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Sandia National Laboratories

Exceptional service in the national interest

Nuclear Fuel Cycle & Grid Modernization

Sylvia Saltzstein

Senior Manager of Advanced Nuclear Energy Program

DECOVALEX

Albuquerque, NM

November 7, 2022

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc. for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

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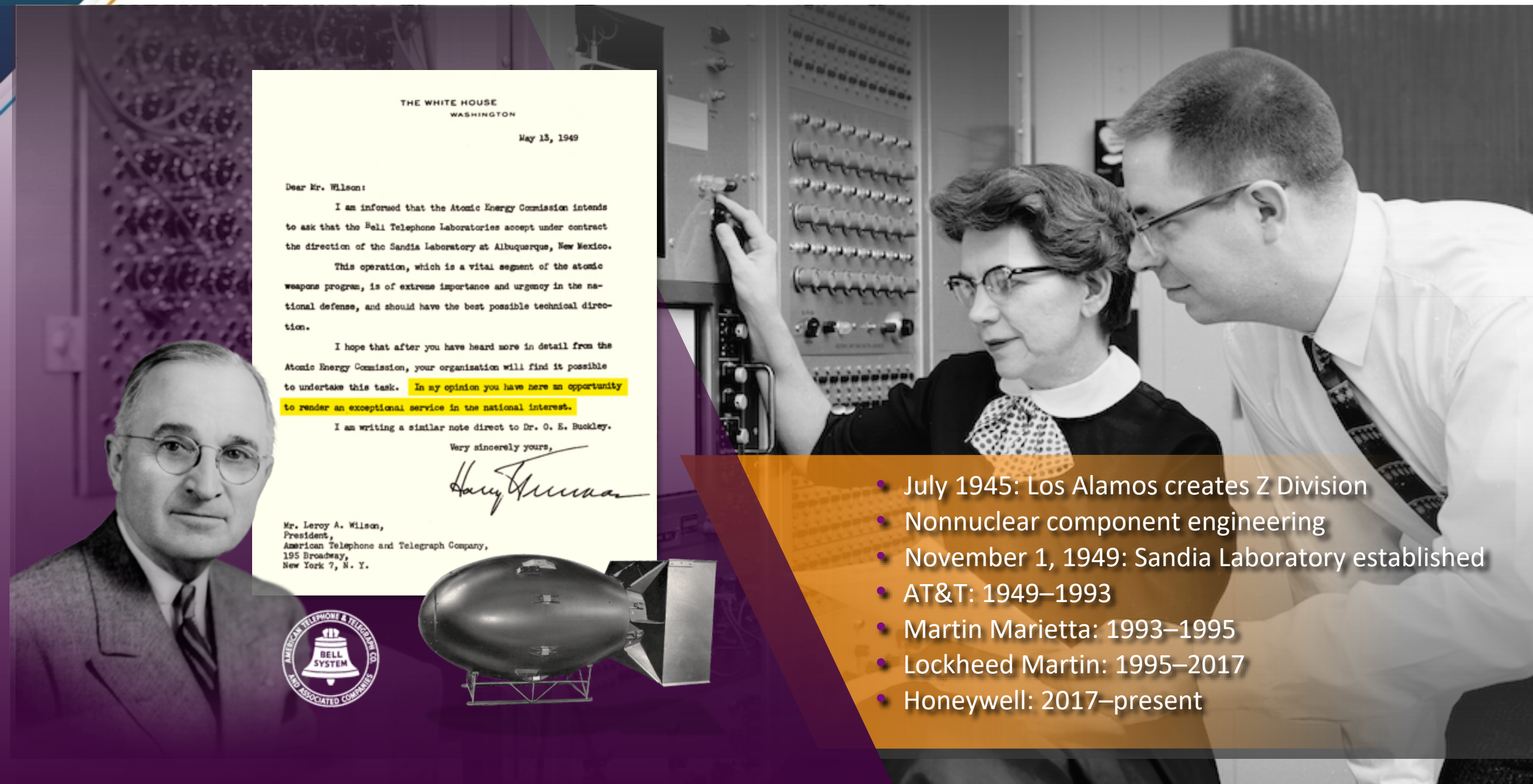
Sandia's History is Traced to the Manhattan Project



THE WHITE HOUSE
WASHINGTON

May 13, 1949

Dear Mr. Wilson:

I am informed that the Atomic Energy Commission intends to ask that the Bell Telephone Laboratories accept under contract the direction of the Sandia Laboratory at Albuquerque, New Mexico.

