RHIC Retreat

What Can Shut Us Down?

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BROOKHAVEN NATIONAL LABORATORY
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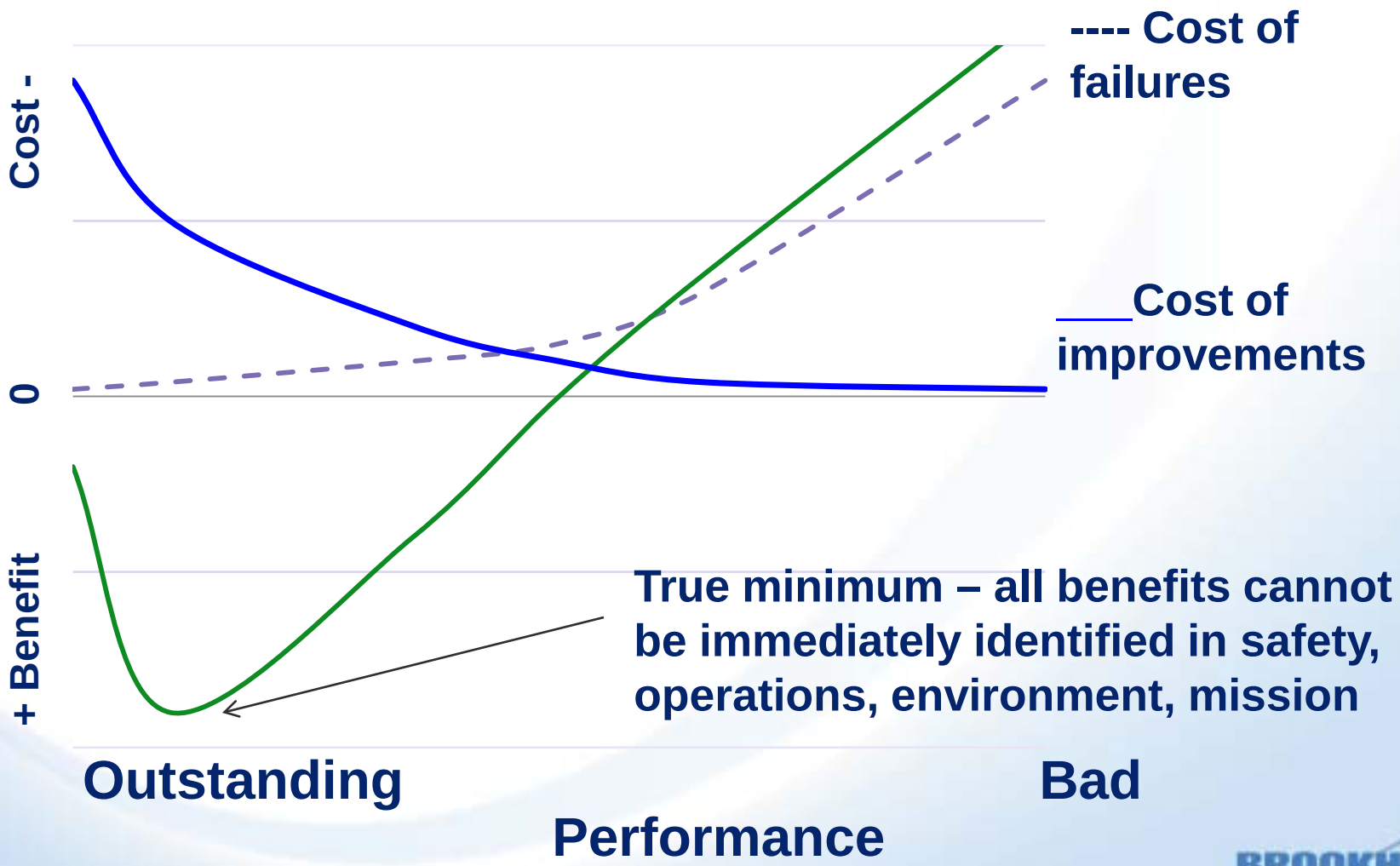
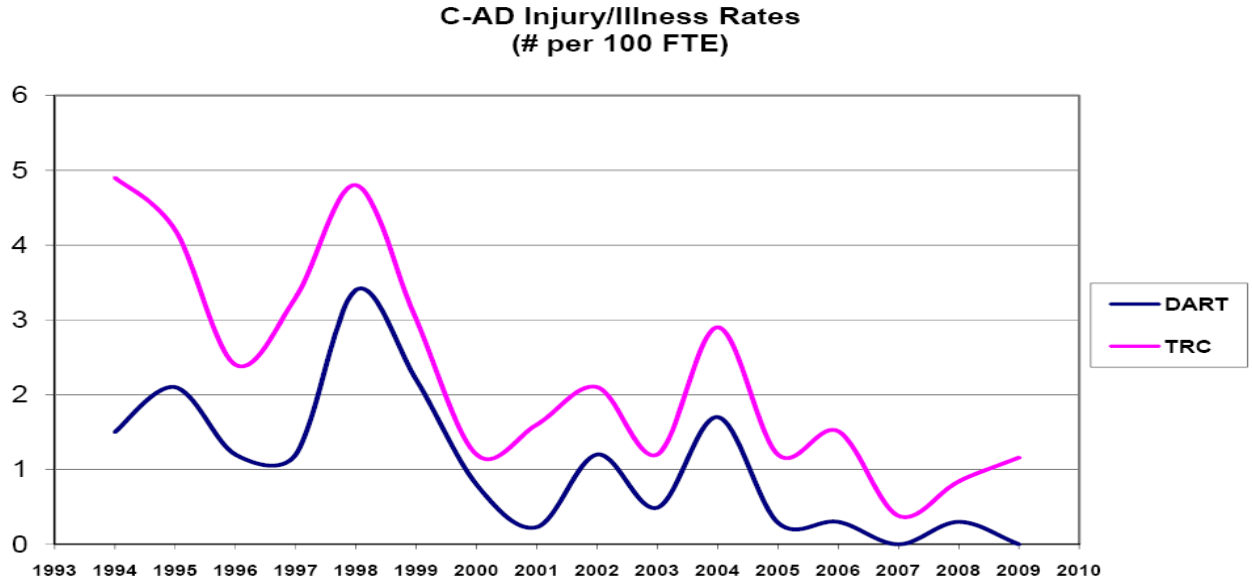
Can Bad Performance Be Avoided?

