

SEP 06 1989

MEMORANDUM FOR: Jose A. Calvo, Chief  
Technical Specifications Branch  
Division of Operational Events Assessment, NRR

FROM: David C. Fischer, Chief  
Special Projects Section  
Technical Specifications Branch

SUBJECT: MINUTES OF WORKSHOP ON 10 CFR 50.59

On August 16, 1989, the NRC staff met with NUMARC, EPRI, and other industry representatives to participate in a workshop on 10 CFR 50.59. The purpose of the workshop was to discuss the applicability of 10 CFR 50.59 and the NRC staff's interpretation of the phrases in 10 CFR 50.59 that define which changes, tests, and experiments involve an unreviewed safety question.

During the workshop, industry described NSAC-125, "Guidelines for 10 CFR 50.59 Safety Evaluations," an industry developed guidance document that discusses the process of performing safety reviews for facility changes, tests or experiments at nuclear power plants. Industry representatives also discussed the use of screening criteria to limit the 10 CFR 50.59 safety evaluation documentation process to activities consistent with the intent of 10 CFR 50.59.

In addition, a representative from Westinghouse gave participants a Nuclear Steam Supply System vendor's perspective of 10 CFR 50.59 and NSAC-125 and industry led a discussion of the terms, "consequences" and "margin of safety" as used in these documents.

Original Signed by  
David C. Fischer  
David C. Fischer, Chief  
Special Projects Section  
Technical Specifications Branch

Enclosures:  
List of Attendees  
NSAC-125  
Presentation slides

DISTRIBUTION:  
Please see attached

(50.59M.DOC)

NVG  
OTSB:DOEA:NRR  
NVGilles  
09/6/89

DCF  
OTSB:DOEA:NRR  
DCFischer  
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CJHaughney  
JLieberman  
BDLiaw  
JWRoe  
ELJordan  
CIGrimes  
WGKennedy  
MGMalsch

OTSB Members  
OTSB R/F  
DOEA R/F  
Regional Administrators  
NRC Participants

## MEETING ATTENDEES

<u>NAME</u>	<u>AFFILIATION</u>
J. H. Sniezek	NRR
J. A. Calvo	OTSB/DOEA/NRR
D. C. Fischer	OTSB/DOEA/NRR
N. V. Gilles	OTSB/DOEA/NRR
B. Clayton	OEDO/NRR
J. Norris	PDII-2/DRP/NRR
D. Brinkman	PDI-1/DRP/NRR
R. Hernan	PDI-4/DRP/NRR
D. Hickman	PDV/DRSP/NRR
A. Bournia	PDIV/DRSP/NRR
L. Kinter	PDII-1/DRSP/NRR
D. Pickett	PDIV/DRSP/NRR
P. J. Noonan	PDIV/DRSP/NRR
E. B. Tomlinson	PDIV/DRSP/NRR
D. L. Wigginton	PDIV/DRSP/NRR
W. A. Paulson	PDIV/DRSP/NRR
G. Klingler	ILPB/PMAS/NRR
E. Butcher	ILPB/PMAS/NRR
R. Pulsifer	PDIII-1/DRSP/NRR
R. Martin	PDI-2/DRP/NRR
E. Leeds	PDI-3/DRP/NRR
D. Hood	PDII-3/DRP/NRR
J. B. Hopkins	PDII-3/DRP/NRR
P. W. O'Connor	PDIV/DRSP/NRR
T. V. Wambach	PDIII-3/DRSP/NRR
K. N. Jabbour	PDII-3/DRP/NRR
G. C. Lainas	ADR2/NRR
C. Poslusny	PDIV/DRSP/NRR
B. Siegel	PDIII-2/DRSP/NRR
T. Alexion	PDIII-3/DRSP/NRR
T. M. Ross	PDIII-2/DRSP/NRR
L. Zerr	DRIS/NRR
S. A. Reynolds	PDV/DRSP/NRR
M. Fleishman	DRA/RES
J. Wing	PRAB/DREP/NRR
J. Stone	PDI-2/DRP/NRR
T. Reed	PDII-3/DRP/NRR
S. Hoffman	PDII-2/DRP/NRR
W. Hodges	SRXB/DEST/NRR
W. Troskoski	OE
C. J. Haughney	DOEA/NRR
D. Langford	PDI-1/DRP/NRR
F. Burrows	SELB/DEST/NRR
T. Colburn	PDIII-3/DRSP/NRR
G. Dick	PDIV/DRSP/NRR
E. Trottier	PDI-3/DRP/NRR
G. Vissing	PDI-4/DRP/NRR
T. O. Martin	Region III
J. Durr	Region I

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T. O. Martin	Region III
J. Durr	Region I

