



U.S. Department of Energy



DOE/NRC Quarterly Management Meeting

February 17, 2005
Las Vegas, Nevada



U.S. Department of Energy



Project Update

Presented to:
DOE/NRC Quarterly Management Meeting

Presented by:
W. John Arthur, III
Deputy Director, Office of Repository Development
U.S. Department of Energy

February 17, 2005
Las Vegas, Nevada

License Application Content and Supporting Documents

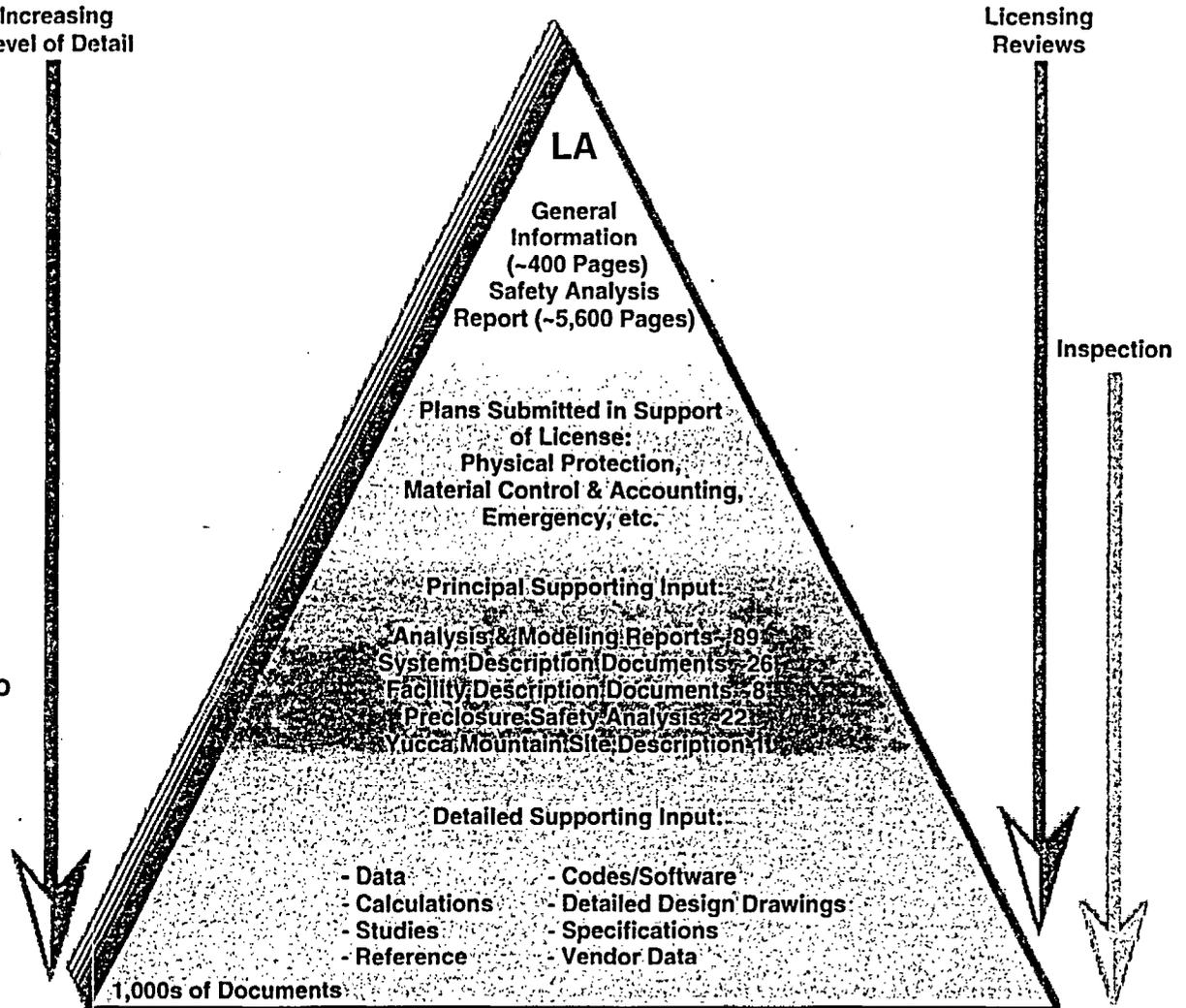
- **General Information (GI)**

- General Description
- Proposed Schedules for Construction, Receipt and Emplacement of Waste
- Physical Protection Plan
- Material Control and Accounting Program
- Site Characterization

- **Safety Analysis Report (SAR)**

- Repository Safety Before Permanent Closure
- Repository Safety After Permanent Closure
- Research and Development Program to Resolve Safety Questions
- Performance Confirmation Program
- Administrative and Programmatic Requirements

Increasing
Level of Detail



Key Technical Issue Agreements Status Summary

Reflects activity through February 8, 2005

KTID ID	Agreements Reached	Agreements Submitted to NRC	Responses Submitted In NRC Review	Partial Responses Submitted	NRC Needs Additional Information	Responses Remaining to be Submitted	Agreements Complete
CLST	58	58	14	0	0	0	44
ENFE	41	41	13	0	1	0	27
GEN	1	1	1	0	0	0	0
IA	22	22	4	0	4	0	14
PRE	9	9	2	0	2	0	5
RDTME	23	23	5	0	0	0	18
RT	29	29	14	0	0	0	15
SDS	10	10	5	0	0	0	5
TEF	15	15	7	0	0	0	8
TSPAI	58	58	23	0	6	0	29
USFIC	27	27	5	0	0	0	22
Total =	293	293	93	0	13	0	187

NRC acknowledges that it is up to DOE to determine how, or whether, to respond to NRC staff feedback in DOE's response to the agreements.

