APPENDIX II–A

DESIGN CONTROL

Design controls are the measures established to assure that the design process activities are carried out in a planned, orderly, correct, and documented manner. These controls assure the quality of the design requirements and design basis obtained through the design process. Design controls are constraints to the design process that ensure the following results: the correct identification of design inputs and constraints; the design analysis and calculations are complete and correct; and the design outputs are complete and consistent with the design basis. Design controls are implemented through procedures.

DOE 5700.6C, *Quality Assurance,* defines DOE design control requirements. ANSI/ASME NQA-1, *Quality Assurance Requirements for Nuclear Power Plants,* provides additional guidance on design control. Examples of design controls include:

- Organizational responsibility for design functions
- Training and qualification of engineering personnel
- Information exchange and interface controls
- Controls for preparation, review, approval, release, and revision of design documents
- Document controls for maintenance and retention of design documents
- Identification of appropriate design inputs and constraints
- Identification of required design output documents
- Identification of required changes to facility configuration documents
- Determination of quality levels, and acceptance standards
- Programs to track cumulative effects of design changes
- Design verification reviews
- Requirements for and performance of design assurance reviews
- Conduct of audits and management reviews
- Conduct of corrective action programs

Design controls should provide some measure of assurance that proposed changes do not incorporate the same design deficiencies built into the original design, if any exist. The design engineering organization should not blindly accept previous design work as correct. Rather, it should maintain a questioning attitude that considers the credentials, vintage, methods, and assumptions of previous design work. Design controls should call for reasonableness checks of key calculations and assumptions, and other calculations on a sample basis. In cases in which the original design is suspect and in other specified cases, a zero-basis justification should be performed. The zero-basis justification involves a clean sheet approach to critically review or reanalyze the system design requirements to an appropriate interface point. Further, whenever new design requirements are issued for SSCs with incomplete, inadequate, or missing design basis, critical portions of the SSCs' design basis should be re-established at that time.

Programs to track cumulative effects of design changes are important design controls that are sometimes overlooked. Critical load growths should be identified for tracking. If untracked, these load growths might exceed the design capacities or design assumptions. Design verification checklists may be used to track cumulative effects for variable design features such as loads on batteries or emergency diesels, heatloads in equipment rooms, or weight loads on structures, including cable trays. The checklist could identify the need to update the applicable load lists and take other necessary actions. This approach can ensure that the design constraints imposed by previous designs are met.

Design control measures should also provide for verifying or checking design adequacy. Such measures would include performance of design reviews, by the use of alternate or simplified calculational methods, or performance of a suitable testing program. The verifying or checking process should be performed by individuals other than those who performed the original design, but who may be from the same organization. Where a test program is used to verify adequacy of a specific design feature in lieu of other verifying or checking processes, it should include suitable qualification testing of a prototype unit under the most adverse design conditions.

Other design process controls that facilitate responsive, efficient, and effective design include processing of requests for design changes, root cause determination of facility hardware problems, development and selection of alternate solutions, cost/benefit evaluations of design changes, conceptual design phase, project controls and planning of engineering design process work, and, physical change tracking. These controls might or might not have a direct effect on the quality of the design produced. These types of controls are largely administrative, and while they can be very important to providing a responsive, efficient, and effective design, they are not required design controls.

Design Authority vs. Design Agency. One of the more important aspects of design control is the establishment of a single design authority, with defined relationships to the supporting design agencies. The design authority is the organization responsible for establishing the design requirements and ensuring that design output documents accurately reflect the design basis. The design authority is responsible for design control and ultimate technical adequacy of the design process. These responsibilities are applicable whether the process is conducted fully in-house, partially contracted to outside organizations, or fully contracted to outside organizations. The design authority should be a single organization within the owner/operator organization. The design authority may delegate design work, but not its responsibilities. In a CM program context, the design authority assures that the design requirements and design basis are fully identified and in a form compatible with needs. Policies and procedures should clearly identify the design authority. Many facilities have policies and procedures establishing the facility design authority; these should be retained and upgraded, if necessary, to better support the CM program.

The design agency is the organization that performs the design activities, particularly those associated with design analysis and calculations. The design authority can perform as the design agency. Other organizations also can perform as the design agency for design work ranging from a given design to all designs. The design agency performs design activities at the direction of and under the responsibility of the design authority. For example, the organization performing DOE 4700.1 design work is a design agency, but often not the design authority. The design agency should provide the content and format of the design outputs and design basis, as well as the technical adequacy, according to the requirements of the design authority.

Design interfaces should be identified and controlled, and design efforts coordinated among and within participating organizations. Interface controls should include the assignment of responsibility and establishment of procedures among participating design organizations. Formal interface controls between the design authority and the design agency are necessary, even for the case where the design agency is within the same corporate organization. In this case, the size of the organization influences the degree of procedural controls necessary; the larger the organization, the greater the need for procedural controls. In large matrixed organizations, support from other groups should be handled formally through specifications, requisitions, and work control. In essence, the design authority treats these matrixed organizations as outside vendors. For both vendor activities and these matrixed organizations, the design authority should establish acceptance criteria to define satisfactory work completion. The program management element provides further direction on programmatic and organizational interfaces, and vendor control.

Multi-Tiered Design Process. The design process produces both design requirements and the associated design basis. Changes to design requirements need to be supported by the design basis. The design process identifies, documents, categorizes, and sorts by SSC every new facility design requirement, as well as changes or modifications to existing design requirements. The design process also identifies and documents the design basis of every new facility design requirement, in addition to changes or modifications to existing design requirements.

The design process is called upon whenever a change to the facility design requirement is contemplated. Permanent and temporary facility physical changes need engineering design if they involve potential changes to design requirements. Changes to final designs, field changes, facility physical changes, and nonconforming items dispositioned use-as-is or repair should be evaluated, and subject to design control measures commensurate with the original design. Requests for, engineering design may be initiated from within the design organization, and also from non-design organizations, such as operations, maintenance, and technical support.

