BSC	Criteria/Basis Change Notice Complete only applicable items.	1. QA: QA 2. Page 1 of 6

3. Document Identifier:		4. Rev.:	5. CBCN:
000-3DR-MGR0-00100-000	ENG.20080305.0002	007	008
6a. Title:		6b. Safety Classification of SSC:	
Project Design Criteria Document SCK 3/5/08 -MGR0-		ITS & Non-ITWI	

7. Reason for Change:

Recent changes to the *Repository System Codes*, 000-30X-01200-000-00E, changes the designation of the Emergency Electrical Power System to the ITS Power System and created a new sub-system for the Emergency (Life Safety) Power to include systems like emergency lighting. This CBCN provides for the name change and the criteria split between the sub-systems.

Additionally, the criteria provided in 4.3.1.8.11 is clarified to only refer to the DBGM classifications in the *Basis of Design for the TAD Canister-Based Repository Design Concept*, 000-3DR-MGR0-00300-000-~~001~~ 002 SCK 3/5/08; such that the criterion is not provided for in two separate documents.

There is no impact to the LA, as the power system engineering products are referencing the system codes and the LA sections refer to the products.

8. Supersedes Change Notice:	☐ Yes If, Yes, Change Notice: _____	☒ No

9. Disciplines/Organizations Affected by this Change:

Nuclear Facilities Project Engineer 04 MAR 08	Electrical and I&C Discipline Engineering Manager KF 3/4/08	L&NS Document Review 3/4/08
Preclosure Safety Analysis Manager 03/04/08	ESH Review Coordinator (EM) 3/4/08	
		If 6b is ITS/ITWI: Quality Assurance: Quality Assurance 3/4/08

10. Description of Change:

Revise the following PDC criteria as follows:

4.3.1.1.6 Division of Power Systems

Electric power systems shall be divided into normal, standby, **ITS,** and emergency **(life safety)** power systems. The uninterruptible and direct current (DC) power sources shall be included for uninterruptible power as well as protective relaying and control functions **respectively**. Distribution shall be in accordance with:

- IEEE Std 141-1993, *IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants* [DIRS 122242]
- IEEE Std 241-1990 (Reaffirmed 1997), *IEEE Recommended Practice for Electric Power Systems in Commercial Buildings* [DIRS 169314]
- IEEE Std 399-1997, *IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis* [DIRS 122246]
- IEEE Std 336-2005, *IEEE Guide for Installation, Inspection, and Testing for Class 1E Power, Instrumentation, and Control Equipment at Nuclear Facilities* [DIRS 177587]
- IEEE Std 112-2004, *IEEE Standard Test Procedure for Polyphase Induction Motors and Generators* [DIRS 177608]
- IEEE Std 739-1995, *IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities* [DIRS 116978].

[These industry standards provide for requirements for defining power distribution systems. ***The reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements.]***

4.3.1.1.29 Diesel Generators

The standby diesel generators, the ~~emergency~~ **ITS** diesel generators, and the emergency ~~and security~~ diesel generators shall be rated 13.8 kV, 4.16 kV, or 480~~v~~V, as appropriate, 3-phase, and 60 Hz, wye connected. Upon loss of **offsite power** ~~voltage on its associated bus, th~~ **each ITS, emergency, and standby diesel generator within building 26B** ~~diesel generator~~ shall be automatically started. Each diesel generator shall have a minimum fifteen percent spare capacity at the time of procurement. The electrical system shall be designed to accommodate additional paralleled diesel generators. ~~(except for CCCF).~~

4.3.1.1.29 Diesel Generators (continued)

[This criterion is required for the optimum system design. The spare capacity is provided to allow sufficient margin for future load growth. ***Standby generators on the crest for the ventilation fans and any diesel generators in remote buildings or facilities, will be manually started. The electrical system (as a whole not parts) will be designed to accommodate paralleled diesels. However, generators in CCCF, EOC, Fire Stations, etc., may not be designed to accommodate paralleled operation. The reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements.]***

4.3.1.2 Lighting System

Normal, essential, and emergency **(life safety)** lighting systems (including illumination levels) shall be designed in accordance with:

- *IESNA Lighting Handbook, Reference and Application, with Errata* (Rea 2005 [DIRS 176384])
- ANSI/IESNA RP-22-05, *IESNA Recommended Practice for Tunnel Lighting* [DIRS 177606]
- ANSI/IESNA RP-1-04, *American National Standard Practice for Office Lighting* [DIRS 174537]
- ANSI/IESNA-RP 7-01, *Recommended Practice for Industrial Lighting, with Errata* [DIRS 176343]
- ANSI/IESNA RP-8-00, *Standard Practice for Roadway Lighting, with Errata* [DIRS 173093]
- NFPA 70, *National Electrical Code, with Tentative Interim Amendment*, 2005 Edition [DIRS 177982]
- NFPA 101-2006 [DIRS 177965].

