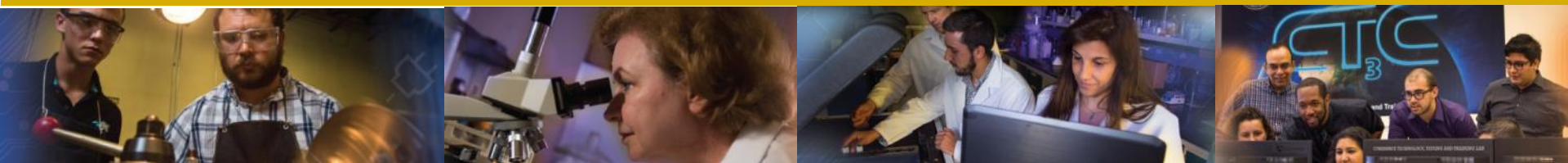
DOE-EM Cooperative Agreement FIU Performance Year 6 Research Review

Presented: April 5 - April 7, 2016
to the U.S. Department of Energy
Dr. Leonel Lagos, PhD, PMP® (Principal Investigator)

Florida International University



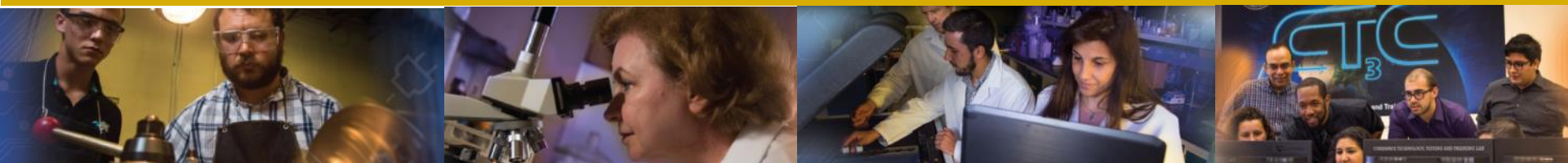
FIU Research Review

Tuesday April 5, 2016	Wednesday April 6, 2016	Thursday April 7, 2016
1:00-2:30 High Level Waste / Waste Processing (FIU Project 1)	10:00-12:00 Workforce Development & Training (FIU Project 4)	10:00-12:00 Wrap Up (All Projects)
2:30-4:00 **D&D/IT for EM** **(FIU Project 3)**	1:00 - 3:00 Soil/Groundwater (FIU Project 2)	

Project 3: Waste and D&D Engineering and Technology Development

Leonel Lagos, PhD, PMP®
Director of Research, Applied Research Center

Florida International University



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SRNL SAVANNAH RIVER NATIONAL LABORATORY™

Project Description

This research project focuses on delivering solutions under the deactivation and decommissioning (D&D) and waste areas as well as the management of D&D knowledge (storage, preservation and dissemination) for environmental management.

This work supports DOE HQ (EM-13, EM-12, EM30, EM 2.1) and is also relevant to D&D and facility engineering activities being carried out at other DOE sites such as Oak Ridge, Savannah River, Hanford, Idaho and Portsmouth as well as internationally.

Project Task Descriptions

- D&D Support to DOE EM for Technology Innovation, Development, Evaluation and Deployment
  - Provides direct support to assist DOE EM in meeting the D&D needs and technical challenges around the DOE complex. Identifying and evaluating innovative technologies in support of D&D projects.
- D&D Knowledge Management Information Tool (KM-IT)
  - A web-based community-driven system developed to maintain and preserve the D&D knowledge base and tailored to serve the technical issues faced by the D&D workforce across the DOE Complex.
- Waste Information Management System (WIMS)
  - Receives, integrates and organizes the DOE waste forecast data from across the DOE complex on an annual basis and to automatically generate waste forecast data tables, disposition maps, GIS maps, and transportation details.

DOE-FIU Cooperative Agreement

Project 3 Accomplishments

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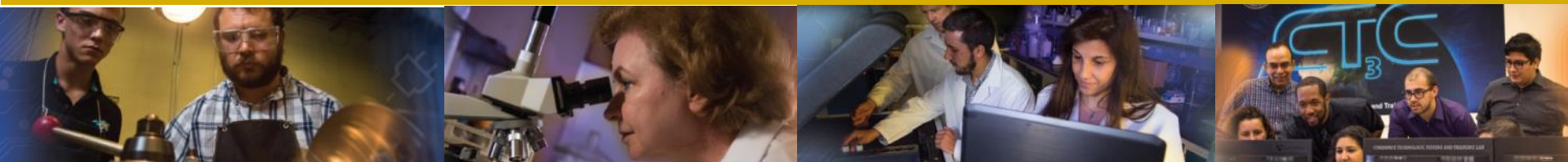
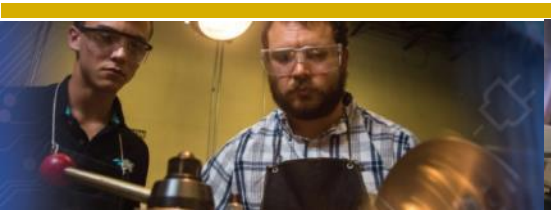
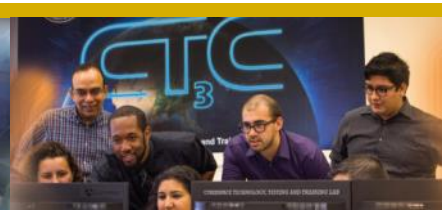


D&D Tasks

Mr. Joseph Sinicrope

Florida International University





D&D Portfolio Overview

- Conduct basic R&D of potential D&D technologies
  - Enhancing operational performance of fixatives, strippable coatings, and decontamination gels
    - Emphasis on enhancing fire resiliency to mitigate the potential release of radioisotopes during fire / extreme heat conditions
- Conduct comprehensive test and evaluations of D&D technologies
  - Over 200 technology demos, tests, & evaluations
  - Leading development of Phased Technology Test & Evaluation Model
  - Work with ASTM International and community stakeholders to develop and promulgate Uniform Testing Protocols and Performance Metrics for D&D technologies
- Baseline robotic technologies for application at SRS facility
- Fogging research support for INL

Basic R&D: Enhancing Fire Resiliency of Fixatives

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- **Problem Statement**: Mitigate the potential release of radioisotopes under fire conditions during D&D and storage activities.
- **Goal:** Improve operational performance of fixatives by enhancing their fire resiliency.
- **Potential Solution:** Adapt intumescent coatings as fire resilient fixatives.
- **Explanation:** Since 9/11, there have been significant improvements in fire retardant / fire resistant technologies, with intumescent coatings being at the forefront. Intumescent coatings develop a thick char to insulate the substrate and protect it from fire / extreme heat conditions. Adapting that technology to serve as a fixative could increase fire resiliency and mitigate the risk of contamination under those extreme conditions.

Basis for Interim Operations (BIO) for SRS 235-F

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- Potential consequences of a seismically-induced full-facility fire are greater than 10 rem offsite and 27,000 rem to the collocated worker at 100 meters
- Fires could start inside the building if energized electrical equipment or wiring failed or was damaged during a seismic or other natural hazard event
- Very proactive fire preventive controls ISO D&D activities
  - Eliminating potential ignition sources
  - Controlling the amount of combustibles
  - Removal of residual contaminants
  - Identification and deployment of tools, fire resilient fixatives, etc.

Contingency Planning

Table 1. Types of Accidents (and Frequencies) Summarized

DOE Site/Facility	Fire Events	Explosion Events	Loss of Confinement (Spill) Events	Natural Phenomena Hazards	Other Events
RFETS Bldg 440	• ***1,200 Drum Fire (EU)*** • ***15 Crate Fire (U)*** • Truck Fire (EU)		• LLW Repack Spill (U) • Drum Spill (A)	• ***Earthquake Collapse (U)***	• ***Aircraft Crash (EU)***
RFETS Bldg 664	• ***3 Drum Fire (U)*** • ***15 Crate Fire (U)*** • *336 Drums + 72 Crates Fire (EU)* • Truck Fire (EU)		• *Multi-Container Drop*	• ***Earthquake Collapse (U)***	• ***Aircraft Crash (worst-case) (EU)*** • ***Aircraft Crash (realistic case) (EU)***
SRS APSF	• *Accountability Msmt. Room Fire (U)*	• *Explosion in Repackaging Area (A)*		• *Seismic Induced Full Facility Fire (U)*	
SRS HB-Line	• Full Facility Fire (EU) • Full Facility Fire & Secondary Events (EU) • ***Intermediate Fire (U)*** • ***Intermediate Facility Fire & Secondary***		• Spill (A)	• Earthquake with Secondary Events (EU)	
SRS Bldg 235-F	• Fire – Best Case (U) • Fire – Worst Case (U)			• Design Basis Earthquake (EU)	
SRS SWMF	• ***TRU Pads - Internal Culvert Drum Fire (U)***	• ***TRU Pads - Culvert Explosion (U)***	• TRU Pads - High Energy Vehicle Impact (EU) • ***TRU Pads - Dropped Steel Box (A)***	• TRU Pads -Tornado (EU)	• 634-7E Buried Waste Helicopter Crash (EU)
Hanford WRAP Facility	• *4 Drum Fire (U)* • *Single Drum Fire in Glovebox (U)*	• ***Drum Explosion with 4 Drum Fire (U)*** • *Single Drum Explosion in Glovebox (U)*	• Solid Waste Box Failure (A)	• ***Design Basis Earthquake (U)*** • Beyond DBE (EU)	
INEEL RWMC	• ***Vehicle Fire (U)***	• *Drum Explosion (A)*	• *Box Spill (A)*	• Design Basis Earthquake (U)	
LANL RAMROD Facility	• Small Fire (A) • Medium Fire (EU) • Large Fire (EU)	• Small Natural Gas Explosion (A) • Large Natural Gas Explosion (EU)	• Coring Glovebox Spill (A)	• Design Basis Earthquake (U)	• Aircraft Crash (EU)

Note: Scenarios in *Italics* are risk dominant events, based on Risk Class I or II for the collocated worker. ***Bold Italics*** denotes that it is also risk dominant for the public.

