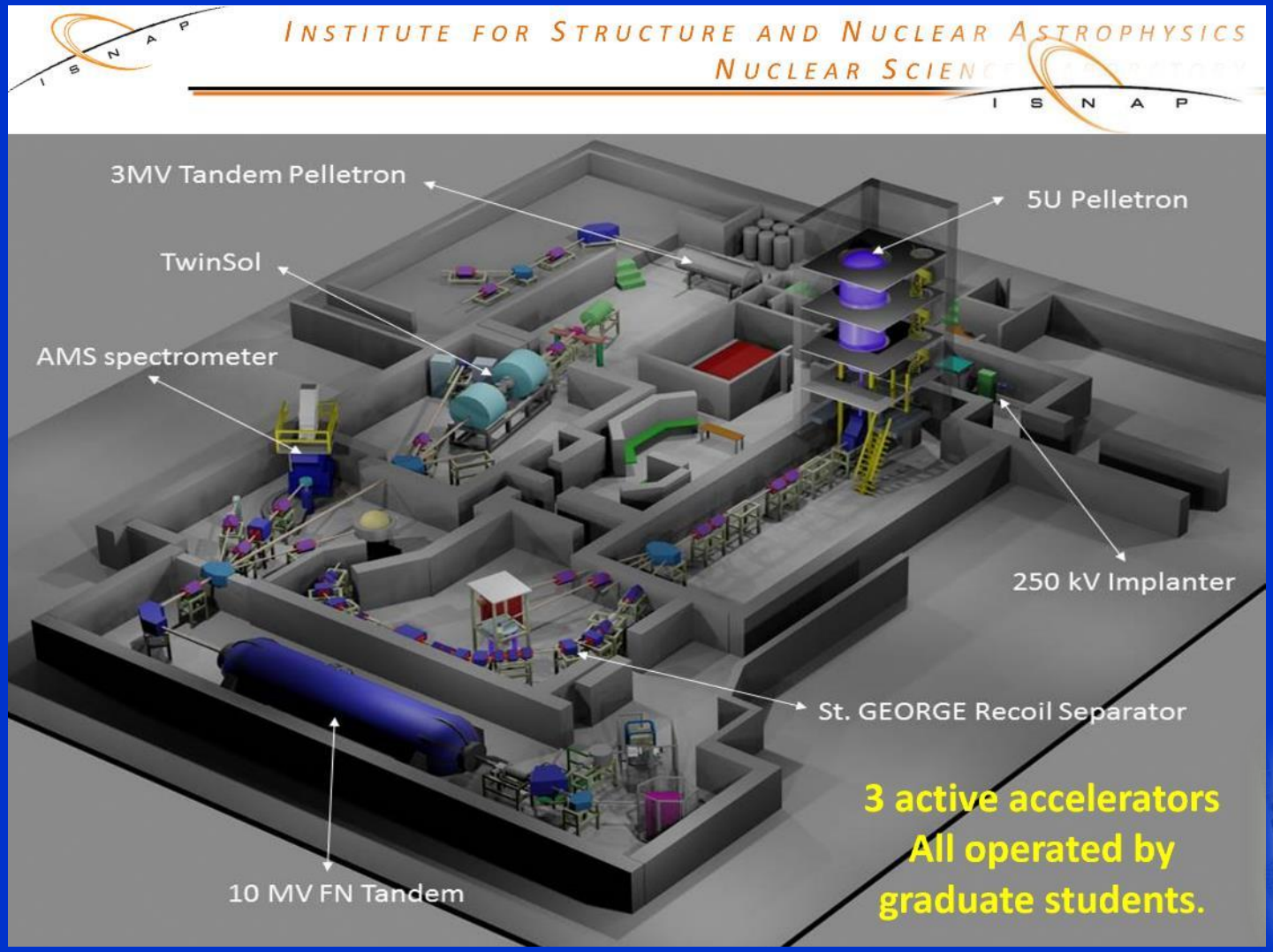
An Applied Nuclear Physics Program at the University of Notre Dame

Graham Peaslee
Department of Physics

NSAC Meeting
April 8, 2019

Nuclear Science Laboratory at the University of Notre Dame



Basic vs. Applied Science

Nuclear Reactions for DHS

Ion Beam Analysis for Archeology

Ion Beam Analysis for Public Health:

- Environmental Lead
- Heavy Metals
- Halogenated Flame Retardants
- PFAS – Consumer Products
  - Environmental Fate
  - Occupational Health

Radioisotope Tracing

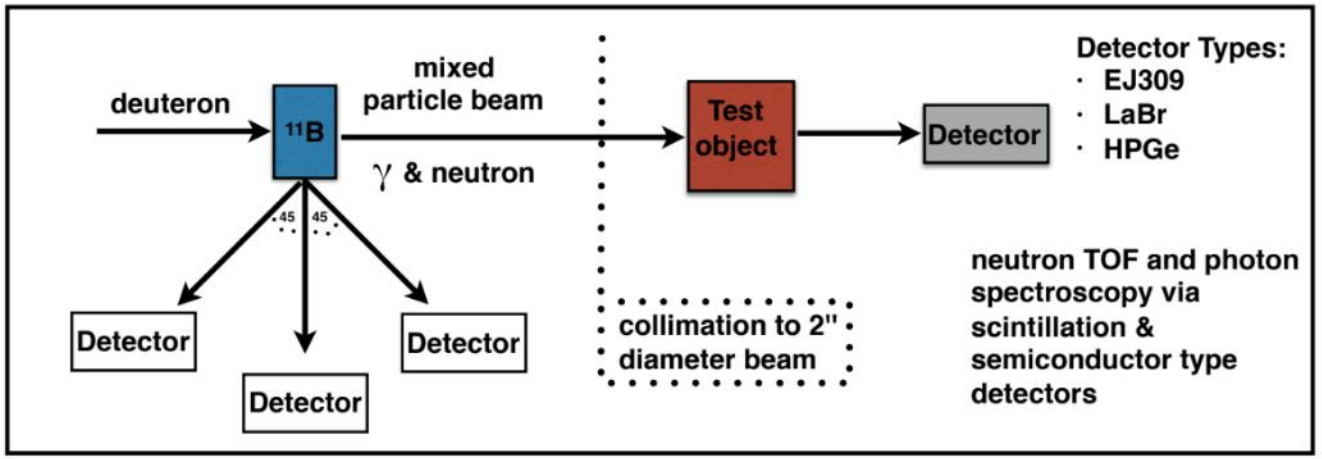
Isotope Harvesting

Impact & Education

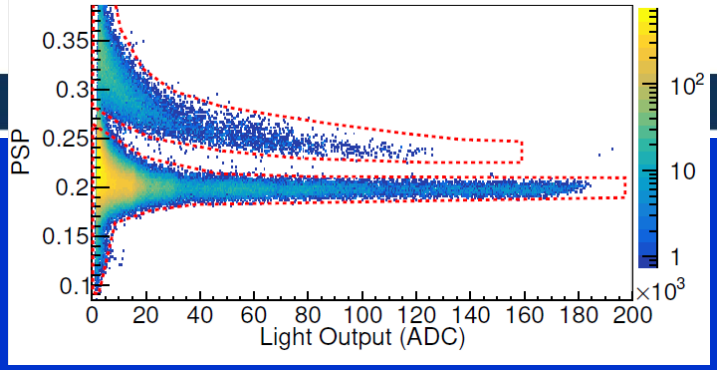
High-contrast Material Identification by Energetic Multi-particle Spectroscopic Transmission Radiography

