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Fabrication Of New 7uPCX Control and Safety Elements

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Special Thanks to: Kristy Martinez

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OVERVIEW

- IER 441 Assembly
- Control & Safety Elements Overview
- Minor Design Modifications
- Procurement, Fabrication & Process Development Status
- Qualification Testing
- Conclusion
- Acknowledgements

IER 441 Assembly

DRIVE MOUNTING PLATE, 1.02cm HEX PITCH (J92811)

3X Control & Safety Elements

CENTRAL TEST REGION ASSEMBLY, 0.81cm HEX PITCH (J92808)

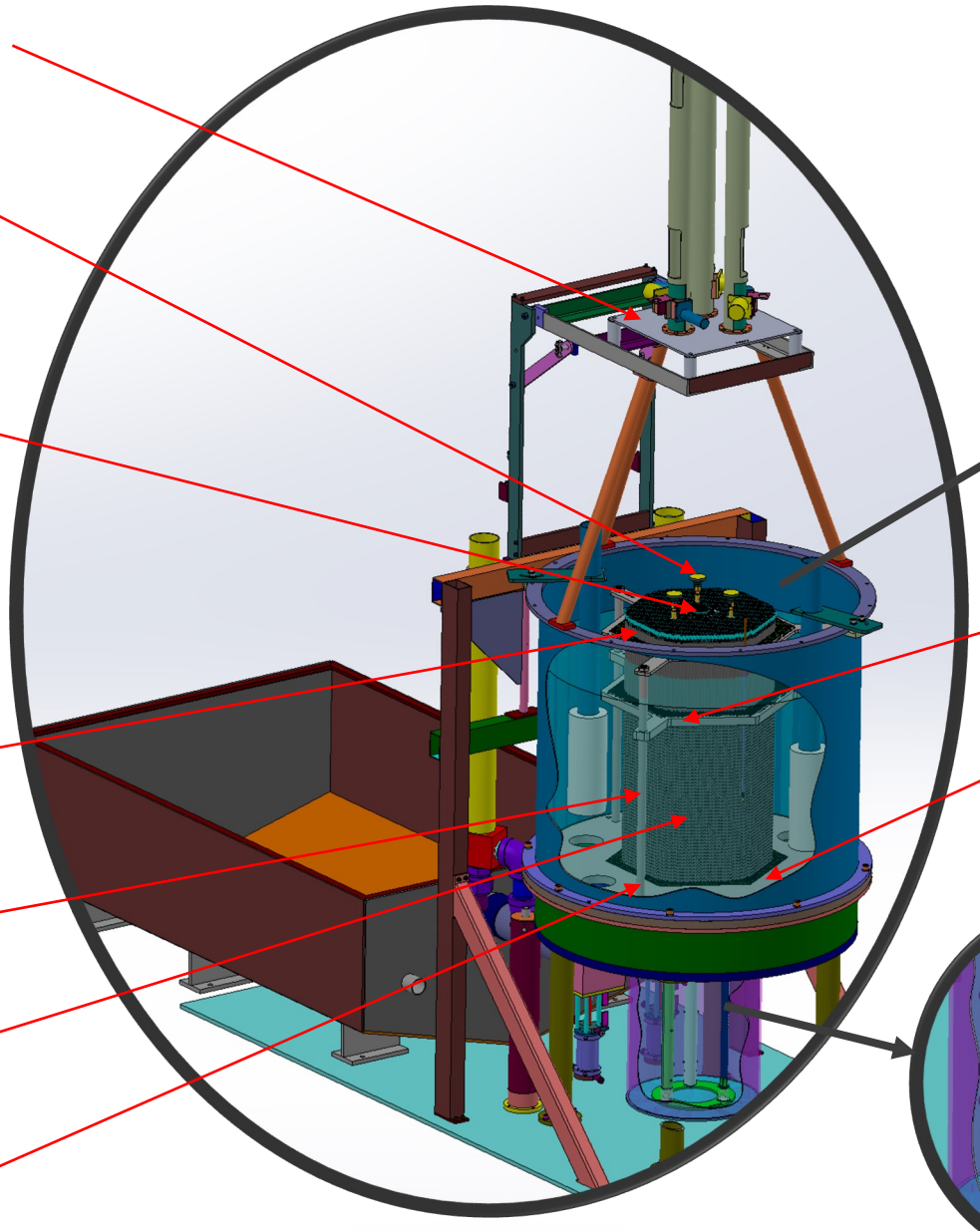
- 85X TANTALUM TEST ROD (J92810)