Design controls may vary based on the complexity and significance of the design change. For example, some commercial nuclear facilities employ a three-tiered design process. Once the design process is initiated, a scope assessment is conducted to determine which tier the design change will take. This assessment reviews the technical complexity, the magnitude of the change, and the potential impact on previous commitments, including the authorization basis. Based on the scope assessment, the engineering management decides which of the three tiers the design task will pursue. These three tiers might be designated: Field Change Notices (for simple drawing changes to reflect as-built conditions); Minor Modification Packages (for minor facility changes such as component re-designs, with minor systems impact or systems interaction, and minor safety significance); and Design Change Packages (for other facility changes). Within DOE, an important distinction is between those changes managed as projects under DOE 4700.1, and those not managed as projects. The facility may also establish separate design control provisions to accommodate those changes to documents only, without any associated physical changes.

The specific design control measures to ensure that the design process is correctly implemented may vary depending on which tier is appropriate for a design change. However, regardless of the level of design control applied, the design process needs to produce both new/revised design requirements and associated design basis. The design process is the same at the different levels. Without proper controls, designs performed on the lower tiers often do not produce the necessary design basis and design outputs. The design authority needs to carefully control and monitor each design tier to ensure the design inputs, design constraints, design analysis and calculations, and design requirements are identified, accurate, complete, and documented.

APPENDIX II–B

EXAMPLES OF DESIGN INFORMATION

This appendix provides examples of design documents at various stages of the design process. This illustrates how certain common design documents may be categorized within the design process. The important differentiation demonstrated here is between design requirements (design output documents) and design basis (design inputs, constraints, and analysis and calculations).

This appendix also provides examples of both design requirements and design basis, illustrating the relationship between them and demonstrating their differences. The examples show the types of information; they do not constitute complete requirements or basis.

Design Input Documents.

- Specific functional requirements
  - Interfacing systems/functions
  - Safety/quality class
  - Load purpose/function
  - Load sequence
  - Interlocks/protection requirements
  - Operator interface requirements
  - Bypass indications
  - Post-event accessibility
  - System support requirements

- Specific survivability requirements
  - Normal service environment
  - Loss of HVAC
  - Site hazards (seismic, tornado, missile, flood, freeze, lightning)
  - Transients
  - Fire/Safe shutdown
  - Vibration

- Specific performance requirements
  - System flow requirements
  - Preferred failure modes
  - Reliability/availability goals
  - System/component impedance
  - Load duty cycle
  - Load electrical characteristics
  - Transient response
  - Testability
  - Separation/independence/diversity requirements

- Specific standards
  - American Society of Mechanical Engineers (ASME)
  - American National Standards Institute (ANSI)
  - American Society of Civil Engineers (ASCE)
  - Institute of Electrical and Electronics Engineers (IEEE)
  - American Concrete Institute (ACI)

- American Institute of Steel Construction (AISC)
- Hydraulics Institute (HI)
- Instrument Society of America (ISA)
- Standards from DOE Orders, commitments, etc.
- Applicable NRC standards (10CFR, Standard Review Plan, Reg. Guides)

- Specific regulatory requirements
  - DOE rules
  - DOE Orders
  - DOE safety guides

- DOE correspondence and commitments
  - DOE safety evaluation reports
  - Facility safety analysis reports

Design Constraints.

- Engineering standard practice guidance, procedures, instructions
  - Design process methodology
  - Setpoint methodology
  - Design discipline methodologies
  - Architect Engineer/Vendor guides and standards

- Computer codes used for design or design analysis (including user manuals)

- General Regulatory Requirements
  - DOE 4700.1
  - General Design Criteria
  - Safety Classification
  - Quality Classification

- General Codes and Standards
  - American Society of Mechanical Engineers (ASME)
  - American National Standards Institute (ANSI)
  - American Society of Civil Engineers (ASCE)
  - Institute of Electrical and Electronics Engineers (IEEE)
  - American Concrete Institute (ACI)
  - American Institute of Steel Construction (AISC)
  - Hydraulics Institute (HI)
  - Instrument Society of America (ISA)
  - Applicable NRC standards (Standard Review Plan, Reg. Guides)

- Quality Assurance Requirements
  - ANSI NQA-1
  - ANSI N.45.2.11

Design Analysis and Calculations.

- Engineering forms, evaluations, and documents used to implement designs and design changes

- Calculations or analyses that verify that the design inputs and constraints are met
  - Component classification evaluations
  - Load sequencing and electrical supply sizing calculations
  - Setpoint calculations and methodologies
  - Equipment sizing calculations
  - Motor-operated valve calculations, analyses, or test results that establish switch setting/tolerances

- Design baseline analysis and calculations to establish effects of postulated accidents:
  - Transient analysis
  - Site Hazards analysis
  - Seismic site specific criteria
  - Flooding site specific criteria
  - Ultimate heat sink analysis
  - Loss of spent fuel cooling analysis
  - Anticipated transient without scram

- Instrument and Electrical
  - Diesel generator sizing
  - Power and instrument cable sizing
  - System voltage profiles
  - System short circuit analysis
  - Diesel generator performance
  - Bus transfer analysis
  - System protection and coordination analysis - Battery sizing
  - Instrument accuracy calculations
  - Instrument Setpoint calculations
  - Current loop response time calculations
  - Electrical separation analysis
  - Raceway fill and loading
  - Failure modes and effects analysis
  - Thermal form evaluation
  - Electromagnetic compatibility
  - Surge withstand capability
  - Control room design review
  - Set point tolerance
  - Calibration and scaling calculations
  - Lightning protection analyses
  - Emergency lighting calculations
  - Motor starting calculations
  - Station blackout analysis
  - Offsite/onsite independence
  - Operator response time calculations

- Nuclear
  - Control room habitability analysis
  - Tornado loadings and external missile,
  - External flooding analysis
  - Pipe break effects
  - Equipment environmental qualification
  - Radiation source term identification

