Safety Performance in C-AD

Biennial Science and Technology Review of RHIC

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September 2019

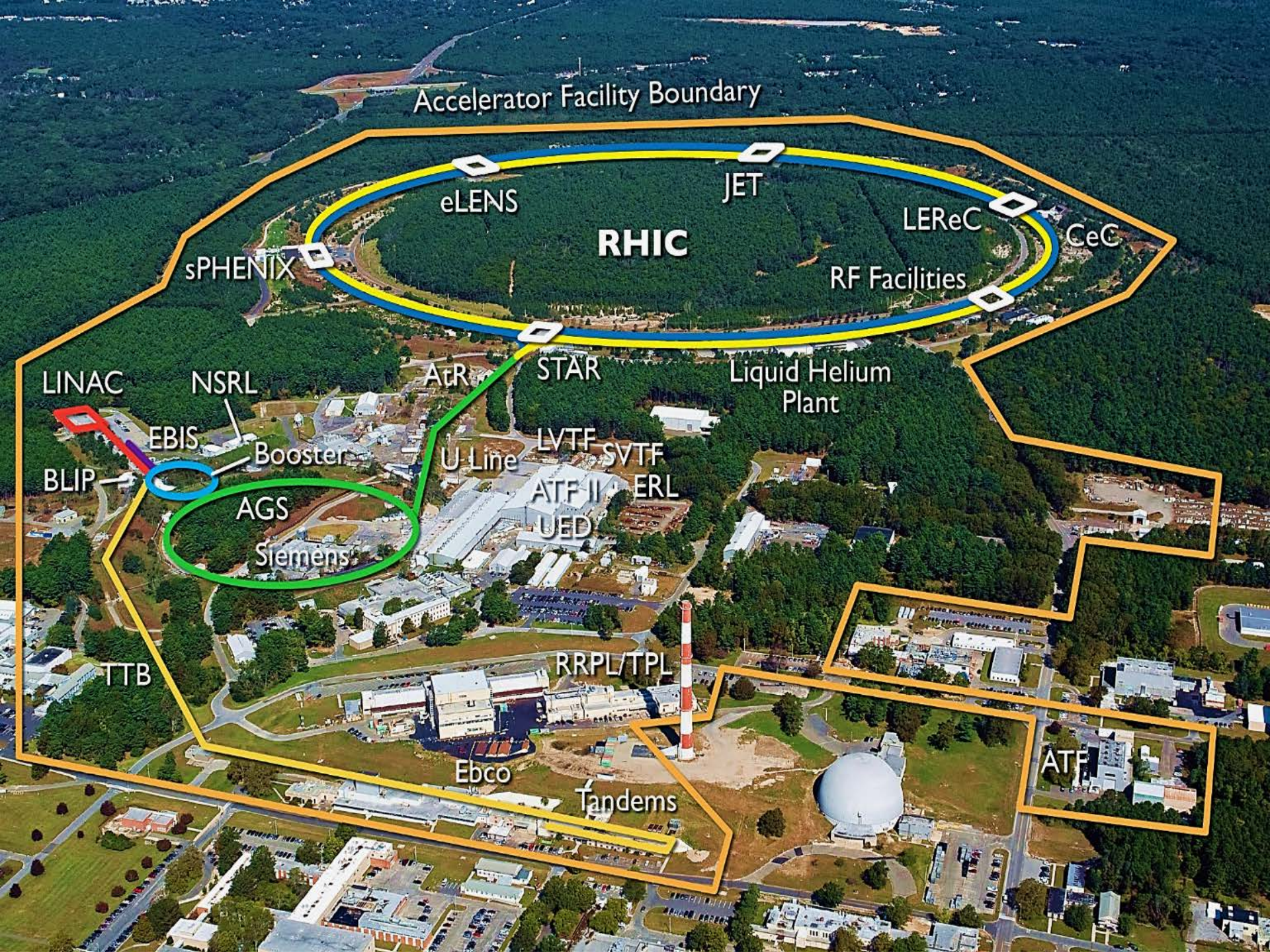
BROOKHAVEN NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY

BROOKHAVEN SCIENCE ASSOCIATES

Agenda

- Safety Values and Culture
- Safety Organization and Programs
- Safety Performance Successes
- Challenges
- Vision for the Future

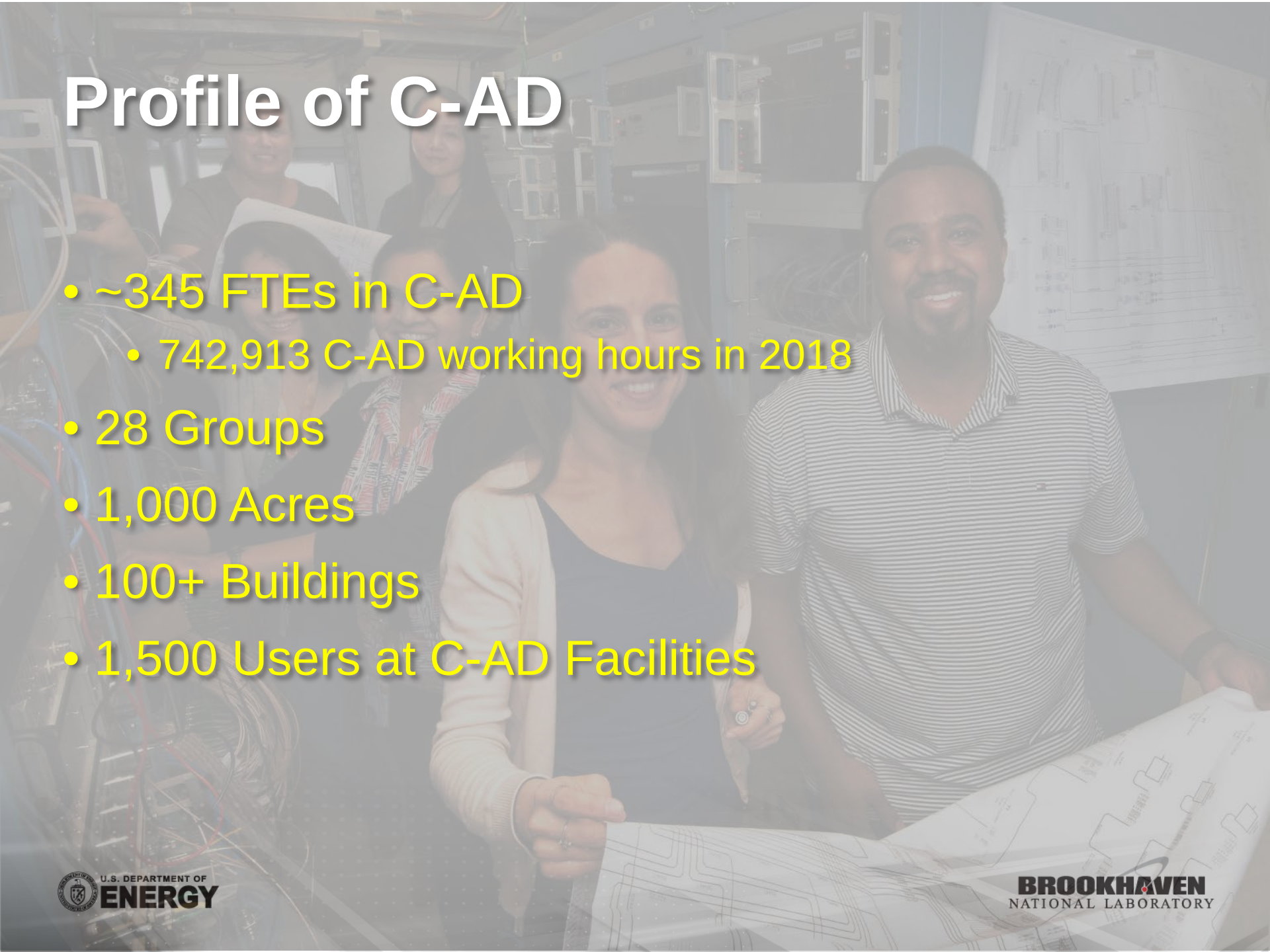

Accelerator Facility Boundary
eLENS
JET
LEReC
CeC
RHIC
sPHENIX
RF Facilities
LINAC
NSRL
AtR
STAR
Liquid Helium Plant
EBIS
Booster
LVTF
SVTF
U Line
BLIP
ATF II
ERL
AGS
UED
Siemens
TTB
RRPL/TPL
Ebco
Tandems
ATF