Baseline of Fixatives ISO D&D

- Conducted extensive baseline of 5 industry fixatives and decon gels on various substrates (stainless steel, wood, glass, sheetrock)
- Primary focus was on determining fire resiliency
  - Exposure to open flame
  - Incremental temperature increases in muffle furnace
- Collected date on combustibility, mass loss, impact on adhesion, contaminant transport, chemical breakdown

Baseline of Fixatives ISO D&D Executive Highlights

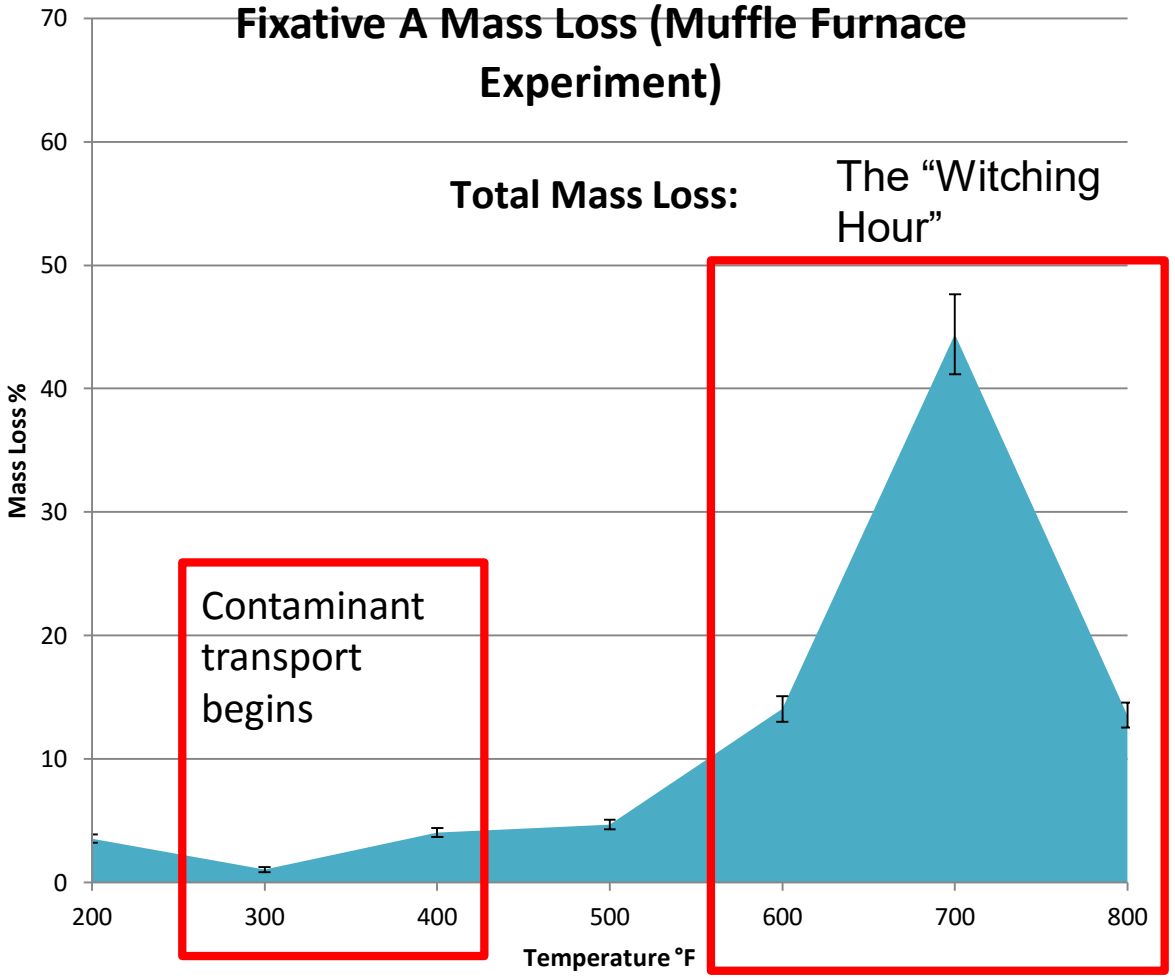
Melting / expansion / transport of fixative and contaminant began, on average, at 300-400 F within minutes of exposure

All 5 fixatives began to exhibit minor mass loss starting at temperatures as low as 200 F, but most significant degradation in terms of mass loss, desiccation, chemical breakdown, etc. occurred between 600-800 F (ref matrix and charts)

All fixatives lost anywhere from 70% to upwards of 90% mass when exposed to incremental temperature increases (200-800 F). Again, greatest mass loss percentage occurred between 600-800 F.

All 5 fixatives “ignited” / became flammable almost immediately when exposed to the propane torch / open flame and burned completely between 1-5 minutes.

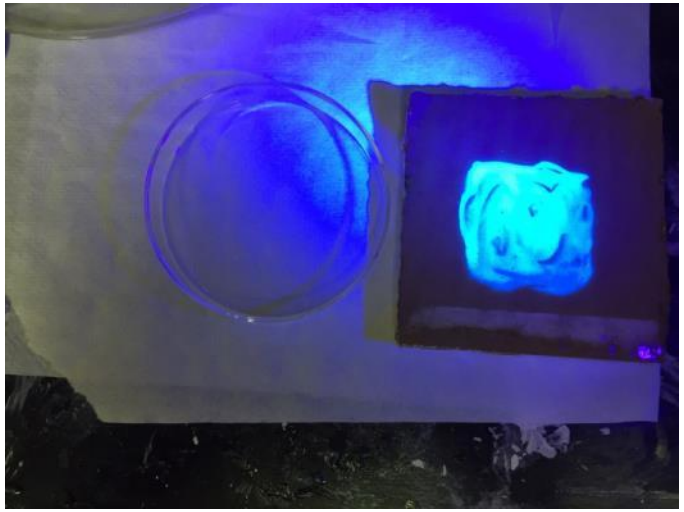
Basic Fixative Profile

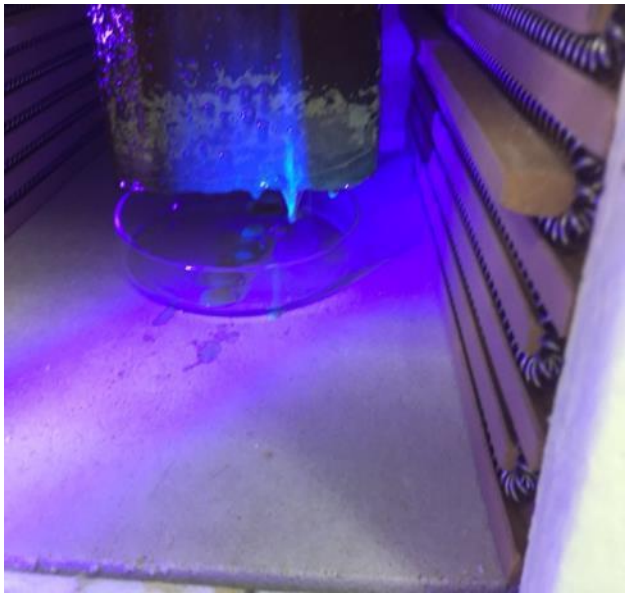


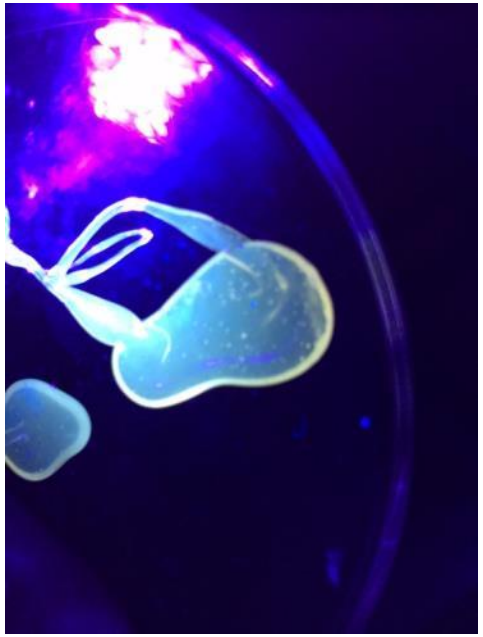
Contaminant Transport

All 5 x fixatives baselined demonstrated contaminant flow beginning at temperature ranges between 250-300 degrees in less than 5 minutes of exposure. At 500 degrees and above GloGerm particles could no longer be tracked due to extensive damage to fixative.