CLST: Container Life and Source Term

RT: Radionuclide Transport

ENFE: Evolution of the Near Field Environment

SDS: Structural Deformation and Seismicity

GEN: General IA: Igneous Activity

TEF: Thermal Effects on Flow

PRE: Pre-Closure Safety

TSPAI: Total System Performance Assessment and Integration

RDTME: Repository Design and Thermal-Mechanical

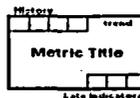
USFIC: Unsaturated and Saturated Flow under Isothermal Conditions



Yucca Mountain Project Annunciator Panel

Performance Indicators based on January 2004 Data

Work Execution	Primary		Secondary				Focus Areas				
	Y	V	G	Y	V	G	Y	V	G	Y	V
Work Execution	1.1 Licensing	1.1.1 License Application Development	1.1.2 NRC Interactions	1.1.3 License Support Network Input	1.1.4 NRC Commitments	1.1.5 Key Technical Issues	FA1.1 Safeguards				
	1.2 Engineering/Design	1.2.1 Surface Facilities	1.2.2 Subsurface Facilities	1.2.3 Engineered Barriers	1.2.4 Risks & Integration Management						
	1.3 Safety Analysis	1.3.1 TSPA	1.3.2 Performance Confirmation	1.3.3 Open	1.3.4 Proclosure Safety Analysis	1.3.5 AMR Production					
		1.3.6 Data Qualification	1.3.7 Model Validation	1.3.8 Software Qualification							
1.4 Site Operations	1.4.1 Site Engineering	1.4.2 Site Construction	1.4.3 Site Maintenance	1.4.4 Operations	1.4.5 Becthel Nevada						
Management	Primary		Secondary				Focus Areas				
	Y	V	G	Y	V	G	Y	V	G	Y	V
Management	2.1 Project Support										
	2.2 Safety, Health, and the Environment	2.2.1 Incidents	2.2.2 ES&H Program Awareness	2.2.3 ES&H Reporting							
	2.3 Quality Assurance	2.3.1 Technical Product Compliance	2.3.2 Verification of Quality	2.3.3 Open	2.3.4 Quality Procedure Process Health						
	2.4 Corrective Action Mgmt System	2.4.1 Prevention	2.4.2 Self Reporting Culture	2.4.3 Causal Analysis & CAP Development	2.4.4 Timely & Effective CAR	2.4.5 CAP Performance & Infrastructure					
	2.5 Management Framework	2.5.1 Procedures	2.5.2 Requirements Management	2.5.3 Management Programs							
	2.7 Project Management	2.7.1 Cost Performance (Overall CPI)	2.7.2 Schedule Performance (Overall SPI)	2.7.3 Scope Baseline	2.7.4 Risk & Contingency	2.7.5 Key Deliverable Critical Path Float					
	2.8 Organizational Climate	2.8.1 Employee Concerns	2.8.2 Safety Culture	2.8.3 SCWE	2.8.4 Open	2.8.5 Internal Communication					
		3.1 External	3.1.1 Open	3.1.2 External Communication	3.1.3 Open	3.1.4 Open	3.1.5 Funding				



Key

- Y** Exceptional performance that exceeds requirements and expectations for the desired outcome, established for more than six months.
- V** Degraded or adverse performance warranting significant level of management attention, resources, and intervention.
- G** Good performance which meets or exceeds requirements and expectations. The minor code "D" indicates that the score would be Blue, but has not demonstrated sustained performance.
- L** Gray for Late - Updated metric not provided by the data.
- D** Approved metric not put reporting data.
- Y** Performance which warrants increased management attention and resources to achieve desired results or to reverse a negative trend.
- V** Acceptable performance that falls on a set of conditions which could change and good performance into the insufficient data or metric definition is not yet approved.



Yucca Mountain Project Annunciator Panel
Performance Indicators based on data for: April 2004

	Primary		Secondary				Focus Areas
	Metric Title	Indicator	Metric Title	Indicator	Metric Title	Indicator	
W o r k E x e c u t i o n	1.1 Licensing	1.1.1 License Application Development	1.1.2 NRC Interactions	1.1.3 License Support Network Input	1.1.4 NRC Commitments	1.1.5 Key Technical Issues	FA1 Safeguards
	1.2 Engineering/Design	1.2.1 Surface Facilities	1.2.2 Subsurface Facilities	1.2.3 Engineered Barriers	1.2.4 Route & Integration Management		FA2 Regulatory Integration Team (RIT)
	1.3 Safety Analysis	1.3.1 TSPA	1.3.2 Performance Confirmation	1.3.4 Preclosure Safety Analysis			
		1.3.6 Data Qualification	1.3.7 Model Validation	1.3.8 Software Qualification			
	1.4 Site Operations	1.4.1 Site Engineering	1.4.2 Site Construction	1.4.3 Site Maintenance	1.4.4 Operations	1.4.5 Backfit Nevada	1.4.6 Site Critical Systems
M a n a g e m e n t	2.1 Project Support						
	2.2 Safety, Health, and the Environment	2.2.1 Incidents	2.2.2 ESHM Program Awareness	2.2.3 ESHM Reporting			
	2.3 Quality Assurance	2.3.1 Product Quality	2.3.2 Process Quality	2.3.3 Vendor Quality	2.3.4 Corrective Action Program	2.3.6 Quality Systems	
	2.4 Corrective Action Mgmt System	2.4.1 CAP Effectiveness	2.4.2 Self Reporting Culture	2.4.3 Timely Analysis & Plan Development	2.4.4 Timely CA Resolution		
	2.5 Management Framework	2.5.1 Procedures	2.5.2 Requirements Management	2.5.3 Management Programs			
	2.7 Project Management	2.7.1 Cost Performance (Overall CPI)	2.7.2 Schedule Performance (Overall SPI)	2.7.3 Scope Baseline	2.7.4 Risk & Contingency	2.7.5 Key Deliverable Critical Path Fleet	
	2.8 Organizational Climate	2.8.1 Employee Concerns	2.8.2 Safety Culture	2.8.3 SCWE	2.8.5 Internal Communication		
	3.1 External Communication	3.1.2 External Communication	3.1.5 Funding				
	4.1 Human Performance	4.1.1 Error Prevention	4.1.2 Human Performance Awareness	4.1.3 Risking Management	4.1.4 Learning Culture		

Key

	Exceptional performance that exceeds all requirements and expectations for the desired outcome, sustained for more than six months.	Good performance which meets or exceeds requirements and expectations. The status code "R" or "G" indicates that the priority would be high, but has not demonstrated sustained performance.	Yellow is used to denote performance which warrants increased management attention and resources to achieve desired results or to reverse a negative trend. Acceptable performance that relies on a set of conditions which could change and send performance into the "Red" category.
Less indicators indicate a change to metric this month.	Degraded or adverse performance warranting significant level of management attention, resources, and involvement.	Gray for Lags - Updated metric not provided by due date.	Insufficient data or metric definition is not yet approved.
<p>A lettered history (the white background) indicates the point at which a change occurred in the underlying metric. The performance reported in the history (the white background) is the point of change should be used over current. A change is defined as a change in the metric definition, threshold, weighting, calculation, data source(s) used in the calculation, or the data/ordering of a sub-metric. Trend indicators are based on a rolling average of six months of data. If there are not six data points because the metric is new or has been changed, then the trend is based upon the data available, or is indicated as neutral.</p>			



