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Radioisotope Use at the ORD/EPA

Presented to Workgroup 2
Research Use of Isotopes

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EPA/ORD/NHEERL/NTD
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Outline

- EPA Organization
- Current use pattern
- Novel uses that may arise

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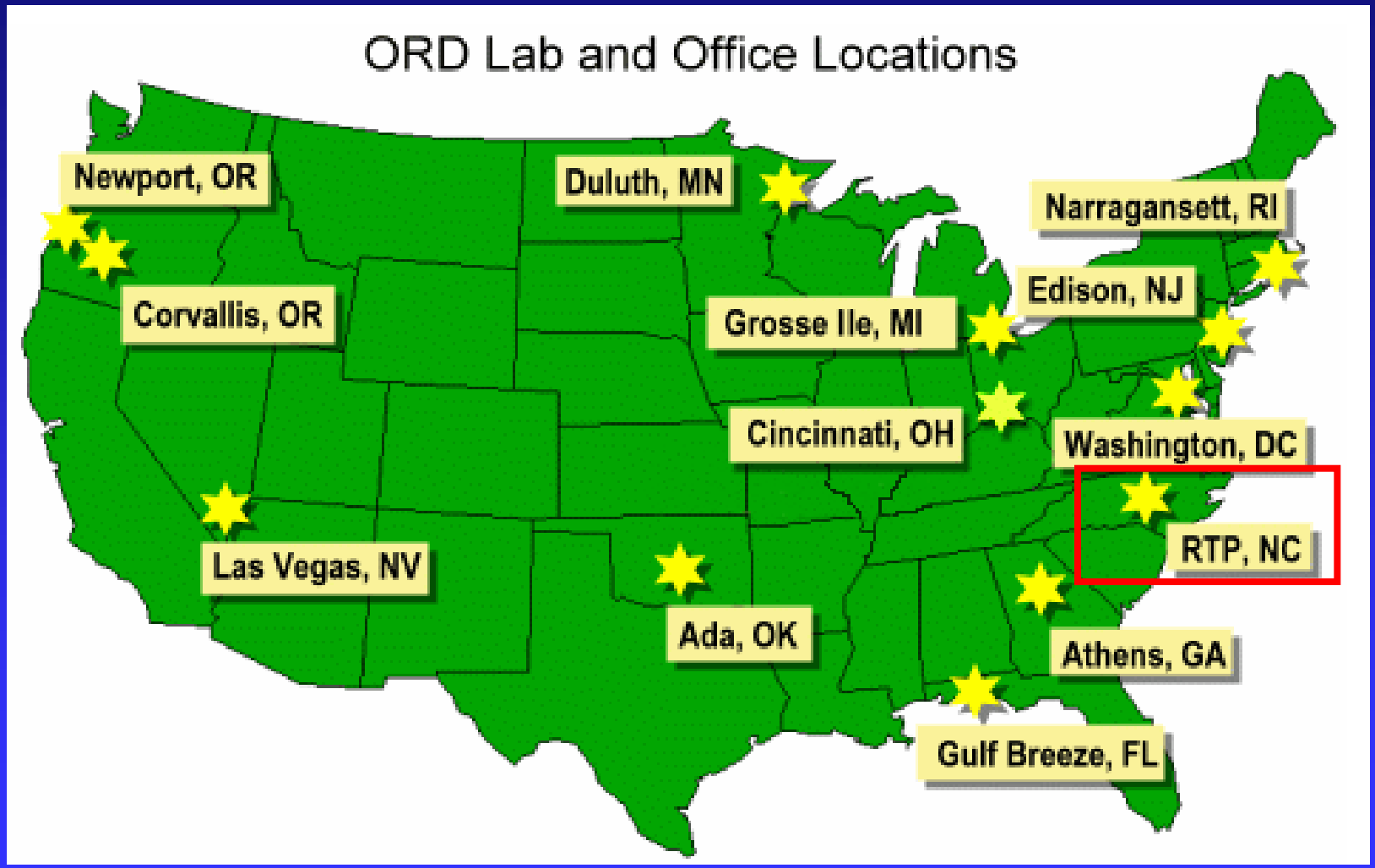
EPA Office of Research and Development



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List of Isotopes used at EPA/RTP*

Am-241	I-125
As-73**	Kr-85
C-14	Ni-63
Ca-45	P-32
Cd-109**	P-33
Cl-36	Po-210
Cr-51	S-35
Fe-59	U-238
H-3	Zn-65**