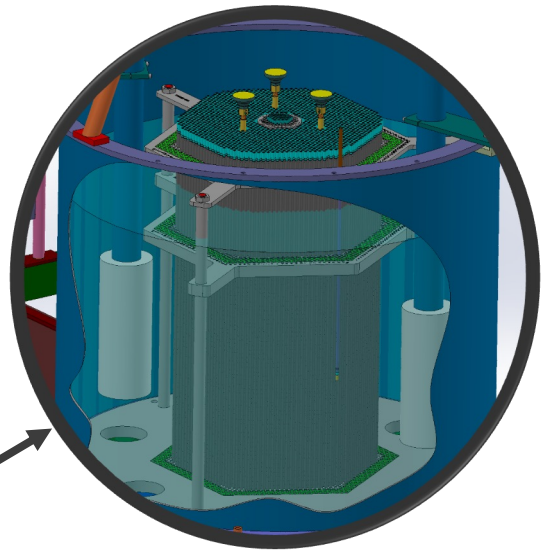
UPPER GRID PLATE GUIDE, 1.02cm HEX PITCH (J92802)

GUIDE GRID PLATE STANDOFF (J92801)

7uPCX FUEL RODS

LOWER GRID PLATE STANDOFF (J92799)

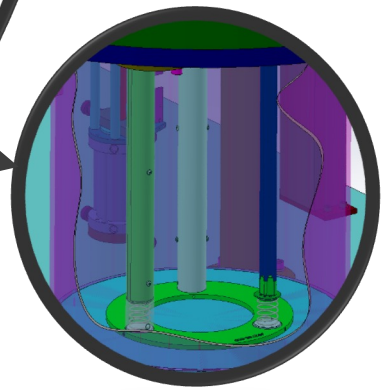




UPPER GRID PLATE, 1.02cm HEX PITCH (J92800)