YMP Draft Annunciator Panel

Yucca Mountain Project Annunciator Panel										
Performance Indicators based on data for: < FY2005 Q2 Timeframe >										
YMP OVERALL	PERFORMANCE					TECH/QUALITY	RISKS			
	COST (\$)		SCHEDULE							
PED - TPC	06/04 ESAAB \$ 2,798 M		06/04 ESAAB 10/02 - 07/08							
	Current Baseline \$ 2,559 M		Current Baseline 10/02 - 09/11							
PED - PMB	COST		SCHEDULE		FORECAST (\$)					
	CPI (Month)	0.97	SPI (ITD)	0.96	BCWR	\$ 1,105 M				
	CPI (FYTD)	1.01	Float to LA (LAMOAM)	-27 Days (FD=-27)	ETC	\$ 1,103 M				
IOC Range (includes PED - TPC)	COST (\$)		SCHEDULE							
	IOC-Range (06/04 ESAAB)	Low	\$ 7,356 M	IOC-Range (06/04 ESAAB)	FHF-IOC	???				
		Most Likely	\$ 7,810 M		CHF-IOC	???				
		High	\$ 9,683 M		DTFHOC	???				
	IOC-Trend Forecast	Low	\$ 8,006 M	IOC-Trend Forecast	FHF-IOC	TBD				
		Most Likely	\$ 8,450 M		CHF-IOC	TBD				
High		\$ 10,323 M	DTFHOC		TBD					
COST		SCHEDULE		PED FORECAST (\$000)						
REF.	WBS TITLE	CPI (Month)	CPI (FYTD)	CPI (ITD)	SPI (ITD)	BCWR	ETC	TCPI ₁₀₀₀		
15.01	Project Support	1.20	1.27	1.07	1.00	\$ 144,386	\$ 145,058	1.00		
15.02	License	1.26	1.06	1.02	0.94	\$ 116,680	\$ 115,220	1.01		
15.03a	Post-Closure Safety Analysis & Assessment					\$	\$			
15.03b	Pre-Closure Safety Analysis & Assessment					\$	\$			
15.05	Initial Infrastructure Readiness	1.02	1.03	1.03	0.93	\$ 135,911	\$ 135,012	1.01		
15.06	Balance of Plant Infrastructure	0.65	1.05	0.83	0.95	\$ 170,395	\$ 170,996	1.00		
15.12	Subsurface Repository	0.69	0.99	1.01	0.98	\$ 47,642	\$ 47,823	1.00		
15.13	Waste Package	1.82	1.51	1.09	0.93	\$ 116,262	\$ 115,093	1.01		
15.14	Fuel Handling	5.14	1.55	1.07	0.97	\$ 76,169	\$ 75,676	1.01		
15.15	Canister Handling	0.54	0.79	1.19	0.85	\$ 15,762	\$ 14,678	1.07		
15.16	Dry Transfer -1	1.87	3.20	0.99	0.83	\$ 54,268	\$ 54,467	1.00		
REF.	SUB-PROJECT TITLE	CPI (Month)	CPI (FYTD)	CPI (ITD)	SPI (ITD)	BCWR	ETC	TCPI ₁₀₀₀		
Note 1	License Support Network					\$	\$			
Note 2	IOC - Fuel Handling Facility					\$	\$			
Note 3	IOC - Canister Handling Facility					\$	\$			

Top Half of Panel

KEY PROCESSES	Primary				Secondary				Focus Areas	
	1.1 Licensing (15.02)	1.1.1 Completion of LA Document (15.02.02)	1.1.2 NRC Commitments (15.02.03)	1.1.3 NRC Interactions - Effectiveness	1.2 Facilities EPC Performance	1.2.1 Fuel Handling Facility (HFC)	1.2.2 Canister Handling Facility (HFC)	1.2.3 Dry Transfer Facility - 1 (HFC)		
1.3 Pre-closure Safety Analysis Documents	1.3.1 Doc Updates for Direct Input to SAR	1.3.2 Updates to SAR Supporting Documents	1.3.3 Updated Revisions Resulting from Change							
1.4 Post Closure Safety Analysis Documents										
1.5 Site Operations	1.5.1 Site Status	1.5.2 Site Performance								
1.6 License Support Network (15.02.04)										
KEY PROCESSES	Organization & Safety Culture								Focus Areas	
	2.1 Safety Performance	2.1.1 Industrial Safety Performance	2.1.2 Emergency Management							
	2.2 Human Performance	2.2.1 Lessons Learned Effectiveness	2.2.2 Self Assessment Effectiveness	2.2.3 Corrective Action Effectiveness						
	2.3 Work Management Quality									
2.4 SCWE										
W	No Paper Trail									
Y	MDS Keyed Into MAD									
B	MDS Approved									
E	Need Answers Regarding Status									
G	MDS Signed									
Colors and date in the YMP Overall Project status represents current performance. Colors in the Work Execution and Key Process areas are for status only and DO NOT represent current performance.										

