Beryllium Hazard Awareness

Fermi National Accelerator Laboratory

PPD Environment, Safety and Health

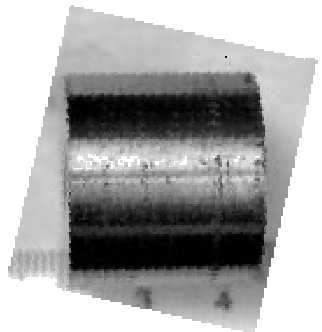
At FermiLab...

- Beryllium is defined as any object that contains greater than or equal to 0.1% beryllium
- Includes beryllium, beryllium alloys, and ceramic beryllia
- Beryllium is handled in bulk form only - no cutting, sanding, or grinding occurs on site

Uses at FermiLab

- Beam Targets
- Beam Pipes
- Beam Windows
- Support Structures for Detectors

Beryllium Target



Beryllium Window

Properties

- Silver-gray metal
- 1/3 lighter than aluminum
- 6 times stiffer than steel
- Good corrosion resistance
- High Melting Point
- Brittle
- Toxic

Health Hazards

- Skin Disorders
- Lung Disease

Ingestion

- Beryllium is not intended for internal consumption
- Hands should be thoroughly washed after contact
- Eating and smoking are not allowed in beryllium areas

Skin Contact

- Water soluble beryllium salts can cause skin irritation also called Dermatitis
- If beryllium is imbedded in the skin, ulcers and corn-like lesions can develop
- Skin disorders usually heal completely

Inhalation - Primary Concern

- Inhalation of small particles
- Reach into the air sacs of the lung
- Lung has a mechanism to remove particles
- Problem occurs when:
  - Can not remove particles as quickly as they are inhaled
  - Allergic reaction occurs

Inhalation – Primary Concern

- Exposure should be kept As Low As Reasonably Achievable (ALARA)
- Minimize…
  - Number of workers
  - Time
  - Amount of Beryllium
- Currently, there are 0 employees at Fermi Lab trained as Beryllium Workers

Acute Beryllium Lung Disease

- Caused by inhalation of very high levels of beryllium dusts
- May occur 2 weeks after exposure
- Symptoms are similar to those of bronchitis or pneumonia
- Symptoms disappear after exposure ends
- Rarely occurs today

Chronic Beryllium Disease

- Can occur when:
  - Inhale small concentrations of beryllium over a certain time period
  - AND the individual has become sensitized (allergic) to beryllium

Chronic Beryllium Disease

- Three requirements for disease development:
  - Individual must be sensitized to beryllium
  - Individual must be exposed to airborne beryllium for some amount of time
  - Airborne beryllium particles must be small enough to enter air sacs in the lungs
- Different levels of exposure may cause this disease, depending on the individual

Two Stages of CBD

- Sensitization - allergic development
  - 3 - 10% of the population
  - *May develop disease at this point*
- Granuloma Development
  - Lung tissue is irreversibly scarred
  - Reduces ability of lung tissue to transfer oxygen to blood
  - *Particles become lodged in lung tissue*

Symptoms

- Coughing
- Shortness of breath
- Fatigue
- Blood in mucus
- Chest and joint pain
- Rapid heart rate
- Loss of appetite
- Fevers and night sweats

Chronic Beryllium Disease

- Medical tests can determine if individuals are sensitized to beryllium
- Symptoms may occur 5-10 years after exposure
- No cure exists, but treatments are available

Lung Cancer

- Listed by OSHA as potential cancer hazard
- Research continues

OSHA Exposure Limits

- 8 hour time weighted average - 2 $\mu g/m^3$
- 15 minute peak exposure limit - 25 $\mu g/m^3$
- Exposure depends on
  - Concentration
  - Frequency
  - Duration
- These limits have greatly reduced incidence of CBD

To Minimize Your Exposure…

- Use Personal Protective Equipment (PPE)
- Follow Safe Work Guidelines
- Practice personal hygiene
- Contact the Medical Department if symptoms occur

Department of Energy

- All DOE contractors must have a Chronic Beryllium Disease Prevention Program to address this concern
- Many question the adequacy of OSHA's limits
  - *Permissible Exposure Limit – 2 $\mu g/m^3$*
  - *Action Limit – 5 $\mu g/m^3$*
  - *Short term Exposure Limit - 10 $\mu g/m^3$*
- *These limits require medical surveillance and personal protection*

Chronic Beryllium Disease Prevention Program

- Reduction and minimization of exposures
- Exposure monitoring
- Medical surveillance
- Facility characterization and sampling
- Hazard analysis
- Recordkeeping
- Training
- Performance feedback

FermiLab's Program

- FermiLab Environment, Safety and Health Manual, Chapter 5052.5

- www-esh.fnal.gov/FESHM/5000/5052_5.html

Definitions

- Action Level: concentration of airborne beryllium which prompts series of requirements. This is an eight hour time weighted average of **0.2ug/m3**
- Beryllium Worker: Person with the training and clearance from Medical to perform work that may produce levels in excess of Action Level
- Beryllium Area: Area where concentration exceeds the Action Level