Safety and the C-AD Mission

- Collider-Accelerator Department Mission:
  - Improve and operate accelerators, support the experimental program, and design and construct new accelerator facilities in an environmentally responsible and safe manner under a rigorous conduct-of-operations approach.
- Safety is the highest priority for our operations
  - Integral part of the mission
  - Operations are conducted with an understanding of the hazards
  - Conducted with adherence to procedure
  - Each worker is responsible for maintaining an awareness of safety
  - Deep respect for our co-workers
  - Deep respect for the environment

Profile of C-AD

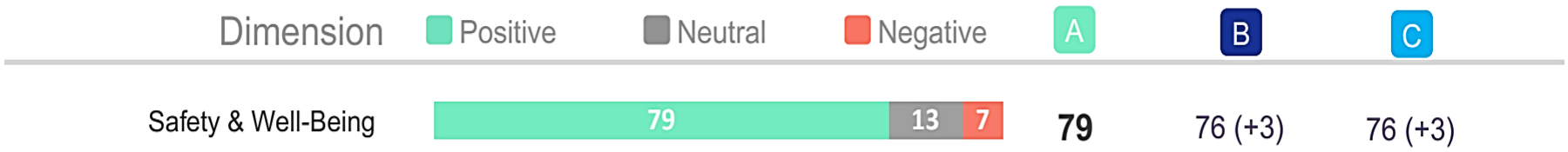
- ~345 FTEs in C-AD
  - 742,913 C-AD working hours in 2018
- 28 Groups
- 1,000 Acres
- 100+ Buildings
- 1,500 Users at C-AD Facilities



C-AD Safety Values

Management Committed to Excellence	Line Responsibility for Safety	Everyone is Involved	Training is Essential	Broad Array of Safety Systems and Practices
• Establish vision and goals • Establish safety improvement objectives • Track performance • Maintain personal involvement • Maintain learning organization	• Executive, manager, supervisor all responsible to prevent injuries and events within jurisdiction • Individuals responsible for their safety and that of coworkers • Responsibility for outcomes • Operational discipline	• Respect for coworkers and stakeholders • Integrity of operations	• Training compliments but cannot replace learning by doing • Training fosters discipline and excellence	• No single practice or safety system is perfect • Multiple practices ensure some barriers remain even if some are defeated • Implement best practices that demonstrate success • Safe Conduct of Research Principles

Our Values



- Safety highly valued at Brookhaven and within the NPP Directorate
- Survey results indicate a strong commitment to safety