Bottom Half of Panel

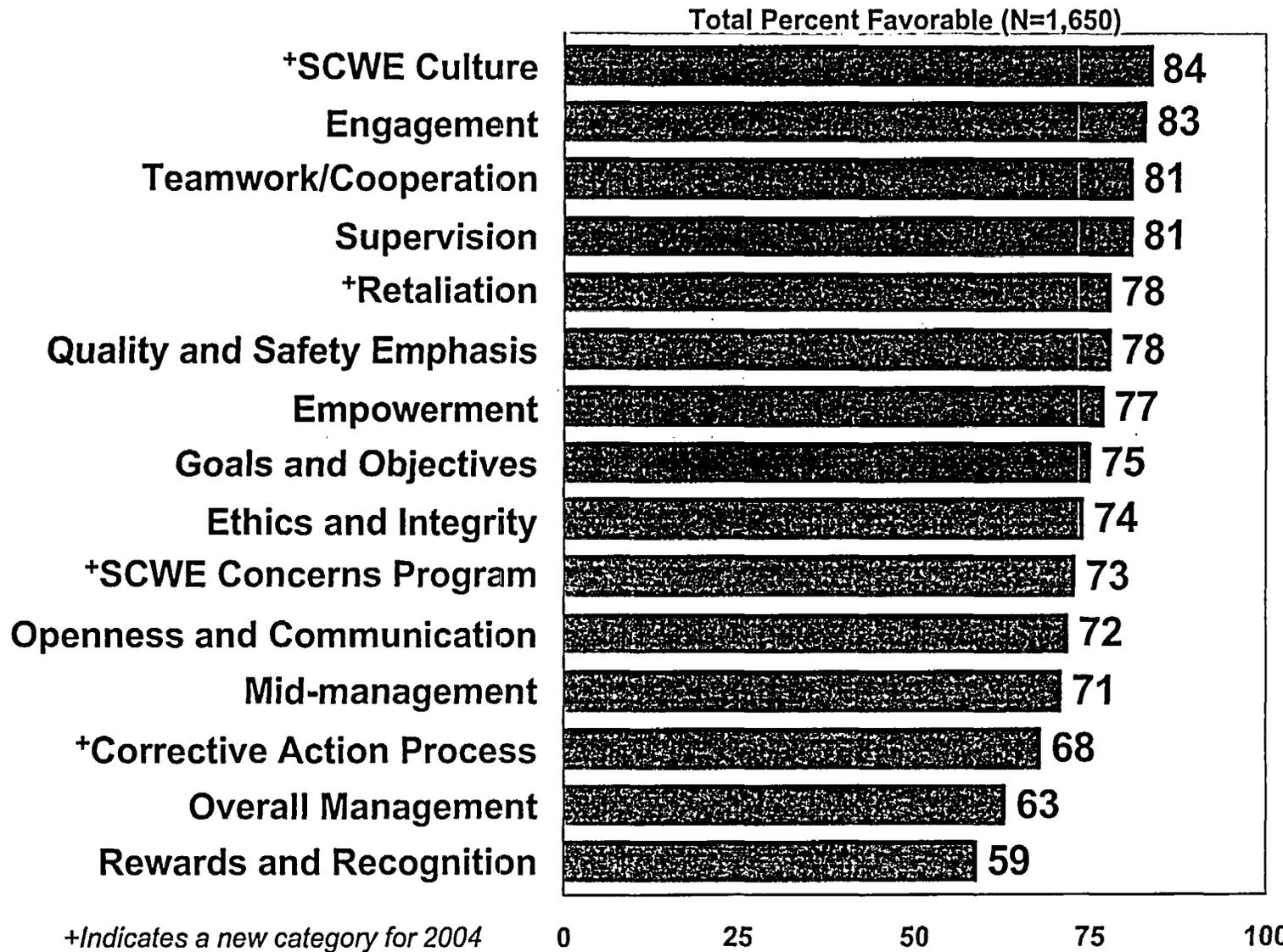


2004 Organization Climate and Safety Conscious Work Environment Survey

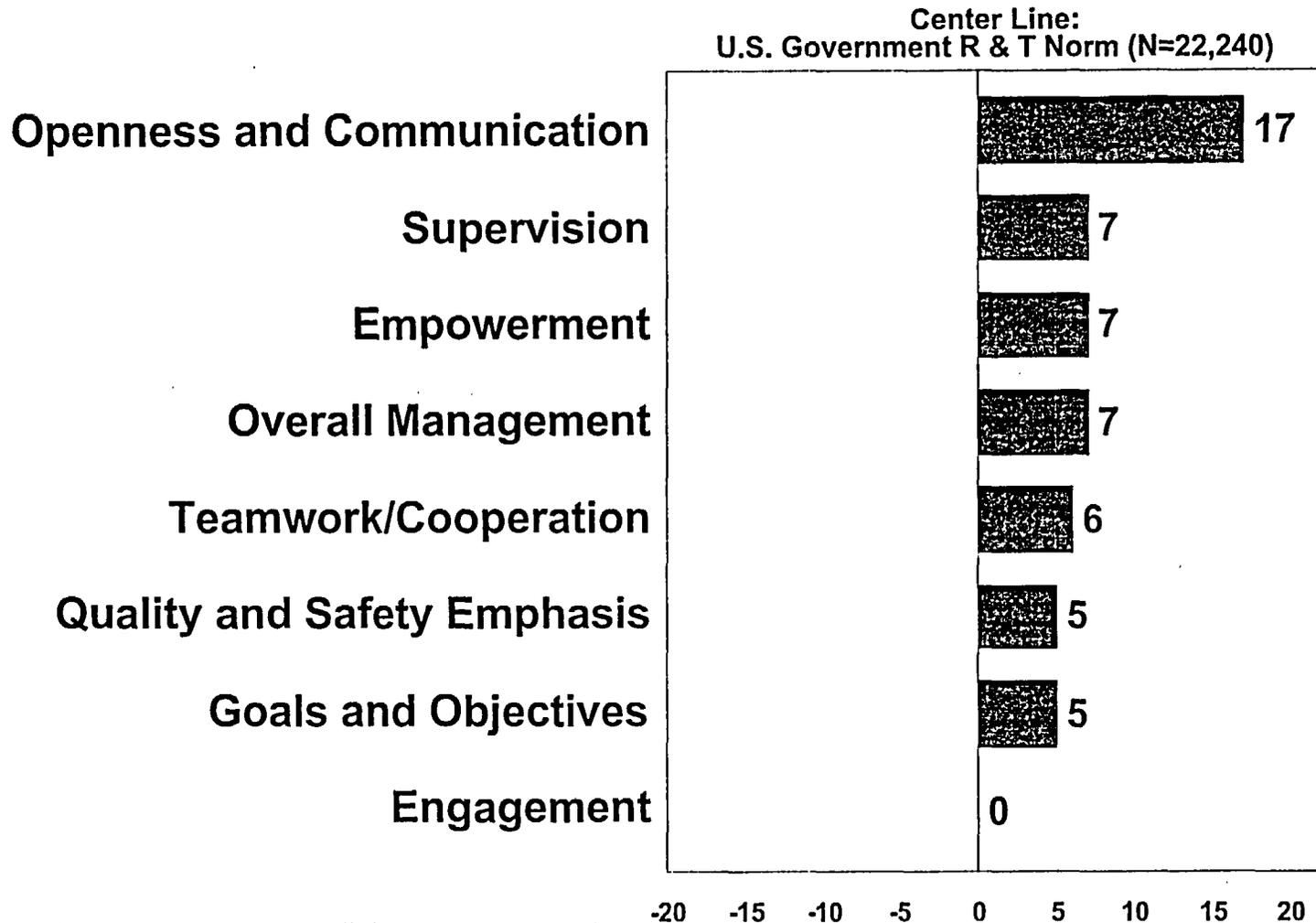
- **Second annual project-wide survey conducted by independent experts**
- **Anonymous process; 65% participation**
- **15 management and program categories**
- **Comparison made with U.S. National and U.S. Government R&T Norms, and last year's results**
- **Analysis of results now underway**
- **Project-wide action plans developed and communicated March-April time frame.**



