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Title: Los Alamos R&D project for FY2020 Pressurized Airborne Release Equipment (PARE)

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Delivering science and technology
to protect our nation
and promote world stability

Los Alamos R&D project for FY2020: Pressurized Airborne Release Equipment (PARE)

Aerosol Engineering Facility
RP-SVS Radiation Protection Services
Los Alamos National Laboratory

Murray E. Moore, PhD PE
Yong Tao, PhD

98 miles from Colorado, further north than Amarillo

Pajarito Mountain (6 miles from town)

Los Alamos: 7,300 feet elevation

Pajarito Mountain: 9,000 to 10,000 feet

Omega Bridge – from the town to the lab

Los Alamos National Laboratory

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- Nuclear Deterrence Stockpile Stewardship
- Protecting Against Nuclear Threats
- Emerging Threats, Cybersecurity
- Energy Security Solutions

Albuquerque Journal – Aug. 9, 2019

- **LANL officials detail potential building boom**

- By Mark Oswald / Journal Staff Writer
  Published: Friday, August 9th, 2019 at 9:46pm
  Updated: Friday, August 9th, 2019 at 9:58pm
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- Lab officials provided details of **$5 billion worth of building plans over the next five years** and $13 billion over the next decade, driven largely by the lab's assignment to ramp up production of plutonium cores for nuclear weapons.

Albuquerque Journal – Aug. 9, 2019

- LANL Director Thomas Mason, in an interview Friday,

said the lab **currently has 1,400 openings** and has been hiring about 1,000 people annually over the past several years, with about 500 each year placed in new job slots as opposed to replacing retirees or others who've left the lab.

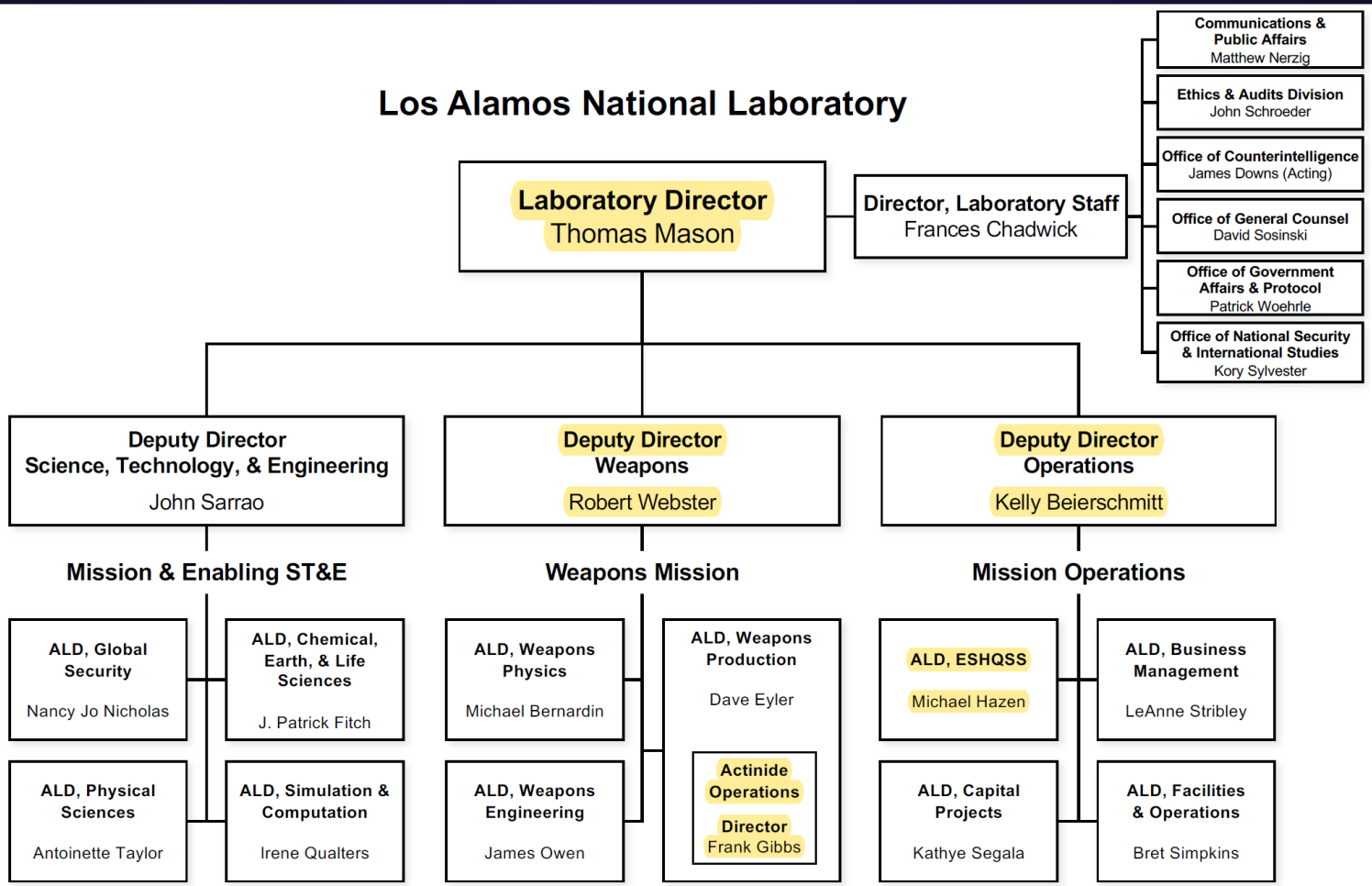
- Mason said LANL provides about 12,000 jobs now and should **add 1,200 more by 2026**, by which time the lab is supposed to be producing 30 plutonium "pits" for warheads annually.