Normal lighting shall be provided in areas where sudden loss of light does not affect safety or production. Essential lighting shall be provided in areas where sudden loss of light does have an ~~affect~~ **effect** on production and safety to personnel. Emergency lighting shall be provided in areas where manual operations, sustained system operations, and exits from the facilities are required during postulated emergencies. Emergency lighting shall include egress, safeguard, and security lighting.

[This criterion is required to ensure adequate illumination for all areas in the facility and operations during all modes of facilities operations. The documents identified are accepted industry standards. 29 CFR 1910.34, .35, .36, and .37 endorse NFPA 101 as sufficient to demonstrate compliance with exit route provisions. Although a later version of NFPA 70 *is available, the responsible DEM has elected to utilize the referenced version.* ***The reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements. This change necessitates that the emergency lighting mentioned above will be powered from this sub-system.]***

4.3.1.8.11 ~~Cable Raceway Seismic Qualification~~ Electrical and Control System Seismic Design

Seismic design of Electrical and Control ITS systems that are not credited with preventing or mitigating seismic event sequences and Electrical and Control non-ITS systems shall be in accordance with *International Building Code 2000, with Errata to the 2000 International Building Code* (ICC 2003 [DIRS 173525]).

~~All cable raceway that support functions of the emergency power subsystem and supports the function of ITS circuit cables shall be designed for DBGM-2 seismic loads, with sufficient margin for BDBGM. These raceway supports shall be qualified in accordance with IEEE Std 344-2004, *IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations* [DIRS 176259].~~

[*This design criterion is based on the requirements* ***that none of the electrical power system, ITS or otherwise, is required to function during a seismic event sequence.*** ~~of IEEE Std 344-2004. The design for DBGM-2 seismic load is in accordance with BOD (*BSC 2007* [DIRS 182131]), Section 17.2.3.3.~~]

4.3.2 ~~Emergency~~ ITS Electrical Power Design Criteria

The following criteria apply to the ~~emergency~~ ITS power system in addition to the criteria listed in Section 4.3.1.

4.3.2.1 *ITS* ~~Emergency~~ Power Supply Voltages

The ~~facility emergency~~ ITS power supply voltages shall be in compliance with IEEE Std 141-1993 [DIRS 122242]. Supply voltages shall be 13.8 kV, 4.16 kV, 480/277 V, and 208/120 V, 3-phase, 60 Hz for AC system. The DC battery system voltage shall be 125 V.

This criterion is required to define the facility application voltages. These voltages are commonly used in industry in the United States for medium- and low-voltage systems. Electrical equipment is most readily available in these voltages. Their performances

4.3.2.1 (Continued)

have long been proven. ***The reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements.]***

4.3.2.2 *ITS* ~~Emergency~~ Power Equipment

~~All equipment in the ITS emergency power subsystem, including the ITS emergency diesel generators, shall be designed to DBGM-1 seismic event.~~ The ITS ~~portions of the~~ electrical power **subsystem**, ~~and electrical~~ support systems, **and equipment** are subject to programs including, but not limited to, design control, quality control, equipment qualification, installation, maintenance, periodic testing, and surveillance. **ITS power subsystem credited with mitigating consequences of a seismically initiated event** ~~Equipment qualification~~ shall be **designed** in accordance with IEEE Std 344-2004 [DIRS 176259], ~~Section 9, and~~ IEEE Std 323-2003 [DIRS 166907] and conformance with the guidelines in Regulatory Guide 1.9, *Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants* [DIRS 146732] and in IEEE Std 387-1995 (REAF 2001), *Standard Criteria for Diesel-Generator Units Applied as Standby Power Generating Stations* [DIRS 178084].

