



Minutes of the Beryllium Health & Safety Committee (BHSC) 2024 Spring Meeting



The Beryllium Health and Safety Committee (BHSC)
Washington, DC, U.S.A.

URL: <https://berylliumhealthandsafetycommittee.com/>

Minutes of the Beryllium Health & Safety Committee (BHSC) 2024 Spring Meeting

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The Beryllium Health & Safety Committee (BHSC) 2024 Spring Meeting was held on 23-24 April 2024 at the New Hope Center at the Y-12 National Security Complex in Oak Ridge, Tennessee, U.S.A. The meeting has been held annually since 1995, with a break due to the recent pandemic.

The Minutes of the Spring Meeting have been compiled from the documents generated by the meeting organizers, combined with the abstracts and presentation files submitted by the participants in the event.

The BHSC 2024 Spring Meeting was organized by the BHSC's Meetings & Symposia Sub-Committee, with local support from members of the US Department of Energy (DOE) in Oak Ridge. The meeting was held both in-person and online. Overall, there were more than 120 participants, who came mainly from the U.S., but also from Canada, the UK, Germany, Switzerland, Latvia, and India.

Keywords: Beryllium Health & Safety Committee (BHSC), Beryllium, Beryllium Oxide, Fusion Engineering, Irradiation Effects, Beryllide Intermetallic Compounds, Beryllium Fluoride, Plasma-Facing Materials, Neutron-Multiplier Materials, Health and Safety, Chronic Beryllium Disease, Beryllium Sensitization, Fusion Start-Ups, Molten Salt, FLiBe, FLiBe Purification, FLiBe Corrosivity, Tritium Extraction, Fluorescence Analysis, New Hope Center at Y-12, Oak Ridge National Laboratory, Y-12 National Security Complex

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Introduction & Post-Meeting Overview

The Beryllium Health & Safety Committee (BHSC) 2024 Spring Meeting was held on 23-24 April 2024 at the New Hope Center at the Y-12 National Security Complex in Oak Ridge, Tennessee. This meeting has been held annually as an in-person event from 1995-2019. Due to the pandemic, the Spring Meeting was not held from 2020-2022, and it was finally resumed again in 2023. There is also an annual Fall Meeting, and a larger BHSC Symposium that typically happens bi-annually.

Mission Statement

The BHSC is committed to promoting activities/efforts that will help to understand and prevent beryllium-induced conditions and illnesses, including beryllium sensitization (BeS) and chronic beryllium disease (CBD), that may be caused or exacerbated by workplace exposure to beryllium. The BHSC mission is primarily educational in nature, and is accomplished through generation, collection, and dissemination of information to members and other interested parties.

The Spring Meeting is an activity resulting directly from carrying out the foregoing Mission Statement. This year's meeting was organized by the BHSC's Meetings & Symposia Sub-Committee, with major technical support from U.S. DOE staff. Participants came mainly from the U.S., but also from Canada, the UK, Germany, Switzerland, Latvia, and India. Some key aspects to this year's meeting:

- Run in a hybrid format with both in-person and online attendees and presenters
- Highlighted beryllium molten salt (FLiBe) as an up-and-coming product form
- Featured presentations from U.S. DOE facilities as well as fusion-focused research
- Announced the formation of a new FLiBe Sub-Committee, and they met for the first time
- Included participation from vendors, who presented their products and services in the field

The technical portions of the meeting were comprised of 14 presentations, including introductory remarks by U.S. DOE and NNSA senior leadership; updates and beryllium worker protection program activities from the U.S. Department of Energy and the NNSA; history of the U.S. DOE's beryllium medical surveillance program and Beryllium-Associated Worker Registry (BAWR); beryllium research activities in the fusion industry, including FLiBe molten salt; designing and building of a new, state-of-the-art award-winning beryllium fabrication facility in the UK; demolition of a beryllium-contaminated legacy reactor facility in the U.S.; and a call to action for revising the Beryllium Practitioner's Guide, a critically important BHSC activity that is now being launched in earnest. All of these presentations called attention to the importance of beryllium health and safety to ensure the success of the research.

There was also a BHSC business meeting, at which it was announced that the BHSC 2024 Fall Symposium would be held from 28-30 October 2024 in Las Vegas, Nevada.

The final BHSC 2024 Spring Meeting agenda is included near the beginning of this document to introduce the abstracts and presentations that follow. A list of organizations represented at the Meeting may also be found in the Appendices. Thanks again to all who participated to make this a great meeting!

Josef SOBIERAJ
Chair, BHSC Meetings & Symposia Sub-Committee
April 2024

BHSC 2024 Spring Meeting Agenda

The meeting agenda was organized under the leadership of BHSC Meetings & Symposia Sub-Committee Chair, Josef SOBIERAJ, with help from Committee Members Chris DORN of Kyoto Fusioneering and Be4FUSION, Gary GRIFFIN of GEG Consulting, Julie FOWLER of the NNSA, as well as BHSC Chair Roland CHRETIEN. Local support from U.S. DOE staff in Oak Ridge was provided by Katie McCCLURE and Holly WALKER. Below is the version of the agenda that was presented at the meeting.

AGENDA – Beryllium Health and Safety Committee Meeting 23-24 April 2024 – New Hope Center at the Y-12 National Security Complex, Oak Ridge, Tennessee

All times listed below are Eastern Daylight Time (EDT)

Day 1 – Tuesday, 23 April 2024
Wamp Auditorium

Time (EDT)	Activity	Task Lead(s) or Speaker(s)
<i>Morning (EDT) - available via webinar</i>		
07:30	Coffee and Pastries / Meet and Greet	
08:30	BHSC Welcome and Overview	Chretien, Dorn, Sobieraj
08:45	Break	
09:00	YFO and CNS Senior Leadership Remarks	Hitson, West
09:15	Past to Present: History of DOE's Beryllium Medical Surveillance Programs and the DOE BAWR	Golden
09:45	Update to 10 CFR 850	Brown
10:15	Break / Group Picture	
10:30	Design and Implementation of Molten Salt Safety Program	Devine
11:00	BHSC FLiBe Subcommittee	Heldt
11:30	Overview of the Beryllium Field and Mobile Accreditation Program	Morton and Griffin
12:00	Lunch	
<i>Afternoon (EDT) – available via webinar except for Tours</i>		
13:30	Proposed 850 Limits for Beryllium – Is ICP an Option?	Bennett
14:00	Update on Beryllium-Related Activities in ASTM and ISO	Brisson
14:30	Break	
14:45	Nano-textile as Wipe to Decontaminate Surfaces	Doshi
15:15	Wrap-up	Chretien, Dorn, Sobieraj
15:30	Tours (TBD for In-Person Registrants)	
18:00	Evening Reception: Calhoun's Restaurant featuring Ray Smith, Y-12 National Security Complex Historian (Ret.)	Griffin

(Second day on next page)

Day 2 – Wednesday, 24 April 2024
Wamp Auditorium

Time (EDT)	Activity	Task Lead(s) or Speaker(s)
<i>Morning (EDT) – available via webinar</i>		
07:30	Coffee and Pastries	
08:30	Second-Day Agenda Review	Chretien, Dorn, Sobieraj
08:45	Challenges & Successes of Building a Beryllium Facility	Walker
09:15	Break	
09:30	Safe Demolition of a Be-Contaminated Legacy Test Reactor	Holden
10:00	Beryllium H&S in Fusion Materials Research at KBHF	Goraieb
10:30	Break	
10:45	A Practitioner’s Guide to Beryllium Hazard Management	Field, Chretien, Adams
11:15	Lunch	
<i>Afternoon (EDT) – available via webinar</i>		
13:00	Vendor Technical Presentations	Moderator: Griffin
13:30	Break	
13:45	BHSC Business Meeting	Members
14:30	Break	
14:45	Subcommittee Breakout Sessions	Members
15:15	Break	
15:30	Reports from Subcommittee Breakouts	S/C Chairs
16:00	Wrap-up	Chretien, Dorn, Sobieraj
16:30	Adjourn (End of Day)	
End of Day 2		

(Note: BHSC Board Meeting: Monday, 22 April 2024)

BHSC Meetings & Symposia Sub-Committee

Name	Position	Organization
Josef SOBIERAJ	Chair	National Nuclear Security Administration
Chris DORN	Communications, Program, Logo Design, and Meeting Minutes	Kyoto Fusioneering America Ltd. Be4FUSION LLC
Gary GRIFFIN	Vendor & Sponsor Liaison Meeting Hotel Arrangements	GEG Consulting LLC
Julie FOWLER	Website Pages including Links Meeting Participant Registration & Coordination	National Nuclear Security Administration

BHSC 2024 Spring Meeting Vendor Organizations

The organizers of the BHSC 2024 Spring Meeting would like to thank the following vendors for their support of the event:



ALS Testing Services Salt Lake City, Utah, U.S.A.	GVS-RPB: Respiratory Protection Solutions Royal Oak, Michigan, U.S.A.	Scientific Sales, Inc. Oak Ridge, Tennessee, U.S.A.
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Day 1: Beryllium H&S: DOE & CBD Program Updates, Fusion, Fission & FLiBe Molten Salt, and Field & Mobile Accreditation

Past to Present: A History of the U.S. DOE's Beryllium Medical Surveillance Programs including the Beryllium-Associated Worker Registry (BAWR)

A. GOLDEN (Oak Ridge Associated Universities, Tennessee, USA)

Past to Present: A History of the U.S. DOE's Beryllium Medical Surveillance Programs including the Beryllium-Associated Worker Registry (BAWR)

Ashley GOLDEN

*Oak Ridge Associated Universities, Oak Ridge, Tennessee, U.S.A.
Oak Ridge Institute for Science & Education (ORISE), Oak Ridge, Tennessee, U.S.A.*

The [U.S. Department of Energy \(DOE\)](#) Beryllium-Associated Worker Registry is a collection of health and exposure information of individuals potentially at risk for chronic beryllium disease (CBD) due to their work at DOE-owned or leased facilities. Data reported to the Registry are analyzed and summarized for use in managing CBD prevention programs.

[Title 10, Code of Federal Regulations, Part 850 \(10 CFR 850\)](#), "Chronic Beryllium Disease Prevention Program," requires DOE sites to inventory and assess beryllium exposure hazards to determine whether employees are at risk for CBD. Sites that determine employees are at risk due to ongoing or past work must implement CBD prevention programs that include reporting health and exposure data to the DOE Beryllium-Associated Worker Registry.

Health data are collected through the operation of medical surveillance programs for current workers. Exposure data are collected through the operation of industrial hygiene programs at sites that have continuing beryllium operations.

The [Oak Ridge Institute for Science and Education \(ORISE\)](#) maintains the Beryllium-Associated Worker Registry for the Office of Environment, Health, Safety and Security (EHSS-13).

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EMAIL: Ashley.Golden@orau.org

URL: <https://orau.org/>

URL: <https://oriseapps.orau.gov/BAWR/>

Past to Present: History of DOE's Beryllium Medical Surveillance Programs and the DOE Beryllium Associated Worker Registry

BHSC Spring Meeting

Ashley Golden, PhD
Senior Director ORISE Health Studies
Oak Ridge Associated Universities

April 23, 2024

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Overview

- Brief background on BeS and CBD
 - Disease etiology
 - Understanding the BeLPT
- History of Be in the DOE complex
 - Historical milestones
 - Beryllium medical screening
 - Brief Review of 10 CFR 850
- Beryllium Associated Worker Registry (BAWR)
 - History, Objectives, On-going Initiatives
 - Future directions and considerations



Brief Review of Beryllium Health Effects

- Health effects of beryllium exposure include:
 - Beryllium Sensitization (BeS)
 - Berylliosis or chronic beryllium disease (CBD)
 - Lung cancer
- **Be sensitization** occurs after Be exposure and activation of immune cells
 - BeS an early indicator of *possible* progression to CBD
- **CBD** - granulomatous lung disease as a result of BeS
 - Symptoms: chronic shortness of breath, dry cough, fatigue, weight loss, night sweats
 - There is no cure. Treatment is aimed at controlling the disease.
 - CBD can develop from less than 1 year, to as long as 40 years, after exposure.
- Primary exposure route – **inhalation**
 - Skin contact can result in sensitization, but not sufficient to cause CBD



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Immunology of BeS, CBD

“Type IV, delayed hypersensitivity, cell-mediated immunity”

Lymphocyte Proliferation Test (LPT):

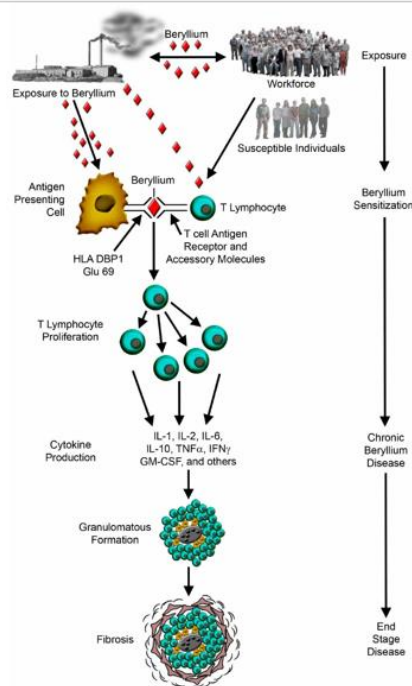
Examines how white blood cells (Lymphocytes) react to a foreign antigen.

- Rapid growth (proliferation) is a positive or abnormal BeLPT

BeLPT assesses this response

CBD diagnosis - clinical signs of lung damage

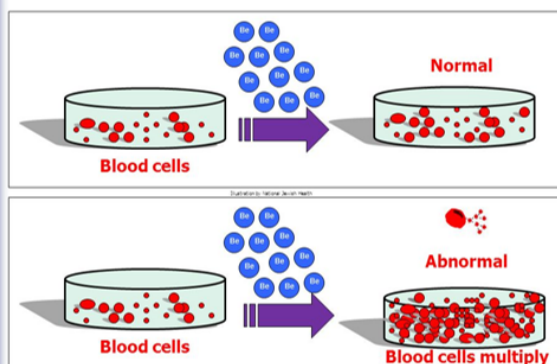
- Imaging studies - X-ray, CT scans, etc.
- Pulmonary function tests, spirometry
- Granulomas in lung biopsy tissue



BeLPT: screening test for BeS

- Complex test – 12 steps, 2 weeks
 - High variability of immune response/cell growth requires rigorous controls & statistical analyses
 - Requires highly trained medical laboratory technologists
- Criteria for case definition of BeS:
 - Two abnormal blood BeLPT results
 - One abnormal & one borderline blood BeLPT
 - One abnormal bronchoalveolar lavage (BAL)
 - Three borderline BeLPTs
 - Per DOL – 3 tests within 3 years

BeLPT: Blood Test for BeS and CBD



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BeLPT interpretation

- A 'stimulation index' (SI) is calculated to compare the Be-stimulated cells to negative control, looking for increased proliferation
 - NORMAL - All Be concentrations (6) display a normal response
 - ABNORMAL – 2 or more Be concentrations are greater than SI reference range
 - BORDERLINE - 1 Be concentration is greater than SI reference range
- A screening test, not a diagnostic test
 - Serial testing, particularly in presence of Be exposure, is critical
 - A single abnormal needs to be repeated
 - Abnormal and borderline results should be repeated
 - EFCOG occupational medicine implementation guide recommends split-tests

Reference: Middleton et al., 2008 and 2011

	1 abnormal result	2 abnormal results	1 abnormal + 1 borderline	3 borderline results
PPV at 1% prevalence	38.3%	96.8%	89.3%	83.7%
PPV at 2% prevalence	89.3%	98.4%	94.4%	91.2%

Positive predictive value (PPV) - probability that a person with a positive result has the disease or condition being measured

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BeLPT: Unacceptable vs. Uninterpretable

- **UNACCEPTABLE** : >30-48 hours from blood draw, low cell counts, or insufficient amount of blood received (<30cc)
- **UNINTERPRETABLE** – repeat test
 - **STATISTICAL VARIATION**: Variability is too high
 - **POOR MITOGEN**: Poor response to positive controls
 - **POOR CELL GROWTH**: Poor growth in negative controls
 - **OVERPROLIFERATION**: Too much growth in negative controls
 - **CELL DEATH**: cell killing in Be-stimulated cells

```
D101968.H49T001.03/25/2021
ctrl or Test CV too high = No
PNA SI or CONA SI too low (33.32) = No
DP/PG for D5: No Acceptable control limits for D5 = 52 - 1450
DP/PG for D7: No Acceptable control limits for D7 = 50 - 6012
Cell Killing: No Num. SIS < 0.05 = 0
(Num. SIS > 1.92) = 0
(Num. StdLnsis > 2.5) = 0
StdScore = 1.19 matching StdLnsi = 0.13
StdScore = 1.13 matching StdLnsi = -0.06

BeLPT Analysis using Least Squares on Ln Counts
-----
Treatment      well Counts      exp      Residuals
-----
D5ctrl101      200      125      185      137      0.21      38      -9      18      0
D5ctrl102      138      113      104      116      0.21      1      -19      -28      -17
D5ctrl103      141      113      113      100      0.21      1      -1      -19      17
D5bel101      112      156      126      171      0.19      -22      11      -10      21
D5bel102      90      105      64      103      0.21      1      17      -13      15
D5bel103      153      141      118      136      0.11      11      3      -14      0
D7ctrl101      318      305      242      346      0.24      20      18      -5      31
D7ctrl102      384      214      181      241      0.24      41      -17      -34      -5
D7ctrl103      249      269      202      187      0.24      -2      6      -23      -21
D7bel101      205      200      243      189      0.11      -2      -4      15      -10
D7bel102      439      66      91      75      0.11      0      88      111      -59      -48
D7bel103      310      131      98      97      0.55      79      -7      -36      -37
PNA          78590      71307      55076      74620      72226      0.08      8      -1      -10      3
CONA          94622      91338      97146      118360      99898      0.12      -5      -9      -3      17

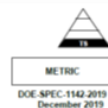
SIS, Lnsis, and Standardized Lnsis
-----
SI      D5bel D5bel0 D5bel00 D7bel D7bel0 D7bel00      PNA      CONA
SI      1.01      0.65      0.99      0.82      0.47      0.55      526.09      727.65
Lnsi      0.01      -0.43      -0.01      -0.20      -0.76      -0.60      6.27      6.59
StdLnsi      0.13      -3.80      -0.06      -0.78      -2.99      -2.34      54.66      57.49

StdLnsi=Lnsi/StdErr: Lnsi standardized to pooled StdError from 5 or 7
Large positive value (> 2.5) indicates positive response
-----
Stdev of LnCounts (correspond to cv on original scale) *
-----
Overall:      0.32
D5 Control:      0.21      D5 Treated:      0.18      D5 Pooled:      0.2
D7 Control:      0.24      D7 Treated:      0.6      D7 Pooled:      0.44

Background Counts - Minimum, Mean, and Maximum
pkgr      4      10      16      4      8      302
```

DOE-SPEC-1142: Specification for Beryllium Lymphocyte Proliferation Testing (BeLPT)

- Informal voluntary consensus standard with criteria for:
 - BeLPT assay
 - Includes details for sample collection through processing
 - Analysis and reporting of assay results
- Establishes acceptable criteria for performing BeLPTs
 - Allows for some variability between laboratory approaches to equipment, process, and statistics
 - Certification requirements for laboratories
 - Current Performing labs include:
 - Oak Ridge Institute for Science and Technology at ORAU,
 - National Jewish Health, and
 - Cleveland Clinic
- Established 2001; updated 2019



DOE SPECIFICATION

BERYLLIUM LYMPHOCYTE PROLIFERATION TESTING (BeLPT)



U.S. Department of Energy
Washington, D.C. 20585

AREA SDMP

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History of Beryllium in the DOE Complex

Chronology of Beryllium Events: 1933 - 1949

- 1933: First description of beryllium disease in literature – Germany
- 1941: First US cases reported – from fluorescent tube industry in Massachusetts
- 1943: US PHS published NIH Bulletin 181, *"The Toxicology of Beryllium,"* stating that be metal was not toxic
- 1943-48: Beryllium used at the University of Chicago Metallurgical Laboratory, Site B
- 1944-49: MED contracts with MIT to conduct beryllium research & development
- 1948: Occupational exposure limit of $2 \mu\text{g}/\text{m}^3$ "taxicab standard" (by analogy with lead, mercury and cadmium) was proposed by Merrill Eisenbud
- 1949: AEC establishes Advisory Committee on Beryllium, chaired by Dr. Harriet Hardy

- PHS = Public Health Service; NIH = National Institutes of Health
- MED = Manhattan Engineering District
- MIT = Massachusetts Institute for Technology
- AEC = Atomic Energy Commission (predecessor to DOE)

Chronology of Beryllium Events: 1951 - Present

- 1951: AEC began funding Beryllium Case Registry directed by Dr. Hardy
- 1955: ACGIH, AIHA adopted the proposed limit ($2 \mu\text{g}/\text{m}^3$) – used for 50+ years
- 1956: AEC adopted “Recommendations for the Control of Beryllium Hazards
- 1958: AEC contracted with Brush Beryllium & Beryllium Corp for 200,000 lbs Be/year
- 1972: IARC lists Be and Be compounds as *reasonably anticipated to be carcinogenic*
- 1984: First case of beryllium disease confirmed at the Rocky Flats Plant
- 1999: 10CFR850 - Chronic beryllium disease prevention program
- 2002: IARC listing for Be was revised to *known to be human carcinogens*
- 2017: OSHA implements $0.2 \mu\text{g}/\text{m}^3$ permissible exposure limit

- AEC = Atomic Energy Commission (predecessor to DOE)
- ACGIH = American Conference of Governmental Industrial Hygienists
- IARC = International Agency for Research on Cancer
- OSHA = Occupational Safety & Health Administration



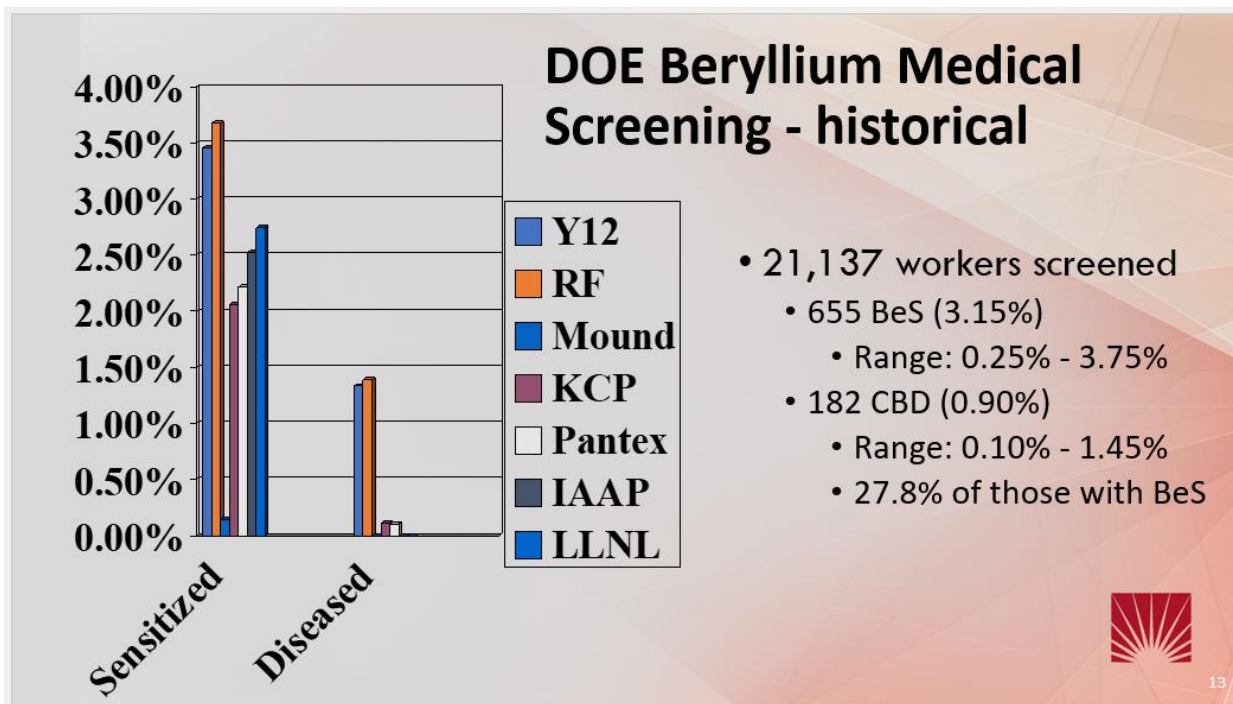
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DOE Beryllium Medical Screening - historical

- Pilot program began in 1991
 - Started with Rocky Flats, then Y12
 - Screening tests at NJH, ORISE labs
- Operated 1991 - 2003
 - Approximately 110,241 workers contacted
 - 74,814 (68%) Invited to be tested
 - 31,881 (43%) responded to invite
 - 21,137 (66%) workers screened
- 21,137 workers screened
 - 9,192 Rocky Flats
 - 4,236 Y12 Plant
 - 2,984 Kansas City
 - 1,748 LLNL
 - 1,068 Pantex
 - 890 Other
 - 681 Mound
 - 338 IAAP, Burlington



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DOE Beryllium Medical Screening - historical

- Important findings
 - Chronic beryllium disease more prevalent than initially thought
 - BeS and CBD cases are not restricted to those job titles indicating beryllium work
 - Many workers with BeS will likely go on to develop CBD
 - Serial re-testing finds cases of BeS and CBD after initial negative test, even after beryllium exposure has been removed
- Recommendations
 - Complex-wide exposure and medical screening programs for current workers
 - Implementation of 10CRF850 moves this responsibility to DOE sites and contractors
 - Medical re-screening programs for former workers
 - DOE EHSS-14 (Office of Former Worker Programs) has responsibility for programs
 - Additional research on disease mechanisms, dose-response, and latency

DOE Chronic Beryllium Disease Prevention Program (CBDPP)

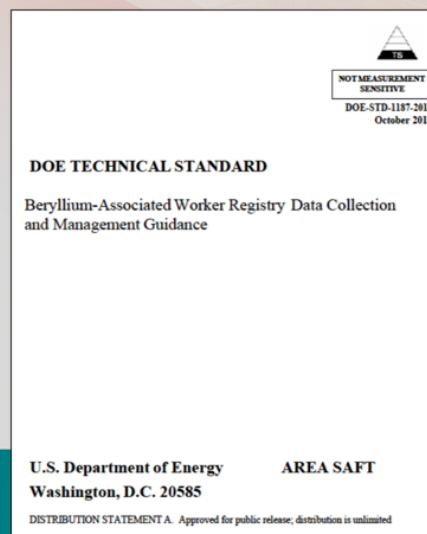
- [10 CFR 850, Chronic Beryllium Disease Prevention Program](#) (12/8/1999)
 - Reduce the number of workers currently exposed to beryllium in the course of their work at DOE facilities managed by DOE or its contractors,
 - Minimize the levels of, and potential for, exposure to beryllium, and
 - Establish medical surveillance requirements to ensure early detection of disease.
- [Amendment to 10 CFR 850](#) (2/9/2006)
- [10 CFR 850, Request for Information](#) (12/23/2010)
- [10 CFR 850, Notice of Proposed Rulemaking](#) (signed 6/7/2016)

10 CFR 850 - Definitions

- Beryllium (Be)
 - Be, insoluble Be compound, or alloy containing $\geq 0.1\%$ Be that may be released as an airborne particulate
- Beryllium worker
 - Current worker who is regularly employed in a DOE beryllium activity
- Beryllium-associated worker
 - Current worker who is or was exposed or potentially exposed to airborne concentrations of beryllium at a DOE facility. Includes:
 - Current worker whose work history shows that the worker may have been exposed to airborne Be concentrations at a DOE facility;
 - Current worker who exhibits signs or symptoms of beryllium exposure;
 - Current worker who is receiving medical removal protection benefits.

DOE-STD-1187: Beryllium-Associated Worker Registry Data Collection and Management Guidance

- Provides acceptable methods for compliance with the requirements of 10 CFR 850.39
 - Recordkeeping and Use of Information
- Developed for employers subject to 10 CFR 850
 - To guide submissions to the BAWR
 - To promote consistent reporting and efficient analysis and dissemination of information
- BAWR reporting requirements began 2002
 - Bi-annual data submission for annual reporting
 - Updated 2019 – changes to required/optional fields



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Beryllium-Associated Worker Registry (BAWR)

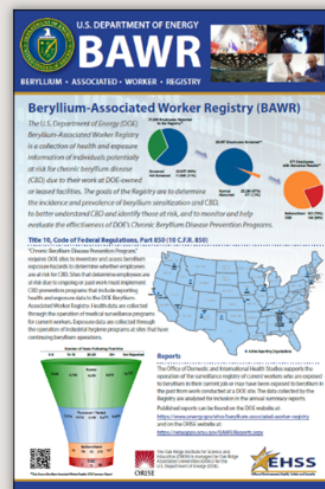
- The DOE Beryllium Registry was established to collect and maintain information on workers who are exposed to beryllium. It is used to:
 - Conduct health studies to better understand the nature of the disease,
 - Measure the burden of health effects related to beryllium exposure, and
 - Evaluate the effectiveness of CBDPP in mitigating exposure and disease
- DOE Office of Domestic and International Health Studies (EHSS-13)
 - Program Director, Dr. Robin Elgart; Program Manager (interim), Dr. Linh Duong
 - BAWR operated by ORISE for DOE: Elizabeth Holcomb, Sherry Atkins
- Annual summary reports (2002-2017)
- Data Dashboard – 2018, 2019, 2020
 - Goal for 2021, 2022 Dashboards this CY



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Beryllium Associated Worker Registry (BAWR)

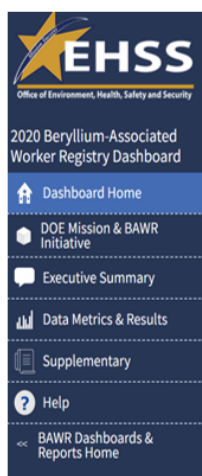
- BAWR is a valuable **reporting** tool
 - Covers 26 sites active reporting sites; 10+ inactive sites
 - Provides transparency to workers/public on exposure & disease
- Utilizes unique identifiers (no PII)
 - Maintain confidentiality, limit privacy concerns
 - Not a true surveillance program
 - Limited ability for longitudinal follow-up
 - Summary data may not represent unique numbers
- How are BAWR data utilized?
 - OSHA - in evaluating lowering the PEL to $0.2 \mu\text{g}/\text{m}^3$
 - DOL – evaluating 3 borderlines as criteria for BeS
 - DOE – to support current rule-making
 - Some minor research activities: ORISE, NNSA
 - Program benchmarking?



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Beryllium-Associated Worker Registry Dashboard



Beryllium-Associated Worker Registry Dashboard (2020)

Welcome to the Beryllium-Associated Worker Registry (BAWR) Dashboard, developed by the [Oak Ridge Institute for Science and Education \(ORISE\)](#) [\[orise.orau.gov\]](#) BAWR project team, under a contract with the U.S. Department of Energy (DOE). The BAWR program began in 2002, and since its inception has tracked, monitored, and analyzed data on workers exposed to beryllium and produced annual reports and summary data tables for more than 30 DOE sites throughout the United States. The first Registry publication reported data for 12,267 workers through 2005. In 2020, the Registry has grown to more than 41,000 workers (including those at inactive reporting organizations such as Rocky Flats and some retrospective data provided prior to the 2002 start date of the Registry).