By Mark Oswald / Journal Staff Writer Updated: Friday, August 9th, 2019 at 9:58pm *Copyright © 2019 Albuquerque Journal*

Many Los Alamos specialties

Montoya JM 2015 LAUR-15-20962 Leveraging Hybrid Solutions to Support Manufacturing and Surveillance

Los Alamos National Laboratory



3-19-19

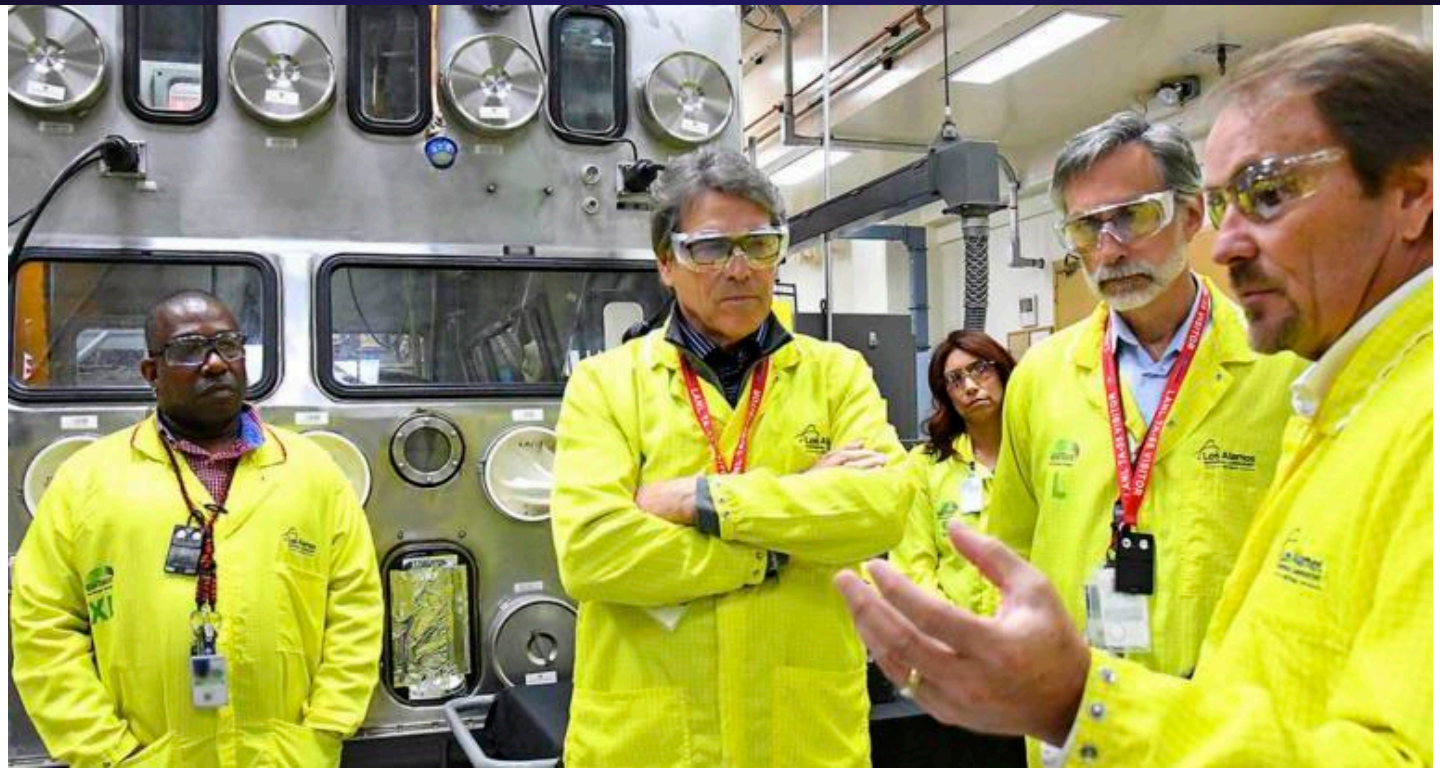
The Los Alamos Aerosol Engineering Facility supports Plutonium Facility operations

Aerosol Engineering Facility
RP-SVS Radiation Protection Services
Murray E. Moore*
Yong Tao*

SPE-2 Strategic Development Office
Paul H. Smith, PhD
Tristan Karns*
Jude M. Oka, MS*
John T. Davis*

* Authorized for hand-on work in the Aerosol facility.

Los Alamos Plutonium Facility



U.S. Secretary of Energy Rick Perry (second from left).
Former Lab Director Charlie McMillan (second from right).

(Los Alamos National Laboratory via AP, May 10, 2017, file photo).

Gloveboxes protect workers from dangerous material

Note the workers are NOT wearing respirators.

Continuous air monitors sound an alarm if they sense an airborne release of radioactivity (1992).

Canberra™ Alpha Sentry
1992
(since upgraded)

