# Replacement of a Leaking Beam Port Bellows

## in the UT-Austin TRIGA Reactor

Tracy N. Tipping
Nuclear Engineering Teaching Laboratory

# Initial Discovery

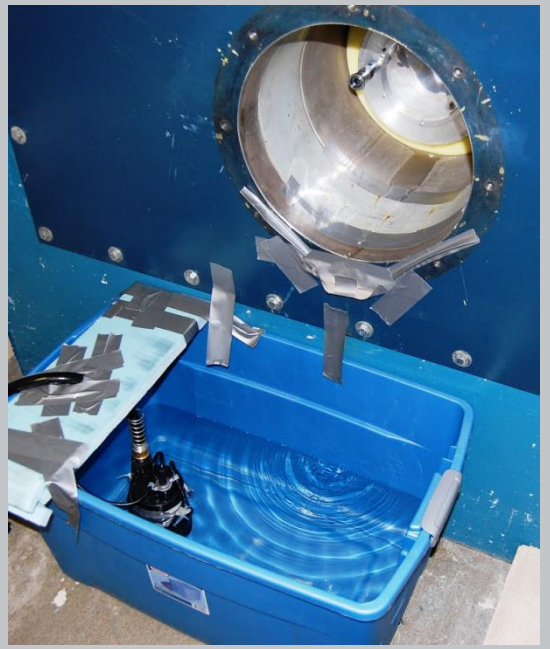
- November 2013
  - BP5 shutter track wet
  - Roof leak history


# Further Investigation

- Water originating inside beam port
- Radiological analysis confirmed pool water

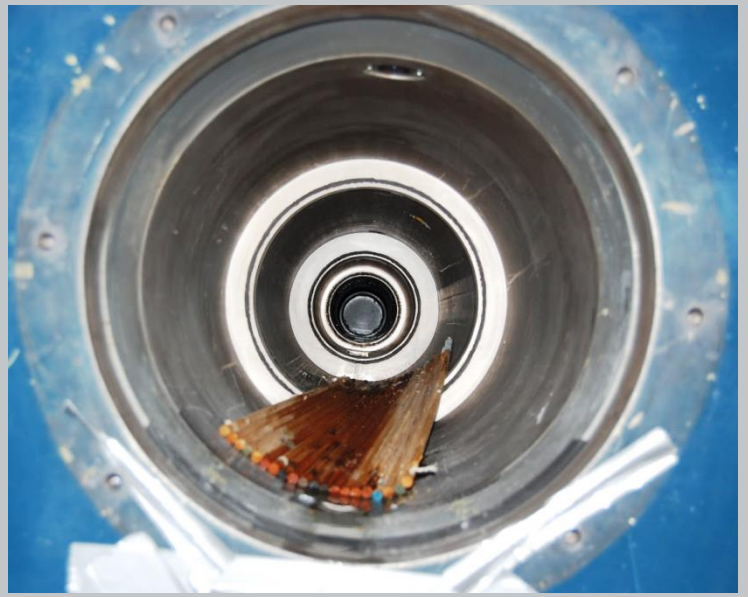
# Initial Actions

- Heavy run schedule
- Holidays approaching
- Small leak rate
  - Evaporative losses from pool surface greater than leak rate