YMP 2004 Overall Category Scores



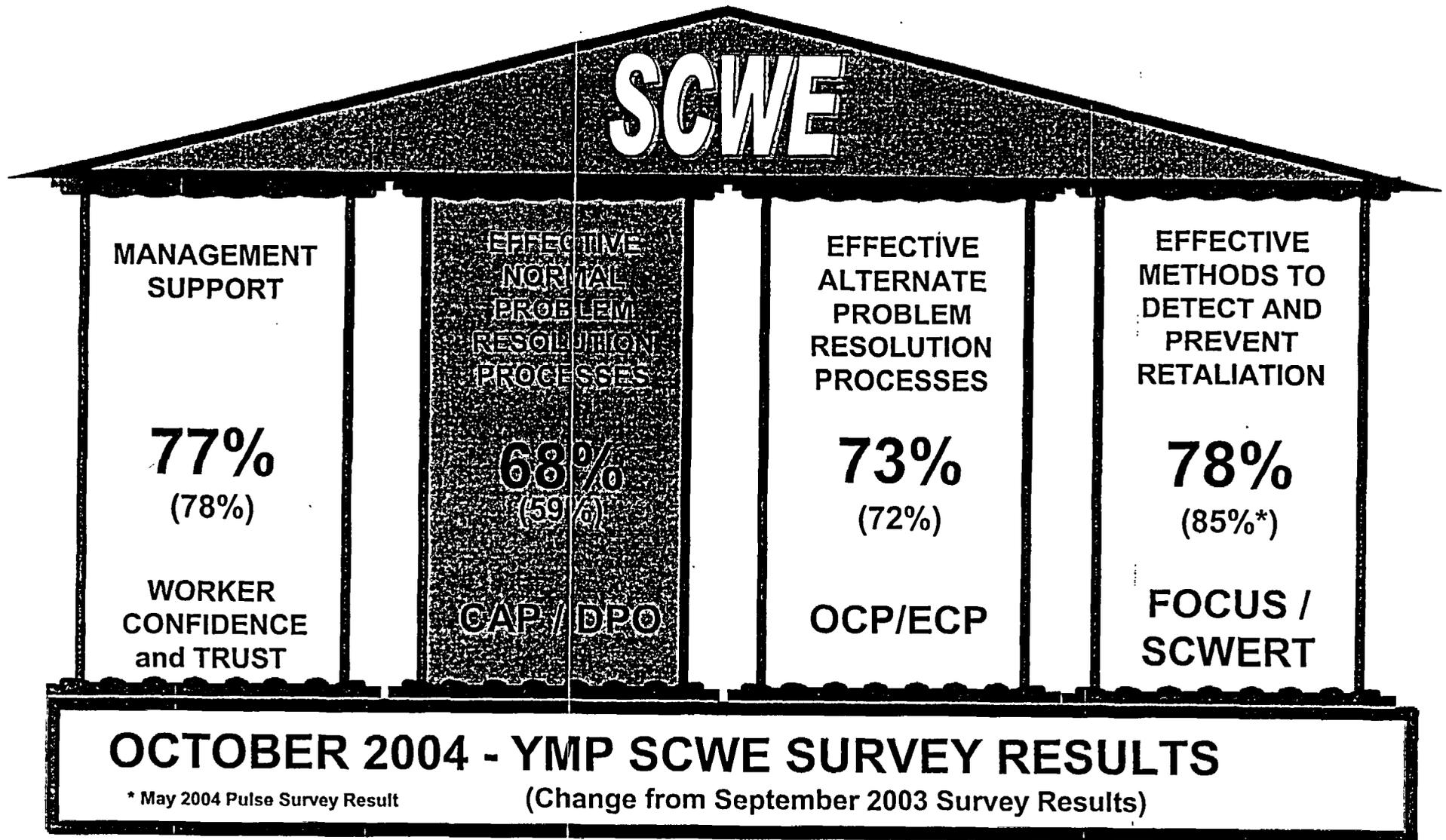
YMP 2004 Compared with U.S. Government Research and Technology Norm



*Normative data not available for all categories.
Colored bars indicate a statistically significant difference.*



SCWE Four Pillars Survey Result





U.S. Department of Energy



License Application Status

Presented to:

DOE/NRC Quarterly Management Meeting

Presented by:

Joseph D. Ziegler

Director, Office of License Application and Strategy

Office of Repository Development

U.S. Department of Energy

February 17, 2005

Las Vegas, Nevada

Topics for Discussion

- **License Application (LA) Plans**
 - **LA Enhancement**
 - ♦ **Post Closure Safety Analysis and Integration**
 - ♦ **Preclosure Safety Analysis/Design and Integration**
 - ♦ **LA Integration with Supporting Documents**
- **Key Technical Issue (KTI) Agreements Status**
- **NRC/DOE Interaction Planning 2005**
- **Accomplishments**



License Application Plans

Postclosure Safety Analysis and Integration

- Produced over 3,000 action items
- Identified the 89 documents to be updated (specific evaluation checklists were used to determine which of documents considered should be revised)
- Complete; (4 steps – drafting, checking, review, approval) as of November 23, 2004
- Total System Performance Assessment undergoing revision



License Application Plans

(Continued)

Preclosure Safety Analysis/Design and Integration

- Focused effort to ensure the preclosure safety basis is well defined, understandable, complete, and reflected in an integrated manner in LA support documentation
- A primary purpose is to ensure consistency between the LA and supporting preclosure documentation
- Basis documents will be issued before submittal of the LA



License Application Plans

(Continued)

License Application Integration

- **Improving integration of the LA with its supporting technical documents**
 - **Transparency and traceability continues to improve**
- **Integrated Issue Resolution Status Report**
- **Another round of reviews of LA sections was initiated in January**
 - **Includes checking support documents and references for an adequate basis of assertions**
 - **Plan additional senior management and senior external reviews**



Key Technical Issue Agreement Status (as of February 9, 2005)

- 187 of 293 agreements are considered complete by the NRC
- Continuing dialogue with NRC technical staff and the Center to assist in completing the reviews

	High Risk	Medium Risk	Low Risk
Completed	32	49	106
In NRC Review	1*	38	54

(Add'l Info Needs for High = 8, Total = 13)

Interaction Planning 2005

- In discussions with NRC staff to identify need & timing for upcoming interactions, notably pre-closure topics
- Held Technical Exchange on Quality Assurance Requirements and Description (QARD), Rev 17 on February 10, 2005

*GEN 1.01 is closed for the High Risk portions only.