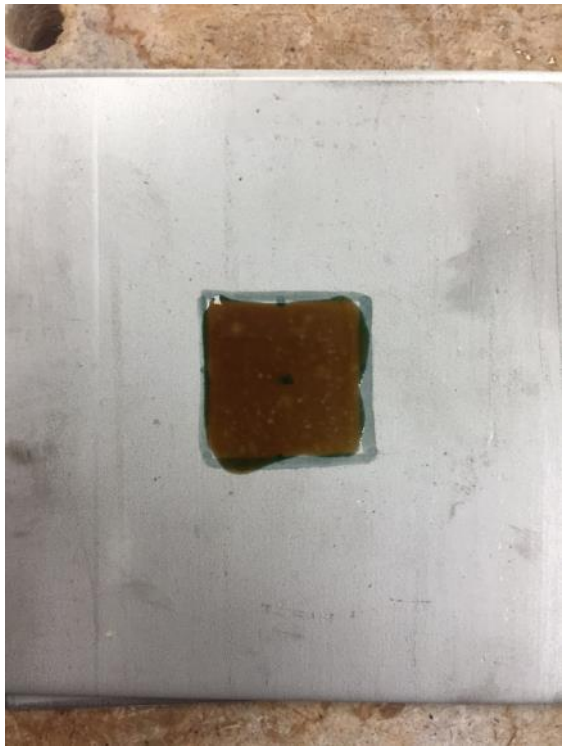
A product called GloGerm was used to simulate the contaminant and track particle flow during degradation. When exposed to a black light the GloGerm particles glow (note photos – Fixative A with GloGerm at 300 degrees).





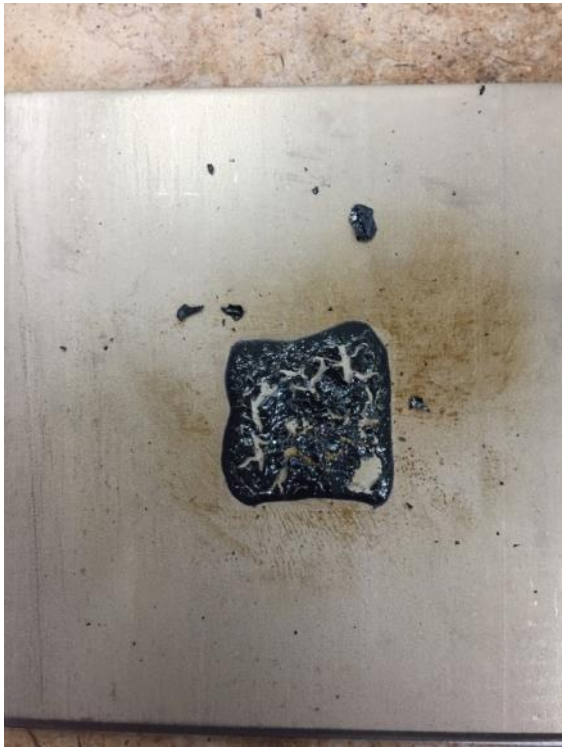


Observed Impacts to Fixative "A" at Incremental Temperatures



Discoloration, expansion, and minor mass loss
(400 degrees)

Discoloration, bubbling, continued expansion, "off gassing", desiccation and mass loss
(600 degrees)



Significant mass loss, discoloration, desiccation, cracking, and flaking. Slightest abrasion with fixative resulted in total flaking.
(800 degrees)

Observed Impacts to Fixative "B" at Incremental Temperatures

Discoloration, expansion, and minor mass loss (200 degrees)

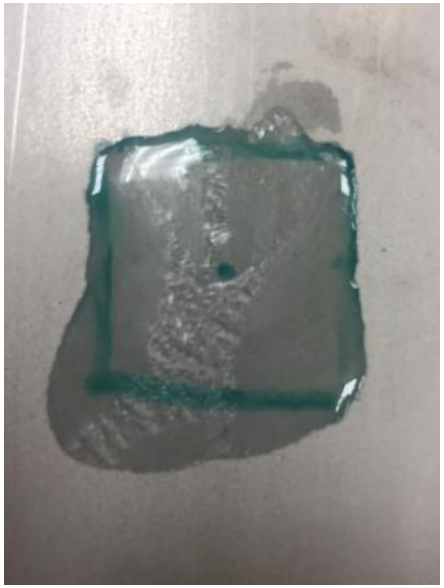
Discoloration, bubbling, continued expansion, "off gassing", and mass loss (400 degrees)

Significant discoloration, continued expansion, "off gassing", mass loss, desiccation, cracking, and brittle composition (500 degrees)

Significant mass loss, discoloration, desiccation, cracking, and flaking. Slightest abrasion with fixative resulted in total flaking. (800 degrees)

Observed Impacts to Fixative "C" at Incremental Temperatures

Starting Point



Discoloration, bubbling, continued expansion, "off gassing", and mass loss noted (200 degrees)

Significant discoloration, continued expansion and "off gassing", mass loss, desiccation, cracking, and brittle composition (500 degrees)

Significant mass loss, discoloration, desiccation, cracking, and flaking. Slightest abrasion with fixative resulted in total flaking. (800 degrees)

Observed Impacts to Fixative "D" at Incremental Temperatures

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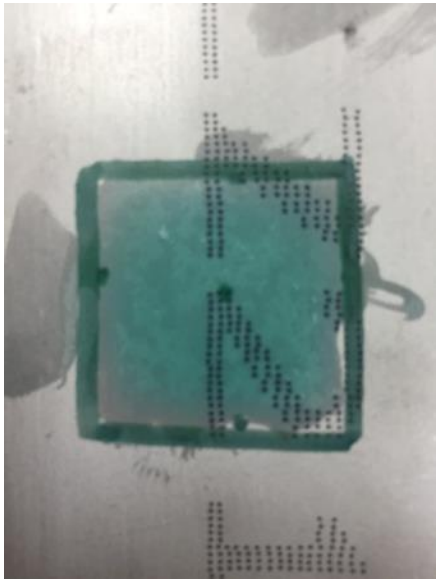
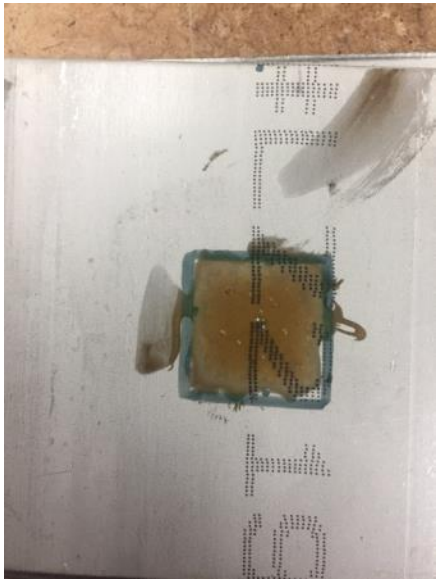


Starting Point



Discoloration, bubbling, continued expansion, "off gassing", and mass loss noted (500 degrees)

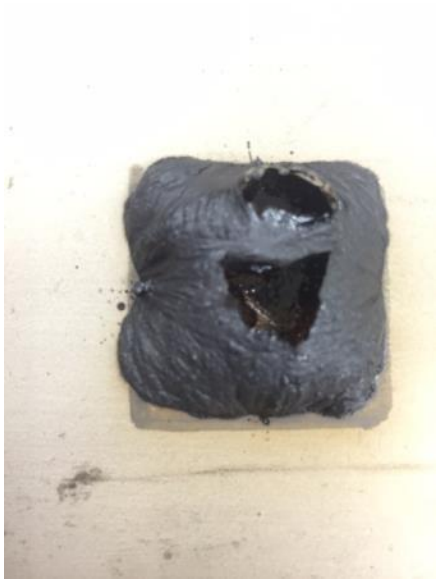
Significant discoloration, continued expansion and "off gassing", mass loss, desiccation, cracking, and brittle composition (700 degrees)

Significant mass loss, discoloration, desiccation, cracking, and flaking. Slightest abrasion with fixative resulted in total flaking. (800 degrees)

Observed Impacts to Fixative "E" at Incremental Temperatures

Starting Point

Discoloration, "off gassing", and mass loss
(500 degrees)

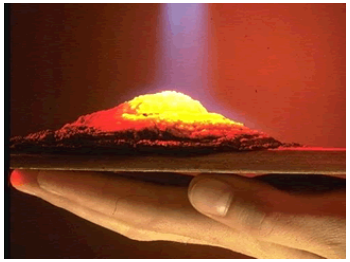


Significant discoloration, continued expansion and "off gassing", mass loss, desiccation, cracking, and brittle composition
(700 degrees)

Significant mass loss, discoloration, desiccation, cracking, and flaking. Slightest abrasion with fixative resulted in total flaking.
(800 degrees)

Adapting Technological Advancements in other Industries (Intumescent Coatings)

- **Goal:** Improve operational performance of fixatives used in D&D activities by enhancing their fire resiliency
- **Potential Solutions:** 1) Layer an intumescent coating (IC) with existing fixatives; or 2) adapt / formulate IC as a standalone fixative
- **Explanation:** Since 9/11, there have been significant improvements in fire retardant / fire resistant technologies, with intumescent coatings being at the forefront of this development. U.S. Military, NASA, oil and gas industry and others use this proven technology extensively to fire harden / protect facilities.