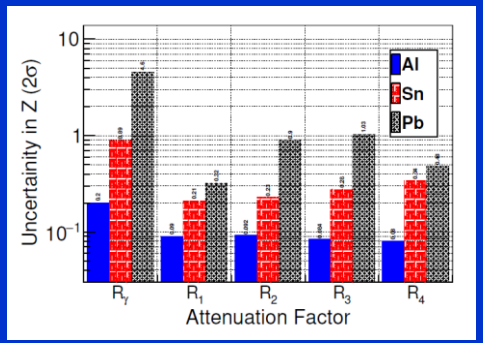
J. Nattress[1],* T. Nolan[1], S. McGuinness[2], P. Rose[3], A. Erickson[3], G. Peaslee[2], and I. Jovanovic[1†]
[1] *Department of Nuclear Engineering and Radiological Sciences, University of Michigan, Ann Arbor, MI 48109 USA*
[2] *Department of Physics, University of Notre Dame, Notre Dame, IN 46556 USA and*
[3] *G.W. Woodruff School of Mechanical Engineering, Nuclear and Radiological Engineering Program, Georgia Institute of Technology, Atlanta GA 30332, USA*

(*In Press: Phys. Rev. Appl.*, 2019)



***n* beam**





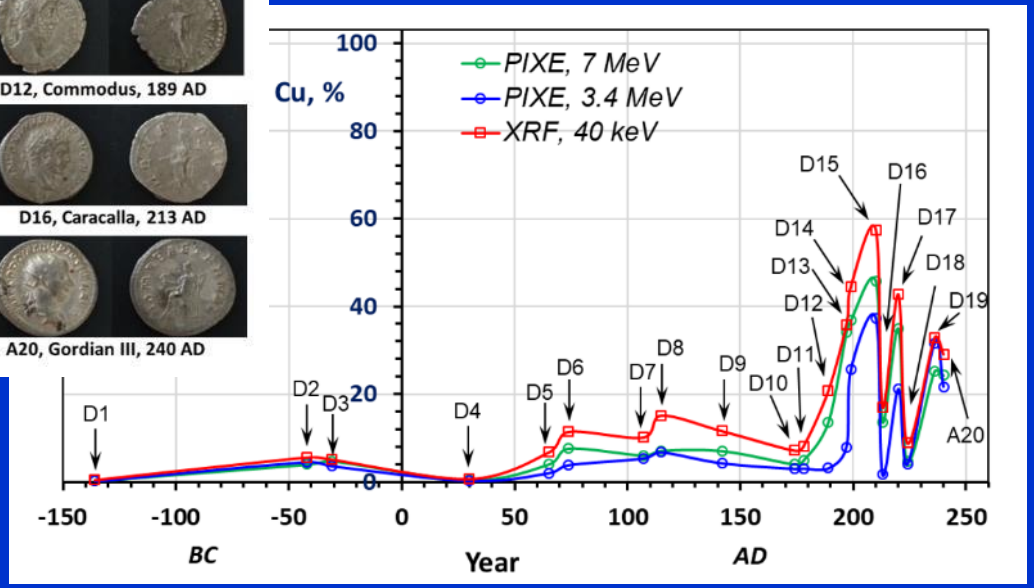
Surface Manipulation Techniques of Roman Denarii

Khachatur Manukyan*, Cecilia Fasano, Ashabari Majumdar, Graham F. Peaslee, Mark Raddell, Edward Stech, Michael Wiescher

Nuclear Science Laboratory, Department of Physics, University of Notre Dame, Notre Dame, IN 46556

(*Submitted: Appl. Surface Sci.*, 2019)

Differential PIXE

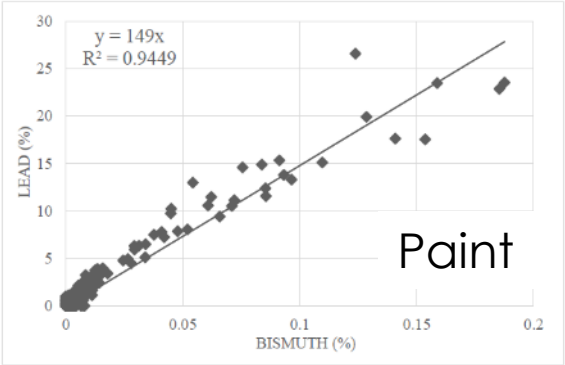


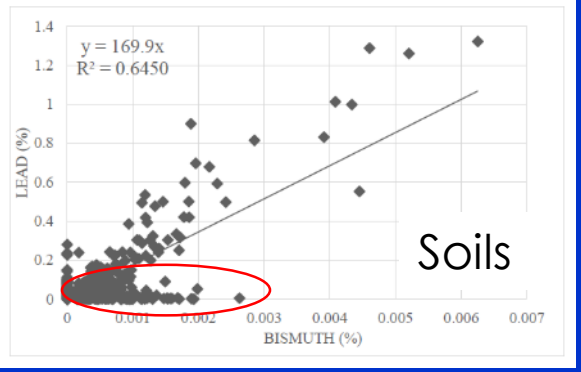
Risky Bismuth: Distinguishing Between Lead Contamination Sources in Soils

Meghanne Tighe[*,1], *Heidi Beidinger*[3,5], *Christopher Knaub*[3], *Matthew Sisk*[3,4], *Graham F. Peaslee*[2], *Marya Lieberman*[1]

1. Department of Chemistry and Biochemistry, University of Notre Dame, Notre Dame IN 46556
2. Department of Physics, University of Notre Dame, Notre Dame IN 46556
3. Eck Institute for Global Health, University of Notre Dame, Notre Dame IN 46556
4. Navari Family Center for Digital Scholarship, University of Notre Dame, Notre Dame IN 46556
5. Department of Biological Sciences, University of Notre Dame, Notre Dame IN 46556

