



# **NNSA Safety-Infrastructure Integration**

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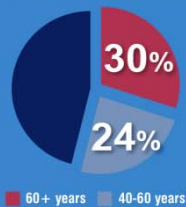
# NNSA SAFETY, INFRASTRUCTURE & OPERATIONS

## A VAST AND COMPLEX ENTERPRISE



### THE CHALLENGE: AGING & DECLINING INFRASTRUCTURE

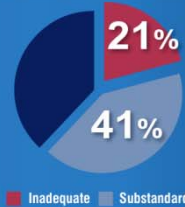
AGE OF FACILITIES



EXCESS FACILITIES



CONDITION OF FACILITIES



## Vision

Safely operate and modernize our enterprise to meet demands now and in the future.

## Mission

Maintain, Operate, and Modernize NNSA Infrastructure in a safe, secure, and cost-effective manner to enable program results.

**41,000**

LABORATORY & PLANT EMPLOYEES

**2,000**  
miles of roads

NEARLY THE DRIVING DISTANCE FROM DC TO LOS ALAMOS



TRACK **400,000**  
METRIC TONS OF  
NUCLEAR MATERIALS



safety for **400**  
nuclear facilities

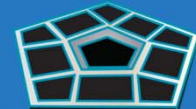


**2,160**  
square miles  
of land area



ABOUT  
THE SIZE  
OF DELAWARE

**36 Million**  
SQ. FEET OF  
FACILITY SPACE



(~ six Pentagons worth)

**15.2 MILLION FT<sup>3</sup>**  
OF HAZMAT

ENOUGH TO FILL - 15  
WASHINGTON MONUMENTS



**9.1 Trillion BTUs**  
ANNUAL ENERGY CONSUMPTION



enough to  
power  
~ 250,000  
homes for  
one year



# Bottom Line Up Front



## Challenges

- NNSA's infrastructure is too big, too old & too brittle
- Failures are increasing in frequency, severity & unpredictability
- Infrastructure risks become safety & program risks

## Strategic Objectives

- Ensure safe operations
- Arrest the declining state of NNSA infrastructure
- Modernize NNSA facilities/equipment & halt the growth of Deferred Maintenance
- Deliver construction projects on time & under budget with safety designed-in
- Dispose of excess facilities

## Progress

- Established the Office of Safety, Infrastructure & Operations
- Created new, data-driven, risk-informed management tools
- Integrated safety into the construction design & review process
- Increased Maintenance/Recapitalization funding & begun to achieve improvements
- Established Master Asset Planning process

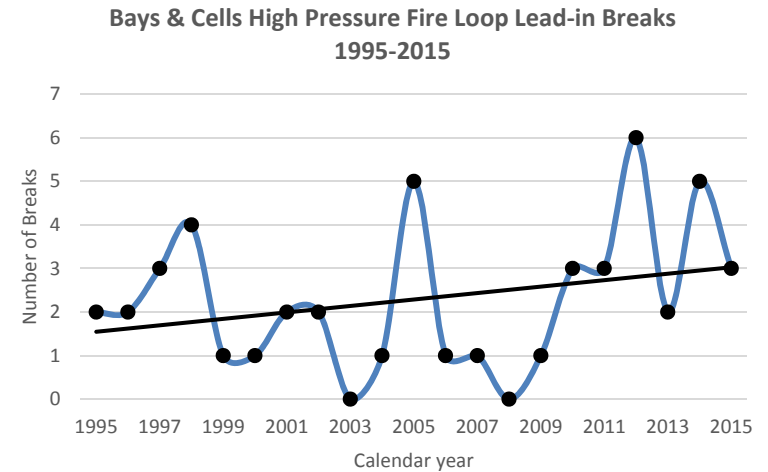
**Investments are needed over 15-20 years to reach steady state**



# Infrastructure Challenges



- Risk & inefficiency posed by poor condition of operating & excess facilities
- Failures are increasing in frequency, severity & unpredictability
  - PX: High Pressure Fire Loop (HPFL) failure (July 2016)
  - LANL: Diesel Engine for Fire Water Pump failure at PF-4 (August 2016)
  - Y-12: Kathabar dehumidification unit in Beta-2 taken out of service due to failed exhaust duct clamp (September 2016)
- Infrastructure risk becomes safety & program risk



LANL Diesel Engine Failure



Y-12 Kathabar System Failure

**NNSA infrastructure is too big, too old & too brittle**



# Nuclear Criticality Safety Program



- **DOE Nuclear Criticality Safety Program (NCSP)**
  - Goal: Continue to improve the criticality safety infrastructure necessary to ensure safe, efficient operations from a criticality safety perspective
  - NCSP provides sustainable expert leadership, direction, and the technical infrastructure to develop, maintain and disseminate essential technical tools, training, and data required to support safe, efficient fissionable material operations within the US DOE
- **NCSP provides funding for the National Criticality Experiments Research Center**
  - Conducts critical experiments and trains current and future nuclear criticality safety personnel.
- **NCSP five technical elements:**
  - Analytical Methods
  - Information Preservation & Dissemination
  - Integral Experiments
  - Nuclear Data
  - Training & Education
- **Three Technical Expertise Groups:**
  - Criticality Safety Support Group
  - Criticality Safety Coordinating Team
  - Nuclear Data Advisory Group
- **NCSP information:** <http://ncsc.llnl.gov/planMain.html>