Adaptation of Intumescent Coatings as a Fire Resilient Fixative

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- Designed to swell 50 to 100 times original thickness into an insulating char upon exposure to heat / fire
  - Provides physical barrier to heat and mass transfer
- Inhibits transport of volatiles to the environment and the transport of oxygen to unburned regions beneath char
  - Retention of mass in the char limits further involvement of the underlying materials in the fire
- Undergo rigorous ASTM, NFPA, UL, and UBC fire testing:
  - UL 263 / UL 723 / ASTM E-119 / ASTM E-84 / ASTM E-2768/ UL 10B
  - NFPA: 251 / NFPA: 255 / NFPA: 703 / NFPA: 252
  - As context, ASTM E119 test subjects a given wall / structure to 24 gas flames that reach temperatures between 1800-2000º F for periods between 1-2 hours
- Exceptionally cost effective (as low as $0.75 cents per square foot)
- Easily applied via brush, roller, or sprayer to a wide variety of substrates (stainless steel, wood, sheetrock, sheet metal, etc.)
- Very resilient to environmental conditions (heat, humidity, etc.)

Proof of Concept Executive Highlights
Intumescent Coatings

- All 5 fixatives, when layered with the intumescent coating, conclusively displayed enhanced fire resiliency during the propane torch / open flame on all substrates
  - Excellent Thermal Insulation Protection
    - Fixative and substrate remained relatively intact
  - Minimum Flame Spread
  - Long-term thermal protection
    - Exposed coupon to propane torch for 35+ minutes with minimal damage to fixative
  - No smoke
  - Easy application via brush or sprayer
- During muffle furnace tests, reduced off-gassing and mass loss

Flame Spread Comparison

Flame Spread Test #2

- 4”x4” steel coupon was coated with intumescent coating except for a 1 cm portion in the center which was coated with Fixative A only
- 2 propane torches were ignited and pointed towards outer edges (upper and lower, respectively) at a distance of ~1 ¾” from the exposed fixative (middle)
- Charring at both edges commenced immediately, and prevented flame spread and heat transfer to exposed fixative

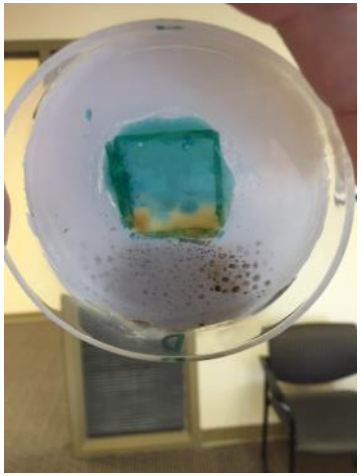
Thermal Insulation / Heat Transfer Comparison

Thermal Insulation Reaction

- Each substrate (stainless steel, wood, glass, sheetrock) was layered to IC manufacturer's recommended thickness
- Charring commenced immediately when exposed to propane torch; it occurred at ~700º F in muffle furnace
- Dense charring ranged from 1"-2.5" depending on time, substrate, fixative, etc.
- Provided excellent thermal insulation to both substrate and fixative

Thermal Insulation Test #2

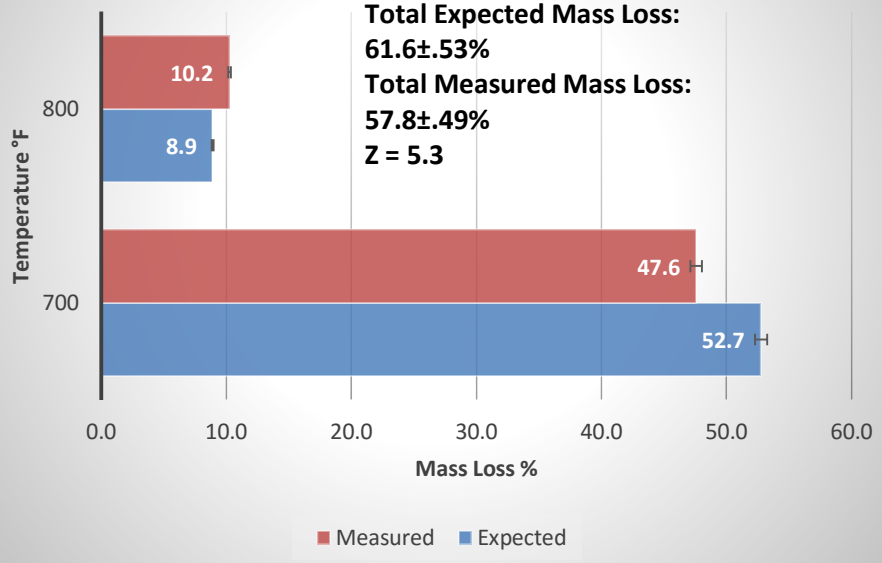
- Used glass substrates to observe impact to fixative when covered with intumescent coating
- Charring commenced immediately when exposed to propane torch; it occurred at ~700º F in muffle furnace
- As long as charring is immediate, thermal insulation begins and provides protection to fixative



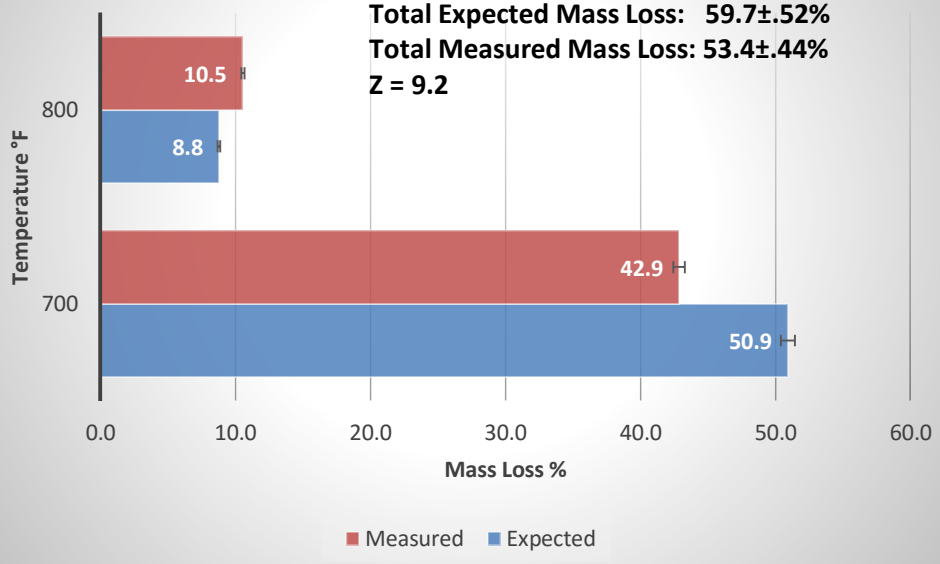
Mass Loss IC+E:G700-1 vs. "Projected" Loss

Mass Loss IC+E:G700-2 vs. "Projected" Loss

Mass Loss IC+A:G700-1 vs. "Projected" Loss



Mass Loss IC+A:G700-2 vs. "Projected" Loss



Future Work

- Based on initial results from Proof of Concept experiments, SRS 235-F site personnel requested expedited adaptation of intumescent coating to address requirements with hot cells
  - Rad hardened to withstand heat generation of Pu-238
  - Able to fix Pu-238 particle sizes between 10-300 um
  - Capable of being applied via existing devices

- Preference is to pursue adaptation of intumescent coating as a standalone fixative, but need to continue R&D in optimizing the layering process as well
  - Baseline other top rated industry ICs and identify one that matches most closely with requirements – modify from there
  - Enhance intumescent coatings thermal reaction at lower temperatures
  - Improve adhesion and bonding characteristics

- Conduct full scale demo
  - Replicate hot cell at SRS 235-F
  - Schematics approved for release

Test and Evaluation: Technology Test and Evaluation Model in support of D&D Requirements

FIU Applied Research Center

- **Challenge Area:** Standardizing and implementing proven processes to refine and better synchronize FIU support to DOE-EM technology needs, requirements, testing, and evaluation.