May 1992, Volume 62, Number 5

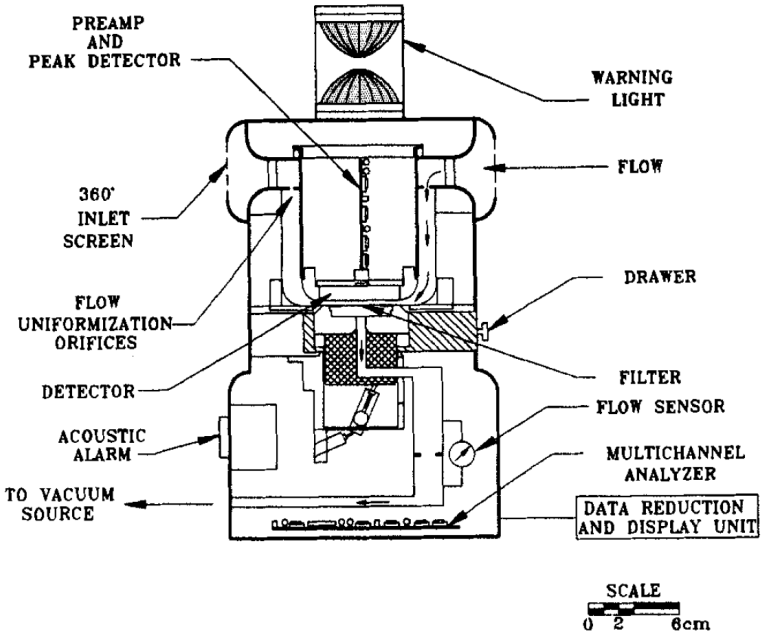


Fig. 1. CAM with a background–radionuclide suppression inlet. Aerosol enters the system through the screened inlet, which removes unattached RTP, and collects the TRU particles on a filter where they are analyzed with a PIPS detector.

AR McFarland, JC Rodgers, CA Ortiz and ME Moore (1992)

Containers allow storage of material outside a glovebox

Hagan: Threaded lid, face seal. **SAVY:** Bayonet locking lid, bore seal.

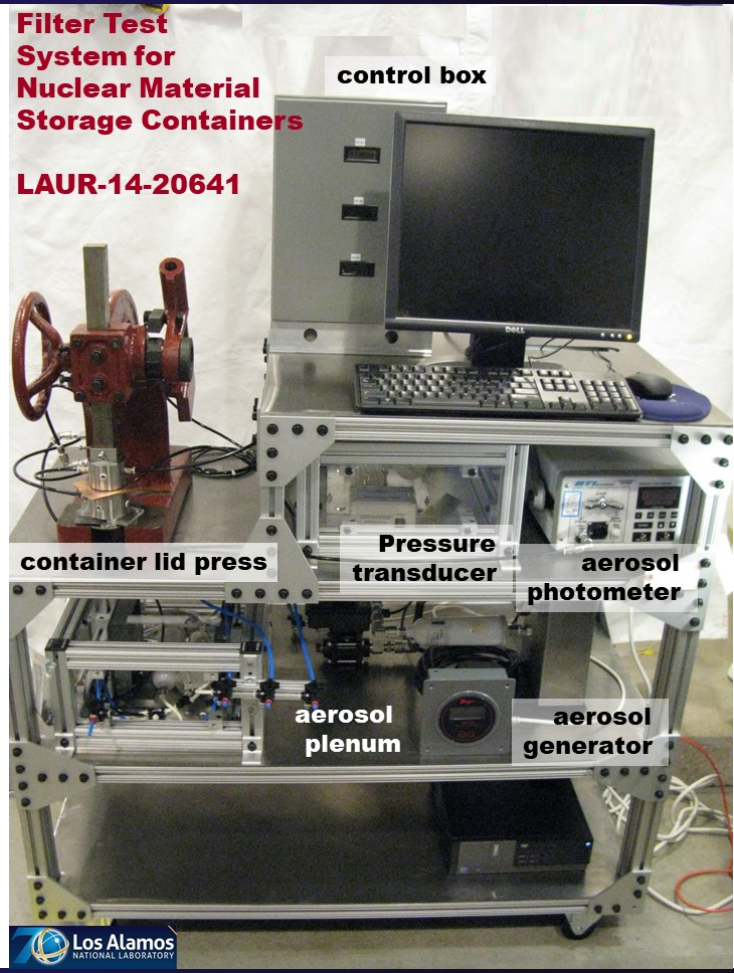
Both have filtered lids, O-ring seals, and stainless steel construction.

Our building started working with containers in 2010

Two units: one "hot" and one "cold"

Product Surveillance:

- Remove the container lid and measure the pressure drop across the filter.
- For the filter in the lid, measure the collection efficiency of airborne liquid droplets (about 0.5 µm diameter).



Drop tests by Los Alamos at Southwest Research Institute (2015)

Containers with payloads and test powder.

Older style containers broke open and released test powder.

Measure mass difference.

