Building 212 Legacy Beryllium and Other Metals

Presented to:

Building 212 area occupants

Presented by:

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Beryllium

- Beryllium (Be) is a naturally occurring element.
- One-third lighter than aluminum, making it one of the lowest density materials – also one of the most rigid, with stiffness six times greater than steel.
- Common uses today:
  - Cellular telephones
  - Ceramics in crucibles, jet engine blades, rocket covers
  - Computer and telecommunication parts
  - Automotive parts
  - Heat shield, nuclear reactors, components for nuclear weapons
  - Dental alloys in crowns, bridges, and dental plates
  - Golf club heads and bicycle frames
- Health effects caused by exposure to beryllium identified in the 1940s

Beryllium use at Argonne

- Primary use at Argonne:
  - Crucibles
  - Neutron reflectors
  - Neutron beam filters
  - X-ray machine windows
- From 1950s to 1980s, Argonne had a state-of-the-art, dedicated beryllium machine shop.

Legacy Beryllium Cleanup

- Argonne performed an extensive review in the early 2000s to look for beryllium.
- 70 locations in 11 buildings were identified and sampled.
- Beryllium surface levels in 27% of buildings exceeded “free release” criteria established by DOE.
- However, none of the results exceeded levels that require posting as a designated beryllium area.

What does “free release” mean?

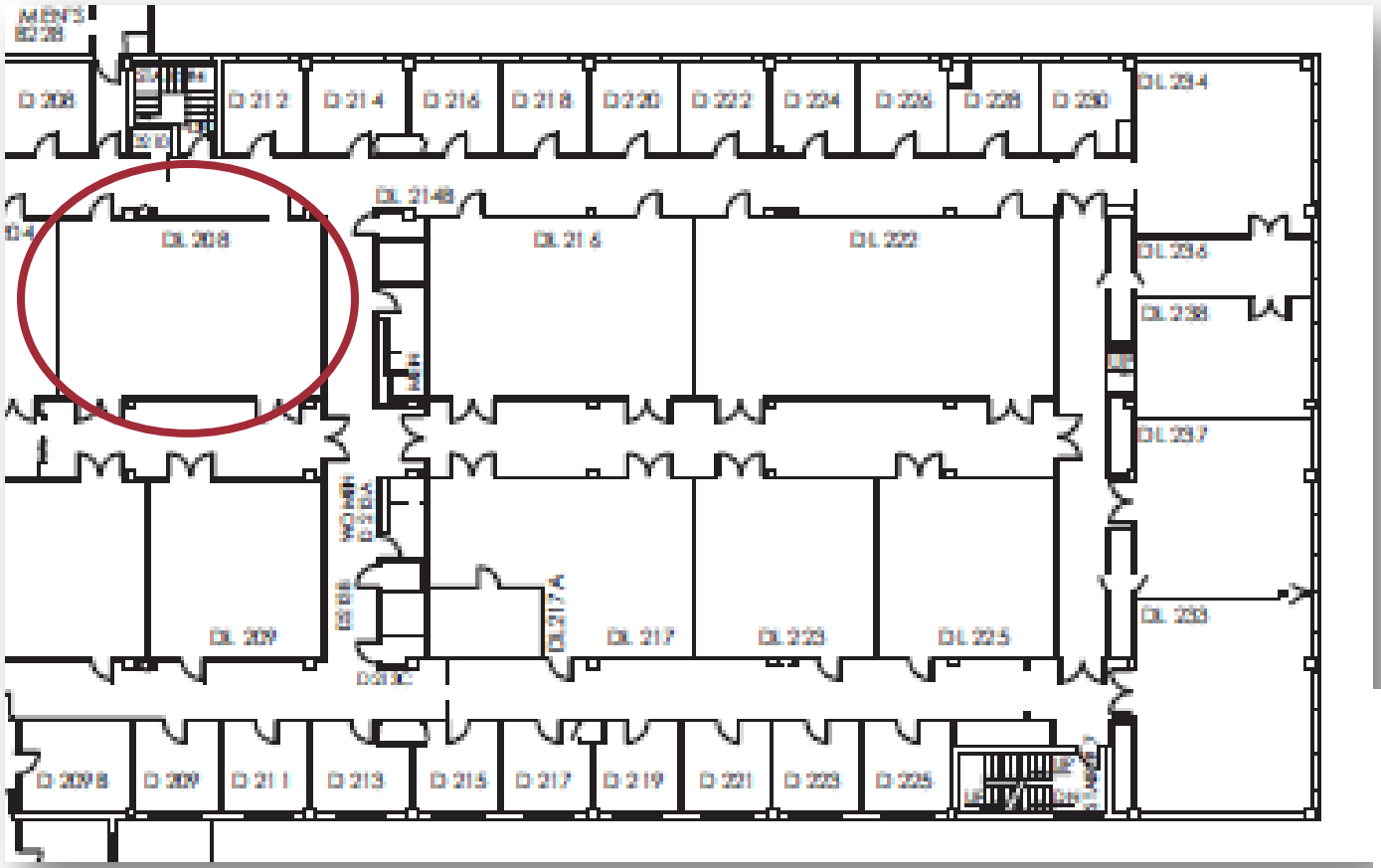
This is the level at which an item with beryllium on its surface can be “released” to the general public (i.e., wasted or used without need for special handling)

