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TA-55 PF-4 Glovebox System Overview
JOWOG 39

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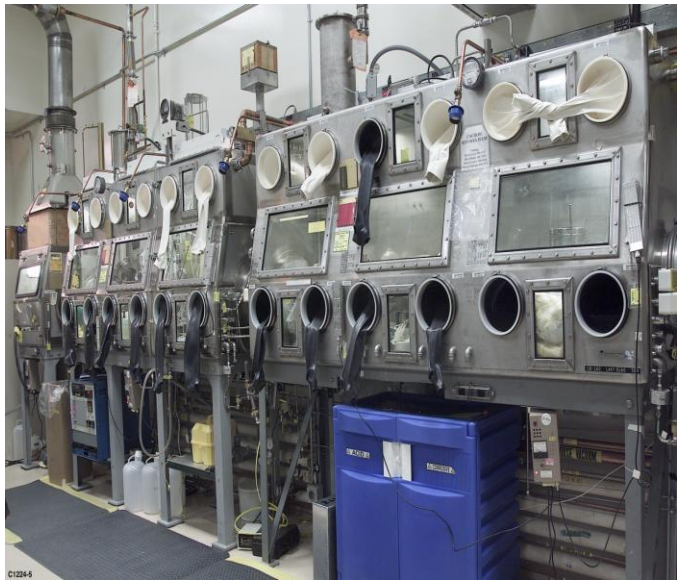
Support Stands: Sal Macias, Rick Hinckley

Abstract

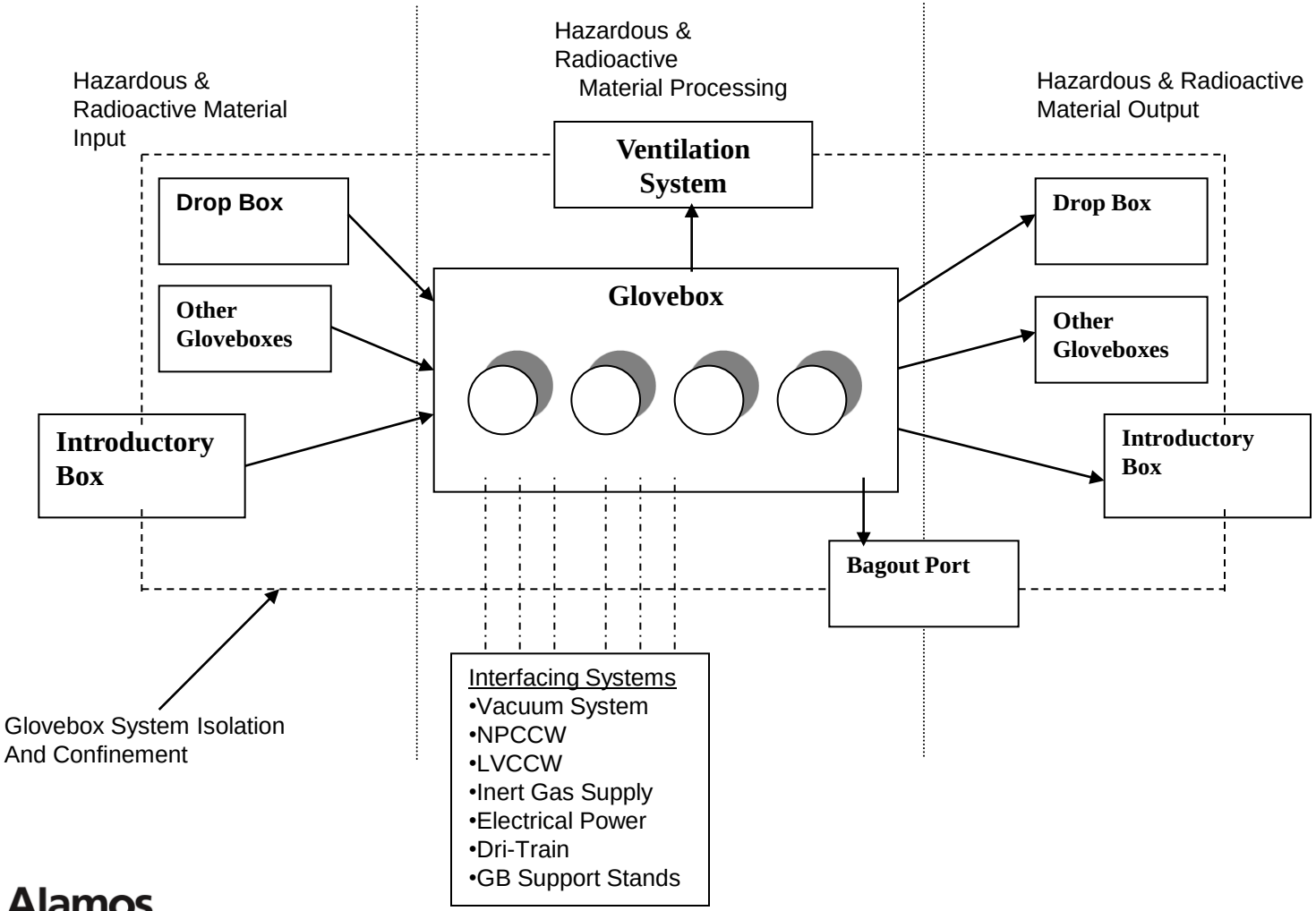
Programmatic operations at the Los Alamos National Laboratory Plutonium Facility (TA-55) involve working with various amounts of plutonium and other highly toxic, alpha-emitting materials. The spread of radiological contamination on surfaces, airborne contamination, and excursions of contaminants into the operator's breathing zone are prevented through the use of a variety of gloveboxes (the glovebox, coupled with an adequate negative pressure gradient, provides primary confinement). In the following presentation, key aspects of the glovebox system are discussed.