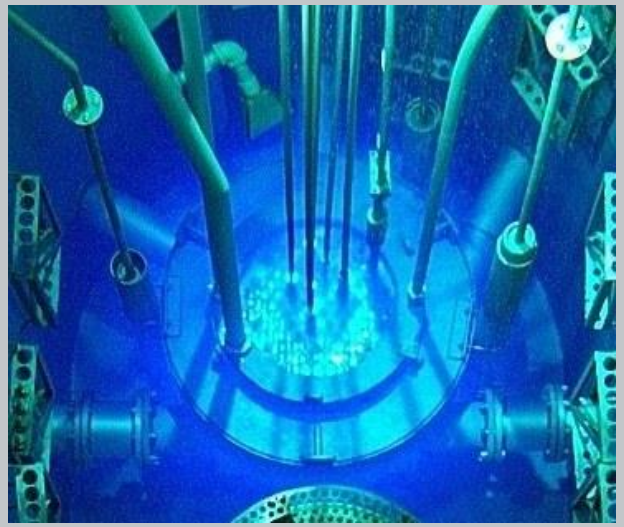


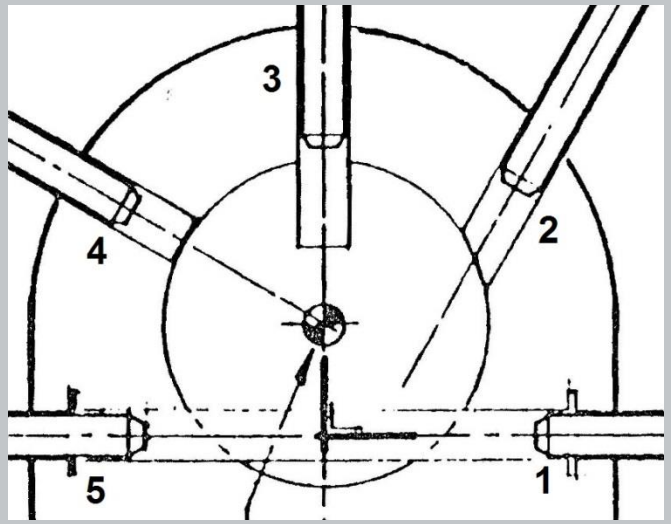
# Detailed Investigation

- January 2014
  - Pulled collimator out of BP5
  - Water was not coming from BP5



# Beam Port Configuration






# More Investigation

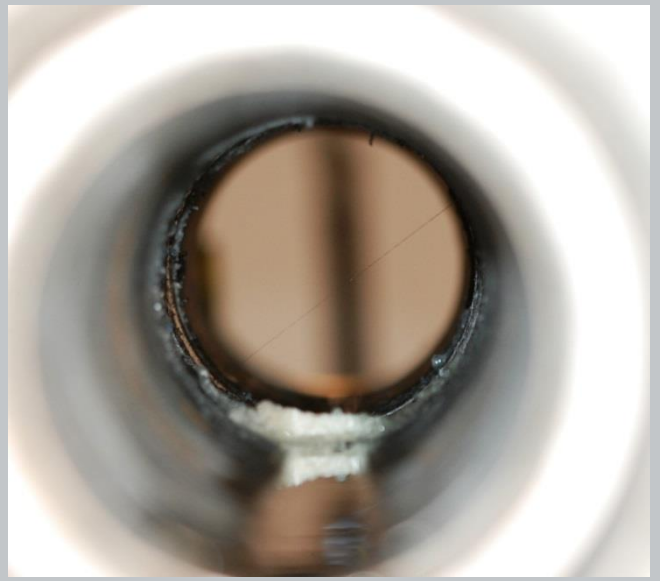
- No water on the BP1 side
- Attempted to pull collimator out of BP1
  - It was stuck
  - Required some convincing

# Sticky Situation

- Joint between tank and BP sealed with tar
- Clean up on BP1

# BP 1 Investigation

- Looked into BP1 with spotting scope and saw hair on lens
- Water jet from pin hole in convolution of bellows

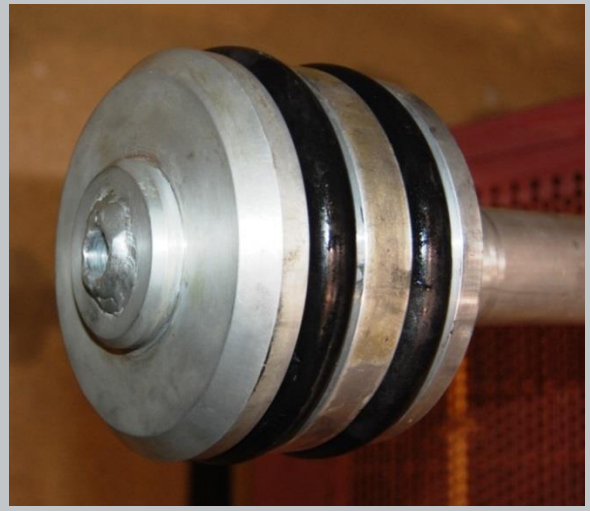


# What to Do?

- Patch won't work
  - Curved, flexing surface
  - Thin wall
  - Inaccessible outer surface
- Must replace bellows
- Requires time and $$$

# Temporary Fix

- Expanding pipe plugs
- Allow BP to flood
- Center tube in plugs allows thermal expansion, purging, and monitoring of water in BP



# Time Passes

- Operated with plugs for about a year and a half
  - Radiography system moved from BP5 to BP3
  - Flux profile shifted due to flooded BP
- $$$ accumulated