Report the release fraction:

$$R = \frac{mass\ difference}{total\ mass}$$

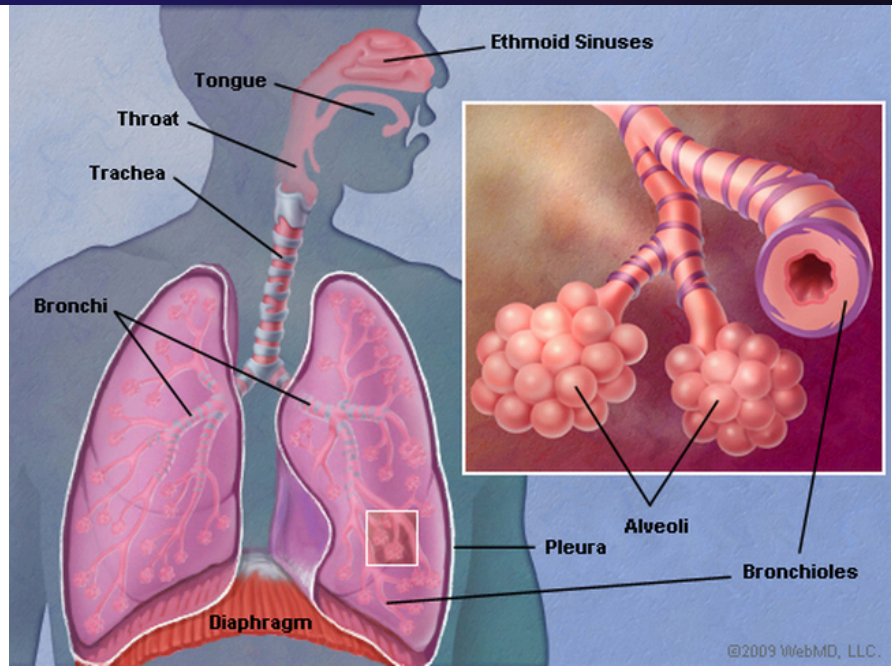
How much inhaled plutonium gives a 5 Rem dose?

Isotope	Mass (g) for 5 Rem
Pu-238	1.6×10^{-9} g
Pu-239	4.4×10^{-7} g

Too small to measure by mass balance methods….

Respirable Release Fraction (RRF)

$$RRF = \frac{m(respirable)}{total\ mass\ at\ risk}$$

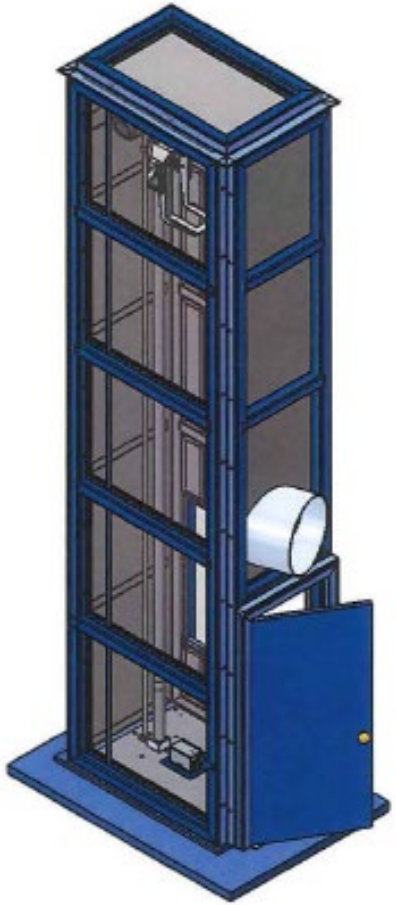


Respirable aerosol are airborne particles less than or equal to 10 µm AD (aerodynamic diameter).

