




**Implementation of the Seismic Design  
Criteria of DOE-STD-1189-2008, Appendix A  
*Safety System Design Criteria*  
(Project Hanford Management Contract)**

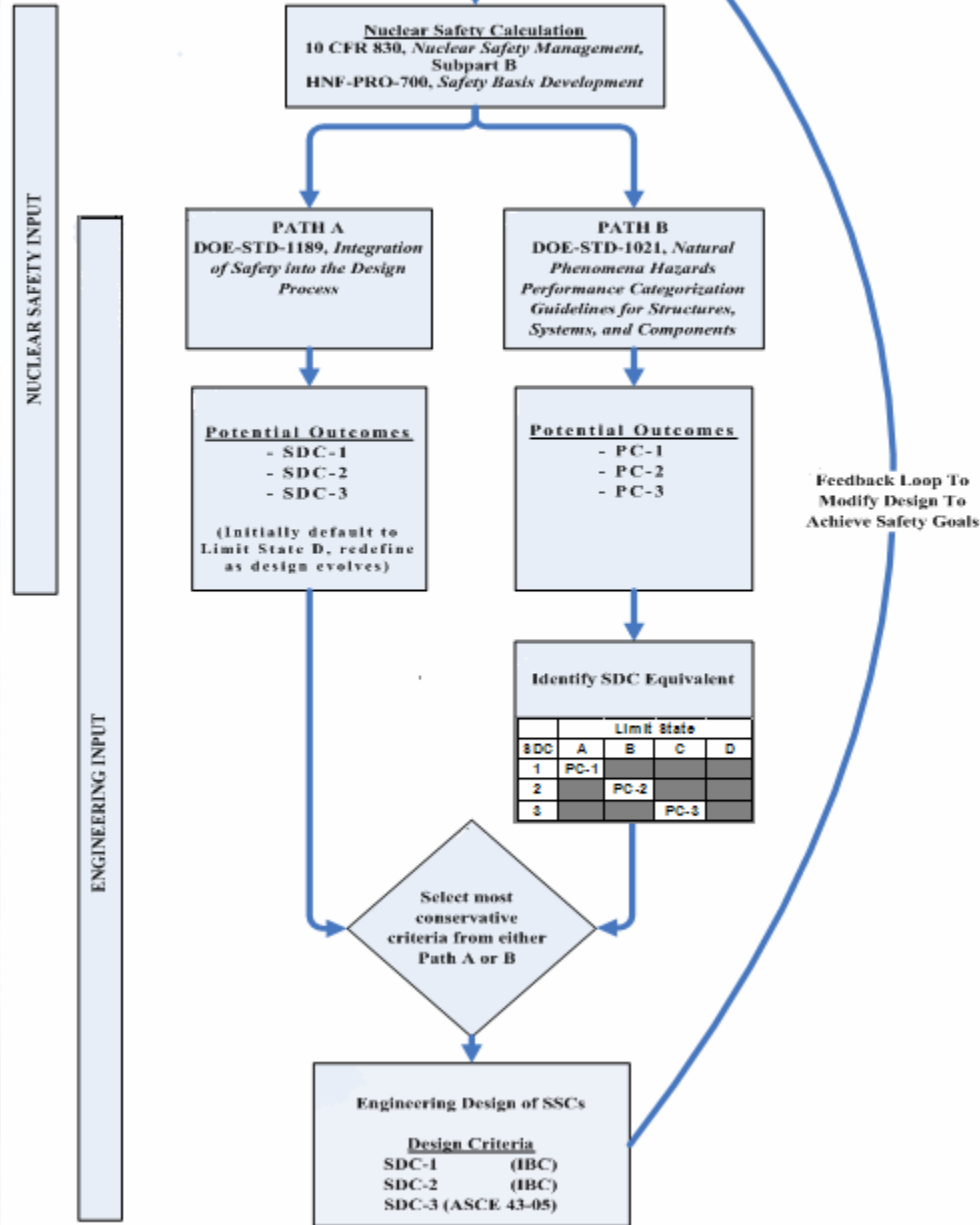
**S. A. Fargo  
Fluor Hanford**

**May 2008**



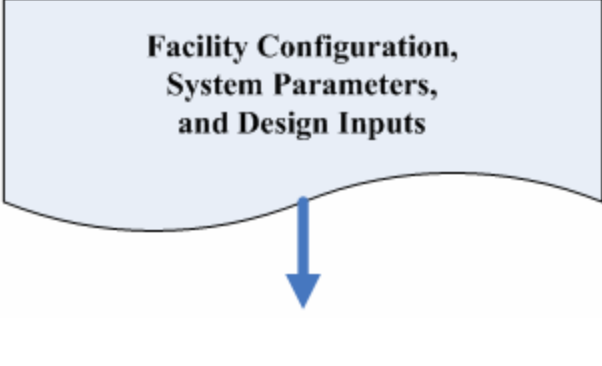
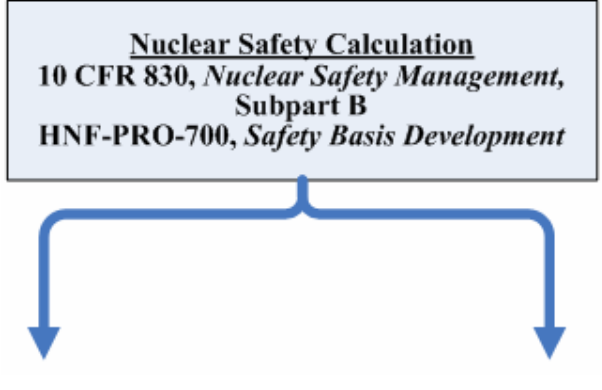
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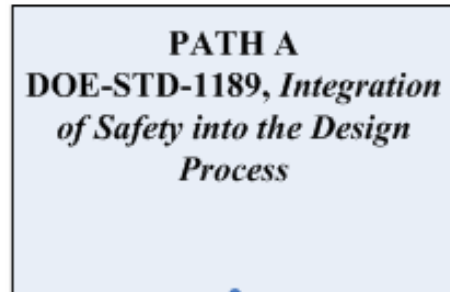
The following is a methodology for determining applicable and conservative seismic design requirements that consider both current Project Hanford Management Contract requirements and those specified in DOE-STD-1189, Appendix A for the Sludge Treatment Project and M-91 Solid Waste Processing Facilities Project at the DOE Richland Operation Office (RL)



## Seismic Design Requirements Selection Methodology

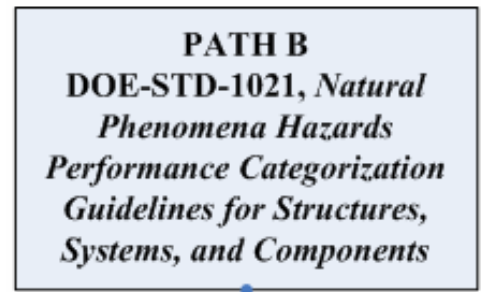
**Description of Seismic Methodology Elements and Technical Bases**

 <p><b>Facility Configuration, System Parameters, and Design Inputs</b></p>	<p>Develop hazard and accident analysis based on a review of existing documentation. This will include review of the facility general layout drawings; process and instrumentation diagrams; process flow sheets; electrical one-line diagrams; and a listing of material at risk by location.</p>
 <p><b><u>Nuclear Safety Calculation</u> 10 CFR 830, <i>Nuclear Safety Management</i>, Subpart B HNF-PRO-700, <i>Safety Basis Development</i></b></p>	<p>Scenario development and consequence calculations are performed in accordance with DOE-STD-3009, which provides a safe harbor methodology under 10 CFR 830, <i>Nuclear Safety Management</i>. Candidate engineered controls are classified as Safety Class or Safety Significant.</p>

A light blue rectangular box with a black border containing the text for Path A. A blue arrow points downwards from the bottom center of the box.

**PATH A**  
**DOE-STD-1189, *Integration of Safety into the Design Process***

The consequence calculation is modified as mandated by DOE-STD-1189, Appendix A, which specifies an alternate dispersion coefficient for the collocated worker.

