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# Beryllium in RFI Shielding Materials

Update on Beryllium Contamination Found on  
Rooms Shielded with Beryllium Copper Materials

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Gary E Whitney, CIH  
Occupational Safety & Health Division  
Los Alamos National Laboratory

# Disclaimer

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# Background

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- Beryllium surface contamination was discovered on the doors of the Faraday cages in the u1a .05A Drift at NNSS (maximum 120 ug/100 cm<sup>2</sup>).
- A breathing zone sample for one of the two workers performing the cleanup exceeded the beryllium action level, but was within the protection factor of the respirator used.
- Contamination was localized and had not spread to other areas of the tunnel.
- Lesson Learned went out to other DOE sites.

# Concern

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- LANL has a number of Faraday cages, shielded rooms, screen rooms, or other worker occupied areas that use in-place beryllium copper materials.
- Based on earlier sampling results, in the past these areas were typically not considered to present a beryllium exposure or contamination hazard and were not designated as beryllium areas or placed in the beryllium inventory. Considered a beryllium article.
- From the experience at NNSS, it is appeared that this may not be the case.

# What are Shielded Rooms?

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- Known under various names, shielded rooms provide protection from radio-frequency (RF) energy.
  - Faraday Cages
  - Screen Rooms
  - Shielded Rooms
  - RF Enclosure
- Often employ **beryllium copper** finger stock on door and other openings to provide RF shielding and electrical continuity.

# Examples of Screen Rooms

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# Examples of Shielded Rooms

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# Comparison of Room/Cage Size

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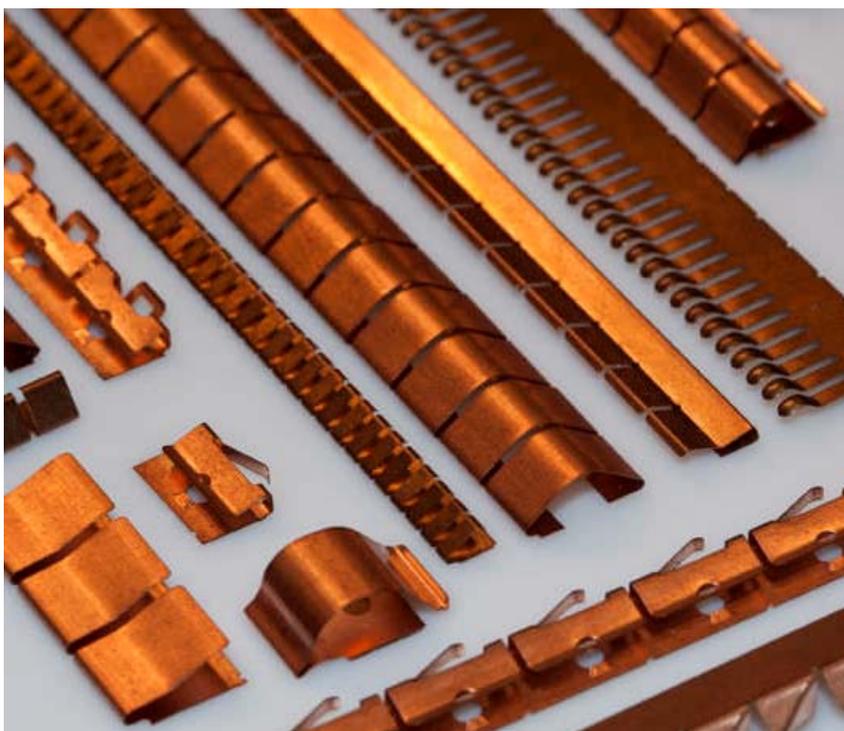