(*Submitted: Chemosphere,* 2019)





PIXE & XRF & ICP

Scientific Research Publishing

J. Environmental Protection, *8*(11), (2017) 1243.

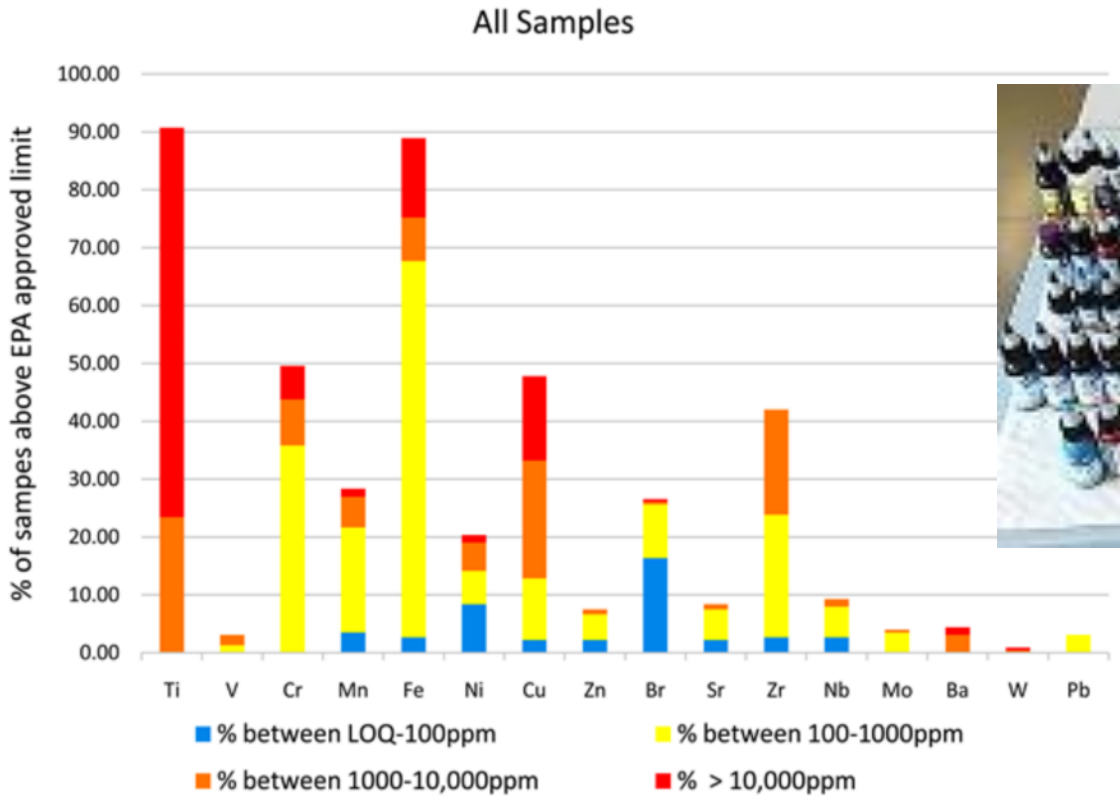
http://www.scirp.org/journal/jep

ISSN Online: 2152-2219

ISSN Print: 2152-2197

A Survey of Metals Found in Tattoo Inks

Meghanne E. Tighe[1,2], D. Kai Libby[3], Stanna K. Dorn[1], Jeffrey R. Hosmer[3], Graham F. Peaslee[2]



PIXE

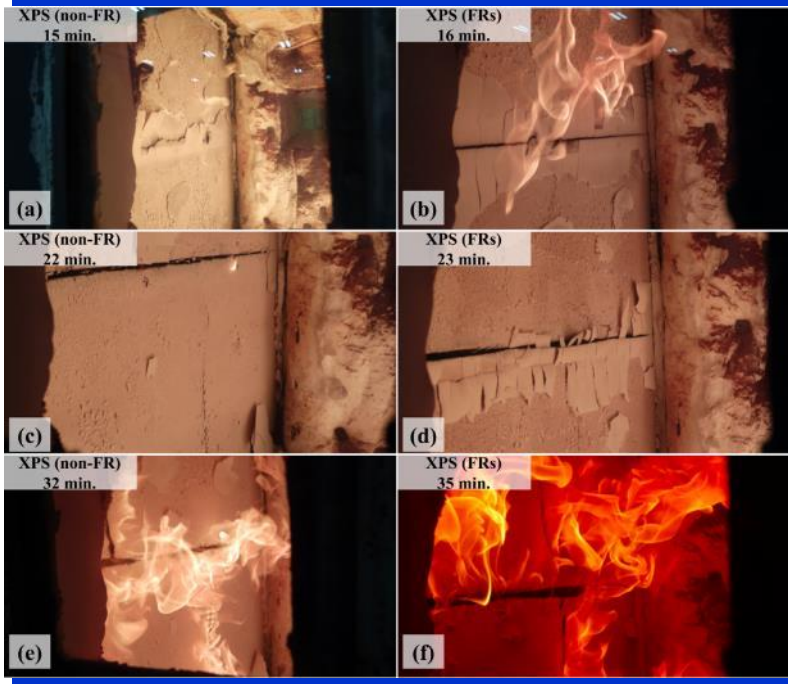
Fire test performance for foam plastic insulation with and without flame retardants: ASTM E119 and ASTM E84

Donald Lucas, Sara M. Petty, Vytenis Babrauskas, David Rich, Avery Lindeman, Graham Peaslee, Arlene Blum

(*Submitted: Fire Technology*, 2019)

Table 2 Measured bromine content.