** Supplied by DOE; *All lots <10 mCi

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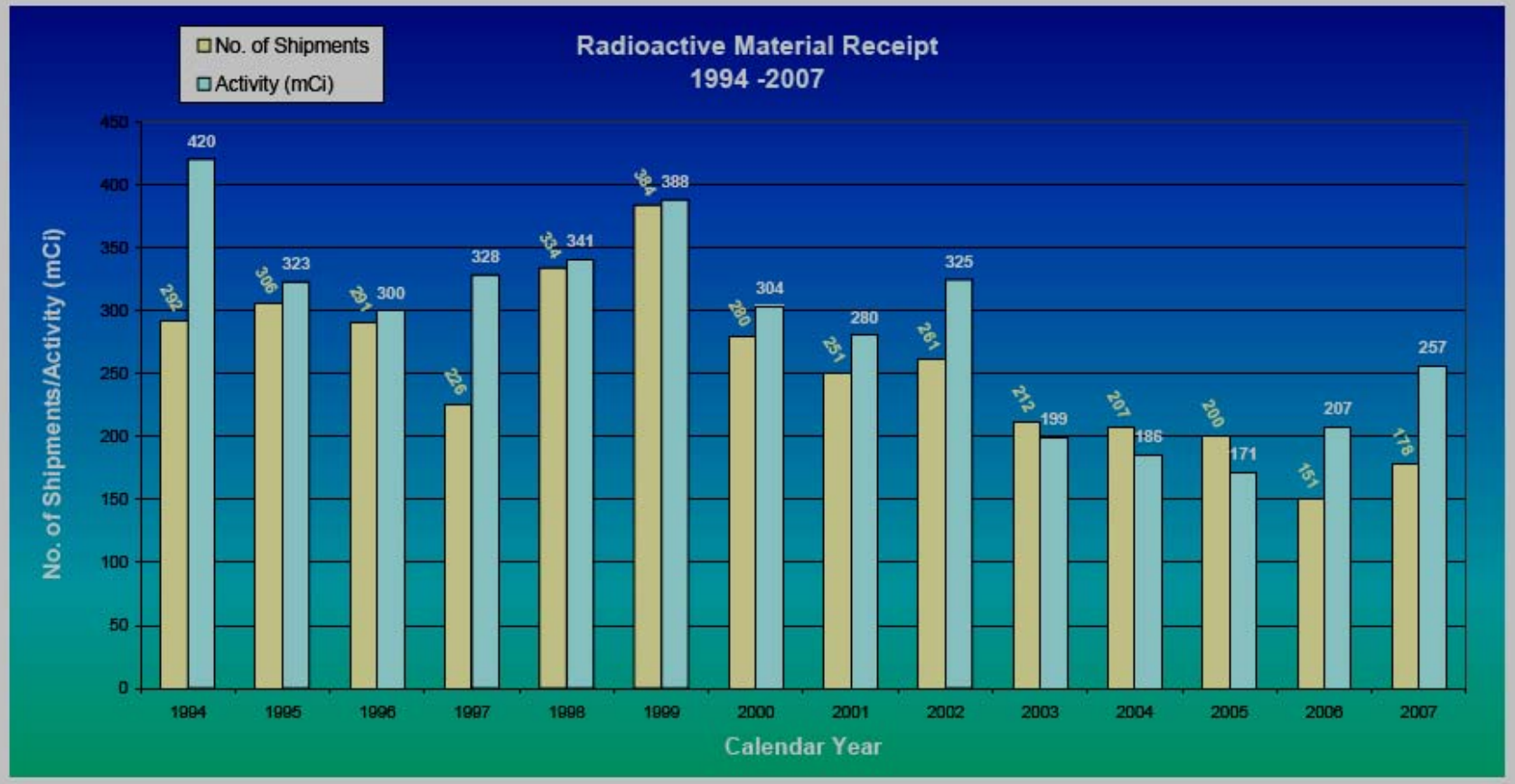
RAM Use Trend at EPA/RTP 1994-2007



Compiled by Todd Baker, RSO for the Radiation Safety Committee

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EPA/RTP Vendor List

Open Compounds

Vendor/Company Name
Amersham Biosciences Corp. (Now GE HealthCare)
ARC, Inc. (American Radiolabeled Chemicals)
Bachem Americas, Inc.
Brookhaven National Laboratory
Chemsyn Science Laboratories
Diagnostic Products Corp. (Now Siemens Medical Solutions Diagnostics)
Diagnostic Systems Laboratories
GE Health Care (See Amersham)
ICN Pharmaceuticals
IDS Inc.
Linco Research, Inc. (Division of Millipore)
Los Alamos National Laboratories
MP Biomedicals (See ICN)
Nichol Institute Diagnostics
PerkinElmer Life Sciences
Phoenix Pharmaceuticals, Inc.
Siemens Medical Solutions Diagnostics (See DPC)

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EPA/RTP Vendor List

Sealed Sources

(distributed under general licenses usually in equipment/instruments)

Vendor/Company Name
Agilent Technologies (formerly Hewlett Packard)
Anderson
Femtoscan
Inficon
Isotope Products Laboratories (See TSI/3M)
Largus Applied Technology

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New Needs/Applications

Example

Neutron activation of Fe nanoparticles for ADME

- Iron nanoparticles are used in water remediation, hence toxicity studies needed
- Iron is an abundant element in biological systems, hence extraneously administered iron is difficult to measure through ICP-MS, AAS, AES or neutron activation analysis
- It is difficult to manufacture radioactive iron nanoparticles
- Neutron activation of nanoparticles only alternative for ADME studies (oral gavage)

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Neutron Activation of Fe

Considerations

Iron-derived radionuclides

Isotope	Abund. %	Therm. Xn barns	Product	$T_{1/2}$ (d)	Decay mode
Fe-54	5.9	2.3	Fe-55	997	EC, no γ emission
Fe-56	91.7	2.6	Fe-57	Stable	
Fe-57	2.1	2	Fe-58	Stable	
Fe-58	0.28	1.3	Fe-59	45	B decay, γ ~ 1 MeV

Other radionuclides observed

Isotope	$T_{1/2}$	Gamma energy (MeV)
Cr-51	27 d	0.32
Mn-54	312d	0.835
Co-60	5.2 yr	1.17, 1.33

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Summary

- Results
  - 100 mg Activated for 75 hours at ~1MW at NCSU
  - Yield ~ 30 µCi: Sp act:~ 0.3 µCi/mg
  - Cost $6000/run
- Problems
  - Higher specific activity desired
  - Extend activation time- costly!
  - Create Fe nanoparticles with higher Fe 58- possible?
- Future needs
  - Other such applications should be anticipated in in future