This operation, which is a vital segment of the atomic weapons program, is of extreme importance and urgency in the national defense, and should have the best possible technical direction.

I hope that after you have heard more in detail from the Atomic Energy Commission, your organization will find it possible to undertake this task. In my opinion you have here an opportunity to render an exceptional service in the national interest.

I am writing a similar note direct to Dr. O. E. Buckley.

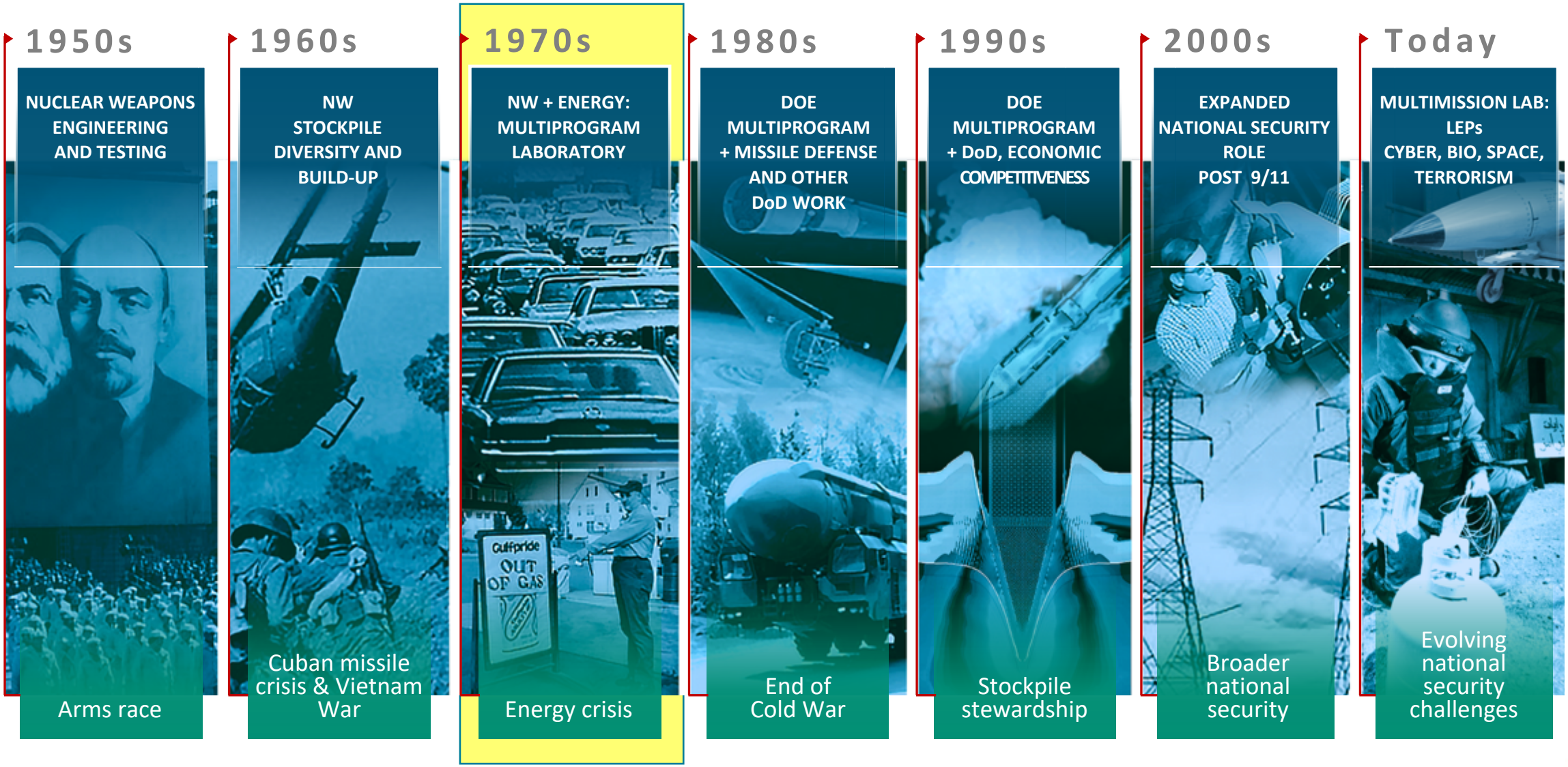
Very sincerely yours,

Harry Truman

Mr. Leroy A. Wilson,
President,
American Telephone and Telegraph Company,
195 Broadway,
New York 7, N. Y.