Name of Insulation	Type	Origin	FR Content (BR ppm)
XPS FOAMULAR 400	XPS	US	27800
XPS SL 300 Sundolitt	XPS	UK	ND
XES Ecoprim Paroc	XPS	Sweden	ND
EPS Type XIV Insulfoam	EPS	US	39500
EPS S300 Sundolitt	EPS	UK	ND
XPS FOAMULAR 250	XPS	US	41900
XES Ecoprim Paroc	XPS	Sweden	ND
EPS Insulfoam	EPS	US	6000



PIXE

WINNER OF THE 2012 PULITZER PRIZE FOR COMMENTARY

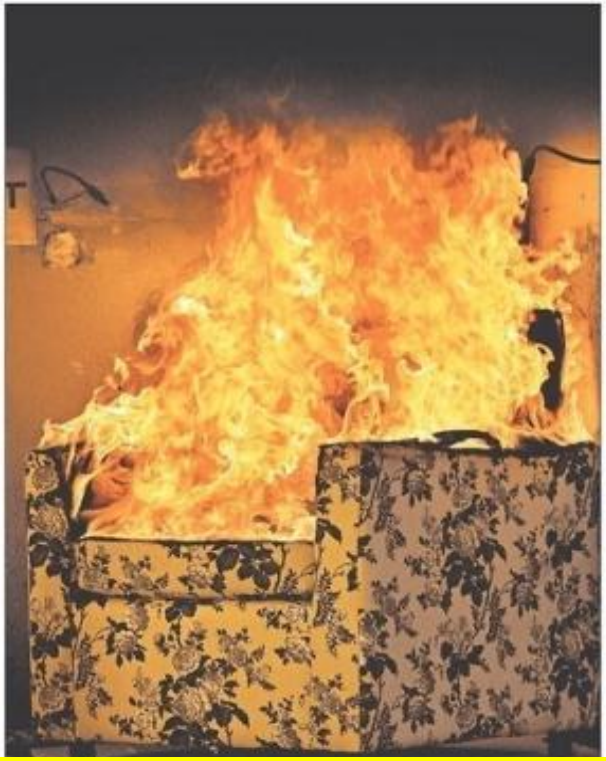
Chicago Tribune

QUESTIONS? CALL 1-800-TRIBUNE | SUNDAY, MAY 6, 2012 | BREAKING NEWS AT CHICAGOTRIBUNE.COM

TRIBUNE WATCHDOG

Playing with fire

A deceptive campaign by industry brought toxic flame retardants into our homes and into our bodies. And the chemicals don't even work as promised.



BY PATRICIA CALLAHA
Tribune reporters

Dr. David Heim
Before Cali
surgeon drew
7-week-old baby girl who
while she lay on a pillow
"Now this is a tiny
greyhound at home," said
baby's size. "Half of her
died after about three wee
Heimbach's passionat
the long-term health co
doctors, environmentali
and petty.
But there was a prol
Records show there was
baby he described didn't
Neither did the 9-we
patient who Heimbach
California legislators di
candle fire in 2009. Nor
6-week-old patient who
Alaska lawmakers was
burned in her crib in 200
Heimbach is not just a
inent burn doctor. He is
witness for the manufa
of flame retardants.
His testimony, the T
found, is part of a decade
campaign of deception t
loaded the furniture an
tronics in American
with pounds of toxic che
linked to cancer, neuro
deficits, developmental
lems and impaired fertili
The tactics started wi
Tobacco, which wanted
focus away from cigaret
the cause of fire death
continued as chemical c
nies worked to preserve
tive market for their pr
ording to a Tribune
housands of gover
ntific and internal in
uments.
hese powerful ind
orted science in way
estated the benefits

Science & Policy

Office of
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NOTICE

THIS ARTICLE MEETS THE FLAMMABILITY REQUIREMENTS OF CALIFORNIA BUREAU OF ELECTRONIC AND APPLIANCE REPAIR, HOME FURNISHINGS AND THERMAL INSULATION TECHNICAL BULLETIN 117-2013. CARE SHOULD BE EXERCISED NEAR OPEN FLAME OR WITH BURNING CIGARETTES.

The upholstery materials in this product:

_____ contain added flame retardant chemicals

__X__ contain NO added flame retardant chemicals

The State of California has updated the flammability standard and determined that the fire safety requirements for this product can be met without adding flame retardant chemicals. The State has identified many flame retardant chemicals as being known to, or strongly suspected of, adversely impacting human health or development.

Journal of Environmental Protection, 2016, 7, 341-350
Published Online February 2016 in SciRes. http://www.scirp.org/journal/jep
http://dx.doi.org/10.4236/jep.2016.73030

Scientific Research Publishing

Toys, Décor, and More: Evidence of Hazardous Electronic Waste Recycled into New Consumer Products

Gillian Z. Miller[1], Meghanne E. Tighe[2], Graham F. Peaslee[2], Karla Peña[3], Jeff Gearhart[1]

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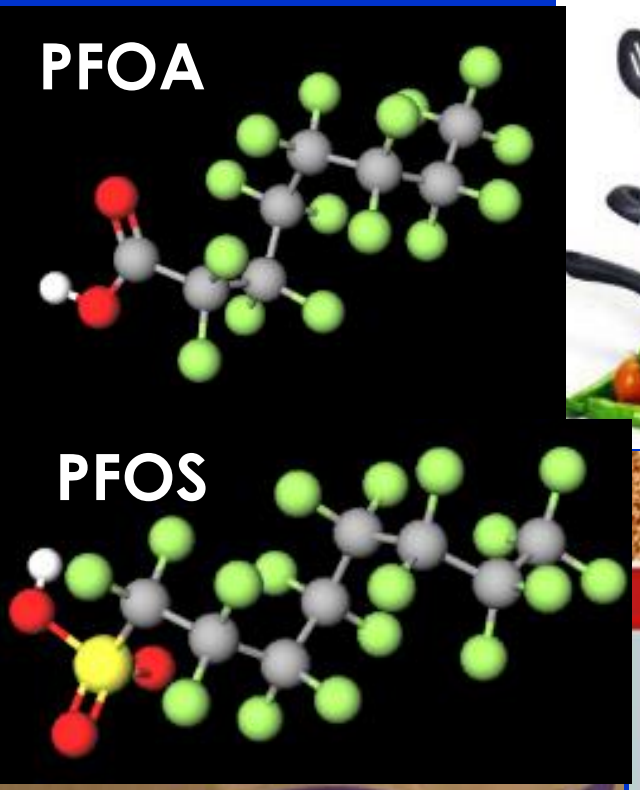
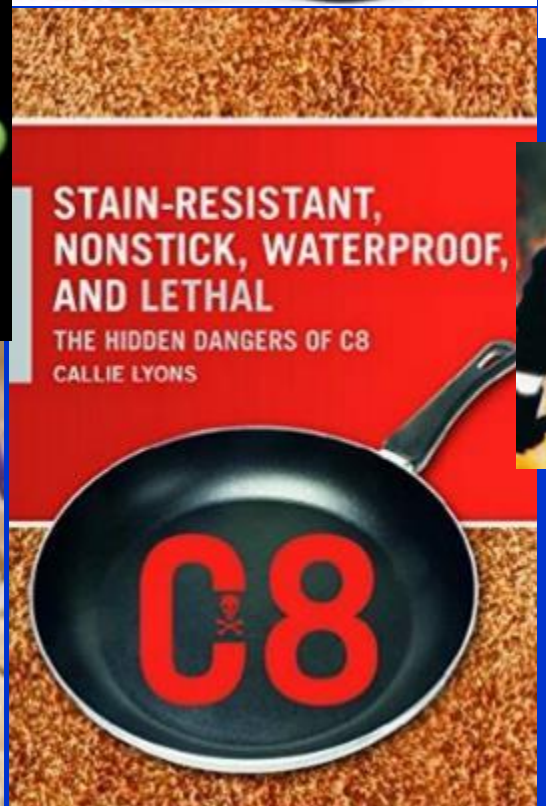
Holiday and Mardi Gras beads found to contain lead and hazardous flame retardants