Los Alamos drop tower for containers (2017)

RRFMC Respirable Release Fraction Measurement Chamber

- 16 ft drop height
- 150 LBM total container capacity
- Aerosol particle counters are able to measure released test powder in a completely filtered, ducted system…
- …with high speed video…



8-24-18 SAVY container w/ pewter shielding (1)

8-24-18 SAVY container w/ pewter shielding (2)

8-24-18 SAVY container w/ pewter shielding (3)

8-24-18 SAVY container w/ pewter shielding (4)

8-24-18 SAVY container w/ pewter shielding (5)

8-24-18 SAVY container w/ pewter shielding (6)

DOE Nuclear Safety R&D Committee (2019)

REQUEST: More testing for ARF (airborne release fraction ≤ 20 µm AD) and RF (respirable fraction ≤ 20 µm AD) releases, per the 1994 DOE 3010 "Airborne release fractions" handbook.

$$ARF = \frac{m(airborne)}{m(released)}$$

$$RF = \frac{m(respirable)}{m(airborne)}$$

We wrote a proposal for FY2020 (fiscal year 2020)

R&D contract was awarded!

Instead of dropping containers

for test powder release measurements…

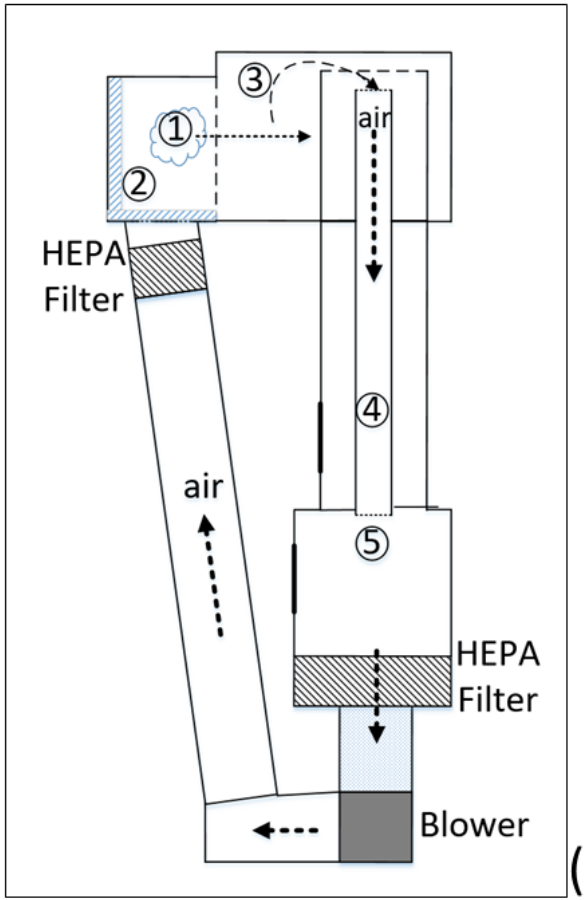
FY2020 R&D contract

We are going to blow them up instead…

Use existing drop tower infrastructure

Drop testing is performed by remote control from adjacent room.

(a)



(b)