This BAWR Dashboard for 2020 is the continued presentation of the BAWR data on an annual basis. As a means of providing a better user experience with this tool, the BAWR program has transitioned from presenting data in a paper-based annual report to an interactive digital format, or a Dashboard. This transition from paper to digital format is intended to allow for interaction

**We Want
Your
Feedback!**

- How do you use these data?
- What data/info would you like to see?

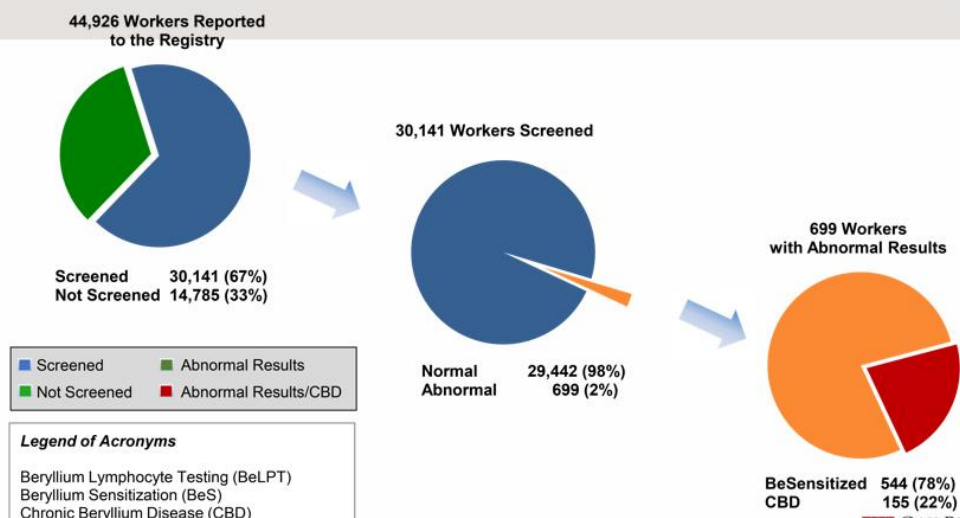
bawr@orau.org

Source: [Beryllium-Associated Worker Registry Dashboard \(through 2020\) \(orau.gov\)](#)

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BAWR

Progression from Screening to Sensitization to CBD (Cumulative through 2020)



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BAWR – Current/Ongoing Initiatives

- Further Dashboard Publications
 - 2020 – Now available!
 - 2021 – QA underway; early summer target
 - 2022 – By end of CY24 (maybe sooner)
- Technology Enhancements:
 - Secured data file submittal
 - User/password management
 - Dashboard functionality
- Education/training/outreach
 - New data coordinators, SOMDs, IHs
 - Collaboration with EFCOG, AHIA, Beryllium Health & Safety Committee



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BAWR in the Future

- Once a year data submittals?
- Dashboard content
 - Industrial Hygienist review
 - DOE EHSS-11 collaboration
 - Seek ways for improvement
 - Possible survey with EFCOG/BHSC group
 - Collaborate with NNSA SAFER
- New DOE Beryllium Rule
 - Updates to Technical Standard
 - Updates to data collected, analyses, etc.



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Future Considerations for BAWR

- Transition to a Federal System of records
 - A system of records contains information that is retrieved by an individual's name
 - Official record of beryllium exposure/outcomes for DOE workers
- Value proposition – Why change?
 - Reduce efforts for records requests (FOIA, Privacy Act) – centralized database
 - Ability to track workers longitudinally
 - Improve CBDPP managers' ability to obtain exposure history
 - Link workers with other programs: former worker programs, compensation programs, military record
 - Enhance ability to evaluate dose-response, disease latency, and other scientific questions
- What's needed to get there?
 - System of Records Notice (SORN) in the Federal Registrar
 - Central DOE Institutional Review Board approval
 - Updates to the DOE Technical Standard
 - Prospective PII requirements
 - Retrospective PII capture, resolution



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Analytic/Research Opportunities

- Longitudinal analyses of BeS/CBD prevalence and incidence
 - Comparison with legacy Be medical program, data from other industries or countries?
- Latency analyses – time to event (first abnormal, BeS)
- Dose-response analyses – evaluation of threshold models
- Mortality studies – comparison of Be workers with general population, other worker populations
- Evaluation of co-morbidities: impact on testing and disease outcomes
 - Smoking, COPD, asthma, other respiratory conditions
- Economic analyses – impact of associated costs
 - disability/productivity, healthcare burden, compensatory programs, cost of compliance



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Thank you!

ORISE

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<https://orise.ornl.gov>

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10 CFR Part 850 Chronic Beryllium Disease Prevention Program Rulemaking Update
A. BROWN (US Department of Energy, Maryland, USA)

10 CFR Part 850 Chronic Beryllium Disease Prevention Program Rulemaking Update

April BROWN

*US Department of Energy, Office of Worker Safety & Health Policy (EHSS-11),
Germantown, Maryland, USA*

The U.S. Department of Energy (DOE) published a Notice of Proposed Rulemaking (NPR) for public comment in the Federal Register on 7 June 2016, proposing to amend its existing Chronic Beryllium Disease Prevention Program (CBDPP) regulations. In August of 2023, DOE proposed a new supplemental notice of proposed rulemaking to instead of adopting OSHA's current or prospective Time Weighted Average (TWA) Permissible Exposure limits (PEL).

The Department's proposed TWA PEL, short-term exposure limit (STEL), and action level would be consistent with OSHA's current TWA PEL, STEL, and action level. This presentation will discuss the upcoming final rule and will dive into final rule preparation process.

The presentation will also discuss the Implementation Guide for use with 10 CFR Part 850, Chronic Beryllium Disease Prevention Program. The purpose of this guide is to provide supplemental information and describe implementation practices to assist responsible employers in effectively developing, managing, and implementing a CBDPP.

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Ms. April BROWN, CIH

U.S. Department of Energy, Worker Safety and Health Policy

Office of Environment, Health, Safety, and Security (EHSS-11)

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URL: <https://www.energy.gov/ehss/worker-safety-and-health-policy-assistance>



10 CFR Part 850 Chronic Beryllium Disease Prevention Program

Department of Energy
Beryllium Health and Safety Committee
April 23, 2024

Presented by:
April Brown, CIH, EHSS-11

Office of Environment, Health, Safety and Security
U.S. Department Of Energy



Agenda

10 CFR Part 850 Updates

- DOE Office Off General Counsel (GC) Interpretation Regarding the Applicability of 10 C.F.R. Part 850, Chronic Beryllium Disease Prevention Program, to Entities that are not DOE Contractor at A Facility Operated for DOE.
- Economic Assessment
- Rulemaking process
- Implementation Guide

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DOE Office of General Counsel Interpretation Regarding the Applicability of 10 C.F.R. Part 850 to Non-DOE Entities

DOE Facility Questions:

1. Are the Leased building owner's employees subject to 10 CFR Part 850?
2. If so, [are] the building owner's employees [required to] be enrolled in the same medical surveillance program as the DOE [Management and Operating (M&O)] contractor employees?

[Office of General Counsel Interpretation Regarding Applicability of 10 Part 850 to Non-DOE Contractors at DOE-Contractor-Operated Facility | Department of Energy](#)

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GC's Conclusion for the Interpretation

1. Part 850 applies to DOE Offices and DOE contractors;
2. The term "worker," as defined in Part 850, includes any person who performs work at a DOE facility. Workers must be protected from exposure to airborne beryllium at DOE sites where beryllium activities take place;
3. Only responsible employers and employees of DOE and DOE contractors are required by Part 850 to comply with the CBDPP; and
4. Only "responsible employers" are required to develop and implement medical surveillance programs for "beryllium-associated workers," who must be current workers at DOE sites and their participation in the surveillance program must be voluntary.

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10 CFR Part 850 Amendment Process

✓ **Notice of Proposed Rulemaking (NOPR)**

- Closed September 6, 2016
- Four public hearings: Richland, WA; Oak Ridge, TN; Las Vegas, NV; and Washington, DC

✓ **Supplemental Notice of Proposed Rulemaking (SNOPR)**

- Closed September 22, 2023.

✓ **Economic Assessment**

- Published January 2016

Economic Assessment 2

- Economic Assessment Questionnaire to Beryllium-affected Program Offices: EM, NA, NE, and SC
- Responses completed on April 30, 2023.
- Follow up questions sent to sites in December of 2023, and responses were due by January 15th, 2024.
- Economic Assessment is currently being drafted by Economist

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Where is 10 CFR Part 850 in the Rulemaking Process?

EHSS and Economists

- EHSS received responses from EM, NA, NE, and SC
- Reviewing responses and formulate a draft Economic Assessment

Update Final Economic Assessment

Develop draft Final Rule

- Based on comments from the NOPR and SNOPR's public comments

Based on comments from the NOPR and SNOPR's public comments

- Review and concur
 - Comments
 - Comment resolution – EHSS and Program Offices

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10 CFR Part 850 Amendment Process

Office of the General Counsel

- Unofficial Review
 - GC Comments
 - Comment resolution – EHSS and GC

EHSS Review

- Unofficial Review
 - GC Comments
 - Comment resolution – EHSS and GC

Program Offices and Office of the General Counsel

- Official Review and Comment Period
 - EHSS works with Program Offices and GC to resolve comments

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10 CFR Part 850 Amendment Process

Secretary of Energy

- Review and concur

Office of Management and Budget Review

- Other Federal Agencies review and comment
- Approves draft final rule and economic assessment
 - Final rule Publication in the Federal Register

Secretary of Energy

- Approves and signs the final rule

Congressional Notification

- GC and EHSS

Federal Register

- Review and comment
- EHSS and GC resolve comments
- Publish in the Federal Register

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Proposed 10 CFR Part 850 Final Rule

Effective Date: 30 days after publication date

- Compliance Date: One year after the effective date
- Engineering controls – 2 years after the effective date

Strengthen existing provisions

- Incorporates lessons learned
- Clear distinction between Beryllium worker and Beryllium-associated workers

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Implementation Guide DOE G 440.1-7A

- EHSS-11 is seeking examples to add to Implementation Guide based on the updates to the rule.
 - Areas includes inventory, hazard assessment, exposure limits, monitoring, exposure reduction, regulated areas, hygiene practices, etc.
- EHSS-11 wants to create a working group to help revise the guide.
 - There will be a breakout session during the Fall Symposium to discuss upcoming changes to the implementation guide.

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Questions



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Contacts

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 - **April Brown, Industrial Hygienist**
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Design & Implementation of Molten Salt Safety Program

M. DEVINE (Commonwealth Fusion Systems, Massachusetts, USA)

Design and Implementation of Molten Salt Safety Program

Meghan S. DEVINE

Commonwealth Fusion Systems, Devens, Massachusetts, USA

The utilization of molten salts, specifically those containing beryllium, presents unique challenges in establishing a comprehensive safety and health program. This abstract outlines the primary hurdles encountered by Commonwealth Fusion Systems (CFS) in implementing such protocols, focusing on the inherent risk of beryllium exposure and understanding how exposure with molten salts differs from traditional metallic beryllium.

The decision to use beryllium molten salt for the ARC (Affordable, Robust, Compact) fusion device's design resulted in the development of a cross-disciplinary team to establish the needs of our first research space. Due to the need for flexibility, a temporary space was identified for the first lab work at CFS. During this set up and design, the Beryllium Worker Protection model was employed. This design focused on ensuring that beryllium containing material always had multiple layers of containment between beryllium workers and employees outside of the space, including gloveboxes, dressing rooms, and HEPA (High-Efficiency Particulate Air) filtration. As the design was completed, the team was able to focus on the logistics of completing work and how we would assess potential contamination.

CFS uses multiple methods for determining exposure and potential migration of beryllium in and outside the lab space. For personal and area air monitoring, OSHA 125G has been used. These results, however, cannot be used when real-time data is needed for informed decisions. This need has been supplemented by the Berylliant system, which has allowed us to take wipe samples and analyze immediately. This has been crucial in understanding where packaging could be contaminated and how effective cleaning is. During the setup and initial experimentation with FLiBe (lithium-beryllium-fluoride), we have learned crucial lessons on sampling and data interpretation, PPE (Personal Protective Equipment) selection for worker safety and comfort, and continued education for non-beryllium workers to understand their personal safety.

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Senior EHS Engineer

Commonwealth Fusion Systems

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URL: <https://cfs.energy/>



Design and Implementation of Molten Salt Safety Program

Meghan Devine, CSP

Commonwealth Fusion Systems



Overview

- Background on Interest in FLiBe
- Our Approach
- Key Challenges
- Answer Your Questions

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Background

On CFS and our interest in FLiBe

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CFS on a path to deliver commercial fusion energy



- CFS founded in 2018, spun out of MIT
- Raised more than \$2 billion
- Built a high caliber, diverse team
- Over 750 employees



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Construction of SPARC Facility in Devens, MA



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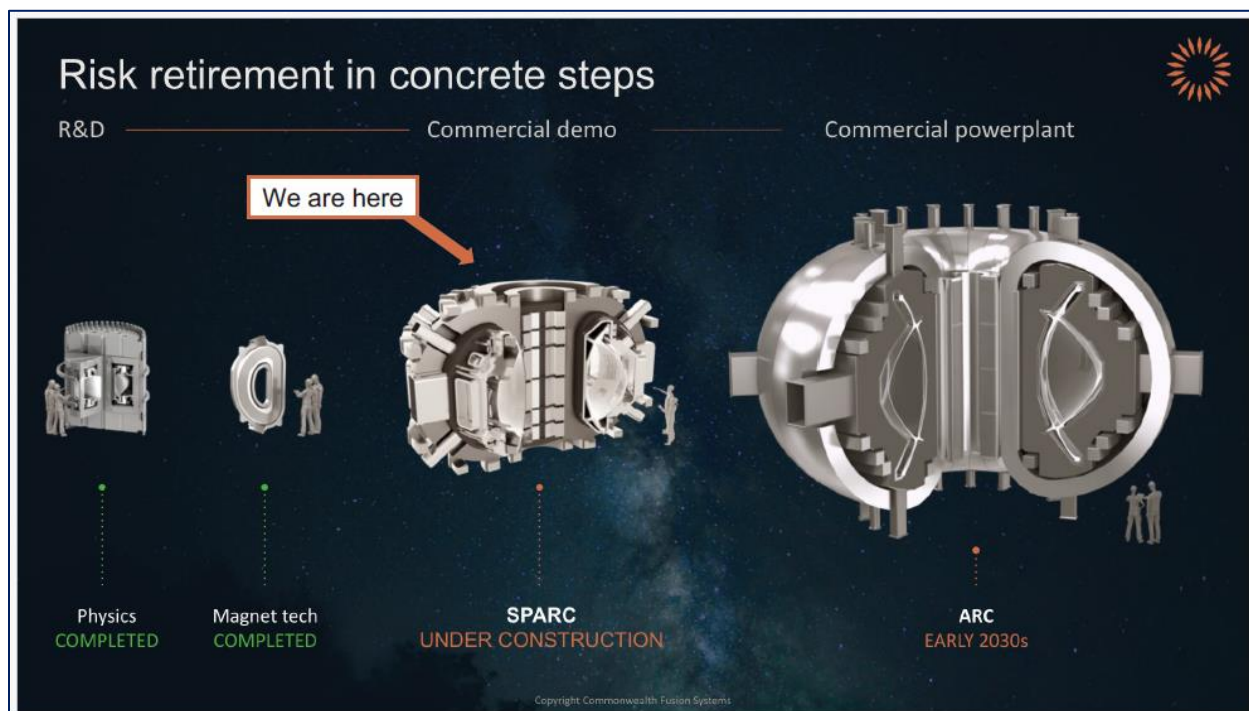
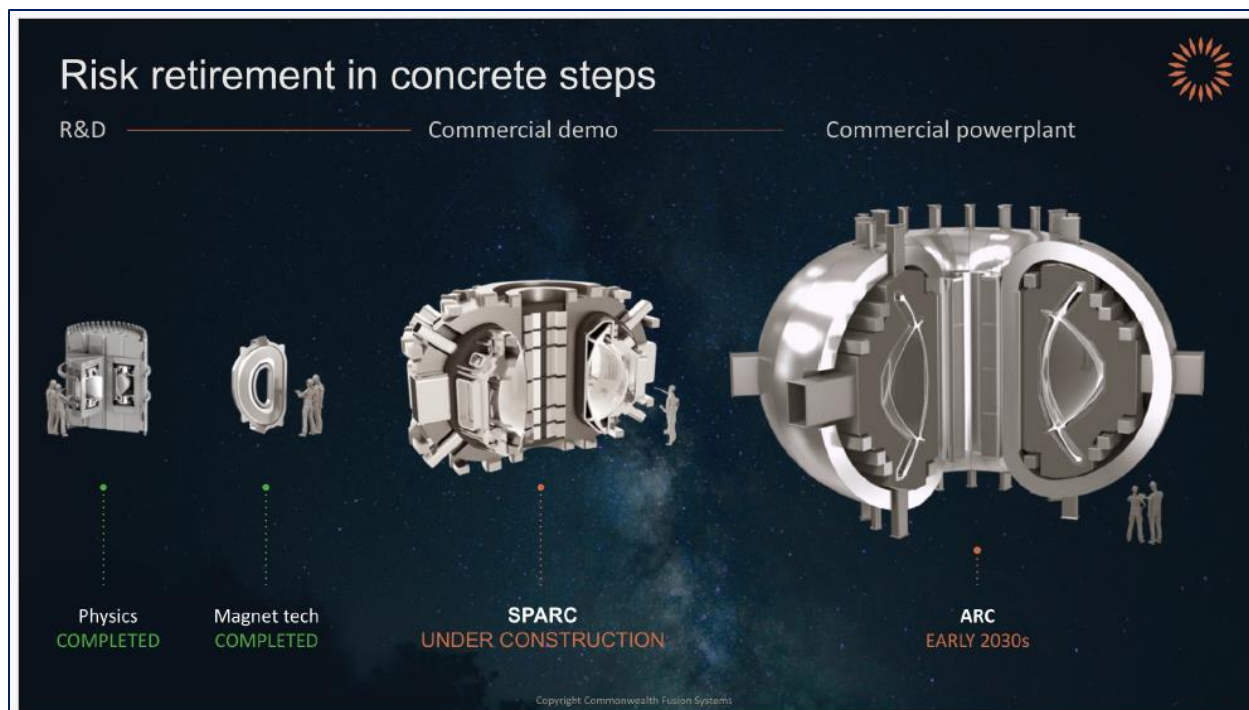
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CFS magnet factory in Devens, MA



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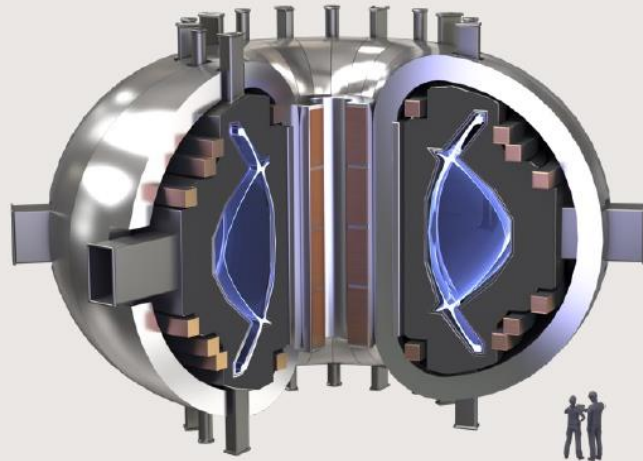
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ARC, world's first commercial fusion power plant



- Validation from SPARC platform:
 - **Economics de-risked** using SPARC costs and supply chain
 - **Performance de-risked** using SPARC operations to optimize
 - **Technology de-risked** using SPARC and innovative R&D pathways in parallel
- Preparing to construct ARC, site search underway



10/19/20

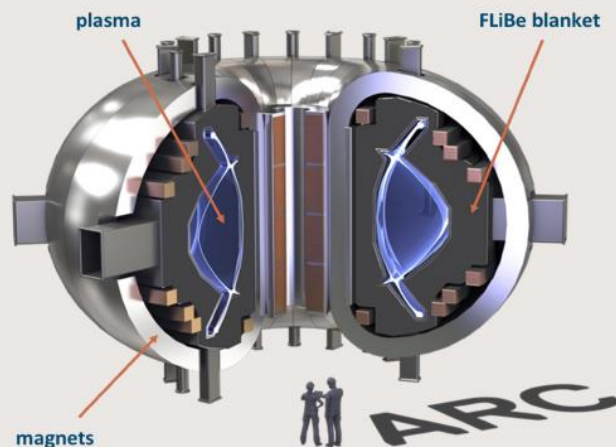
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ARC has a few key differences from SPARC



- ARC needs to produce electricity
 - need some way to convert neutrons from fusion reactions into heat
- electricity production must be continuous
 - total power on time is orders of magnitudes greater than in SPARC!
- **ARC needs to produce its own Tritium**



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Our Approach to Working with FLiBe

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Start small so we can learn quickly...

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Began with Benchmarking (1 year + before FLiBe)



- Understand what has been done previously...
 - Program set up
 - Proper PPE
 - Understand packaging
- Learn what the common pitfalls are
 - Potential sources of migration of Be from process

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Set up of our first FLiBe Lab



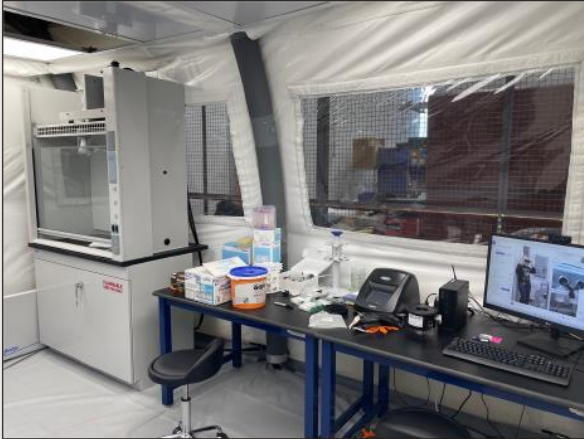
- Utilize the Materion Beryllium Worker Protection Model
 - Multiple layers of containment
- Design a space that can be flexible for our current needs and future scale up



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The final product



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Controlling Migration and Exposure



- Physically remove people from the work
 - Controlled access
 - Negative pressure in highest risk work areas
 - HEPA filtration and exhausting air out of building
- Administrative control set up
- Validation of controls through monitoring

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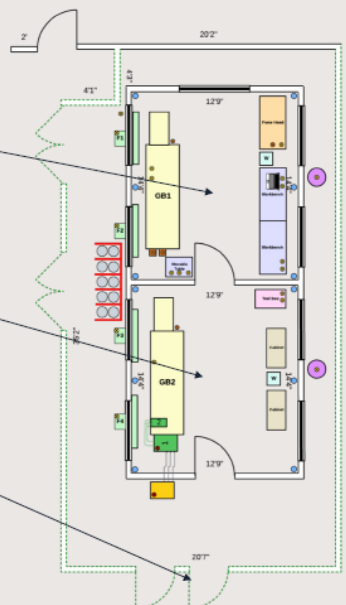
People and Air Flow Control



East Tent has most negative pressure

West Tent has negative pressure to outside shop

Controlled access gate and fenced area



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Defense in Depth

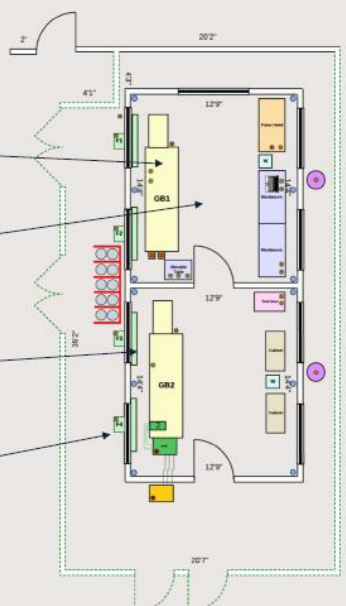


Salt work occurs in gloveboxes

HEPA-filtered internal recirculation built into ceiling

Exhaust has a further HEPA filter

Exhaust to be routed directly to roof



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Setting up good processes...

1. Being thoughtful as we set up new habits:
 - using SOPs and JHAs as much as possible
 - setting regular housekeeping and PM schedules
 - trainings for not just beryllium workers but also adjacent teams (e.g. shipping and receiving, facilities)
2. Asking for feedback
 - daylong safety review with 5 external reviewers
 - engaging internal reviews regularly
3. Building a broader FLiBe safety community
 - including safety as a topic in collaborations
 - starting a new subcommittee in the beryllium workshop specifically on flibe!



Measurement Systems to Validate Be Levels

1. Air monitoring samples and surface swipe samples
 - external partner uses ICP system
 - internally we can use fluorometry for quick turnaround times (hours to get a result)
 - we will test air samples inside and outside the lab
2. Medical testing for salt workers
 - yearly blood test to see if a worker has become sensitized and medical checks

Employee Education

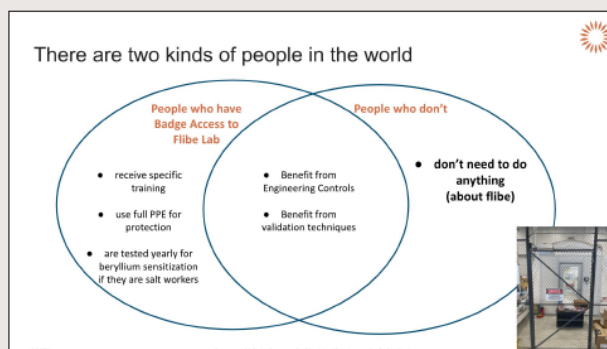
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Education for Non-Be Workers



- General concern around working in the building that has Beryllium
- Town hall set up before FLiBe was brought on site
 - Pathways for exposure
 - Be Sensitization
 - Containment methodology
 - Redundancy in controls



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Education for Non-Be Workers



- Targeted training for employees receiving FLiBe
 - How FLiBe is shipped
 - Defects to check for before receipt

How is FLiBe packed?



- Material will be received in specific packaging
 - Double mylar bag, then ziplock, and bubble wrapped
 - Sealed metal can
 - Packaged in a marked box



What to do when receiving FLiBe?



Before accepting package:

- check for any damage on outside packing material
- If there is any damage... Stop and notify a member of the salt team (salt@cfs.energy)

After package has been accepted:

- Notify an authorized employee to bring to lab
- Bring to designated cabinet in Inventory

Key Challenges

Key Challenges



- Gathering relevant monitoring data
- Correlating BeFinder results with accredited lab results
- Worker comfort in lab while in PPE
- Lack of best practices for FLiBe-specific operations

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Questions

Meghan Devine
mdevine@cfs.energy

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Beryllium Health & Safety Committee: FLiBe Sub-Committee
G. HELDT (Materion Brush Inc., Ohio, USA)

Beryllium Health and Safety Committee: FLiBe Sub-Committee

Gregory H. HELDT

Materion Brush Inc., Mayfield Heights, Ohio, USA

Historically, beryllium health and safety efforts have revolved around controlling occupational exposure to commercially available forms of beryllium, including beryllium metal, beryllium alloys, and beryllia ceramics. In October of 2023, Kairos Power, in partnership with Materion, completed the production of 14 tons of lithium beryllium fluoride (Li_2BeF_4), or FLiBe, for a fluoride salt-cooled high-temperature reactor. This initiated the largest FLiBe transfer since the US Molten Salt Reactor Experiment at Oak Ridge National Laboratory in 1969. Universities, private industries, and government agencies are increasingly researching FLiBe for application in new energy technologies.

FLiBe is a molten salt made from a mixture of lithium fluoride (LiF) and beryllium fluoride (BeF_2) with potential applications as a coolant in molten salt-cooled nuclear fission reactors and as a liquid blanket for ARC fusion reactors. Beryllium salts, such as BeF_2 and FLiBe, are soluble compounds and require special industrial hygiene and design considerations beyond typical controls used for insoluble metal forms of beryllium.

To address the growing commercial and research presence of FLiBe, the Beryllium Health and Safety Committee proposed the formation of a new subcommittee to engage private industry, government agencies, and universities on the safe and responsible handling of FLiBe for use across a broad range and scale of fission and fusion energy applications. The subcommittee is meant to act as a clearinghouse of information to share and establish best practices and worker protection models for the reduction of occupational exposure to soluble forms of beryllium, control of beryllium migration from designated beryllium work areas, and the prevention of beryllium sensitization and chronic beryllium disease.

The scope applies to all uses of FLiBe, from laboratory-scale research efforts to FLiBe production and purification systems, to the implementation of FLiBe for prototypes and energy-producing machines. Those working with FLiBe, or are planning to work with FLiBe, are encouraged to join and contribute to the subcommittee.

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**Beryllium Health and Safety Committee:
FLiBe Subcommittee**

*Prepared by Gregory H. Heldt, MS MPH CIH
Materion Brush, Inc.*

23 April 2024

New Hope Center at 1-12

**BHSC 2024
Spring Meeting**
Beryllium Health & Safety Committee
Oak Ridge, Tennessee, USA
23-24 April 2024

MATERION

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Brief Introduction

- Product Stewardship Manager – Materion Brush, Inc.
- 11+ years working with beryllium
- MPH Epidemiology
- MS Occupational Health / Industrial Hygiene
- Certified Industrial Hygienist

New BHSC Sub-Committee!

FLiBe for the Advancement of Fission and Fusion

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What Is FLiBe?

- FLiBe is a molten salt made from a mixture of lithium fluoride (LiF) and beryllium fluoride (BeF_2)
- Applications for both fission and fusion energy technologies:
 - Fission: Fluoride-salt-cooled high temperature reactor (FHR)
 - Fusion: Liquid blanket for tritium production
 - Other potential applications



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History of FLiBe

- FLiBe has generated research interest as early as the 1950's
- Some of the most significant research with FLiBe started right here in Oak Ridge, TN

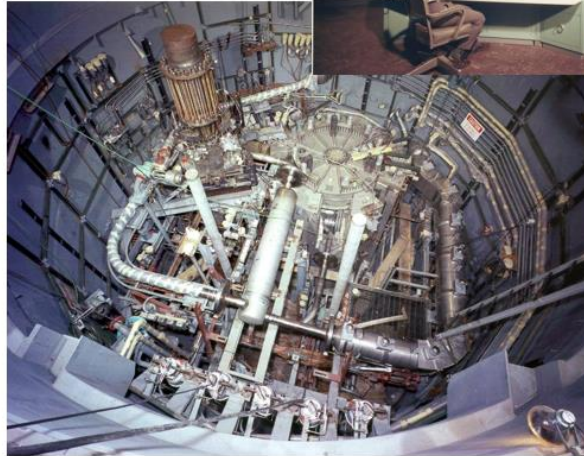


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Molten Salt Reactor Experiment

- Oak Ridge National Laboratory
- Operated from June 1965 to May 1969



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Molten Salt Reactor Experiment - ORNL



- Acted as an economic proof of concept for molten salt nuclear power
- Fuel did not sit in the reactor core while coolants circulated through; rather, the molten salts acted both as a carrier for the fuel and as a coolant
- Logged more than 13,000 hours during its four years of operation
- The molten salt program ended in 1973, when the Atomic Energy Commission decided to focus on other designs

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FLiBe in the Modern Era

- Advancements in technology have helped renew interest in FLiBe for the commercialization of nuclear energy
- Significant technological developments have occurred in the last five to seven years

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Kairos Power and FLiBe

- The Kairos Power fluoride salt-cooled high-temperature reactor (KP-FHR) is a novel advanced reactor technology that leverages TRISO fuel in pebble form combined with a low-pressure fluoride salt coolant. The technology uses a steam cycle to convert heat from fission into electricity.
- Molten fluoride salts, such as FLiBe, have outstanding capability to transfer heat at high temperature, excellent chemical stability, and the ability to retain radioactive fission products that might be released from fuel.