- July 1945: Los Alamos creates Z Division
- Nonnuclear component engineering
- November 1, 1949: Sandia Laboratory established
- AT&T: 1949–1993
- Martin Marietta: 1993–1995
- Lockheed Martin: 1995–2017
- Honeywell: 2017–present

Our National Security Role has Evolved over 70+ Years



Capabilities Housed Across the Nation

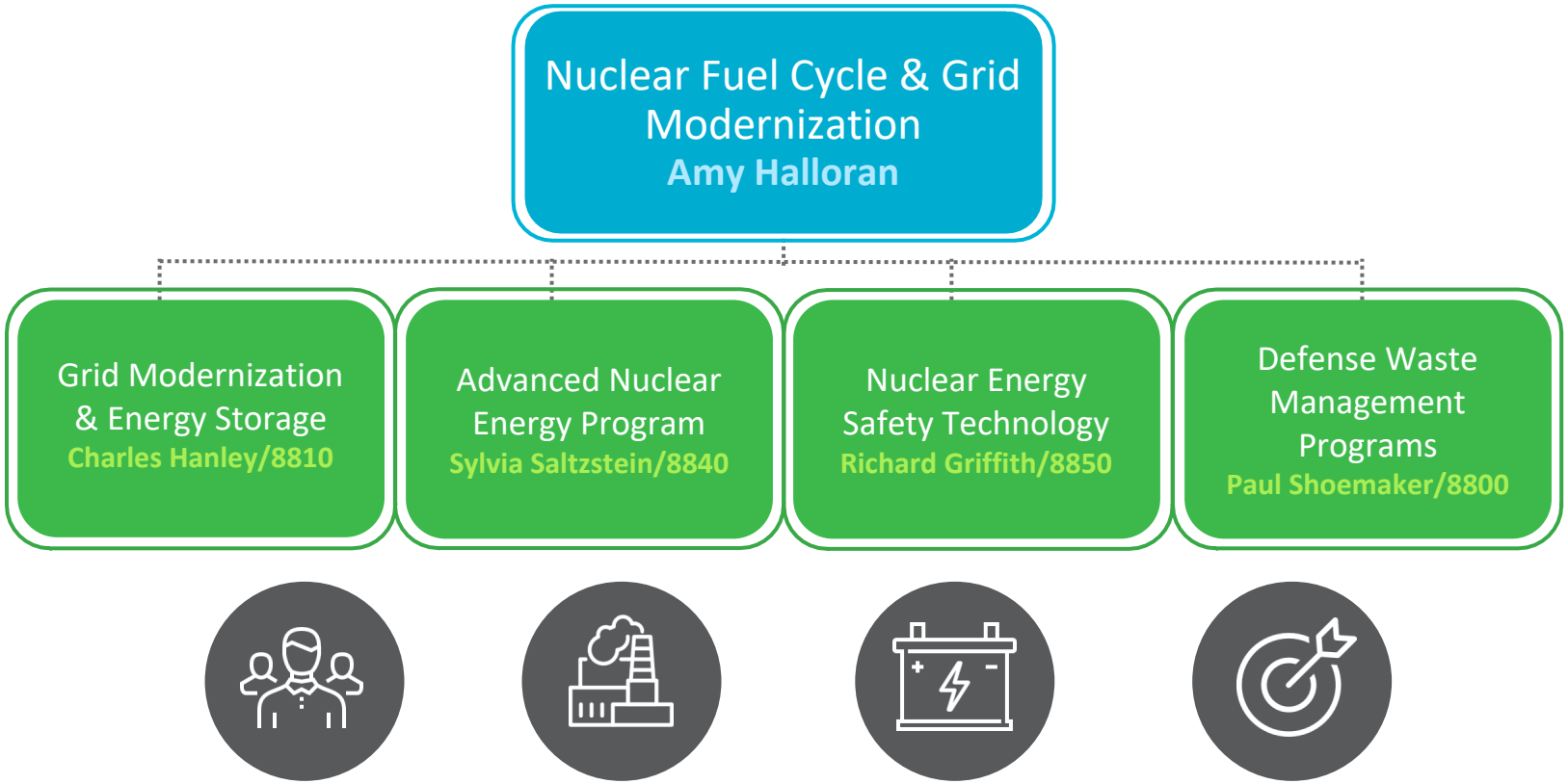
Activity locations

- Kauai, HI
- Waste Isolation Pilot Plant, Carlsbad, NM
- Pantex, Amarillo, TX
- Tonopah, NV
- Utqiagvik (Barrow), AK
- Lubbock, TX

