RAI Volume 2, Chapter 2.1.1.2, First Set, Number 13:

> Provide information on the design characteristics for the local controllers (SAR Section 1.4.2). Also, confirm whether the controllers and input/output modules are classified as Class 1E equipment, and provide DOE's plans for periodically calibrating these analog signals.
>
> In SAR Section 1.4.2, DOE has described the DCMIS. Its major components are controllers, human-machine interface consoles, input and output modules, engineering workstations, data historians, networks and network interface devices, and foreign-device interfaces. However, information regarding the required design characteristics for the local controllers is not provided. It can be inferred from other sections of the SAR that the intention is to utilize the local controllers to regulate operation of the GROA in that the combination of hardware and software is configured to await for permissive signals from either a local or remote operator before allowing the automation functions to proceed. From a safety perspective, it is important to evaluate the criteria used to implement the logic incorporated into the controllers. Analog signals are not linear over a wide range and hence changes from input to output will not be constant over time and hence will tend to drift. Therefore, periodic calibration of the equipment may be necessary.

1. RESPONSE

1.1 PROVIDE THE DESIGN CHARACTERISTICS FOR THE LOCAL CONTROLLERS

In general, local controllers are programmable logic controllers (PLCs). There are no PLCs credited with mitigating or preventing a safety function; therefore the PLCs are not important to safety (non-ITS). Detailed design characteristics will be determined during the detailed design phase. However, the following information provides the general design characteristics of the non-ITS PLC controllers.

1.1.1 Power Supply Feeds

Each PLC will accommodate two power supply feeds. The primary feed will be from an uninterruptible power supply, and the secondary feed may be from unregulated alternating current. The PLC will distribute the selected source of power and provide protective fuses and/or breakers within the PLC for power distribution, thermal protection of wiring, and overcurrent protection. Fuses will be located in the leg of the wiring scheme that provides power from the source to the field devices. In addition, fuses, breakers, and/or current-limiting input/output devices will be provided so that an accidental grounding of a field conductor will not disable more than the one input/output point to which the conductor is connected.

The processor and input/output rack power supplies will be fed from the primary source, with the secondary source as backup. A "Diode OR" of the two power supply outputs may be used for

DC voltages. Input modules will utilize the same selected (primary or secondary) source for interrogating field input devices.

Field power for digital output modules may be fed from the secondary power source to avoid undue loading of the uninterruptible power supply. An exception to this will be the motor control centers, where the source of power for input and output modules will be the individual motor starter control power transformer. Power supplies will include thermal overload, short circuit, and surge protection.

1.1.2 Diagnostics

The digital control and management information system (DCMIS) will provide online system diagnostics to detect, identify, and alarm any malfunctioning module or malfunction within the system. To facilitate online replacement, system components will be removable and installable while energized to the maximum extent practicable.

1.1.3 Shielding

DCMIS components will be shielded against electrical noise, radio frequency interference, and heat.

1.1.4 Terminal Blocks

The input/output points will be pre-wired to interposing terminal blocks. Where input/output chassis are located in motor control centers, the terminals in the starter compartments are considered as interposing terminal blocks.

1.1.5 Digital Modules

Digital input modules will be rated for up to 120 volts of alternating current isolated or nonisolated. Minimum isolation between input and logic voltage will be 1500 volts root mean square. Each input will have a light emitting diode to indicate on/off status. Digital inputs to the PLC will be individually fused. Digital inputs will not exceed 16 per card.

Digital output modules will be rated up to 120 volts of alternating current isolated or nonisolated solid-state with sufficient capacity to accommodate normal inductive loads found in the facility, such as motor starter coils and solenoid valve coils. Outputs will have a light emitting diode to indicate on/off status and blown fuse conditions.

1.1.6 Digital Signals

Digital output signals from the PLC will be individually fused. Digital outputs will not exceed 16 per card. The system will be capable of providing normally open and normally closed contact outputs.

1.1.7 Analog Signals

Analog input signals to the PLC will be isolated, and individual channels will be either current limited or fused. Analog inputs will not exceed 16 per card. The DCMIS will provide quality checks for all analog inputs. Data will be automatically tagged as bad if the input value is out of range. System inaccuracy will not exceed 1% of calibrated range (excluding transmitter).

Analog output signals from the PLC will be isolated, and individual channels will be either current limited or fused. System inaccuracy will not exceed 0.5% of output signal range (excluding final element). A maximum of 16 analog outputs per card is permitted.

1.1.8 External Fuses

External fuses will be provided in those instances where the input/output module individual internal fuses are not readily accessible, or cannot be replaced without taking the entire module out of service. These fuses will be coordinated with the internal module fuse and sized to blow before the internal fuse. Fuses will be equipped with blown fuse indicators.

1.1.9 Spare Capacity

Spare capacity will be designed with at least 15% installed spare input/output points of each type used and 15% installed spare intermediate terminal blocks. Spare input/output points will be wired to appropriate terminal blocks. In addition, cabinets will be furnished with 10% spare card slots in every card cage and 20% in each cabinet for future use.

1.1.10 Loading and Loop Processing Time

The PLC will be designed such that each controller will not be more than 70% loaded for the processing of its input/output, control, and monitoring functions. Control loop processing time will not exceed 250 milliseconds.

1.1.11 Memory

The DCMIS will have the capability of recording from memory to hard drive, to load memory from hard drive or CD/DVD as required, and to verify memory against the data in the hard drive. The hard drive and CD/DVD drive will be provided as an integral part of the PLC programming computer.

1.1.12 Failure Conditions

Outputs will fail off, and the system operation will fail safe upon loss of input/output rack power, loss of communication with the processor, or any other fault detection that could inhibit proper output reaction to process requirements. Logic implementation of each PLC-controlled device will address these failure conditions on both input and output points. Diagnostic alarms will be configured for each condition.

