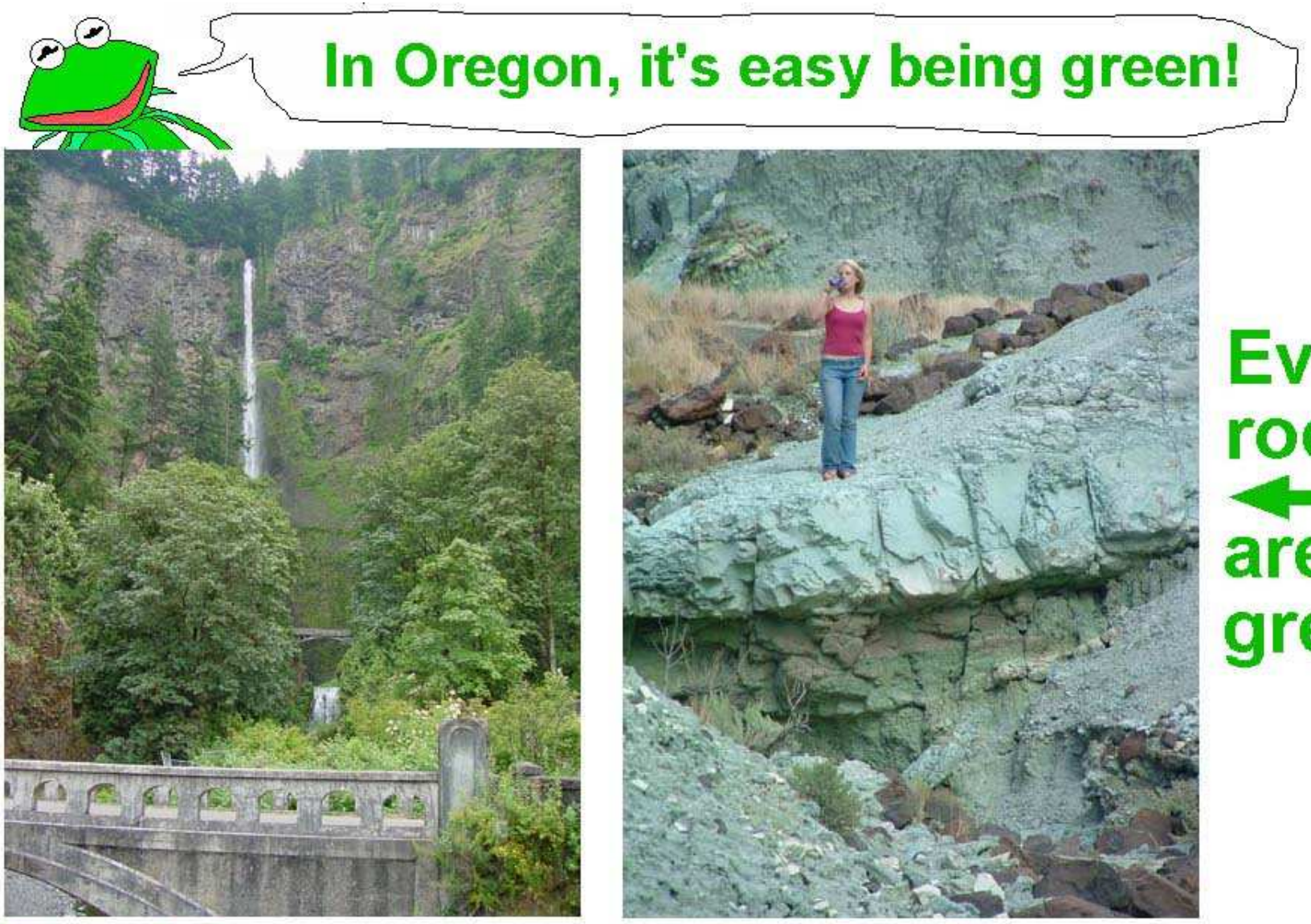
O kształceniu inżynierów od technologii jądrowych w Oregon State University

Tomek Giebułtowicz

2 czerwca 2010

Mogę dzisiejsze seminarium przedstawić dzięki m. in. szczodrej pomocy Fundacji Fulbrighta, za którą na zdjęciu poniżej dziekuję b. Ambasadorowi USA w Polsce, Panu Victorowi Ashe:



And nuclear energy is green, also, so it surely makes sense to train nuclear energy and nuclear medicine specialists in Oregon!