PIXE & GC-MS

Science & Policy

The "Forever" Chemicals: PFAS





PIGE Analysis of Fluorine

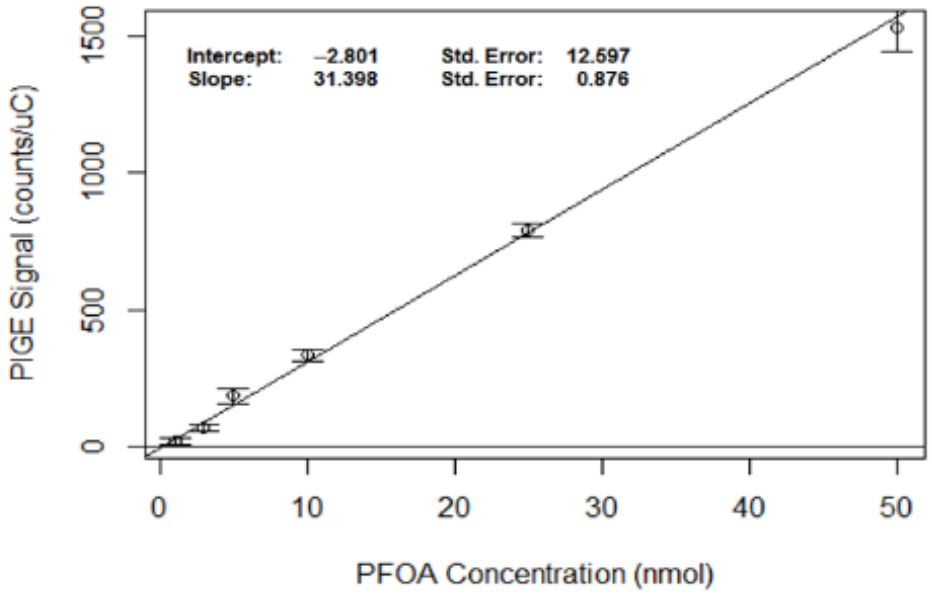
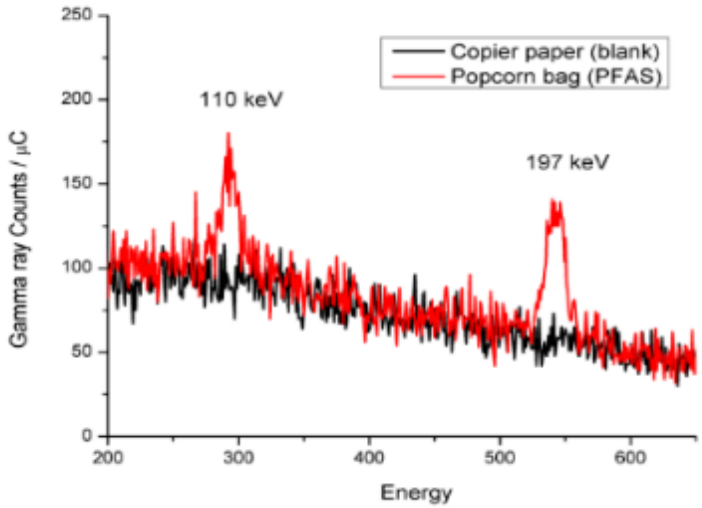


Fig. 3: PFAS-coated paper sample compared with uncoated paper. Irradiation time of 180 second with 9 nA of 3.4 MeV protons.