# Wet or Dry?

- Estimated dose rates
- Water is our friend
  - Lower doses
  - Less to disassemble

| Area | Distance from Area | Dose rate in air (mrem/hr) | Dose rate in water (mrem/hr) |
|---|---|---|---|
| 1 | 100 cm | 1252.27 | 68 |
| 2 | 100 cm | 727.43 | 93 |
| 3 | 100 cm | 202.86 | 52 |
| 4 | 100 cm | 65.21 | 14.5 |

# Bellows Replacement

- Decided to replace both bellows
- New bellows from stainless steel

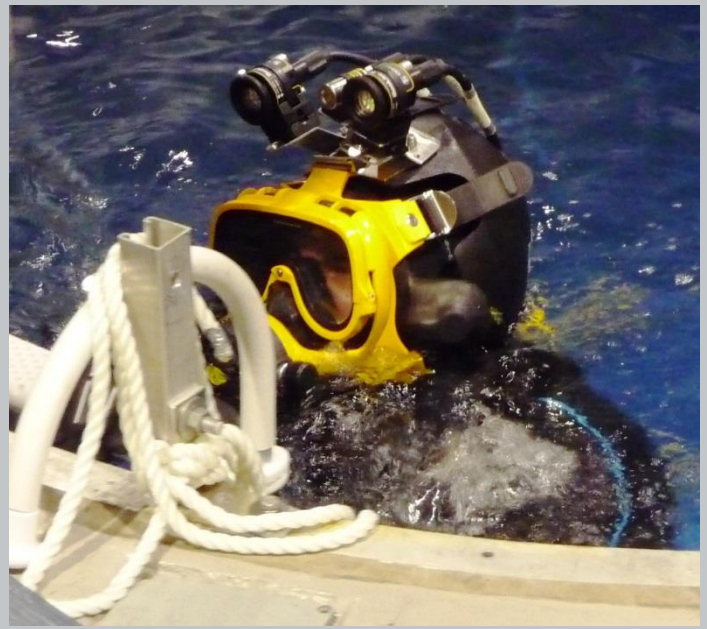
# Dive Preparations

- July 2015
  - Moved fuel to storage
  - Installed shield curtains in pool
  - Trained divers as radiation workers

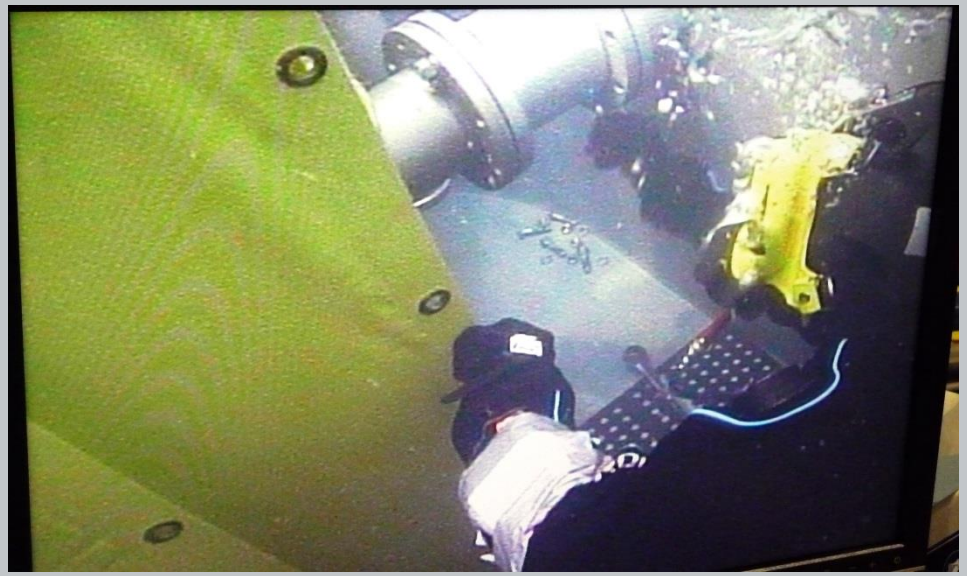
# Dive! Dive! Dive!