Nuclear at OSU

Nuclear Engineering &
Radiation Health Physics (NERHP)
and
the OSU Radiation Center (RC)

Tomasz Giebultowicz, PhD
for
Kathryn Higley, PhD, CHP
And
Steven Reese, PhD, CHP

Background

- **Long tradition of nuclear related research:**
  - **Nuclear Engineering at OSU for 50 years**
  - **TRIGA reactor at OSU for ~ 40 years**
- **Research spans decades & disciplines:**
  - **Fundamental nuclear science**
  - **Nuclear power plant design**
  - **Radiation safety**
  - **Medical applications**
  - **Environmental protection**
  - **National security and defense**

NERHP and the RC

- **RC provides to NERHP and others:**
  - **Specialized facilities for research**
  - **Instructional faculty**
  - **Radiation safety support**
  - **Emergency response support to Oregon**
- **NERHP:**
  - **Academic entity within Engineering**
  - **Focus on teaching and research**
  - **Emergency response support to Oregon and elsewhere**
- **Complementary & symbiotic - but distinct missions and objectives**

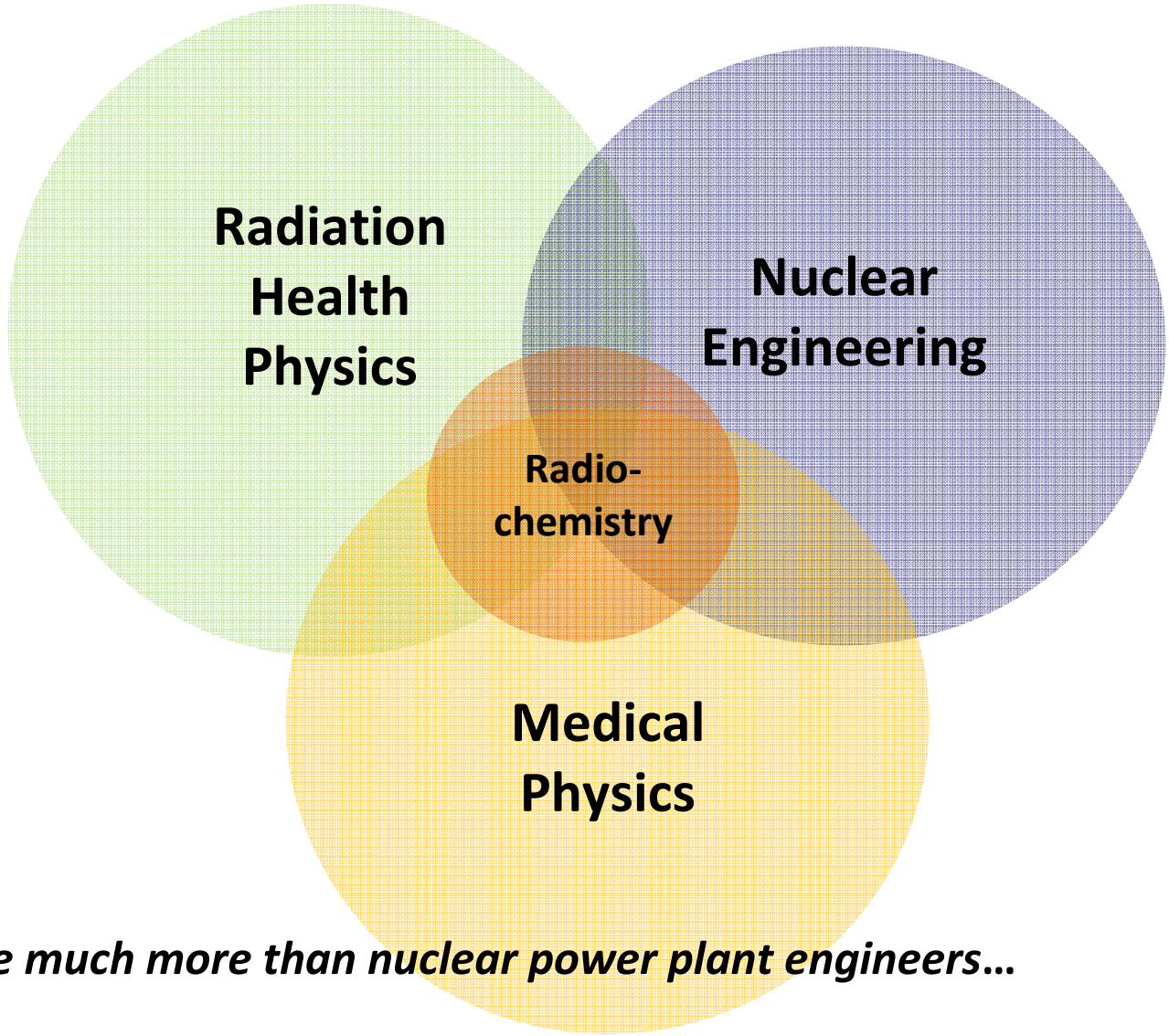
NERHP Research

- **Funded research from agencies such as:**
  - **United Nations (IAEA)**
  - **US NRC**
  - **US DOE**
  - **NASA**
  - **National Laboratories (LLNL, INL, PNNL)**
  - **University Consortia**
  - **Private Industry**

RC Research & Support

- **Service organization**
- **“Neutron” provider for educational institutions and others:**
  - **Geochronology**
  - **Archaeology**
  - **Radioecology**
  - **Others fundamental science support**
- **DHS**
- **PNNL**
- **US NRC**
- **US DOE**
- **Oregon Emergency Response Support**
- **Oregon Nuclear Instrumentation Calibration**