- Containment analytical model
- Radioactivity transport analysis
- Post accident conditions
- Offsite dose analysis
- Onsite personnel dose analysis
- Heat load determination analysis
- Heating, ventilation, and air conditioning (HVAC) failure modes and effects analysis (FMEA)
- HVAC instrumentation setpoints
- HVAC design analysis
- Pipe flow hydrodynamic loads analysis
- Piping network dynamic flow analysis
- Valve operability analysis
- ASME Code of record calculations
- Computer code validations and certifications
- Thermal analysis of components, supports, and structures
- Component minimum wall thickness calculations

• Civil
  - Concrete structures analysis
  - Steel structures analysis
  - Civil structure dynamic/earthquake analysis
  - Dynamic/stress analysis of substructures
  - Tornado analysis of structures
  - Weld evaluations
  - Block wall evaluations
  - Component seismic/structural qualification
  - Pipe rupture restraints
  - Bolt anchorage analysis
  - Probable maximum flood analysis
  - Platform steel, cranes, monorails, doors, ladders
  - Heavy loads analysis
  - Piping analysis
  - Generically qualified piping and supports
  - Rigorously analyzed piping and supports
  - Seismic analysis of electrical conduit
  - Instrument line analysis
  - Supports analysis (pipe, duct, conduit, instrumentation, etc.)
  - Foundation analysis
  - Seismic Category 2/Category 1 evaluation
  - Differential building settlement
  - Buried piping
  - Supplemental steel, building steel load tracking program
  - Equipment anchorage qualification
  - Anchor bolt load capacities

• Mechanical
  - Piping minimum wall thickness
  - Pump minimum positive suction
  - Pump total system head
  - Valve pressure drops (C)
  - Tank nozzle/branch line reinforcement:

- Heat transfer analysis
- Pump/system performance analysis
- Pressure/vacuum relief valve sizing
- Sump capacity
- Cooling water flow rates
- Equipment performance calculations
- Corrosion/erosion allowances
- Tank sizing and wall thickness calculations
- Pipe sizing/flow analysis
- System design/operating pressures and temperatures
- Pump brake horsepower requirements
- Valve actuation and check valve closure times
- Vibration data
- Thermal expansion data
- Design cycles for equipment and systems
- System resistance

• Identification and Consideration of Vendor Information
  - Vendor equipment allowable loads
  - Vendor equipment functional, seismic, and environmental qualification
  - Vendor equipment installation and maintenance requirements
  - Vendor standard component load capacities
  - Pressure ratings

• Correspondence, meeting minutes, and other documents pertaining to design evaluations and considerations

Design Output Documents.

• System Descriptions, Modifications Descriptions

• Specifications
  - Component
  - Material
  - Design
  - Installation Procurement
  - Piping classification list
  - Valve mark number list

• Facility Component Lists
  - Valve Lists
  - Equipment Lists (Q-Lists)
  - Electrical Load Lists
  - Setpoint Lists
  - Fuse and Breakers Lists
  - Instrument and Controls
  - Environmental Qualification

• Safety Analysis Report Changes

- Safety Evaluations and Technical Review Checklists/Results
  - Technical Review Checklists
  - USQ safety evaluations and checklist

- Process Software (or Firmware) Requirements Specifications

- Instrument and Control Setpoints (Document)

- Mechanical Outputs
  - Basic flow diagrams
  - Heat balance diagrams
  - Piping and Instrument drawings (P&IDs)
  - Layout and arrangement
  - HVAC (area drawings)
  - Plumbing (area drawings)
  - Isometric drawings
  - Equipment location drawings
  - Typical support detail for field routed pipe
  - Design cycles for equipment and systems

- Electrical Outputs
  - One line diagrams
  - Elementary diagrams
  - Wiring diagrams
  - Equipment requirements and arrangements
  - Diesel generator load sequencing
  - Logic for electrical system
  - Fire and safety
  - Grounding
  - Conduit and tray
  - Communication and lighting
  - Underground conduit
  - Breaker coordination

- Control Systems Outputs
  - Field locations and arrangement
  - Logic diagrams
  - Loop diagrams
  - Panel and console diagrams
  - User's guides

- Nuclear Outputs
  - Core reload report

- Pipe Support (Hanger and Support Design)

- Operational Requirements
  - Operator action requirements
  - Normal operating parameters
  - Environmental requirements
  - Support system requirements

- Maintenance Requirements
  - Preventive Maintenance
  - Vendor requirements

- Testing Requirements
  - Post-modification testing
  - Surveillance testing
  - In-service inspection and testing

- Construction and Installation Specifications
  - Inspection requirements

Examples of Design Requirements and Design Basis Information.

- System Level Design

  - Design Requirement: Emergency cooling system flow of 500 gpm must reach the reactor vessel within 25 seconds after initiation signal.

    Design Basis: The facility transient analysis assumes 500 gpm with a 25 second delay to mitigate a small break loss-of-coolant accident. The actual engineering analysis provide design margin for uncertainties by using 450 gpm with a 35 second delay. (ref. aa)

  - Design Requirement: Emergency electrical system must provide 1000 kW within 60 seconds of initiation.

    Design Basis: The nuclear safety electrical loads total 900 Kw. Cumulative additions to this electrical load lists are tracked (ref. ee). The facility transient analysis identifies that no more than 60 seconds elapse until emergency power is restored; the analysis assumes 85 seconds. (ref. xy)

  - Design Requirement: Primary system water chemistry must be maintained with dissolved oxygen between 500 and 1500 parts per billion.

    Design Basis: Dissolved oxygen above 500 parts per billion is enough to keep nitrate stable. Dissolved oxygen below 1500 parts per billion minimizes corrosion of stainless steel. (ref. fg)

- Component Level Design

  - Design Requirement: Motor operated valve xyz must open in 10 seconds at 1 psid and 80 percent of rated voltage.