(1)Drop impact location

(2)Plenum to reroute air inside RRFMC

(3) Air mixer

(4) Duct with air velocity probe

(5) Aerosol measurement location

PARE Pressurized Airborne Release Equipment

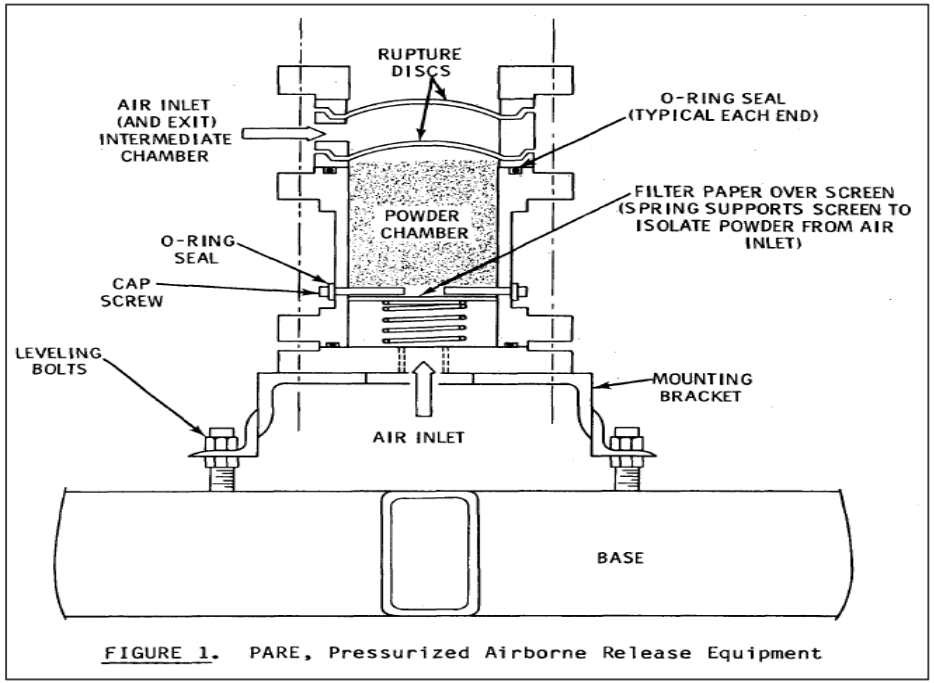
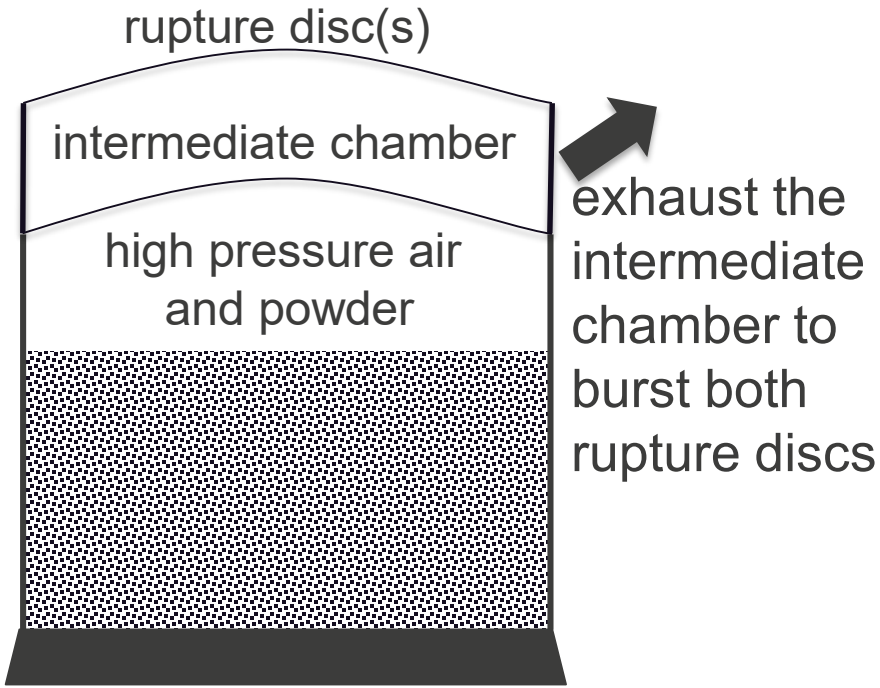


FIGURE 1. PARE, Pressurized Airborne Release Equipment

(Sutter 1983)



Los Alamos FY2020

Benefits mentioned in our proposal

"This project would have application
to all DOE sites with dispersible materials,

involving but not limited to gloveboxes,
nuclear material storage containers,
TRU (transuranic) waste drums, etc.

This could affect safety basis documents
and documented safety analyses."

Student safety is non-negotiable!

Define the scope of work
•Work planning to consider what might go wrong.

Identify and analyze hazards associated with the work
•Hazards? (Anticipate human errors).

Develop and implement hazard controls
•How can the hazards be eliminated?

Perform work within controls
•Follow the plan that uses the controls.

Provide feedback and continuous improvement
• Communicate successes and issues.

Questions?