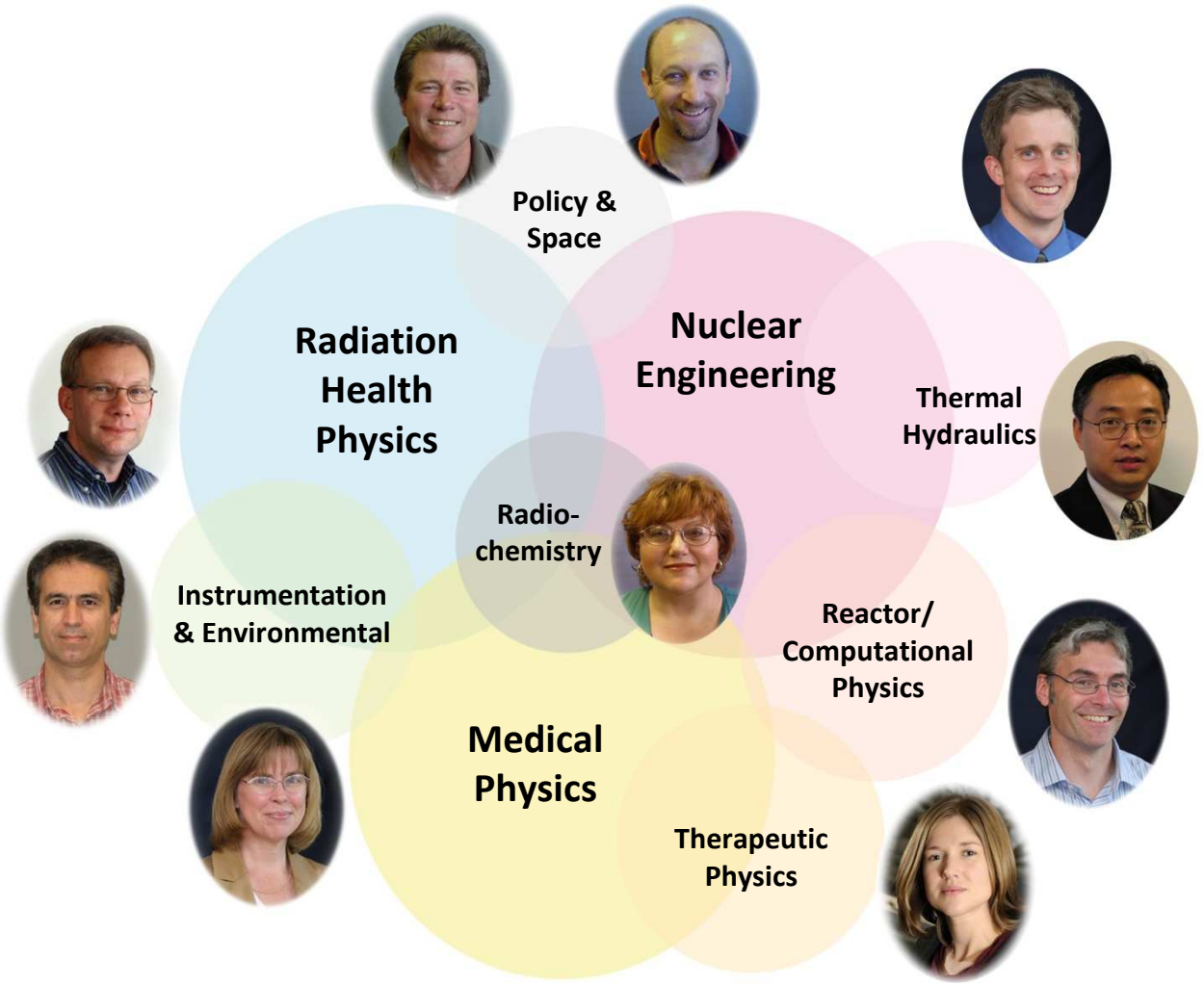
NERHP Organization



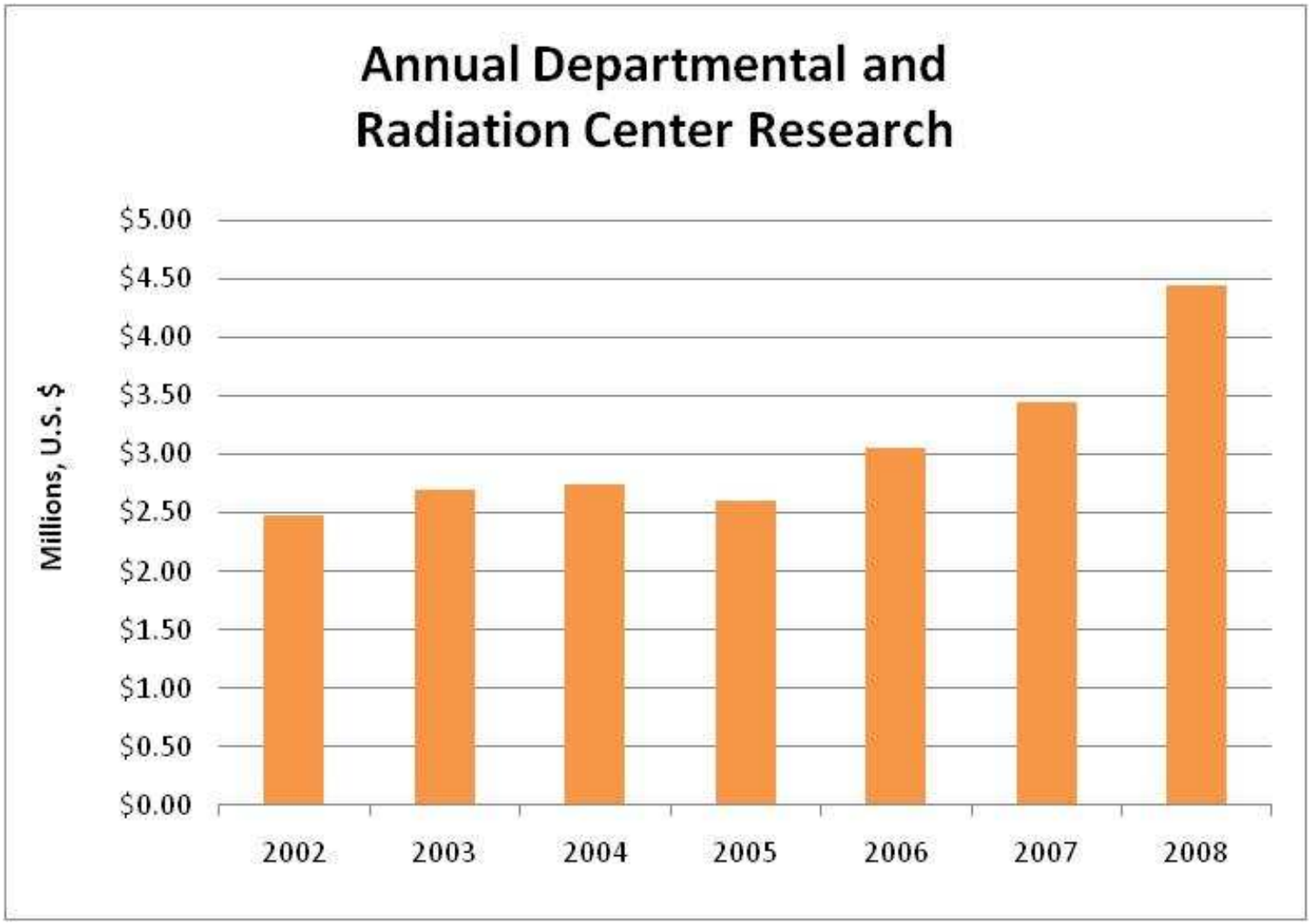
We are much more than nuclear power plant engineers…

Thematic & Research Areas

- **Thermal hydraulics / computational fluid dynamics**
- **Reactor/computational physics**
- **Radiochemistry of actinoids & lanthanoids**
- **Therapeutic radiologic physics**
- **Nuclear instrumentation design**
- **Environmental health physics**



10 Full-time faculty


Annual Departmental and Radiation Center Research
Millions, U.S. $
$5.00
$4.50
$4.00
$3.50
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
2002
2003
2004
2005
2006
2007
2008