    Design Basis: 10 seconds is desired in order to meet the system response time requirement of emergency cooling system injection within 25 seconds at design basis conditions. (ref. calc. jk)

- Design Requirement: Relief valve abc pressure setting of 165 psig and flow rate of I gpm.

  Design Basis: Parameters must meet ASME Section III, Section 7000 code requirements. Per code, pressure equals piping design pressure (ref. ef). Flow rate must be sufficient to prevent a pressure greater than 110 percent of the design pressure due to thermal expansion and leakage through the reactor vessel isolation valves. (ref. yz)

- Design Requirement: Miniflow bypass valve pqr must open in 4 seconds.

  Design Basis: 4 seconds is the desired opening time. The valve is designed to open as fast as practicable to minimize the time that the pump operates deadheaded. Valve and bypass piping are specified as 4 inch to pass pump miniflow requirement (ref. st). Past experience has demonstrated that vendors can supply fast opening valves with stem stroke rates of I inch per second. Hence, a 4 second stroke time for this 4 inch valve was selected. The engineering analysis indicates that up to 8 seconds is acceptable (i.e., 4 seconds of design margin is built into the design requirement). (Note: ref. pq).

• Structure Level Design

- Design Requirement: Lateral load resisting system elements must be designed to withstand 100 mph wind pressures.

  Design Basis: The lateral load resisting system provides stability to the structure under wind loading. A 100 mph wind velocity was selected according to ANSI A58.1 based on a review of the geographical location of the structure. (ref. bc)

APPENDIX II–C

CONDUCT OF WALKDOWNS

This exhibit provides an overview and discussion of selected key issues related to CM walkdowns. These CM walkdowns are conducted as part of each phase of programmatic assessments: initial assessments, post-implementation assessments, and periodic programmatic assessments.

This exhibit serves as additional guidance to prevent unnecessary rework and costs. It includes a generic CM component walkdown procedure for use in developing detailed walkdown procedures. The following discussion addresses selected key issues that should be considered when developing a walkdown program.

Walkdown Objectives. The objectives of the CM walkdowns should be clearly stated, documented, and understood by facility personnel involved in the walkdowns. This will help ensure consistency among the CM walkdowns, prevent confusion (especially with the objectives of other facility walkdown efforts), and minimize rework. The objectives of the CM walkdowns are to (1) establish the as-found physical configuration of the facility and (2) identify any discrepancies between the as-found configuration and associated facility documentation.

Consolidation of Walkdowns. Experience has shown that numerous walkdowns may be performed at a typical facility for different (but similar) reasons. For example, walkdowns may be performed as part of a hazards evaluation, design package preparation, functional evaluation, or in response to a regulatory commitments related to seismic, equipment qualification, or fire protection concerns. Prior to beginning the CM walkdowns, consideration should be given to identifying other walkdown efforts that may be needed within the same time frame and consolidating and/or integrating them, as appropriate. Some of the information gathered by different walkdowns may be identical and can be obtained once if the interfaces are established and consolidation is properly achieved. Other types of information can be added to the CM walkdown procedures and used to satisfy other needs thereby reducing the total number of walkdowns performed at each facility.

Critical Component Characteristics. Central to the success of the walkdown effort is the identification of critical component characteristics. These characteristics provide the structure for the component data sheets, which are used to collect, document, and transmit the data for inclusion into the equipment database. Prior to the commencement of the CM walkdowns, critical characteristics for each SSC should be identified in the walkdown procedures. Acceptable sources for these characteristics are the available design requirements, industry codes and standards, comparison of the critical characteristics with similar SSCs, and engineering judgement. The following are examples of some critical characteristics for mechanical, electrical, and I&C components:

Mechanical Components

- component number
- flow diagram number
- manufacturer
- model number
- serial number
- style/type
- system
- size (e.g., pipe size, flow, critical velocity, etc.)
- pressure rating

- temperature rating
- material
- operator type (if applicable)
- orientation
- other (e.g., locking devices, extensions, etc.)

Electrical Components

- component number
- drawing number (e.g., schematic, one-line diagram, etc.)
- manufacturer
- model number
- serial number
- component type
- power (watts)
- voltage (e.g., 125 DC, 4KV AC, etc.)
- amperage
- contact rating
- other (e.g., environmental qualification, fuse type, location, etc.)

Instrumentation and Control Components

- component number
- drawing number
- manufacturer
- model number
- serial number
- style/type
- range
- input (e.g., psi, milliamperes, inches, H_20, etc.)
- output
- pressure rating
- power
- voltage (if applicable)
- amperage (if applicable)
- other

Methodology. The following generic CM walkdown procedure incorporates good practices and successful features of numerous configuration management walkdown efforts performed throughout the industry. By design, it is conceptual and not facility-specific but will provide general guidance and a basic foundation from which to develop a detailed configuration management component walkdown program. For significant walkdown efforts, pilot walkdown programs may be useful in refining the walkdown methodology.

CONFIGURATION MANAGEMENT
GENERIC WALKDOWN PROCEDURE

CONTENTS

1.0 PURPOSE.

This procedure describes the responsibilities and steps necessary to perform walkdowns for the purpose of establishing the as-found physical configuration of the facility, and identifying any discrepancies with the associated facility documentation.

2.0 OBJECTIVES.

The objectives of the CM walkdowns are to:

- Establish the as-found physical configuration of the facility
- Identify any discrepancies between the as-found configuration and associated facility documentation

3.0 SCOPE.

This document applies to all formal efforts by facility and contractor personnel to reconstruct missing data or field verify existing Equipment Database information through walkdowns on mechanical, electrical, and instrumentation and control (I&C) systems. This will be accomplished by performing the walkdowns on a system-by-system basis to identify the as-found physical configuration and to obtain missing nameplate data for inclusion into the CM Equipment Database.