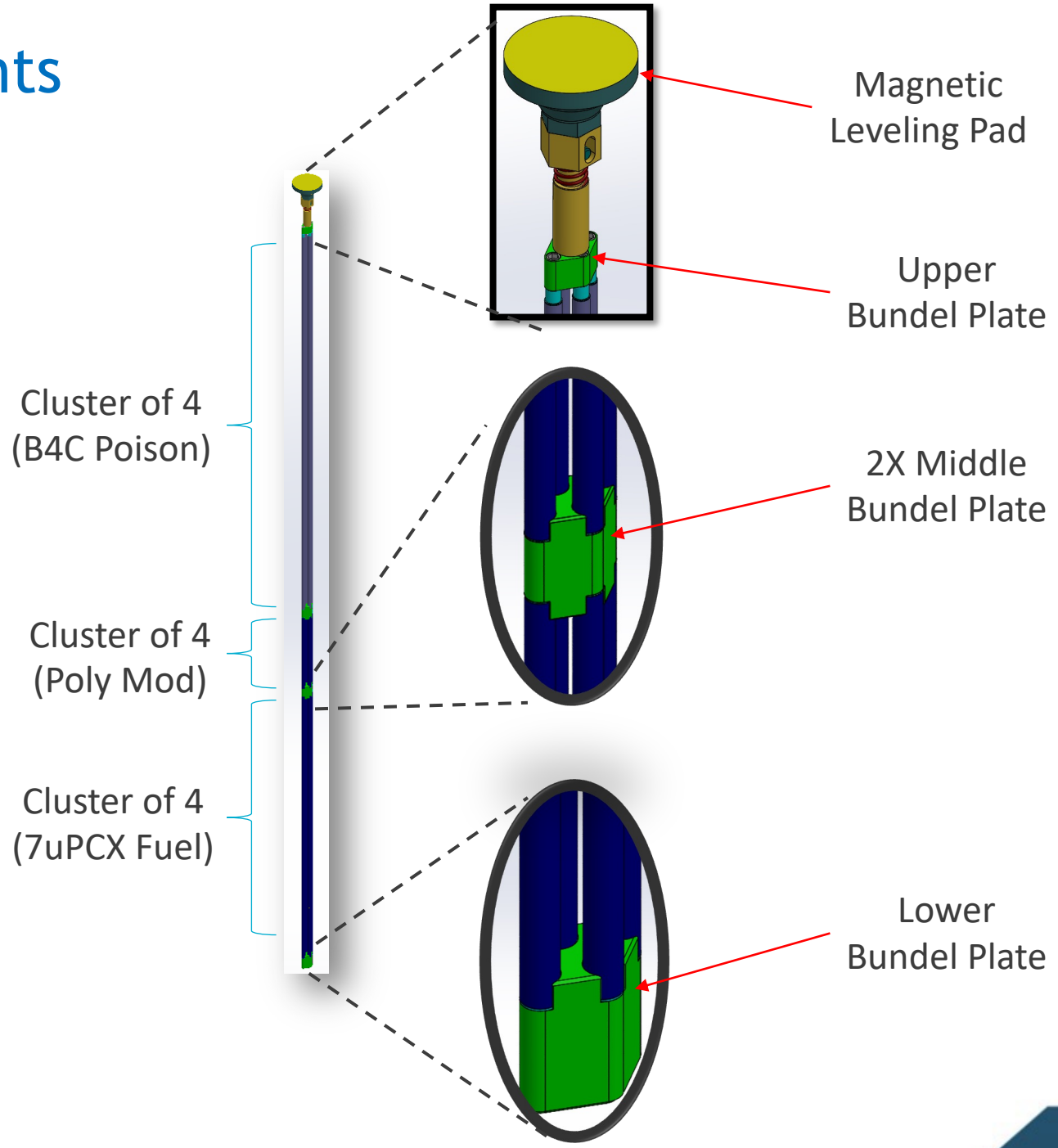
LOWER GRID PLATE AND HYDRO TUBE ASSEMBLY, 1.02cm HEX PITCH, (J92792)

- HYDRO TUBE ASSEMBLY, 1.02cm HEX PITCH (J92794)
- HYDRO TUBE SPACER, 1.02cm HEX PITCH (J92797)



Control & Safety Elements Overview

- Control & Safety Elements
  - Magnetic Leveling Pad
  - Bundel Plates Maintain Spacing
  - Cluster of 4 Rods
    - 3 Sections
      - Fuel (7uP)
      - Moderator (Poly)
      - Poison (B4C)
  - Dimensions: Dia. 1.875” x 60.667” Lg



Procurement, Fabrication, Laser Welding Process Development Status and B4C fill Process

Fabricate 12 Each Polyethylene & B4C For SPR/CX Critical Spare Parts

- Procured Raw Stack for End Caps and Cladding (Support Future Builds)
- Using Previously Purchased Boron Carbide Powder (B4C) (No Expiration Date)
- Procured Vibrating Table
- Fabricated the Following:
  - 100 End Caps
  - 20 Al-3003 Cladding Tubes 0.250” OD X 0.014” WT
    - Polyethylene (5.493±0.002”)
    - B4C Rods (28.810±0.002”)
  - 20 Polyethylene Rods
  - Vibrating Table B4C Rod Mounting Fixture
- Developed Laser Welding Processes
- Laser Welded Lower End of Poly & B4C Rods
- Assembled Poly Rods and laser welded other end (Qualification Process)
- Weight Scale Calibrated by SNL Primary Standard Laboratory (PSL) November 21, 2024
  - Developing B4C Fill Process