- **Institutional Solution:**
  - **Phase I:** Identification, initial assessment, and approved selection of technologies for further test and evaluation
  - **Phase II:** Test and evaluate designated technologies at FIU Testing and Evaluation Facility that replicates operating environment and conditions in which technology will be employed to the maximum extent
  - **Link to larger DOE-EM Test Bed initiative:** Formal operational test and evaluation of technology in a radioactive environment at DOE facilities

Test and Evaluation: Technology Test and Evaluation Model in support of D&D Requirements

- Task 1: Identification of technology for T&E
  - Collaborative Approach: EM-13, sites project teams, national labs, etc.
  - Maintain flexibility pending highest priority (functional need vs specific technology)
    - Approach I: Identify technology in a functional area
      - Fire Resilient Fixative
      - Robotics
      - 3D Modeling
      - Unique sensor networks
    - Approach II: Test and evaluate a specific, designated technology
  - Decision brief to EM-13 on recommended technologies that address rqt (June 2016)
  - Output from this serves as input for following year (e.g.; PTP Year 7)

Test and Evaluation: Technology Test and Evaluation Model in support of D&D Requirements

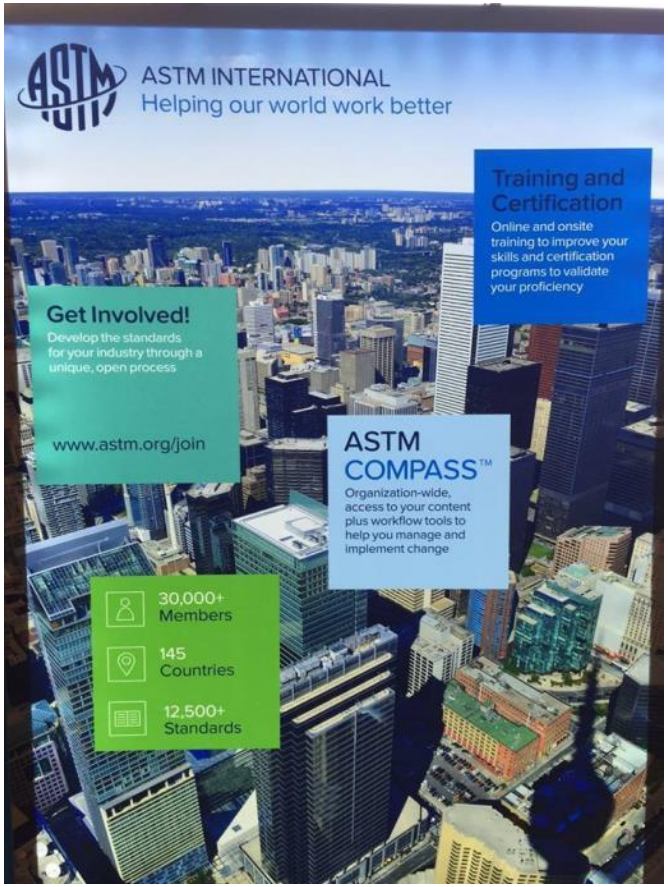
FIU Applied Research Center

- Task 2: Test and evaluate selected technology at FIU Testing and Evaluation Facility that replicates operating environment and conditions in which technology will be employed to the maximum extent
  - Conduct T&E (Mar 2017)
  - Task incorporated under Cooperative Agreement in PTP Year 7
  - *Output from this T&E could serve as D&D input to larger DOE-EM Test Bed Initiative*

- Possible linkage to DOE-EM Test Bed Initiative**:** Formal operational test and evaluation of technology in a radioactive environment at DOE facilities
  - 2017 - 2018
  - Funded by DOE-EM Test Bed Initiative

ASTM International

- Engaging ASTM International on development and promulgation of testing standards and protocols for D&D technologies
  - Primary Objective is to ensure standardized comparison metrics across the DOE-EM complex for similar technologies (apples to apples)
    - Current testing and evaluation practices afford too much variance within technology categories
  - Joe Sinicrope is incoming ASTM International E10.03 Subcommittee Chair which should assist in expediting standards development

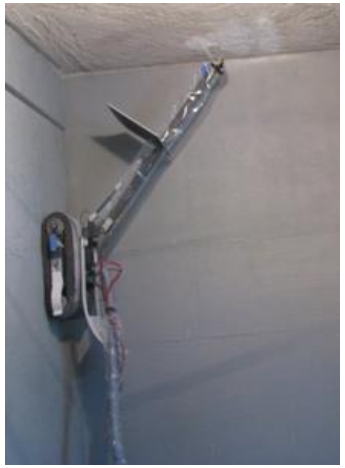


Baseline Robotic Technologies

- Initial focus on robotic technologies relevant to SRS-235F problem set
- Coordinating with SRNL to identify specific requirements
- Start with existing database in D&D KM-IT to identify potential robotic technologies to meet the requirements

Phantom (DJI)

Mighty Mouse (Sandia National Lab)



Remote Climber (ICM)

HRP-3 Promet MK-II (Kawada Industries)

Future D&D Work

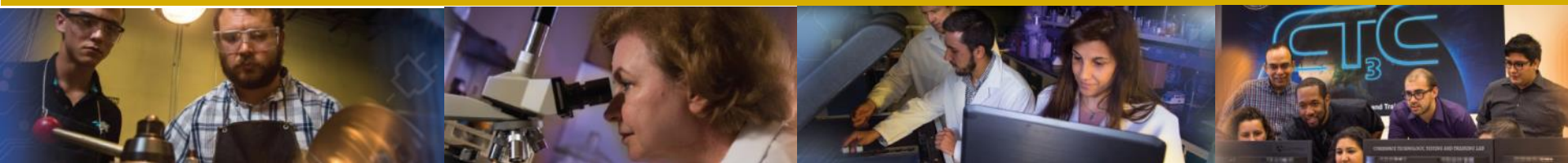
As part of FIU performance year 7, FIU will:

- Terminate/remove Advanced Fogging Research task.
- Continue adaptation / development of intumescent coating as a fire resilient fixative.
- Conduct full-scale test and evaluation of remote application of intumescent coating replicating hot cell at SRS 235-F.
- Assist in T&E of ARC robotics development project for D&D.

Deactivation and Decommissioning Knowledge Management Information Tool (D&D KM-IT)

Dr. Himanshu Upadhyay

Florida International University



D&D KM-IT

Deactivation and Decommissioning Knowledge Management Information Tool

- D&D KM-IT is successfully deployed and can be accessed from the web address http://www.dndkm.org.

- A web-based knowledge management information tool custom-built for the D&D user community by FIU-ARC in collaboration with DOE, EFCOG, and the former DOE ALARA Centers.

D&D KM-IT Goal

To attain the long-term active use, operation, and continued growth of the D&D knowledge from across the D&D global community and capture within the D&D KM-IT system resulting in enhanced worker safety, improved operational efficiencies, improved communication & knowledge among stakeholders, and the **cross-generational transfer of D&D knowledge to the future workforce.**

D&D KM-IT – Objectives

To prevent the loss of D&D knowledge and expertise that has been gained over the years by employees and contractors of DOE

To collect, consolidate, and share this valuable information in a universally available and easily usable system

To provide single-point access into the collective knowledge-base of the D&D community within and outside of the U.S. Department of Energy

D&D KM-IT MODULES

D&D KM-IT Modules

- D&D Hotline
- Technology Module
- Vendor Module
- Collaboration tools
- Mobile applications
- Lessons Learned
- Documents
- Pictures/videos
- Search tools
- Training
- Specialists
- Best Practices

D&D KM-IT – Mobile Applications

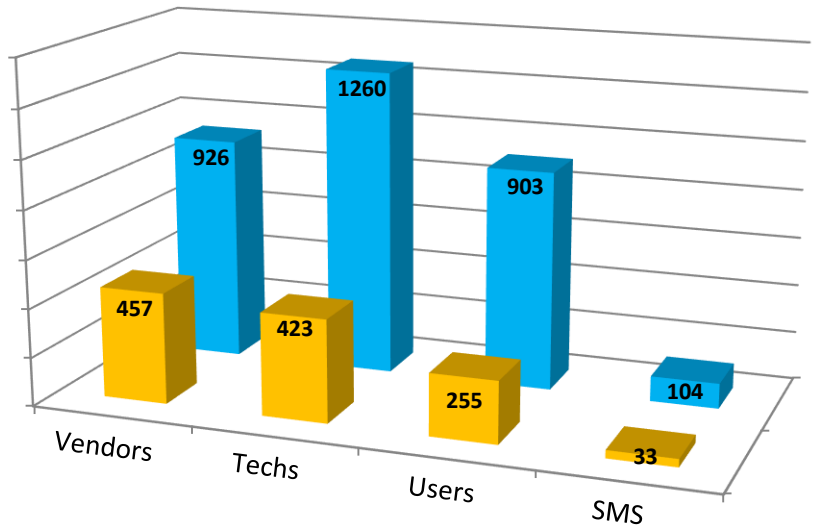
The D&D KM-IT mobile web application is now available on the iPhone, iPad, Blackberry, Android, or Windows smart devices to access the following modules:

- Vendors
- Technology
- Specialist Directory
- Picture Library
- Hotline
- Lessons Learned
- Best Practices

M.DNDKM.ORG

D&D KM-IT: Current Statistics

- 903 registered users
- 104 subject matter specialists
- 926 D&D vendors
- 1260 D&D technologies
- 494 robotic technologies
- 195 questions and solutions in Hotline module
- 169 ALARA Center reports archived
- 231 Innovative Technology Summary Reports archived



Growth from March 2012 to March 2016

What is Web Analytics?

- The measurement, collection, analysis and reporting of internet data for purposes of understanding and optimizing web usage
  (Defined by Wikipedia)
- Information gathered:
  - How visitors locate and reach dndkm.org
  - How visitors navigate through the system
  - How to enhance visitors experience
- Parameters tracked:
  # of visits, page views, pages/visit, bounce rate, time on site, new visit, unique visitors, traffic source, etc.