4.0 REFERENCES.

The following are examples of relevant types of documents that should be identified and referenced In support of this walkdown effort:

- Drawings (e.g., P&IDS, schematics, location drawings, vendor drawings, etc.)
- Operations Procedures (e.g., system startup, system operations, etc.)
- QA Procedures (e.g., non-conformance items, field deviation notices, drawing change notices, independent verification, etc.)
- Equipment Database Procedures
- Engineering Procedures
- Maintenance Procedures (e.g., work request, scaffold erection, etc.)
- Security and Safeguard Procedures
- Radiation Protection Procedures (if applicable)
- Special Requirements covering EQ, fire protection, etc.
- Safety Analysis Report

5.0 KEY DEFINITIONS.

- Walkdown: A visual inspection of facility SSCs to identify the as-found physical configuration and any discrepancies with currently approved facility documentation.

- Nameplate: The plate or label attached to a component by the manufacturer to provide applicable component identification and design data, such as temperature, pressure, flow etc.

- Walkdown team: Personnel responsible for gathering information during the walkdown, and for verifying and documenting the accuracy and completeness of this information. For this effort, each walkdown team should consist of at least two qualified personnel.

- Second Party Verification: Verification of the data gathered during the walkdown by a second member of the walkdown team. Periodic sampling by QA/QC may also be performed, as appropriate.

- Component Configuration Data (CCD) sheets: The method used for documenting both the component nameplate data and the independent verification. The CCD sheets will also be the mechanism for identifying missing nameplates or for transferring acquired data into the equipment database. Attachment A provides an example CCD.

- Configuration Management Equipment Database: The computerized database that contains facility component information such as the design requirements, manufacturer's identification numbers, etc.

- Piping and Instrument Diagram (P&ID): A drawing which graphically displays the process for each facility system and depicts the relevant components within each system. The P&ID also shows the functional relationship between components (e.g., first a pump, followed by an isolation valve, then a tank, etc).

6.0 PRECAUTIONS AND LIMITATIONS.

- At nuclear facilities, a radiation work permit (RWP) is required for each walkdown performed inside the radiation controlled area and shall be obtained in accordance with the applicable facility procedures.

- All relevant facility safety practices shall be in effect and shall be followed, as appropriate (e.g., use of hard hats, ear protection, eye protection, scaffolding erection, chemical hazard protection, etc). Minimal risk to personal safety will be exercised in obtaining walkdown information; if in doubt, ask for assistance.

- Components shall not be operated, disassembled, or affected in any way, except by authorized personnel (e.g., walkdown personnel can not change a valve position, open an energized cabinet, turn a switch, etc).

- The Operations Department shall be notified and authorization obtained (e.g., from the shift supervisor, wing supervisor, or other operation's manager on shift) prior to conducting a walkdown of each system.

7.0 RESPONSIBILITIES.

- The walkdown teams are responsible for:

  - conducting the walkdowns in accordance with this document and other relevant facility procedures; collecting nameplate data;

  - assuring the accuracy and completeness of the data;

  - performing second party verification of this data; documenting this verification; and

  - providing the completed CCD sheets to the Walkdown Coordinator for review and further processing.

- The Configuration Management Coordinator is responsible for:

  - selecting the walkdown teams and ensuring that team members have appropriate background experience and training to be qualified to perform their role in walkdowns;

  - supervising the activities of the walkdown teams;

  - reviewing and approving the CCD sheets for completeness;

  - transmitting completed and approved CCD sheets to the Equipment Database coordinator for inclusion into the Equipment Database; and

  - initiating any follow up actions (e.g., work requests, re-walkdowns, drawing change notices, NCRS, etc.). to resolve discrepancies, including soliciting approval from the design authority

- The Equipment Database coordinator is responsible for:

  - obtaining the CCDs from the Configuration Management Coordinator, and incorporating this data into the Equipment Database; and

  - providing the Configuration Management Coordinator with a printout for any components within a system that have not been field verified after the system walkdown has been completed. The objectives are to ensure that a component has not been missed during the walkdown and that the CCD sheets have been properly submitted and the information included in the Equipment Database.

- The QA/QC group is responsible for:

  - reviewing the methodology and procedures used to field verify component data;

  - periodically inspecting the walkdown work in progress to ensure that it conforms to the approved procedures and that an acceptable level of accuracy is achieved;

  - identifying and tracking to completion QA/QC discrepancies; and

  - working with the Configuration Management Coordinator and walkdown teams to resolve any identified deficiencies.

8.0 INSTRUCTIONAL GUIDANCE.

- All individuals associated with the component as-bulk configuration walkdown effort will be trained on this procedure prior to conducting the verification walkdowns.

- Each walkdown team will consist of at least two individuals experienced in the use of applicable drawings (e.g., P&IDS, electrical single-line drawings and schematics, etc.). Prior to each walkdown, the walkdown team will obtain and use the latest approved revisions of the applicable drawings from the master file maintained by the Document Control Group.

- The major steps to be followed by each CM walkdown team member are as follows:

  a. Prior to each walkdown, meet with the Configuration Management Coordinator to discuss which system(s) or portions of systems are scheduled for a walkdown.

  b. Obtain the appropriate drawings, a copy of this procedure, and an adequate number of blank CCD sheets.

  c. Contact the Operations Department and obtain authorization from the operations supervisor on shift to conduct a walkdown of the scheduled system(s).

  d. Consistent with the appropriate Radiation Protection procedures, determine and comply with the Radiation Work Permit (RWP) requirements for the area(s) scheduled for a walkdown.

  e. Upon entering the area, comply with the necessary safety requirements (e.g., ear protection, hard hats, etc.) and determine the need for special access equipment (such as ladders, scaffolding, etc.) as soon as practical; follow proper facility procedures for acquiring and using this equipment.

     CAUTION: Do not step on cable trays, insulated pipe, hand wheels, cantilevered valves, operating equipment, or anything that may be damaged or could cause harm.

  f. Conduct walkdowns of the identified system(s) or portions of systems to verify as-built configuration by gathering component nameplate data and documenting this data on the CCD sheets. Copies of the CCD sheets are included as Attachment A to this procedure.