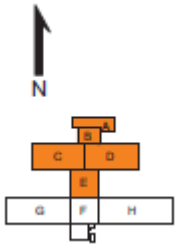
So why are you here?

- Surface samples in Building 212 collected as part of the Extent of Condition project exceeded “free release” criteria. Samples were located in three areas:
  - On the surface of ceiling (above tile) in DL-208.
  - On equipment surfaces in H-209 and H-209A, an area that surrounded dust collections from an old non-radiological machine shop in H-121 and an old radiological machine shop in H-133.
  - On surfaces of light fixtures, trusses, beams, ducts, pipes and conduit in the overhead space in H-121.

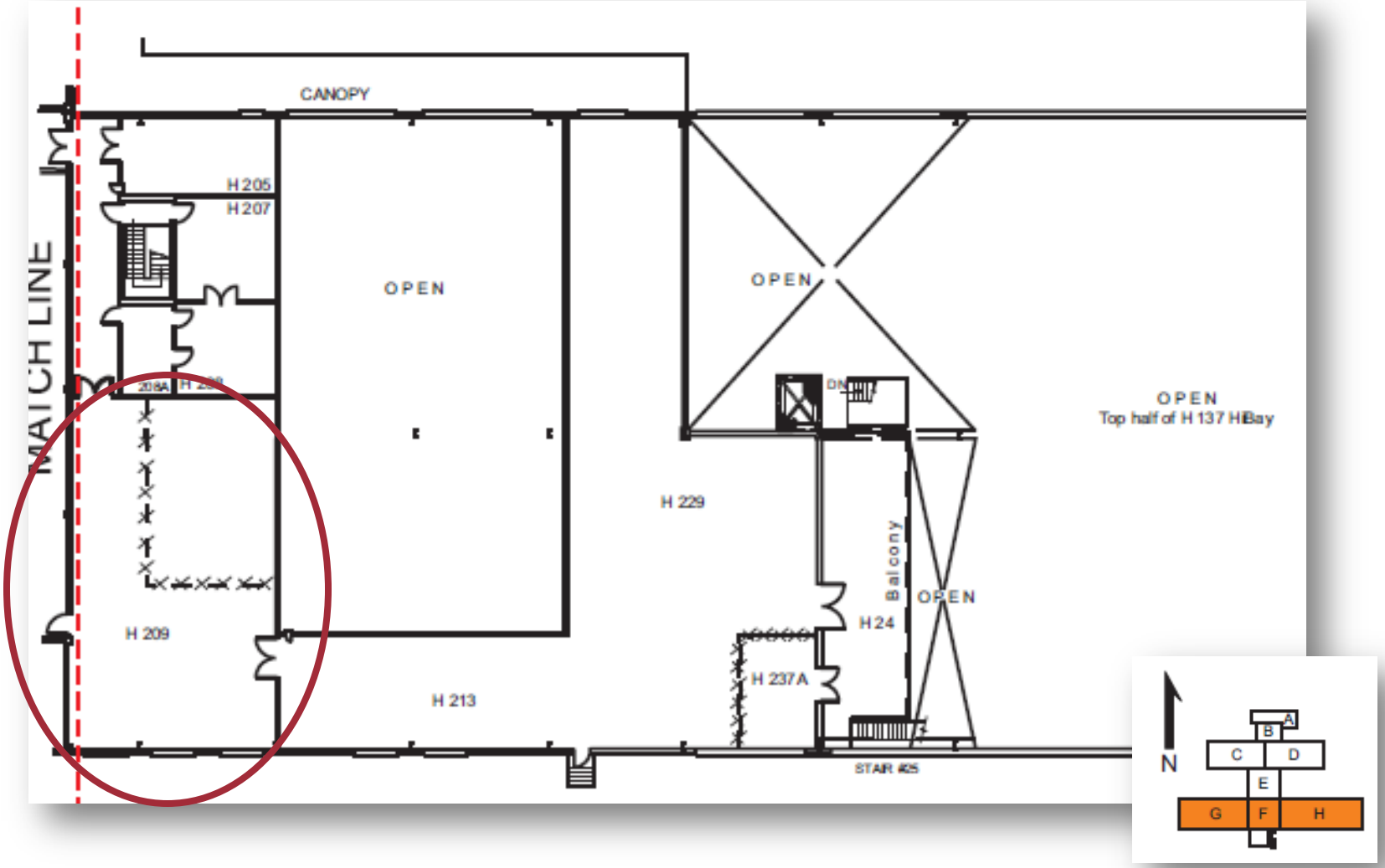
Samples in these areas were all below the level requiring posting as designated beryllium or other metal areas, but above “free release” criteria.