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FLiBe Molten Salt Purification Pilot (MSPP)

- Materion Brush Inc and Kairos Power partnered to produce FLiBe as a coolant for the Kairos Power Fluoride salt-cooled High temperature Reactor (KP-FHR).
- The Molten Salt Purification Pilot (MSPP) facility was commissioned at Materion's Elmore, OH plant in July 2022.



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FLiBe Molten Salt Purification Pilot (MSPP)

- MSPP is the largest FLiBe production facility ever built and has the capacity to generate commercial quantities of material
- Materion operates the facility and provides beryllium fluoride and lithium fluoride as throughput material
- Produced approximately 14 tons of FLiBe – the most ever produced



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FLiBe and Beryllium Safety

- Most industrial hygiene concepts are developed for the control of exposures in relatively high concentrations ($\sim\text{mg}/\text{m}^3$) and are less effective for controlling beryllium exposure
- Occupational beryllium exposures are measured in <micrograms, not milligrams

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FLiBe and Beryllium Safety

Most beryllium worker protection models concentrate on the processing or machining of insoluble, commercially-available forms of beryllium:

- Beryllium Alloys (Cu-Be)
- Beryllia Ceramics (BeO)
- Beryllium Metal



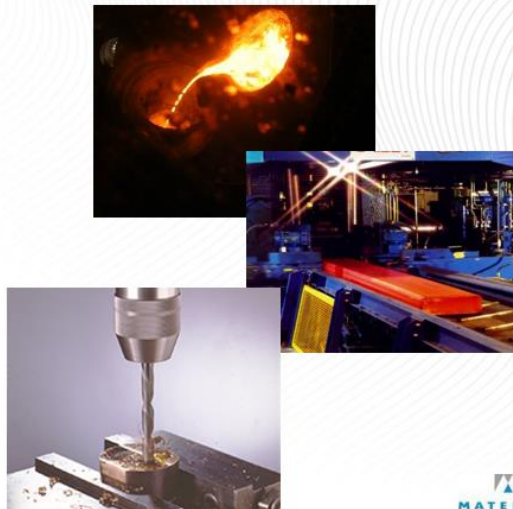
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FLiBe and Beryllium Safety

Insoluble, commercial forms of beryllium are typically processed through casting, rolling, grinding, milling, polishing, and machining.

These activities do not cleanly translate to the processing and handling of FLiBe.



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FLiBe and Beryllium Safety

Soluble forms of beryllium, including BeF_2 and FLiBe, have not generally been commercially available.

The increasing commercial availability of FLiBe for industrial and research purposes has necessitated a closer look at occupational protection models



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FLiBe Sub-Committee

- FLiBe exists as both a solid at room temperature and as a liquid under high temperatures, each with unique potential hazards
- FLiBe is handled by wide range of organization, from private industry seeking to commercialize nuclear power, to small laboratory-scale experiments



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FLiBe Sub-Committee

- Therefore, in early 2024, a new sub-committee dedicated to the safe handling, testing and processing of FLiBe was incorporated into the bylaws of the Beryllium Health and Safety Committee:
- FLiBe for the Advancement of Fission and Fusion (FAFF)



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FLiBe Sub-Committee

- “The FLiBe Subcommittee exists to engage private industry, government agencies, and academic universities on the safe and responsible handling of lithium beryllium fluoride (FLiBe) for use across a broad range and scale of fission and fusion energy technologies. The subcommittee acts as a clearinghouse of information to share and establish best practices and worker protection models for the reduction of occupational exposure to soluble forms of beryllium, control of beryllium migration from designated beryllium work areas, and the prevention of beryllium sensitization and chronic beryllium disease. The scope of the subcommittee applies to all uses of FLiBe, from laboratory-scale research efforts to FLiBe production and purification systems, to the implementation of FLiBe for prototypes and energy-producing machines.”

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Who Should Join?

- Private Industry
- Government Agencies
- Academic Institutions
- Prospective Users/Researchers

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Topics of Discussion

- Beryllium Worker Protection Models
- PPE Selection
- Ventilation
- Transition Rooms
- Engineering Controls
- Administrative Controls
- Non-Routine Work
- Maintenance
- Emergency Response Plans
- Loss of Containment
- Best Practices
- Lessons Learned



MICROCHEM 2000



MICROCHEM 2300+



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How to Join

- Send an email of interest to:

Gregory.heldt@materion.com

- Or reach out to any other BHSC Board Member

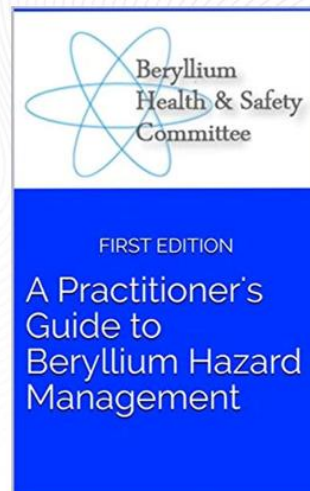
First Meeting will be held in May

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Other Opportunities for Involvement

- The BHSC has initiated a revision of “The Practitioner’s Guide to Beryllium Hazard Management” for 10 CFR 850
- Update will include a new chapter dedicated to the safe handling of FLiBe
- Your insights are greatly appreciated!



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Other Opportunities for Involvement

Additional Sub-committees:

- Medical & Epidemiological
- Research Needs
- Sampling & Analysis
- Risk Communication
- Technical Practices
- Meetings & Symposia

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Overview of the Beryllium Field and Mobile Accreditation Program

C. MORTON & G. GRIFFIN (American Industrial Hygiene Association, Virginia, USA)

Overview of the Beryllium Field and Mobile Accreditation Program

Cheryl O. MORTON¹ and Gary E. GRIFFIN^{1,2}

¹*American Industrial Hygiene Association (AIHA) Laboratory Accreditation Programs,
Falls Church, Virginia, USA*

²*GEG Consulting LLC, Shorewood, Illinois, USA*

AIHA Laboratory Accreditation Programs released a new Policy Module (Module 2 G) on May 15, 2023 called the Beryllium Field/Mobile Accreditation Program (BeFAP.) Developed in collaboration with members of the Beryllium Health and Safety Committee, BeFAP gives mobile units and field operations analyzing Be the same opportunities as fixed site stationary laboratories to become accredited.

Each accredited mobile or field entity will have its own independent accreditation (and AIHA LAP identification number and symbol) and may be able to share quality management systems with other field/mobile operations.

AIHA LAP is a third-party, internationally recognized accreditation body that conforms to the requirements of the ISO/IEC 17011:2017, while laboratories seeking accreditation must conform to the requirements of the ISO/IEC 17025:2017, in addition to program-specific requirements as detailed in AIHA-LAP. The speakers will provide an overview of AIHA LAP and provide details about BeFAP and its requirements including how site assessments will be conducted.

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LAP Executive Director

AIHA Laboratory Accreditation Programs

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Mr. Gary E. GRIFFIN, PE

AIHA Chief Site Assessor

GEG Consulting, LLC

EMAIL: gegconsultingllc@gmail.com



Beryllium Field/Mobile Accreditation Program

Cheryl O. Morton, Executive Director
AIHA Laboratory Accreditation Programs
Gary Griffin, PE
GEG Consulting, LLC

OBJECTIVES

- ABOUT AIHA LABORATORY ACCREDITATION PROGRAMS
- AIHA LAP and BHSC DISCUSSIONS
- MODULE 2G INTRODUCTION/REVIEW
- SA CHECKLIST INTRODUCTION/REVIEW
- ACCREDITATION/ASSESSMENT PROCESS

About AIHA LAP

AIHA Laboratory Accreditation Programs is a third-party, internationally-recognized accreditation body.



History of AIHA Lab Accreditation



IH Laboratory Accreditation Program

Developed in 1974 with significant input from NIOSH, OSHA and CDC. Labs required to participate in proficiency testing program.



AIHA also assumed NIOSH's proficiency testing program later that year.



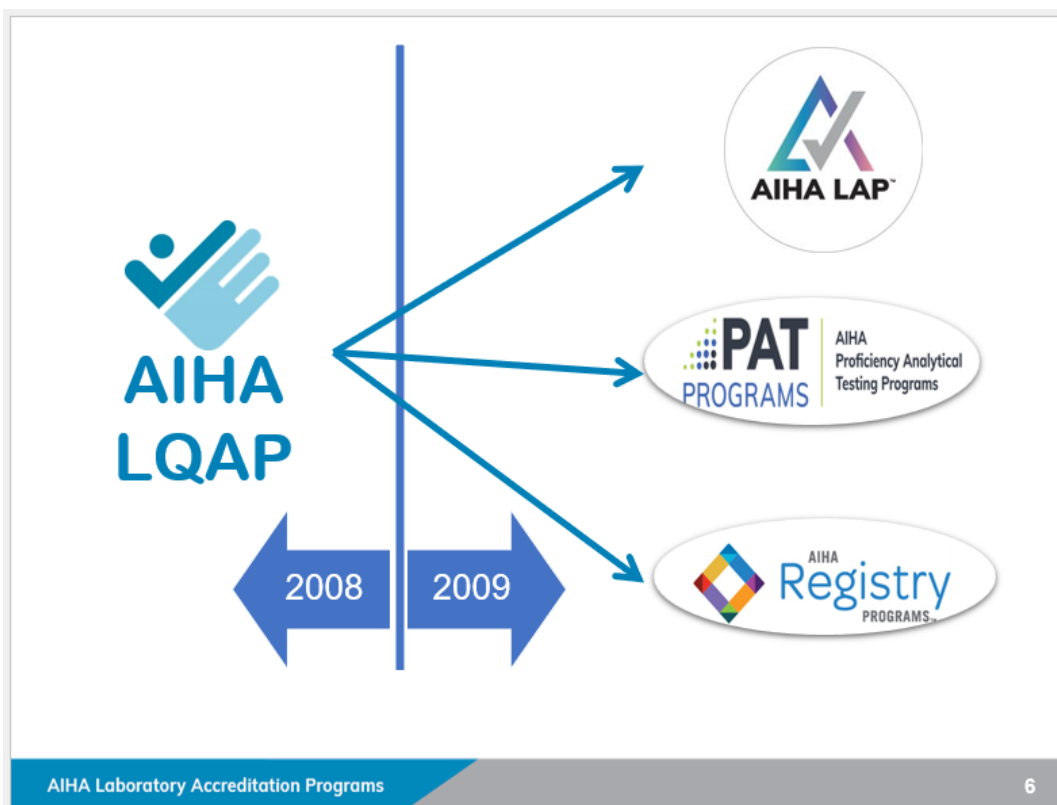
Growth of Programs

AIHA established the lead program in 1985 and microbiology accreditation program in 2000 (and companion proficiency testing programs) along with an Asbestos Analyst Registry Program

All programs operated and branded under Laboratory Quality Assurance Programs (LQAP)

Started accrediting to the International Standard ISO/IEC 17025:2005 in 2005 along with AIHA's own policies

AIHA Laboratory Accreditation Programs 5

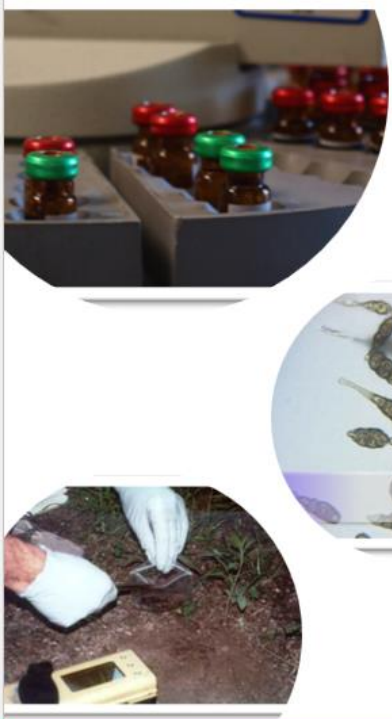




AIHA Laboratory Accreditation Programs, LLC

-  Accreditation now done by **AIHA Laboratory Accreditation Programs, LLC**
-  AIHA LAP continues to accredit all testing labs to the ISO/IEC 17025 Standard and additional AIHA LAP policies.
-  Professional Services Agreement.
-  Licensing Agreement with AIHA to use AIHA in our name.
-  270 labs accredited across 5 programs
-  7.5 FTEs

AIHA Laboratory Accreditation Programs 7



AIHA LAP Accreditation Programs

- **The Industrial Hygiene Laboratory Accreditation Program (IHLAP)** for labs involved in testing to evaluate workplace exposures. 60% of all accredited labs are in IHLAP. 177 labs
- **The Environmental Lead Laboratory Accreditation Program (ELLAP)** for labs testing lead in environmental samples. Recognized by the U.S. Environmental Protection Agency. 95 labs
- **The Environmental Microbiology Laboratory Accreditation Program (EMLAP)** for labs identifying microorganisms detected in air, fluids, and bulk samples. 140 labs

AIHA Laboratory Accreditation Programs 8



AIHA LAP Accreditation Programs

- **Food Laboratory Accreditation Program (FoodLAP)** for labs testing food products (including raw agricultural commodities), finished food products, and food ingredients. 7 labs
- **Unique Scopes Accreditation** ISO/IEC 17025:2017 only accreditation. Covers consumer product testing, cannabis and accreditation for other types of testing not typically part of legacy programs. 14 labs

AIHA Laboratory Accreditation Programs 9



International Laboratory Accreditation Cooperation

Global Network of bodies engaged in conformity assessment formed to:

- Increase global confidence in testing results
- Harmonize accreditation practices
- Eliminate redundant testing activities
- Accreditation bodies from 95 economies
- More than 52,000 accredited laboratories

AIHA Laboratory Accreditation Programs 10

Recognition Means...



LAP has been evaluated by its global accreditation body peers and deemed equivalent for relevant scopes (testing for us.)



LAP meets requirements under ISO/IEC 17011:2017 that include language on:

Impartiality
Competency of personnel
Risk-based thinking
Adding Accreditation schemes

MOU Signed

- In 2018, BHSC and AIHA LAP signed a Memorandum of Understanding to develop accreditation program requirements for field analysis of beryllium for Department of Energy labs.

Task Force Formed

- Michael Brisson, SRS
- Linda Youmans, SRS
- Larissa Welch, Y-12
- Gary Whitney, Los Alamos
- Gary Griffin, Site Assessor
- AAB: Beth Bair, Michael Breu, Bob Lieckfield, Patrick Dunn
- Staff: Cheryl Morton, Olena Bulgakova

BHSC-AIHA LAP Task Force

- Regular conference calls
- Looked at different frameworks - TNI Field Sampling and Measurement Organization Accreditation Program and Asbestos Analyst Registry (AAR) as a starting point.
- Michael Breu conducted an in-depth analysis of TNI and AIHA LAP policies.

Task Force Consensus

Policy Needed

- AIHA LAP to develop a stand-alone program (Module 2G) for Beryllium Field/Mobile Accreditation
 - Loosely based on a “mother ship” concept
 - Considered a FoT for field/mobile of Be, but certificate wouldn’t be acceptable by DOE
 - Considered but decided against a generic program (will pursue later.)
 - Module 2A required

Task Force Consensus

Revised Definitions

- A “field location” is a location outside of a fixed laboratory. A field location is typically not “mobile” in the sense described below.
- A “mobile facility” is one that can move from place to place and houses analytical equipment.
- Environmental conditions specified in ISO/IEC 17025:2017 are expected to be met.

Task Force Consensus

Requirements

- A mobile unit or field operation will have to operate just like a fixed site operation. They will have to do all the same things required by a fixed site operation.
- The unit will have its own independent accreditation, although it may share a QMS with other field/mobile operations.

Task Force Consensus

Requirements

- Will accredit the satellite field/mobile units even if they all have the same address and use the same QMS.
- Different pricing scheme for field/mobile units.

Beryllium Field/Mobile Accreditation Program Module 2G

- BeFAP
- Similar to AIHA LAP's Industrial Hygiene Laboratory Accreditation Program (IHLAP) Module 2B
- New--2G.2.1 and 2G.3.8-2G.3.10

BeFAP Checklist

- Similar to Industrial Hygiene Laboratory Program (IHLAP) checklist
- New--2G.2.1 and 2G.3.8-2G.3.10

Accreditation Process

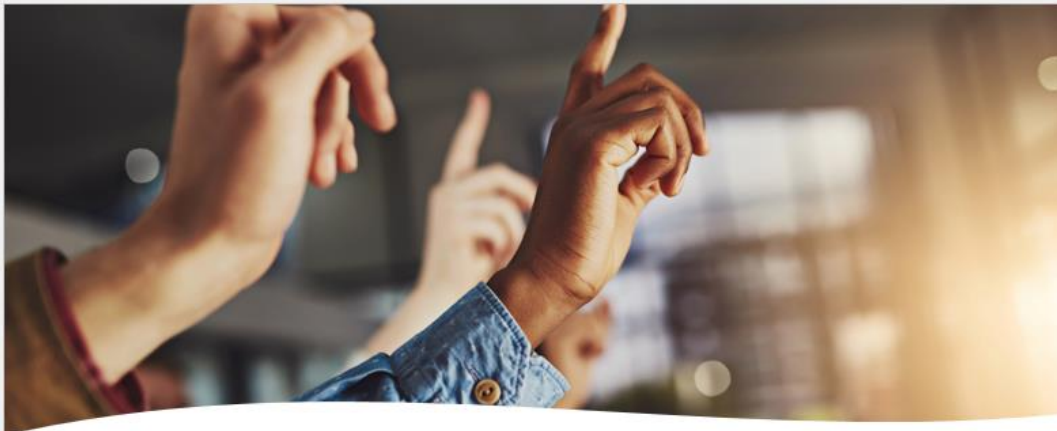
- Each field-mobile unit will require its own application
 - Mother Ship QA Program
- Each field-mobile unit will have unique ID LAP # XXXXXX-A, B, C, etc.
- Each field-mobile unit will have their own PT
 - BePAT
- Certificates will say **Beryllium Field Mobile Accreditation Program**

Likely Conduct of Assessments

- Review of Mother Ship QA Program—Day 1
- Field-Mobile Units 2G Assessment—Day 2 to Day ?
- Some site assessment techniques will be more like remote assessments.
- All Field-Mobile Units to be assessed—may need to utilize assessor teams if needed for multiple field/mobile units.
- Gary Griffin will be first BeFAP Site Assessor
 - Assessment Planning will be key
 - Will document the process, challenges and share with other SAs
 - First assessment will be a pilot

Status

- AAB approved Module 2G in 2020.
- Data management system upgraded.
- Module 2G was put on hold due to pandemic.
- Module 2G and 9 (definitions) posted for stakeholder review and comment April 2023.
- Final Module 2G published May 2023.
- Site Assessor discussion around what site assessments will look like.
- One application in the queue.



Questions?

cmorton@aiha.org

(703) 846-0789

Proposed 10 CFR 850 Limits for Beryllium: Is ICP an Option?

J. BENNETT et al. (Lawrence Livermore National Laboratory, California, USA)

Proposed 10 CFR 850 Limits for Beryllium: Is ICP an Option?

Jack BENNETT and Cora MADDEN

Lawrence Livermore National Laboratory (LLNL), Livermore, California, U.S.A.

Inductively coupled plasma - optical emission spectroscopy (ICP-OES) is a cost-effective method of analyzing samples for beryllium. However, there have been concerns about the ability of ICP-OES to meet the proposed limits under 10 CFR Part 850.

This may have been the case with older instrumentation, but modern instrumentation can easily meet these limits. This presentation will provide data to support that premise derived from both Revisions 1 and 2 of the U.S. Environmental Protection Agency (EPA) Method Detection Limit (MDL) procedure.

Corresponding Author:

Mr. Jack BENNETT

Lawrence Livermore National Laboratory

EMAIL: bennett67@llnl.gov

URL: <https://www.llnl.gov/science-technology/nuclear-chemical-isotopic-science-technology>

LLNL-PRES-862900

Proposed 10 CFR 850 Limits for Beryllium – Is ICP An Option?

Jack Bennett - AS&I Manager, LLNL
Cora Madden – ALAB Group Leader, LLNL

April 23, 2024



LLNL-PRES-802900

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344. Lawrence Livermore National Security, LLC

Lawrence Livermore
National Laboratory

The 10 CFR 850 Economic Assessment Survey

■ Proposed three Action Levels:

- $0.05 \mu\text{g}/\text{m}^3$
- $0.10 \mu\text{g}/\text{m}^3$
- $0.15 \mu\text{g}/\text{m}^3$

Economic Assessment Questionnaire

The purpose of this questionnaire is to obtain information on the cost impacts of implementing proposed amendments to Title 10, Code of Federal Regulations, Part 850 (10 CFR Part 850), *Chronic Beryllium Disease Prevention Program (CBDPP)*. The Office of Worker Safety and Health Policy within the Office of Environment, Health, Safety and Security will use this information to assess the impact and prepare the economic analysis for these proposed amendments.

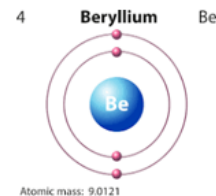
Proposed Rules

Federal Register
Vol. 88, No. 162
Wednesday, August 23, 2023

This section of the FEDERAL REGISTER contains notices to the public of the proposed issuance of rules and regulations. The purpose of these notices is to allow interested parties to submit comments.

Submission of Comments) of this SNOPIR for additional information. ADDRESSES: You may send comments,

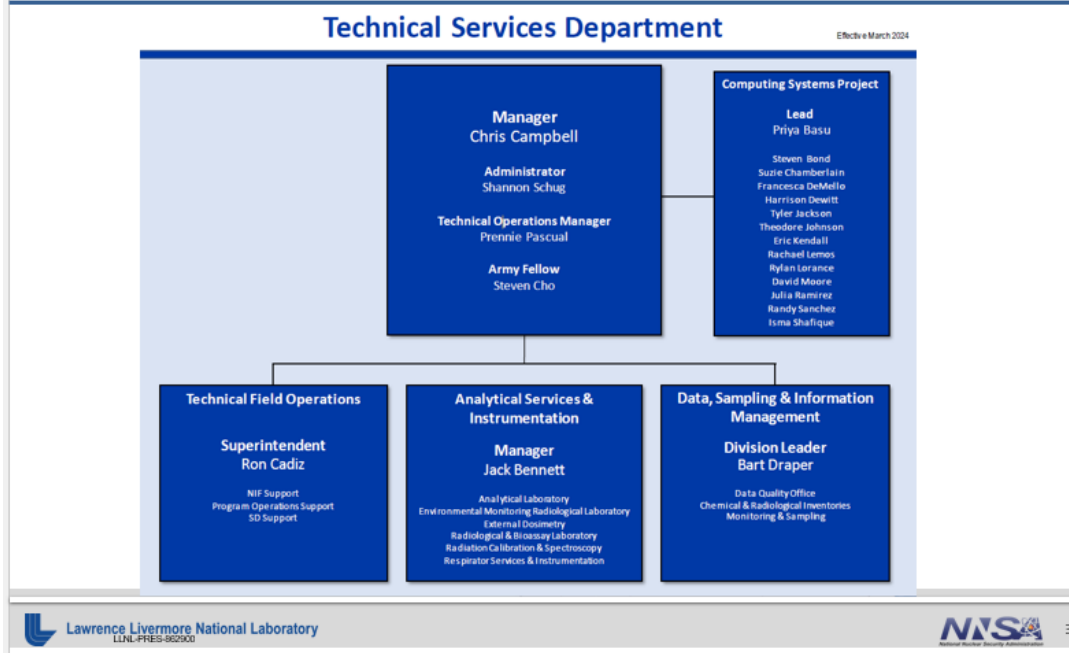
III. Discussion of Specific Proposed Sections
A. Proposed § 850.22—Permissible Exposure Limits
B. Proposed § 850.92—Action Level



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LLNL-PRES-802900

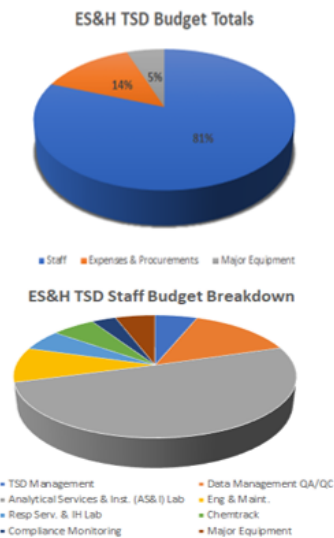
NNSA
2

Technical Services Department

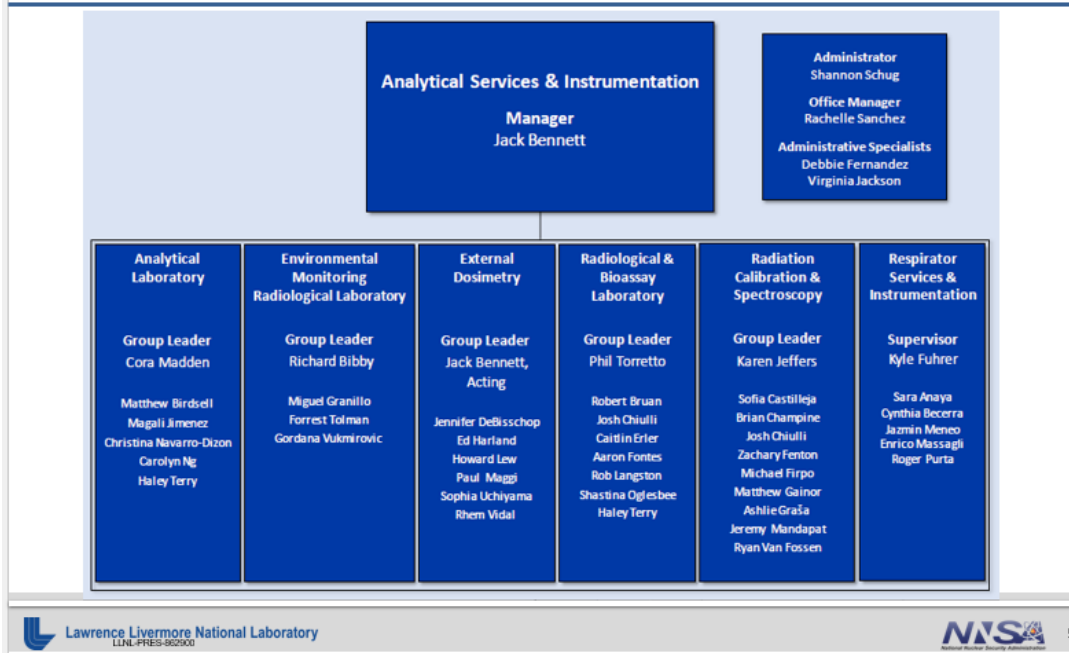


ES&H Technical Services

- **Mission Statement:** Provide quality field, laboratory, and information management support to ES&H and LLNL programs.
- **Total Staff:** Over 100 staff, 45 ES&H technicians, and more than 90 FTE
 - includes: chemists, engineers, scientists, health physicists, software developers, data managers, quality assurance specialists, scientific associates, and technicians.
- **Impact:** Essential compliance and operation services throughout LLNL
 - including radiological hazards, occupational exposures, research laboratories, construction projects, waste discharges, and permit-required monitoring, and compliance reporting.

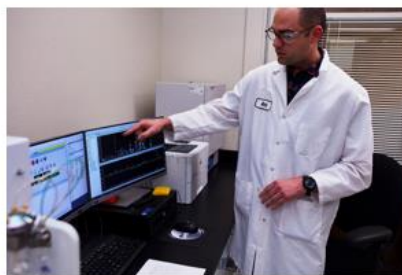


Analytical Services and Instrumentation



AS&I Mission and Vision

- Vision - To provide excellent service and quality in our analytical and calibration services while exceeding our client's expectations.
- Mission - To provide excellence through our dedication, expertise and talented people



AS&I Services

- Industrial Hygiene Analytical Chemistry
- Personnel External Dosimetry
- Whole Body Counting
- Soils chemical analyses (VOCs-Terra-Core, metals TTLC & STLC)
- Environmental radiological analyses (water, wastewater, air filters, soils, vegetation, wine)
- Bioassay Lab (BLAB) for staff supplied samples
- Radiological Measurements Lab (swipes, filters, wastewater)
- Radiation Calibration Lab (M&TE equipment)
- Respirator Services masks and fit testing
- Industrial Hygiene instrument calibration and loan



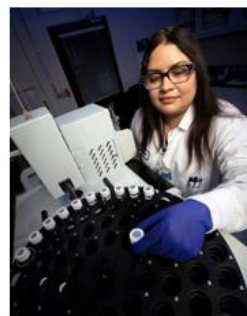
LLNL Analytical Laboratory (ALAB)

- Accredited to ISO 17025 through AIHA for IH testing.
- Accredited to CA ELAP through IAS for environmental testing.
 - CA ELAP is really to the TNI Standard with two minor deletions.
 - The TNI Standard is ISO 17025 with specific modules developed for environmental testing.
- Staffing:
 - Six Chemists.
 - One QA Manager.



ALAB, ctd.

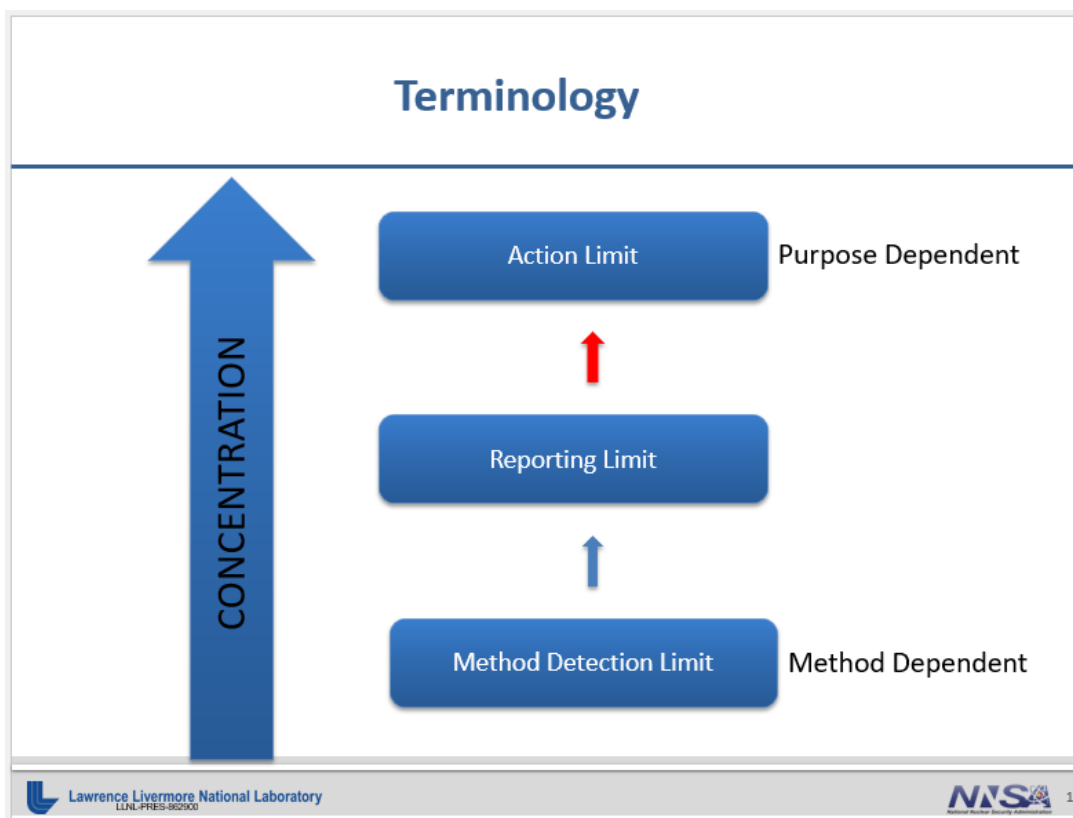
- Primarily does metals by ICP-OES
 - Most of samples are in support of IH surveys.
 - Also does testing of environmental samples for VOC's by GC\MS and metals by ICP-OES.
 - Typically analyzes 25,000 to 30,000 samples per year.
 - Mix of Be Swipes, IH Metals swipes, Be Air Filters and IH Air Filters.
 - Recently upgraded from PE Optima to Agilent 5800 ICP-OES.
 - Agilent instrument is very sensitive.