     NOTE: One or more of the team members may gather this data; however, care should be taken to insure some degree of independence (i.e., at least one member should be designated as the "first" party and a second member designated as the "second" party (independent) verifier for each component).

  g. During the walkdowns, check the accuracy of the P&IDs to ensure that the functional relationships are correctly represented and that all components are accurately depicted. Annotate the drawings, as appropriate, to show the as-found configuration and retain the original for review and processing.

  h. Perform the second party verfification of the component nameplate data and P&ID. Both the first party and the second party verifier will sign the completed CCD street and P&ID, as appropriate.

     NOTE: The objective of the second party verification is to ensure, by direct observation, that the correct data is obtained. For example, if a valve is located overhead and access to the component nameplate is by ladder, both team members will climb the ladder to verify the information. Only one person going up and calling down to the other is not considered a second party, independent verification and is therefore unacceptable for the purposes of this step.

  i. During the walkdowns, general facility material and housekeeping conditions should also be observed and any irregularities or unusual conditions should be reported in the comments/remarks section of the CCD. Examples of what to look for are as follows:

- Obvious physical damage to equipment
- Missing or illegible tags
- Loose, bent, or missing supports and/or anchors
- Valve packing glands "bottomed out" or unsymmetrical
- Leaks e.g., water, oil, steam, etc.
- Missing, bent, or broken valve handwheels
- Missing or loose cover plates
- Gagged relief valves
- Unterminated cables showing bare wire
- Missing fuses
- Unauthorized temporary modifications
- Debris

j. If the documentation becomes contaminated, the information can be transferred to non-contaminated documents and verified accurate, by signature and date, by both first party and second party personnel. The contaminated documents may then be destroyed.

k. Record the progress of the walkdown by highlighting the applicable drawings. These highlighted drawings, along with the completed CCDs should be given to the CM Coordinator at the end of each day to keep him updated on the progress of' the walkdown effort.

l. The Configuration Management Coordinator shall:

- Review the completed CCD sheets and, if approved, make copies and transmit the copies to the Equipment Database coordinator for inclusion into the database. If not approved, the Configuration Management Coordinator will take whatever action is necessary to resolve the problem(s);

- Review the annotated P&IDs and submit document change notices, as required; and

- Handle the completed CCDs and associated documentation as QA records and ensure that they are maintained in controlled files for a retention period consistent with standard facility document control/records management procedures.

ATTACHMENT A

COMPONENT CONFIGURATION DATA SHEET
"SAMPLE"

VALVES

Drawing Number_____

Plant_____ Unit Number_____

Component Number_____ System_____

Manufacturer_____ Style/Type_____

Model Number_____ Serial Number_____

Pipe Size_____ Cv_____

Pressure_____ Temperature_____

Material_____ Operator Type_____

Remarks/Comments:_____

Collected by (first party)_____ Date_____

Verified by (second party)_____ Date_____

Approved by (CM Coordinator)_____ Date_____

APPENDIX II–D

CONTENT OF DESIGN INFORMATION SUMMARIES

There are many different design information summary (DIS) formats that adequately present the needed information. This appendix presents an acceptable format and discussion that may be useful in establishing facility-specific DIS formats. This appendix also discusses DIS benefits.

The following discussion focuses on a system DIS. Format and content for a topical DIS can be developed using this general guidance. The following general format could be adopted for a system

DIS:

- System Description
- Operability Requirements
- System Design Requirements
- System Design Basis
- Component Requirements and Basis
- Design Topics
- Additional Information

This format captures the recommended DIS contents and organizes them into a user-friendly format. This format has the fundamental attribute of starting with basic and going into increasing levels of detail. Component-level design considerations are separated from system-level design considerations. Certain design topics (such as operations, maintenance, and testing requirements) are separated from other design considerations to provide focused attention for the end-users.

DISs should use the matrix approach, which makes significant use of text material but references key supporting design process documents. The text includes system descriptions and drawings, operability requirements, system functions, component information, system and component design basis, regulatory requirements, and DOE commitments. Referenced documents should include calculations and analyses, codes and standards, design practices, procurement specifications, and TSR. It is unnecessary to duplicate the content of other self-contained documents such as ASME code stress reports, environmental qualification data packages, vendor manuals, operations and maintenance procedures, industry codes and standards, specifications, generic regulatory requirements, and calculations.

The following discussion provides the information that should be included in each DIS section. The type of information included in the DIS should be directly related to specific user needs in support of the overall program objective. DISs are written for a variety of users and experience levels. DIS users will range from operations, maintenance, testing, procurement, training, and QA personnel to design engineers. DISs should be tailored to meet individual facility needs and constraints, making use of existing programs and results.

SYSTEM DESCRIPTION

This information provides general background and introduction regarding the DIS's subject. To avoid reliance on current experience levels, DISs should be written for a hypothetical 3-year engineer. Such an engineer (or scientist) would have a general facility background, would know the facility layout, and would know the general actions the system needs to perform. The descriptive information for a system DIS could be presented in the following DIS sections:

- System Description. A narrative discussion of the system configuration. A general discussion of system location and boundaries (with drawings). General narrative of functional and operational requirements for the various plant modes and operating conditions.

- System Boundaries. A detailed discussion of system boundaries and how they, were established. Reference location or listing of complete scope of system SSCs.

- System Interfaces. A listing or narrative description of interfacing systems that are necessary for the subject system to perform its function. A description of functional requirements necessary from support systems. Typical support systems include electrical distribution systems, instrument air systems, HVAC systems, component cooling water systems, lube oil systems, etc.

- System Classification. A discussion of applicable CM system grade (i.e., safety, environmental, mission, or other). Identification of principal functions or requirements that established the system grade. In addition, identification of basis for any other applicable system classifications used at the facility, such as quality classification, seismic classification, etc.

- System Issues. Discussion of any critical system issues that provide important perspective on the system design requirements or design basis. These may be major issues under study or investigation, code cases under review, positions under DOE review, or generic. issues under resolution.