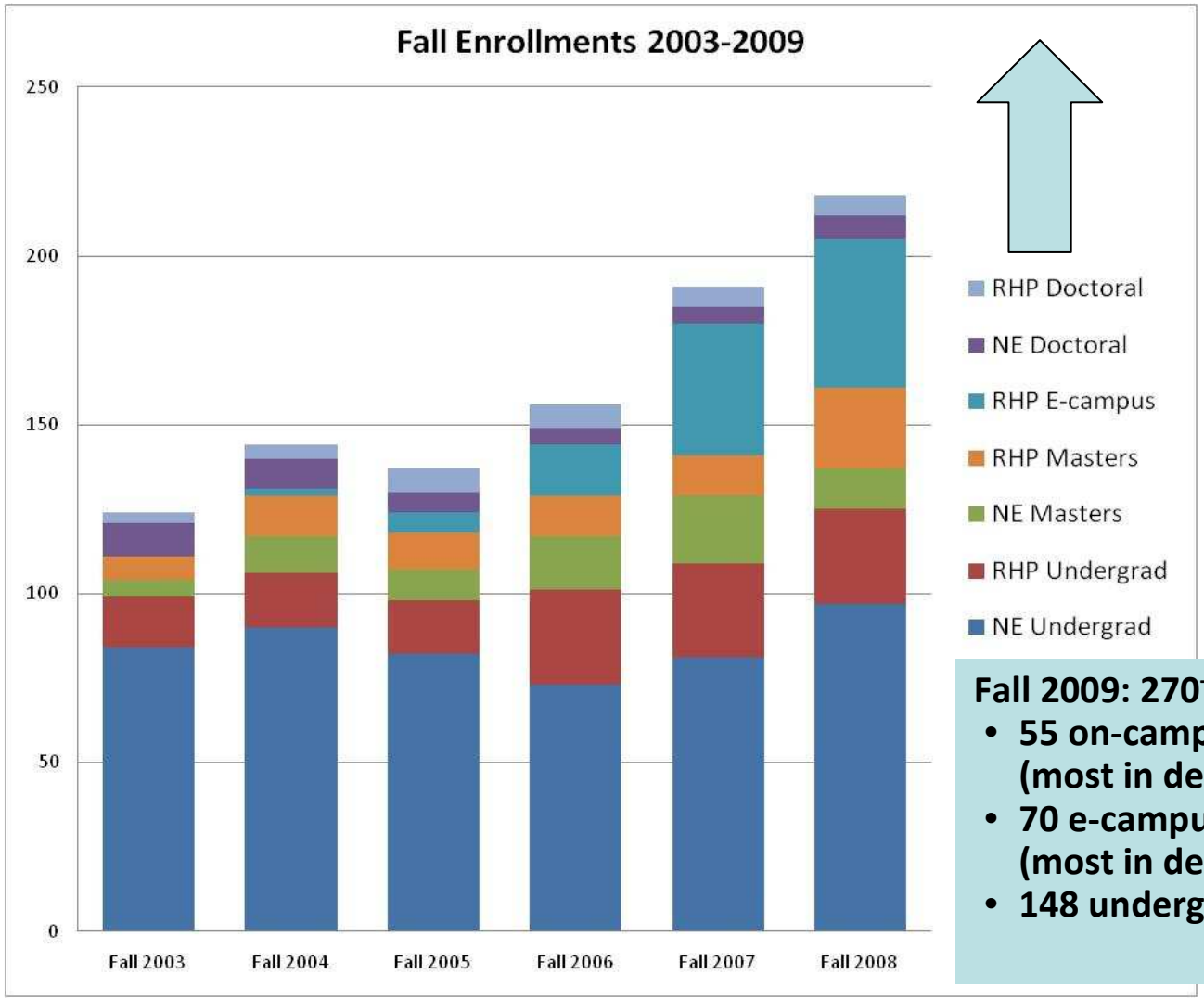
As an Academic Institution

Students are a Priority

NERHP at OSU

- **Ranked 10th in the Nation for Nuclear Engineering**
- **One of 8 US institutions to offer complete suite of B.S., M.S., and Ph.D. degrees in both Nuclear Engineering & Radiation Health Physics**
- **Added Medical Physics Graduate Program, 2009**
- **Radiochemistry is forthcoming**
- **Distance graduate degree in Health Physics**

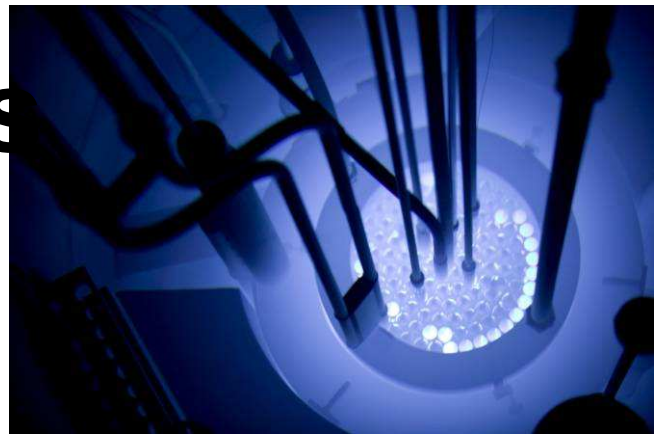
Enrollments Increasing



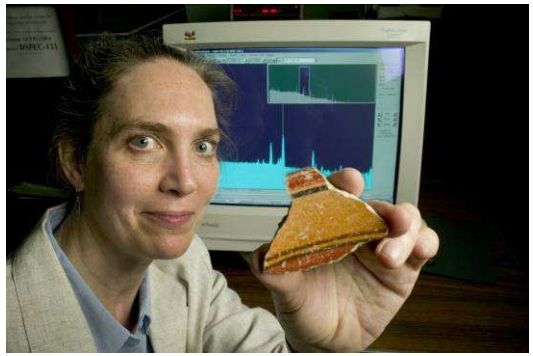
Fall 2009: 270^{+} Students:

- **55 on-campus grad's (most in dept. history)**
- **70 e-campus MHP grad's (most in dept. history)**
- **148 undergrad's**