cultureiQ

A n = 587 NPP

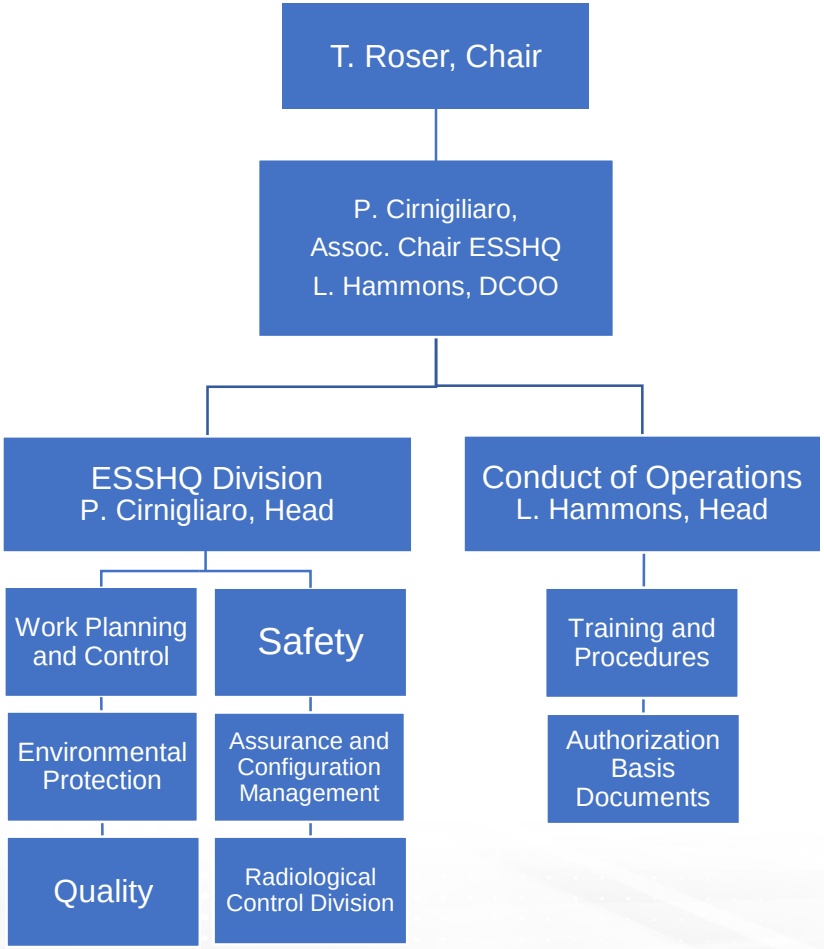
B n = 1921 Lab

C n = - Best Companies to Work For

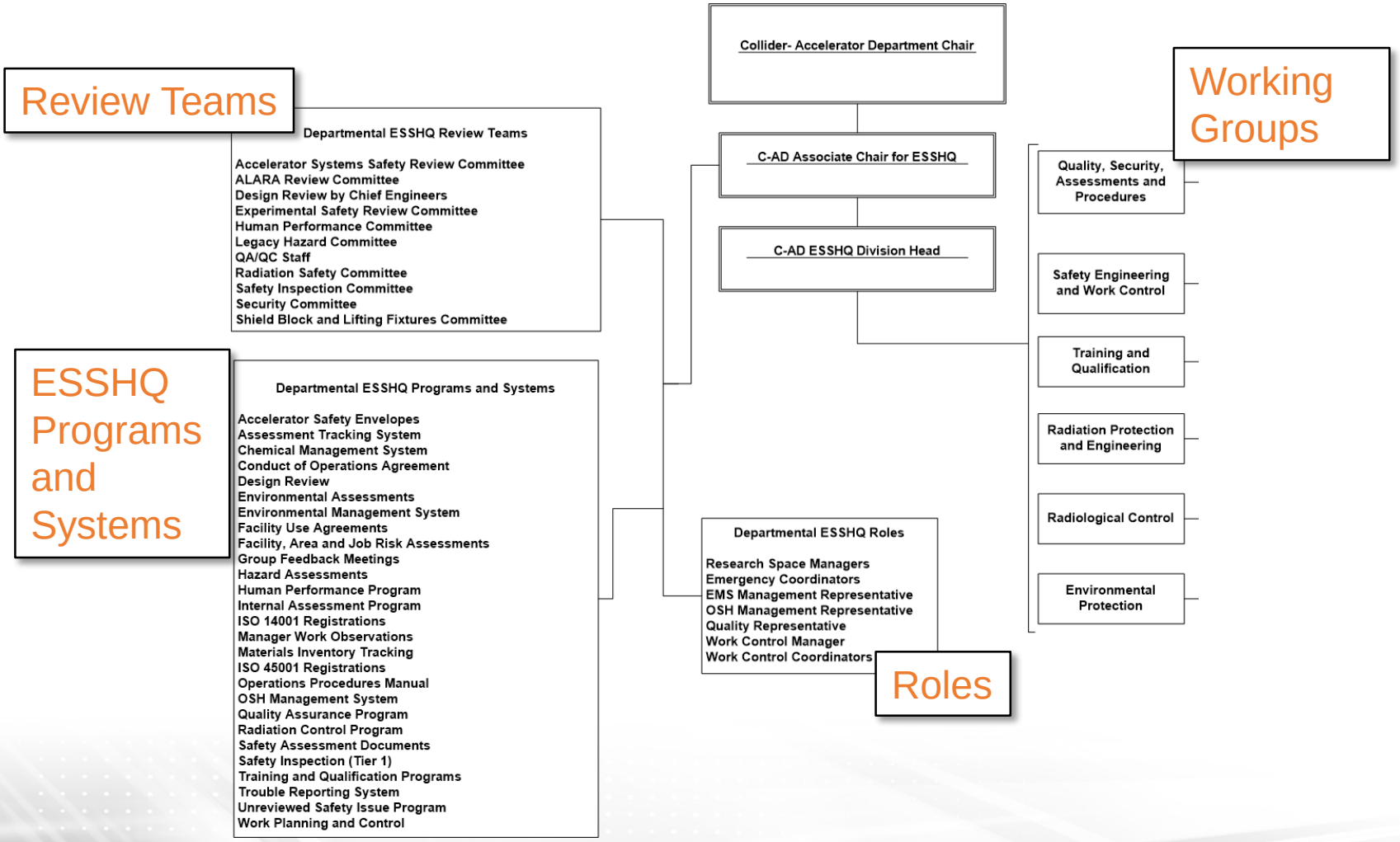
ESH Practices

- **Performance and Project Reviews**
  - 3 programs
- **Events and Issues Management**
  - 3 programs
- **Internal Assessments**
  - 16 programs
- **External Assessments**
  - 9 programs
- **Operational ESSHQ Activities**
  - 12 programs

ESSHQ Groups in C-AD



Safety Organizations in C-AD



Safety Performance Successes

- New Projects at RHIC
  - Low-Energy RHIC Electron Cooler (LEReC) Readiness Review
    - Approval for commissioning in March 2018
  - Coherent Electron Cooling (CeC) Readiness Review
    - Approval for commissioning and operation in May 2016
  - STAR Experiment Upgrades
    - Completed successfully and without incidents
  - PHENIX Removal and Repurposing
    - Removal of experiment, structural components, and shielding without incidents
  - sPHENIX PD 2/3 Safety Reviews
- Completion of important initiatives:
  - Implementation of new requirements in electrical safety
  - Human performance refresher training of entire C-AD staff
  - Support of BNL's effort to reregister to ISO (EMS and OSH) standards
  - Disposal of legacy gas cylinders
- Successes are result of years of steady, persistent work on the part of entire department including safety teams

Environmental and Sustainability Objectives

- Reduce greenhouse gas emissions by improving energy efficiency in day-to-day operations
- Reduce or eliminate the acquisition, use, and release of hazardous chemicals and materials
- Regulatory Objectives
  - Zero Notices of Violation
  - Zero Permit Violations
  - Zero Lost Workdays
  - Zero Total Recordable Injuries

Environmental Monitoring and Waste Disposal

- ERM CVS Audit 2018
  - One institutional non-conformance
    - Compressed gas storage
  - Two institutional opportunities for improvement
- Two minor spills in 2018
- No wastewater discharge exceedances in 2018