Accomplishments

- **Postclosure Safety Analysis and Integration activities – completed and considered successful**
- **Substantial progress in Preclosure Safety Analysis/Design and Integration in identifying and resolving comments in LA support documentation**
- **Relocated the NRC OR's offices with enhanced direct access**





U.S. Department of Energy



Quality Assurance Overview

Presented to:

DOE/NRC Quarterly Management Meeting

Presented by:

R. Dennis Brown

Director, Office of Quality Assurance

Office of Repository Development

Office of Civilian Radioactive Waste Management

U.S. Department of Energy

February 17, 2005

Las Vegas, Nevada

Quality Assurance Overview

- **Quality Assurance Requirements and Description (QARD)**
- **Corrective Action Program (CAP) Oversight**
- **Corrective Action Report (CAR)-001 Status**
- **Office of Quality Assurance (OQA) Audits/Surveillances**
- **Management and Operating (M&O) Contractor Quality Assurance (QA) Audits/Surveillances**
- **M&O Quality Management Directive**



Quality Assurance Requirements and Description

- **Twelve (12) questions from the NRC Additional Information Needs (AIN), dated December 22, 2004**
- **DOE/NRC Video Teleconference held on February 10, 2005**
- **AIN responses and QARD Rev 17 will be sent to NRC by late February 2005**



Corrective Action Program Oversight

- **Both Office of Repository Development (ORD) and M&O QA organizations continue to review 100% of their Level C Condition Reports (CR)**
- **Seven M&O surveillances of effectiveness of CR actions – No Conditions Adverse to Quality (CAQs)**
- **OQA's January 2005 audit of the Corrective Action (CA) Program noted several areas of improvement and identified additional opportunities**



CAR-001 Status

- **Verification Team**
- **Selection of Analysis Model Reports to Sample**
- **Summary of Evaluation**
- **Remaining Steps**



Office of Quality Assurance Audits/Surveillances

- **Completed Audits**

- Compliance Audit of Training of M&O Personnel – 1 CAQ
- Performance Based Audit of Pre-Closure Safety Analysis – 4 CAQs
- Performance Based Audit of the M&O Corrective Action Program – 4 CAQs

- **Completed Surveillances**

- Exploratory Studies Facility (ESF) – Determination of Importance Evaluation Requirements – No CAQs



Office of Quality Assurance Audits/Surveillances

(Continued)

- **Completed Surveillances**
 - Preclosure and Design Products – 3 CAQs
- **Upcoming OQA Audits**
 - Compliance Audit M&O Procurement/Las Vegas
 - Compliance Audit of National Laboratory Activities
 - Compliance Audit of Augmented Quality Assurance Program (AQAP) Applicable Activities (OCRWM and M&O) Las Vegas, YMP Site
 - Performance Audit of M&O Records/Las Vegas



Office of Quality Assurance Audits/Surveillances

(Continued)

- **Upcoming EM/OCRWM Audits**
 - **National Spent Nuclear Fuel Program (Idaho)**
 - **Savannah River Defense Waste Processing Facility (High-Level Waste)**
 - **West Valley (High-Level Waste)**



Office of Quality Assurance Audits/Surveillances

(Continued)

- **Upcoming OQA Surveillances**
 - **Test Coordination Office activities support DOE suppliers**
 - **Weld Closure program at Idaho National Engineering and Environmental Laboratory (INEEL)**
 - **Use of Data**
 - **Effectiveness of ORD Level C CR Actions**



Management and Operating Contractor Quality Assurance Audits/Surveillances

- **Completed QA Audits**

- Implementing Documents Process (Compliance based and Limited Scope) – 14 CAQs
- Software Use and Configuration Management (Compliance based) – 7 CAQs
- Compliance Audit of Site Activities – 7 CAQs

- **Completed QA Surveillances**

- Data Confirmation Package – 1 CAQ
- Criticality Calculations – No CAQs
- Disposition of Discrepancies from PCSA Review Surveillance – 1 CAQ
- Compliance check of calculations that support PCSA – 2 CAQs
- Five Design and Engineering Processes – No CAQs



Management and Operating Contractor Quality Assurance Audits/Surveillances

(Continued)

- **Upcoming QA Audits**
 - Repository Design Project (Compliance-based)
 - M&O East (Compliance-based)
 - M&O West (Compliance-based)
- **Upcoming QA Surveillances**
 - Screening of CRs
 - Four Design and Engineering Processes
 - Document Input Reference System Usage
 - Use of Unqualified Document Transmittal Notices and Technical Reports



Management and Operating Contractor Quality Assurance Audits/Surveillances

(Continued)

- **Concept**
 - BSC-QMD defines one QA Program
 - BSC-QMD requirements reviewed and accepted by DOE
- **Requirements Integration**
 - QARD Rev 17 and DOE-Order 414.1B
- **Schedule**
 - Transmitted to DOE in mid-March
 - BSC-QMD and QARD Rev 17 effective concurrently





U.S. Department of Energy



Transportation Cask Systems Acquisition

Presented to:
DOE/NRC Quarterly Management Meeting

Presented by:
Gary Lanthrum, Director
Office of National Transportation
Office of Civilian Radioactive Waste Management
U.S. Department of Energy

February 17, 2005
Las Vegas, Nevada

Cask System Requirements

- **Office of National Transportation (ONT) is focused on using existing cask designs and Certificates of Compliance (CoC) where possible for its transport casks**
- **ONT has a preference for cask systems that provide the maximum flexibility in terms of facility and fuel compatibility**
- **ONT has communicated with the Nuclear Regulatory Commission's (NRC) Spent Fuel Project Office (SFPO) that existing hardware will meet many of our needs, but some certificate modifications and new cask designs will be needed**