Major RC Facilities

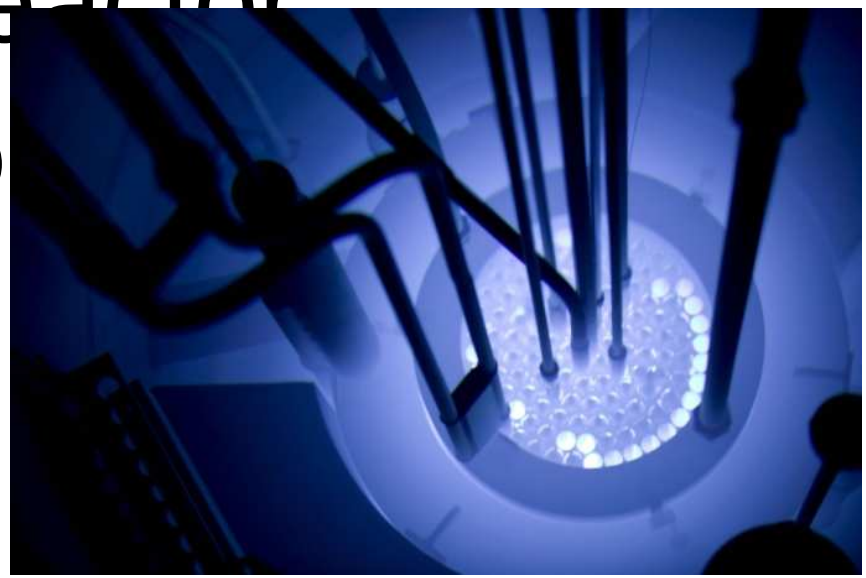


- 1.1 MW_{th} TRIGA Reactor
- Integral Advanced Thermal Hydraulic Testing Facilities
- Radiochemistry labs
- Instrumentation labs
- Radioecology Greenhouse
- and more…..