How to Figure Out if ICP Can work

- Perform MDL studies.
 - Even though IH labs do not report to the MDL, Accrediting Bodies require that labs perform MDL's.
 - They don't say "how", though.
- There are multiple ways to do MDL's
 - EPA 40 CFR 136 MDL Procedure.
 - USGS Long Term Detection Limit.
 - ASTM Interlaboratory Detection Limit.
 - And many more.
- Many labs follow one of the EPA versions.
 - Labs understand what it means.





Analytical detection limits are:

- developed by statisticians,
- applied by analytical laboratories,
- and used by policy makers, regulators, and lawyers.

- Michael Brisson

Detection Limit

- Can you see me now? (8pt)
- Can you see me now? (10pt)
- Can you see me now? (12 pt)
- Can you see me now (18 pt)
- Can you see me now? (24)

At what font size can you see words?

Lloyd Currie - 1968

- Lloyd Currie's paper "Limits for Qualitative Detection and Quantitation: Application to Radiochemistry" Anal. Chem. 40, 586-593 (1968) was the seminal paper on the concept of detection limits.
- Introduced terms of:
 - Critical Level (L_C), the detection decision.
 - The signal above which an observed signal may be reliably recognized as detected.
 - Random chance of a false positive being $\leq 1\%$.
 - Detection Limit (L_D).
 - The "true" net signal which may be *a priori* expected to lead to detection.
 - Determination Limit (L_Q) commonly called limit of quantitation or quantitation limit.
 - The level at which the measurement precision will be satisfactory for quantitative determination.
- Currie's approach minimized false positives.

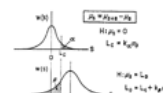


Figure 2. Hypothesis testing
Errors of the first and second kinds

EPA - 1981

- Method detection limit (MDL) was first published in a paper by John Glaser and others at EPA's laboratory in Cincinnati in 1981 in Environmental Science and Technology.
- MDL based on Currie's work but employs low-level spikes rather than backgrounds.
- The EPA approach minimized false negatives.
- Codified in 40 CFR 136 Appendix B and was in place from 1984 – 2017.
 - EPA tried to make some changes to the procedure in 1999.
 - They were sued!!



The Lawsuit

- In 1999, several industry groups filed suit against EPA (Alliance of Automobile Manufacturers, et al. v. EPA, No. 99-1420, (D.C. Cir.)) – re: EPA Method 1631E.
- **October 2000**, the parties reached a settlement agreement that required EPA to **assess existing Agency and alternative procedures** for determining detection and quantitation limits and sign a notice for publication in the **Federal Register** on or **before February 28, 2003**, and to invite comment on the assessment.

EPA MDL Procedure Rev 2

- Promulgated in the 2017 Method Update Rule.
 - 40 CFR 136 Appendix B.
- Includes the use of Method Blanks in determining the MDL and requires that the MDL is performed over several days.
- The method detection limit (MDL) is defined as the minimum measured concentration of a substance that can **be reported with 99% confidence** that the measured concentration is distinguishable from **method blank results**.
 - Used to be "... 99% confidence that the analyte concentration is **greater than zero...**".
 - Now analogous to Currie's definition of a random chance of a false positive being $\leq 1\%$ was the Critical Level (L_c).

Be Air Filters Hypothesis Testing

- Analysis by ICP-OES using Modified NIOSH 7302.
 - Modification is use of 1% Ammonium Bifluoride.
 - Digest in microwave.
 - Bring to a final volume of 10 mLs.
- Since no guidance on what level will be promulgated, decided to test most stringent case.
 - $0.05 \mu\text{g}/\text{m}^3$
- Assumptions:
 - Flow Rate is 1 LPM.
 - Sample time is 8 hours.



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- NISA
National Nuclear Security Administration
- 19

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LNL-PRES-062000

NNS
National Nuclear Security Administration

20

[illegible]

Solution Name: SIC									
Solution Name	Date	Rack:Tube	Weight (g)	Volume (mL)	Dilution				
SIC	3/8/2024 12:19:18 PM	S1:5	1	1	1				
Comments									
Label	QC Report Value	Solution Concentration	Unit	Conc SD	Conc %RSD	Intensity (c/s)	Calculated Concentration		
Al 308.15	Skipped	499.27388832	mg/L	0.31413946	0.06	5217290.59476582	499.27388832		
Be 313.042 Alt	Skipped	-0.00016023	mg/L	0.00000643	4.01	-190.70601327	-0.00016023		
Be 313.107	Passed - 0.00000278	-0.00000278	mg/L	0.00000233	83.99	13.49172280	-0.00000278		
Fe 234.35	Skipped	495.82150108	mg/L	0.41305817	0.08	7436853.49474727	495.82150108		
Mn 257.610	Skipped	19.82236352	mg/L	0.00688278	0.03	9372878.28425108	19.82236352		
Ti 334.941	Skipped	19.93645147	mg/L	0.02967595	0.15	6228376.47909329	19.93645147		
V 292.401	Skipped	9.95520194	mg/L	0.00809299	0.08	479984.67290008	9.95520194		

Method Blank

Solution Name: BLK-1

Solution Name	Date	Rack:Tube	Weight (g)	Volume (mL)	Dilution
BLK-1	3/7/2024 3:15:13 PM	1:9	1	25	1

Comments

Label	QC Report Value	Solution Concentration	Unit	Conc SD	Conc %RSD	Intensity (c/s)	Calculated Concentration
Al 308.15	N/A	-0.00333048	mg/L	0.03884682	46.66	1741.52203701	-0.08326212
Be 313.042 Alt	N/A	-0.00004240	mg/L	0.00014535	13.71	639.12729187	-0.00106005
Be 313.107	N/A	-0.00000514	mg/L	0.00017012	> 100.00	12.47788638	-0.00012845
Fe 234.35	N/A	-0.00517812	mg/L	0.01000923	7.73	3002.85382765	-0.12945293
Mn 257.610	N/A	-0.00001704	mg/L	0.00080476	> 100.00	1050.52443790	-0.00042591
Ti 334.941	N/A	-0.00017125	mg/L	0.00130039	30.37	255.80260888	-0.00428136
V 292.401	N/A	0.00031195	mg/L	0.00795233	> 100.00	47.50232425	0.00779876

MDL Sample

Solution Name: 202404710-REP1

Solution Name	Date	Rack:Tube	Weight (g)	Volume (mL)	Dilution
202404710-REP1	3/7/2024 3:21:19 PM	1:12	1	25	1

Comments

Label	QC Report Value	Solution Concentration	Unit	Conc SD	Conc %RSD	Intensity (c/s)	Calculated Concentration
Al 308.15	N/A	-0.00532964	mg/L	0.01507335	11.31	1720.97947004	-0.13324106
Be 313.042 Alt	N/A	0.00015295	mg/L	0.00026674	6.98	1193.61117958	0.00382382
Be 313.107	N/A	0.00017566	mg/L	0.00027041	6.16	266.71639516	0.00439143
Fe 234.35	N/A	0.00644942	mg/L	0.02211034	13.71	3171.00637249	0.16123548
Mn 257.610	N/A	0.00000870	mg/L	0.00081332	> 100.00	1062.43494218	0.00021760
Ti 334.941	N/A	-0.00010899	mg/L	0.00056055	20.57	275.07949055	-0.00272469
V 292.401	N/A	-0.00023556	mg/L	0.00441286	74.93	21.42337127	-0.00588900

Is ICP An Option?

- Converting instrument concentration to air concentration:

$$- \mu\text{g}/\text{m}^3 = \frac{(\text{concentration on instrument in } \mu\text{g}/\text{mL})(\text{final volume in mL})}{\text{volume of air sampled in m}^3}$$

$$= \frac{(0.00003)(10)}{0.48} = 0.0006 \mu\text{g}/\text{m}^3$$

- Remember, the desired RL = $0.005 \mu\text{g}/\text{m}^3$ and the (although not required in Rev 2 of the MDL procedure) RL/MDL should be >2 , then:

Yes!!

Jack Bennett
bennett67@llnl.gov

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Update on Beryllium-Related Activities in ASTM and ISO

M. BRISSON (Savannah River National Laboratory, South Carolina, USA)

Update on Beryllium-Related Activities in ASTM and ISO

Michael BRISSON

Savannah River National Laboratory, Aiken, South Carolina, USA

This presentation will review activities over the last two years in developing and updating consensus standards in ASTM (American Society for Testing and Materials) International and the International Organization for Standardization (ISO) related to sampling and analysis of beryllium materials. Anticipated future activities will also be discussed.

Fusion facilities are of interest to the beryllium community since that metal is typically used in such facilities. In ISO, standards development activities have begun for aspects of fusion facilities, and these will be briefly mentioned.

Corresponding Author:

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URL: <https://www.astm.org/>

SRNL-MS-2024-00130, Rev. 1

RIRR #58142



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Update on Beryllium-Related Activities in ASTM and ISO

Michael BRISSON, MS, PMP, FASTM, FAIHA

Beryllium Health and Safety Committee Meeting, April 23, 2024
SRNL-MS-2024-00130, Rev. 1 – RIRR #58142



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Disclaimer

- Views or opinions expressed by the author are his own, and do not necessarily reflect those of the Department of Energy or Savannah River National Laboratory.

Standards Development Organizations (SDOs)

- ASTM International and the International Organization for Standardization (ISO) develop voluntary consensus standards on a wide variety of topics
- ASTM, ISO, and other SDOs adhere to principles of development defined by the World Trade Organization's Agreement on Technical Barriers to Trade
 - Openness; Transparency; Impartiality and Consensus; Effectiveness and Relevance; Coherence; and Development Dimension (access for developing countries)
- Standards provide:
 - Consistent and reproducible way of performing work based on consensus of experts in the field (industry, government, users) – agency standards (e.g., NIOSH, EPA) are not consensus standards
 - Basis for data quality objectives (DQOs)
 - Comparability of data
 - Legal defensibility
 - See White and Brisson, *The Synergist*, October 2019, pp. 25-28.
- Standards (ASTM and ISO) are routinely reviewed, typically every five years, and updated as needed
- In the U.S., the National Technology Transfer and Advancement Act of 1995 (NTTAA, PL 104-113) directs federal agencies to use technical standards developed by voluntary consensus bodies, unless impractical or inconsistent with applicable law
 - However, the NTTAA has no enforcement provisions



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ASTM International

- Standards are developed by technical committees (n~150) based on subject matter
 - Participation and voting are at the individual level (only one vote allowed per voting interest)
- Each committee has some number of subcommittees for specific topics within the committee's scope
- Committee D22, Air Quality
 - Subcommittee D22.04, Workplace Air Quality (current chair: Mike Brisson), has most beryllium-related standards
- Committee D18, Soil and Rock
 - Subcommittee D18.01, Surface and Subsurface Investigation, has one Be-related standard
- ASTM changed its name to ASTM International in 2001
- Numbering of ASTM Standards (example: D7439-21):
 - D7439 is the standard designation
 - "-21" is the year it was most recently updated or reapproved



ASTM INTERNATIONAL
Helping our world work better



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ASTM Sampling and Sample Preparation Standards

Designation	Year	Short Title	Status
D5438	2023	Collection of Floor Dust for Chemical Analysis (vacuum) (Note 1)	Current
D6966	2018	Wipe Sampling for Determination of Metals	Revision in Progress (K. Ashley)
D7144	2021	Collection of Surface Dust by Micro-vacuum Sampling	Current
D7296	2018	Collection of Settled Dust for Beryllium – Dry Wipe Sampling (Note 2)	Being reviewed for updates
D7659	2021	Strategies for Surface Sampling of Metals and Metalloids	Current
D7822	2019	Dermal Wipe Sampling for Determination of Metals and Metalloids	Being reviewed for updates
D8344	2020	NH ₄ HF ₂ -HNO ₃ Digestion of Air and Wipe Samples	Current
D8404	2021	NH ₄ HF ₂ -HNO ₃ Digestion of Soil Samples	Current
E1370	2021	Air Sampling Strategies for Worker Protection	Current

Notes:

1. D5438 is under the jurisdiction of D22.05 (Indoor Air); all others are in D22.04.
2. D7296 is intended for use on surfaces that could be damaged by wetted wipes.



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ASTM Measurement Methods (D22.04)

Designation	Year	Short Title	Status
D4185	2023	Measurement of Metals by Flame Atomic Absorption	Current
D7035	2021	Metals and Metalloids by ICP-ES	Current
D7202	2022	Beryllium by Extraction and Optical Fluorescence (air samples and surface wipes)	Current
D7439	2021	Metals and Metalloids by ICP-MS	Current
D7458	2021	Beryllium in Soil and Sediment by Extraction and Optical Fluorescence	Current

D4185 is mentioned for completeness but is not sufficiently sensitive for most beryllium measurements. D7202 and D7458 offer the greatest sensitivity but are also beryllium-specific, so they are not typically used by commercial laboratories.

Research is ongoing that hopefully can be shared at the BHSC Symposium later this year.



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Other Pertinent ASTM Standards

Designation	Year	Short Title	Status
D6062	2019	Guide for Personal Samplers of Health-Related Aerosol Fractions	Being reviewed for updates
D7707	2021	Specification for Wipe Sampling Materials for Beryllium	Current
D8299	2019	Guide for Using Metal Ratios in Soils to Distinguish Between Anthropogenic and Natural Beryllium	Due for review
D8358	2021	Assessment and Inclusion of Wall Deposits for Single-Stage Samplers for Airborne Particulate Matter	Current

D8299 is under jurisdiction of D18.01, Surface and Subsurface Investigation. Others listed are under the jurisdiction of D22.04.



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International Organization for Standardization (ISO)

- Standards are developed by technical committees (n~250) based on subject matter; these are divided into subcommittees similar to ASTM
 - Individual experts participate, but voting is at the national level
- ISO/TC 146, Air Quality (analogous to ASTM D22)
 - ISO/TC 146/SC 2, Workplace atmospheres (analogous to D22.04)
 - SC 2 is further divided into nine working groups
 - WG 2, Inorganic particulate matter, is most pertinent to beryllium sampling/analysis



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ISO Standards for Workplace Sampling/Preparation/Analysis

Designation	Year	TC/SC/WG	Short Title	Status
ISO 7708	1995	TC 146/SC 2/WG 1	Particle size fraction definitions	See separate slide
ISO 15202-1	2020	TC 146/SC 2/WG 2	Metals and metalloids by ICP-ES: Sampling	Current
ISO 15202-2	2020	TC 146/SC 2/WG 2	Metals and metalloids by ICP-ES: Sample preparation	WG discussing potential revisions
ISO 15202-3	2004	TC 146/SC 2/WG 2	Metals and metalloids by ICP-ES: Analysis	WG discussing updates (example: newer nebulizer technologies)
ISO 30011	2010	TC 146/SC 2/WG 2	Metals and metalloids by ICP-MS	Revision in progress; publication by late summer 2025
ISO/WD 13977-1	N/A	TC 146/SC 2/WG 8	Framework for assessment of dermal exposure	Working draft (publication in early 2026)



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ISO 7708:1995

- ISO/TC 146/SC 2/WG 1
- Defines particle size conventions (inhalable, respirable, thoracic)
- ACGIH® TLV® for beryllium is based on inhalable fraction
 - OSHA Be regulation and (current) 10 CFR 850 based on “total” beryllium
- European Standard EN 481:1993
 - Currently EN 481 and ISO 7708 are largely harmonized
 - CEN (Committee for European Normalization) discussing updates to EN 481, mainly to include conventions for calm air (below 1 m/s)
 - Reference: Analytical Performance Criteria: The Need for an International Sampling Convention for Inhalable Dust in Calm Air, Liden and Harper, JOEH, October 2006, pp. D94-D101 (K. Ashley, Ed.)
 - Due to conflicting rules between CEN and ISO, EN 481 may get updated while ISO 7708 does not get updated



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Fusion Standards

- No activity in ASTM currently
- ISO/TC 85, Nuclear energy, nuclear technologies, and radiological protection
 - ISO/TC 85/SC 6, Reactor technology
 - ISO/TC 85/SC 6/ WG 2, Research, test and isotope-production reactors
- Current fusion-related activity in WG 2:
 - Proposals largely being brought forward by China
 - Items in progress:
 - ISO 19991, "Reactor technology — Experimental magnetic confinement fusion reactor — Supersonic molecular beam injection fueling technique for nuclear fusion devices", being drafted
 - New work item proposal being balloted for "Reactor technology — Magnetic confinement fusion — Test methods for low temperature mechanical properties of electrical insulation materials of superconducting devices"
 - Others have been proposed but are not being discussed currently
 - I am corresponding with Fusion Industry Association on WG 2 fusion-related activities
 - If you have interest, let me know



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Conclusion

- Participation in standards development activities:
 - Ensures standards are useful
 - Ensures we don't get standards imposed on us by others
 - Is therefore in our interest
- Questions? Comments?



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Cleaning Media for Decontamination of Equipment & Structures
J. DOSHI et al. (eSpin Technologies Inc., Tennessee, USA)

Cleaning Media for Decontamination of Equipment & Structures

Jayesh DOSHI, Sam WALL, Meg MURALI, and Joe CARIGNAN

eSpin Technologies Inc., Chattanooga, Tennessee, USA

eSpin Technologies Inc., under U.S. DOE (Department of Energy) contract, has successfully developed and executed a feasibility demonstration of a novel category of high-performance decontamination wipes, designed to efficiently remove radiological and hazardous contamination and minimize exposure risks.

The technology notably demonstrated superior decontamination efficacy compared to the wipes currently utilized by Deactivation & Decommissioning (D&D) contractors. The presentation will discuss the technology, cleaning efficiency, and potential uses of technology.

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Cleaning Media for Decontamination of Equipment and Structures

Jayesh Doshi (PI)
Sam Wall
Meg Murali
Joe Carignan
eSpin Technologies, Inc.

April 23, 2024

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Report Outline



1. Introduction to eSpin
2. Project overview
3. Project progress
4. Next Steps
5. Summary
6. Acknowledgments

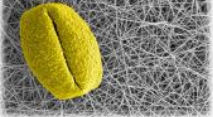
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Company Overview – eSpin Technologies

- Leading industrial scale producer of high-quality nanofiber and nanofiber-based products.
- Production facility 67,000 ft²
- ISO 9001-2015 certified
- US DOD supplier



KEY CAPABILITIES

- Nanofiber Production
- Lamination
- Slitting
- Calendering
- Pleating
- Polymer Synthesis
- Testing & Characterization

PRODUCTS

- Filter media
- Ion Exchange Membranes
- Air Filters
- Detection swipes
- Decontamination wipes



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Problem

- Decontamination major issue (\$\$\$)
- Numerous contaminants are found during the D&D and Weapons part production processes
 - Radiological (Uranium, Plutonium, Cobalt-60, Cesium, Trillium, etc.).
 - Non-radiological (Beryllium, PCB, asbestos, oils, resins, hazardous chemicals, lead in paint, etc.)

Nuclear power plants

- Nuclear explosion
- Nuclear tests & reactors
- Nuclear metal processing
- Radio-active waste
- Radio-isotopes
- Weapons Production
- Hospitals, Electronics manufacturing plants

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Contamination Types, Engineering Controls, and Contamination Monitoring



- Radioactive contamination Type
 - Fixed
 - Removable, loose, Air Borne
 - Solid, Liquid, Aerosol
- Contaminated surfaces (Smooth/Porous)
 - Equipment, structures, tools
 - Piping, electrical switchgears, conduits
 - Wall, floor, door
 - Lab bench, fume hoods
 - Metal, wood, plastics, other surfaces

SURFACE CONTAMINATION

↓

LOOSE CONTAMINATION AIR BORNE CONTAMINATION FIXED CONTAMINATION



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Project Overview



- Develop and manufacture a new class of decontamination wipes
- Develop novel ion exchange polymer(s)
- Produce ion exchange nanofiber using five novel polymers
- The technology will bring to the market robust and cost-effective cleaning media and minimize or eliminate nuclear contaminants encountered during decontamination and demolition (D&D) process.

Current TRL 3 7 Month Phase I Phase I TRL 4 24 Month Phase II Phase II TRL 7

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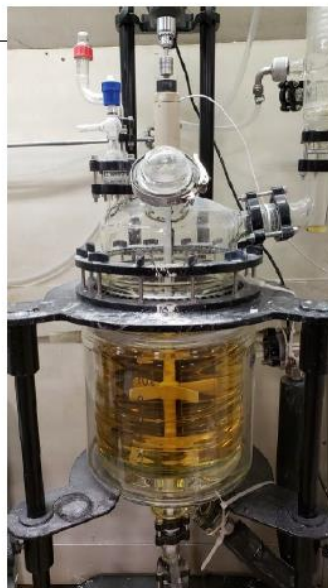
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Polymer Synthesis

- Develop ion exchange polymer(s)
- Produce repetitive 4 batches, each 200 gm
- Characterize polymers
 - MW~ 70,000
 - IEC >2.0
 - Ion conductivity > 0.15 S/cm
 - Soluble in water, alcohol



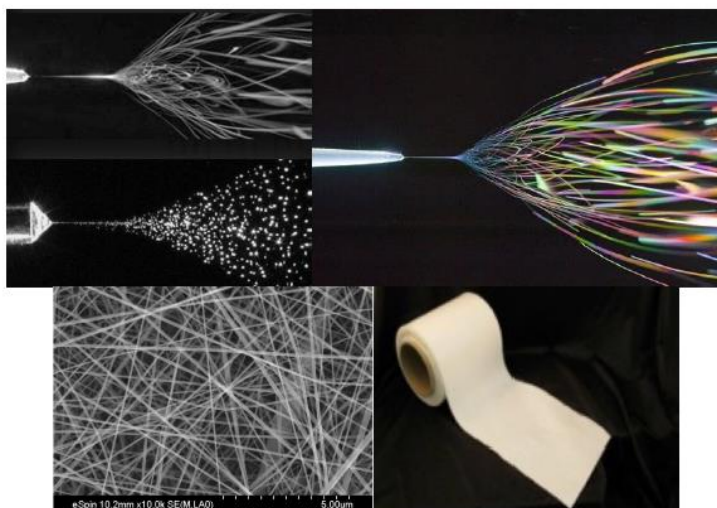
eSpin Technologies, Inc.

Topic ID: C55-24b

2



Fiber Spinning

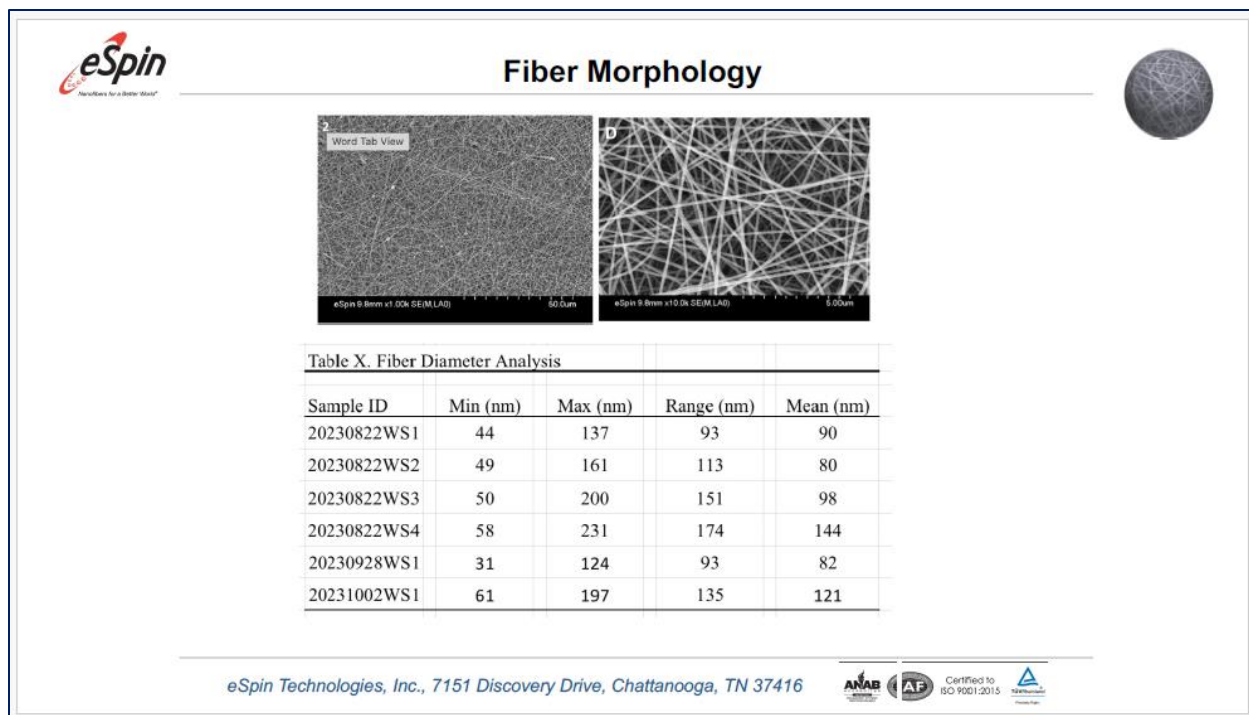


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Wipe Sample preparation



- Nanofiber production Roll
- Postproduction of Roll
 - Die cutting
 - Sample testing




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Wipe Sample Characterization

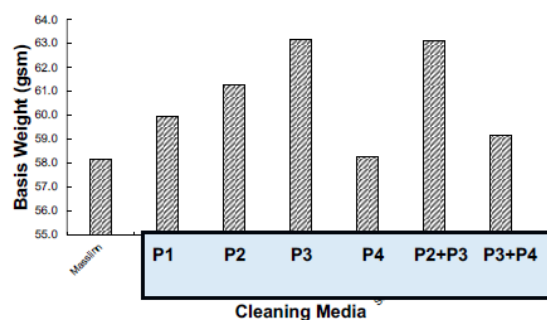
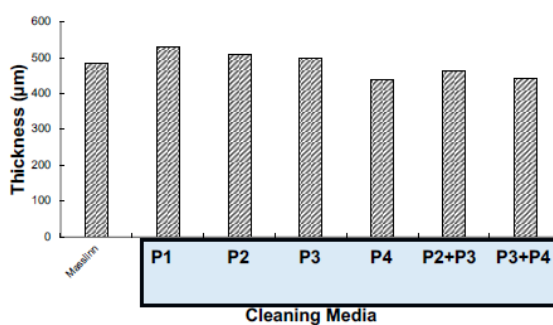


- Weight and thickness
- Water uptake, wicking, dry time
- Tensile strength, Youngs modulus
- Abrasion, Porosity, Pore size
- Sample testing in house
- Sample testing MCL Lab, Oak Ridge, TN

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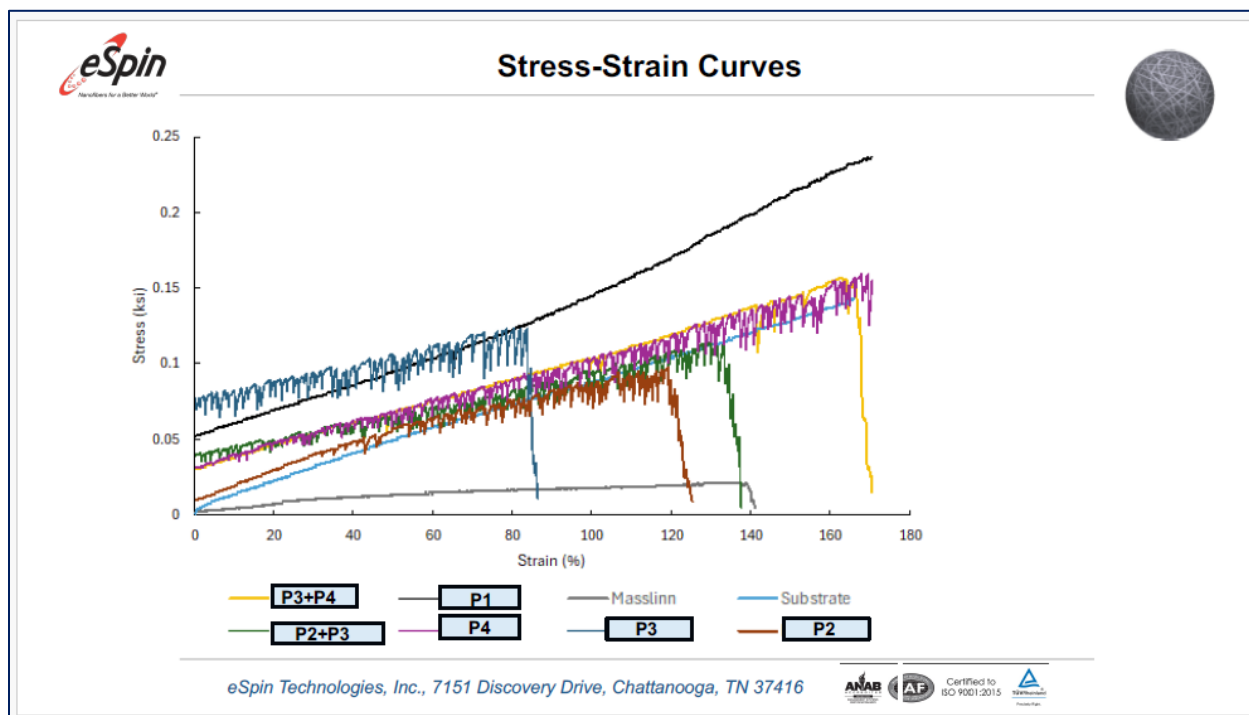
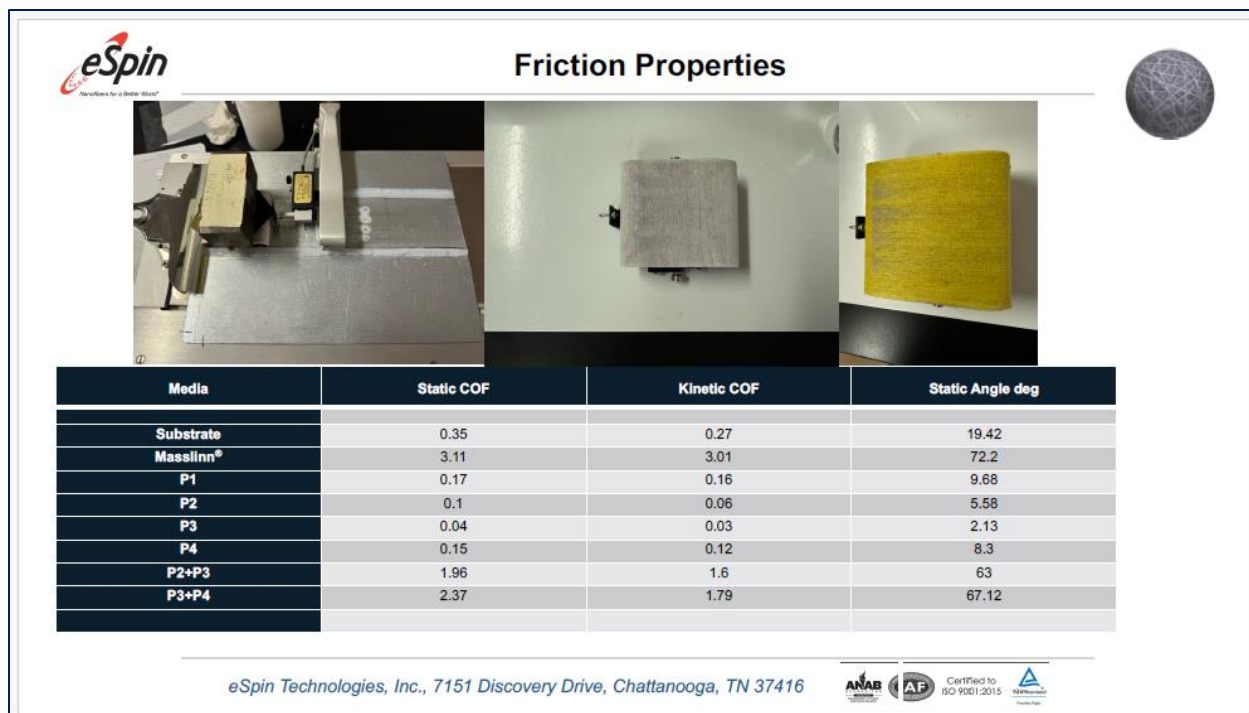