Building 212 DL-208 Conference Room

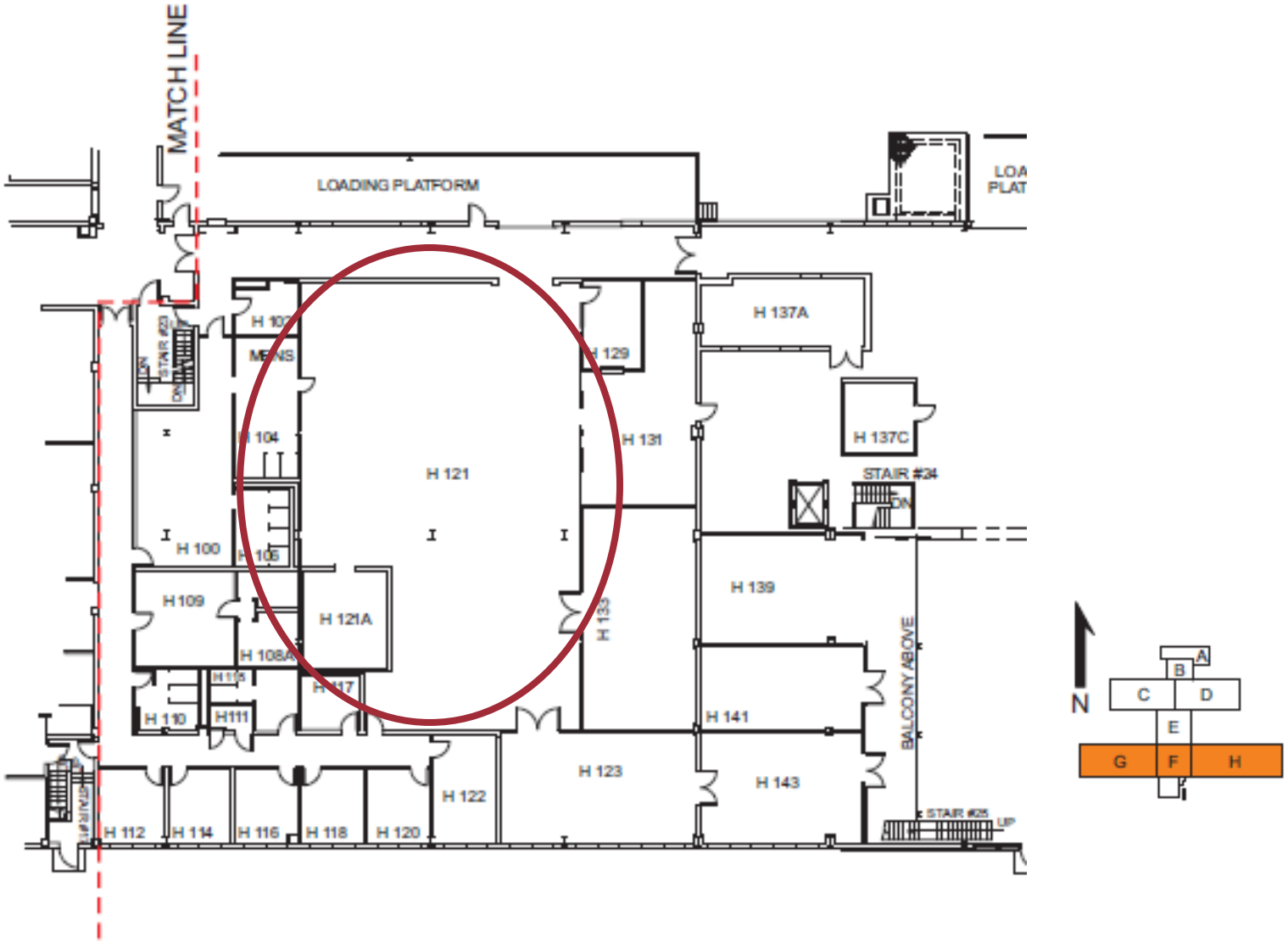




Building 212 H-209 and H-209A

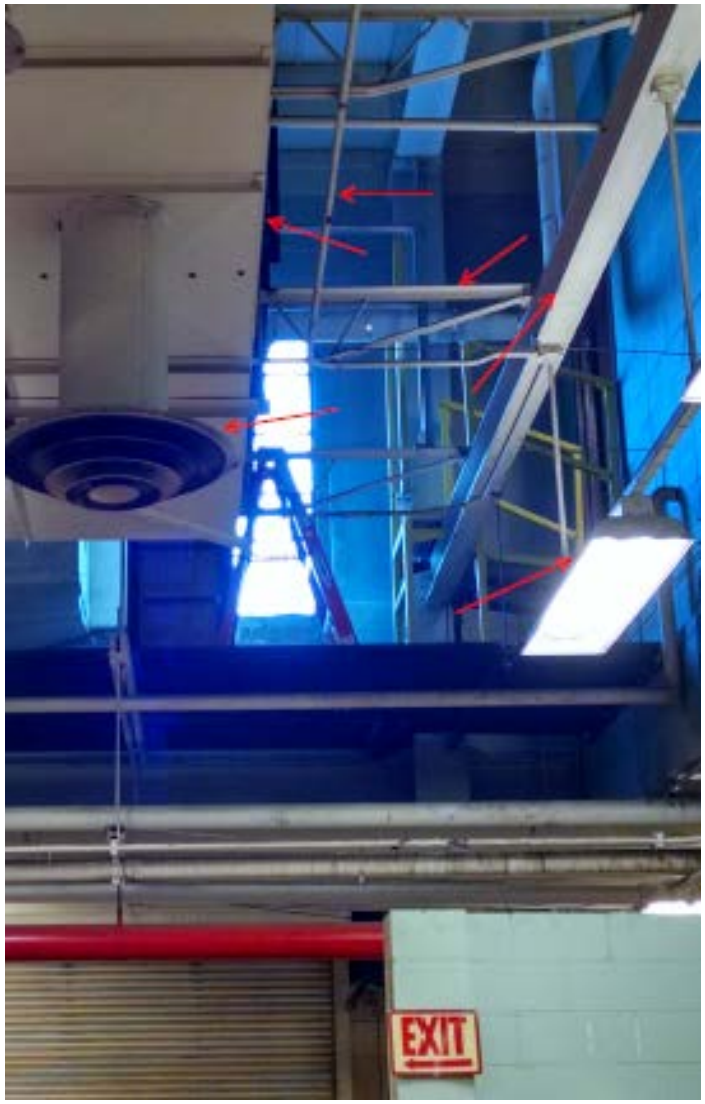


Building 212 H-121



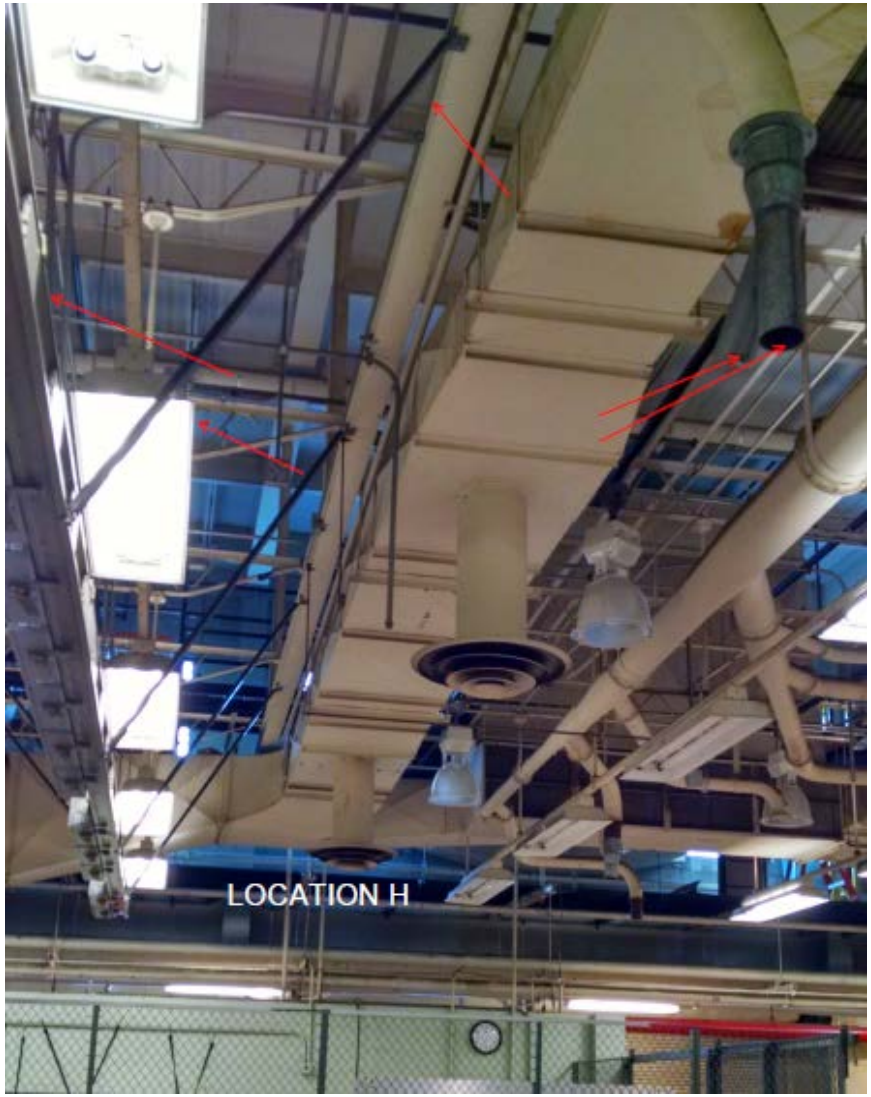
Building 212 H-209 and H-209A

Building 212 H-121



- Surface “free release” criteria were exceeded in several overhead space samples. Analysis identified As, Be, Cd, Cr, and Pb.

Building 212 H-121



Building H-121 Refrigerator

- Surface wipe sampling for metals in surface dust were collected from the exterior of the refrigerator.
- All surfaces were within applicable surface clearance guidelines.

What are we doing?

Area airborne monitoring was completed in all locations and confirmed ***no detectable airborne concentrations****.*

- Easily accessible surfaces are to be cleaned, re-surveyed, and then confirmed by industrial hygiene to be at levels below free release limits.
- Hard-to-reach surfaces will require pre-cleaning of surfaces prior to work on or in the vicinity of affected surfaces.