# Weird Examples of Faraday Cages



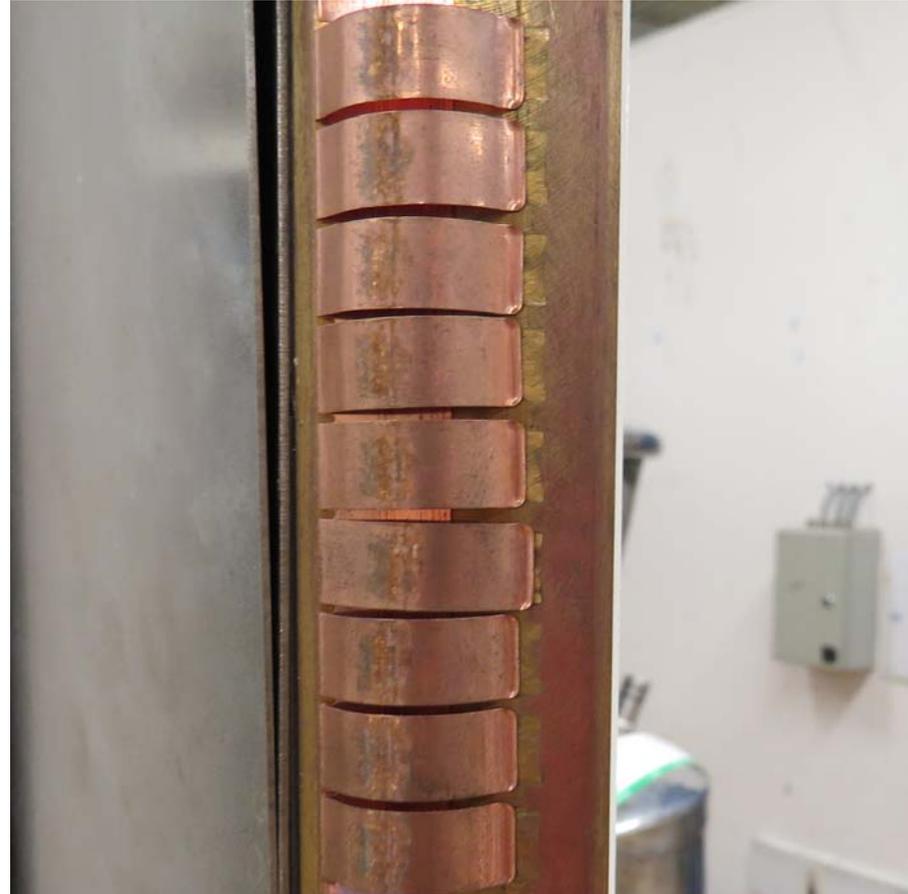
# Examples of BeCu Finger Stock

Beryllium copper finger stock is often installed on door and other openings to provide RF shielding and electrical continuity.