Special Responsibilities

- Division/Section heads must be aware of materials, operations, and related hazards
- Supervisors, coordinators, and task managers must conduct operations in a safe manner
- Beryllium workers must have knowledge and training
- Medical department must provide medical surveillance program for beryllium workers

Inventory

- Includes current beryllium locations and operations
- Maintained in Particle Physics Division ES&H inventory
- *Contact PPD ES&H: x2977, x3511, x2557*

Storage and Labeling

- Label
  - Areas where exposure may exceed action level
  - Beryllium-containing materials
- Store in dry, designated storage areas
- Containers must be sealed and secured

Beryllium Area Label

RESTRICTED AREA - NO ENTRY

DANGER

BERYLLIUM WORK AREA

INHALATION OF DUST OR FUME MAY CAUSE SERIOUS LUNG DISEASE

POTENTIAL CANCER HAZARD

NO SMOKING OR EATING

CONTACT _____ PRIOR TO ENTRY

Beryllium Hazard Label

Caution: Beryllium

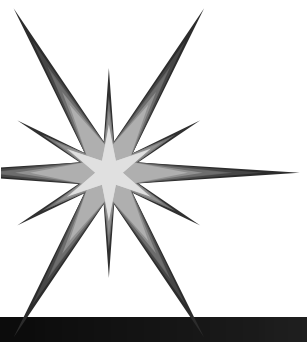
Dust and fume may cause rashes and ulcers on cut skin.

Suspect cancer hazard. Inhalation of dust or fume can cause lung damage. Allergic reaction is possible.

Work which may cause exposure to dust or fume must be cleared with ES&H Group.

Only beryllium trained workers may use this material.

If contacted, rinse area with water. If inhaled call Medical. Use gloves when handling this material.



HAZ-MAPS

Hazard Assessment and Control

- Minimize employee exposure
- Gloves are required to prevent skin contact
- Beryllium activities must be approved

Beryllium Work Permits

- Needed for
  - Work related to beryllium activities
  - Moving large quantity parts with removable surface beryllium
- Includes
  - Exposure Assessment
  - Medical
  - Training
  - Pre-Job Conditions
  - Required Controls
  - Required Sampling
  - PPE
  - Hygiene Facilities and Practices
  - Waste
  - Approvals

Toxic Material Handling Permit

TOXIC MATERIAL HANDLING PERMIT

Date:	**Expires:**	**Extended To:**
Location of Work (Please be specific)		
Description of Work		
Employees (names) **1.** **2.** **3.** **4.** **5.** **6.**	**Training Current**	**Medical Approval**
Pre-Job Conditions (contamination, safety factors, etc.)		
Required Controls		
Required Sampling		
Required Personal Protective Equipment		
Hygiene Facilities Needed		
Waste Disposal Instructions		
Special Instructions		
Approvals **Division/Section ES&H** **Task Manager**		

Exposure Assessment

- Conducted by an ES&H professional
- Exposure during activities are assumed over the Action Level unless data from similar procedures document exposures below the Action Level

Medical

- Must be notified prior to any job that requires a permit
- Must approve each worker assigned to the job

Training

- Beryllium Awareness Training
- Respiratory Protection Training
- Beryllium Worker Training

Pre-Job Conditions (Permit)

- Work area analysis
  - Wipe Samples
  - Beryllium Component analysis
- Job safety Analysis
  - Ergonomic concerns
  - Safety concerns

Required Controls (Permit)

- Engineering, work practice, and administrative controls
  - Exhaust ventilation
  - Hygiene practices
  - Enclosing the work area
  - Restricting work area access

Required Sampling (Permit)

- Permit indicates number and frequency of
  - Personal and area air samples
  - Surface wipe samples

Personal Protective Equipment (Permit)

- Respirators
- Coveralls
- Gloves
- Hoods
- Disposable shoe covers

Hygiene Practices

- Keep work area free of beryllium accumulation
- Food, beverages, and tobacco may not be stored or consumed in beryllium areas
- Maintain low beryllium levels at all times

Waste

- Beryllium–contaminated residues must be contained, collected and packaged for disposal

- Dispose of waste in accordance with Fermi Lab's regulated chemical disposal program

Approvals

- Permit must be signed by
  - ES&H Group of the division or section overseeing the project
  - Task manager

Decontamination

- Use Soap and water
- Consult the Medical Department

PPD Requirements

- Always wear gloves when handling beryllium
- Determine concentration of removable beryllium on new parts before use and clean if necessary
- Beryllium contaminated materials are classified as Special Waste
- If part breaks, call PPD ES&H for clean-up or x3131

Questions?

Contact PPD ES&H Group

x2977

x3511

x2557