Main sites

- **Albuquerque, New Mexico**
- **Livermore, California**

Nuclear Fuel Cycle & Grid Modernization Program



300+ Research Staff:
LTEs, Post Docs & Students
Working in 25 states

13 Research Facilities:
Including the Distributed Energy Technologies Laboratory, Energy Storage Test Lab, Geochemistry Facility, Nuclear Energy Work Complex, and the Transportation Lab

A unique set of Modeling, High Performance Computing, Experimental, Engineering, & Testing capabilities

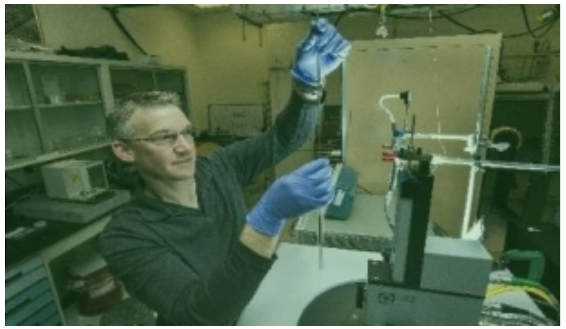
Our Work at Sandia

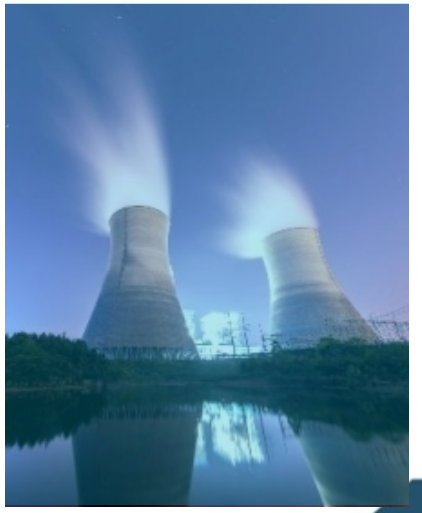
OUR PROJECTS ARE…

Developing an advanced Electric Grid with Reliable Resources and Storage

Enhancing the safety, security, safeguards and economical viability of Nuclear Energy

Advancing the science and engineering of Nuclear Waste Management





We Steward Unique Large-Scale Test Facilities and Labs

Critical Partners

Academic

Texas Tech University
CUNY The City University of New York
Montana Technological University
NC State University
University of Wisconsin–Madison
The University of Oklahoma
New Mexico
The University of Tennessee, Knoxville
Texas A&M
MIT Massachusetts Institute of Technology
Texas
Colorado School of Mines
University of Denver
University of Illinois
Kansas State University
NM State
University of Maryland
University of Nevada, Reno
Ohio State

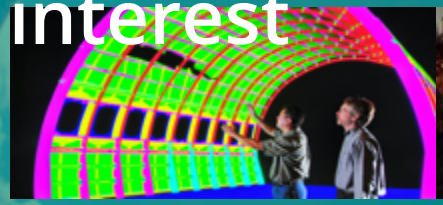
Industry

Holtec International
Westinghouse
NAC International
NTI
PNM
General Atomics Electromagnetics
EPRI Electric Power Research Institute
UL
orano
Emera Technologies
NRECA America's Electric Cooperatives

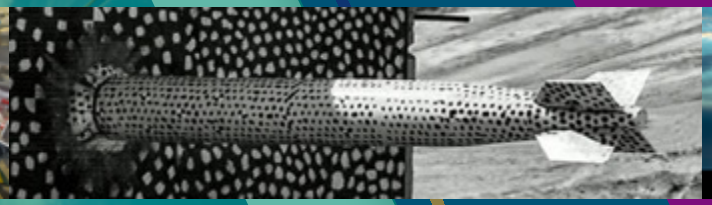
Govt/ National Labs

NREL Transforming Energy
Department of Energy
Los Alamos National Laboratory
Oak Ridge National Laboratory
INL Idaho National Laboratory
SRNL
Pacific Northwest National Laboratory
U.S. Army Research Laboratory ARL 1992-2017
US Army Corps of Engineers
U.S.NRC United States Nuclear Regulatory Commission Protecting People and the Environment