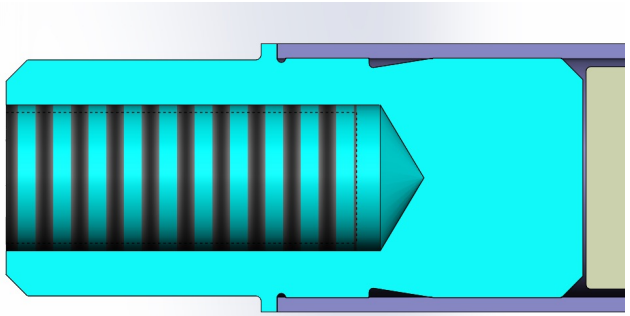
Minor Design Modifications

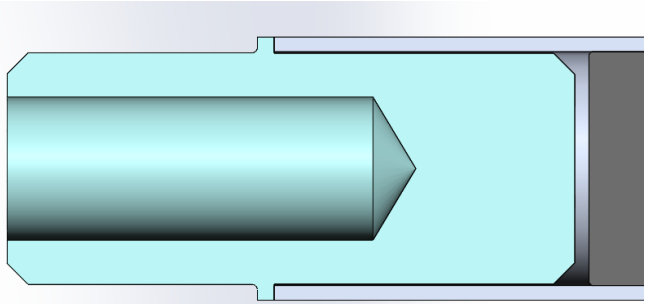
Control & Safety Elements

- Originally designed and fabricated at Sandia 2004 (20 years ago)

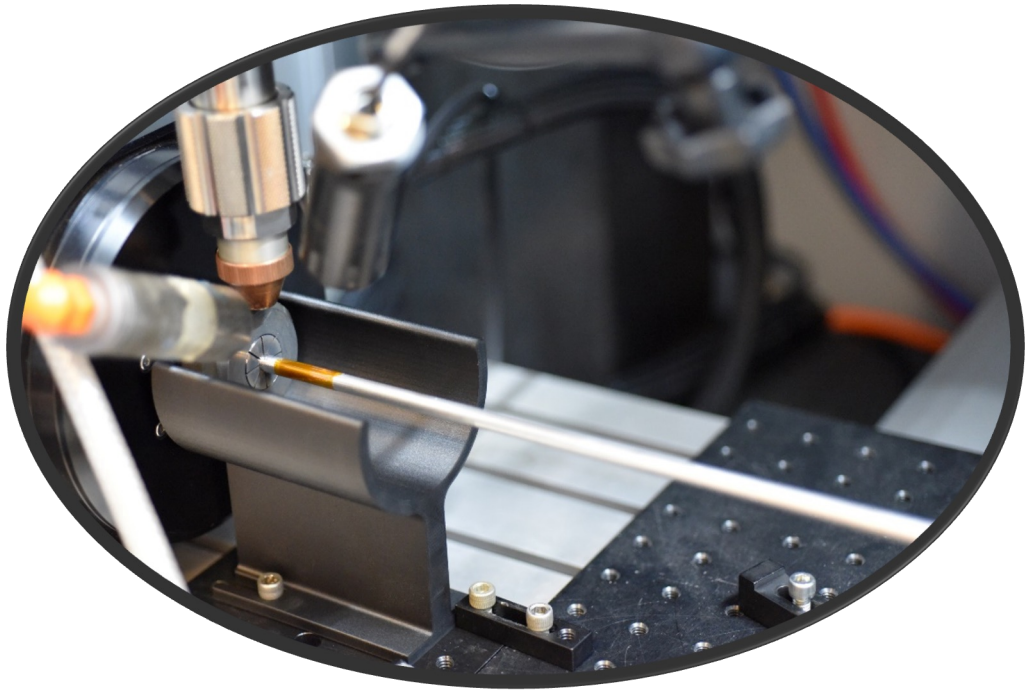
Modified End Cap

- Removed Crimping feature and 0.005” Radii
  - Existing rods were failing @ the crimp location
  - Help develop successful and repeatable weld
- Modified Dimensions and Tighter Tolerances
  - Assembly of end caps to cladding
  - Develop successful and repeatable welds