Tools

Google Analytics

Google Webmaster Tools

bing Webmaster

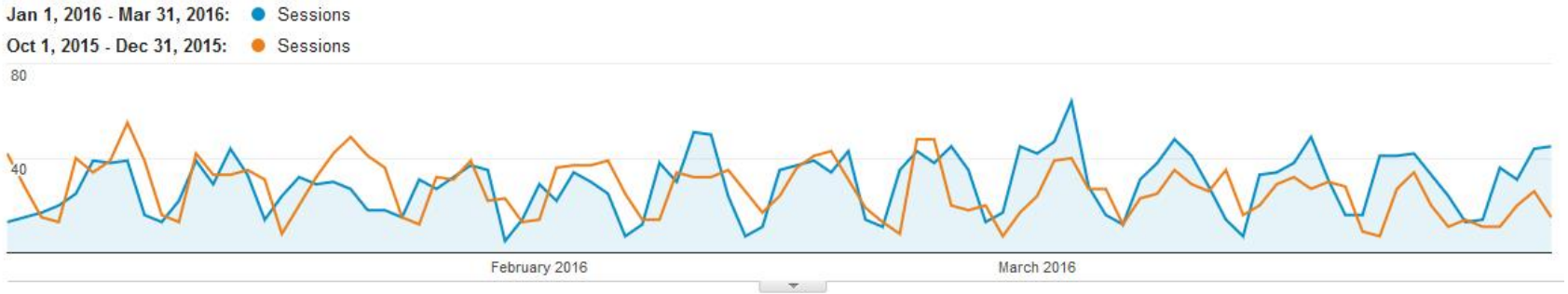
Alexa The Web Information Company

Web Analytics Methodology

Web Analytics - Application

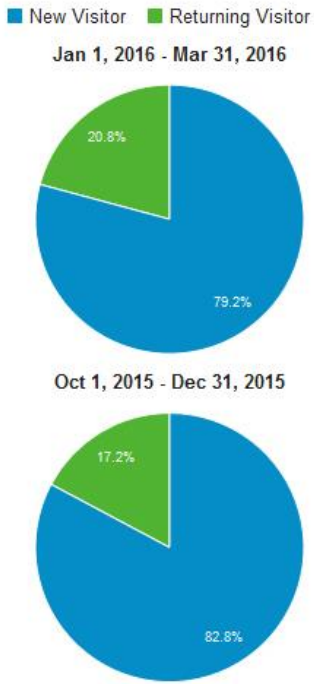
- Provides baseline measurements of critical metrics
- Used to improve weak metrics and enhance strong metrics
- Follow up on feedback from visitors
- Measures the impact of D&D KM-IT on the D&D community

Web Analytics – Analysis



Sessions	Users	Pageviews	Pages / Session
7.75%	2.35%	43.05%	32.76%
2,641 vs 2,451	2,136 vs 2,087	8,692 vs 6,076	3.29 vs 2.48

Avg. Session Duration	Bounce Rate	% New Sessions
60.14%	-4.09%	-4.31%
00:02:44 vs 00:01:42	69.10% vs 72.05%	79.17% vs 82.74%



2015 Q4 DND KM-IT WEB ANALYTIC DATA (dndkm.org)

TOTAL PAGEVIEWS

6,076

UNIQUE USER VISITS

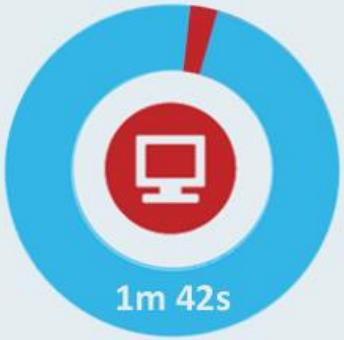
2,087

NEW **82.8%**

RETURNING **17.2%**

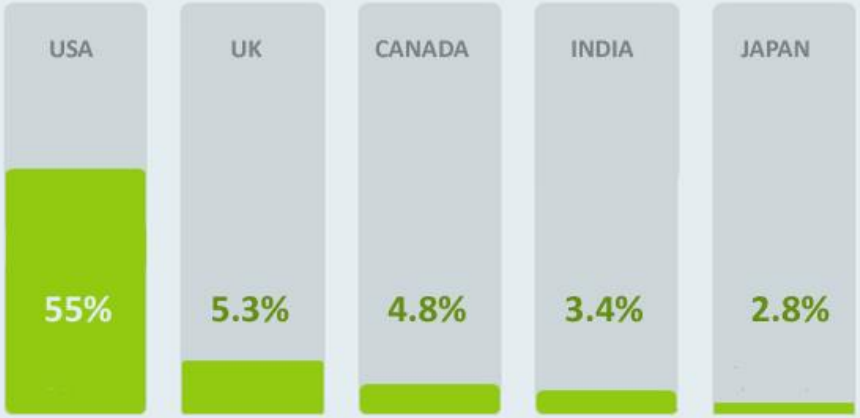
FIU **4%**

AVG. TIME ON SITE

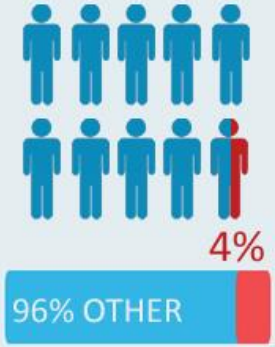


TRAFFIC TYPE

TOP 5 DEMOGRAPHICS



FIU FACTOR



POPULAR QUERIES

alaron alloy analyzer anti cellular circular concrete contamination decontamination denitration density giraff gloves htfx inc knucklehead laboratory logistics macroencapsulation milwaukee mobile niton nuclear shaver special suit system technologies tent vasteras xlt

BROWSERS

CHROME	INTERNET EXP.	FIREFOX	SAFARI
45.65%	27.83%	11.14%	11.10%

MODULE DESTINATION

D&D KM-IT – Strategic Approach

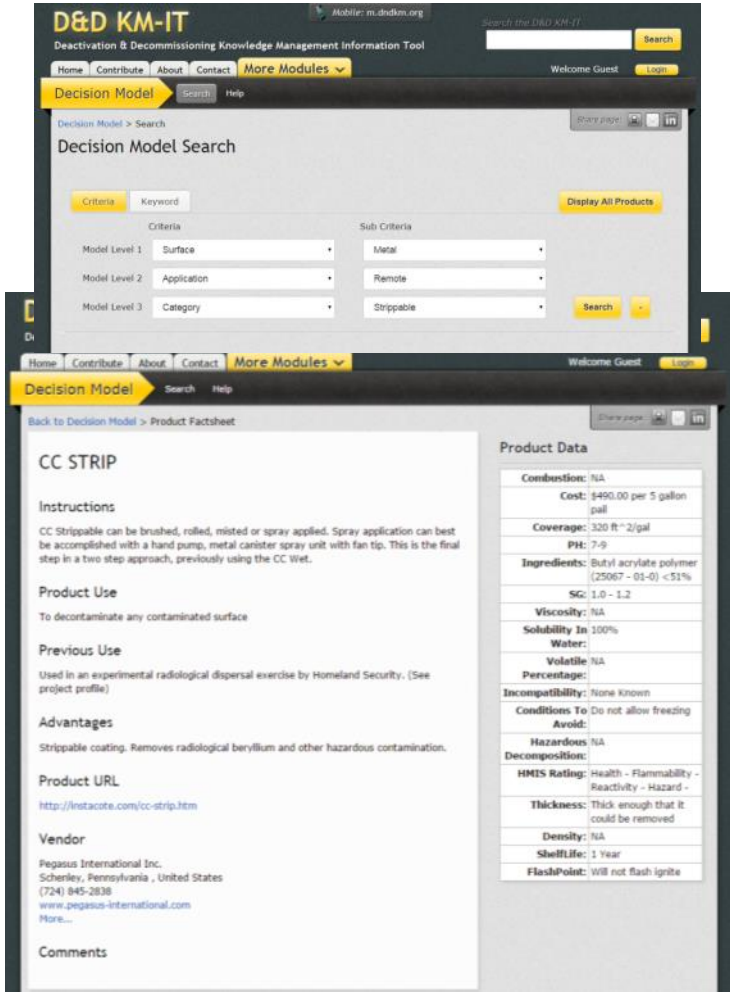
- Optimize search engine to increase site traffic
- Supplement original content from other sources
- Get linked and get more backlinks
- Use of social media
- Promote web presence w/ newsletters, updates, direct email
- Collaborate with Wikipedia, Powerpedia
- Engage user involvement via user advisory group and feedback loop on website
- Evaluate and incorporate information from web analytics
- Offer original and quality content

D&D KM-IT – Outreach

- Participation in conferences (e.g., Waste Management Symposium, DD&R, etc.)
- Newsletters to registered D&D KM-IT users & SMS
- Periodical memos from DOE HQ to site managers
- Collaboration with other databases/systems like Decontamination and Decommissioning Science Consortium (DDSC), OSTI and ORAU
- Engage DOE Project Directors
- Engage DOE EM-72
- Engage user involvement via a user advisory group
- Share knowledge by contributing to wiki resources like Wikipedia and DOE's Powerpedia