Exceptional service in the national interest








Sandia National Laboratories

The Nuclear Energy Fuel Cycle

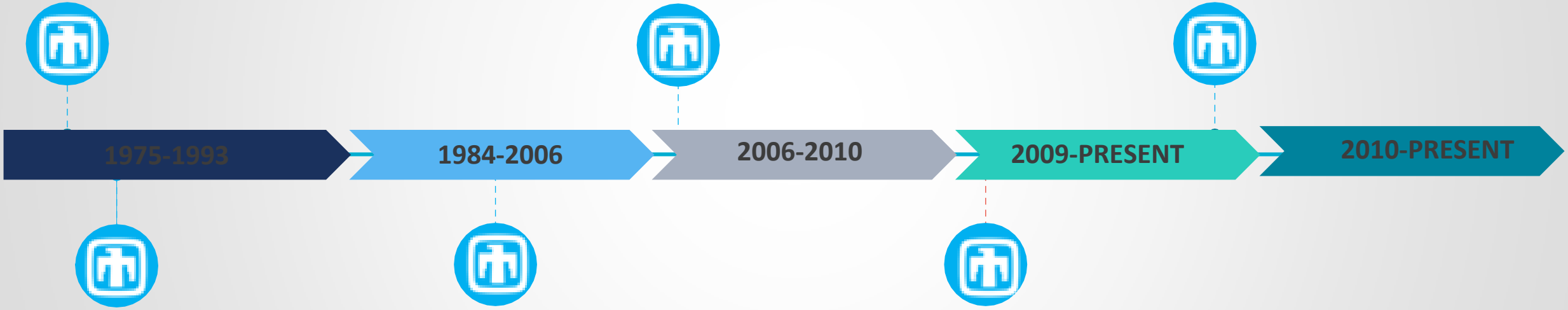
Sylvia Saltzstein, Senior Manager, Nuclear Energy Fuel Cycle

45+ YEARS OF NATIONAL AND INTERNATIONAL LEADERSHIP IN NUCLEAR WASTE MANAGEMENT

Developed the probabilistic performance assessment methodology for deep geologic repositories, as the NRC-designated lead laboratory.

Developed the scientific bases and TSPA for disposal of radioactive waste as DOE's Office of Civilian Radioactive Waste Management's lead laboratory for Repository Systems

Leading the R&D strategy, organization, and implementation for the DOE Office of Nuclear Energy's Spent Fuel and Waste Science & Technology R&D Campaign.



Developed the scientific bases for the disposal of transuranic radioactive waste from defense activities for the DOE Waste Isolation Pilot Plant.

Developed the Post-Closure Total System Performance Assessment (TSPA) for the DOE's permanent radioactive waste disposal facility.

Developed deep borehole repository concepts for specialized waste forms and lead the demonstration and feasibility testing as the Lead Lab for the DOE Deep Borehole Field Test. Continuing as the international leader in deep borehole disposal applications.