- Work will be phased to limit disruption of routine activities.

Is there concern for health effects? Metals – Points before details

- Metals cause health effects through inhalation or ingestion (dermal exposure is rare cause of significant exposure for any health effects other than skin irritation)
  - There is no evidence that these metals are airborne
  - Hopefully for anyone who may have worked in these areas without gloves, hands were washed before eating!
- All these metals are found in the environment
- All can have immediate health effects at higher intake doses or after prolonged exposure at lower doses
- Tests and “normal” results for each vary and depend on the situation
- Should not be treated unless levels correlate with clinical symptoms in most cases
- Have low level of concern that our employees would have any findings specifically related to the metals found in these areas.

Beryllium

- Beryllium exposure is associated with 2 diseases:
  - Chronic Beryllium Disease (CBD)
  - Lung cancer
- Research indicates that CBD and lung cancer typically develop under the following conditions:
  - High levels of airborne beryllium is inhaled AND
  - Genetics that predispose persons exposed to react to beryllium AND
  - Smoking history
- The beryllium lymphocyte proliferation test checks an individual's "sensitization" or "immune response" to beryllium:
  - An individual must have had exposure to beryllium to be sensitized
  - Beryllium sensitization is NOT a disease. It is a means to let the individual know they are more likely to react to beryllium and should minimize repeated exposure to avoid developing CBD
  - Being sensitized DOES NOT mean you will definitely get CBD or lung cancer
- Based on results that we've collected indicating that the beryllium in these legacy areas is low and fixed on surfaces, our concern for health effects is extremely low.