Thickness and Basis Weight



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Tensile Properties

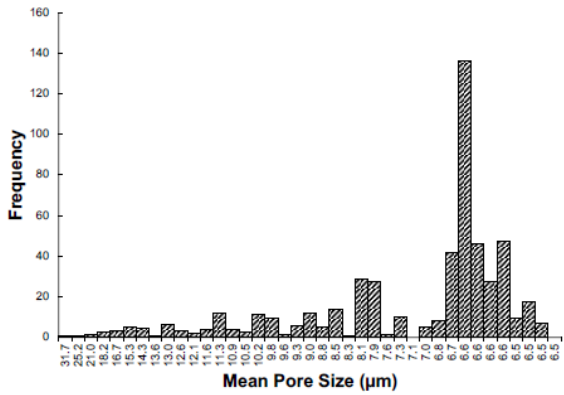
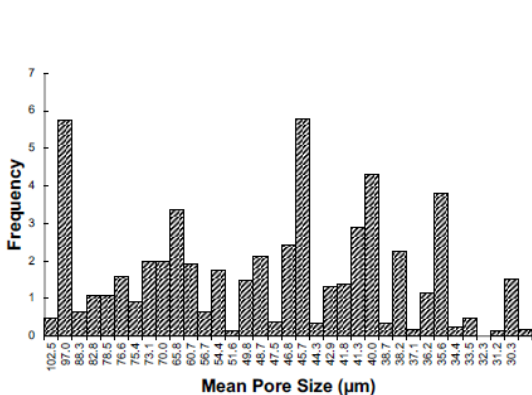


Cleaning Media	UTS (PSI)	Strain-at-failure (%)	Modulus (PSI)
Masslinn	20	274.8	7.28
Substrate	162	200.4	80.85
P1	61	118.1	51.65
P3	124	80.5	154
P4	164	178.2	92
P2+P3	114	133.1	85.6
P3+P4	98	87.2	112.4

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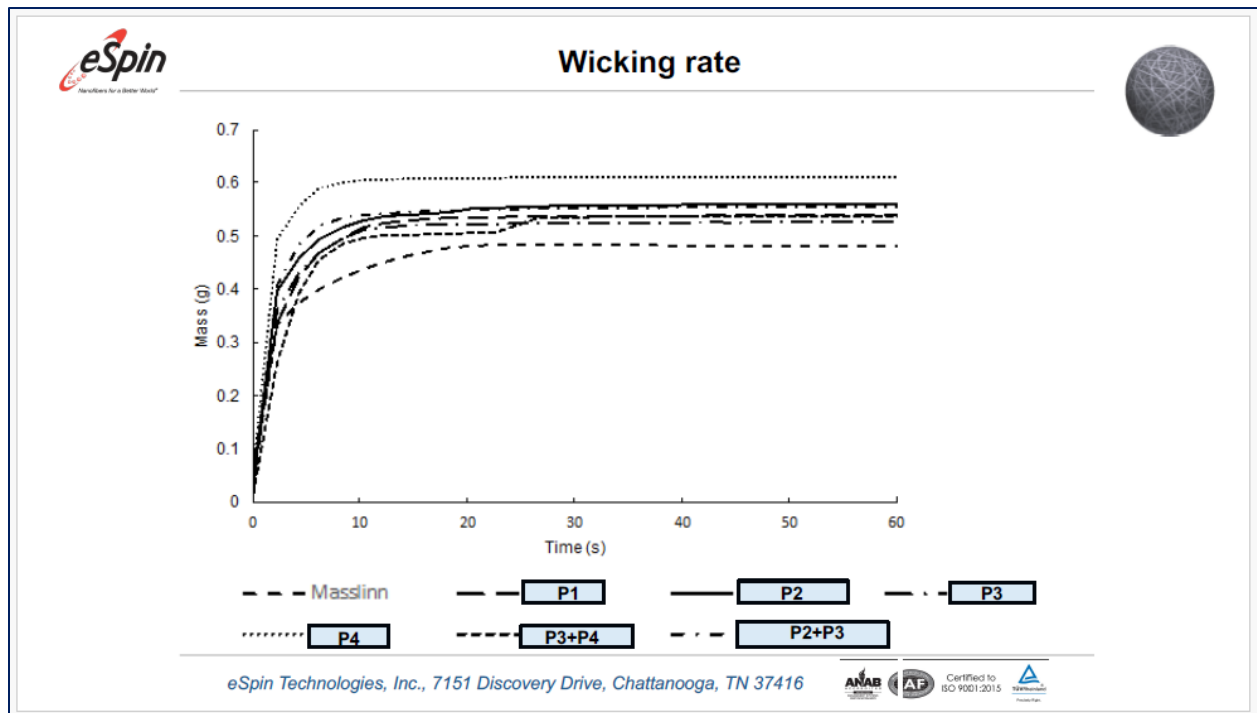


Pore size distribution: Masslinn® Wipe vs nanofiber wipe



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eSpin
Handles for a Better World™

Wipe Test protocol

Prepare suspension with:
TiO₂ nanoparticles and IPA (10 wt%)
Contaminate steel surface with:
Place suspension at 20 locations (Fig 2)
Evaporate alcohol @75°C to obtain solids
Solid particles suspension (9 mg)
100% dry suspension removal by wipe = (100% wipe efficiency)
Weigh clean wipe and attach to cart (Fig 3)
Add 1000 gm wt on Cart (to simulate constant wipe pressure)-Fig 4
Wipe at constant speed and distance
Weigh contaminated wipe (Fig 6)
Determine **1st pass** efficiency
Repeat test for 2nd pass wiping with new test sample
Wipe (2nd pass)
Weigh & Determine **2nd pass** efficiency

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Project Overview – Results: Test Protocol Photographs



Fig 1. Instrument setup



Fig 2. Dried nanoparticles on steel surface



Fig 3. Clean weighed wipe attached to cart

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Project Overview – Results: Test Protocol Photographs

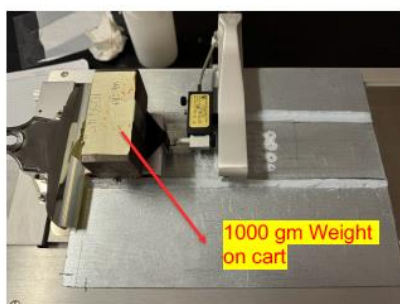


Fig 4. 1000 g, weight on cart-ready to start test



Fig 5. Dirty test wipe with contamination on cart



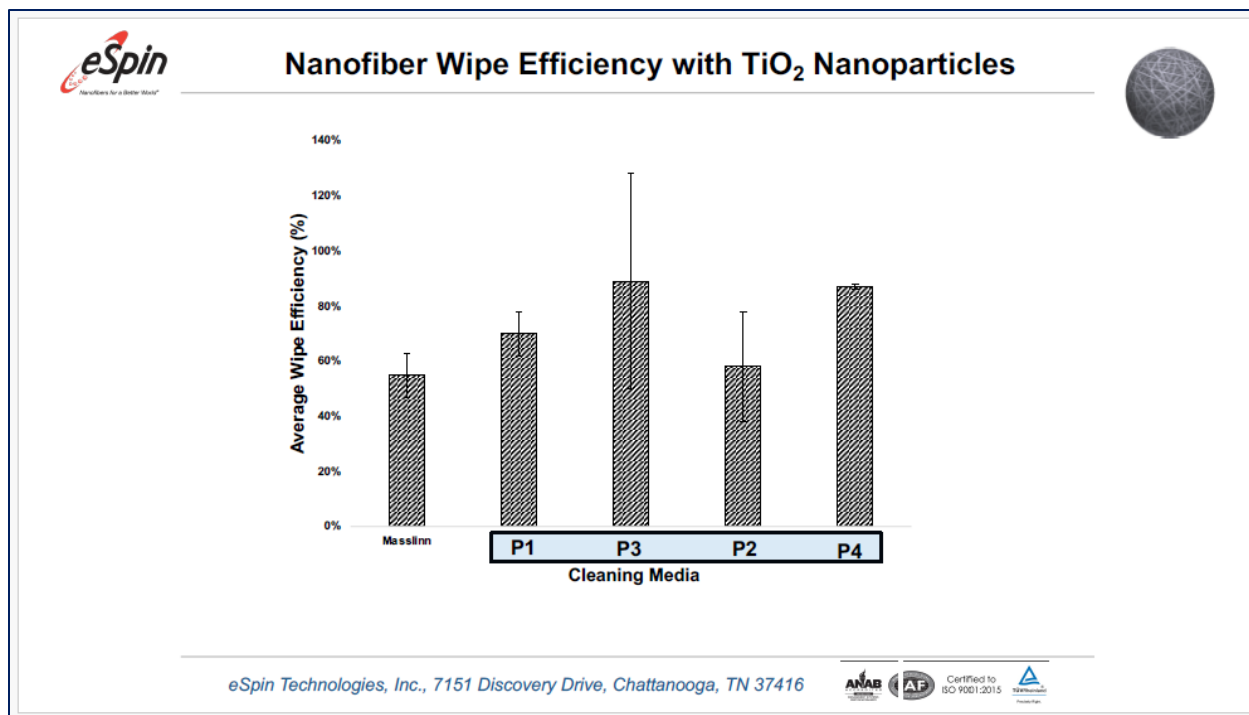
Fig 6. Dirty test wipe with contamination

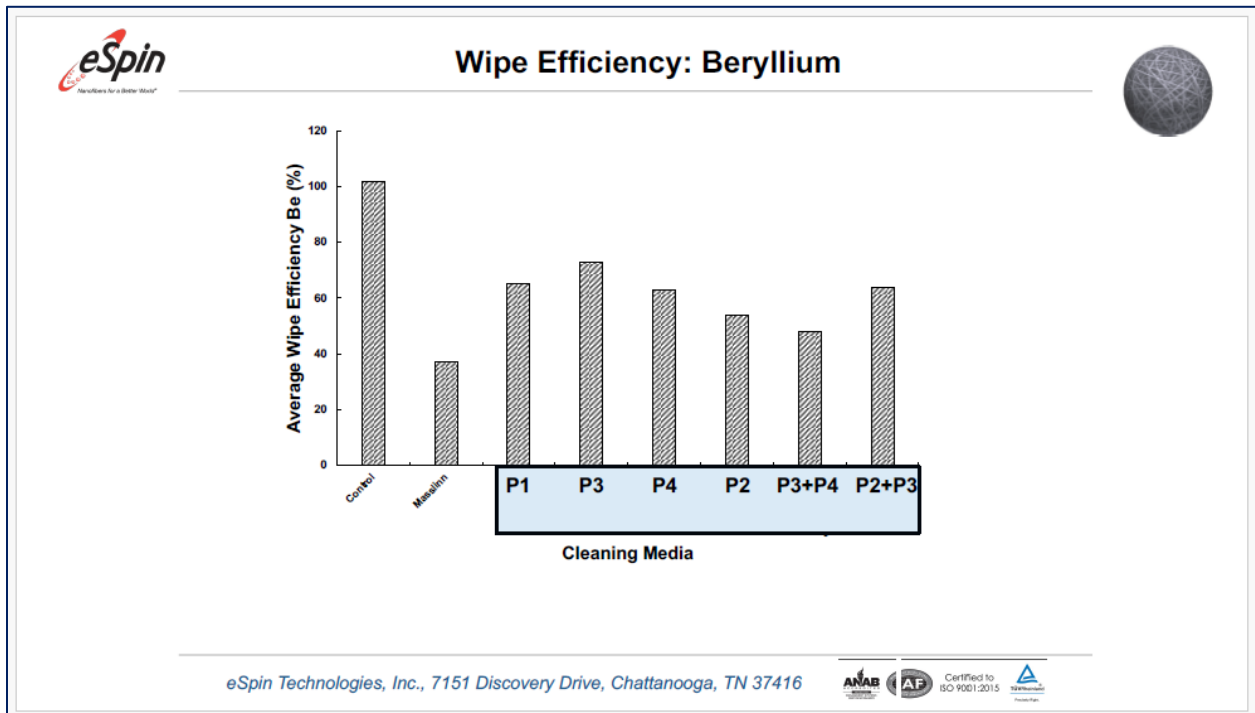
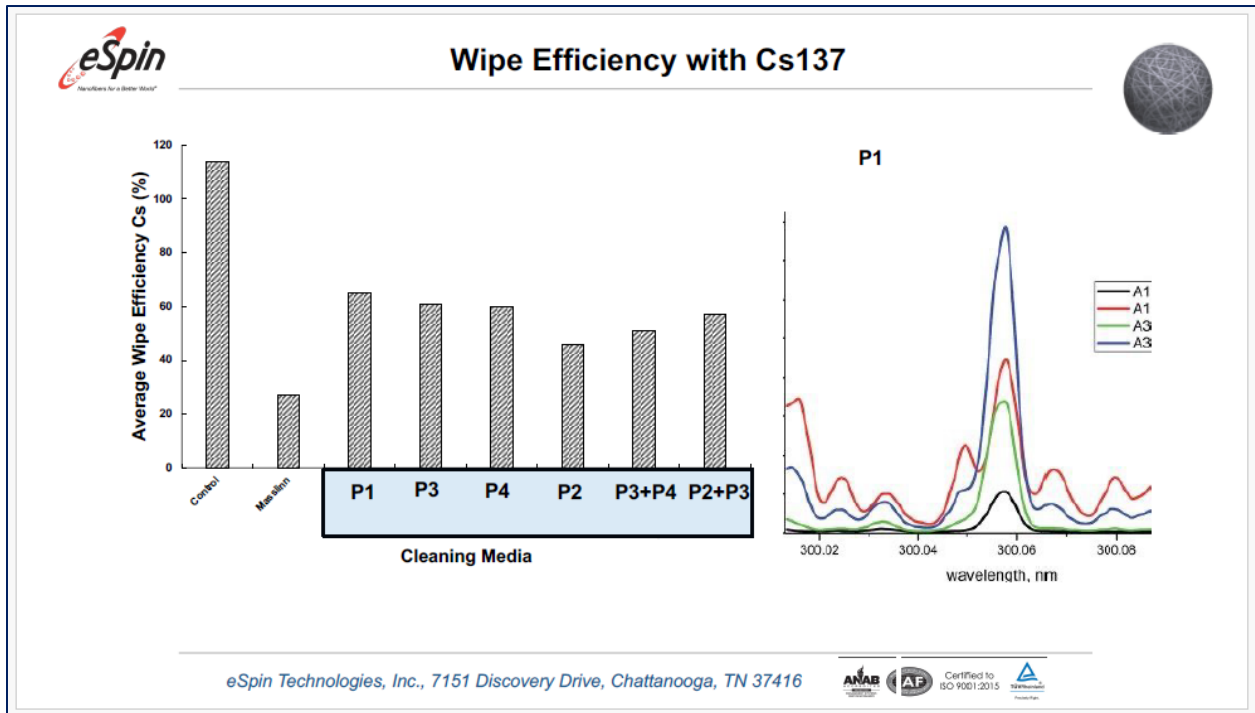
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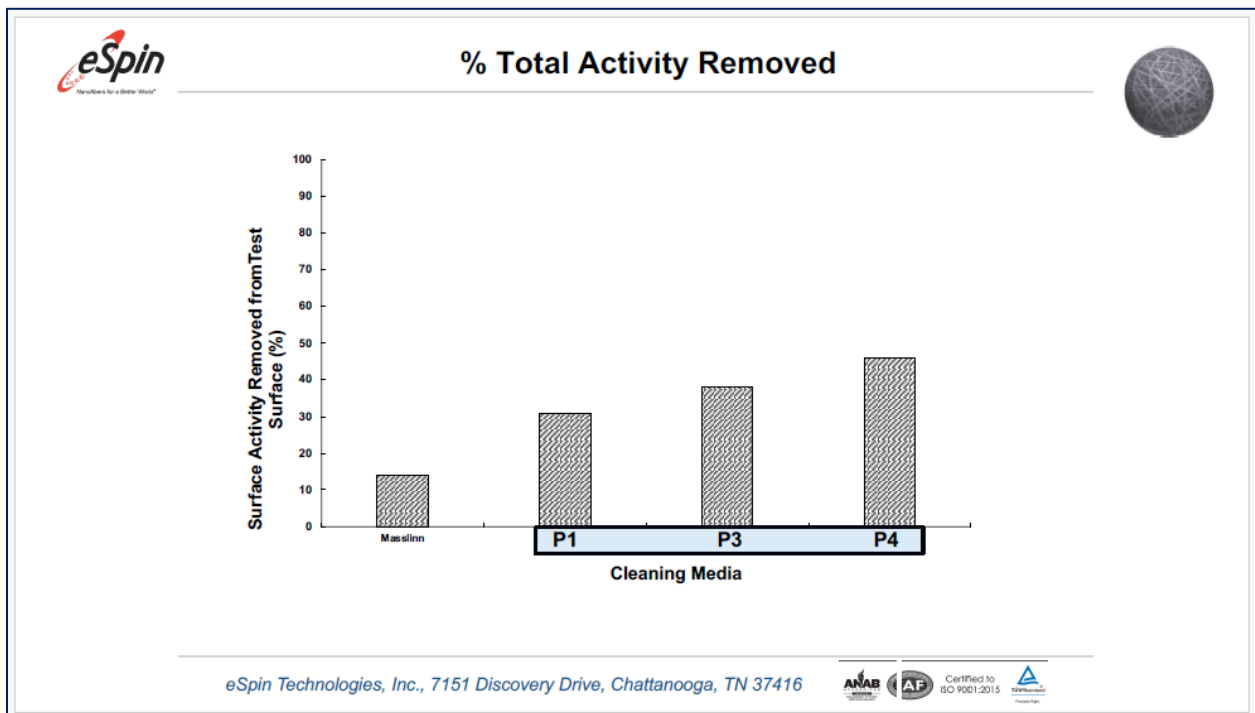
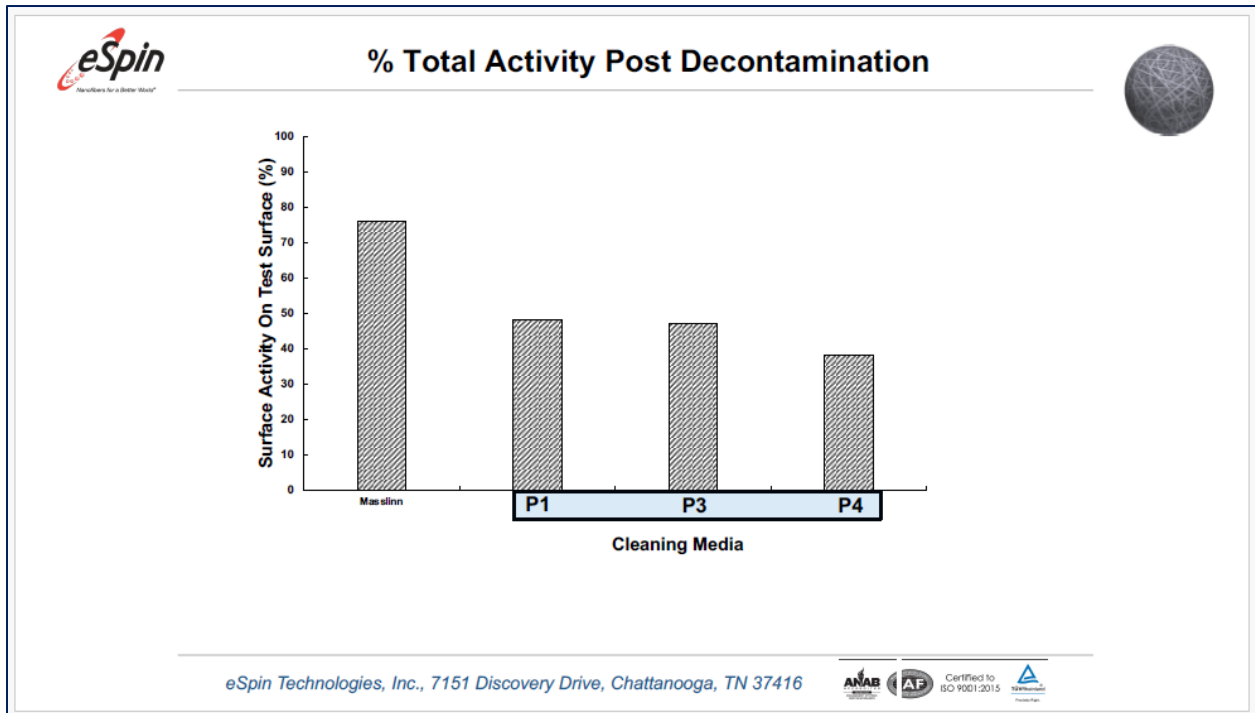


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	Decontamination Factor		
Cleaning Media Type	Decontamination Factor		
P1	2.17		
P3	2.18		
P4	2.65		
Masslinn®	1.37		

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	Why Nanofiber Wipes – Attributes		
Features	Benefits	• High submicron-particle capture efficiency • High volumetric capacity to retain liquid • Fast absorption kinetics • Particle retention • Works with nitric acid and other chemistries • Can be bio-compostable/Green • Non tacky, leaves no residues, cleans to non-detect level • Reduced cleaning cycle, less waste • Cost efficient • <u>Multiple products</u> for Nuclear world • Wipes, Swipes/Swabs • HEPA Filters • Protective clothing • Containment Packaging	

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Summary



- Ion exchange nanofiber wipes are found to be:
 - Mechanically strong
 - Effective on steel surface
 - Effective in removal of small particles
 - High particle capture and retention efficiency
- Nanofiber were found to not delaminate or fracture
- We are interested collaborating with interested parties for field testing of wipes

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Acknowledgments



Department of Energy-Environmental Management
Mr. Mike McDougall, Eberline Analytical
Mr. Barry Stephenson, Materials and Chemistry Laboratories

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Day 2: Beryllium H&S: New Be Facility Construction, Old Be Facility Demolition, and Be Materials in Fusion Research

Challenges of Building a New Beryllium Facility

B. WALKER (Safer Environment Ltd., England, UK) et al.

Challenges of Building a New Beryllium Facility: The Wins from Challenges Faced when Creating a Facility Specifically Designed to Manufacture Beryllium Parts with Safety of the Staff at the Core

Beth WALKER¹, Lee CROSS², and Jayrajsinh JADEJA²

¹*Safer Environment Ltd., Burtle, England, United Kingdom*

²*Novanta Technologies UK Ltd., Taunton, England, United Kingdom*

Three years ago, Novanta Technologies UK Ltd. decided to move to a new facility in Taunton, England. This presentation will give an overview of that facility, including an update on the challenges faced and successes achieved in the design and construction of this state-of-the-art beryllium manufacturing facility.

This new facility is a bespoke building that was designed with beryllium safety at the core, safety of the staff, the wider environment, and the customer. Novanta is now shortlisted for a Safety and Health Excellence award in the manufacturing category, due to safety being so intrinsic to the design of the building.

Designing and building such a complex facility came with many challenges, world firsts, and specifically designed equipment. This presentation gives a broad overview of the considerations made when dealing with these challenges, the standards we have set for the building to become operational, and the progress the building has made since opening 2 years ago.

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URL: <https://novantaphotonics.com/>

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Challenges of Building a New Beryllium Facility

BHSC 2024 Spring Meeting

B Walker, L Cross, J Jadeja

In 2020, we took receipt of 4 warehousing units, ready to be converted to a Beryllium manufacturing facility.
This was a challenging but rewarding project from the outset.



Background

Choosing the right land

- Novanta was based in a 1950's Asbestos 'Northern lights' building that had not undergone major refurbishment for nearly 30 years and the decision was made to build a new, state of the art facility, designed specifically around staff, stakeholder and local environment safety.
- The building chosen was in a sensitive area that required extensive habitation, flooding and ground contamination assessment.
- A permit was required from the Environment Agency.
- The local Highways Agency and Water Company also had to issue permits.

Old Building



3



Airflow

Airflow

- The air flow moves from a positive pressure in the clean room, where the finished product is handled. (+10 pascals)
- To full negative pressure in the beryllium facility (-20 pascals)
- Moderate risk, controlled, but non-respirator areas are between -5 to -15 dependent on risk



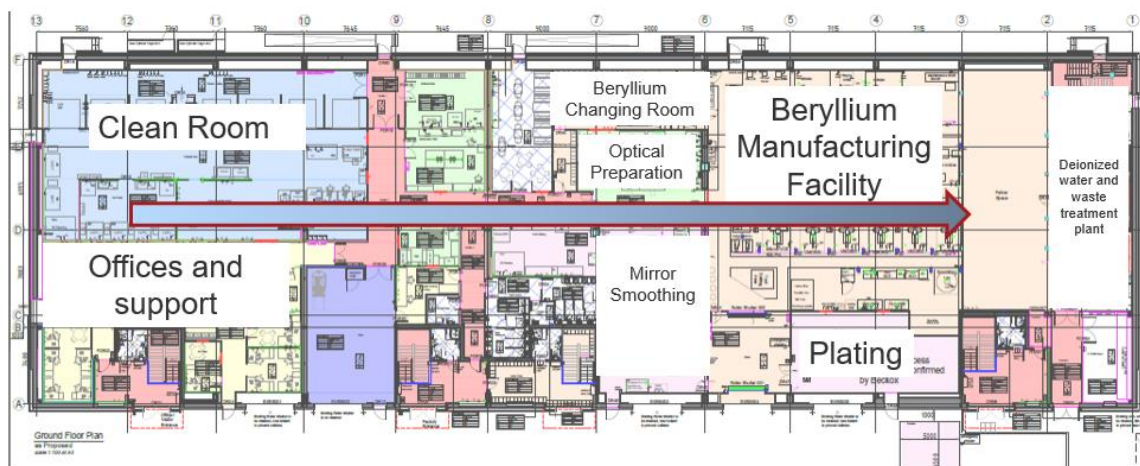
Challenges

- The air flow was designed to work using pascals, a measure of pressure.
- This meant establishing the Air changes per hour(ACH) was difficult.
- Testing shows that it is between 8-10 ACH
- The amount of air ingress was adjusted to maintain both Pascals and ACH

4



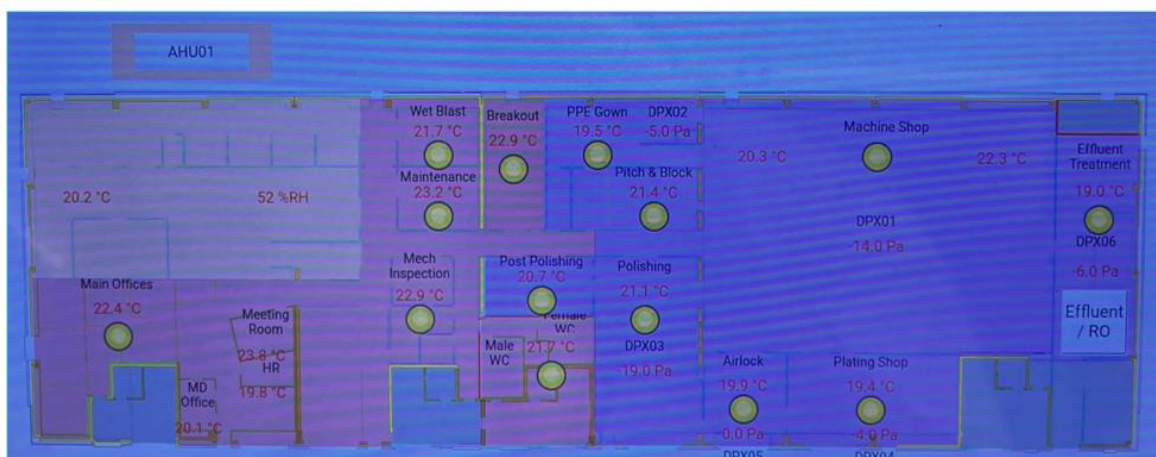
Air flow and layout



5



Humidity, temperature, and pressure control



6



Safe air

HEPA Bank for extracted air



Air conditioning for incoming air, including Humidity, purity and flow



7

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Acid scrubber

- The plating facility, whilst not expected to produce a vast amount of Beryllium risk, did come with its own challenges and the air had to be safe.
- All contaminants are removed through a bespoke designed system.

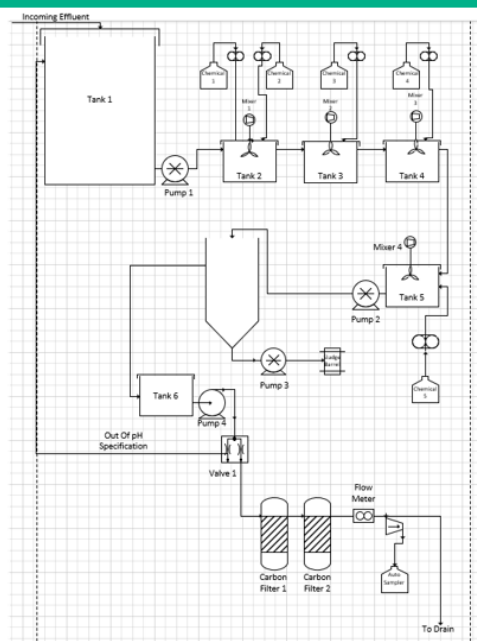


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Water treatment

- The water treatment was especially important, as the effluent discharge is heavily controlled by the Environment Agency and Water Company Permits.
- There are strict tolerances that we must adhere to.
- The water treatment facility was state of the art, never been used before for such a process.
- It uses a mixture of Chemistry and a centrifuge to eliminate coagulated solids.
- This came with challenges!



9

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Challenges of Building on 'The Somerset Levels'

- We were determined that the new facility remain in the local area, to maintain the wealth of knowledge already employed.
- This meant we had to ensure the facility would not be compromised in the event of a flood.



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Flood protection

- The carpark was given a camber that allowed a 15,000-liter capacity.
- Penstocks prevent water leaving the facility, or water from inside, mixing with flood water.
- Floodgates are used around the building to prevent water ingress to the building.
- There is a 350,000 liter, slow release tank under the car park.