Challenges to Safety Performance

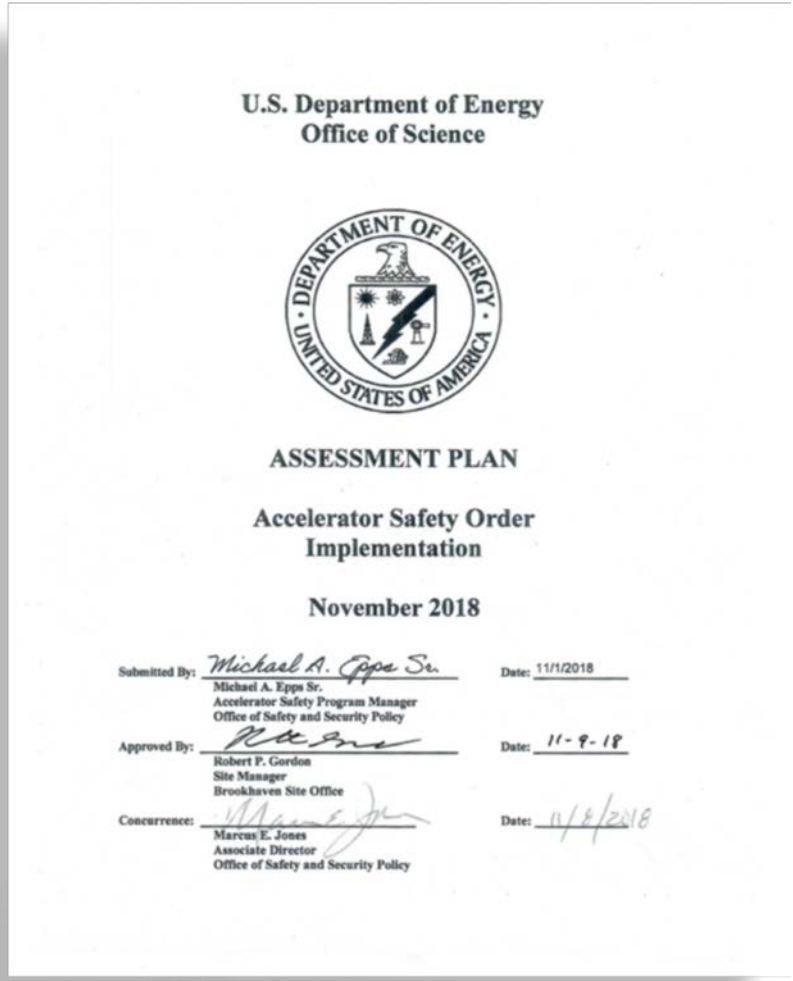
- **Small uptick in injuries over last four years**
  - Aging workforce – greater frequency of minor injuries
  - Redouble efforts to raise safety awareness
  - Plans for additional human performance training
  - Mandatory slip simulator training for all of C-AD staff
  - Safety caps purchased for workers in RHIC tunnel
- **Succession planning and changes in leadership**
  - Aging workforces means higher priority to plan for succession and insure knowledge transfer
  - Retirement of Ed Lessard, former Associate Chair of ESSHQ
    - Responsibilities divided between Peter Cirnigliaro and Lee Hammons
    - Ed put in place a strong succession plan to transfer knowledge and responsibilities
    - Ed worked to put in place a robust set of programs that have built a strong and a lasting safety culture
- **Response to Accelerator Safety Assessment of November 2018 and Office of Science Management Review of July 2019**

Events in C-AD

- 2019
  - Plugging in Extension Cord to Power Chemical Insertion Pump at 1005 Cryo Cooling Tower Results in Spark at Pump-End of Cord, 7-15-19
  - Employee Receives Minor DC Elec Discharge to Hand, 6-24-19
  - Improper Escort into Radiological Area, 2-27-19
- 2018
  - 1005P Mech Tech Fractures Left Shoulder, 11-2-18
  - Minor Injury to Worker from a Falling Object from Crane, 7-30-18
  - An Improper Electrical LOTO Procedure was Discovered During a Post Job Review, 7-25-18
  - Employee Received Minor Discharge from Capacitor, 6-27-18
  - Radiation Alarm Response Did Not Follow Procedure, 4-17-18
  - Guest slips in STAR Parking Lot, 3-23-18

Accelerator Safety Assessment

- Completed November 2018
- Objectives:
  - Evaluate implementation of Accelerator Safety Order
  - Examine SCMS
  - Examine SBMS
- Elements of assessment included:
  - SAD and ASE
  - USI
  - ARR
  - Training and Qualifications
  - Procedures and Plans
  - Approvals



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ASSESSMENT PLAN

Accelerator Safety Order Implementation

November 2018

Submitted By: Michael A. Epps Sr. Date: 11/1/2018
Michael A. Epps Sr.
Accelerator Safety Program Manager
Office of Safety and Security Policy

Approved By: Date: 11-9-18
Robert P. Gordon
Site Manager
Brookhaven Site Office

Concurrence: Date: 11/8/2018
Marcus E. Jones
Associate Director
Office of Safety and Security Policy

Key Areas of Concern

Table 1 Risk Matrix for Hazar...