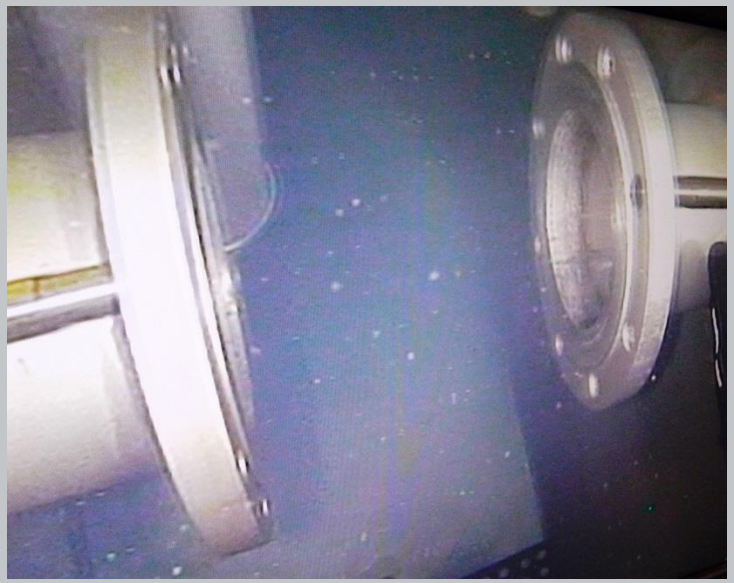
22-24 September 2015

# Dive! Dive! Dive!

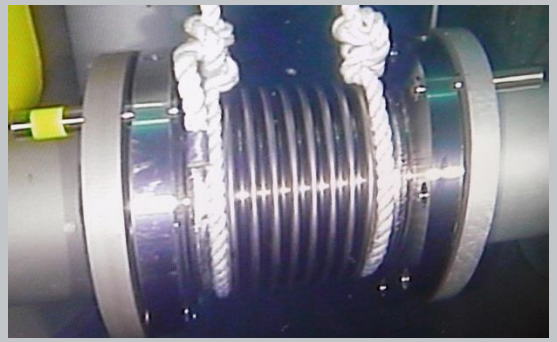


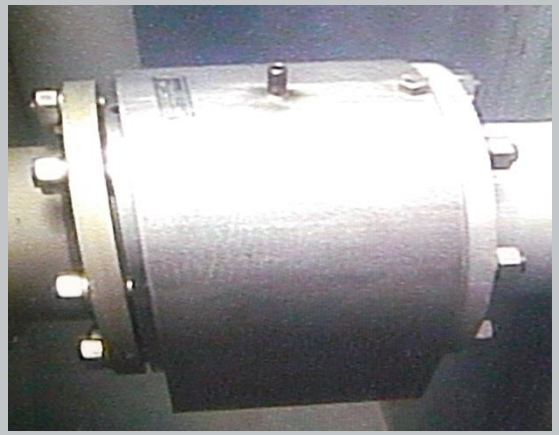
# Out With the Old





# In With the New





# Déjà vu

- Out with the old…again
- In with the new…again


# Lessons Learned

- Divers are dirty!

# Divers are Dirty!

- Visibility down to 4 meters
- Conductivity > 30 µS
- Water biologically contaminated
  - UV treatment
  - Filtration
- Resin decomposing

# Lessons Learned

- Divers are dirty!
- There has to be a better way to move fuel

**Good, Better, Best**

# Building a Better Mouse Trap

- Specifically designed fuel transfer cask
- Details in Mike Whaley's talk

# Lessons Learned

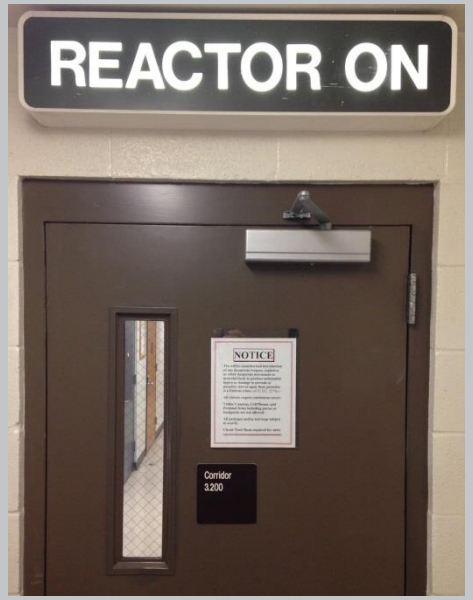
- Divers are dirty!
- There has to be a better way to move fuel
- First responders like to play during fuel moves

# First Responders Playing

- Military WMD unit
- FBI
- FD Special Operations

# Back in Business

- November 2015
  - Fuel loaded after water quality recovered
  - Required surveillances performed
  - Normal operations resumed





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