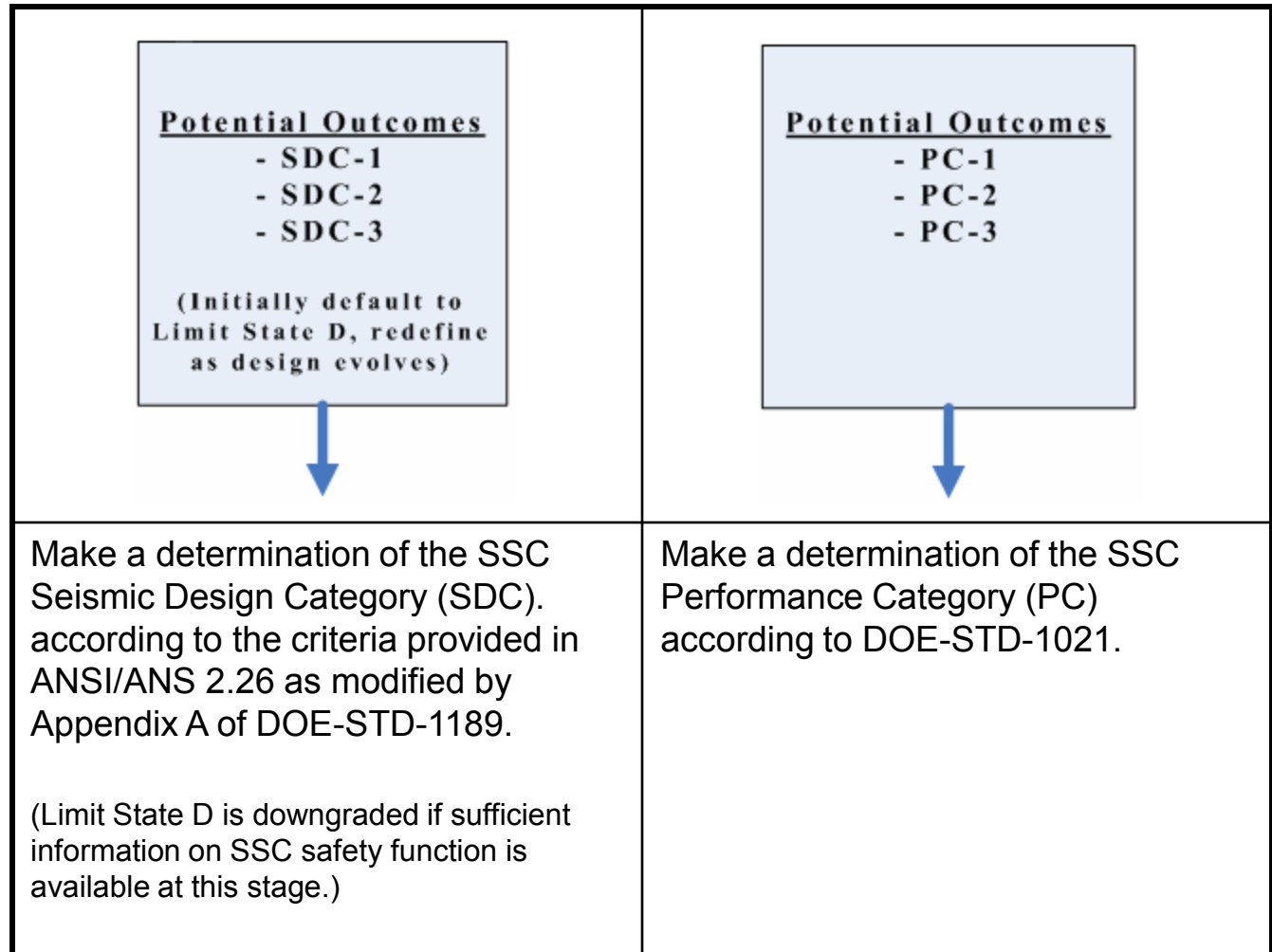
A light blue rectangular box with a black border containing the text for Path B. A blue arrow points downwards from the bottom center of the box.

**PATH B**  
**DOE-STD-1021, *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components***

Consequence calculations are used with DOE-STD-1021 guidelines to assign safety classification to candidate engineered controls in accordance with DOE-STD-3009.


### DOE-STD-1189-2008 Requirements for Categorization of SSCs

<b>Seismic Design Category</b>	<b>Collocated Worker</b>	<b>Public</b>
SDC-1	$D < 5 \text{ rem}$	N/A
SDC-2	$5 \text{ rem} < D < 100 \text{ rem}$	$5 \text{ rem} < D < 25 \text{ rem}$
SDC-3	$100 \text{ rem} < D$	$25 \text{ rem} < D$