D&D KM-IT – Accomplishments

- Deployed pilot **D&D Decision Model for the Selection of Fixatives, Strippable Coatings, and Decontamination Gels**
- Beta testing by field site users to be completed in April 2016
- Active participation by beta testers is key and may need DOE HQ management assistance
- After beta testing, model to be deployed on public server
- **Pilot mobile app** to be completed in May 2016

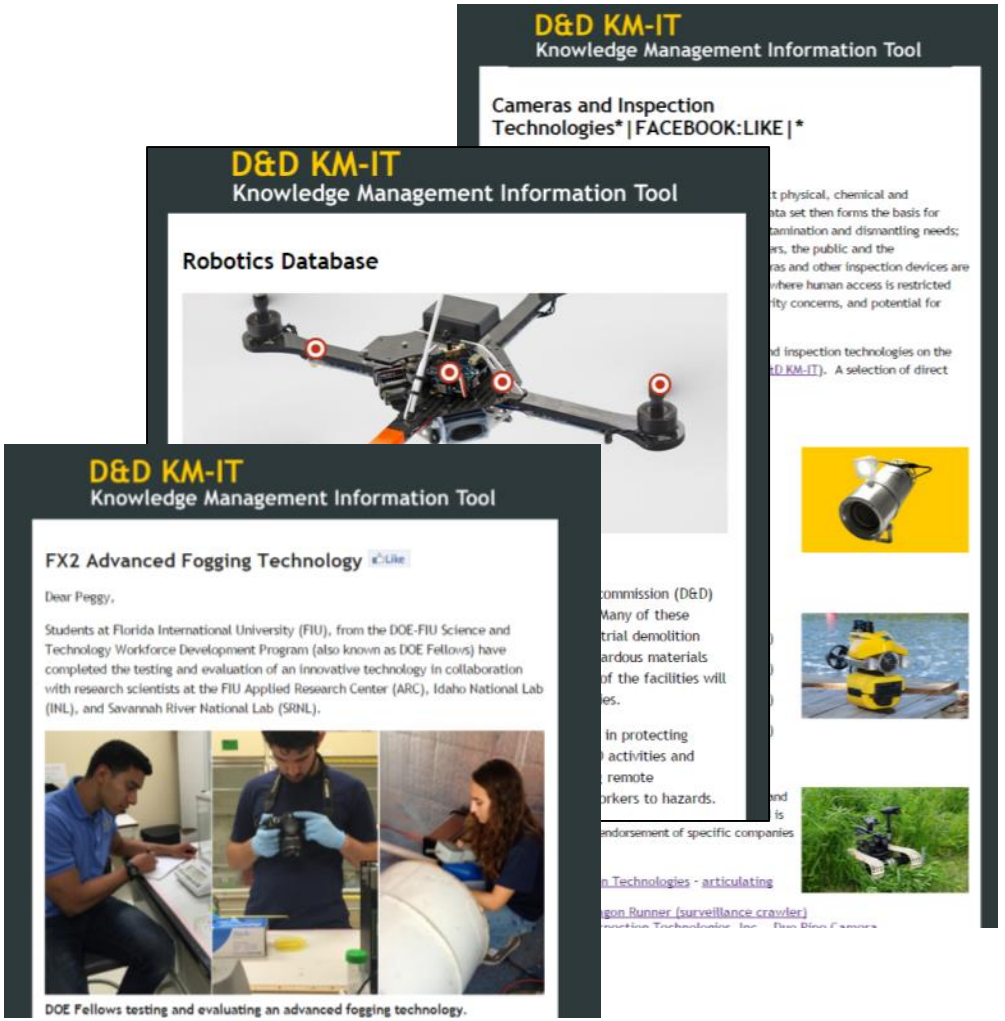


D&D KM-IT – Accomplishments

FIU Applied Research Center

Developed and distributed newsletters:

- Availability of Robotics Database
- FX2 Advanced Fogging Agent Test/Evaluation
- Inspection Technologies/Cameras



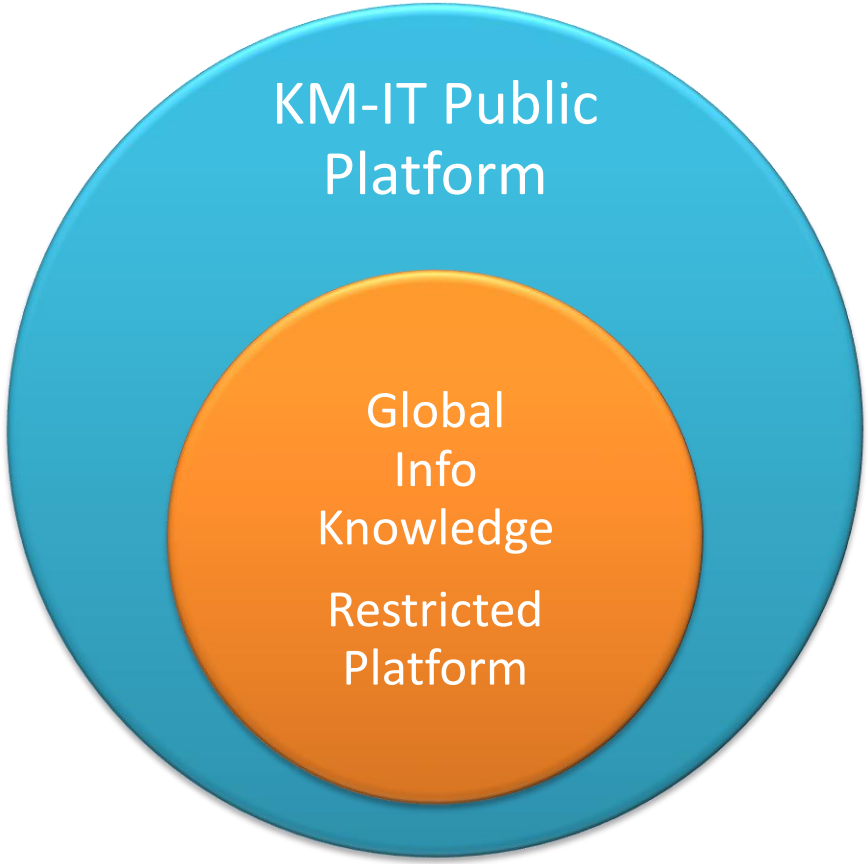
D&D KM-IT – Accomplishments

To develop an **Global Knowledge Sharing & Collaboration Platform** for unclassified information.

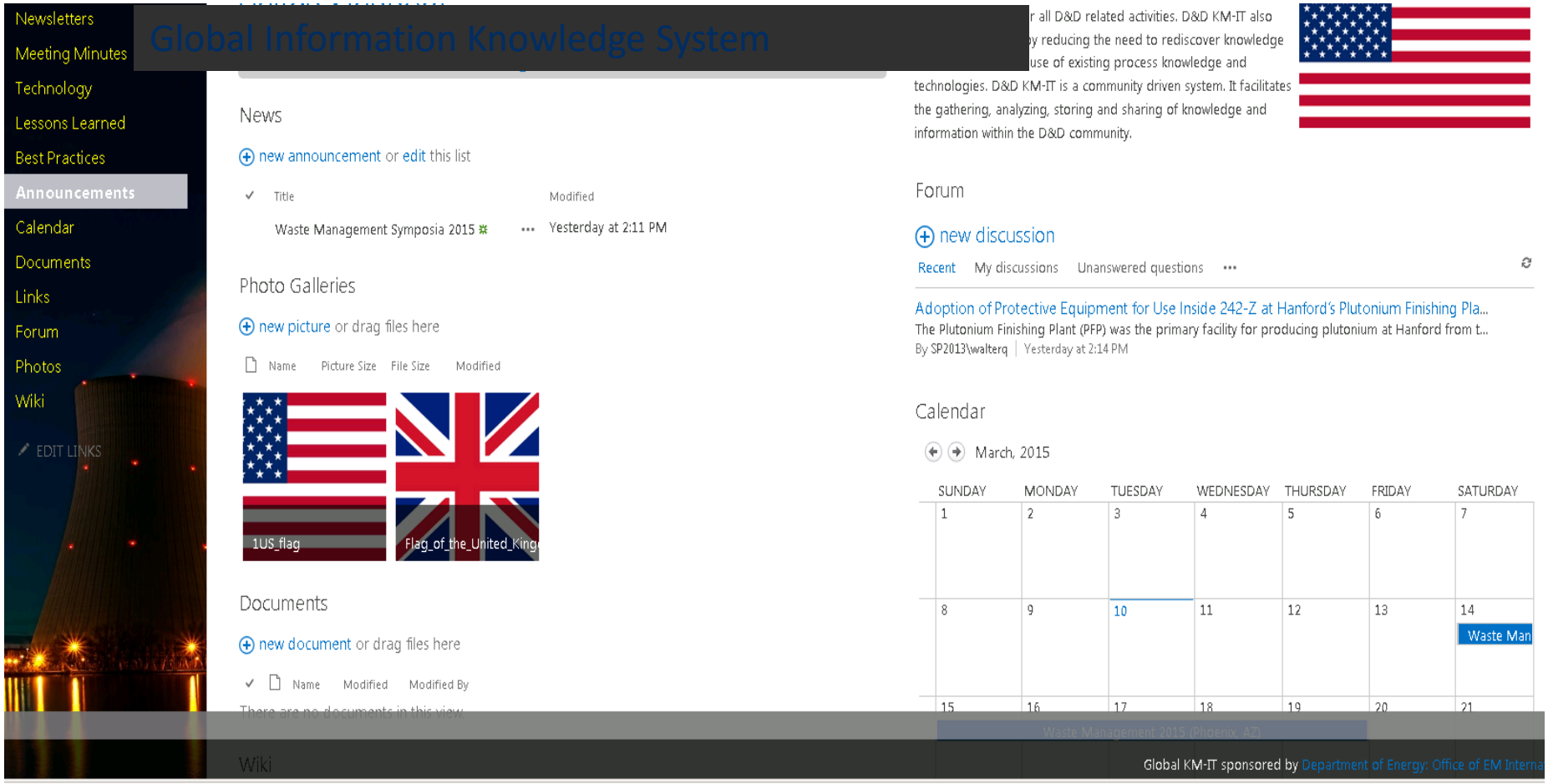
- Platform was developed based on the protocols and standards for knowledge sharing with a focus on the U.K.
- Platform contain features like Newsletters, Meeting Minutes, Technology, Lessons Learned, Best Practices, Documents, Announcements, Calendars, Link, FAQ, Wikis, etc.