	Low Risk – Acceptable	Medium Risk- Unacceptable	High Risk- Unacceptable	Hi... Unacc...
Medium	Extremely Low Risk - Desirable	Low Risk – Acceptable	Medium Risk- Unacceptable	High Risk- Unacceptable
Low	Extremely Low Risk - Desirable	Extremely Low Risk - Desirable	Low Risk – Acceptable	Medium Risk- Unacceptable
Extremely Low	Extremely Low Risk - Desirable	Extremely Low Risk - Desirable	Extremely Low - Desirable	Low Risk – Acceptable
	Extremely Unlikely ($<10^{-6}$/y)	Unlikely (Between 10^{-6}/y and 10^{-5}/y)	Anticipated Medium (Between 10^{-5}/y and 10^{-4}/y)	Anticipate[d] High ($>10^{-4}$/

Safety Documentation

Operational Limits

Change Management

Conduct of Operations

Self Assessment

SC Management Review

- Completed in July
- Charged with determining safety of operations and ways that process could be improved
- Conclusions:
  - Operations are safe
  - Procedures and work controls maintain the safety envelope
  - Staff is competent
  - Recommended Improvements:
    - Enhance clarity of safety documentation
    - Improve flowdown of credited controls into operating procedures
    - Use increased self-review of procedures and activities to drive continuous improvement
    - Improve quality and clarity of procedures
    - Benchmark USI process against other SC sites

Key Questions

- Do we understand the hazards and the risks?
- Is the safety analysis adequate?
- Are facility operations and procedures adequately documented and managed?
- Does the staff have an adequate understanding of procedures and controls?