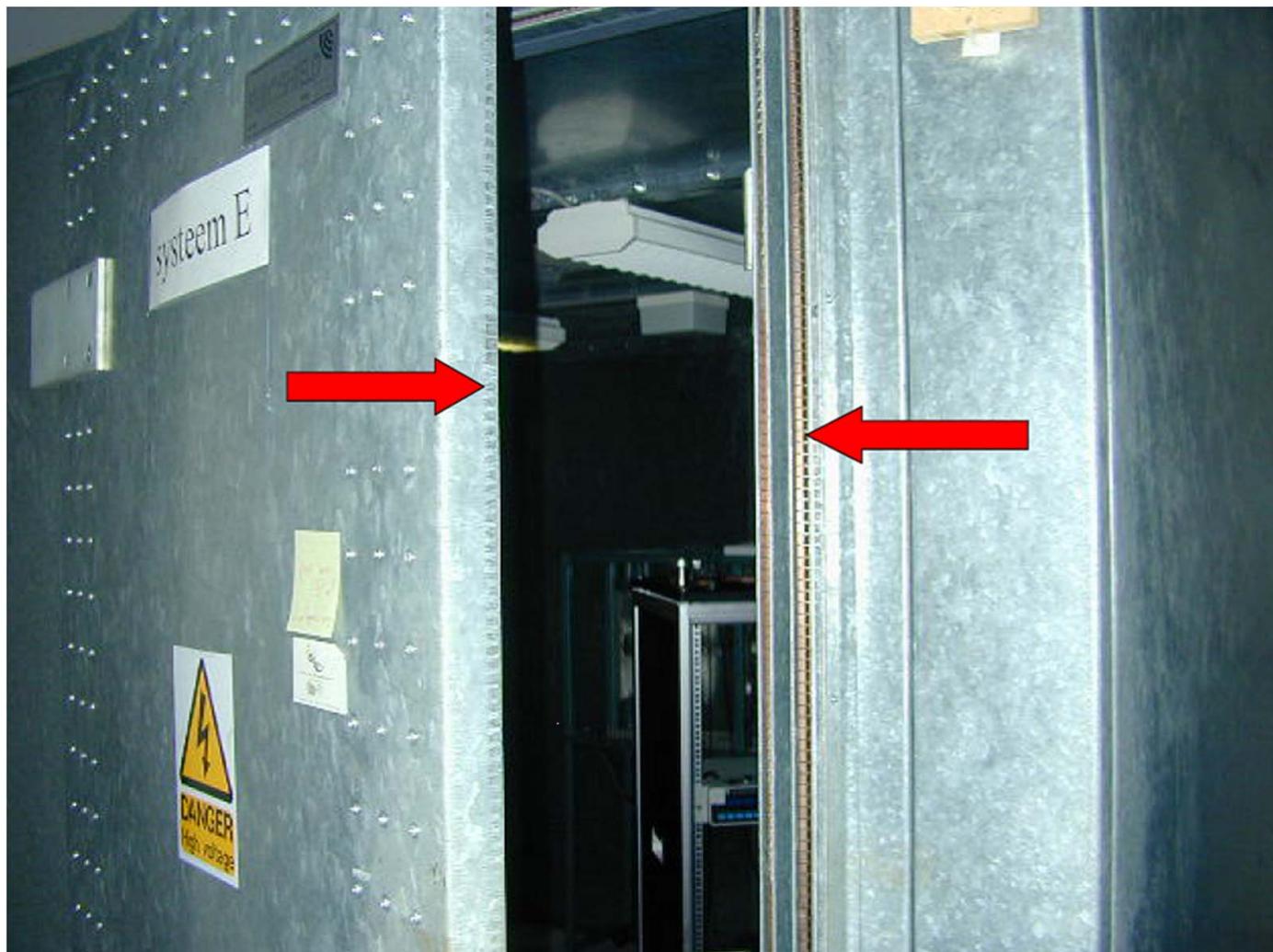


# Example of Installed BeCu Finger Stock

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# Example of Installed BeCu Finger Stock



# Response to Concerns Raised

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- In response to the NNSA warning, LANL initiated an Extent of Condition (EOC) evaluation and began sampling shielded rooms and screen rooms across the Laboratory.
- The door frame and threshold of one shielded room was found to have elevated beryllium contamination (maximum 200 ug/100 cm<sup>2</sup>). This was the worst case of all areas evaluated.
- The area was cordoned off, access was restricted, and it was posted as an Accessible Beryllium Contamination Area.
- Additional samples were collected to better characterize the shielded room where beryllium contamination was identified.

# Shielded Room with Highest Contamination

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## Follow-Up Samples on Worst-Case Room

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- 28 follow-up samples collected in the shielded room and adjacent areas outside room.
- Three samples on door & frame were found to have elevated beryllium contamination (2.4, 4.3, and 5.0 ug/100 cm<sup>2</sup>).
- All other samples below 0.2 ug/cm<sup>2</sup>. Most below LOQ.
- No contamination spread beyond door.
- Sampling of undisturbed horizontal surfaces gave no indication of airborne beryllium.

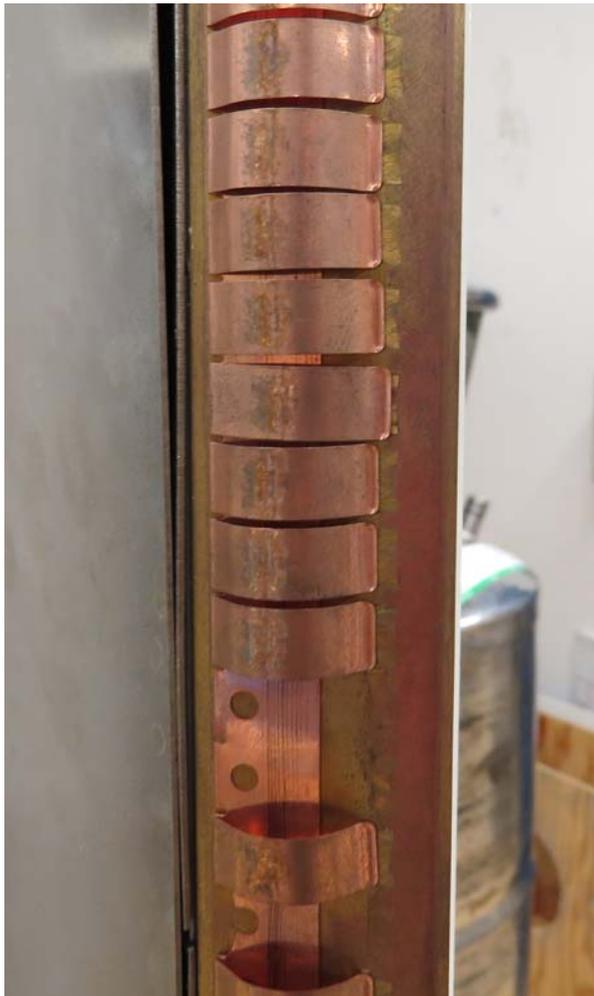
**This general pattern was followed when beryllium contamination was found during the EOC.**