EPRI/NPD

## **BACKGROUND**

# **NSAC-125 GUIDELINES FOR 10CFR50.59 SAFETY EVALUATIONS**

**NRC Seminar  
August 16, 1989**

**W. B. Reuland**

NSAC

- **Chernobyl story**
- **Committee respect for the concerns facing the regions**
- **Originated as an educational, not enforcement tool**
- **Relationship to safety**

## **Use of Guidelines**

- **The Guidelines are designed to accomplish three things:**

- 1. Help the nuclear plant determine when 50.59 applies**

- 2. Help improve the the review process and documentation**

- 3. Help narrow the threshold definitions for unreviewed safety questions**

- **Guidelines are not likely to settle all differences of opinion**

- **The "S" word**

- **The need to test for reasonableness**

## **NSAC-105**

- **Basis for getting involved in 50.59**
- **Discusses the safety and control of design changes**
- **Used by many utilities, NRC and INPO**



## **1987 Draft**

- **Used process parameters as consequences**
- **Allowed for small increases over bounding SAR calculated values**
- **Margin of safety based on safety limits to failure**
- **Probabilities based on accident categories**
- **Approximately 40 industry comment letters**

## **1988 Draft**

- **Consequences confined to radiological**
- **Margin based on an acceptance limit identified as that value reviewed and approved by NRC**
- **Increased input from NSSS Vendors**
- **36 Industry Comment Letters**

## **4 NRC Mtgs**

- **First meeting with Jim Taylor and others led to agreement that NRC would give guidance to an industry initiative on 50.59**

- **Second meeting with Bill Russel provided further guidance and continuity following NRC reorganization**

- **Met with Sam Bryan committee June 1988 and discussed May 88 letter**

- **Met with Ernie Rossi-discussed draft of Dec 1988 and May 1989 NRC letter**

- **May 10, 1989 Letter to Tom Tipton**

- **June Letter to Ernie Rossi**

- **Workshop participation and conclusions**

TREATMENT OF UNREVIEWED SAFETY QUESTIONS  
IN PART 50.59 REVIEWS

PRESENTED BY

DAVID FISCHER  
TECHNICAL SPECIFICATIONS BRANCH  
DIVISION OF OPERATIONAL EVENTS ASSESSMENT  
OFFICE OF NUCLEAR REACTOR REGULATION  
U.S. NUCLEAR REGULATORY COMMISSION

10 CFR 50.59 GUIDELINES WORKSHOP

AUGUST 16, 1989

### SCOPE OF APPLICABILITY OF 10 CFR 50.59

- 10 CFR 50.71 REQUIRES THAT THE SAFETY ANALYSIS REPORT BE UPDATED
- THE UPDATED FSAR SHOULD BE CONSISTENT WITH THE LICENSING BASIS (NOT ALL ASPECTS OF THE LICENSING BASIS ARE TO BE INCORPORATED INTO THE FSAR)

### LICENSING BASIS DOCUMENTS

#### LICENSEE-GENERATED

- APPLICATION FOR AN OPERATING LICENSE
- FINAL SAFETY ANALYSIS REPORT (FSAR)
- RESPONSES TO NRC GENERIC LETTERS AND BULLETINS
- ENVIRONMENTAL REPORT
- OTHER (E.G., SECURITY PLAN, ANTITRUST REPORT)

#### NRC-GENERATED

- OPERATING LICENSE AND TECHNICAL SPECIFICATIONS
- SAFETY EVALUATION REPORT (SER) AND SUPPLEMENTS
- LICENSING BOARD, APPEAL BOARD AND COMMISSION DECISIONS
- ORDERS
- REGULATIONS
- SAFETY EVALUATIONS
- ENVIRONMENTAL ASSESSMENTS
- FINAL ENVIRONMENTAL STATEMENT

PROBABILITY OF AN ACCIDENT OR MALFUNCTION OF EQUIPMENT

- CHANGES THAT INVOLVE AN ACTUAL INCREASE IN PROBABILITY MUST GET PRIOR NRC APPROVAL
- REASONABLE ENGINEERING PRACTICES, ENGINEERING JUDGEMENT, AND PRA INSIGHTS (PLANT-SPECIFIC AND GENERIC) SHOULD BE USED AS APPROPRIATE
- EVALUATIONS SHOULD CONSIDER ACCIDENT SEQUENCES

CONSEQUENCES OF AN ACCIDENT OR MALFUNCTION OF EQUIPMENT

- ENDPOINT IN TERMS OF DOSE
  - ONSITE AND OFFSITE PERSONNEL
  - NOT OCCUPATIONAL EXPOSURE
- CHANGES THAT INVOLVE AN ACTUAL INCREASE IN CONSEQUENCES MUST GET PRIOR NRC APPROVAL
- LICENSING BASIS MUST BE EXAMINED TO DETERMINE ACCEPTANCE LIMIT