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OUR UNIQUE FACILITIES

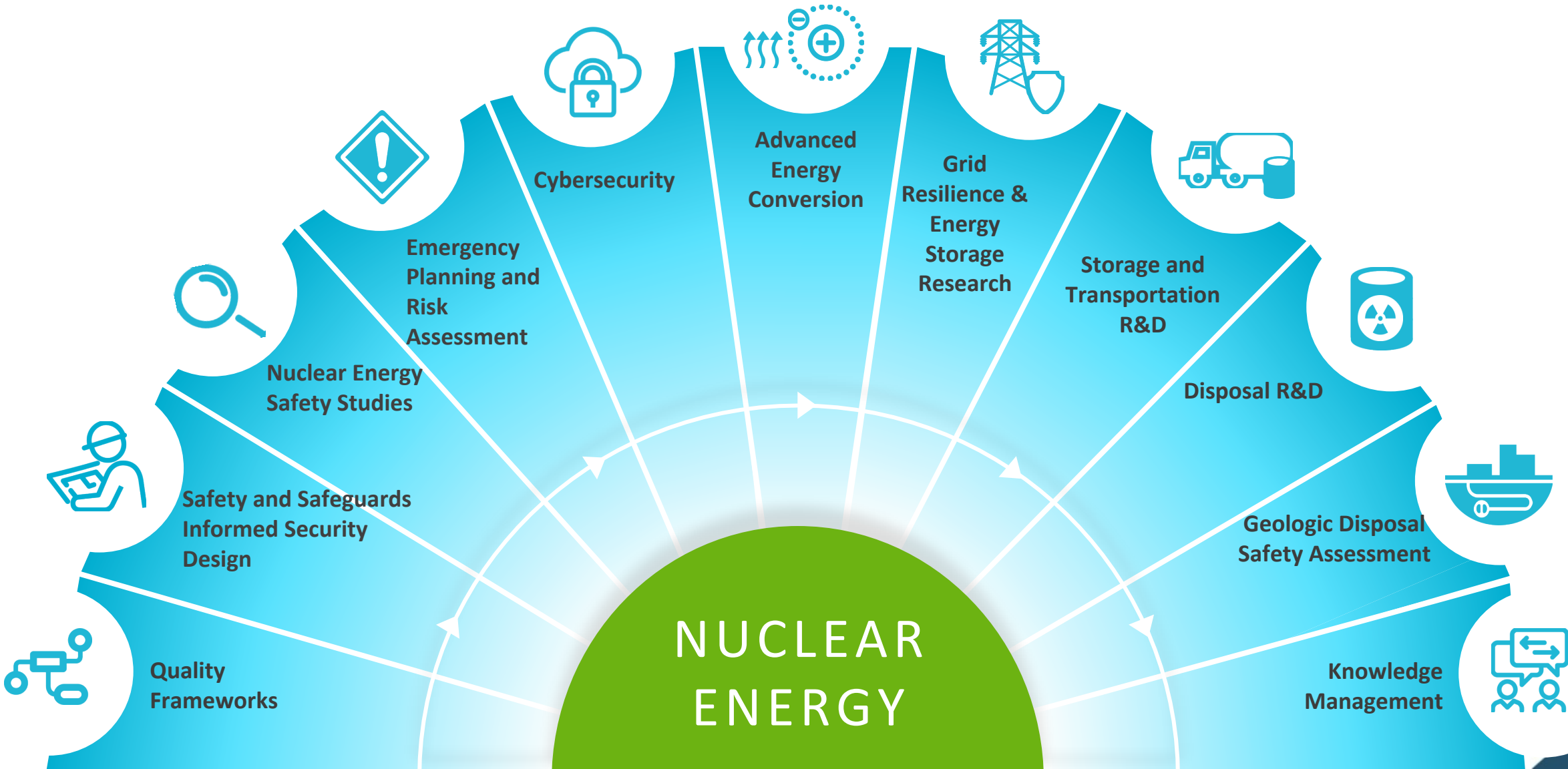
NEWC

BRAYTON LAB

LARGE TESTING CAPABILITIES

TESTING LABS

We don’t design nuclear facilities.
We help ensure they are **safe, sustainable, and secure.**



AREAS OF FOCUS

SAFETY AND SAFEGUARDS INFORMED SECURITY DESIGN

- **Advanced Reactor Safeguards (ARS)**
  - Material Control & Accounting and Physical Protection for the next generation of advanced reactors
- **Material Protection, Accounting, and Control Technologies (MPACT)**
  - Fuel cycle facilities (e.g., HALEU enrichment)
- **International Safety, Safeguards, and Security**
  - 3S-informed nuclear fuel cycle facility design

AREAS OF FOCUS

ENERGY CONVERSION

- sCO2 Brayton Component Testing
- 1 MW Core Testing
- Waterless Power
- Refractory High-Entropy Alloys
- Systems Engineering

AREAS OF FOCUS

STORAGE AND TRANSPORTATION

- **Stress Corrosion Cracking:**
  - Process, Prevention and Mitigation
- **External Loads:**
  - Measure strain and acceleration experienced by spent nuclear fuel assemblies during storage and transport
- **Fuel Integrity**
  - How does High Burnup fuel age over time?
- **Thermal Behavior**
  - What is the thermal condition of the fuel from drying through extended storage?
- **Mobile Guardian Transporter:**
  - Over-the-road transportation