# Nuclear Safety Research & Development



- **Process is separate, but informed from DOE (AU-executed) NSRD process. Collaborate with NA-10 on ranking all R&D including Defense Stockpile Weapons**
- **On an annual basis, NNSA reviews proposals and top proposals are funded. Recent examples:**
  - Pipe Overpack testing at SNL
  - Nonlinear Soil-Structure Interaction Analysis (seismic)
  - Portable, Rapid, Interim Smoke Monitoring - Deployable wireless fire alarm system to monitor fire suppression system outages
  - In Situ NCS Holdup Monitoring (SNAPSHOT)

## **As a separate project, NA-51 is developing an effort to evaluate Nonlinear Dynamic Analysis (NLDA) of PF-4 seismic behavior**

- Requirements and Criteria document for RFP being finalized
- NLDA RFP will be issued in FY 17
- Funding to be provided by NA-50
- NLDA may inform NNSA of best facility improvements for enhanced seismic safety





# Operations & Maintenance



## Scope

- Operations of facility functions including safety equipment
- Most ES&H functions (e.g., Safety Bases, ORRs, USQs) & Waste Management
- Preventive & Corrective Maintenance
- Source of funding for emerging issues, including nuclear & industrial safety

## Initiatives

- Projectizing of major maintenance activities (e.g., Nuclear Facilities Electrical Modernization at Y-12)
- Centralized procurements under Asset Management Programs
- Safety professionals selected as HQ Site Portfolio Managers

## New, Data-Driven, Risk-Informed Tools

- Mobile Maintenance Work Packages replacing paper at LANL (25% now; goal 90%)
- Implementing Computer Based Procedures and Video Procedures
- Integration of Mobile Work Packages; Computerized Maintenance Management Systems; and BUILDER



# Recapitalization & Disposition



## Prioritization

- Recapitalization & Disposition use risk-based prioritization that include safety
- Prioritization scores along with the M&O Partner's priority ranking & stakeholder interests are used as an aid for determining the final Integrated Priorities List
- The Recapitalization project prioritization criteria is shown in the chart below

Factors	Description	Weight
Safety Risk Reduction	Safety risks range from expensive, productivity limiting compensatory measures to significant events (e.g., accidents or environmental releases) which could shut down operations for extended periods. The calculation is based on the total Safety Risk Reduced divided by Total Project Cost (TPC).	35%
Program Risk Reduction	Program risks range from older systems with less capability and throughput than current models to obsolete systems with no replacement parts and frequent shutdowns for corrective maintenance. The calculation is based on the total Program Risk Reduction multiplied by Mission Dependency Index (MDI) divided by TPC.	35%
Sustainability & Productivity Return on Investment	Savings range from reduced resource consumption and lower annual operating costs. The calculation is based on the total sustainability, operating, and programmatic cost savings divided by TPC.	20%
Deferred Maintenance Reduction	The calculation is based on the Deferred Maintenance (DM) Reduction divided by TPC.	10%





# Integrating Safety into the Design Process



- **Office of Safety (NA-51) provides dedicated support to NNSA Acquisition and Project Management (NA-APM), Program Offices, and the Project Management Executive (PME) in the oversight of nuclear facility design and construction.**
- **Chief, Defense Nuclear Safety (CDNS) responsibilities for design and construction activities are defined in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets***
- **CDNS reviews the Safety Design Strategies (SDS) for nuclear projects and provides formal advice to the Safety Basis Approval Authority (SBAA) and the Federal Project Director (FPD).**
  - CDNS reviewed six Safety Design Strategies in 2016 and transmitted the associated Advice memos
- **CDNS staff manages the process and participates in the review of nuclear safety in design requirements during annual NA-APM reviews and DOE External Independent Reviews (EIRs) of NNSA nuclear construction projects.**
  - NA-51 routinely supports these project reviews with needed subject matter experts (Fire Protection, Criticality Safety, Quality Assurance, Industrial Hygiene, etc.)
  - The staff performed twelve reviews of NNSA nuclear construction projects in 2016, each of which included an evaluation of integration of safety into the design process.



# Summary



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# Backups





# Results



Before

After

Y-12 Bldg. 9204-2 Oven Room Ceiling Repair



Pantex Bay/Cell and Lead In/Flame Detection System



NNSA Lead In Line Replacements





# Results



SNL Tonopah Main Distribution Hub



Before



After

LANL Casa 3 Demolition



SRS Fire Suppression Modifications



LLNL B131 Chiller Replacement



# Recapitalization Projects at TA-55



## TA-55 Facility Control System Modifications

Install controllers, transmitters, and part replacement of embedded systems that monitor facility conditions and the safe operability of PF-4.



## RLWTF Collection Ground Leak Detection Alarm Upgrade

Replace the 40 year old secondary leak detection alarms that are a requirement of the new Ground Water Discharge Permit to be issued by the State of New Mexico. PF-4 cannot operate without this system in operations.







## (cont.) Recapitalization Projects at TA-55



### TA-55 Seismic Event Safety Mitigations

Modifications performed to improve the shear capacity of the interior roof girders. The stirrup reinforcement prevents shear cracking and spalling of the girder



### TA-55 Potable Water Loop Replacement

Replace the existing severely corroded steel pipe line that services domestic water needs for TA-55.