Laser Welding



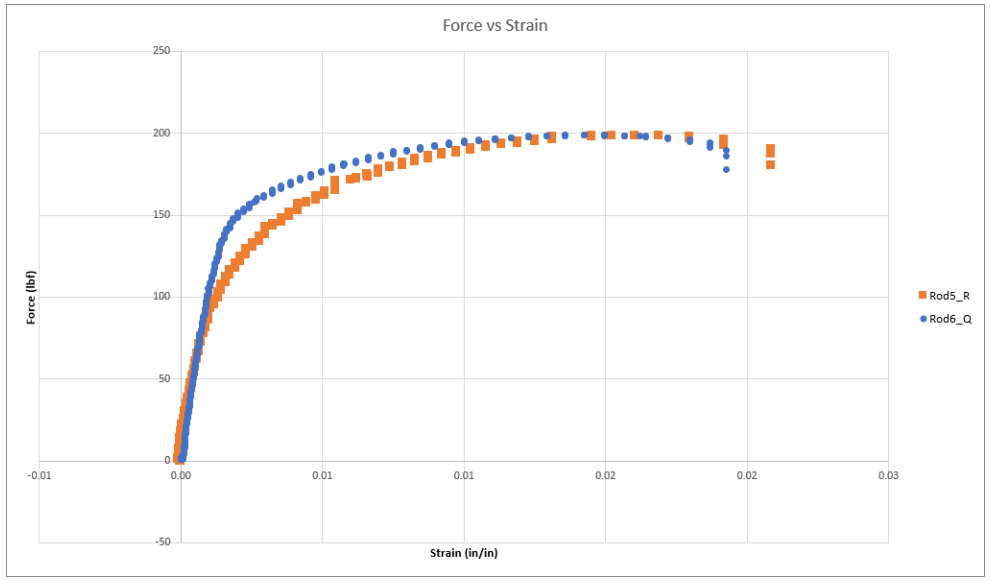
Laser Welding of End Cap

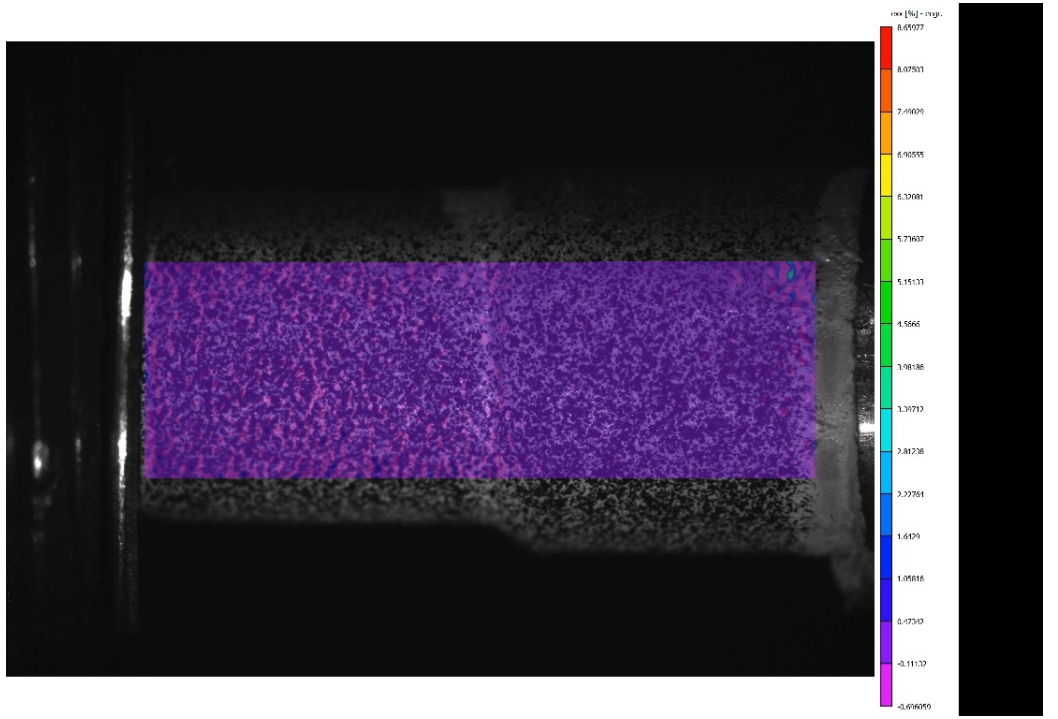
Good Weld Bad Weld?