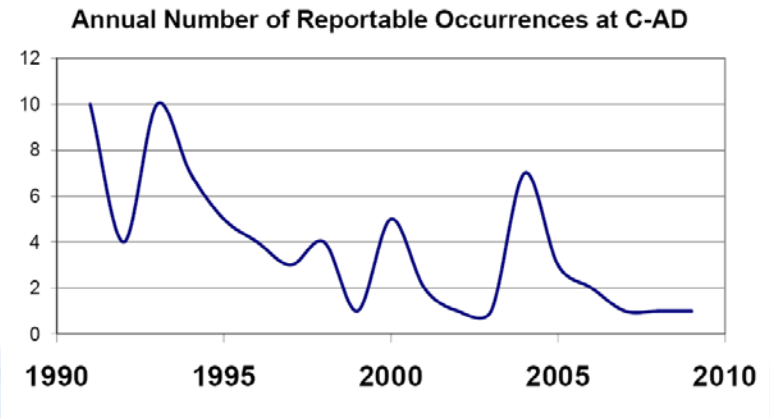


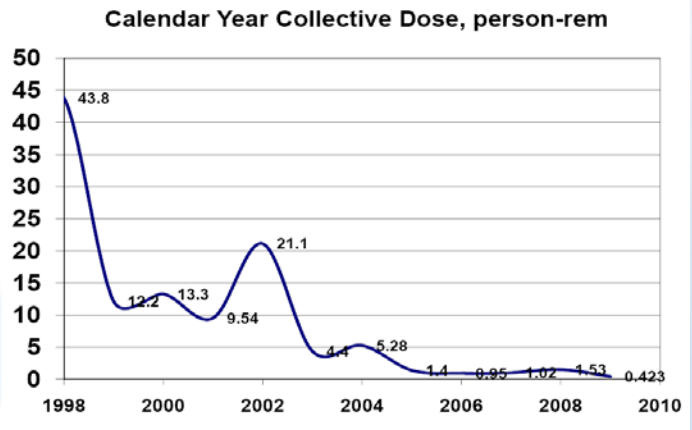
Benefits From Improvements

- **In the long run there will be net benefits greater than cost of improvements – some are intangible**
  - **Operating costs continue to decrease**
  - **Fewer equipment failures in the future**
  - **Less impact on the environment**
  - **Injuries continue to decrease**
  - **Fewer "enforced" shut downs**
  - **Relations with stakeholders continue to improve**
- **There is no statistically strong correlation between forced shutdowns and lack of improvements but there is a qualitative relationship: arc flash events, capacitor fires, tritium leaks…**