## MARGIN OF SAFETY

- CHANGES THAT INVOLVE AN ACTUAL REDUCTION IN MARGIN OF SAFETY MUST GET PRIOR NRC APPROVAL
- SHOULD BE EXPLICITLY DEFINED/ADDRESSED IN THE TECHNICAL SPECIFICATIONS BASES (IF NOT IN BASES THEN CONSULT LICENSING BASIS)
- IT MAY BE SUFFICIENT TO DETERMINE THE DIRECTION OF THE CHANGE IN MARGIN
- BASE DECISION ON PHYSICAL PARAMETERS OR CONDITIONS WHICH CAN BE OBSERVED OR CALCULATED
- THE KEY TO DEFINING THE MARGIN OF SAFETY IS IDENTIFYING THE ACCEPTANCE LIMIT AND CONDITIONS
- EXAMPLES OF BASES THAT EXPLICITLY ADDRESS MARGINS OF SAFETY
  - FUEL DESIGN LIMITS
  - REACTOR COOLANT SYSTEM DESIGN PRESSURE
  - PROVIDED CHANGES ARE MADE CONSISTENT WITH LICENSING BASIS (METHODS AND SPECIFIC ACCEPTANCE CONDITIONS, CRITERIA, LIMITS, ETC.)



PLANS AND SCHEDULES

GOAL: ESTABLISH A PROCESS THAT ENHANCES SAFETY REVIEWS

NUMARC/NSAC ISSUE GUIDANCE DOCUMENT (NSAC-125):	JUNE 1989
TRAIL PERIOD (APPROX. 6 MONTHS) TO GAIN EXPERIENCE WITH GUIDANCE DOCUMENT:	JULY 1989 TO JANUARY 1990
STAFF PLANS TO FORMALLY ENDORSE/ISSUE GUIDANCE:	JUNE 1990

**SCREENING FOR APPLICABILITY**

**FRANK LENTINE**

**COMMONWEALTH EDISON COMPANY**

## SCREENING FOR APPLICABILITY

### QUESTIONS TO ANSWER:

- WHAT IS THE "SAR"?
- WHAT IS A "CHANGE TO THE FACILITY AS DESCRIBED IN THE SAR"?
- WHAT ARE "CHANGES TO PROCEDURES AS DESCRIBED IN THE SAR"?
- WHAT ARE "TESTS OR EXPERIMENTS NOT DESCRIBED IN THE SAR"?

### PITFALLS TO AVOID:

- "SCREENING BY SAFETY CLASSIFICATION"
- "SCREENING BY UTILITY ADMINISTRATIVE PROCESS"

### SUCCESSFUL SCREENING EXAMPLE:

- PROCEDURE CHANGES

**10CFR50.59(A)(1) STATES THAT,**

**"THE HOLDER OF A LICENSE AUTHORIZING OPERATION OF A PRODUCTION OR UTILIZATION FACILITY MAY (I) MAKE CHANGES IN THE FACILITY AS DESCRIBED IN THE SAFETY ANALYSIS REPORT, (II) MAKE CHANGES IN THE PROCEDURES AS DESCRIBED IN THE SAFETY ANALYSIS REPORT AND (III) CONDUCT TESTS OR EXPERIMENTS NOT DESCRIBED IN THE SAFETY ANALYSIS REPORT, WITHOUT PRIOR COMMISSION APPROVAL, UNLESS THE PROPOSED CHANGE, TEST OR EXPERIMENT INVOLVES A CHANGE IN THE TECHNICAL SPECIFICATIONS INCORPORATED IN THE LICENSE OR AN UNREVIEWED SAFETY QUESTION."**

**(4.1)**

## QUESTIONS TO ANSWER

- WHAT IS THE "SAR"?
- WHAT IS A "CHANGE TO THE FACILITY AS DESCRIBED IN THE SAR"?
- WHAT ARE "CHANGES TO PROCEDURES AS DESCRIBED IN THE SAR"?
- WHAT ARE "TESTS OR EXPERIMENTS NOT DESCRIBED IN THE SAR"?