Purpose of the TA-55 Glovebox System

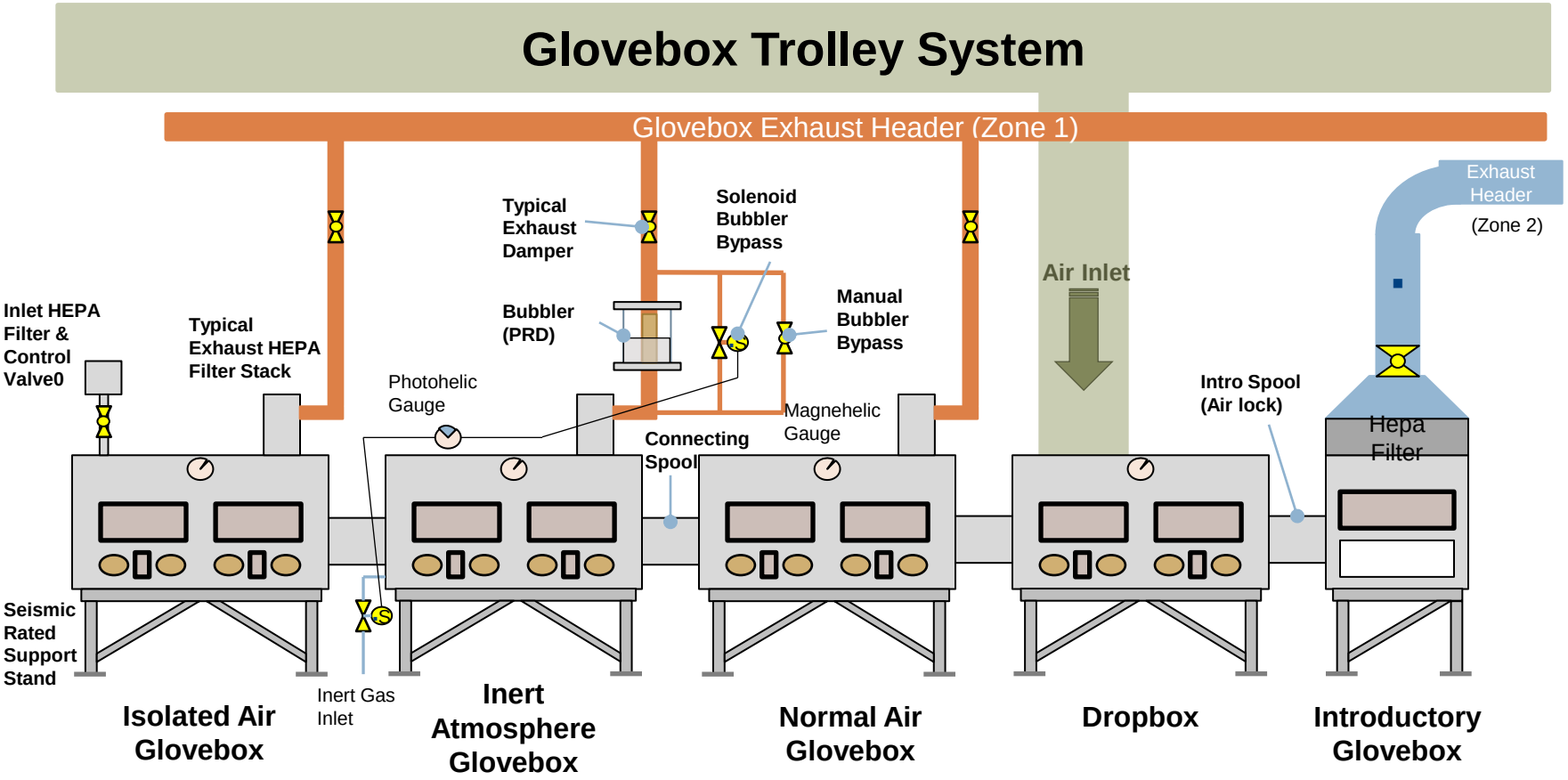
- **The glovebox system protects workers *and the public* from airborne exposure to hazardous and radioactive materials by containing the materials inside the GB enclosure in a controlled atmosphere.**
- **The glovebox system provides primary confinement by containing hazardous and radioactive material and providing a barrier against the release of radioactive particulate during normal operations, loss of ventilation and during and after a seismic event.**
- **The glovebox system includes: gloveboxes, drop boxes, introductory boxes, tunnels, fume hoods and GB stands. Many of the GBs are inter-connected via drop boxes and trunk lines to allow transfer from one GB to another.**