Answers

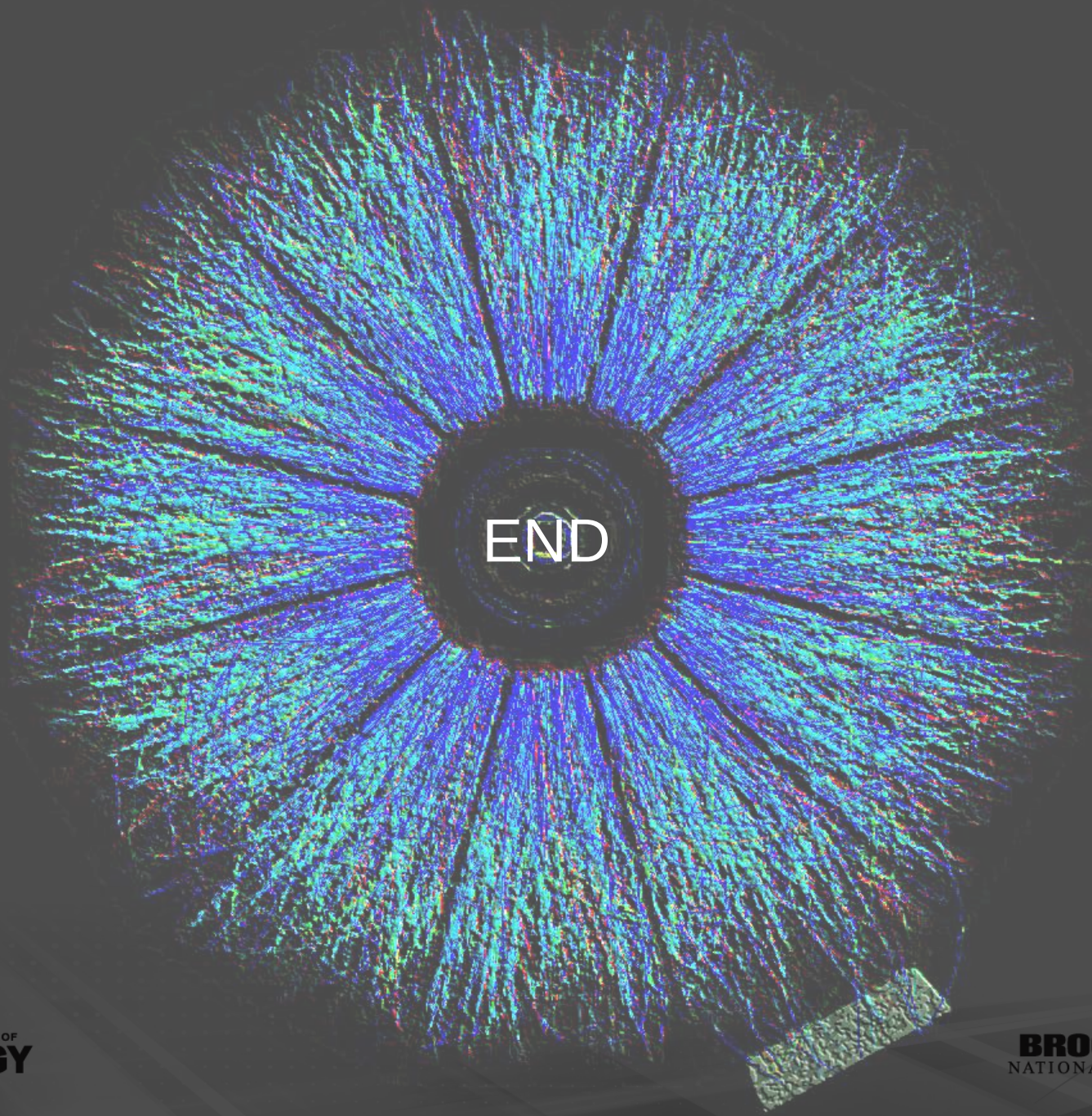
- **Do We Understand the Hazards and Risks?**
  - Yes, and C-AD is working to improve our safety documentation and procedures to more effectively address and identify hazards and risks
  - C-AD works closely with the Laboratory ESH organization and with BHSO to help manage the safety of the facilities
- **Is the Safety Analysis Adequate?**
  - Yes, the safety analyses of our facilities have been developed over many years and with the help of many experts
  - Successful reviews and robust processes attest to the adequacy
  - C-AD has comprehensively analyzed the safety of our facilities, but we are always working to improve the quality and the clarity of our analysis for the future
- **Are Facility Operations and Procedures Adequately Documented and Managed?**
  - Yes, but C-AD is working to improve the documentation and procedures
- **Does the Staff Have an Adequate Understanding of Procedure and Controls?**
  - Yes, but training and continuous improvement is an important part of C-AD culture
  - Succession planning and knowledge transfer is critical to maintaining our programs
  - Continuous improvements require ongoing efforts to train and raise awareness of staff about hazards and risks
  - C-AD is always working to improve our training and engage staff in identifying hazards

Vision for the Future

- **Operational Excellence**
  - Procedures and programs that that demonstrate best practices in the DOE complex
  - Safety leadership
  - Best management tools and practices to manage present and future programs
  - Best tools and technologies to manage safety of facilities
  - Full engagement of staff in managing safety of facilities
  - Continued open and honest dialogue about challenges
  - Vigorous communication with all stakeholders regarding safety performance
  - Partnership with our Site Office to ensured continued successful operations
- **Fully resourced commitment to safety excellence**
  - Thoughtful succession planning and knowledge transfer
  - Full complement of staff to manage safety programs

Conclusions

- C-AD, NPP, and BNL are committed to maintaining a culture of safety
  - Values and culture are aligned
  - All stakeholders understand and value our safety commitment
- C-AD has been successful in maintain RHIC operations and bringing new operations online
  - LEReC, CeC, STAR Upgrade, PHENIX R & R
- C-AD maintains are large number of safety programs and initiatives that provide for safe and environmentally sound operations
- Challenges include:
  - Aging workforce
  - Small uptick in injuries in past several years
    - Heightened awareness of staff
    - Additional training
  - Transition to new leadership with retirement of longtime Associate Chair for ESSHQ
  - Continuous improvement of operations to address concerns of accelerator safety assessment now and into future
- C-AD is committed to a future of operational excellence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