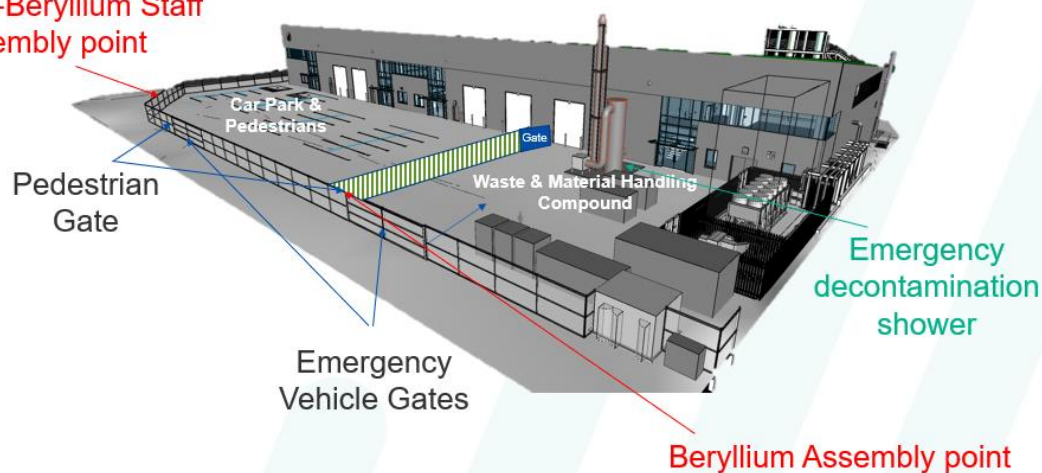


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Emergency response

Non-Beryllium Staff
Assembly point



12

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Clean room



The decision was taken to build an ISO 8 clean room, despite the requirement being much lower, as this meant the staff had an extra degree of protection wearing full suits.

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Beryllium to non-Beryllium communication

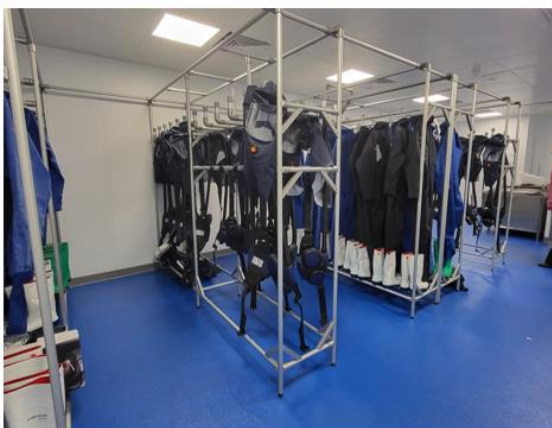


- Direct coms into the room with a large viewing area, so it is easy to communicate, This was always an issue previously.
- Large, extracted, transfer hatches, for safe handover from Be room after clean, and ability to pass paperwork safely to staff if needed (mostly paper free)
- Full intercom and tannoy system for communication and emergency

14



PPE and RPE storage



- Over the years of storing and using RPE and PPE, we discovered that the environment had to be dry, warm and have a permanent air flow.
- This prevents the RPE corroding and the keeps the PPE hygienic.
- There is plenty of space between racks for airflow.
- Particular attention was paid to how the RPE would be hung from the racks to ensure residual liquid did not pool inside, but would be able to dry off naturally

15



Decontamination

- The first stage is a pre wash.
- This is head to toe.
- There is a mix of soap and water mixing at the brush.
- This stage is completed as many times as required.



16



Decontamination

- There is then a high-pressure rinse stage.
- This is followed by a drying stage.
- This uses a new technique called an 'air knife'



17

 Novanta

Decontamination

- Once the 3 stage decontamination is completed, staff use the extracted and temperature controlled drying room to remove PPE.



18

 Novanta

Compliance with the Carcinogen and Mutagen Directive 2004/37/EC



We wanted to ensure that only those who needed entry to the controlled area were allowed access.

This is controlled by access control key cards, with rigorous training being the only way to allow access being added to the individual keys.

CCTV is used throughout to allow external auditing and compliance monitoring.

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Storage of Beryllium



- To protect the Beryllium from corrosion, and to protect staff from Beryllium that may have been damaged in transit.
- Beryllium is taken to the facility and stored in special cupboard with hepa filtered air flow

20



Health and Safety Training facility



21



Arrival of Equipment

- Equipment arriving to site from the old facility had to be dealt with very carefully.
- After undergoing a full decontamination clean, it was wrapped in 1000-gauge polythene, transported with a specialist company and moved into the facility.
- Only when all equipment was in place was the facility turned on and the items unwrapped carefully. This was done under strict suppression conditions.



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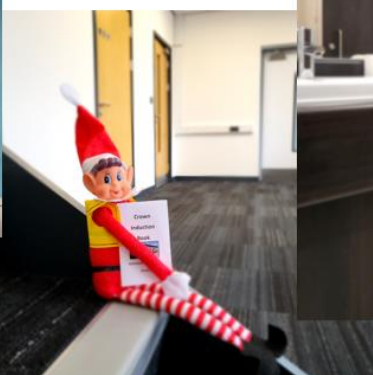


Staff Engagement



We held Open days, sent updates of construction and 'sneak peaks' using our elf and safety expert!

One of the most unexpected challenges was staff engagement



23

 Novanta

Being recognised as a contribution to UK Health and Safety

- Now the facility is up and running, it can demonstrate the commitment to worker protection and Health & Safety.
- This was recognized at the UK Excellence in Health and Safety Awards earlier this year.



24

 Novanta



Thank you

Beth Walker MSc Nebosh DIP CMIOSH
Health, Safety and Environment Consultant
+44 (0) 7715280216
saferenvironmentltd.com
MD, Safer Environment Ltd



Safe Demolition of a Beryllium-Contaminated Legacy Test Reactor
V. HOLDEN (UCOR LLC, Tennessee, USA)

Safe Demolition of a Beryllium-Contaminated Legacy Test Reactor

Vern HOLDEN

UCOR LLC, Oak Ridge, Tennessee, USA

Deactivation and demolition of legacy nuclear reactors may potentially expose workers and the public to hazardous substances such as asbestos, beryllium, lead, crystalline silica, and various radioactive isotopes. Deactivation and demolition of U.S. Department of Energy (DOE) facilities must comply with all applicable federal regulations including those in Title 10 Code of Federal Regulations Part 850 Chronic Beryllium Disease Prevention Program.

Beryllium is present in neutron reflectors and moderators in three generations of DOE thermal reactors and in nuclear weapons components. Process knowledge indicates that beryllium is a constituent of fuel rods. De-cladding and dissolution of fuel elements may have resulted in generation of airborne beryllium oxide, dust, fume, or mist. Potential beryllium sources also include fuel improvement experiments, laboratories, maintenance shops and maintenance activities in various facilities and in support buildings from storage of beryllium containing materials and use of non-sparking beryllium alloy tools.

Diligent facility assessment includes targeting early beryllium characterization when beryllium is a potential contaminant based on process knowledge, legacy information, empirical sampling results and/or visual inspection. If beryllium surface contamination is found, then the primary goal is to remediate, remove, decontaminate and down-post Beryllium Controlled Areas and Beryllium Regulated Areas. If excessive removable surface contamination remains, then the secondary goal is fixative application to prevent airborne dispersion of beryllium particulates. Post remediation verification sampling is performed to evaluate the effectiveness of decontamination efforts and fixative application. If airborne OELs for beryllium are exceeded or if excessive removable surface beryllium contamination remains in area(s) in a facility prior to demolition, then applicable beryllium controls are implemented.

Deactivation and demolition are extremely intrusive work activities. Field execution of classic hazard controls is integral to the ability of those operations to ensure protection of workers and the public from chemical and physical airborne contaminants during demolition. This conclusion underscores the importance of source identification and control of beryllium contamination in work site preparation prior to mobilization.

Mr. Vern HOLDEN, CIH CSP ARM
UCOR LLC

EMAIL: vernard.holden@orcc.doe.gov

Project Overview Video URL: https://www.youtube.com/watch?v=Dq2fmJ_abPk

URL: <https://ucor.com/>

Safe Demolition of a Beryllium Contaminated Legacy Test Reactor



BHSC
April 24, 2024
Oak Ridge, TN

Vern Holden, CIH, CSP, ARM
Industrial Hygienist / CBDPP TE
UCOR LLC



■ UCOR Overview



- United Cleanup of Oak Ridge (UCOR) is the new iteration of UCOR LLC, a partnership with Amentum, Jacobs, and Honeywell.
- Cleanup of contaminated excess facilities, maintenance of those awaiting disposition, and upgrading still active aging facilities.

■ ORREC at Oak Ridge National Laboratory (ORNL)

- DOE's Oak Ridge Office of Environmental Management (OREM) has laid out its course for cleanup in 2024, setting the stage for a busy year of projects including demolitions, construction and addressing inventories of nuclear waste stored at the site.
- As in years past, OREM is focused on safely deactivating and removing excess contaminated facilities across the Oak Ridge Reservation, thereby eliminating risks and opening land for reuse to support expanding research and national security missions.
- Several old deactivated thermal reactors at ORNL have been or are in the process of removal:
 - Bulk Shielding Reactor
 - Low Intensity Test Reactor
 - Oak Ridge Research Reactor
 - Experimental Gas Cooled Reactor
 - Homogeneous Reactor Experiment

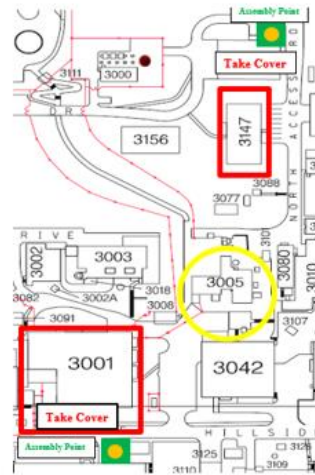
PAGE 3

■ ORNL OREM Deactivation & Demolition Sites



PAGE 4

Low Intensity Test Reactor – ORNL Bldg 3005



PAGE 5

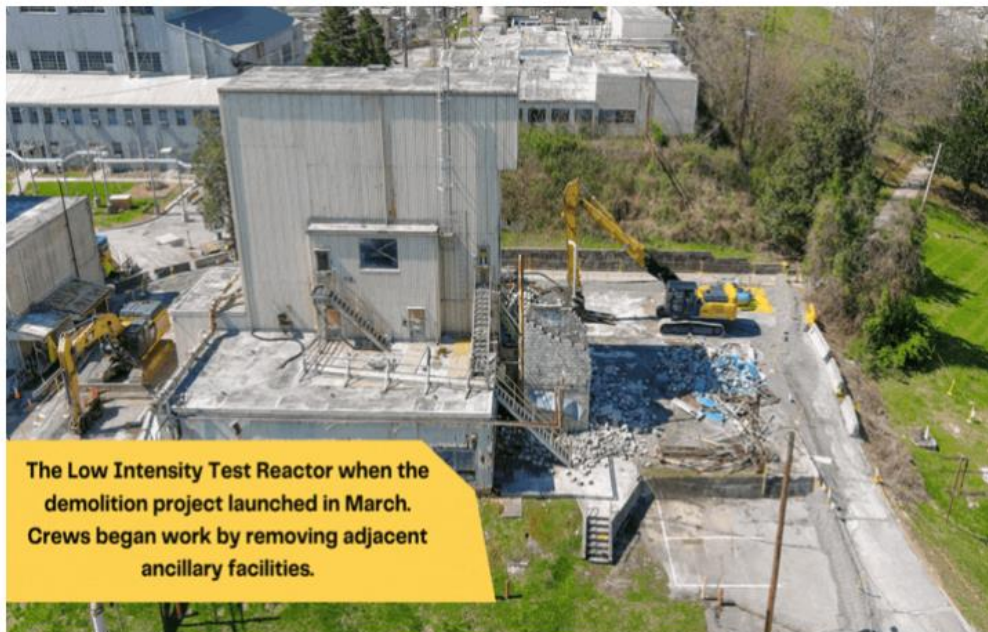
Low Intensity Test Reactor (LITR)



- Started operation in 1951 (as a 500-kW training reactor)
- Reached power generation of 3000-kW as test reactor in 1953
- Water-moderated, water-cooled reactor used enriched uranium as fuel
- 4500 lb. Beryllium neutron reflector
- Shut down in 1968
- Deactivation started – Oct. 2020
- Demolition started - March 22, 2023
- Reactor vessel removed - Sept. 8, 2023
- Reactor packaged in container for staging and waste disposition - Sept. 13, 2023
- Demolition completed - Nov. 2023 except Sub-pile room
- Heavy equipment decontamination completed - January 10, 2024
- Final loadout scheduled April 19, 2024

PAGE 6

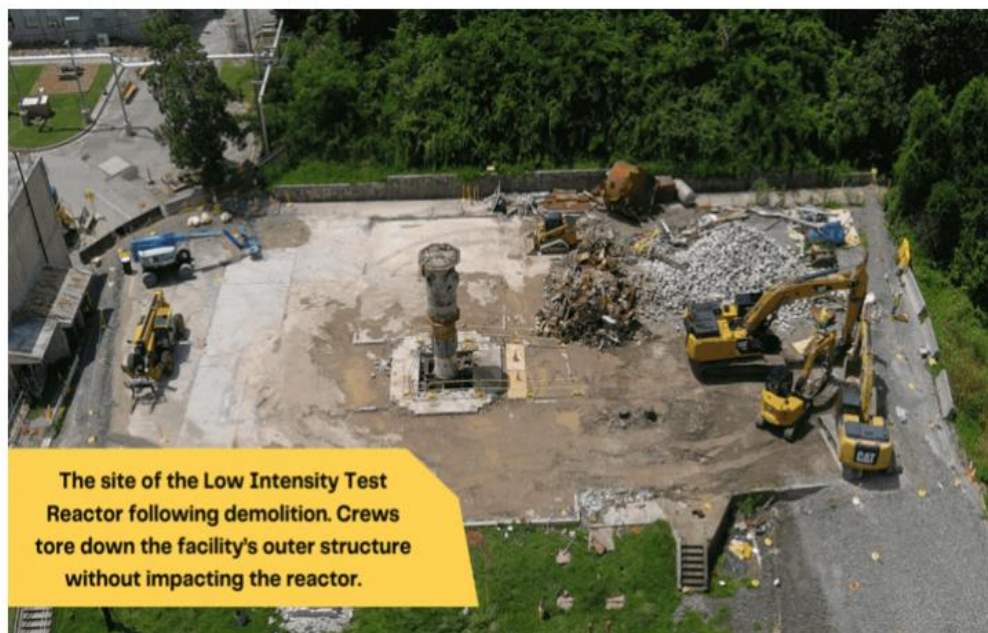
LITR Demolition



The Low Intensity Test Reactor when the demolition project launched in March. Crews began work by removing adjacent ancillary facilities.

PAGE 7

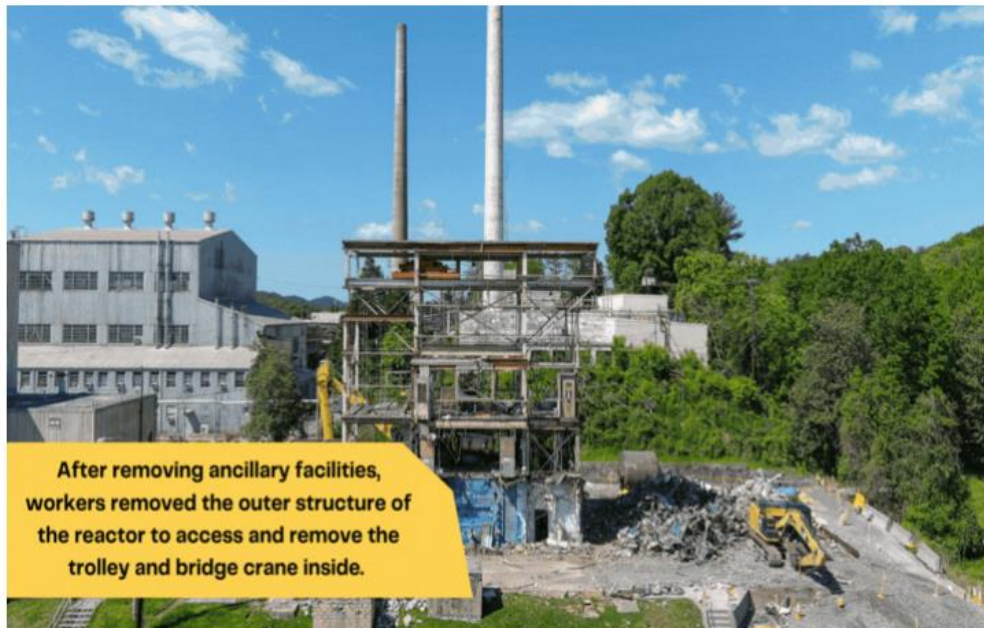
LITR Demolition



The site of the Low Intensity Test Reactor following demolition. Crews tore down the facility's outer structure without impacting the reactor.

PAGE 7

LITR Demolition



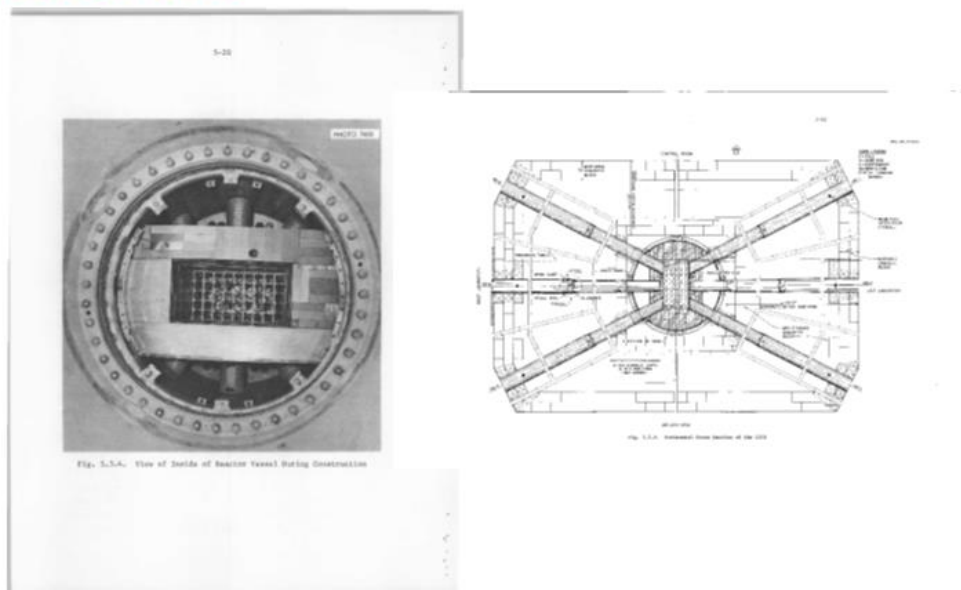
PAGE 7

Reactor Removal



PAGE 8

■ Reactor Core



PAGE 9

■ HAZARD ANALYSIS

- Task – Demolition of legacy test reactor
- Hazards

- **Beryllium**
 - Inhalation, ingestion, and skin contact from Beryllium contaminated surfaces during demolition
- **Other health hazards**
 - Asbestos
 - Respirable silica
 - Lead
 - Heat stress
 - Noise
 - Pressurized liquid from use of hydro-seeder to apply fixative
 - Exhaust gases from heavy equipment
 - Eye and skin contact
- **Radiological**
 - Personnel exposure to external sources of radiation and/or radiological contamination (e.g., inhalation, absorption, skin contact) when working in radiological areas
 - Personnel exposure to dose
- **Safety**
 - Struck-by injuries from flying debris/falling objects
 - Striking energized equipment and/or underground electrical/mechanical utilities
 - Contact with overhead power lines
 - Fall hazards from scaffolds/ portable or platform ladders, aerial lifts
 - Injuries to hands and/or body including cuts, bruises and crushes from pinch points and hand and portable power tool use
 - Fire hazards when refueling equipment

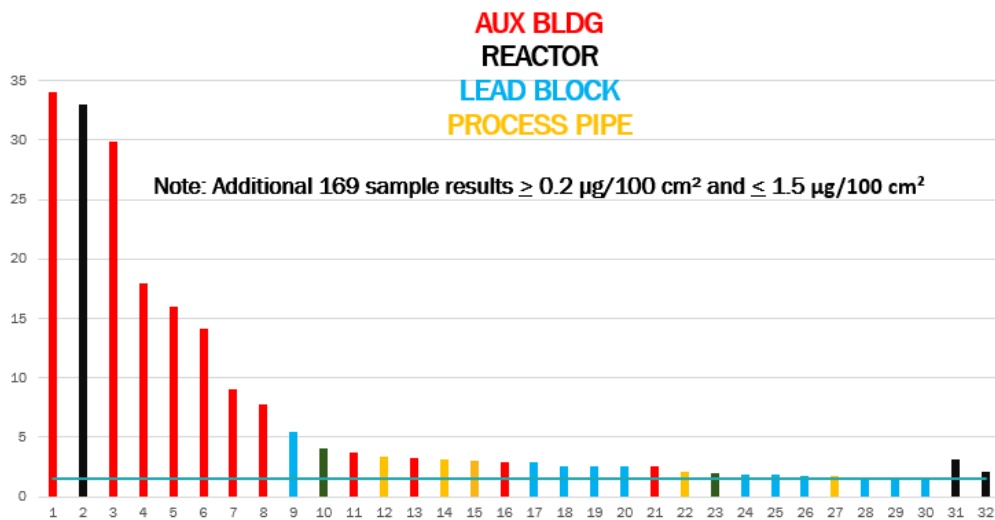
PAGE 10

Beryllium Contamination

- Neutron reflector - LITR reactor core
- Lead shielding blocks - exterior reactor vessel
- Demineralized water tanks
- Seal tank
- Tunnel to control room

PAGE 11

Beryllium Surface Concentrations ($\mu\text{g}/100\text{ cm}^2$)



PAGE 12

■ Methodology



IH Criteria for Open-Air Demolition of Beryllium Contaminated Facilities (UCOR-5616/R1)– March 2023



LITR Addendum – sequencing of demolition and controls based on results of Beryllium Characterization Sampling



Exposure monitoring - evaluate and adjust control set



Integration into Work Package

PAGE 13

■ Integrated Work Control

WORK PACKAGE

WP2-22-EF2304

WC-06

**ORNL – Final Demolition of
Building 3005**

(Multi-Use)

*Return to Work Planning, 100 UNV, Room 115

ORNL Cleanup Enterprise

PAGE 14

LITR Demolition Scope

- Primary areas:
 - Tower Area
 - West Laboratory
 - East Laboratory
 - Control Room
- Ancillary structures
 - Demineralizer Building
 - Seal Tank Shield Wall Structure
 - East Block Shield Wall Structure 1
 - East Block Shield Wall Structure 2
 - Sub-pile room
- Work site preparation - work zone boundaries, barricades, postings (demolition, asbestos, radiological, beryllium)
- Mobilization - Contamination Migration Control Plan, storm drain protection, spill supplies
- Monitor weather forecast prior to and during demolition
 - Sequential demolition
 - Mark shearing and cut locations
 - Size reduction of demolition debris
 - Marking anomalous items
 - Beryllium contaminated material segregation
 - Truck loadout and inspections
 - Waste shipping preparation
 - Reactor removal
 - Equipment used
 - Two excavators with grappling and shearing heads
 - Combination backhoe
 - Skid steer
 - Dump trucks
 - Mobile Cranes (±10 T, 80 T)
 - Aerial lift
 - Standard industrial power tools/hand tools

PAGE 15

LITR Demolition Support

IH

Radiological

Safety

Hoisting and Rigging

Environmental Compliance

Waste Management

Engineering

Fire Protection

Confined Space Entry Rescue

PAGE 16

■ Pre-Demolition Communication

- In-person and follow-up Team meetings with ORNL including nearby building occupants



PAGE 17

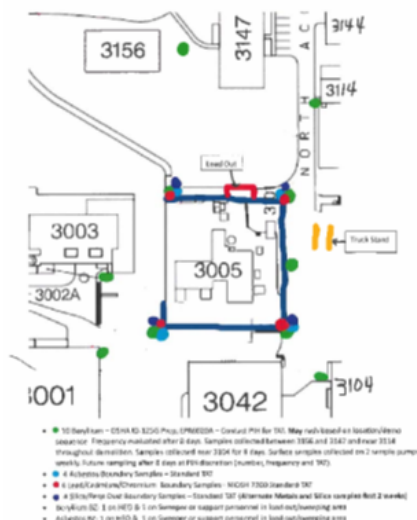
■ Fixative

- Water cannons - typically used
- Fixative applied daily on demo field and debris piles using hydro-seed machine
- INSTACOTE CC Demo 100
 - 30-75% Gypsum base
 - 10-35% Cellulose polymers
 - 5-10% Acrylic polymers

PAGE 18

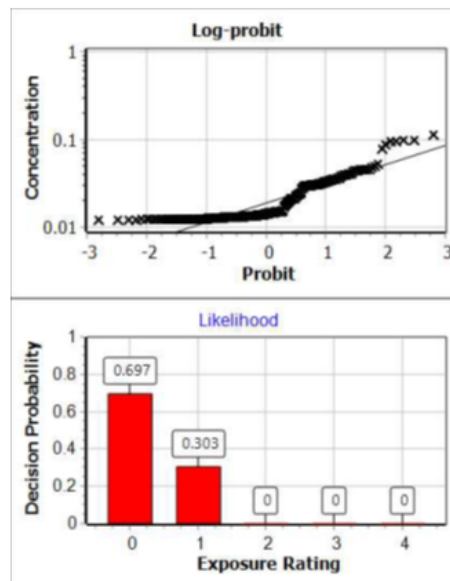
Airborne Exposure Monitoring

- Beryllium (521 samples)
 - EPA SW846 Method 6020A (ICP-MS)
- Asbestos (279 samples)
 - NIOSH 7400 (PCM)
 - NIOSH 7402 (TEM)
- Respirable Silica (60 samples)
 - NIOSH 0600/NIOSH 7500 (Gravimetric, XRD)
- Lead (79 samples)
 - NIOSH 7300 (ICP-AES)
- Cadmium (64 samples)
 - NIOSH 7300 (ICP-AES)
- Chromium (65 samples)
 - NIOSH 7300 (ICP-AES)



■ Area Air Sampling

- 461 area samples
- ZERO samples above LOD
- Minimum concentration of 0.0069 $\mu\text{g}/\text{m}^3$ or 3.5% of the OEL
- Maximum concentration of 0.1136 $\mu\text{g}/\text{m}^3$ or 57% of the OEL
- 95% confidence concentration will fall below 0.01798 $\mu\text{g}/\text{m}^3$ or 9.0% of the OEL
- Using worst case scenario there is a 95% confidence the concentration falls below:
 - 70% chance there is no exposure
 - 30% chance the exposure is <10% of the OEL
 - 0% chance that exposure is >10% of the OEL



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Note: Data analyzed using Kaplan-Meier method by Hunter Morgan, UCOR IH.

■ Lessons Learned

- Beryllium reflector in degraded condition
- Reduce thermal stress by improved sequencing
- HEPA vacuum management
- Conduct asbestos clearance early
- Unplanned lubricant use in confined space - **prevented**
- Breach in anti-contamination clothing
- Cost of release sampling exceeded cost of replacement

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■ Conclusions/Project Benefits

- Focus efforts on exposure reduction and minimization
- Risk assessment with planned approach
- Target early beryllium characterization of facility
- Goal - remediate, remove, decontaminate and down-post BCAs/BRAs
- Proper sequencing of demolition prevented spread of contamination
- Minimal airborne risk due to use of fixatives
- Actively engaged workers, dedicated work team, support crew
- Communication with nearby building occupants reduced risk perception
- Foster trust with stakeholders and the public
- Minimize health and safety risk

PAGE 23

■ Credits

- | | |
|--------------------|--------------------|
| ▪ Josh Farler | ▪ Shianne Adkisson |
| ▪ Scott Harrison | ▪ Emma Richesin |
| ▪ Pam Garrett | ▪ Sarah Yeckering |
| ▪ Herb Chitwood | ▪ Brittany Moseley |
| ▪ Drake Adkins | ▪ Andrew Coppenger |
| ▪ Robby Williams | ▪ Bernie Moore |
| ▪ Zach Johnson | ▪ Mark Langley |
| ▪ Josh Chasm | ▪ Rich Dotson |
| ▪ Tina McAnally | ▪ Anthony Wilkins |
| ▪ Darrell Herron | ▪ Kevin Cunningham |
| ▪ Jason Lowe | ▪ Calvin Shepherd |
| ▪ Mike Braden | ▪ Noah Parks |
| ▪ Harry Long | ▪ Hunter Morgan |
| ▪ Rex Thompson | ▪ Summer York |
| ▪ Tim Wilson | ▪ Bret Cole |
| ▪ Matthew Puckett | ▪ Chris Eich |
| ▪ Russell Horsley | ▪ Dillon Stoner |
| ▪ Dakota Roberts | ▪ Derrick Alt |
| ▪ Rodney Parsons | ▪ Jeremiah Huskins |
| ▪ Curtiss Anderson | ▪ Steve Huddleston |
| ▪ Cody Frogge | ▪ Tyler Lucas |
| ▪ Toby Beasley | ▪ Steve Tippitt |
| ▪ Chris Waters | ▪ Steve Mathes |
| ▪ Billy Nicholson | ▪ Mike Mills |
| ▪ John Harness | ▪ Matt Clark |
| ▪ Greg Brown | ▪ Dustin May |
| ▪ Al Krantz | ▪ Joe Seiber |
| ▪ Ashley Thomas | ▪ Pete Calkin |
| ▪ Tom Kohler | ▪ Bill Haver |
| ▪ Scott Keylon | ▪ Larry Brede |

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■ Link to Project YouTube Video

- https://www.youtube.com/watch?v=Dq2fmJ_abPk

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Questions?



Beryllium Health & Safety in Fusion Materials Research at KBHF

A. GORAIEB (Karlsruhe Beryllium Handling Facility, Germany) et al.

Beryllium Health & Safety in Fusion Materials Research at KBHF

Aniceto GORAIEB¹ and Christopher DORN²

¹*Karlsruhe Beryllium Handling Facility (KBHF), Leopoldshafen-Eggenstein, Germany*

²*Be4FUSION LLC, Upland, California, U.S.A.*

The Karlsruhe Institute of Technology (KIT) in Germany is one of the world leaders in fusion materials research. In the course of that work, KIT has fostered the development of on-site, autonomous laboratory and pilot industrial resources. First came GVT (Goraieb Versuchstechnik) in 1993, and that led to the eventual founding of the Karlsruhe Beryllium Handling Facility (KBHF) in 2009. KBHF is a “spin-in” organization that is located on the KIT North Campus and works closely with other research labs within KIT, but it also can function independently and seek projects with fusion collaboration partners external to KIT.

Beryllium metal has been important in fusion research since the 1980s, first as a plasma-facing material in JET (Joint European Torus). Research progressed on beryllium for use as a neutron-multiplier material in solid breeder-blanket concepts in the designs of magnetically confined fusion machines, such as ITER and DEMO (Demonstration Power Plant). Those investigations included higher-temperature performance materials, such as beryllide intermetallic compounds, in the form of pebble beds and blocks. With the rise of commercial fusion companies over the past several years, beryllium in the form of FLiBe (lithium-beryllium-fluoride) molten salt is now being considered as a liquid breeder material.

Since its inception, KBHF has worked continuously with all these forms of beryllium. The importance of safety in all aspects of fusion research cannot be overstated, and that includes this specialized work with beryllium, which brings its own particular EH&S (Environmental, Health & Safety) challenges. This presentation will delve into KBHF’s work with beryllium over the years, focusing on the systems that have been put in place to ensure the safe handling of the various forms of the material to protect both the workers and the environment.