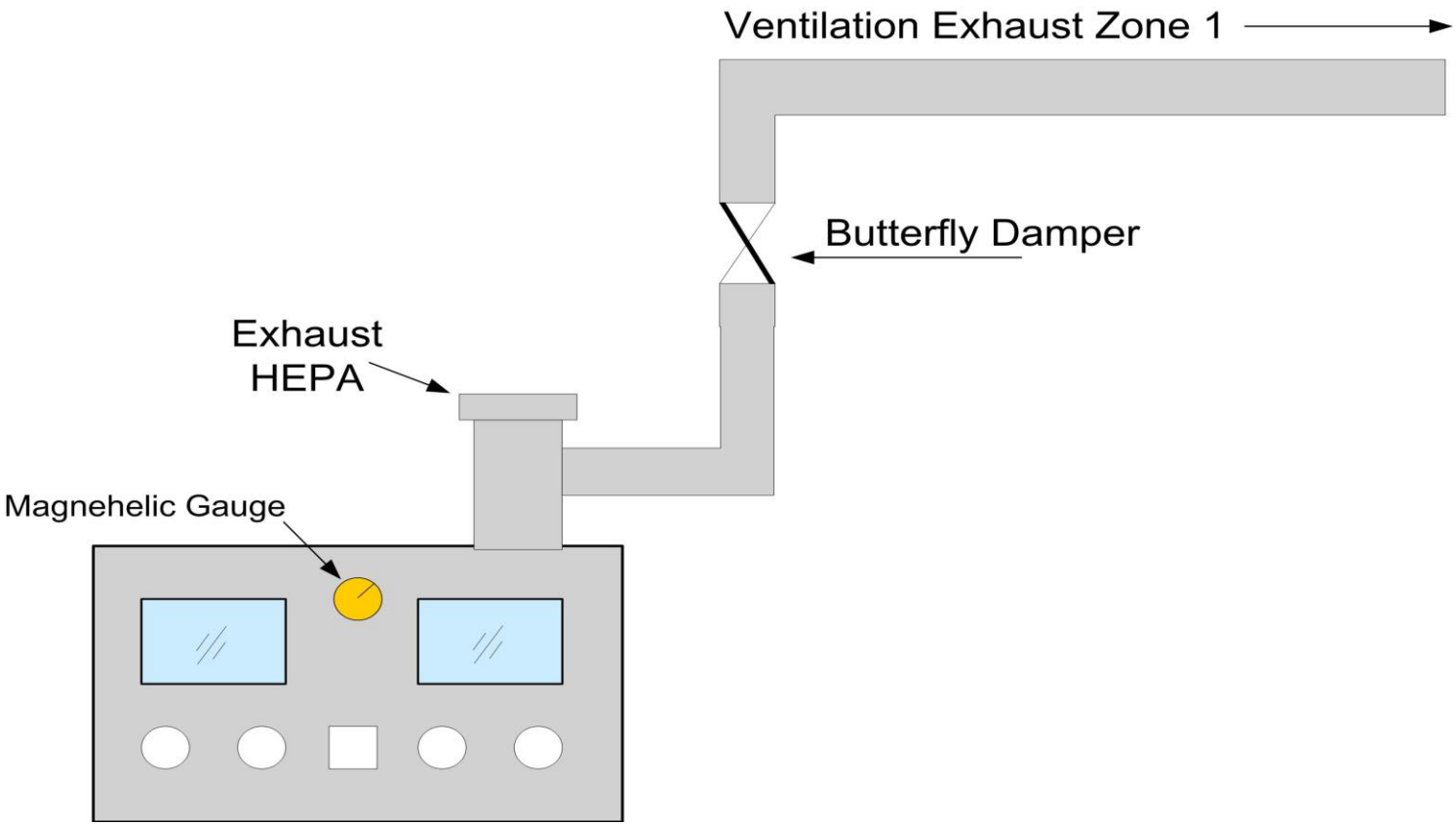
GBS Block Diagram



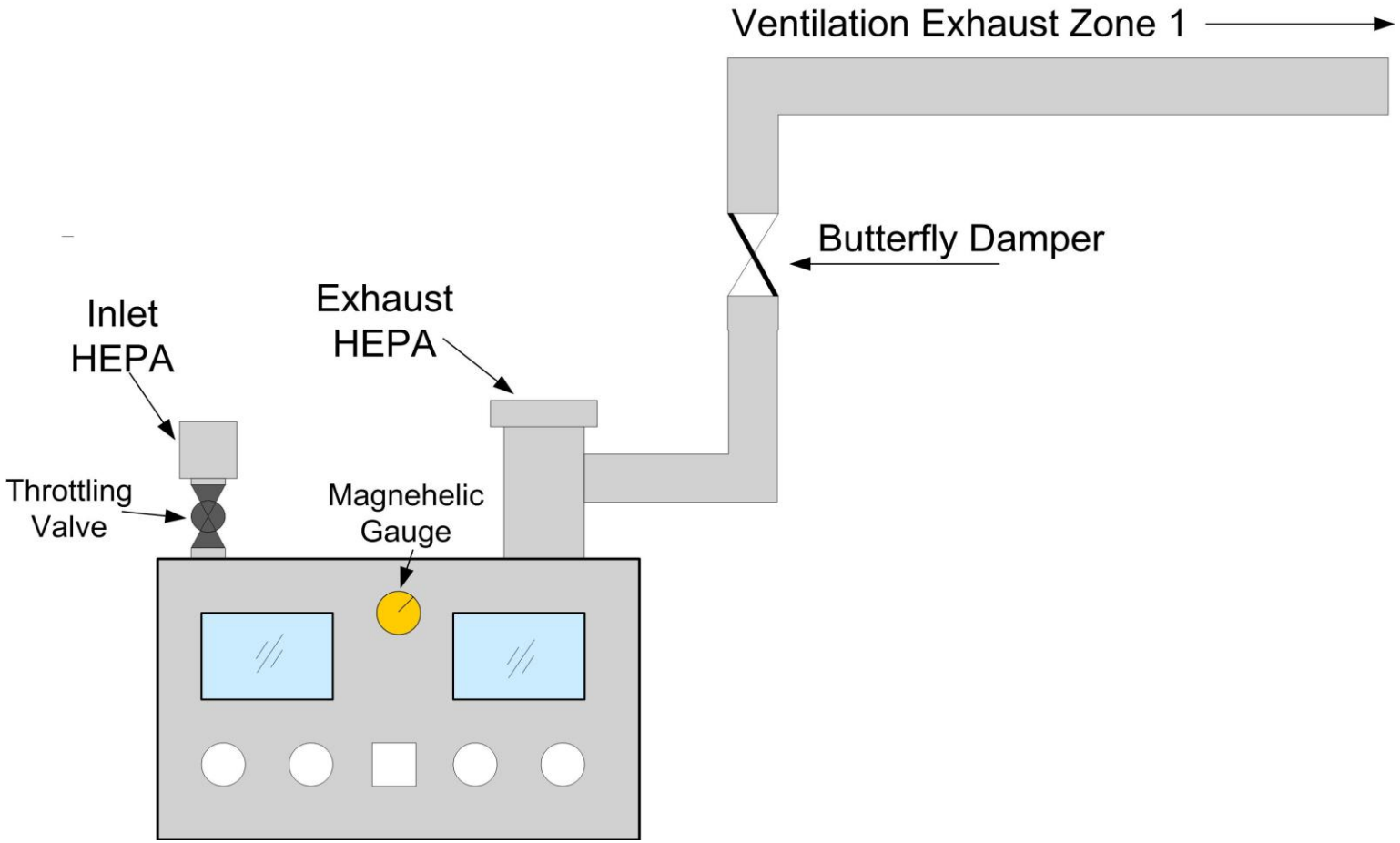
Glovebox Types and Components Schematic