[This criterion is to ensure that the ***ITS*** *~~emergency~~ power subsystem* ***credited with mitigating consequences of a seismically initiated event*** *is available after a seismic event to provide power to loads such as ~~post-event monitoring systems, communications, egress lighting in defined areas,~~ select HVAC units, ~~and worker industrial and life safety systems~~. RGA REG-CRW-RG-000008, Agreement for Regulatory Guide 1.9, Rev. 3 - Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants (BSC 2007 [DIRS 181947]) provided agreement on Regulatory Guide 1.9 and the use of IEEE Std-387-1995. RGA REG-CRW-RG-000074, Agreement for Regulatory Guide 1.89, Rev. 1 - Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants (BSC 2007 [DIRS 181952]) has adopted Regulatory Guide 1.89, Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants [DIRS 102609] with clarification that IEEE Std 323-2003 be used instead of IEEE Std 1974.* ***The reclassification of emergency power, ~~into~~ ITS, and emergency (life safety) power sub-systems was directed by the change to the Repository System Codes (BSC 2007 [DIRS 184183]).]***

4.3.2.3 *ITS* ~~Emergency~~ Power Switchgear Buses

The **ITS** ~~emergency~~ power subsystem shall be designed with redundant 13.8 kV **ITS** ~~emergency~~ switchgear buses. Each bus shall be designed such that electrical isolation and physical separation methods are applied to ensure that failures in one redundant load group will not cause failures to the other redundant load group or non-ITS equipment failures will not cause failures in ITS equipment. The implementation of ~~these design enhancements for~~ the ITS ~~portion of the~~ electrical power system shall be measured against applicable requirements in IEEE Std 384-1992 (REAF 1998), *Standard Criteria for Independence of Class 1E Equipment and Circuits* [DIRS 177952] and IEEE Std 308-2001, *IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations* [DIRS 158851] ~~except, ITS emergency power, including the DC Power, shall not be shared between the facilities~~. The system shall be tested on a 24-month frequency in accordance with Regulatory Guide 1.75, *Criteria for Independence of Electrical Safety Systems* [DIRS 176330]. Each **ITS** ~~emergency~~ switchgear bus shall be connected to an **ITS** ~~emergency~~ diesel generator ~~that will supply loads such as post-event monitoring systems, communications, egress lighting in defined areas, select HVAC units, and worker industrial and life safety systems~~.

[This criterion is to provide reliability and to ensure that the ***ITS*** *~~emergency~~ power subsystem is available to provide power to redundant system loads. RGA REG-CRW-RG-000063, Agreement for Regulatory Guide 1.75, Rev. 3 - Criteria for Independence of Electrical Safety Systems (BSC 2007 [DIRS 181996]) has adopted Regulatory Guide 1.75, with clarification that the results of analysis performed to meet the requirements of IEEE Std 384-1992, Sections 5.5.2, 5.6, 6.1, etc. (Regulatory Guide 1.75 paragraph C.2) may not be available at time of License Application. Results would then be available at a future agreed upon date. RGA REG-CRW-RG-000026, Agreement for Regulatory Guide 1.32, Rev. 3 - Criteria for Power Systems for Nuclear Power Plants (BSC 2007 [DIRS 181639]) endorses Regulatory Guide 1.32, Criteria for Power Systems for Nuclear Power Plants [DIRS 172087], with clarification that the* ***ITS*** *~~emergency~~ power systems* ***operate independent of each other~~are not shared between facilities~~. The reclassification of emergency power, ~~into~~ ITS, and emergency (life safety) power sub-systems was directed by the change to the Repository System Codes (BSC 2007 [DIRS 184183]).]***

4.3.2.4 *ITS* ~~Emergency~~ Power Single Failure Protection

The **ITS** ~~emergency~~ power subsystem shall be designed in accordance with **IEEE Std 379-2000,** ***IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems*** **[DIRS 166688]** ~~IEEE Std 446-1995 [DIRS 125763] and NFPA 110-2005, *Standard for Emergency and Standby Power Systems* [DIRS 173511],~~ including a 13.8 kV ~~emergency~~ **ITS** bus, 480 V ~~emergency~~ **ITS** system, 125 VDC system, and 120 VAC UPS system. ~~Redundant buses satisfying the single failure criterion to ensure the availability of ITS emergency power will be based on IEEE Std 379-2000, *IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems* [DIRS 166688].~~