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EMAIL: goraieb@kbhf.org

URL: <https://www.fusion-for-future.de/kbhf/>

URL: <https://www.fusion-for-future.de/>

LET'S CATCH THE STAR

**RESEARCH
ON BEHALF
OF MANKIND**

**Beryllium Health &
Safety in Fusion
Materials Research
at KBHF**

Aniceto Goraieb, KBHF GmbH
Chris Dorn, Be4FUSION LLC



 **FUSION**
FOR FUTURE
www.fusion-for-future.de



**BHSC 2024
Spring Meeting**
Beryllium Health &
Safety Committee
Oak Ridge, Tennessee, USA
23-24 April 2024

BHSC 2024 Spring Meeting
Oak Ridge, Tennessee, USA
April 2024



Presentation Outline

- Founding, History & Focus
 - GVT (Goraieb Experimental Technics)
 - “Fusion for Future” by mankindproject e.V.
 - KBHF, private organized KIT Infrastructure
 - BeYOND Forum on Blanket relevant Materials
- Evolution of the BeYOND Forum
 - Industrial oriented Beryllium Workshop 2009
 - Blanket oriented Bridging Event 2023
- Beryllium oriented work performed
 - GVT GmbH & Co.KG and its complementary
 - KBHF Infrastructure (build by GVT, as well)
- Other Blanket related activities involved
- Proposal: “State of the Art” and beyond





We came a long way through fusion history

- The Start-Up GVT was established 1993
 - Specialized on Solid Breeder Blanket Design
 - Material design, testing & pilot production
 - Work performed on FLiBe, as well
- Nonprofit organization found in 2000
 - “Fusion for Future” by mankindproject e.V.
 - Events for children and adults
 - Science, industry, politics and the public
- KBHF, a Spin-In at KIT established 2009
 - Private infrastructure for Blanket handling
 - Public-Private-Partnership on KIT Campus
 - Transfer company science to industry
- BeYOND Workshops started the same year in Karlsruhe



23-24 April 2024

BHSC, Oak Ridge, Tennessee, USA

3



Founding of BeYOND 2009

- Workshop Concept
 - Link Research Centers to Industry
 - Greater Emphasis on Industrial Issues
 - Scale-Up from Lab to Production
 - Technology Transfer
 - Environmental, Health & Safety (EH&S)
- Starting the Series
 - Partnership: KBHF & Brush Wellman
 - Funding from KIT & Industry Partners
- Evolution of Program
 - Even-Number Years (opposite BeWS)
 - Timing Coordinated with SOFT
 - All Functional Materials and EH&S
 - Widen up to “Global Fusion Partnerships”



23-24 April 2024

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4



Experimental Devices Built by GVT

BELLA



Beryllium, Beryllide
storage and testing

BETINA



Beryllium, Beryllide
mechanical alloying

BIANCA



Beryllium, Beryllide
cutting and milling

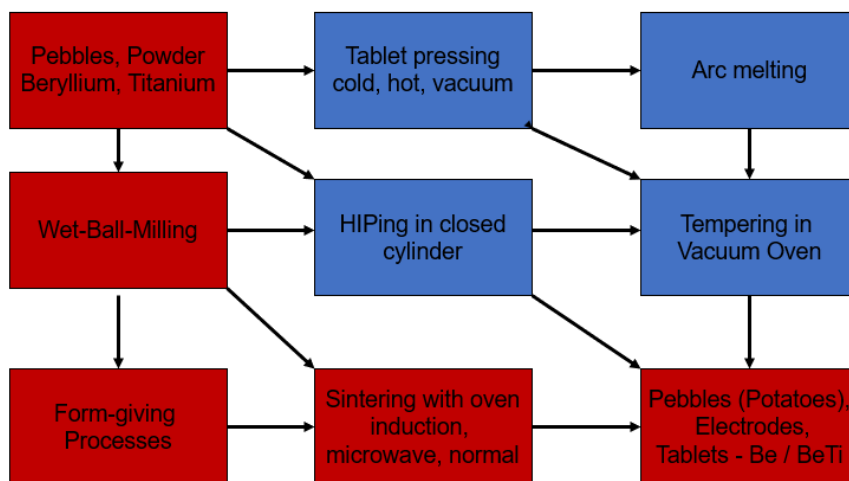
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5



Production Tests Performed for Beryllides



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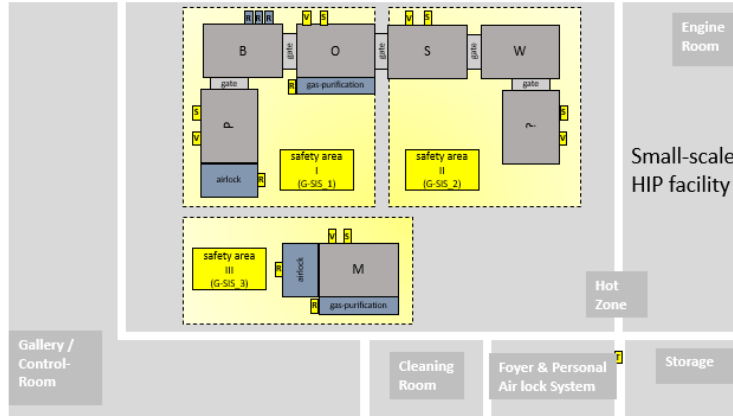
6



Building a High Safety Laboratory @ KIT



KIT North Campus near Karlsruhe and the location of KBHF Buildings, including the High Safety Lab for the handling of blanket-relevant materials



Ventilation system with HEPA Filters and lower pressure inside

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A Look Inside the High Safety Lab



23-24 April 2024

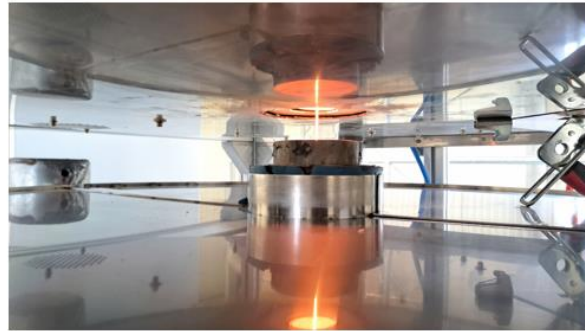
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KBHF – Other Blanket-related Activities

- GVT has worked with FLiBe early 2000s
 - Letter of Intent from UC Berkeley
 - Self-financed research on the behavior of FLiBe
 - We would like to offer our cooperation in future
- KBHF is also running the KALOS Facility
 - Pilot Ceramic Breeder Production
 - On behalf of and in cooperation with KIT
 - 10 years of pre-testing different conditions
 - 5 years of building up and testing the facility
 - Lithium-based breeder ceramic pebbles
 - Pebble sizes can be adjusted
 - Focused on a daily production of several kg
- KBHF - Outlook to Alternatives
 - Private infrastructure for Blanket handling
 - Other neutron-multiplier concepts like lead (Pb) or lead-based alloys/compounds
 - Other advanced solid or liquid-breeder forms



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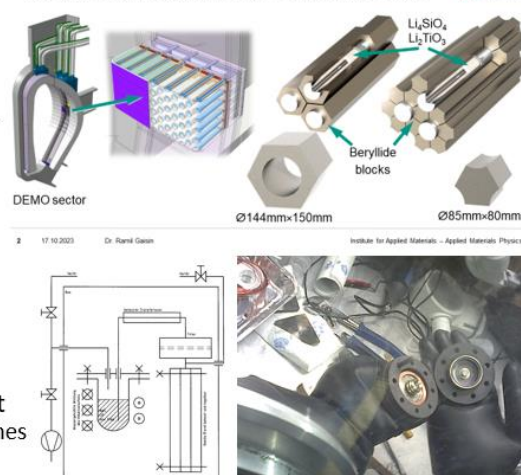
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State of the Art and beyond

- Near State of the Art:
 - The Solid Breeder Concept at KIT
 - ULBA is producing our Be-Ti material concept
 - We run the KALOS pilot production facility at KIT
 - Mass production will be available, soon!
 - The concept is already qualified for fusion
- Mid-Term Technology Transfer:
 - The Molten Salt (FLiBe) Concept
 - Mass production has already begun at KAIROS
 - Until now only data for fission available (1960s)
 - Has to be qualified for fusion applications, now!
- Long-Term Technology Transfer:
 - Liquid-Metal Concepts for the Breeder Blanket
 - MHD Effects cause difficulties in compact machines
 - Coatings have to prove their long-term stability

Helium-cooled pebble bed blanket design of DEMO



23-24 April 2024

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Thank You Very Much for Your Attention!



www.fusion-for-future.de

Aniceto Goraieb, KBHF GmbH



Be4FUSION

Specialty Materials & Business Consulting

<https://be4fusion.com/>

Chris Dorn, Be4FUSION LLC

A Practitioner's Guide to Beryllium Hazard Management

D. FIELD (National Nuclear Security Administration, Washington, DC, USA) et al.

A Practitioner's Guide to Beryllium Hazard Management

Danny FIELD¹, Roland CHRETIEN², and Wesley ADAMS³

¹*National Nuclear Security Administration, NA-ESH-23 WSH Division, USA*

²*Edgewater Technical Associates, South Carolina, USA*

³*National Nuclear Security Administration, Los Alamos, New Mexico, USA*

The Beryllium Health and Safety Committee (BHSC) promotes activities and efforts that help people better understand and prevent beryllium-induced conditions and illnesses, including Beryllium Sensitization (BeS) and Chronic Beryllium Disease (CBD). The BHSC mission is primarily educational in nature, and is accomplished through generation, collection, and dissemination of information to members and other interested parties. The BHSC furthers its mission through meetings, symposia, and publications.

In this regard, the BHSC issued *A Practitioner's Guide to Beryllium Hazard Management*, First Edition, dated February 2018, to provide a single information source that describes the history of beryllium disease, exposure levels and regulations, conduct of sampling, conduct of laboratory analysis, data evaluation, hierarchy of controls, release of equipment and items, training, risk communication, medical surveillance, recordkeeping requirements, and support references and web sites.

There have been regulatory changes and significant advances regarding beryllium safety and health since the 2018 publication of the Practitioner's Guide. The BHSC Technical Practices Sub-committee will be leading a team to update this document with respect to its current chapters, as well as additional focus areas including:

- Handling of lithium-beryllium-fluoride (FLiBe) for use across a broad range and scale of fission and fusion energy applications; and
- Best practices for addressing beryllium exposure and contamination for energetic activities conducted outdoors.

The BHSC Technical Practices Sub-committee will establish a working group at the BHSC 2024 Fall Symposium to update the Practitioner's Guide.

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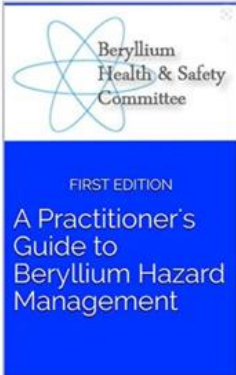
**U.S. DEPARTMENT OF
ENERGY**

**NNSA**
National Nuclear Security Administration

A PRACTITIONER'S GUIDE TO BERYLLIUM HAZARD MANAGEMENT

Danny Field¹, Roland Chretien², and Wes Adams³

¹National Nuclear Security Administration, NA-ESH-23 Worker Safety and Health Division, USA
²Edgewater Technical Associates Southeast Regional Director, USA
³National Nuclear Security Administration, Los Alamos Field Office, USA



Presented: 04/24/2024, BHSC Spring Meeting, Oak Ridge, TN.

**U.S. DEPARTMENT OF
ENERGY**

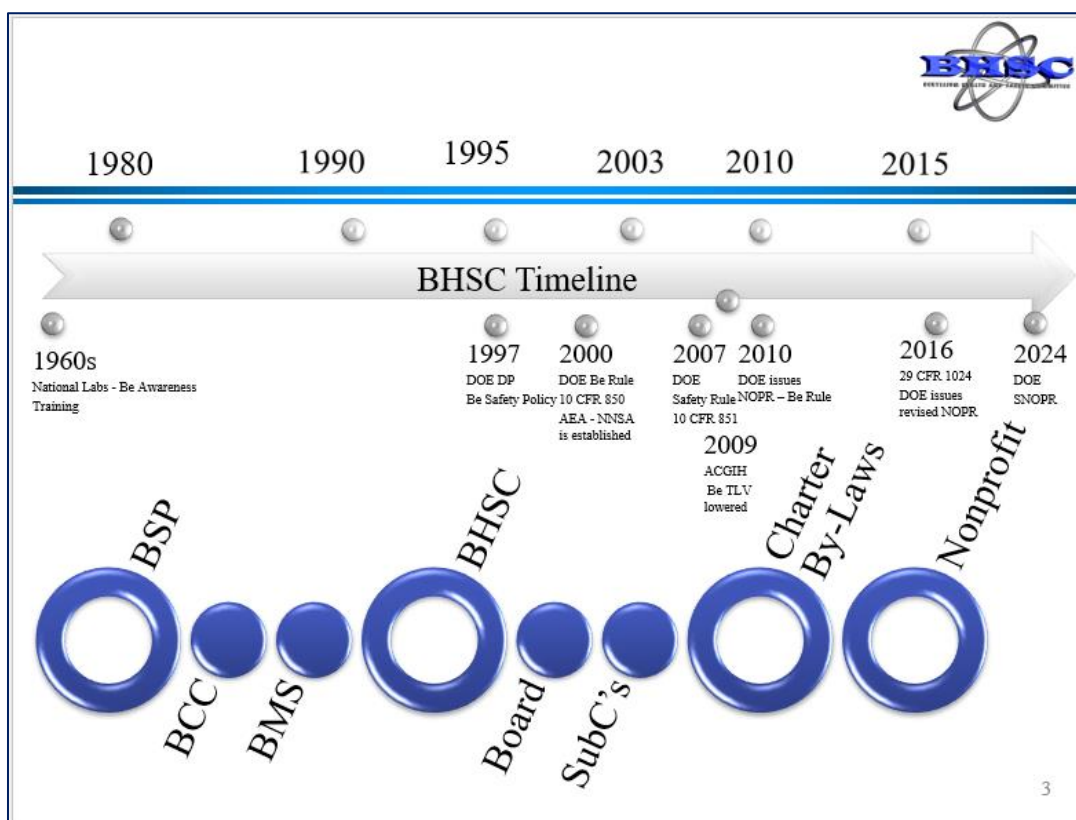
BHSC MISSION

**NNSA**
National Nuclear Security Administration

- The **Beryllium Health and Safety Committee (BHSC)** promotes activities/efforts that help people better understand and prevent beryllium-induced conditions and illnesses, including Beryllium Sensitization (BeS) and Chronic Beryllium Disease (CBD). Such illnesses may be caused or exacerbated by workplace exposure to beryllium.
- The *BHSC mission is primarily educational in nature*, and is accomplished *through generation, collection and dissemination of information* to members and other interested parties.

<https://berylliumhealthandsafetycommittee.com>

2



Service to Vision and Mission

International Symposia – offered every 3 – 5 years to encourage experts and non-experts alike to participate in discussions and exchange of information to assist the collective group, and those outside the BHSC, to understand and prevent beryllium-induced conditions and illnesses caused or exacerbated by workplace exposure to beryllium.

1st - 2002; 2nd - 2005; 3rd - 2008; 4th - 2012; 5th - 2017; 6th - 2024*

Face-to-Face meetings – offered every 6 months for BHSC membership to participate in discussions and exchange of information on current issues impacting Beryllium safety and health.

1995 – 2019; Pandemic (virtual); 2022 – 2024; 2025 Spring and Fall meetings (in planning stage)

Service to Vision and Mission



Publications (direct or indirect participation):

- » A Practitioner's Guide to Beryllium Hazard Management – 2018
 - Partial list - A complete listing is provided in reference sections of Guide
 - Beryllium in soil (Agrawal et al., ES&T, 2008)
 - Special issue of JOEH, December 2009, with 11 papers
 - Beryllium: Environmental Analysis and Monitoring, (Brisson et al., RSC Publ., 2009)
 - BeO Round Robin Study (Oatts et al., JEM, 2012)

White papers:

- » CBD Prevention: Controlling Exposure in Be Work Environment
- » Data Reporting Task Force (two papers on reporting limits, uncensored data)
- » Issues Concerning Wall Deposits
- » Risk Communication (training modules)

5

Practitioner's Guide: Background



- A significant accomplishment of BHSC in fulfillment of its mission is the publication of:

“A Practitioner's Guide to Beryllium Hazard Management”
First Edition: February 2018

- This Guide was conceived to fill the need of beryllium practitioners whose work as:
 - operators,
 - engineers,
 - allied health professionals,
 - union representatives,
 - manufacturers and
 - vendors involves beryllium.
- While briefer and more specific data sources are available on single subject areas, as are multi-volume compendia, there was no current up-to-date compilation of information useful on a daily basis by the beryllium practitioner.

6



Practitioner's Guide: Updating

- Practitioner's guide currently contains various chapters on:
 - History of Beryllium
 - Development of Exposure Levels and Regulations
 - Conduct of Sampling
 - Conduct of Laboratory Analysis
 - Data Evaluation and Related Topics
 - Hierarchy of Controls
 - Release of Equipment and Other Items
 - Training
 - Risk Communication
 - Medical Surveillance
 - Beryllium Management Program Recordkeeping
 - Additional Resources (Where to Go for Help)
- Regulatory changes and significant advances in beryllium safety and health since the 2018.
- The BHSC Technical Practices Subcommittee leading efforts to update current chapters and addition of others starting next month.

7



Practitioner's Guide: Updating Continued

- New/Additional Chapters:
 - Handling of lithium beryllium fluoride (FLiBe) for use across a broad range and scale of fission and fusion energy applications
 - Best practices for addressing beryllium exposure and contamination for energetic activities conducted outdoors.

8



Call to Action

- Looking for individual and subcommittee members as contributors on all of the following:
 - History of Beryllium
 - Development of Exposure Levels and Regulations
 - Conduct of Sampling
 - Conduct of Laboratory Analysis
 - Data Evaluation and Related Topics
 - Hierarchy of Controls
 - Release of Equipment and Other Items
 - Training
 - Risk Communication
 - Medical Surveillance
 - Beryllium Management Program Recordkeeping
 - FLiBe for use across a broad range and scale of fission and fusion energy applications
 - Best practices for addressing beryllium exposure and contamination for energetic activities conducted outdoors.

9



Contact Information

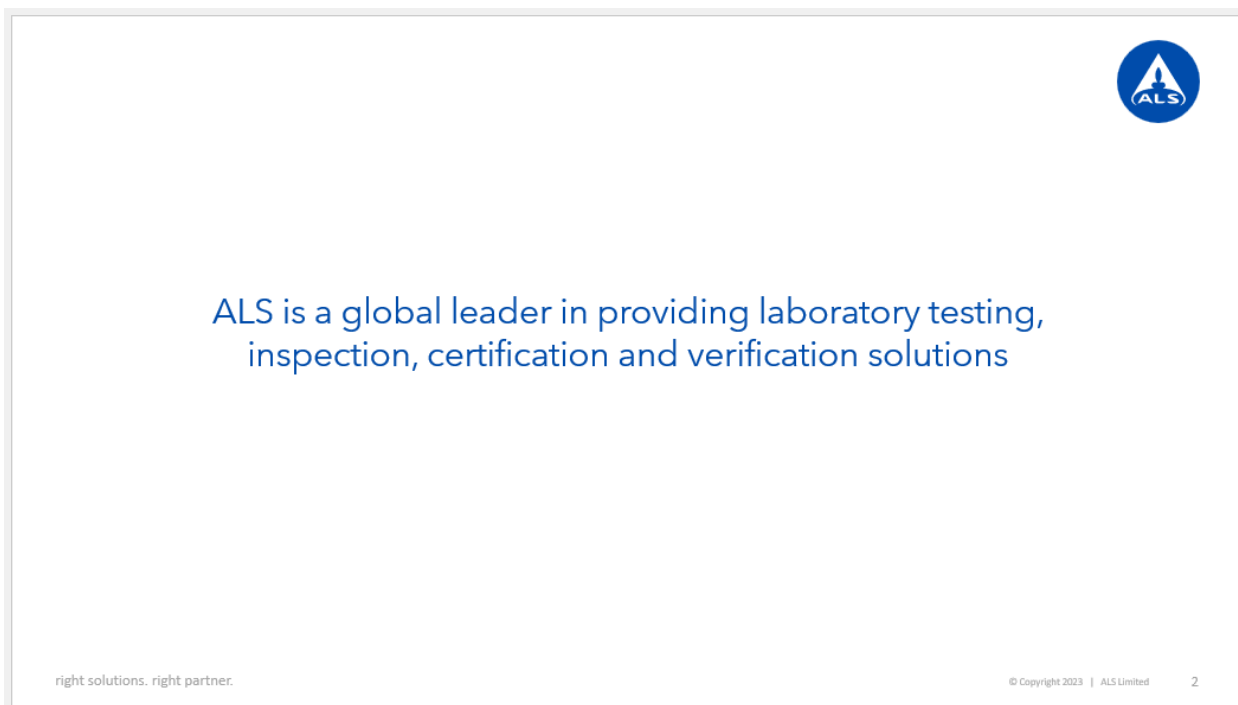
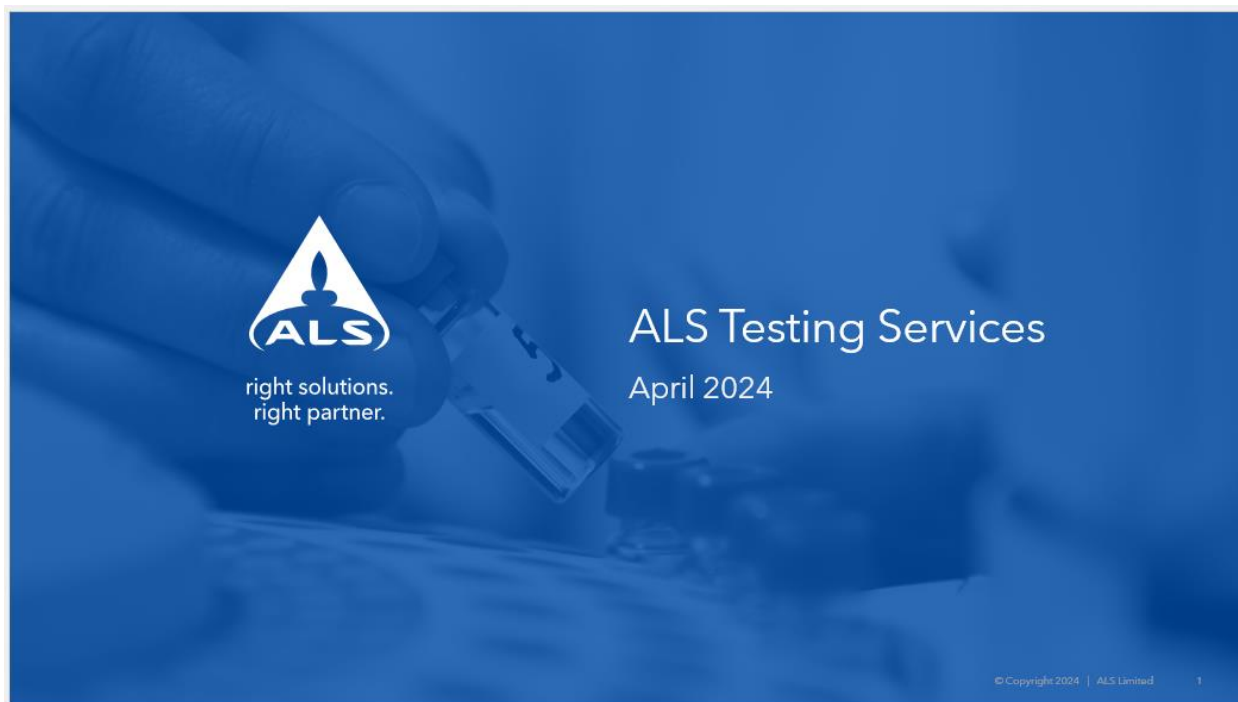
- Roland Chretien, Edgewater Technical Associates
BHSC Chair
roland.chretien@edgewatertech.net
- Josef Sobieraj, National Nuclear Security Administration
BHSC Vice-Chair
josef.sobieraj@nnsa.doe.gov
- Wesley Adams, NNSA Los Alamos Field Office
BHSC Technical Practices Subcommittee Chair
wesley.adams@nnsa.doe.gov
- <https://berylliumhealthandsafetycommittee.com/>

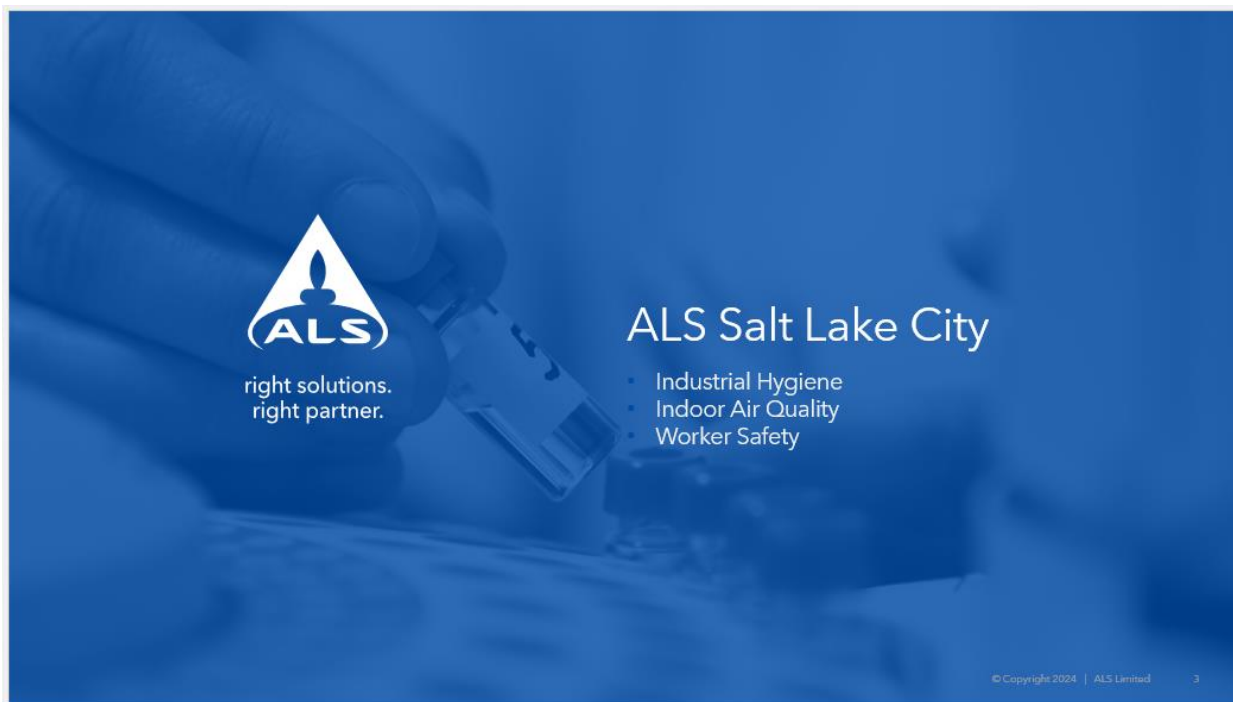
10

Day 2: Vendor Technical Presentations

ALS Testing Services, Salt Lake City, Utah, USA

Mr. Bevan MEADE





ALS Salt Lake City



- History of Quality and Innovation
 - NIOSH Industry Partner (32 years)
 - AIHA Accreditation (1974)
 - 300+ air/wipe methods
 - Celebrating 50 years of Accreditation
 - ISO 17025 Compliant
 - DOECAP-AP: 100+ methods
 - DoE, DoD, EPA Projects



ALS Salt Lake City



- Expertise and Customer Service
 - Project Management
 - Sampling Media and Equipment
 - Level 1 - 4 Reporting and custom EDD's
 - Experienced chemists (15 year average tenure at ALS)

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5

ALS Salt Lake City - Testing Capabilities



- Full-service Laboratory - Industrial Hygiene
 - Metals Analysis:
 - ICP-AES and ICP-MS
 - Personal Air or Surface wipe sampling
- Beryllium/Beryllium oxide
 - 7,500+ submissions processed since 2018
 - BePAT Program (10+ years)
 - AIHA PAT (Be/BeO)

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ALS Salt Lake City – Testing Capabilities



- Full-service Laboratory - Industrial Hygiene
 - Whole-air sampling (Summa canister or Helium Diffusion Sampler)
 - VOCs
 - Mercaptans/Sulfur gases
 - Light Hydrocarbons
 - Fixed gases



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ALS Salt Lake City – Testing Capabilities



- Full-service Laboratory - Industrial Hygiene
 - Respirable Crystalline Silica (new MSHA Rule)
 - PEL: 50 $\mu\text{g}/\text{m}^3$
 - Action Level: 25 $\mu\text{g}/\text{m}^3$
 - Published 04/16/2024 – Effective 08/16/2024
 - Baseline sampling must be completed within 6 months of publication

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8

ALS Salt Lake City - Testing Capabilities



- Full-service Laboratory - Industrial Hygiene
 - Pesticide/Herbicide Analysis (comprehensive screen of 200+ compounds)
 - Polynuclear Aromatic Hydrocarbons - NIOSH 5528
 - Semi-volatiles / OVS tube sample collection
- Lab Network Advantage - ALS Cincinnati
 - Cross-Lab Capability
 - Continuance of work
 - Equivalent Quality System

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Thank You



- | | |
|---|---|
| <ul style="list-style-type: none">• Bevan Meade (DOE Contact)<ul style="list-style-type: none">– Office: +1 (801) 266-7700 ex 277– Bevan.Meade@alsglobal.com• Patrick Noteboom<ul style="list-style-type: none">– Office: +1 (801) 266-7700 ex 381– Patrick.Noteboom@alsglobal.com• Meredith Edwards<ul style="list-style-type: none">– Office: +1 801 266 7700– Meredith.d.edwards@alsglobal.com | <ul style="list-style-type: none">• Lisa Reid (DOE Contact)<ul style="list-style-type: none">– Office: +1 801 266 7700– lisa.reid@alsglobal.com• Stella Hanis<ul style="list-style-type: none">– Office: +1 801 266 7700– stella.hanis@alsglobal.com• Jessica Cofrancesco<ul style="list-style-type: none">– Office: +1 (801) 266-7700 ex 302– Jessica.Cofrancesco@alsglobal.com |
|---|---|

History - Quality - Flexibility - Reliability

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GVS-RPB Respiratory Protection Solutions, Michigan, USA

Mr. Jeremy KENIMER



Who is GVS-RPB®?

GVS | rpb

Protecting you for life's best moments.

- GVS-RPB is the culmination of two strong brands, offering a full solution set for respiratory protection
- Made in USA
- Our US headquarters are located in the greater Detroit area
- Strong supply chain
- Greater than 90% DIFQT through the pandemic
- Offer best in class cooling to remove heat stress issues.

A photograph showing three individuals wearing different types of respiratory protection. The person on the left is wearing a white protective suit and hood. The person in the center is wearing a green protective suit and a large, illuminated green hood. The person on the right is wearing a grey shirt and a blue respirator mask.

GVS-RPB Product Offering



APR Air Purifying Respirators



PAPR Powered Air Purifying Respirators



SAR Supplied Air Respirators



Pair with the headtops below



Peripheral Product Range



- Blasting suit
- GX4® Gas Monitor - Can detect CO, O₂ and H₂S
- The Radex® is fitted with a 6-stage filter cartridge that removes moisture, odor and particulates to 0.5 micron
- Airlines and Fittings.



Past Performance

Our products protect operators at the following facilities



Pacific Northwest National Laboratory

The welders at the Pacific Northwest National Laboratory are using our Z4 PAPRs and they find them perfect. The ADF Lens is super clear, and it's greatly improved their visibility.