OPERABILITY REQUIREMENTS

Provide a concise and complete statement of the operability requirements as specified by the TSR. Identity the SSCs necessary to satisfy these requirements. Specify the auxiliary and support systems required for operability.

This section is separated from other design requirements both to emphasize its importance and for easy reference. This section will likely be used to assist operability determinations and to ensure that new designs maintain these top-level requirements. The Operating Organization is an important end-user of this section.

SYSTEM DESIGN REQUIREMENTS

Always identify design requirements by type: safety requirements, environmental requirements, mission requirements, and others. The design requirement information for a system DIS could be presented in the following DIS sections:

- Functional and Performance Requirements. A listing or narrative description of the system process requirements. This may include the following:

  - System flows, pressures, heat loads, thermal power ratings, operating temperatures etc.;

  - Special system design considerations such as net positive suction head requirements;

  - Facility transients and accidents the system supports and how the availability of the system is ensured;

  - A brief description of environmental limitations on system operation, such as normal radiation fields and possible post-accident conditions;

  - Key instrumentation and control requirements to provide remote shutdown capability and enable local monitoring of process activities and

  - System performance characteristics under various normal and infrequent operating modes and off-normal operating conditions (examples include system head-flow characteristic curves, natural circulation performance curves, and system hydraulic profile).

- System Setpoints. Listing of important system setpoints with reference to design basis.

- System Instrumentation and Alarms. Description of the requirements for instrumentation and controls to ensure proper function and performance of the system. Description of alarm capabilities.

- System Interlocks. Descriptive information on interlocks with interfacing systems, the logic at the interlock, and reference to logic diagram and bases of interlock.

SYSTEM DESIGN BASIS

The design basis information for a system DIS could be presented in the following DIS sections:

- Authorization Basis. This DIS section describes those aspects of the design basis relied on by DOE to authorize operation. The authorization basis is described in documents such as the facility Safety Analysis Report and other safety analyses, hazard classification documents, Technical Safety Requirements, DOE-issued Safety Evaluation Reports, and facility-specific commitments made in order to satisfy DOE Orders or policies. This section may include discussions of the applicable accident scenarios that require the system to operate and the design inputs that need to be met. List any commitments to DOE.

- Design Inputs. List important design inputs with emphasis on codes and standards. Identify the original bases codes and standards (including year and addenda) adopted that specifically apply to the DIS as a whole. Identify NRC and commercial nuclear codes and standards adopted. List applicable DOE Orders, rules, and standards. Identify any exceptions to requirements that are reflected in the design. The applicable codes and standards should be listed along with a reference to the commitment to DOE. Identify whether the codes are optional or required (committed). Any exceptions to, or interpretations of, these requirements that are applicable to the current facility design are provided.

- Design Constraints. List and/or reference applicable system design constraints, including design procedures, methods, and guidelines.

- Design Analysis and Calculations. List and/or reference applicable system design analysis and calculations.

COMPONENT REQUIREMENTS AND BASIS

Major components often merit being addressed separately and uniquely. A separate DIS section on component information addresses important component design information without breaking the flow of system-level design information. Identify major system components. Identify important classes of components within the system, such as motor-operated valves. Provide component-level design

requirements such as capacity, reliability, limits, and settings. Component information such as seismic qualification and equipment environmental qualification would be included here if not in a separate topical DIS. Include or reference component design basis.

Discussion may include the following:

- A description of each major component
- Required functions
- Design basis
- A discussion of operating modes and the role of the component in the system
- A discussion of how the installed component configuration satisfies the system design basis

DESIGN TOPICS

These topics are separated from previous discussion for the benefit of the end-user. Selection of these or other topics may be based on an analysis of user needs. Topics that are not separated would be included in the previous sections. Both design requirements and design basis would be provided, with emphasis on the design requirements. It may be appropriate to reference some basis material. The following design topics for a system DIS could be presented:

- Applicable Topical Areas. This section would reference applicable topical DISs and discuss the scope covered by the topical DIS. Design requirements and design basis covered in topical DISs do not have to be covered in the system DIS. The system DIS would provide a pointer to the applicable topical DISs.

- External Hazards. Discussion of the applicability of certain external hazards to the system may be presented. Alternatively, reference discussion provided in topical DISs, such as environmental qualification requirements, seismic requirements, fire protection requirements, and hazards protection requirements (including flood protection, missile protection, tornado protection, lightning protection etc.).

- Structural Requirements. Discussion of the requirements for seismic, wind, thermal, water, and any other static and dynamic load condition (including accidents), stress, shock, and reaction forces. Equipment foundations and major components (e.g., tanks, pumps, heat exchangers, ducts, and duct supports) may be discussed.

- Operational Requirements. Description of specific operational requirements established in the design process, such as acceptable operating modes, required operating ranges and limits, special operational actions to be taken in the event of component failures or unusual operating conditions (such as severe weather), special system interlocks requirements, and key operational considerations for equipment and personnel protection.

- Maintenance Requirements. Description of specific maintenance requirements established in the design process, such as periodic maintenance requirements, acceptable maintenance practices, preapproved part replacements, and maintenance ranges (e.g., switch setting ranges, torque ranges etc.).

- Special Material or System Chemistry Considerations. Discussion of any special materials used in the system or components and the basis for material selection. Any materials that are prohibited from use in the components/systems should be stipulated. In addition, any special system chemistry considerations should be defined and discussed in this section.

- In-service Inspection Requirements. Discussion of in-service inspection (ISI) and in-service testing (IST) as specified by Section XI of the ASME Code. These requirements should be summarized and the procedures that implement the specific ISI and IST requirements should be listed or referenced.

- Testing and Testability Requirements. Describe testing requirements established by design engineering. Describe unique system testing requirements that resulted in special system design features.

- Material Condition and Aging Management. Describe additional testing or operational measures specified by the MCA program. May include both those measures specified for life extension and other measures for general aging management.