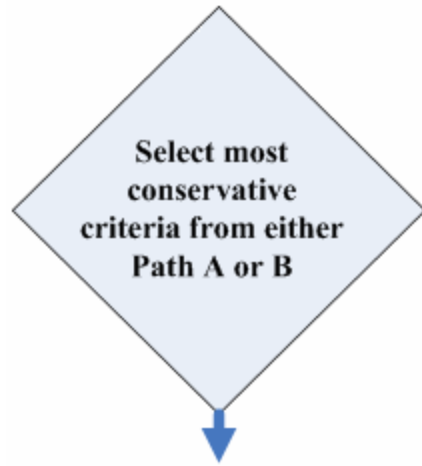


### Identify SDC Equivalent

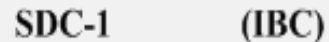
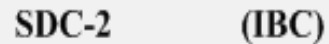
	Limit State			
SDC	A	B	C	D
1	PC-1			
2		PC-2		
3			PC-3	

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Results of the PC determination are compared with the SDC Equivalency chart as prepared by the DOE Seismic Design Implications Working Group



The more conservative SDC and associated Limit State is selected. This defines the SDC and associated Limit State for the SSC.

A title for a section, "Engineering Design of SSCs", centered within a light gray rectangular box with a thin black border.A sub-section header, "Design Criteria", centered within the same light gray box. The text is underlined.A line of text: "SDC-1 (IBC)", centered within the light gray box.A line of text: "SDC-2 (IBC)", centered within the light gray box.A line of text: "SDC-3 (ASCE 43-05)", centered within the light gray box.

The design for SDC-1 limit State A (General Service) and SDC-2 Limit State B (Safety Significant) SSCs will be in accordance with the IBC/ASCE 7-05. The design for SDC-3 (Safety Class or Safety Significant) SSCs will be in accordance with ASCE 43-05.

The design of SDC-3 Limit State C SSCs is equivalent to PC-3. However, SDC-3 Limit State D design is more conservative than PC-3.

The **Limit State** is the limiting acceptable deformation, displacement, or stress that an SSC may experience during or following an earthquake and still perform its safety function.

**Limit State C:** SSC may sustain minor permanent distortion but shall still perform its safety function with no post-earthquake repair required.

**Limit State D:** SSC shall maintain its elastic behavior and perform its safety function during and following an earthquake. Gaseous, particulate, and liquid confinement by SSCs is maintained.

**It should be noted** that for new facilities the cost difference of the design and construction for SDC-3 Limit State C versus D is minimal. However, qualifying an existing PC-3 facility to meet the SDC-3 Limit State D can be very costly and for many older structures not possible.

## Seismic Design Factors for Range of SDC and LS

SDC	LS-A	LS-B	LS-C	LS-D
	Short of collapse structurally stable	Moderate Permanent Deformation	Limited Permanent Deformation	Essentially Elastic
<b>1</b> ASCE 7-05	OC I or II ( $I=1.0$ ) $R_a=R$ (Equivalent to PC-1)	OC I or II ( $I=1.0$ ) $R_a=0.80R$ but $R_a \geq 1.0$	OC I or II ( $I=1.0$ ) $R_a=0.67R$ but $R_a \geq 1.0$	OC I or II ( $I=1.0$ ) Use $R_a=1.0$
<b>2</b> ASCE 7-05	OC III or IV <sup>1</sup> $R_a=R$	OC III or IV <sup>1</sup> $R_a=0.80R$ but $R_a \geq 1.0$ (Equivalent to PC-2)	OC III or IV <sup>1</sup> $R_a=0.67R$ but $R_a \geq 1.0$	OC III or IV <sup>1</sup> Use $R_a=1.0$
<b>3</b> ASCE 43-05	DF = (0.8-1.0) $F_{GM} = 1$ $F_{\mu}$ (Table 5-1)	DF = (0.8-1.0) $F_{GM} = 1$ $F_{\mu}$ (Table 5-1)	DF = 0.9 $F_{GM} = 1$ $F_{\mu}$ (Table 5-1) (Equivalent to PC-3)	DF = (0.8-1.0) $F_{GM} = 1$ $F_{\mu} = 1$

**SDC** = Seismic Design Category; **LS** = Limit State; **OC** = Occupational Category (Table 1-1, ASCE 7-5)

**I** = Importance Factor (Table 11.5-1, ASCE 7-5); **R** = Response Modification Coefficient (Tables 12.2-1 & 15.4-2, ASCE 7-05)

$R_a$  = Actual (reduced) design Response Modification Coefficient; **DF** = Design Factor (Table 2-1, ASCE 43-05);

$F_{\mu}$  = Inelastic Energy Absorption factor

**Note 1:** OC IV ( $I = 1.5$ ) shall be used if there is radiological release consequence of concern to the public or environment