1.1.13 Controller

The PLC programming and monitoring equipment will be able to be connected or disconnected with the controller in operation. The PLC controller, including output devices, will shut down in an orderly manner and alarm in the event of a disruption of program execution or scan, a loss of power, loss of communication between controller essential devices, or a memory error.

1.1.14 Instrumentation Requirements

Instrument ranges will be selected such that the normal operating point is between 35% and 75% of the range of the instrument, and will consider startup and abnormal operating conditions. Flow calculations will use 20% above the maximum design flow rate as the meter maximum. Analog electrical signals will be 4 to 20 milliamps of direct current, 24 volts of direct current, two wire, and analog pneumatic signals will be 3 to 15 psig. In general, instrument accuracies will be 0.5% of span or better. The accuracy of local instruments will be 1% or better and transmitters will be 0.1% or better. Thermocouples and resistance temperature detectors will be 0.2% of span or better, including transmitters.

1.2 CONFIRM WHETHER THE CONTROLLERS AND INPUT/OUTPUT MODULES ARE CLASSIFIED AS CLASS 1E EQUIPMENT

SAR Section 1.4.2.1.1 states that the DCMIS is non-ITS; therefore, the DCMIS local controllers, PLCs, and input/output modules are not Class 1E equipment. In addition, because the DCMIS components perform no safety functions, they are not qualified by the equipment qualification program described in SAR Section 1.13. The hard-wired ITS instrumentation and controls establish the safe operating envelope for mechanical handling equipment, heating, ventilation, and air-conditioning systems, ITS diesel generators and mechanical support systems, waste package transfer trolley, cask transfer trolley, slide gates, transport and emplacement vehicle, and doors (equipment, personnel, and confinement). The DCMIS governs the operation of equipment within the safety envelope, however, malfunctions of the DCMIS can not override the operation of any ITS instrumentation and controls.

1.3 PLANS FOR PERIODICALLY CALIBRATING ANALOG SIGNALS

Periodic calibration and surveillance requirements for channel calibration, channel checks, functional tests, and response time tests of the DCMIS will be determined during detailed design using the methods and practices of IEEE Std 338-1987, *IEEE Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems*.

The design, periodic testing, and calibration of DCMIS controllers and input/output modules use the methods and practices of:

- ANSI/ANS-HPSSC-6.8.1-1981, *Location and Design Criteria for Area Radiation Monitoring Systems for Light Water Nuclear Reactors*

- ANSI N42.18-2004, *American National Standard, Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents*

- CEI/IEC 751-1983 (Amendment 2 1995-07), *Industrial Platinum Resistance Thermometer Sensors*

- IEC 61131-3, *Programmable Controllers—Part 3: Programming Languages*

- IEEE Std 802.3ah-2004, *IEEE Standard for Information Technology—Telecommunications and Information Exchange Between Systems—Local and Metropolitan Area Networks—Specific Requirements. Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications. Amendment: Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks*

- ISA-MC96.1-1982, *Temperature Measurement Thermocouples*

- ISA-RP16.6-1961, *Methods and Equipment for Calibration of Variable Area Meters (Rotameters)*

- ISA-RP31.1-1977, *Specification, Installation, and Calibration of Turbine Flowmeters*.

Periodic calibration of ITS instruments will be performed in accordance with ISA-S67.04, Part 1. 1994, *Setpoints for Nuclear Safety-Related Instrumentation.*

An engineering configuration room is located separate from the Central Control Center to provide a separate engineering workstation to perform online and off-line functions such as configuration of new control and monitor points, changes or additions to graphic displays, and calibration changes/updates to control and monitor instrumentation. The engineering configuration room is not a separate control room and activities performed in it are not related to operations.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

ANSI/ANS-HPSSC-6.8.1-1981. *Location and Design Criteria for Area Radiation Monitoring Systems for Light Water Nuclear Reactors*. La Grange Park, Illinois: American Nuclear Society. TIC: 253112.

ANSI N42.18-2004. *American National Standard, Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents*. New York, New York: Institute of Electrical and Electronics Engineers. TIC: 258574.

IEC 61131-3. 2003. *Programmable Controllers—Part 3: Programming Languages*. 2nd Edition 2003-01. Geneva, Switzerland: International Electrotechnical Commission. TIC: 260193.

CEI/IEC 751-1983 (Amendment 2 1995-07). 1995. *Industrial Platinum Resistance Thermometer Sensors*. Geneva, Switzerland: Bureau of the International Electrotechnical Commission. TIC: 257197.

IEEE Std 338-1987. 2000. *IEEE Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems*. New York, New York: Institute of Electrical and Electronics Engineers. TIC: 258571.

IEEE Std 802.3ah-2004. *IEEE Standard for Information Technology—Telecommunications and Information Exchange Between Systems—Local and Metropolitan Area Networks—Specific Requirements. Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications. Amendment: Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks*. New York, New York: Institute of Electrical and Electronics Engineers. TIC: 257033.

ISA-S67.04, Part 1. 1994. *Setpoints for Nuclear Safety-Related Instrumentation.* Research Triangle Park, North Carolina: International Society for Measurement and Control. TIC: 237537.

ISA-MC96.1-1982. 2003. *Temperature Measurement Thermocouples*. Research Triangle Park, North Carolina: Instrumentation, Systems, and Automation Society. TIC: 254132.

ISA-RP16.6-1961. 1982. *Methods and Equipment for Calibration of Variable Area Meters (Rotameters)*. Research Triangle Park, North Carolina: Instrumentation Society of America. TIC: 255537.

ISA-RP31.1-1977. *Specification, Installation, and Calibration of Turbine Flowmeters*. Research Triangle Park, North Carolina: Instrument Society of America. TIC: 256163.