Los Alamos National Laboratory

Los Alamos National Laboratory has a team of industrial hygiene professionals right on-site. Some of them are generalists, while others specialize in fabrication. They've got 12 of our PAPRs and are big fans of our product line. One of them learned about our products in a previous job and introduced them here.



Protecting you for life's best moments.



Thank You
Want to know more?

Email Jeremy at jeremy.kenimer@gvs.com

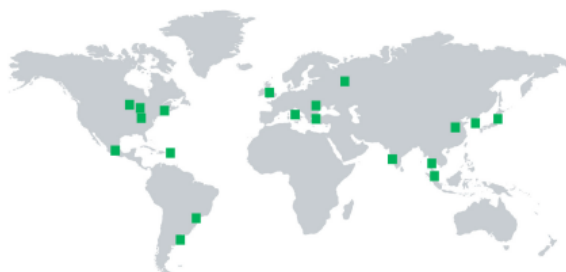
or call at (614) 599-7274

Identifiers:

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gvs-rpb.com



Scientific Sales, Inc., Oak Ridge, Tennessee, USA
Ms. Cynthia BULLARD



Scientific Sales, Inc.

*A Small, Minority and
Woman-Owned Business*

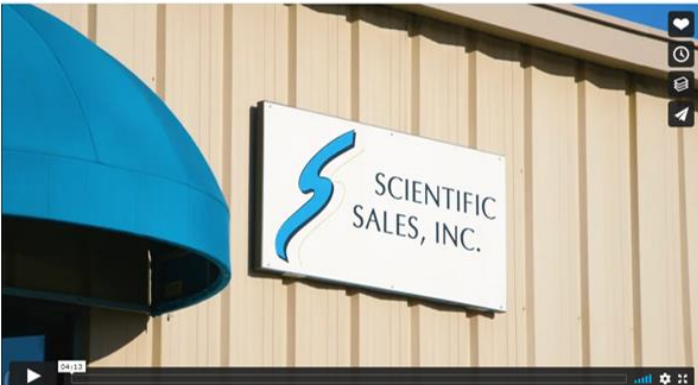
Since 1987

April 2024

Headquartered in Oak Ridge, TN



Introducing Scientific Sales, Inc. (SSI)



2

SSI Introduction

- SSI is a small woman and minority-owned distributor founded in 1987 by Vicki Dyer (current President and Owner).
- Began by representing one national lab supply company, then negotiated distributor agreements with other major lab supply companies.
- Offices and warehouse are in Oak Ridge, TN, but SSI conducts business throughout the United States.
- SSI has done business with DOE and the Federal government for over 35 years developing an extensive list of Safety, Industrial, and Environmental product offerings.

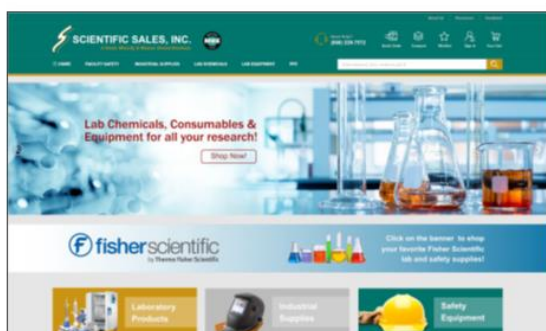
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The SSI Advantage

- Extensive experience supporting construction and remediation projects with safety and industrial products in situations involving Beryllium, Mercury, and many more hazardous materials.
- Strong vendor relationships, extensive experience supplying Lab, Safety, Facilities Maintenance, and Industrial products to customers throughout the US.
- Competitive Pricing through over 2,000 direct relationships with a variety of vendors helping mitigate stock-out situations.
- Unmatched ability to source hard to find items.
- Experienced and Award-Winning Customer Service staff with excellent product knowledge and problem-solving capabilities
- Investing now in first class e-commerce technology to improve the customer purchasing experience.

4

First Class Customer Service and E-Commerce Experience



- Magento 2.4 B2B E-Commerce Platform by Adobe Commerce Cloud with over 2 million products
- AI-enhanced search capabilities
- Compatible with any marketplace system (e.g. SAP Ariba, Coupa, Oracle Cloud)
- Landing page tailored to the customer
- Third party integrations and PunchOut catalogs available
- Enhanced user experience allows for custom quotes, invoice retrieval, order status and history, order tracking, and wish list creation



5

Customers include:

- **Government Agencies** including DOE, DOD, EPA, US Military, USDA
- **Government Contractors** including CNS (Y-12), UCOR, UT-Battelle (ORNL), Fluor, Bechtel, Jacobs, Amentum
- **Utilities** including Tennessee Valley Authority, Duke Energy, Florida Power and Light
- **Automotive Customers** including Denso and Aisin
- **Universities** including University of Tennessee, Vanderbilt University, University of Alabama - Birmingham, Arizona State University, Northern Arizona University
- **Industrial Accounts** throughout the United States

6

Distributor of Safety Products



- Head to Toe PPE
- Fall Protection
- Respiratory Equipment
- Heat Stress and Cold Weather Items
- Safety Showers and Eyewash Stations
- Tool Storage/ Tethering
- Signs and Markings
- Fire Extinguishers
- First Aid

7

Distributor of Facilities Maintenance and Industrial Products



- Head to Toe PPE
- Hearing Protection
- Tools/Tool Storage/Tethering
- Abrasives and Sorbents
- Protective Clothing
- Work Apparel
- Signs and Markings
- Fire Extinguishers
- First Aid

8

Lab Related Products



- Flammable Storage Cans and Cabinets
- Laboratory Matting
- Safety Showers and Eyewash Stations
- Labeling Products
- Laboratory Signage and Markings
- Fire Extinguishers
- Goggles
- Protective Apparel

9

Award Winning Service

- 2022 – UCOR Small Disadvantaged Business of the Year
- 2020—City of Knoxville—Minority-Owned Business of the Year
- 2018—City of Knoxville—Minority-Owned Business of the Year
- 2017—Department of Energy - Small Disadvantaged Business of the Year
- 2017—UCOR - Woman-Owned Small Business of the Year
- 2016—CNS-Y12 - Small Business Achievement Award
- 2016—City of Knoxville - Woman-Owned Business of the Year
- 2015— Oak Ridge National Laboratory - Small Business Impact Award
- 2015—Bechtel National, Inc. – Small Business Impact Award
- 2013—URS/Ch2M – Small Disadvantaged Business Award
- 2010—Wackenhut Services, Inc. — SBA Small Woman-Owned Business of the Year, Nominated
- 2010—Oak Ridge National Laboratory – AVID Supplier of the Year Award
- 2009—Tennessee Minority Supplier Development Council –Minority Supplier of the Year, nominated by TVA



10

Contact SSI:

Scientific Sales, Inc.
130 Valley Court
Oak Ridge, TN 37830



www.scisale.com



Vicki Dyer, President
Wendi Arnold, VP of Sales
Don Evans, VP of Operations
Cynthia Bullard, Dir. Outside Sales
Amy White, E-commerce

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awhite@scisale.com



1.800.229.7252 or 865.483.9332



Day 2: BHSC Business Meeting

Led by Josef SOBIERAJ & Chris DORN, BHSC Vice Chairs

Business Meeting Minutes compiled by Jack BENNETT, BHSC Recording Secretary

AGENDA – BHSC 2024 Spring Business Meeting

24 April 2024

13:45-14:30 Eastern Daylight Time

BHSC Business meeting is being held on site and may use Webinar

Per the BHSC By-Laws, a quorum is ten members or 20% of active membership, whichever is greater. This will apply to the voting session. The non-voting session will not require a quorum.

Agenda (Items 1-5 are in the voting session; remainder are in non-voting session)

1. Approval of this agenda - there were 16 in person attendees and 9 virtual attendees, which constituted a quorum. The agenda was reviewed, and Chris Dorn made a motion to approve, which was seconded by Kul Garg. The agenda was approved by acclamation.
2. By-Laws Revision – Jack Bennett reported that there were 20 votes for the approval on the addition of the FLiBe subcommittee. There were 19 votes in favor of approving the other minor changes. The text of the FLiBe addition is listed below, and the rest of the revisions were reviewed onscreen. The by Laws revisions are approved, and Jack will send Julie Fowler a clean copy to post on the BHSC website.

f. FLiBe for the Advancement of Fission and Fusion

The FLiBe Subcommittee exists to engage private industry, government agencies, and academic universities on the safe and responsible handling of lithium beryllium fluoride (FLiBe) for use across a broad range and scale of fission and fusion energy technologies. The subcommittee acts as a clearinghouse of information to share and establish best practices and worker protection models for the reduction of occupational exposure to soluble forms of beryllium, control of beryllium migration from designated beryllium work areas, and the prevention of beryllium sensitization and chronic beryllium disease.

The scope of the subcommittee applies to all uses of FLiBe, from laboratory-scale research efforts to FLiBe production and purification systems, to the implementation of FLiBe for prototypes and energy-producing machines. The Subcommittee Chair will submit quarterly reports of activities and progress to the First Vice Chair. The Subcommittee also reports on desired research topics tied to the establishment of best practices, beryllium worker protection models, and exposures and risks of beryllium-related activities to the Research Needs Subcommittee.

3. Election of Officers

- Report of Nominating Committee (D. Field)
 - i. There are no nominations, however we need to think about the next chair because the current chair will have served two terms. We are looking for a volunteer with strong leadership skills. Dan also reviewed the current vacancies, which are chair and co-chair of Risk Communication, co-chair for Tech Practices, chair and co-chair of Research.
 - ii. Greg Heldt has been acting as chair of the ad-hoc FLiBe Subcommittee. The BHSC Chair asked him to become chair of the approved Subcommittee, and the board unanimously assented. Additionally, Meghan Devine volunteered to serve as co-chair and the chair and board approved.

4. Other new business requiring a vote today - None

5. Chairman's Brief Report (R. Chretien)

- Review of activities since Fall 2023
 - i. Planning for 2024 Spring meeting
 - ii. Establishment of FLiBe subcommittee
 - iii. Established agreement with Golden Nugget in support of upcoming symposium
 - iv. Initiated discussion of drafting second edition to *A Practitioner's Guide to Beryllium Hazard Management*. This topic was also covered in one of the Technical Sessions.**
- Succession planning was covered in the Report of the Nominating Committee above.
- Discussion about the focus of the upcoming symposium. Will be tracks, which the Subcommittee chairs will develop and recruit speakers.

6. Status of Funds (D. Jensen)

- Funds available
 - i. PayPal - \$6,625.70
 - ii. Wells Fargo- \$5,369.31
- b. Projects/debits –
 - i. The \$2,500 first deposit for symposium has already been paid, the second deposit of \$6,907 will be due 9/10/24.
 - ii. There will be a speaker honorarium of \$200 for Roy Smith to talk at the reception on Tuesday evening and
 - iii. A reimbursement of \$196.19 to Dan Jensen for the refreshments for this meeting.
 - iv. Jack will look on Amazon for the cost of the badges for this meeting and for the fall meeting, which will be approximately \$80.

7. Membership Report (J. Fowler)

- There are 57 paid members. The BHSC thanks our members for maintaining their annual dues. Dues are relied upon to maintain our webpage and pay for other efforts supporting the BHSC mission.

8. Web Site Report (R. Chretien) –

- Improvements to website beyond expectations, Julie & April Brown did a great job!! The changes will make us look good to potential members. (Remove from future agendas).

9. Plans for 2024 Spring Meeting (C. Dorn & J. Sobieraj)

- We signed the contract and paid the 1st deposit. We need a minimum of 35 attendees. There will be more details after subcommittee breakout.

10. Subcommittee Reports

- **Risk Communication- no activity**
- **Research Needs – no activity**
- **Technical Standards/Practices/Measures –** Is getting ready to work on the Practitioner's Guide, and the project getting back on track.
 - i. Report after Breakout: The group needs to figure out path forward for solicitation of membership to participate in the update to the Guide, based on their interest in certain topics and updating it based on current literature. They discussed having monthly meetings to keep moving forward. One idea was to develop relationships with Voluntary Consensus Standard Boards. They plan on meeting with Dan Field and Mike Brisson to capture any lessons learned from the prior edition. After the process gets going, they will look for gaps in sections that need updating and do additional outreach.
- **Medical/Epidemiological –** Met once per quarter, mostly going over the Registry dashboard. They are looking for new topics to work on.
 - i. Report after Breakout: They discussed lots of ideas on new topics of interest and could also ask the membership for ideas as well. Some ideas included: a best practices guide for retesting, how frequently to test, resource sharing, new tests for Be Sensitivity and how that intersects with the FDA Lab Developed Test requirements, maybe develop a White Paper. There were also discussions about the challenges of following people and the three borderlines issue.
- **Meetings and Symposia –** Defer to Breakout report –
 - i. Report after Breakout: The Subcommittee will be sending out an informational email next week, The Symposium will occur 10/28 to 30, with an afternoon session on Monday. Tuesday and Wednesday will be full days. The venue will be the Golden Nugget, and as reported above, we paid the first deposit. The venue will be the Golden Nugget in Las Vegas. The Symposium will be in-person only, however, presenters can be virtual. There will be Early Bird pricing (\$495 before 9/10) and after that it will be \$595. There will be two proposed Keynotes, the first being a senior executive from NNSS and the second will be from the Bureau of Reclamation. The committee is investigating a tour of the Hoover Dam. There will be tracks developed by subcommittees, who will get 4 to 5 speakers. One track will be a ½ day on the Practitioners Guide and implementation guide for 10 CFR 850.
- **Sampling and Analysis –** meeting every other month and discuss any concerns\changes in sampling and analytical methods, we recently shared a list of methods for Be analysis.
 - i. Report after breakout: There were discussions about methods and sampling, AWE shared what they do, Jack volunteered to share his ammonium bifluoride

SOP with AWE. Kul will ask Mike for the list of methods from his presentation. The group also discussed the importance of knowing if BeO is in the sample so that an appropriate discussion could be performed. Since FLiBe is becoming more commonplace, the group wondered if it can cause analytical challenges, since the proposed Action Limits may require a large volume of air to be collected, there was discussion about using appropriate sampling pumps.(e.g. hi vol pumps.

- **FLiBe-** Is planning to have its first separate meeting in May and will start to define its scope but needs to get a good email list together to let people know about its existence.
 - i. Breakout report: The group talked about topics from Gregs presentation. Greg announced that Meghan Devine volunteered to serve as co-chair (see additional discussion above).

11. New Business (not requiring a vote)

- Still need some new committee members, so if you know someone, please ask them to contact us.

12. Adjournment – Chris Dorn made a motion to adjourn, which was seconded by Greg Heldt and was approved by acclamation. The meeting adjourned at 2:17 PM.

Appendices

BHSC 2024 Spring Meeting Participants List

<u>Family Name</u>	<u>First Name</u>	<u>Organization</u>	<u>Country</u>	<u>Status</u>
ADAMS	Wes	National Nuclear Security Administration	USA	Online
ALLRED	Eric	National Nuclear Security Administration	USA	Online
ASHLEY	Chloe	DOE NNSA Production Office	USA	Online
BAILEY	Brian	NNSA Production Office	USA	In person
BANTA	Gregory	Department of National Defence	Canada	Online
BARKER	Matthew	UK Atomic Weapons Establishment	UK	In person
BEJAR ALONSO	Isabel	CERN (Centre for Nuclear Research)	Switzerland	Online
BENNETT	Jack	Lawrence Livermore National Lab	USA	In person
BERNHOLC	Nicole	US DOE Brookhaven National Laboratory	USA	Online
BRAATZ	Jisue	Oak Ridge National Laboratory	USA	Online
BRADLEY	Adam	DOE Portsmouth/Paducah Project Office	USA	Online
BRISSON	Mike	Savannah River National Laboratory	USA	In person
BROUNSTEIN	Robert	TerranearPMC LLC	USA	Online
BROWN	April	US Department of Energy HQ	USA	In person
BROWN	Madeline	NNSA-CNS	USA	In person
BRYSON	Drew	National Nuclear Security Administration	USA	In person
BULLARD	Cynthia	Scientific Sales, Inc.	USA	In person
BYTWERK	David	US Department of Energy	USA	Online
CAMPBELL	Anne	Oak Ridge National Laboratory	USA	In person
CARROLL	Stephanie	EEOICPA Advocacy	USA	Online
CASTLE	Steve	NNSA-CNS	USA	In person
CHAUHAN	Ankur	Bhabha Atomic Research Centre (BARC)	India	Online
CHRETIEN	Roland	Edgewater Technical Associates	USA	In person
CIBUZAR	Mike	Advanced Research Corp.	USA	In person
COPELAND	Terry	NNSA-CNS	USA	In person
COX	Douglas	General Dynamics Missions Systems	USA	In person
DAVIS	Charles	Envirostat & Statistics Ltd.	USA	Online
DAVIS	Lindsay	National Nuclear Security Administration	USA	In person
DEVINE	Meghan	Commonwealth Fusion Systems	USA	In person
DORN	Chris	Kyoto Fusioneering America Ltd. Be4FUSION LLC	USA	In person
DOSHI	Jayesh	eSpin Technologies Inc.	USA	In person
DOVALINA	Stephanie	US Department of Energy, Idaho	USA	Online
DUMAS	Constantine	Materion Brush Inc.	USA	Online
DUONG	Linh	US Department of Energy HQ	USA	Online
EARLEY	Robert F.	Xcimer Energy Corp.	USA	In person
EM	Vira	US Department of Energy, Nevada	USA	Online

*Minutes of the Beryllium Health & Safety Committee (BHSC) 2024 Spring Meeting
23-24 April 2024 – Oak Ridge, Tennessee, U.S.A.*

<u>Family Name</u>	<u>First Name</u>	<u>Organization</u>	<u>Country</u>	<u>Status</u>
FADEL	Gus	US Dept of Energy Office of Science	USA	Online
FECHSER	Matthew	Lawrence Livermore National Lab	USA	Online
FIELD	Danny	National Nuclear Security Administration	USA	In person
FOSHIE	Stewart	Merrick & Company	USA	In person
FOWLER	Julie	National Nuclear Security Administration	USA	In person
FRESCHI	Steve	General Dynamics Mission Systems	USA	Online
GALLEGO	Nidia	Oak Ridge National Laboratory	USA	In person
GARDNER	Cerys	UK Atomic Weapons Establishment	UK	In person
GARG	Kul	NNSA (Lawrence Livermore Nat'l Lab)	USA	In person
GILL	Joanne	UK Atomic Weapons Establishment	UK	In person
GOLDEN	Ashley	Dept of Energy ORAU/ORISE	USA	In person
GORAIEB	Aniceto	Karlsruhe Be Handling Facility (KBHF)	Germany	Online
GORDON	Will	Los Alamos National Laboratory	USA	Online
GRANDAS	Diana	Electric Power Research Institute (EPRI)	USA	In person
GRIFFIN	Gary	GEG Consulting, LLC	USA	In person
HACKETT	Andrew	NNSA-CNS	USA	In person
HAND	Donna	Help by Hand LLC	USA	Online
HANEBUTH	Julie	Dept of Energy Argonne National Lab	USA	Online
HANNA	Cliff	General Atomics Corp.	USA	Online
HEARD	Marcus	NNSA (Lawrence Livermore Nat'l Lab)	USA	In person
HECK	Lindsay	US Army Corps of Engineers	USA	In person
HELDT	Gregory	Materion Brush Inc.	USA	In person
HOLCOMB	Elizabeth	ORAU/ORISE	USA	In person
HOLDEN	Vern	UCOR LLC	USA	In person
HOLEY	Brandy	National Nuclear Security Administration	USA	Online
HOWE	Teresa	General Dynamics Mission Systems	USA	In person
HUDSON	Denae	BWXT Technologies & Nuclear Ops	USA	Online
HUNTLEY	Courtney	Y-12 National Security Complex	USA	In person
JACOBS	Carrie	US DOE Hanford Site	USA	Online
JENSEN	Daniel	National Nuclear Security Administration	USA	In person
JOHNSTON	Brandon	Oak Ridge National Laboratory	USA	Online
JOHNSTON	Jill	US DOE Hanford Site	USA	Online
JONES	Melissa	ORISE Beryllium Laboratory	USA	In person
JUNEAU	Cody	Tennessee Dept. of Environment & Conservation	USA	In person
KELLY	Frank	Oak Ridge National Laboratory	USA	In person
KENIMER	Jeremy	GVS-RPB Respiratory Protection	USA	In person
KHECHFE	Alexander	Commonwealth Fusion Systems	USA	Online
KIM	Laura	Ames Laboratory	USA	Online
KIZANE	Gunta	University of Latvia	Latvia	Online

*Minutes of the Beryllium Health & Safety Committee (BHSC) 2024 Spring Meeting
23-24 April 2024 – Oak Ridge, Tennessee, U.S.A.*

<u>Family Name</u>	<u>First Name</u>	<u>Organization</u>	<u>Country</u>	<u>Status</u>
KOLANZ	Marc	Materion Brush Inc. (Retired)	USA	Online
KOPP	Jody	Cameco Corp.	Canada	In person
KUBIAK	Karen	US Dept of Energy Idaho	USA	Online
LEWRY	Erik	UK Atomic Weapons Establishment	UK	In person
MAESTAS	Lynn	National Nuclear Security Administration	USA	Online
MEADE	Bevan	ALS Testing Services	USA	In person
MERWIN	Gus	Kairos Power LLC	USA	Online
MEYER	Ken	Y-12 National Security Complex	USA	Online
MICHAUD	Keith	Merrick & Company	USA	In person
MILLER	Jae	US DOE NNSA Production Office	USA	Online
MORGAN	Hunter	UCOR LLC	USA	In person
MORTON	Cheryl	American Industrial Hygiene Association	USA	In person
MUSGROVE	James	N/A	USA	Online
NETTLES	Wyman	NNSA-CNS	USA	In person
NORTON	Carey	NNSA-CNS	USA	In person
PAMPLIN	Kim	Abilene Christian University	USA	In person
POLEK	Michael	US Army Corps of Engineers	USA	In person
PRICE	Regina	US Dept of Energy, EHSS-11	USA	Online
PRONOVOST	Jason	US Army Corps of Engineers	USA	In person
PROTTE	Jamie	US DOE NNSA Production Office	USA	Online
REED	Bill	Environmental Mgmt. Los Alamos FO	USA	Online
ROBICHAUD	Victoria	Cameco Fuel Manufacturing	Canada	In person
ROBISON	Aaron	Abilene Christian University	USA	In person
RODDY	Crystal	Cameco Corp.	Canada	Online
SAYRE	Warren	NNSA-CNS	USA	In person
SCHLEDEWITZ-McGINNIS	Helen	Sandia National Laboratories	USA	Online
SCHOTT	Chris	NNSA-CNS	USA	In person
SHIREY	Pamela	BWX Technologies, Inc.	USA	In person
SIMMONS	Jan	Scientific Sales Inc.	USA	In person
SISENSTEIN	Alyssa	BWX Technologies, Inc.	USA	In person
SLACK	Greg	Department of National Defence	Canada	Online
SOBIERAJ	Josef	National Nuclear Security Administration	USA	In person
SORENSEN	Caroline	Commonwealth Fusion Systems	USA	Online
STONE	Erin	NNSA-CNS	USA	In person
STUBER	Edward	SGS North America DBA SGS Galson	USA	In person
TALARICO	Mike	Merrick & Company	USA	In person
THAYN	Paterick	Pacific Northwest National Laboratory	USA	Online
TURNQUEST	Eric	US Dept of Energy Science Office	USA	Online
VRETTOS	Nicolas John	Merrick & Company	USA	In person

Minutes of the Beryllium Health & Safety Committee (BHSC) 2024 Spring Meeting
23-24 April 2024 – Oak Ridge, Tennessee, U.S.A.

<u>Family Name</u>	<u>First Name</u>	<u>Organization</u>	<u>Country</u>	<u>Status</u>
WADLEY	Aaliyah	NNSA-CNS	USA	In person
WAGNER	Greg	Advanced Research Corp.	USA	In person
WALKER	Beth	Safer Environment Ltd.	UK	In person
WALKER	Lakeisha	Oak Ridge National Laboratory	USA	Online
WENTZ	Romona	US Dept of Energy Hanford Site	USA	Online
WHATLEY	Todd	National Nuclear Security Administration	USA	In person
WILLOUGHBY	Adam	Oak Ridge National Laboratory	USA	In person
WILMOT	David (Zeke)	Los Alamos National Laboratory	USA	Online
YADA	Shian	NNSA Production Office	USA	Online
ZALESKI	Christopher	General Atomics Corp.	USA	Online
ZHENG	Guiqiu (Tony)	Commonwealth Fusion Systems	USA (China)	Online
ZHOU	Weiyue	Massachusetts Institute of Technology	USA	Online

Meeting & Venue Photos



Opening remarks kicked off the 2024 Spring Meeting. From left to right: BHSC Vice Chair, Josef SOBIERAJ, Jan WEST, Y-12 Deputy Site Manager, Mary Helen HITSON, Deputy Manager of the NNSA Y-12 Field Office, and Roland CHRETIEN, BHSC Chair. The speakers delivered their welcomes to more than 70 in-person attendees at the Wamp Auditorium in the Y-12 New Hope Center and another 50-60 participants online. Photo credits: Y-12 Photographer (first three) and Chris DORN, Be4FUSION (fourth, far right).



In-Person Participants at the BHSC 2024 Spring Meeting gathered in front of the New Hope Center, where the Meeting was held on Tuesday, 23 April 2024. Photo credit: Y-12 Photographer.



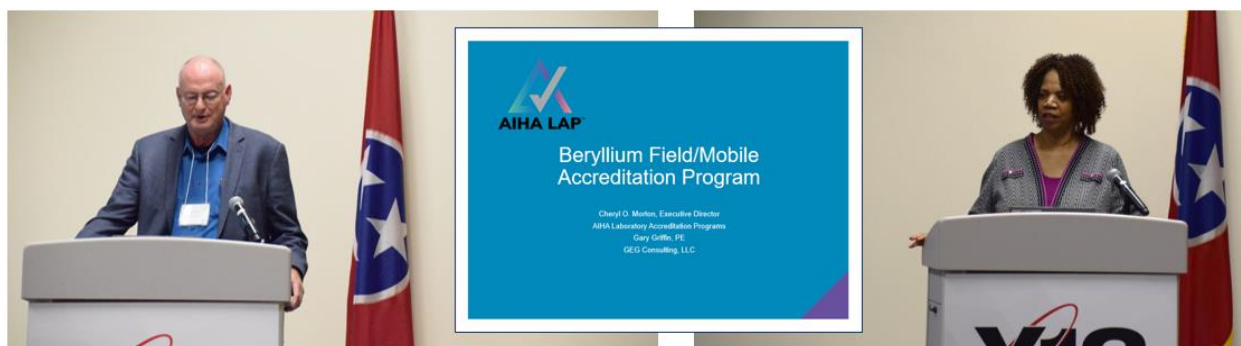
Participants look on as Dr. Ashley GOLDEN, Senior Director of ORISE Health Studies, led off the technical agenda with a History of DOE's Beryllium Medical Surveillance Programs. Photo credits: Y-12 Photographer.



During the Spring Meeting, a special presentation was made on behalf of the BHSC. Courtney HUNTLEY, a Development Scientist at Y-12, was instrumental in the BHSC's ability to secure the New Hope Center as the Meeting venue, which she arranged during a very busy personal time, as she was expecting a baby! In recognition of Courtney's help and dedication during this time, she was presented with a handmade quilt, emblazoned with the BHSC logo, as shown in the photo above right. It is a true, one-of-a-kind item to recognize Courtney's critical contribution to the success of the Meeting. Photo credits: Jack BENNETT, LLNL.



Vendors play an important role in the BHSC mission, and their presence at the Spring Meeting gave them an opportunity to make our members and other practitioners in the field aware of their products and services. Left: Bevan MEADE of ALS Testing Services, who also attended both BHSC 2023 Meetings, tells attendees about the latest services being offered by his company. Middle: Display table for Scientific Sales, Inc. Right: Jeremy KENIMER of GVS-RPB Respiratory Protection Solutions is pictured here with his display table of personal protective equipment (PPE). Photo credits: Jack BENNETT, LLNL.



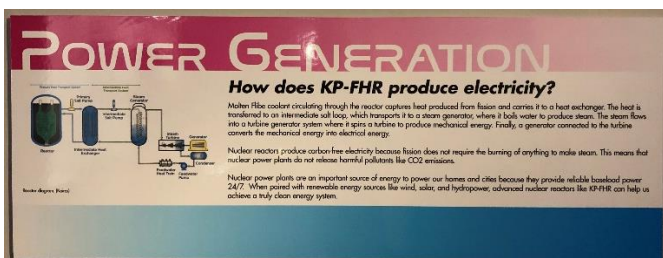
American Industrial Hygiene Association (AIHA), Laboratory Accreditation Program (LAP): Gary GRIFFIN of GEG Consulting and AIHA Chief Site Assessor (left), co-presented with Cheryl MORTON, Executive Director of the LAP (right) on the Beryllium Field/Mobile Accreditation Program. Photo credits: Jack BENNETT, LLNL.



Participants at BHSC Meetings are always encouraged to ask questions. Left: Victoria ROBICHAUD of Cameco Fuel Mfg. asking for clarification after a presentation. Middle left: Greg HELDT of Materion Brush presenting on the new FLiBe Sub-Committee. Middle right: April BROWN of the US DOE's Office of Worker Safety & Health Policy, spoke about 10 CFR 850 Beryllium Program Updates. Right: Meghan DEVINE of Commonwealth Fusion Systems gave the audience some insight into her company's FLiBe-related activities and future plans. Photo credits: Jack BENNETT, LLNL (first, second, and fourth), Y-12 Photographer (third).



In the late afternoon of Day 1 of the Spring Meeting, participants took time for some local technical tours, one of which was a visit to the American Museum of Science & Energy (AMSE). Left: Josef SOBIERAJ, Julie FOWLER, and Jack BENNETT at the museum entrance. Middle: There was an exhibit in the museum's Innovators Gallery, titled "Reaction Time: The Fluoride Salt Future," sponsored by Kairos Power in California. Right: Placard in the aforementioned gallery that talks about the use of FLiBe molten salt in the next generation of modular fission-power reactors, now being developed by Kairos. This exhibit was a great fit with the BHSC 2024 Spring Meeting program!



Left: Another placard in the Innovators Gallery describes how power generation will work in the Kairos prototype reactor.

Right: Attendees at the Spring Meeting dinner were treated to a very interesting presentation on local history given by Y-12 National Security Complex Historian (Retired), Ray SMITH.

Photo Credit:
Chris DORN, Be4FUSION.



Spring Meeting presenters, from left to right: Jayesh DOSHI of eSpin Technologies, who talked about advances in nanofiber wipe materials development; Beth WALKER of Safer Environment Ltd. in the UK, who spoke about her multi-year project of setting up a new, state-of-the-art beryllium manufacturing facility in England; Danny FIELD of the US DOE's NNSA, co-presented on the launching of the initiative to revise the BHSC's "A Practitioner's Guide to Beryllium Hazard Management"; and Jack BENNETT of Lawrence Livermore National Laboratory (LLNL), who told the participants about the potential advantages of considering Inductively Coupled Plasma (ICP) analytical techniques to meet requirements in the US DOE Beryllium Worker Protection Program. Photo credits: Jack BENNETT, LLNL (first two on left) and Chris DORN, Be4FUSION (third and fourth, on right).



The BHSC Board and Membership would like to express our sincere thanks to Materion Brush for generously sponsoring the 2024 Spring Meeting dinner, which was enjoyed by all!