Conclusions Regarding Existing Casks' Ability to Accommodate Commercial SNF

- Vendors in the Cask Capability Assessment (CCA) reports indicated that no single cask could transport more than about 40% of the commercial spent nuclear fuel (SNF) inventory under the conditions of current Certificates of Compliance (CoC's)
- Analysis of the reports has shown that a suite of casks from several vendors could transport upwards of 60% of the projected commercial inventory
- Existing CoC's combined with physical constraints at shipping sites limits current transportation coverage to less than 30% of the commercial SNF inventory
- Both modifications to CoC's for existing casks and new cask designs will be required to transport all of the commercial SNF inventory



DOE SNF and HLW Conclusions

- **Casks exist today that are technically capable of transporting DOE waste material**
 - Generally, the thermal, structural, and shielding requirements for commercial SNF bound those of the DOE material
- **New internal basket designs could be developed to accommodate the DOE canisters**
 - Certificate modifications will be required for the new baskets
- **DOE fuel will only be shipped in canisters during the first five years**



NRC Certification Needs

- **Continued integration planning efforts will be undertaken to minimize the number of new casks for NRC review and certification**
- **In FY06, ONT will have contracts for conceptual designs to address the gaps in current cask capability**
 - **In FY07, vendor applications to the NRC for CoC modifications and new CoCs**
 - **Vendors may choose to pursue additional content coverage for their existing designs through CoC modifications before DOE procurements are awarded**
- **We will keep NRC's SFPO informed of our needs for expanded certificates and new hardware designs**





U.S. Department of Energy



Preclosure and Repository Design Overview

Presented to:
DOE/NRC Quarterly Management Meeting

Presented by:
Richard Craun
Office of Repository Development
U.S. Department of Energy

February 17, 2005
Las Vegas, Nevada

Design Update

- **Design Status**
- **Design Products Alignment**
- **Path Forward**



Design Status

- **NRC's October 8, 2004, letter identified design information needs, which we are addressing**
- **DOE/BSC reviews during the summer and fall of 2004 identified potential surface facility enhancements, based upon the design at that time**
- **DOE has defined the work scope for 11 design enhancements and schedules have been developed for those enhancements**
 - **Most design activities will be completed this May**
 - **Activities are on schedule to support our review this summer**



Bases and Objectives for Enhancements

- Continue development of the design for the operations approach (e.g., fuel in air)
- Increase conservatism in Preclosure Safety Analysis (PCSA) (e.g., use of bounding versus mean values in Category 1 event sequence analyses)
- Enhance the design solution (e.g., addition of fire suppression system)
- Improve the documentation of how the design satisfies the design bases (e.g., reliability values)



Examples of Enhancement and Design Development Areas

- Expand the design details for the site specific aging system
- Define system boundaries for the important to safety (ITS) electrical system design
- Advance the design of non-standard equipment to confirm Preclosure Safety Analysis reliability analyses
- Evaluate potential effects of Non-ITS structures, systems, and components (SSCs) on Important to Waste Isolation (ITWI) SSCs
- Issue aircraft hazard analysis
- Issue seismic design methodology and preliminary facility seismic analysis
- Enhance the thermal management strategy
- Develop automated event trees analysis
- Include direct radiation sources and low-level waste sources in preclosure safety analyses



Aging System

- Existing dry storage system design(s) already certified under 10 CFR 72
 - Evaluate existing storage system designs against YMP site specific criteria (with vendor support)
 - Determine extent of existing vendor Safety Analysis Report (SAR) analyses that are “bounding” for Geologic Repository Operations Area (GROA) conditions
 - Perform YMP-specific analyses where warranted (e.g., seismic)
- Site-specific cask/canister system
 - Canister designed for direct emplacement after aging
 - Conceptual design based on existing waste package design configurations (Navy long waste package with pressurized water reactor (PWR) and boiling water reactor (BWR) waste package inner basket designs)
- Design supported by the suite of calculations and analyses described in NUREG-1567 and NUREG-1536