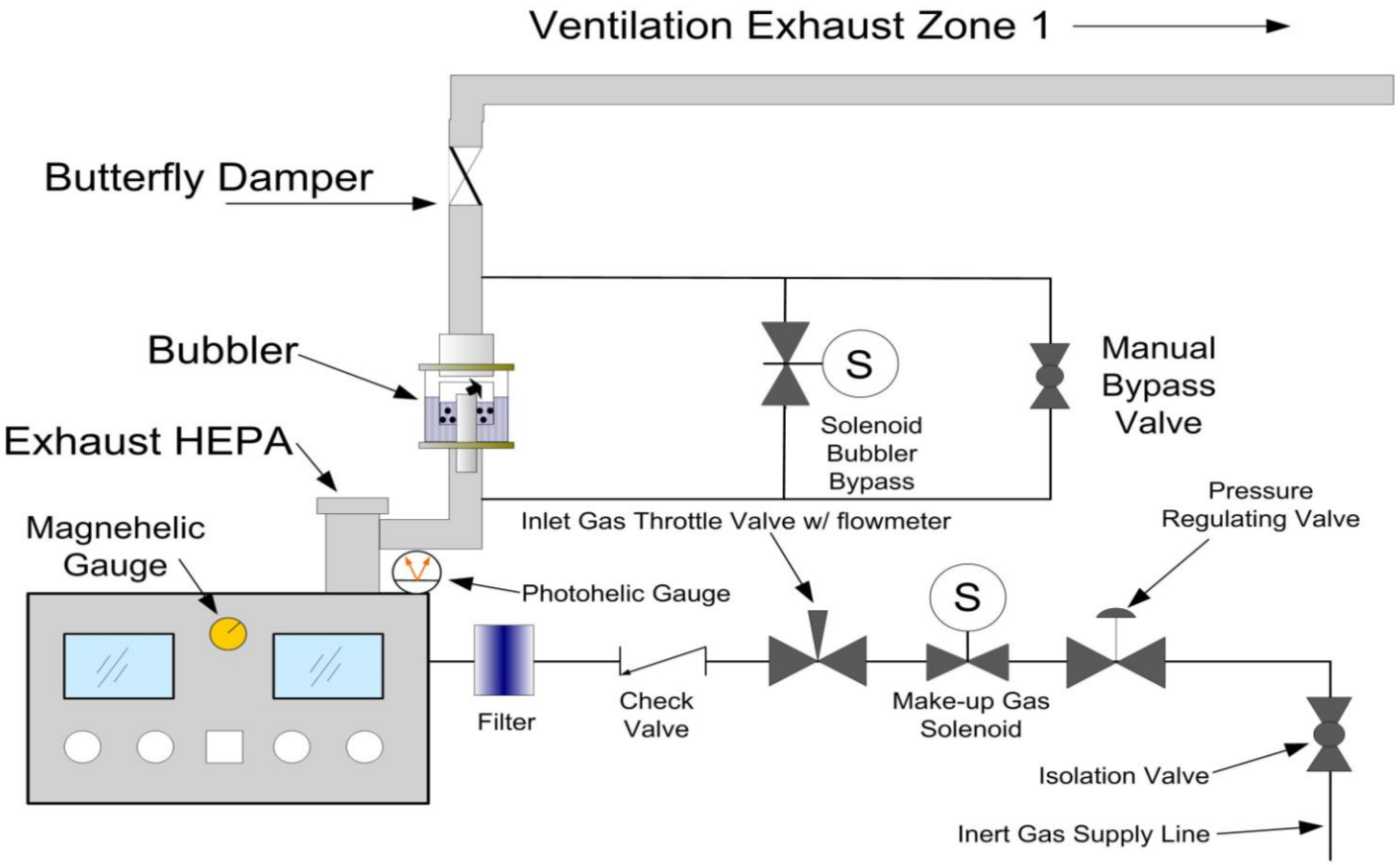
GBS Type 1: Normal Air Schematic



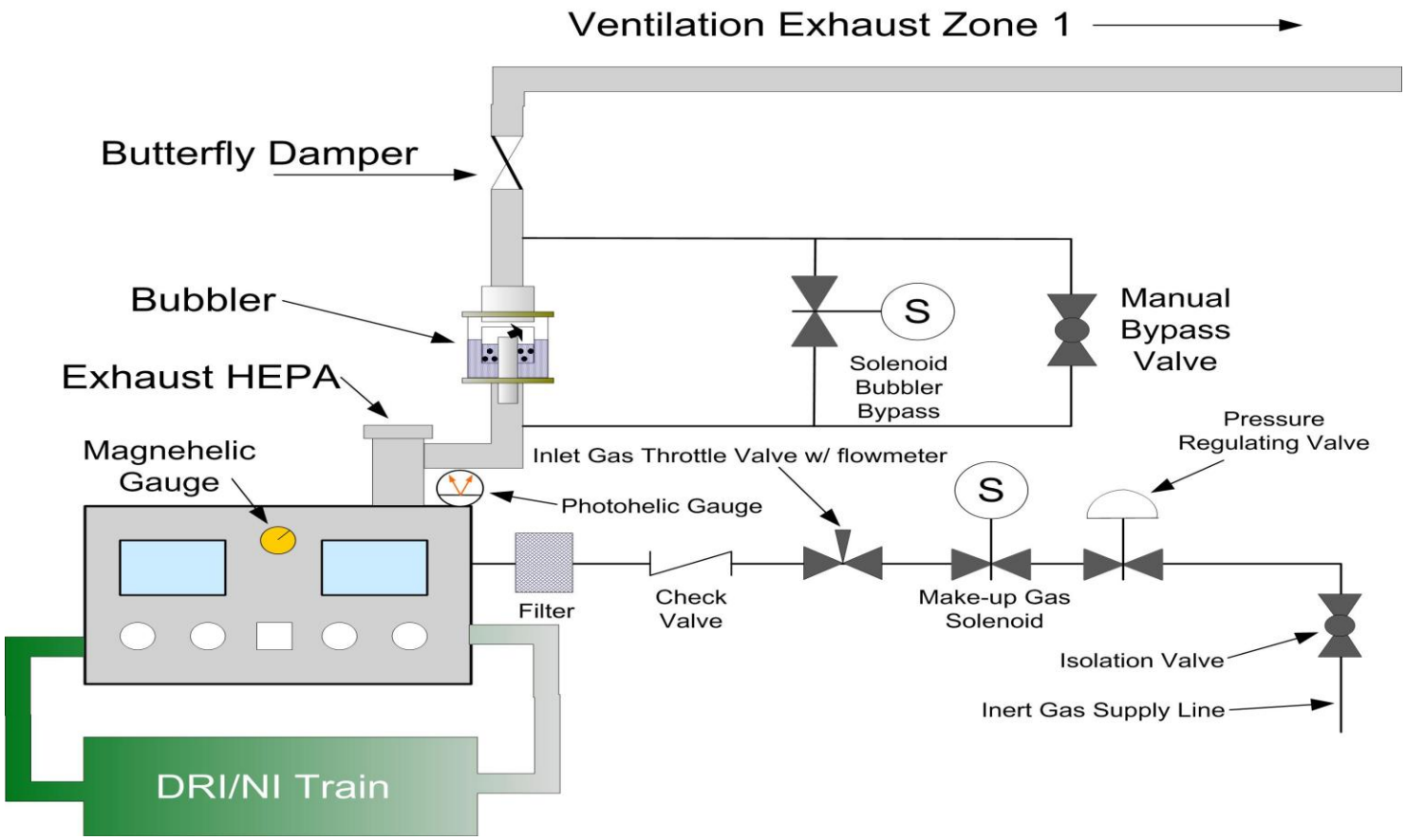