ADDITIONAL INFORMATION

In addition to sections described above, the following provides information that may be useful in understanding existing configuration and evaluating proposed changes. The users and uses of the facility DISs may influence the selection and content of these sections. These sections are optional.

- Change History. Description of the design change history. The change history section is either a narrative or a listing of changes to the system since facility startup with an explanation of the need for each change. This information serves several purposes: (1) provides a ready source of rationale for past changes to systems, structure, and components; (2) aids the review process to ensure design basis and requirements are updated and design continuity is maintained; and (3) assists the process of root cause determination of operational problems.

- Design Margin. Design margin is the conservatism between the specified design requirement and the minimum requirement that could be developed from the design basis. This section could be presented as a table that shows the specified design requirement compared to the possible design requirement if margin was removed. It could be invaluable when evaluating operability concerns. In addition, this section could be a key input to the preparation of USQ safety reviews, since this information addresses the impact of changes on the margin of safety. However, this can be a difficult section to develop in that system sensitivity analyses, which would enable identifying component margins, may not have been performed. It is important not to identify margin that was added for calculational uncertainty as usable design margin. Identifying and documenting margins when specific design basis information is being developed, or as subsequent analyses are performed, could be a valuable reference.

- Summary of Critical Calculations. Summaries of the most important system calculations could be provided along with basic assumptions, calculational methods, relationship to other calculations, and general conclusions of calculations.

- Postulated Failures. Description of failure modes considered in the system design. It could include passive failures, such as pipe breaks, and active failures, such as failure of a valve to close or pump to start on demand. A discussion of the impacts of a postulated support system failure, (such as a valve repositioning on a loss of instrument air) could also be included. Facility events may lead to special tests or analyses that can be used as inputs to this section.

- Response to Transients. The specific response of the system could be described for facility transients and accidents.

GENERAL INFORMATION

DISs would typically include these general sections:

- Introduction. Provide overall document format and content. Describe intended purpose, uses, and users of document. Briefly describe DR process. Describe maintenance and control of document. Reference DIS User's Guide.

- Open Items. DISs might be issued without full resolution of open items and discrepancies identified during the information retrieval, evaluation, and validation. Provide a list of open items from the DR process, such as document conflicts, missing or inadequate documentation, unresolved issues of a specific or generic nature, and discrepancies found during field validation. State the process and schedule to complete resolution of any open items. Include a categorization or prioritization of items, if established. Periodically update open item lists until resolution is complete. This list is typically provided in an appendix or toward the back of the document.

- References. A list of the documents containing design basis information. These include calculations, analyses, engineering evaluations, correspondence, topical reports, vendor reports and evaluations, engineering safety evaluations, and other data.

- Tables/Figures/Appendices. Tables and figures may be utilized to list data. Tables and figures should be referenced to the appropriate section. Appendices or attachments may include detailed information that is not in the main body of the DIS.

- Miscellaneous. DISs typically include Cover Sheet, List of Effective Pages, Table of Contents, List of Figures, List of Tables, and other administrative pages or sections.

DIS BENEFITS

The primary benefits are derived from the actual reconstitution of the design requirements and design basis, rather than from formatting this information into DISs. Once the design information is reconstituted, it is made available through the CM equipment database. However, for facilities with limited databases, DISs serve as the primary source of equipment information.

The greatest benefit of an effective design reconstitution program may be the avoidance of facility downtime (i.e., major shutdown for design basis reconstitution). The ability to identify and use existing design margins when problems arise is also important. DISs provide valuable design input information readily accessible for evaluation of future changes and facility modifications.

The importance of design basis lies in the evaluation of changes -- either previous changes or proposed changes -- including the evaluation of system/equipment degradation. If a change is not being evaluated or if the design requirements are valid and known, the need to understand the design basis would be minimal. In these instances the design basis could be developed in conjunction with proposed changes or the evaluation of changes that impact the design requirements. However, if a prospective design change would also involve the redevelopment of extensive design information for the facility system involved, the cost of making that particular change might become prohibitive and, accordingly, the consequence could be the inability to make needed facility improvements.

The following lists (by primary organization) additional benefits and potential applications of DISs.

Engineering

- Conceptual design development and alternative considerations
- Design specification for in-house or contractor designers
- Calculations and analysis
- Bases for technical reviews, safety reviews, and USQ evaluations
- Independent design verifications
- Procurement specifications
- Identification of information and documents affected by changes
- Installation specifications
- Installation and functional testing requirements and acceptance criteria
- Field change request evaluations
- Evaluations of operational events and nonconforming conditions
- Justifications for continued operation (JCOs)
- Selection and review of equipment performance surveillance data
- Bases for operations, maintenance, and surveillance procedures review
- Evaluation of material substitution, spare parts equivalency, and materials upgrades
- Temporary modification reviews

Operations

- Abnormal event assessment
- Reportability determinations
- Operability determinations
- Bases for unusual system alignment (e.g., for maintenance or testing) assessments
- Selection and review of component and system performance data
- Addressing non-proceduralized events
- Operator aids and training material development
- Operations procedures development and review

Maintenance

- Post-maintenance test requirements and acceptance criteria
- Procedure and work instruction preparation and review
- Assessment of material condition requirements

Training

- Bases for lesson plans and training materials
- Simulator fidelity

Other

- SAR validation, analyses, and changes
- TSR review and changes
- Performing technical audits
- Life extension
- Probabilistic Risk Assessments
- Margin Management

CONCLUDING MATERIAL

Review Activities:

DOE
DP
EH
EM
NE
NS
RW
ER
CE
AD
PR
FE
OE
SA

National Laboratories
ANL
BNL
LBL
LLNL
METC
LANL
PNL
Sandia

Field Offices
AL
CH
ID
NV
OR
RL
SR
SF
Fernald

Area Offices
Amarillo
Brookhaven
Kansas City
Kirtland
Golden
Princeton
Rocky Flats

Preparing Actlvity:

DOE–EH–63

Project Number

CMAN–0001