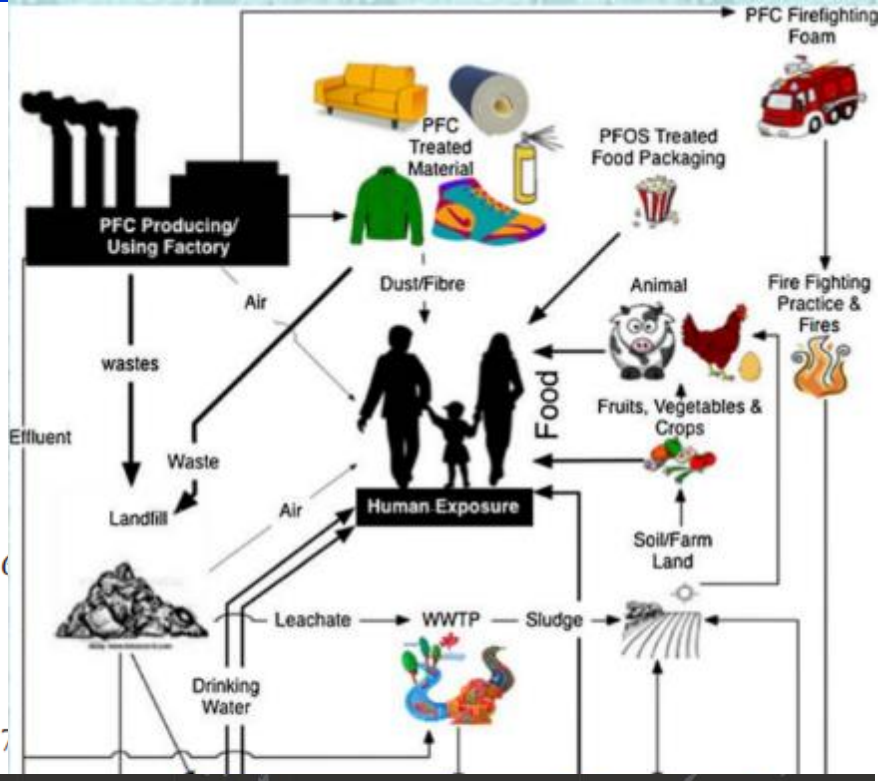


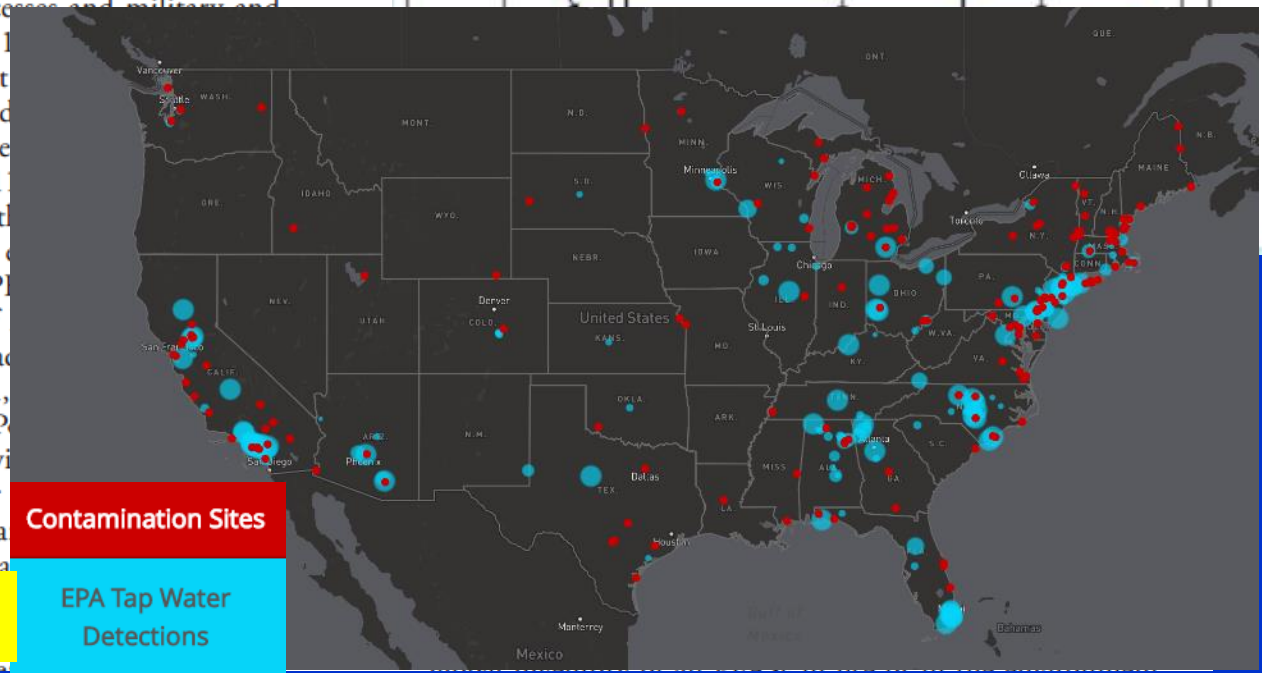
The Madrid Statement on Poly- and Perfluoroalkyl Substances (PFASs)

http://dx.doi.org/10.1289/ehp.1509934

As scientists and other professionals from a variety of disciplines, we are concerned about the production and release into the environment of an increasing number of poly- and perfluoroalkyl substances (PFASs) for the following reasons:

1. PFASs are man-made and found everywhere. PFASs are highly persistent, as they contain perfluorinated chains that only degrade very slowly, if at all, under environmental conditions. It is documented that some polyfluorinated chemicals break down to form perfluorinated ones (D'Eon and Mabury 2007).
2. PFASs are found in the indoor and outdoor environments, wildlife, and human tissue and bodily fluids all over the globe. They are emitted via industrial proces… and military and firefighting operations (Darwin 201… Coalition 2014), and they migrate out… into air (Shoeib et al. 2011), household… 2009), food (Begley et al. 2008; Tittle… et al. 2011), soil (Sepulvado et al. 201… ground and surface water, and make t… water (Eschauzier et al. 2012; Rahman …
3. In animal studies, some long-chain P… to cause liver toxicity, disruption of … the immune and endocrine systems, a… effects, neonatal toxicity and death, … tiple organ systems (Lau et al. 2007; P… growing body of epidemiological evi… effects are supported by significant or … between specific long-chain PFASs a… including associations with testicula…





Science & Policy

Environmental Science & Technology Letters

Published online 1 February 2017
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Letter

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Fluorinated Compounds in U.S. Fast Food Packaging

Laurel A. Schaider,*[,†] Simona A. Balan,[‡] Arlene Blum,[§,∥] David Q. Andrews,[⊥] Mark J. Strynar,[#] Margaret E. Dickinson,[▽] David M. Lunderberg,[▽] Johnsie R. Lang,[○] and Graham F. Peaslee[@]

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PIGE & LC-MS/MS

Environmental Science & Technology Letters

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Letter

Cite This: Environ. Sci. Technol. Lett. 2019, 6, 73−78

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Total Fluorine Measurements in Food Packaging: How Do Current Methods Perform?

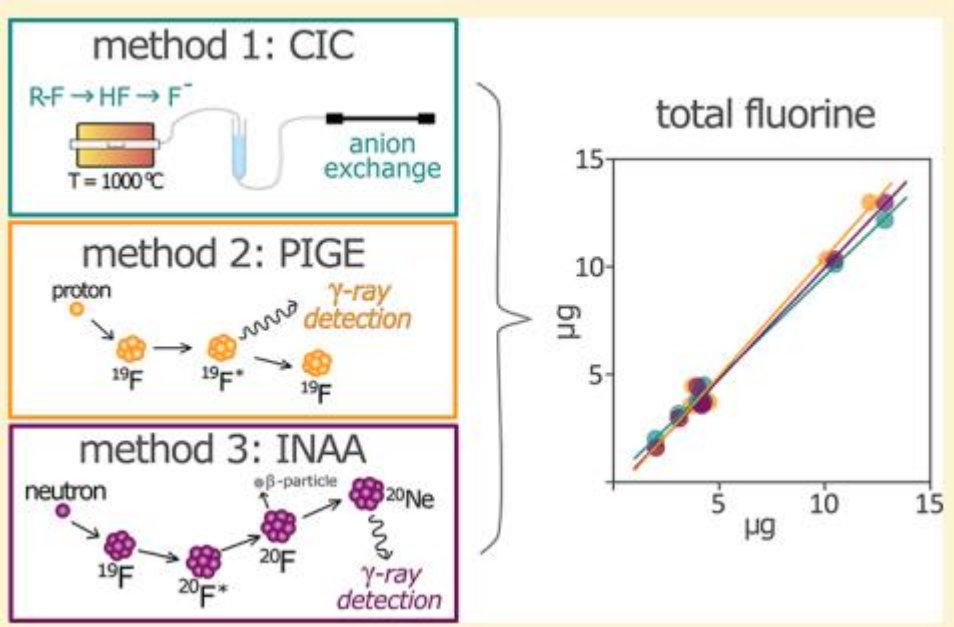
Lara Schultes,*[,†] Graham F. Peaslee,[‡] John D. Brockman,[§] Ashabari Majumdar,[‡] Sean R. McGuinness,[‡] John T. Wilkinson,[‡] Oskar Sandblom,[†] Ruth A. Ngwenyama,[§] and Jonathan P. Benskin[†]