Cadmium

- Background
  - Metal found in earth's crust, environmental metal is from waste stream (mining, batteries, paint industry, etc.).
  - In the United States, for nonsmokers the primary source of cadmium exposure is from the food supply. In general, leafy vegetables such as lettuce and spinach, potatoes and grains, peanuts, soybeans, and sunflower seeds contain high levels of cadmium, tobacco leaves accumulate high levels of cadmium from the soil.
- Health Effects
  - Ingesting or Inhaling high levels of cadmium can cause death or GI issues.
  - Ingesting or inhaling lower levels over time can cause cadmium deposition in the kidneys and kidney damage or even cancer (is a carcinogen).
  - Exposure to lower levels of cadmium for a long time can also cause bones to become fragile and break easily.
- Testing for Exposure: Cadmium can be measured in blood, urine, hair, or nails.
  - The amount of cadmium in your blood shows your recent exposure to cadmium.
  - The amount of cadmium in your urine shows both your recent and your past exposure.
  - Cadmium levels in hair or nails are not as useful as an indication of when or how much cadmium you may have taken in, partly because cadmium from outside of your body may attach to the hair or nails.
  - Mean blood cadmium levels for heavy smokers -reported as high as 5x normal.

Chromium

- Background
  - Chromium is a naturally-occurring element found in rocks, animals, plants, and soil, where it exists in combination with other elements to form various compounds.
  - The three main forms of chromium are:
    - chromium(0),
    - chromium(III), and
    - chromium(VI).
  - Small amounts of chromium(III) are needed for human health.
  - Is excreted through urine
  - Chromium VI is converted to Chromium III in the body
- Health Effects
  - Chromium VI is a carcinogen and the form associated with health effects
  - Respiratory irritation at high inhaled levels as well as skin irritation
- Testing for Exposure
  - Since chromium is a required nutrient in the body and is normally present in food, chromium is normally present in blood, urine, and body tissues.
  - Higher than normal levels of chromium in blood or urine may indicate that a person has been exposed to chromium. However, increases in blood and urine chromium levels cannot be used to predict the health effects that might develop from that exposure.

Arsenic

- Background
  - A Metalloid
  - Found naturally in the environment, will be exposed to some arsenic by eating food, drinking water, or breathing air.
  - Both inorganic and organic forms leave your body in your urine. Most of the inorganic arsenic will be gone within several days .
- Health Effects (only at higher doses)
  - Gastro-enteral irritation
  - Skin changes
  - Respiratory irritation acutely
  - Neuropathy
  - Decrease blood cell production
  - Large oral doses (above 60,000 ppb in water which is 10,000 times higher than 80% of U.S. drinking water arsenic levels) can result in death.
- Tests for Exposure
  - Because most arsenic leaves your body within a few days, analysis of your urine cannot detect if you were exposed to arsenic in the past. Tests of your hair or fingernails can tell if you were exposed to high levels over the past 6–12 months, but these tests are not very useful in detecting low-level exposures.

Lead

- Background:
  - Naturally occurring metal – usually found in combination with other elements
  - Used in radiation shielding, batteries, production of alloys, etc.
  - Most likely source of exposure is ingestion of contaminated food and drinking water. Exposure can also occur via inadvertent ingestion of contaminated soil/dust or lead-based paint.
  - Shortly after lead enters your body, it travels in the blood through "soft tissues" and organs (such as the liver, kidneys, lungs, brain, spleen, muscles, and heart). After several weeks, most of the lead moves into your bones and teeth. In adults, about 94% of the total amount of lead in the body is contained in the bones and teeth.
  - Lead that is not stored in your bones leaves your body in urine or feces.
  - About 99% of lead in the body of an adult will be excreted in waste over two weeks
- Health Effects
  - Disorders of nervous system
  - Anemia
  - Miscarriage
- Testing for Exposure
  - Blood Lead and ZPP testing

Questions and discussion

- FAQ sheets provide detailed information about our findings and plans to mitigate.
- Contact Health and Employee Wellness if you have concerns about health effects and wish to meet with a clinician:
  - Call (630) 252-2800, extension 1
  - Email medical@anl.gov

Questions from BHSC members may be directed to Gary Griffin, email gegrif@anl.gov