Trends in ESH Performance at C-AD







Significant Accelerator Events

- Explosion, Cambridge, MA, 1965
- Radiation Exposure, Protvino, Russia, 1978
- Radiation Exposure, PRC, 1985
- Therapy Over-Exposures, Zargoza, Spain, 1990
- Radiation in Uncontrolled Area, AGS, 1990
- Radiation Exposure, Hanoi, 1992
- Electrical Arc Flash, FNAL, 1997
- Electrical Arc Flash, SLAC, 2004
- Electrical Arc Flash, C-AD, 2006
- Radioactive Contamination, Holifield, 2008
- Electrical / Mechanical Failure, CERN, 2008

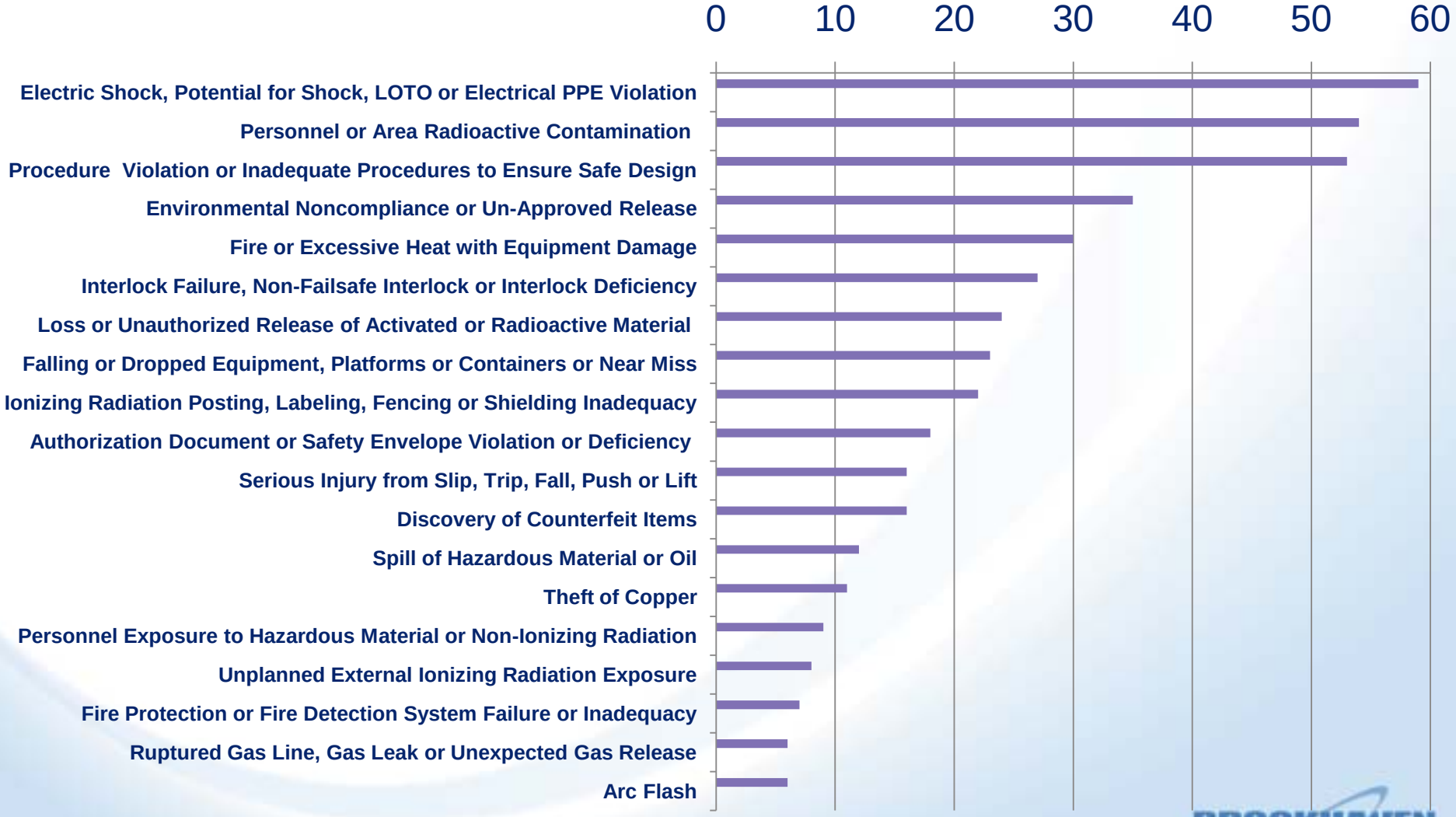
Significant DOE Accelerator Fires Listed in ORPS