Restricted to Public Platform

- Knowledge sharing collaboration platform
- Restricted access to participating countries
- Unclassified information & documentation



Pilot System



D&D KM-IT – Future Work

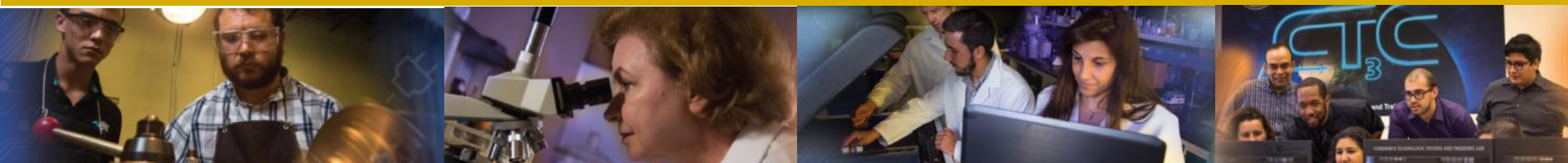
As part of FIU performance year 7, FIU will:

- Outreach to promote KM-IT at DOE sites and national labs, such as Oak Ridge and Savannah River
- Research creating native mobile applications for each of the three major mobile device platforms (Windows, Android and I-OS) using fixatives as a pilot.
- Work with DOE sites to identify additional high priority needs for mobile applications and perform feasibility analysis for design, development and deployment.
- Responsive design of D&D KM-IT User Interface for adaptive rendering on mobile devices.
- Explore social media integration with D&D KM-IT.
- KM-IT Content Management with focus on expanding Robotics Technologies.
- Web Analytics- Monitoring KM-IT platform with Google Analytics, application optimization and reporting / visualization.

Waste Information Management System (WIMS)

Dr. Himanshu Upadhyay

Florida International University

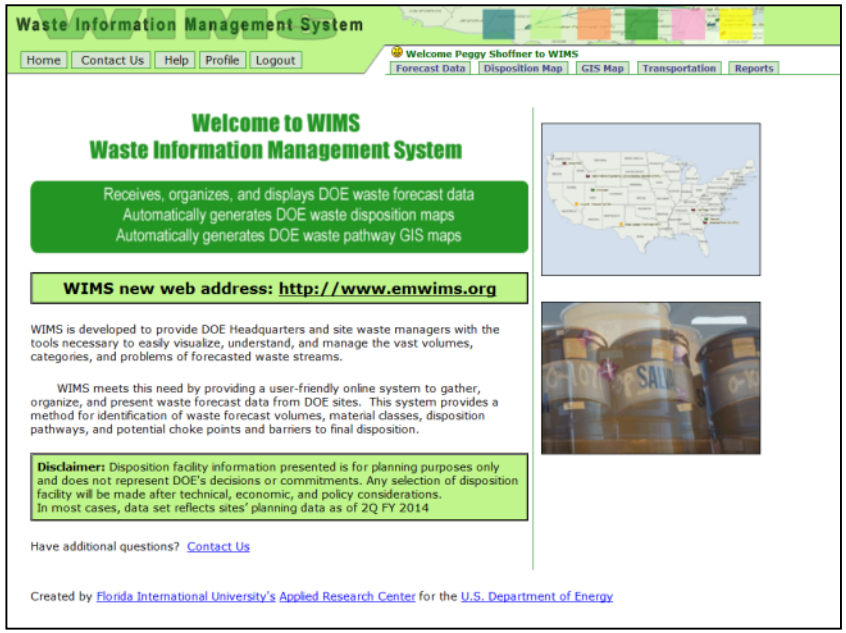


Project 3 – WIMS - Accomplishments

Waste Information Management System

- WIMS is successfully deployed and can be accessed from the web address **http://www.emwims.org**

- Provides DOE and site waste managers with an easy-to-use tool to visualize and understand the vast volumes of forecasted waste streams in the DOE system and to offer a single source for this information.



Project 3 - WIMS - Accomplishments

FIU Applied Research Center

- Completed integration of 2015 waste forecast and transportation data into WIMS.
- New 2016 dataset expected in April 2016, will be integrated and deployed on WIMS.

Project 3 - WIMS - Accomplishments

- Conducted administration and management of the WIMS database and web server.
- Conducted user support on a continual basis.

- Presented WIMS at WM16.

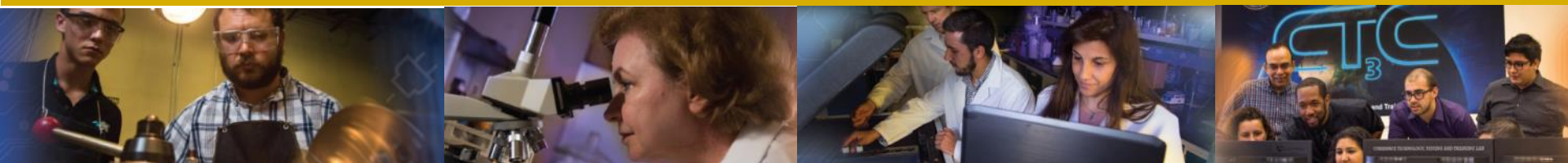
WIMS - Future Work

As part of FIU performance year 7, FIU will:

- Maintain WIMS via database management, application maintenance, and performance tuning.
- Integrate annual forecast data update.

Masters, PhDs, Internships, and Conferences

FLORIDA INTERNATIONAL UNIVERSITY



Masters & Ph.D.s

- Kavitha Megalageri, Master's Project, Engineering Management, *Development of Relational Database of Decision Support Model for Fixatives* (Fall 2015)
- Santosh Joshi, Master's Project, *D&D Web Log Analysis Using Big Data Technology,* Engineering Management (Fall 2015)
- Revathy Venkataraman, Master's Thesis, *Performance Evaluation of Mobile Applications with KMIT Technology Web Services using Windows Communication Foundation,* Information Technology (Spring 2014)
- Sandhya Appunni, Master's Thesis, *Design and Implementation of Disaster Event Information System,* Computer Science (Spring 2014)

DOE Fellow Internships

Janesler Gonzalez – INL with Steve Reese/Rick Demmer
Research on strippable coatings

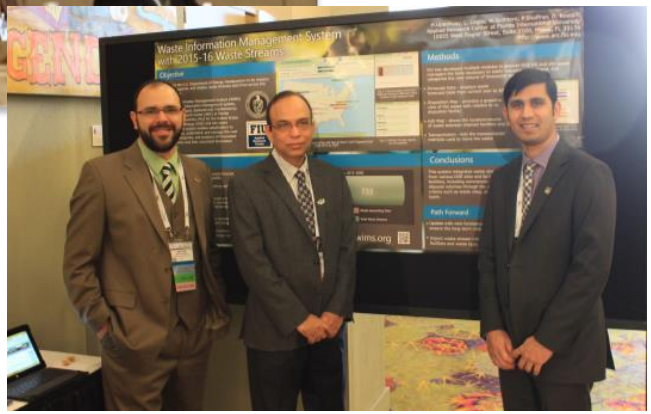
Jorge Deshon – SRNL with John Bobbitt/Steven Tibrea
Research for visualization model of SRS Building 235-F

Jesse Viera – INL with Steve Reese/Rick Demmer
Research on a mock-up ruthenium scrubber system

Andrew De La Rosa – ORNL with Joseph Trien
Research on malware detection using Hyperion

Conferences & Presentations

- Waste Management 2016
  - D&D KM-IT
  - Fire Resiliency for Fixatives
  - WIMS



Conferences & Presentations

Student Posters at Waste Management 2016

- Innovative Process for Abatement of Mercury - Janesler Gonzalez (DOE Fellow)
- The Expanding Nuclear Niche and Growing Requirement for Standardized Testing Protocols and Performance Metrics for D&D Technologies - Jesse Viera (DOE Fellow)
- Fixatives Decision Model on KM-IT Platform - Jorge Deshon (DOE Fellow)
- Cooperative Robotic Scheduling and Path Planning for D&D Applications - Sebastian Zanlongo (DOE Fellow)