Visual Inspection of
Laser Weld

Qualification Testing

- Weld Pull Test
- Helium Bomb/Leak Testing
- Dye Penetrant
- CT scan (Note: The CT scan organization 1529 may have higher SNL priorities, potentially impacting the completion schedule.





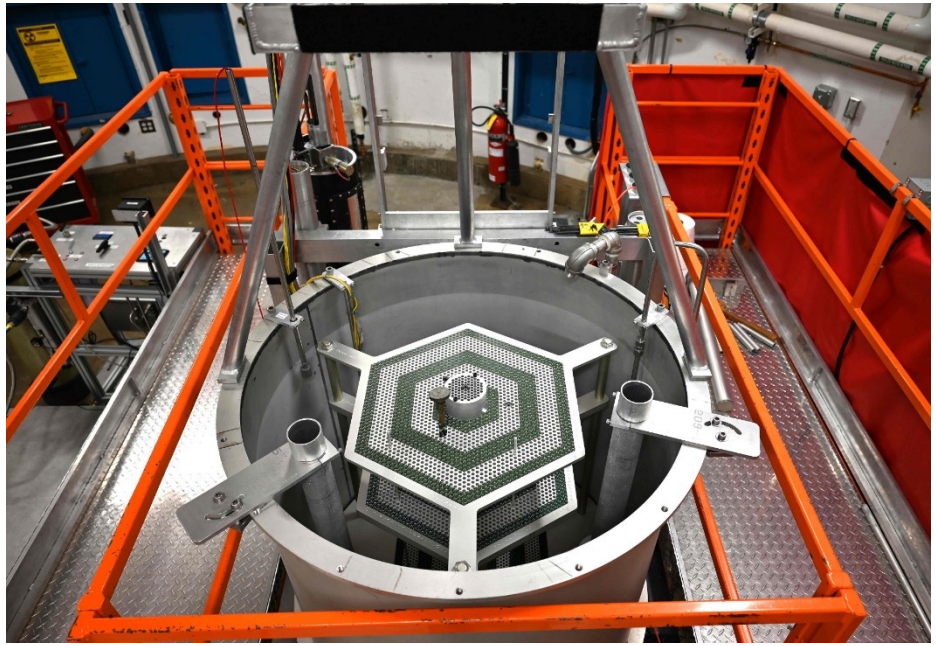
Conclusion

- Challenges, B4C fill process
- On track to complete fabrication and qualification testing end of January

Acknowledgements

Thank you!

- DOE NCSP: The critical experiments at Sandia are supported by the DOE Nuclear Criticality Safety Program (NCSP), funded and managed by the National Nuclear Security Administration for the Department of Energy.



Backup Slides

To calculate the pressure in pounds per square inch (PSI) using the formula:

$$\text{Pressure (PSI)} = \frac{\text{Force (lbf)}}{\text{Area (in}^2\text{)}}$$

we can substitute the given values:

- Force = 200 lbf
- Area = 0.010380 in²

Now, substituting these values into the formula:

$$\text{Pressure (PSI)} = \frac{200\,\text{lbf}}{0.010380\,\text{in}^2}$$

Calculating this gives:

$$\text{Pressure (PSI)} = \frac{200}{0.010380} \approx 19258.69\,\text{PSI}$$

Therefore, the pressure exerted is approximately **19258.69 PSI**.