- Transformer, FNAL, 1991
- Capacitor in Pulse Forming Network, SLAC, 1992
- High Voltage Cable to Ion Pumps, SLAC, 1994
- Power Feed Cable, NSLS, 1997
- Capacitor in Pulse Forming Network, NSLS, 1999
- Capacitor in Pulse Forming Network, SLAC, 2003
- Transformer, SLAC, 2003
- Capacitor in Power Supply, AGS, 2004
- Vacuum Pump, APS, 2006
- Capacitor in Pulse Forming Network, SLAC, 2009
- Capacitor in Pulse Forming Network, ATF, 2009

DOE Accelerator PCB or Tritium Release Events

- Tritium in Groundwater, SLAC, 1992
- PCB Spill, NSLS, 1997
- Tritium in Groundwater, BLIP 1998
- Tritium in Groundwater, AGS, 1999
- Legacy PCB Spill, ORELA, 2000
- Tritium in Surface Water, FNAL, 2005

Number of Accelerator Occurrences Out of 54,000 DOE Occurrences



C-AD ASE Limit Violations That Are DOE Reportable

- **Radiation**
  - **Unsafe radiation detector interlock failure**
  - **Unsafe access interlock system failure**
  - **Failed caps for activated soil**
  - **Exceeding testing period for check on interlock system**
- **Oxygen Deficiency**
  - **Unsafe ODH sensor and alarm failure**
  - **Exceeding testing period for check on ODH system**
- **Fire**
  - **Unsafe fire detection system and alarm failure**
  - **Unsafe flammable gas detection system failure**
  - **Exceeding testing period for check on systems**

C-AD Operations Envelope – Some Events May Be DOE Reportable

- No operators at controls
- Training qualification deficiency for operator
- Work planning not performed
- Environmental non-compliance
- Modification is not reviewed for safety
- Common industrial hazard is not controlled

Summary

- **If aiming for outstanding performance, then cost of improvements is offset by long term benefits; i.e.,**
  - **Zero injuries, no shutdowns and no occurrences**
- **Events that caused shutdown at accelerators:**
  - **Fire**
  - **Electrical safety violation plus injury**
  - **Tritium release to environment**
  - **Unplanned radiation exposure**
  - **Electrical / mechanical failure**
- **Spending on ESH programs that demonstrate manager commitment, improve line accountability and increase worker involvement will eliminate these bad events**