AREAS OF FOCUS

DISPOSAL R&D

- **Testing and Analysis of Dry Storage Canisters**
  - Canister Deposition Field Demonstration (CDFD)
  - Horizontal Dry Cask Simulator (HDCS) – thermal behavior of prototypic canister and cask
  - Advanced Drying Cycle System (ADCS) – potential for residual moisture after drying
  - Aerosol Crack Flow Testing – potential releases through stress corrosion cracks
  - Thermal-Hydraulic Modeling – estimation of temperature profiles; test planning
- **Direct Disposal of Dual-Purpose Canisters**
  - Engineering Feasibility, Thermal Management , Post-Closure Criticality Control
  - Criticality Consequence Modeling – steady state and transient events using PFLOTRAN
  - Fillers – injectable cementitious slurries for moderator exclusion
- **Engineered Barrier System R&D**
  - Seal integrity, material interfaces, coupled processes

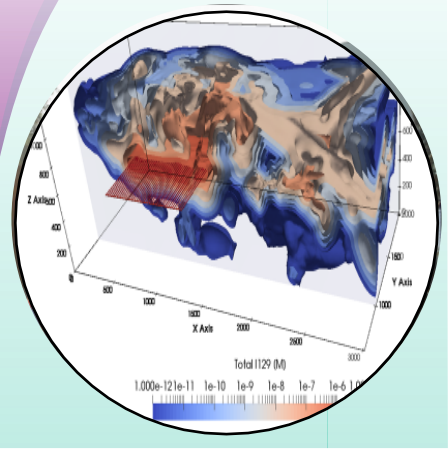
AREAS OF FOCUS

GEOLOGIC DISPOSAL R&D

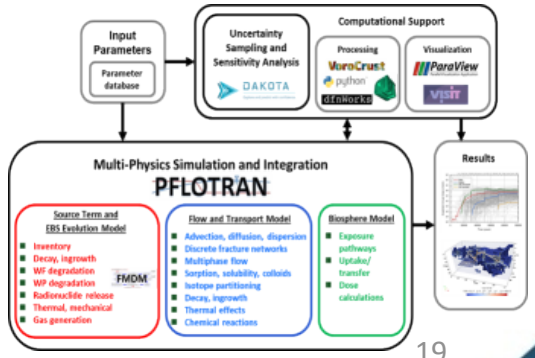
- **Crystalline Host Rock R&D**
  - Fractured media and fluid flow/transport
- **Argillite Host Rock R&D**
  - Temperature effects on clay, bentonite, and barrier system
- **Salt Host Rock R&D**
  - Brine availability
- **Online Waste Library:**
  - Inventory and characteristics of DOE-managed high-level waste
- **Engineered Barrier System R&D**
  - Seal integrity, material interfaces, coupled processes

AREAS OF FOCUS

GEOLOGIC DISPOSAL SAFETY ASSESSMENT



- **Geologic Disposal Safety Assessment (GDSA) https://pa.sandia.gov/**
  - GDSA Framework
  - Repository Systems Analysis (RSA)
  - PFLOTRAN Development
  - Uncertainty Quantification and Sensitivity Analysis (UQ/SA)
- **Salt**
  - Brine Availability Test in Salt (BATS)
  - International Collaborations
- **Waste Isolation Pilot Plant (WIPP) https://www.sandia.gov/salt/**
  - PFLOTRAN Development



AREAS OF FOCUS

KNOWLEDGE MANAGEMENT

Loss of Nuclear Waste Management expert knowledge is a worldwide problem

- NWM SMEs are retiring without an effective means to transfer their experience to new or less experienced staff; NRC estimates an average 10-15 year turnover rate for experts
- More than 70% of NEFC staff have no experience working on an active NWM project

DOE-NE Knowledge Management Program was established in FY20 using a phased approach with a focus on SME Tacit Knowledge Capture

- Quick launch required – With Experts retiring, there was no time to lose
- Phased approach allowed us to benefit from lessons learned and to develop a platform for later expansion to DOE-NE and associated Labs

KM PROGRAM STRATEGY DEVELOPMENT

NEFC STAFF FOCUS GROUPS

MULTI-DAY WORKSHOP

14 PRESENTATIONS

10 HALF-DAY DEEP DIVE SESSIONS

KM REPOSITORY & TAXONOMY DEVELOPMENT