4.3.2.4 (continued)
*[This criterion defines the requirements for the **ITS** ~~emergency~~ power subsystem and ensures power is available to ITS loads, the safety functions of which will be needed after a Category 1 event sequence. Single failure ~~criteria~~**criterion** is **required** ~~satisfied~~ by RGA REG-CRW-RG-000044, Agreement for Regulatory Guide 1.53, Rev. 2 - Application of the Single-Failure Criterion to Nuclear Power Plant Protection Systems (BSC 2007 [DIRS 181680]), which endorses Regulatory Guide 1.53, Application of the Single-Failure Criterion to Nuclear Power Plant Protection Systems [DIRS 171817] and IEEE Std 379-2000. **The reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements.]***

4.3.2.5 *ITS* ~~Emergency~~ Power Equipment Protection

ITS ~~E~~electric power equipment shall be protected in accordance with IEEE Std 741-1997 (R 2002), *IEEE Standard Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations* [DIRS 166689].

*[Industry standard. **The reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements.]***

4.3.2.6 *ITS* ~~Emergency~~ Power for Safety Systems

ITS ~~Emergency~~ power for safety systems shall be designed in accordance with IEEE Std 603-1998, *IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations* [DIRS 125916] endorsed by Regulatory Guide 1.153, *Criteria for Safety Systems* [DIRS 103165].

*[Industry standard for this purpose. RGA REG-CRW-RG-000129, Agreement for Regulatory Guide 1.153, Rev. 1 - Criteria for Safety Systems (BSC 2007 [DIRS 181771]) has provided guidance for Regulatory Guide 1.153. **The reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements.]***

4.3.2.7 *ITS* ~~Emergency~~ Power Subsystem Redundancy and Independence

The onsite (**ITS** ~~emergency~~ diesel generator) power subsystem and the associated distribution system shall be designed in accordance with **IEEE 308, *Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations,*** and the the guidance provided in Regulatory Guide 1.6, *Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems (Safety Guide 6)* [DIRS 110807] to provide sufficient independence to perform their safety function assuming failure. The design shall be such that the safety loads are separated into redundant/independent load groups, each redundant load group is connected to offsite and onsite power sources, each DC load group energized by a battery and battery charger with no automatic connection to any other redundant load group~~, and the onsite power source (emergency diesel generator) is driven by a single prime mover~~.

*[RGA REG-CRW-RG-000005, Agreement for Regulatory Guide 1.6, Rev. 0 - Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems (Safety Guide 6) (BSC 2007 [DIRS 181632]) has adopted Regulatory Guide 1.6 with clarification. **The reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements.]***

4.3.2.8 *ITS* ~~Emergency~~ Power Subsystem Testing

As part of the initial preoperational testing program, and also after major modifications or repairs to a facility, the ~~on-site electric (~~**ITS** ~~emergency diesel generator)~~ power subsystem shall be tested to verify the existence of independence among redundant on-site power sources and their load groups in accordance with the guidance provided in Regulatory Guide 1.41, *Preoperational Testing of Redundant On-Site Electric Power Systems to Verify Proper Load Group Assignments* [DIRS 144748].

*[RGA REG-CRW-RG-000036, Agreement for Regulatory Guide 1.41, Rev. 0 - Preoperational Testing of Redundant On-Site Electric Power Systems to Verify Proper Load Group Assignments (BSC 2007 [DIRS 181839]) has adopted Regulatory Guide 1.41 with clarification. **The reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements.]***

4.3.7.27 ~~Post-Fire Safety~~ Deleted

~~Emergency lighting and communication systems shall be provided to facilitate post-fire safe shutdown and emergency egress in accordance with Regulatory Guide 1.189 [DIRS 155040], Sections C.4.1.6 and C.4.1.7.~~

4.3.7.27 (Continued)
~~[Regulatory guidance Analysis REG-CRW-RG-000164 (BSC 2007 [DIRS 181799]) adopted Regulatory Guide 1.189.~~ The reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements. This criterion was moved to the emergency (life safety) criterion 4.3.9.2.]

4.6.3.1 Equipment Codes and Standards

Seismic qualification of **necessary** seismic monitoring equipment shall be in accordance with IEEE Std 344-2004 [DIRS 176259]. Equipment will be grounded in accordance with IEEE Std 1050-1996 (1999), *Corrections to IEEE Guide for Instrumentation and Control Equipment Grounding in Generating Stations* [DIRS 169773].