GBS Type 2: Isolated Air Schematic



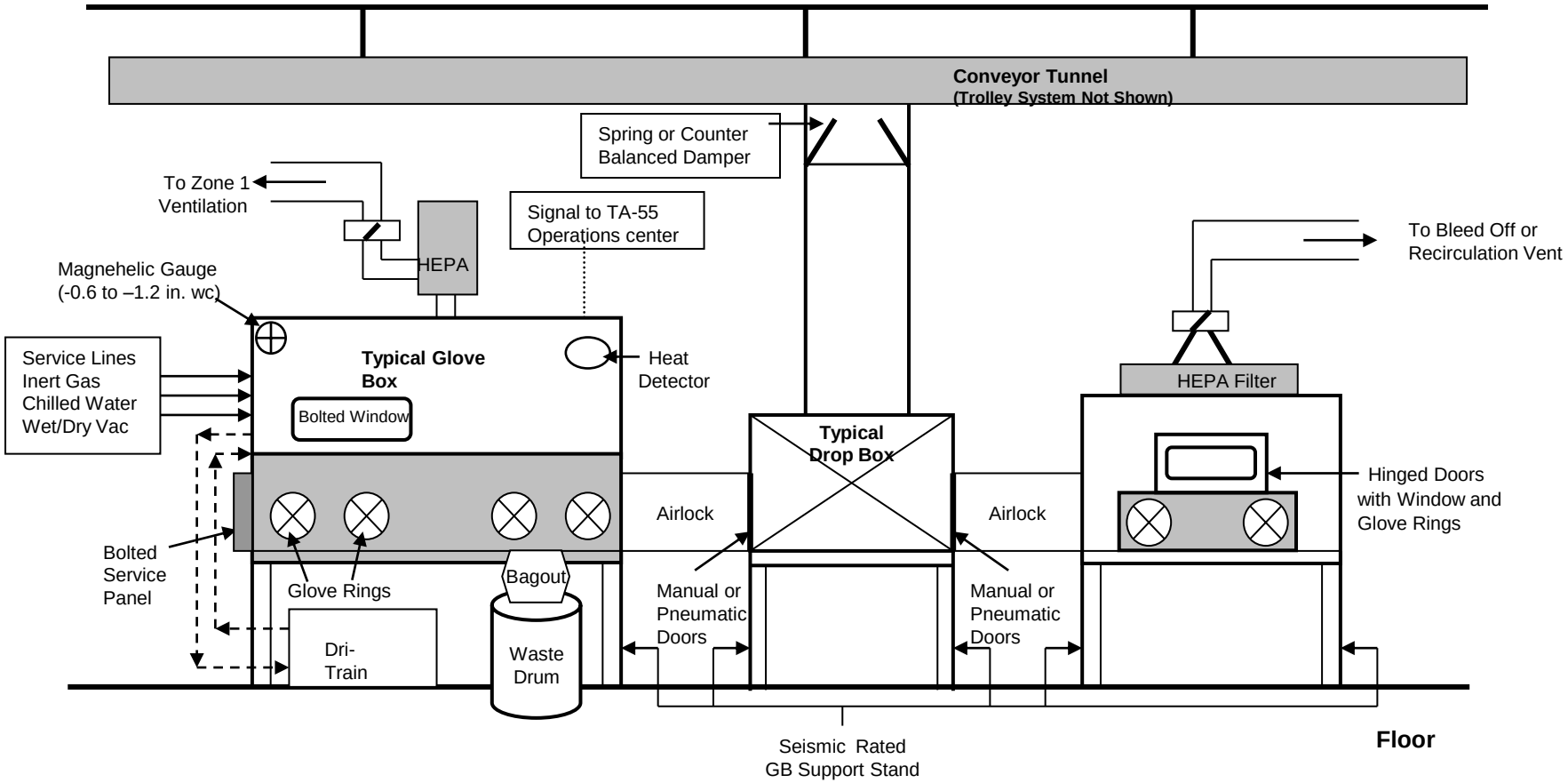
GBS Type 3: Inert Gas Atmosphere Schematic