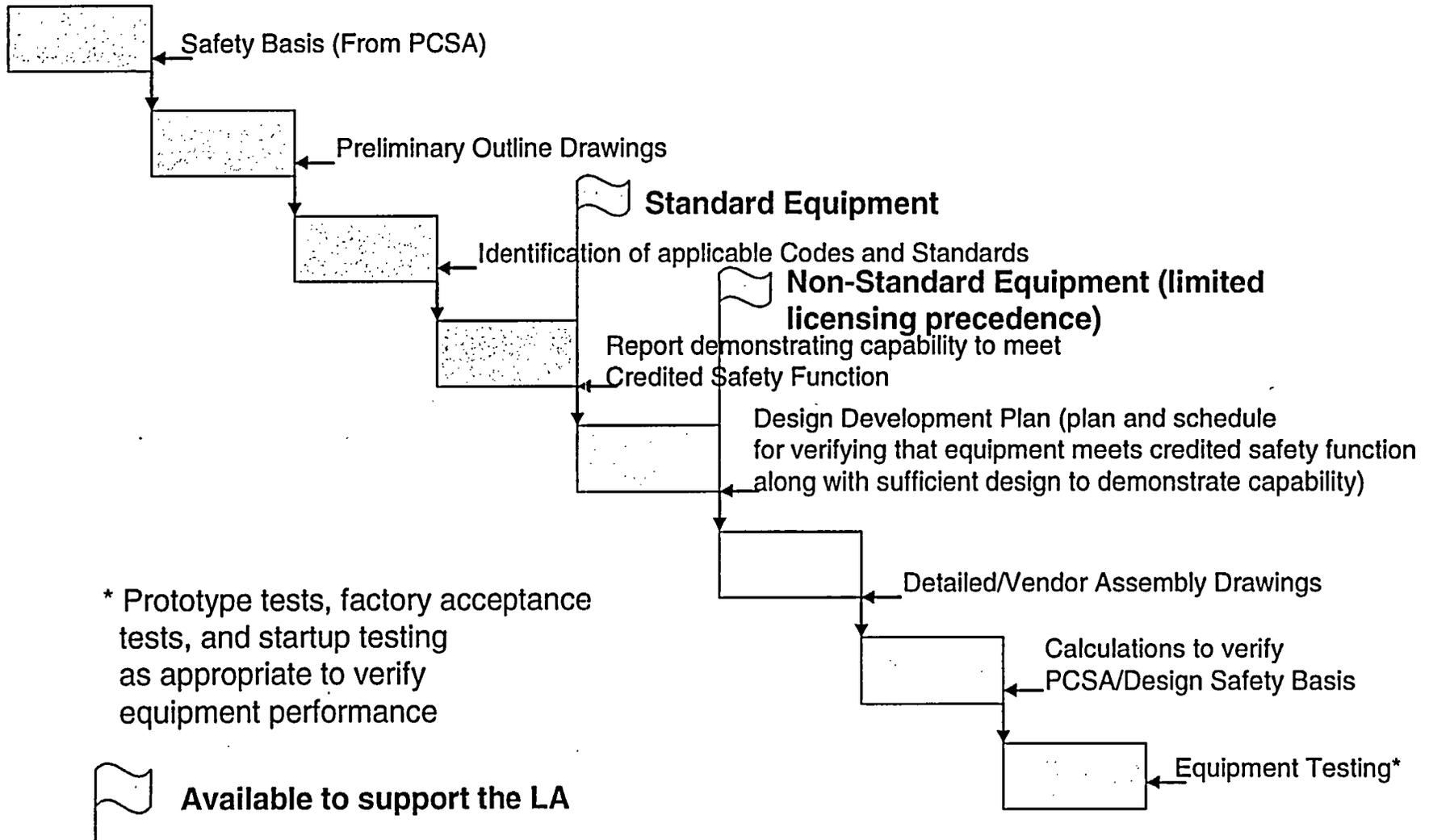


Electrical System

- **Portions of the electrical system will be ITS**
- **The grid reliability is modeled as part of the electrical system fault tree**
- **Loss of grid power concurrent with a Category 1 event is classified as a Category 2 event sequence**
- **Diesel generators provide defense-in-depth, but do not provide an ITS function**
- **Grid reliability will be monitored**



Equipment Design Development



Potential Effects of Non-ITS SSCs on ITWI SSCs

- DOE is evaluating the potential effects of both ITS and non-ITS SSCs on postclosure performance
 - Performed and issued analyses on the impact that the loss of emplacement drift ventilation has on the performance of the SSCs credited with ITWI
 - ◆ The analysis considered
 - » Complete loss of ventilation
 - » Passive ventilation maintained through a thermal gradient
 - » Temperature limits for the drift wall, waste package surface, and cladding
 - ◆ Results of analyses indicate
 - » Cladding temperature limit was reached after approximately 5 months with complete loss of ventilation
 - » Passive ventilation is sufficient to ensure that cladding temperature limits were not exceeded
 - Waste Packages are robust and can withstand the effect of rock fall without exceeding performance objectives, therefore ground control has not been credited with an ITS function



Aircraft Hazards

- **Aircraft hazard analyses scheduled to be issued this month**
- **Developing overflight restriction Memorandum Of Understanding (MOU)**
- **Current approach credits robustness of the nuclear facilities and engineered barrier surrounding aging pads to withstand aircraft crash**
- **Based on the reduction of the target area the probability of an aircraft crash is a beyond Category 2 event sequence**



Seismic Design Methodology

- **Preclosure seismic methodology has been completed**
 - Contained in project report titled “*Preclosure Seismic Design Methodology for a Geologic Repository at Yucca Mountain*”
- **The structural analysis and design of ITS surface nuclear facilities for seismic ground motions is prepared using a two-tier analytical approach**
 - The completed Tier 1 analytical approach, used multiple lumped mass stick models with soil springs of the ITS surface facilities
 - The Tier 2 seismic analysis will use three dimensional, finite element models of the ITS surface facilities



Seismic Design Methodology

(Continued)

- **As a result of the PCSA, SSCs that are credited with preventing or mitigating a seismically initiated event sequence are designed to withstand one of two levels of design basis ground motions (DBGM-1 or DBGM-2) to ensure that consequences do not exceed performance objectives**
 - **DBGM-1 and DBGM-2 are defined as site-specific ground motions having a 1,000 or 2,000 year mean annual return period, respectively**
- **Analyses will be prepared to demonstrate that ITS SSCs that are designed to DBGM-2 maintain credited safety functions when subjected to beyond design basis ground motions (BDBGM) having a mean annual return period of 10,000 years**
- **Additionally, seismic margin analyses using high confidence, low probability of failure (HCLPF) methods will be used to demonstrate adequate seismic capacity margins exist for ITS SSCs. These margins will be used as input to the PCSA where compliance demonstration to 10CFR63 performance objectives for seismically initiated event sequences are prepared.**



Thermal Management Strategy

- **Develop waste package and drift loading plans**
 - **Plans will need to address key parameters (e.g., thermal, shielding, condition of fuel, and criticality)**
 - ◆ **Forms the bases for developing future technical specifications for waste package loading**
 - **Demonstrate technical flexibility and sensitivity in computer calculations and thermal models (e.g., subsurface thermal performance with waste package and drift loading operational approach)**



Automated Event Trees

- **Automated event tree analysis using conventional code System Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE)**
 - Supports design evolution and alternative or “trade-off” decisions – more rapid quantification of differences in risk between options for detailed design solutions
 - Enables quantification of uncertainty and better identification of importance factors as level of design detail increases
 - Enables use of best-estimates for waste throughput, number of lifting and handling operations, etc., with capability to perform sensitivity analyses on key factors
 - Accommodates incorporation of more detailed analyses for human error as level of design details increases



Direct Radiation Sources and Low-level Waste Sources

- **Include potential inadvertent direct exposure of workers to sources due to failure of safety interlocks**
- **Update source terms and dose consequence calculations to include sources other than spent nuclear fuel and high-level radioactive waste**
 - **Low-Level waste collection area**
 - **Facility drain system sumps and retention tanks**



Design Products Alignment

- **Content alignment issues between design and PCSA products**
 - **Driven by the need to incorporate mitigation as well as prevention features**
 - ◆ **Improved understanding of facility event sequences resulted in a re-classification of portions of the heating, ventilation, and air-conditioning (HVAC) and electrical systems as ITS**
 - **Driven by an improved understanding of ITS determination methodology**



Design Products Alignment

(Continued)

- **Transparency issues with design products**
 - Issues related to clarity of bases for assumptions
- **Technical adequacy was not challenged**
- **What did we learn**
 - Improve documentation for selecting the design methodology and analysis inputs



Conclusion and Path Forward

- **Significant technical progress over the past year**
- **Project focus**
 - License Application readiness
 - Support to NRC information needs
- **Path forward – specific areas ready for technical interactions**
 - Material handling
 - Building designs
 - HVAC systems