[Applicable sections of these documents will be determined during the design process and in the development of design products.]

Add the following new criteria:

4.3.8.2 ITS Electrical System Seismic Qualification

ITS Electrical SSC's credited with preventing or mitigating seismic event sequences shall be seismically qualified in accordance with IEEE Std 323-2003, *Standard Qualifying Class 1E Equipment for Nuclear Power Generating Stations* [DIRS 166907], IEEE Std 344-2004, *Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations* [DIRS 176259] and IEEE 628, *Standard Criteria for the Design, Installation, and Qualification of Raceway Systems for Class 1E Circuits for Nuclear Power Generating Stations [DIRS 171698]*

[This design criterion is based on the requirements of RGA REG-CRW-RG-000074 [DIRS 181952 Regulatory Guide 1.89 and RGA REG-CRW-RG-000084, Agreement for Regulatory Guide 1.100, Rev. 2 - Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants (BSC 2007 [DIRS 181689])

4.3.9 Emergency (Life Safety) Power Design Criteria

4.3.9.1 General Emergency (Life Safety) Design Criteria

The emergency (life safety) power sub-system shall meet the criteria listed in Section 4.3.1.

[Although the reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements and necessitated creation of this sub-section, the general design criteria of sub-section 4.3.1 applies.]

4.3.9.2 Post-Fire Safety

Emergency (life safety) lighting and communication systems shall be provided to facilitate post-fire actions and emergency egress equivalent to Regulatory Guide 1.189 [DIRS 155040], Sections C.4.1.6 and C.4.1.7.

[RGA REG-CRW-RG-000164 (BSC 2007 [DIRS 181799]) adopted Regulatory Guide 1.189. The reclassification of ITS and emergency (life Safety) power subsystems was directed by a change to the Repository System Codes (BSC 2007 [DIRS 184183]) to facilitate the separation/isolation of ITS requirements from the non-ITS emergency life safety requirements.. This criterion was previously 4.3.7.27.]

4.3.9.3 Emergency Power Subsystem

The Emergency (non-ITS / life safety) power subsystem shall be designed and installed in accordance with NFPA 70, *National Electrical Code, with Tentative Interim Amendment,* 2005 Edition [DIRS 177982], NFPA 101-2006 *Life Safety Code* [DIRS 177965] and NFPA 110, *Standard for Emergency and Standby Power Systems* [DIRS 173511].

[This is common practice in industry for life safety and non-ITS systems. Although a later version of* NFPA 70 *is available, the responsible DEM has elected to utilize the referenced version.]

4.3.1.8 Raceway System

4.3.1.8.1 Raceway Separation

For redundant loads that may be determined in detailed design, the cables and raceways shall be separated and routed from separate power systems via separate fire areas in accordance with the principles defined in NFPA 70 [DIRS 177982].

4.3.1.8.1 (Continued)

[For the selected ITS ~~emergency~~ redundant loads, physical separation of ITS ~~emergency~~ power cables are required to prevent simultaneous loss of selected ITS ~~emergency~~ loads due to a fire in the same fire zone or other hazards such as flooding, icing, and vandalism. Although a later version of NFPA 70 *is available, the responsible DEM has elected to utilize the referenced version.]*

4.3.1.8.10 Cable and Raceway Design

All cable and raceways that support functions of the ~~emergency~~ electrical power subsystems, as a minimum, shall be designed and installed in accordance with NFPA 70, *National Electrical Code, with Tentative Interim Amendment,* 2005 Edition [DIRS 177982].

[This is common practice in industry. Although a later version of NFPA 70 *is available, the responsible DEM has elected to utilize the referenced version.]*

Add the following to Section 8.1, Documents Cited:

[DIRS 184183]

BSC (Bechtel SAIC Company) 2007. *Repository System Codes.* 000-30X-MGR0-01200-000 REV 00E. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071101.0022

11. REVIEWS AND APPROVAL

Printed Name	Title	Signature	Date
11a. Preparer: David S. Rhodes	Discipline Engineering Manager		3-4-08
11b. Concurrence: Richard Foster (Acting)	Manager of Discipline Engineering		3-4-08
11c. Concurrence: N/A	Project Engineering Manager	N/A	N/A
11d. Approved: Barbara Rusinko	Engineering Manager		3/4/08