[†]Department of Environmental Science and Analytical Chemistry (ACES), Stockholm University, Svante Arrhenius väg 8, SE-10691 Stockholm, Sweden

[‡]Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556, United States

[§]Department of Chemistry, University of Missouri, Columbia, M

PIGE & INAA & CIC



PFAS & Firefighters

Science & Policy

Rate of cancers in firefighters compared to the general public

- Testicular cancer (2.02 times greater risk)
- Multiple myeloma (1.53 times greater risk)
- Non-Hodgkin's lymphoma (1.51 times greater risk)
- Skin cancer (1.39 times greater risk)
- Prostate cancer (1.28 times greater risk)
- Malignant melanoma (1.31 times great risk)
- Brain cancer (1.31 times greater risk)
- Colon cancer (1.21 times great risk)
- Leukemia (1.14 times greater risk)

FDIC INTERNATIONAL

Event Info Attend Exhibit Educa

PFAS 101:

What Are They and How These Chemicals Can Impact Firefighter Health

Friday, April 12, 2019: 10:30 AM - 12:15 PM

Speaker(s)

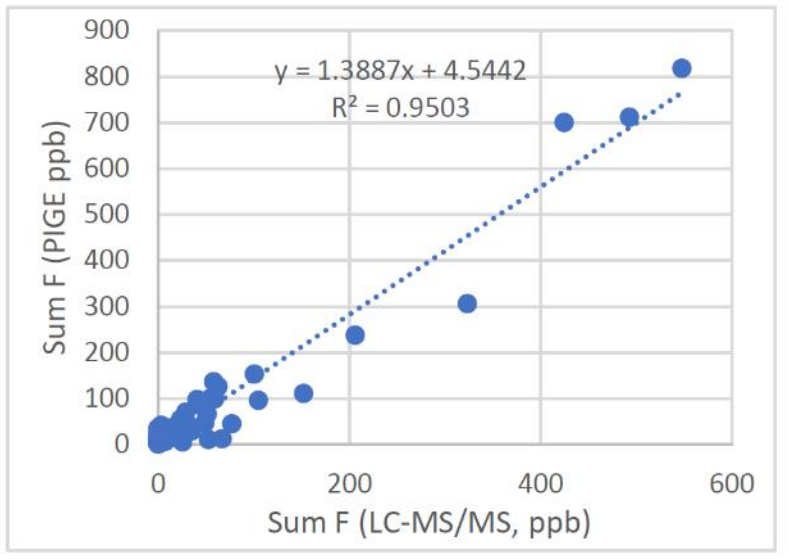
Graham Peaslee — Instructor
Professor of Physics
University of Notre Dame
United States

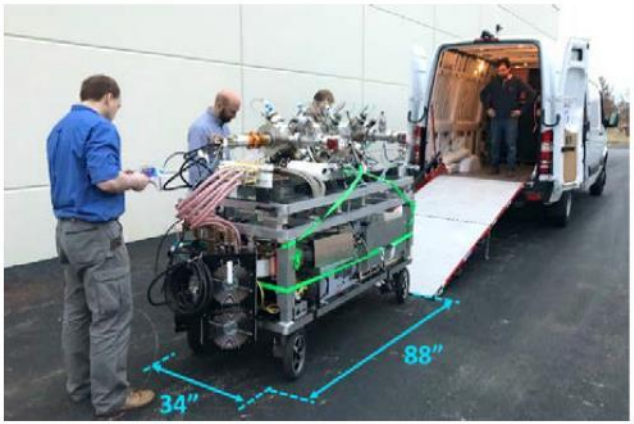
PIGE & LC-MS/MS

Field-Deployable PIGE Analysis

ESTCP

PIGE Screening Data: Groundwater (range of ppb Fl from multiple sample depths)





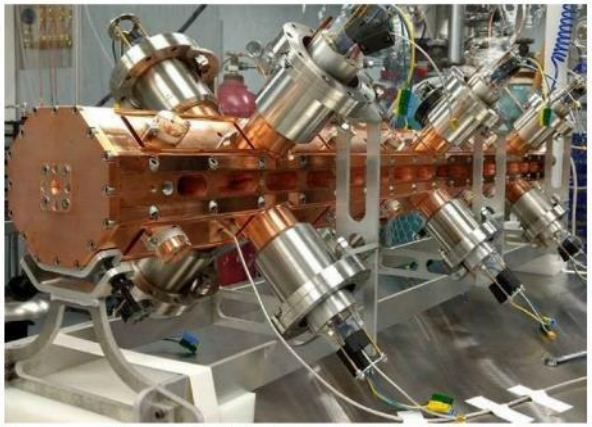


***Figure S4**: (Left) Centurion™ Mk1 system being loaded into a van for transport to an off-site demonstration >1000 miles away. (Right) The compact RFQ LINAC itself (shown assembled with Starfire's patent-pending RF power injectors) is approximately 4' long and can be modified for energies between 1—5 MeV.*

starfire industries

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Environmental Science & Technology Letters