## Summary of EOC Outcome

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- Twelve of the 40 rooms or structures evaluated had beryllium contamination above 0.2 ug/100 cm<sup>2</sup>. Contamination was limited to doors and frames.
- Note that the finger stock in shielded rooms above 0.2 ug/100 cm<sup>2</sup> tended to showed evidence of wear with shiny-bright metal contact points, abrasion marks, and sometimes broken finger stock.
- Finger stock for the shielded rooms with no contamination concerns tended to have a darker, dull patina and only slight evidence of wear and abrasion. Like the difference between an old and new penny.

# Example of Worn BeCu Finger Stock



# Summary of EOC Surface Sample Results

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To date 380 surface wipe samples collected, including:

- Initial samples to identify contamination.
- Additional samples to further evaluate.
- Post-cleaning samples to confirm effectiveness

Results (all per 100 cm<sup>2</sup>)

– Non-Detect	171	45%	(LOQ = 0.013 ug)
– Detect to 0.2 ug	167	44%	mean = 0.03 ug
– 0.2 ug to 3.0 ug	32	8.4%	mean = 0.84 ug
– > 3.0 ug	10	2.6%	mean = 24.8 ug

Maximum sample was 200 ug, with the next highest being 10, 8.6, and 5.0 ug respectively. Maximum appears to be an outlier. Note that additional samples are pending analysis.

# Summary of EOC Air Sample Results

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To date 15 air samples (3 area, 12 BZ) have been collected:

- During initial surface sample collection.
- While BeCu shielding material was being removed.
- During decontamination efforts.

## Results (all 8hr TWA)

- Non-Detect            12            80%            (LOQ = 0.013 ug)
- Detectable            3            20%            maximum = 0.06 ug/m<sup>3</sup>

Maximum air sample was on worker performing determination and removal of finger stock where highest surface contamination was found. Note that additional samples are pending analysis

# Paths Forward for In-Place BeCu Materials

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- Evaluated areas were added to the LANL beryllium inventory.
- Where beryllium contamination above 0.2 ug/100 cm<sup>2</sup> was found, the areas were temporarily posted as Accessible Beryllium Contamination Areas and access was restricted.
- Actions for areas with contamination included:
  - Decontaminating and replacing BeCu finger stock with non-beryllium material. (Some non-contaminated areas also replaced.)
  - Decontaminating and keeping BeCu finger stock in-place with scheduled cleaning and re-sampling.
  - Keep the area posted as contamination area and restrict access.
  - Some areas were not in use and were posted and closed off pending decisions on the final path forward (e.g. D&D).

## Additional Actions

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- Where beryllium contamination was below 0.2 ug/100 cm<sup>2</sup>, the areas will be periodically sampled to ensure contamination does not build-up.
- In-place beryllium materials will be labeled identifying the beryllium and warn against contact or creating any dust or particulate. (Similar to asbestos warning labels.)
- Owners/users of the areas evaluated were advised to check with shielded room designers or manufacturers before deciding to replace BeCu materials. In some cases the manufacturer could not assure that the shielded room would function to required specifications if a substitute material was used. Hence, some BeCu materials will remain in place with periodic cleaning and sampling.

# Questions

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Gary Whitney, CIH  
Los Alamos National Laboratory  
P.O. Box 1663, Mail Stop K494  
Los Alamos, NM 87545

whitney\_gary@lanl.gov  
(505) 665-8549