GBS Type 4: High Purity Inert Schematic



Typical GBS Components



Glovebox Support Stands

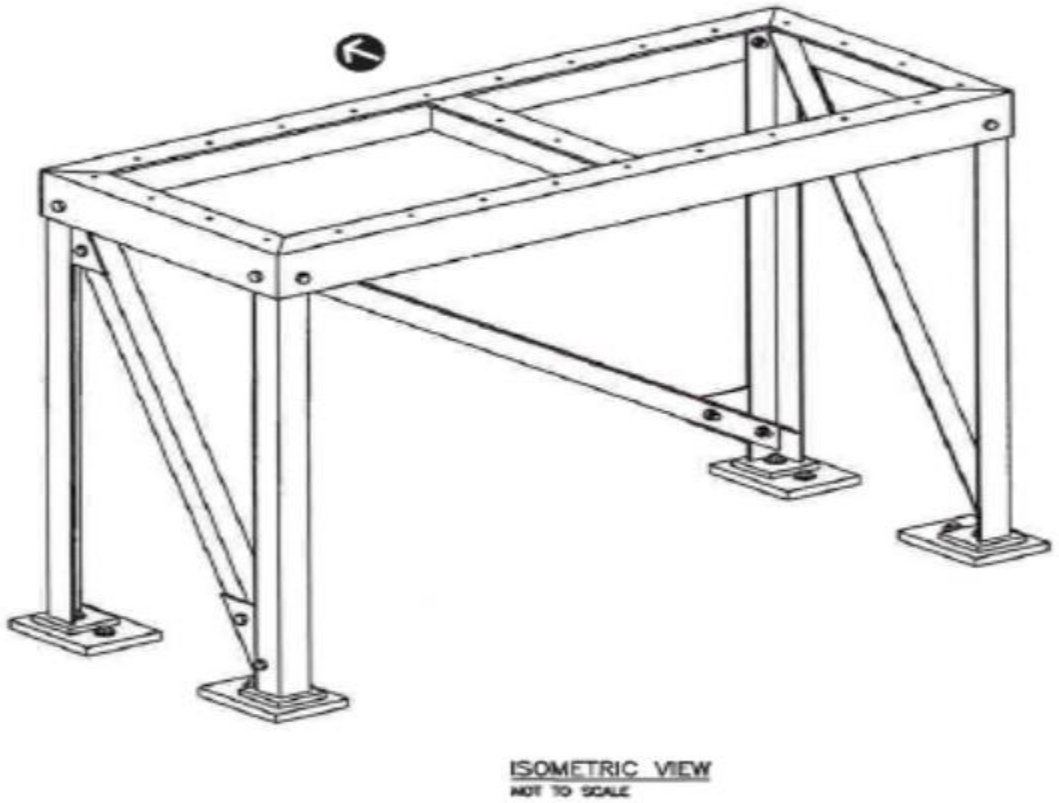
- **The Glovebox Support Stands are critical to the confinement function of the Glovebox System because they provide seismic protection against toppling and protection against major release of hazardous and nuclear materials from the Glovebox System.**
- **The “Glovebox” is a stainless steel shell, connected to the support stand elements, which in turn are anchored to the concrete floor.**
- **The glovebox support stands are typically constructed of steel members, bracing, welding and fasteners. Large Gloveboxes may have support stands with longitudinal and transverse bracing whereas for small gloveboxes, the stands may have bolted/welded moment frame connections.**
- **Longitudinal and Transverse bracing is used to resist lateral forces.**

Glovebox Support Stands

- **All glovebox support stands are required to meet PC-2 seismic criteria. In addition, those gloveboxes which meet any of the criteria (a or b) below, must have support stands that meet PC-3 seismic criteria and are designed to prevent the gloveboxes from toppling over during and following a Evaluation Basis Earthquake (EBE).**
  - **a) New installation of gloveboxes**
  - **b) Associated glovebox contains furnace(s) that are used to intentionally process plutonium in a molten state**.
- **The GB stands structural analysis is performed via one of two methods:**
  - the “Integrated GB Shell and Stand System” method consist of a Finite Element Modeling of both the shell and the support stand as a complete system.
  - Or the “Lumped Mass” method which consist of finite element modeling of the stand and treating the GB shell as a single rigid body with a single lumped mass located at the determined Center of Gravity.

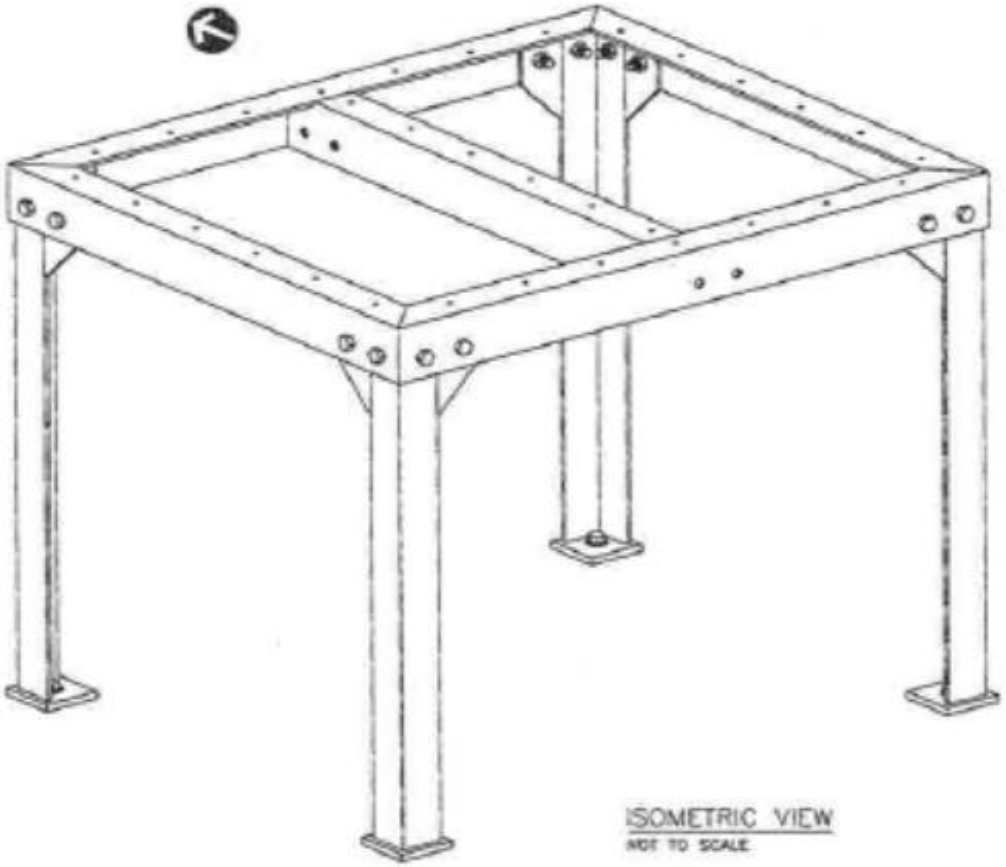
Glovebox Support Stands – typical example:

- **Isometric typical 1x2**



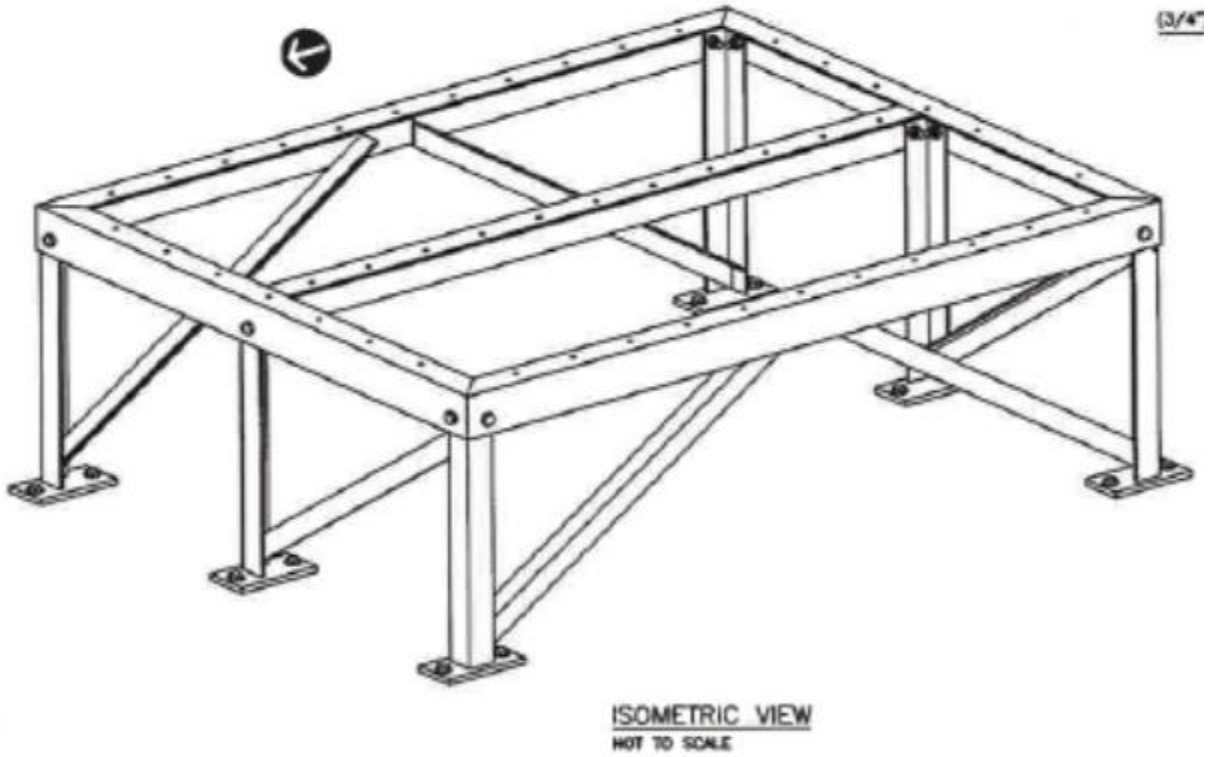
Glovebox Support Stands – typical example:

- Isometric



Glovebox Support Stands – typical example:

- Isometric typical 2x2



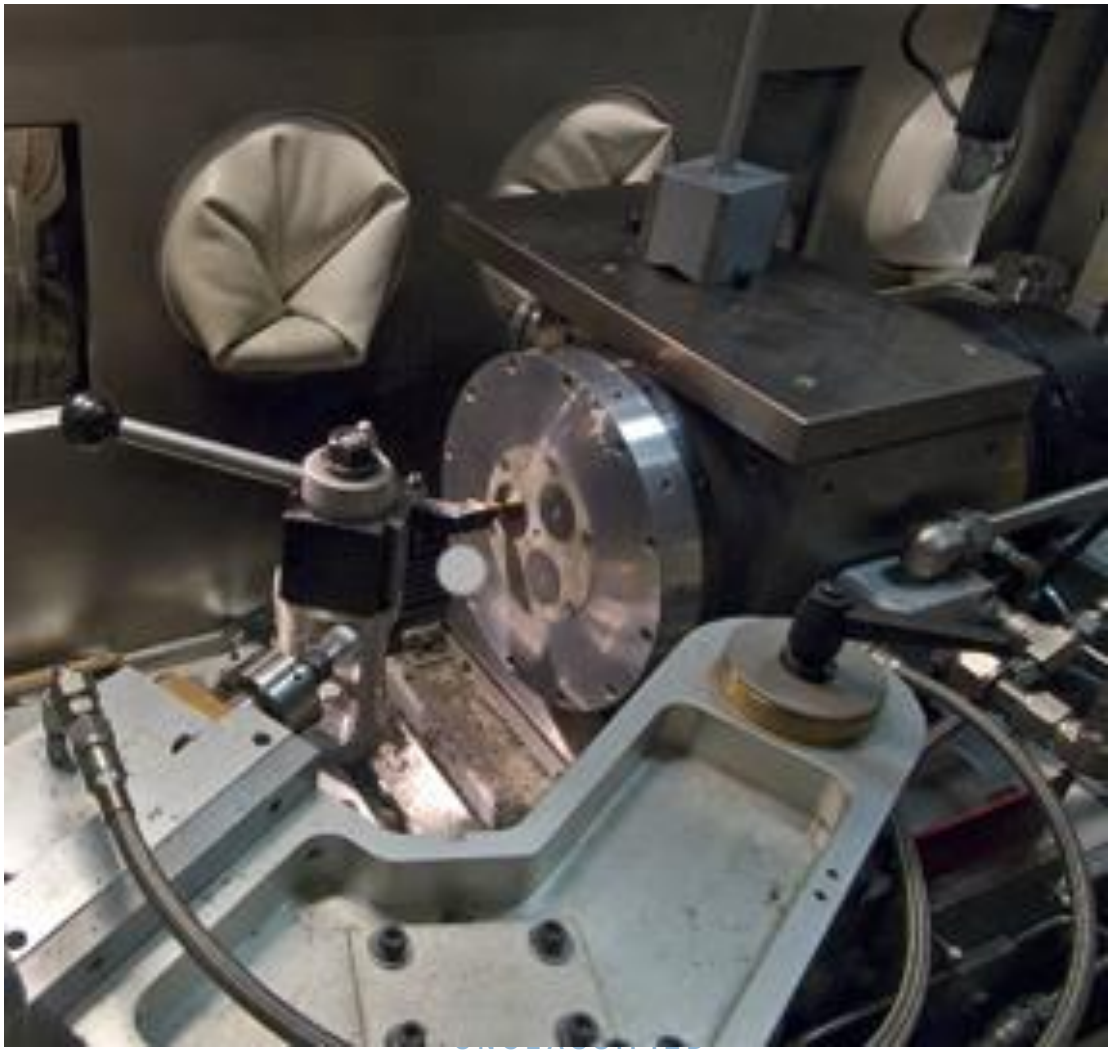
Fire Protection Requirements

- **Each GB and DB is required to have a thermal detector with an alarm that alerts the TA-55 Operations Center.**
- **Post-seismic fire event: New Designs will incorporate Fire Foe Tubes. They are self-contained fire extinguisher tubes.**
- **Mounted as shown:**