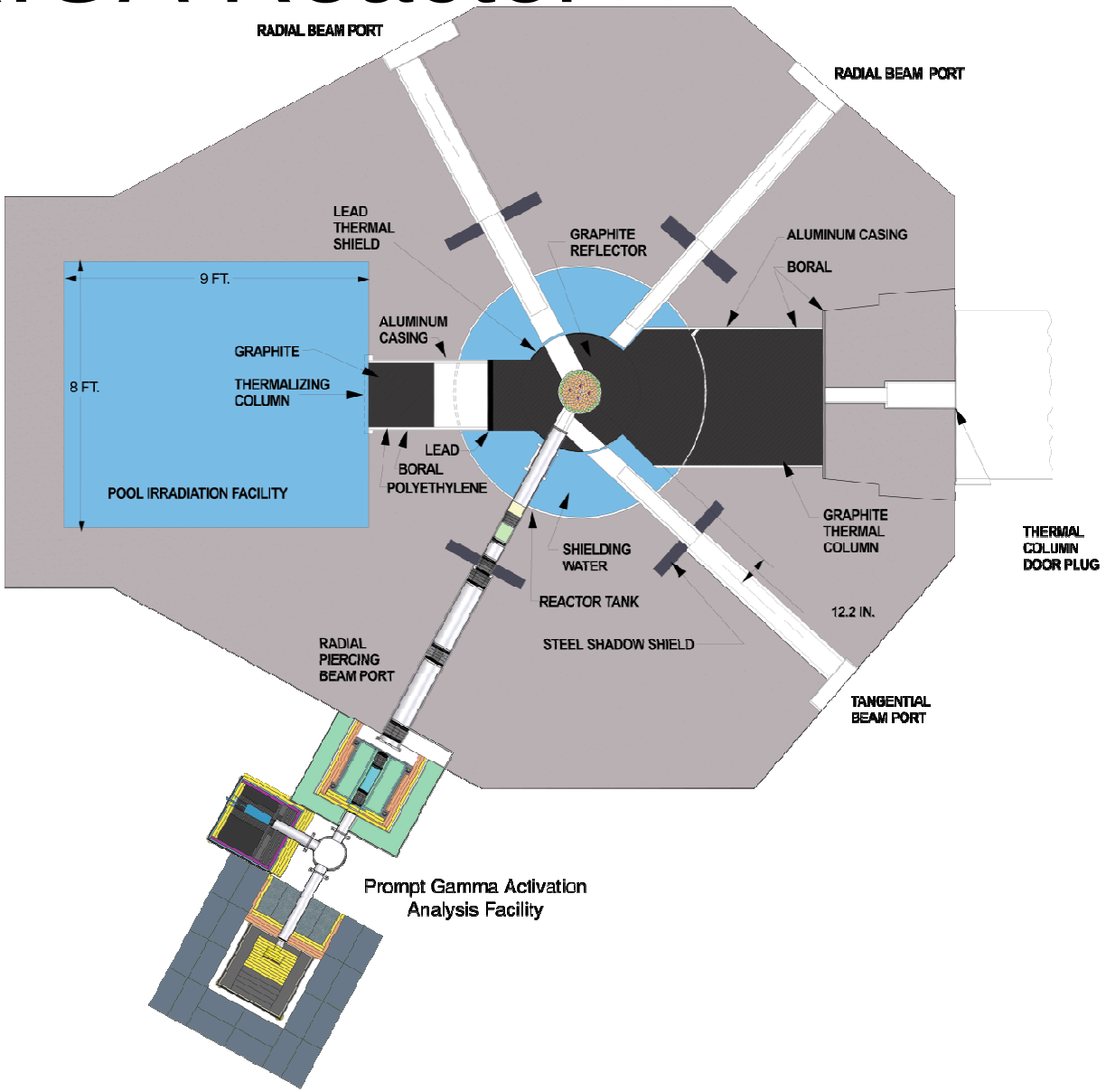
Oregon State TRIGA Reactor

- **1.1MW(t)**
- **Pulsing to ~2500 MW(t)**
- **~45 MWD Annually**



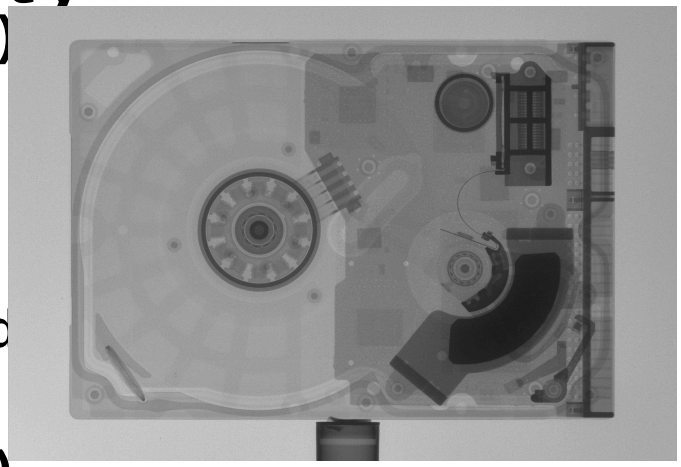
- **Pneumatic system**
- **Dry cadmium lined position**
- **Dry aluminum lined positions**
- **ANSI E721/722 calibrated for material hardness testing**
- **Flux: $1x10^{10}$ – $1x10^{13}$ n cm^{-2} s^{-1}**

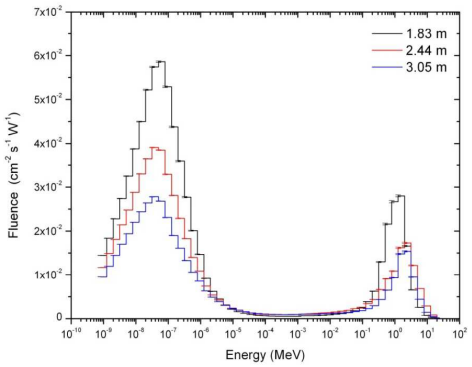
OS TRIGA Reactor



Neutron Radiography Facility

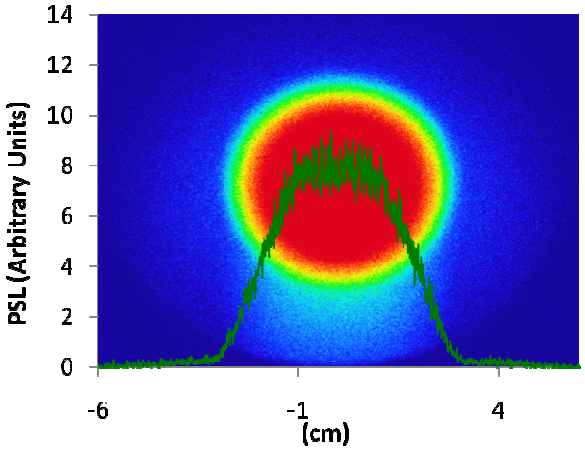