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Letter

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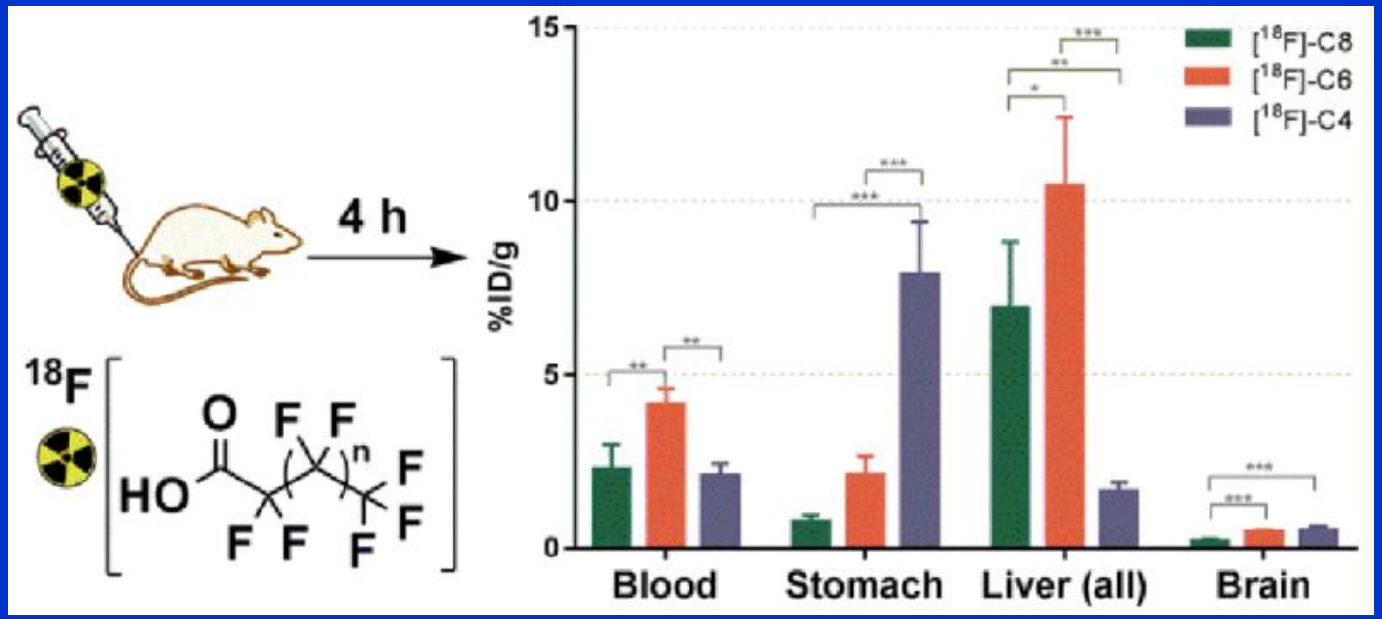
Radiosynthesis and Biological Distribution of ^{18}F-Labeled Perfluorinated Alkyl Substances

Jennifer L. Burkemper,[†] Tolulope A. Aweda,[†] Adam J. Rosenberg,[‡,§] David M. Lunderberg,[∥] Graham F. Peaslee,[⊥] and Suzanne E. Lapi*[,†]

DOI: 10.1021/acs.estlett.7b00042
Environ. Sci. Technol. Lett. 2017, 4, 211−215



Science & Policy

Radioisotope Tracers

Isotope Harvesting on the Proton-Rich Side…

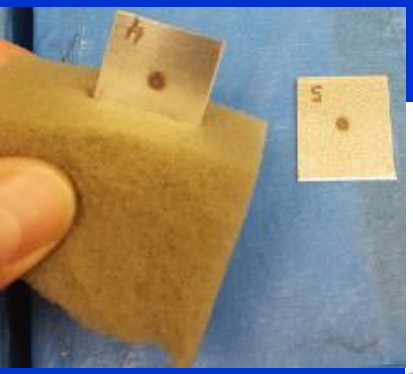
Production of ^{52}Fe from Symmetric Complete Fusion-Evaporation Reactions

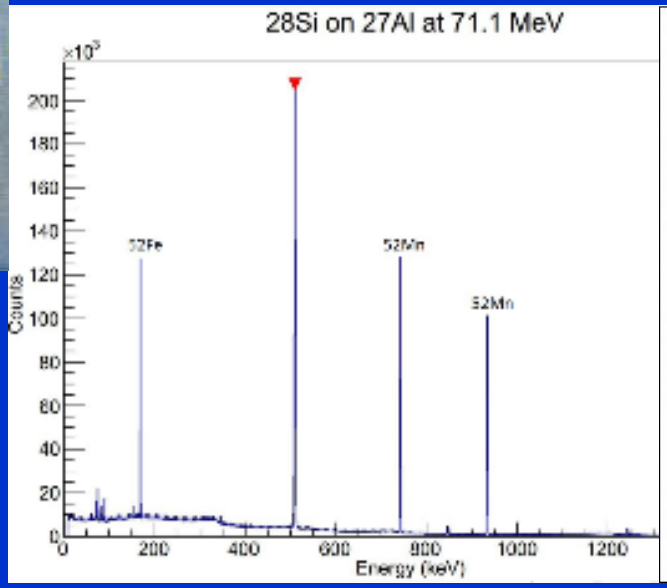
Sean R. McGuinness[1], John T. Wilkinson[1], Samuel J. Ferran[2], C. Shaun Loveless[2], Suzi E. Lapi[2], and Graham F. Peaslee[1]

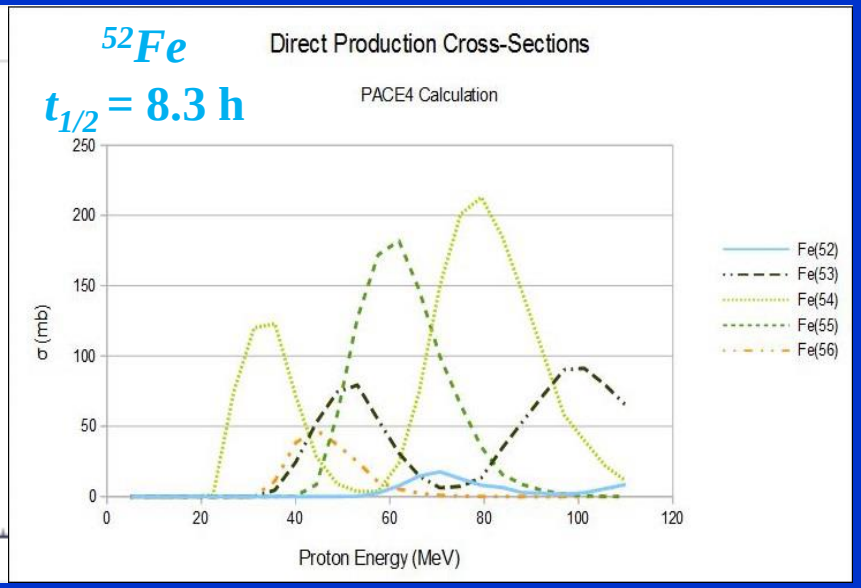
[1]Department of Physics, University of Notre Dame, Notre Dame, IN 46556

[2]Department of Radiology, University of Alabama at Birmingham-School of Medicine, Birmingham, Alabama 35294,

(*In Preparation:* 2019)







The role of students…

The role of funding agencies…

Is to provide stable funding opportunities for basic research in nuclear science…

However, Federal budgets are rarely increasing and we are increasingly asked what is the purpose of basic research?

Including a small mix of applied nuclear science in the funding portfolio will increase visibility, attract students and can take advantage of current events to increase funding streams…

gpeaslee@nd.edu