Corrosive Environment GBS: Internal Linings

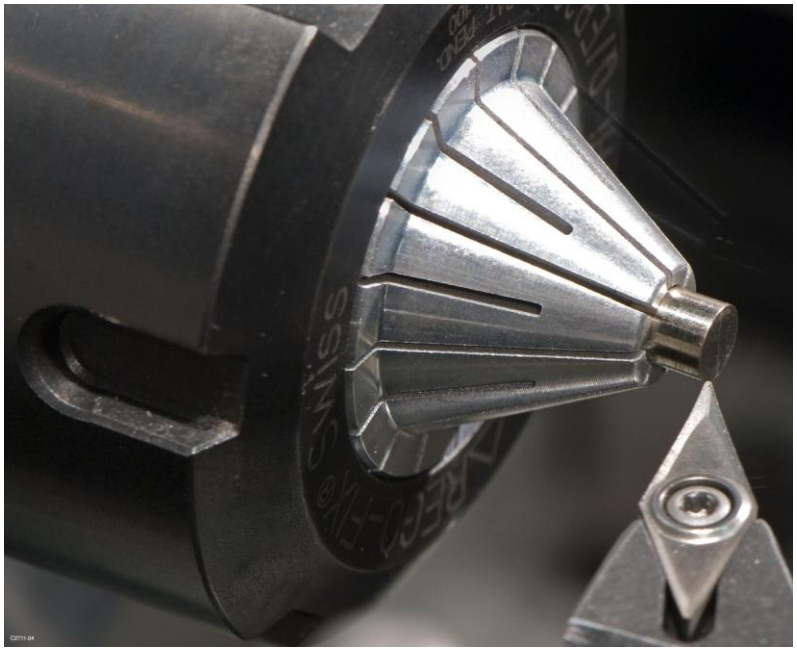
- **Some processes inside gloveboxes involve a corrosive environment. The lining is used to prevent glovebox corrosion which could lead to a breech in confinement of radioactive materials.**
- **Kynar is polyvinylidene fluoride (PVDF) lining**
- **Halar is a melt-processable fluoropolymer lining being used for RLUOB.**

Precitech Lathe - Machining a Gas Gun Part



Capability – Advanced Technology Machines

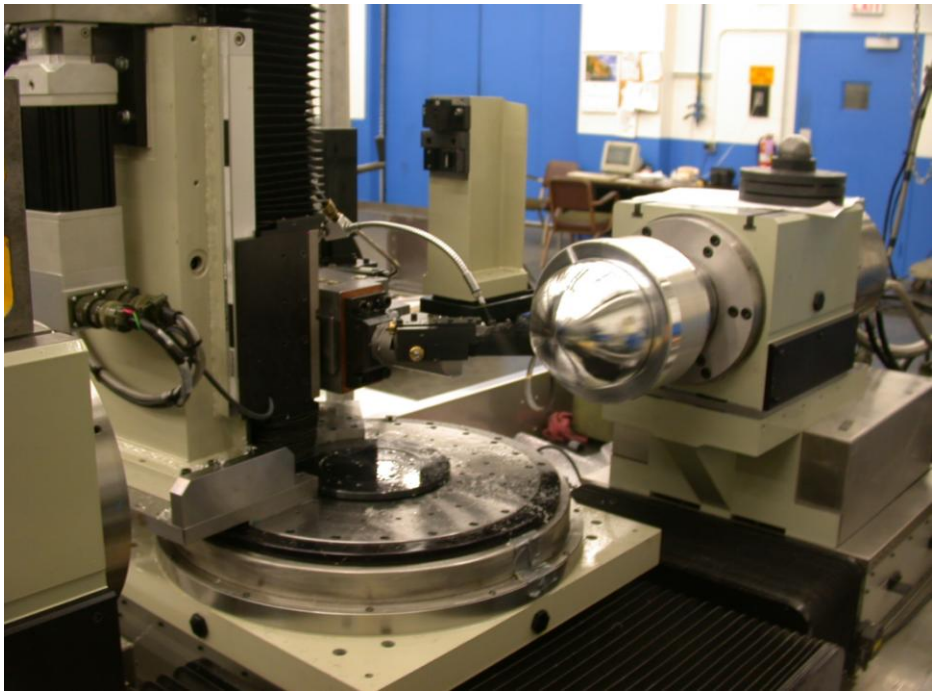
- **Precitech Nanoform 200**
- **Ultra precision diamond turning lathe with 10x higher precision than previous machines and ½ the footprint.**
- **CNC controlled and programmable**
- **Granite base**
- **Hydrostatic oil bearing slides**
- **Air bearing spindle**
- **Linear motors**
- **.3 *u*in (8.6 nanometer) feedback resolution**
- **1 *u*in (25 nanometer) motion accuracy**



- **Kolsky Part**

Capability – Advanced Technology Machines

- Moore Tool Custom 7 axis Lathe
- Ultra precision diamond turning lathe with 10x higher precision
- CNC controlled and programmable
- Poly-crete base
- Hydrostatic oil bearing slides
- Hydrostatic oil bearing spindles
- Servo motors with precision lead screws
- Same glass scales and resolution as Precitech
- Dual opposing spindles aligned to 10 *u*in
- Toolpost w/ rotary and height positioning



Nickel Coated Sphere Tested on L-Base Lathe