- **ASTM E545 Cat. 1 Beam (film)**
- **Beam: $5x10^5$ n cm^{-2} s^{-1}**
- **Beam size 6”X7” (close) to 36”X44” (far)**
- **L/D varies from 86 (close) and 117 (far)**
- **Real-time (CCD camera / 9” II)**
- **MCP real-time camera (~30 um)**
- **Digital image plate technology**



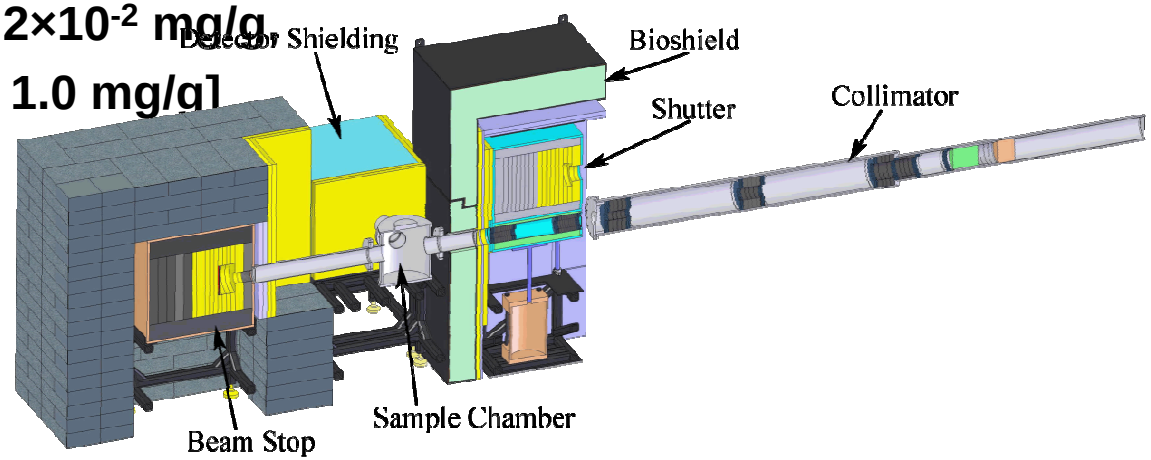


OSTR PGNAA Instrument

- **Neutron Beam**
  - **2 cm diameter**
  - **Thermal flux: 2.81×10^{7} cm^{-2}s^{-1}**
  - **Epithermal flux: 1.70×10^{4} cm^{-2}s^{-1}**
  - **Cadmium ratio 106**



- **Measured Detection Limits (examples from SRM 1571 Orchard Leaves:**
  - **Boron: 5.6×10^{-4}mg/g,**
  - **Chlorine: 8.2×10^{-2} mg/g,**
  - **Potassium: 1.0 mg/g]**

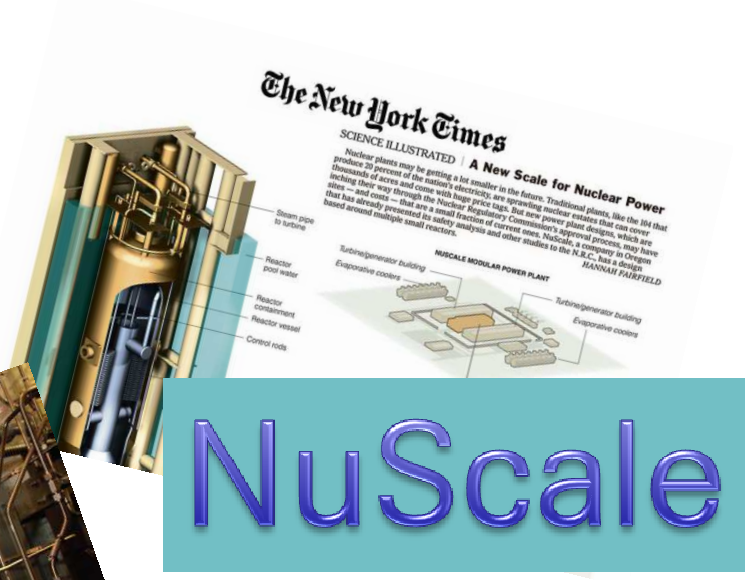


Neutron Depth Profiling (NDP) Instrument

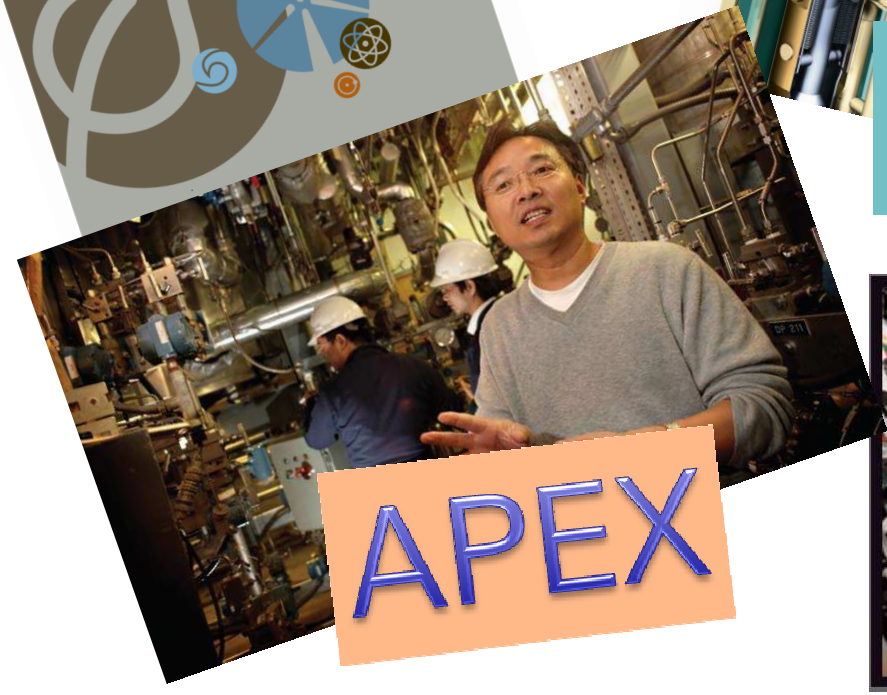
- Near-surface analysis of isotopes having neutron-induced charged particle reactions.
  - Energy of particles leaving sample surface dependent on depth where nuclear reaction occurs
  - Depths determined from the charged particle energy spectrum
- NDP characteristics
  - Nondestructive (No material removal or structural damage)
  - Insignificant induced radioactivity
  - Samples can be recounted to obtain better statistics
  - Bulk sample composition must be known in order to calculate the stopping power of the material. (For many samples such as semiconductor materials this is already known. However for samples in which this is not known PGNAA capabilities could be very valuable.)

OSU Major Nuclear Related Initiatives:

SENERGI



NuScale



APEX

HTGR

NERHP & RC

- **Unique, world-class facilities**
- **Top ranked academic program**
- **Timely & relevant research**
- **A world class-asset**

For information, please contact:

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