## WHAT IS THE "SAR"?

- THE "SAR" REFERRED TO IN 10CFR50.59 IS THE MOST RECENTLY UPDATED FSAR SUBMITTED BY THE LICENSE TO THE NRC AS REQUIRED BY 10CFR50.71(E). (3.2)
- 10CFR50.71(E) REQUIRES THAT THE FSAR BE REVISED TO INCLUDE THE EFFECTS OF CHANGES, SAFETY EVALUATIONS, AND ANALYSES OF NEW SAFETY ISSUES. (3.2)
- CHANGES THAT HAVE NOT YET BEEN INCLUDED IN AN FSAR UPDATE SHOULD BE CONSIDERED. (4.1.1)

WHAT IS A "CHANGE TO THE FACILITY AS DESCRIBED IN THE SAR"?

- 10CFR50.59 IS CONCERNED WITH CHANGES WHICH AFFECT THE DESIGN, FUNCTION, OR METHOD OF PERFORMING THE FUNCTION OF A STRUCTURE, SYSTEM, OR COMPONENT (SSC'S) DESCRIBED IN THE SAR BY TEXT OR DRAWING.
- CHANGES TO SSC'S NOT EXPLICITLY DESCRIBED IN THE SAR ARE INCLUDED IF THE CHANGE HAS THE POTENTIAL FOR AFFECTING THE FUNCTION OF SSC'S WHICH ARE EXPLICITLY DESCRIBED IN THE SAR.
- "CHANGES" DO NOT GENERALLY INCLUDE "MAINTENANCE"
- TEMPORARY ALTERATIONS ARE INCLUDED.
- CHANGING PLANT CONFIGURATIONS WHILE WORK IS IN PROGRESS (OR IF WORK IS LEFT UNCOMPLETED) MAY ALSO REQUIRE EVALUATION.

(4.1.1)

**WHAT ARE "CHANGES TO PROCEDURES AS DESCRIBED IN THE SAR"?**

- CHANGES TO PROCEDURES THAT ARE OUTLINED, SUMMARIZED, OR COMPLETELY DESCRIBED IN THE SAR MUST BE EVALUATED.
  
- CHANGES TO PROCEDURES THAT ARE SIMPLY LISTED IN THE SAR DO NOT REQUIRE EVALUATION.
  
- PROCEDURES CAN INCLUDE DESCRIPTIONS IN THE SAR THAT DEFINE ACTIVITIES OR CONTROLS OVER FUNCTIONS, PLANT CONFIGURATION, TASKS, REVIEWS, ETC.

(4.1.2)



WHAT ARE "TESTS OR EXPERIMENTS NOT DESCRIBED IN THE SAR"?

- 10CFR50.59 IS CONCERNED WITH TESTS THAT MIGHT AFFECT SAFE OPERATION OF THE PLANT BUT WERE NOT ANTICIPATED IN THE SAR.
- PREVIOUSLY EVALUATED TESTS DO NOT REQUIRE SAFETY EVALUATIONS EVERY TIME A TEST IS PERFORMED. EXAMPLES INCLUDE PREOPERATIONAL TESTS, STARTUP TESTS, AND PERIODIC SURVEILLANCE TESTS.
- ONE - OF - A KIND TESTS USED TO MEASURE THE EFFECTIVENESS OF NEW TECHNIQUES THAT CAN AFFECT SAFE OPERATION REQUIRE A SAFETY EVALUATION.
- POST-MODIFICATION TESTING SHOULD BE CONSIDERED IF AN ABNORMAL MODE OF OPERATION IS REQUIRED.

(4.1.3)

## PITFALLS TO AVOID

- "SCREENING BY SAFETY CLASSIFICATION"
  
- "SCREENING BY UTILITY ADMINISTRATIVE PROCESS"

"SCREENING BY SAFETY CLASSIFICATION"

- LIMITING THOSE ITEMS TO BE EVALUATED ON THE BASIS OF CLASSIFICATION SUCH AS IMPORTANT TO SAFETY OR SAFETY RELATED IS NOT CONSISTENT WITH 10CFR50.59  
(3.10)
- NON-SAFETY RELATED SYSTEMS ARE NOT EXCLUDED FROM THE SCOPE OF 10CFR50.59 (2).
- CERTAIN LOSSES OF NON-SAFETY RELATED SYSTEMS ARE INITIATORS IN SAR ACCIDENT ANALYSES. (2)
- CHANGES TO NON-SAFETY RELATED EQUIPMENT NOT DESCRIBED IN THE SAR CAN INDIRECTLY AFFECT THE ABILITY OF EQUIPMENT IMPORTANT TO SAFETY TO PERFORM ITS INTENDED FUNCTION.
- SEISMIC AND ENVIRONMENTAL QUALIFICATION, FLOOD AND FIRE PROTECTION, HIGH ENERGY LINE BREAK, AND MASONRY BLOCK WALLS ARE SOME OF THE AREAS IN WHICH CHANGES TO NON-SAFETY RELATED EQUIPMENT CAN AFFECT SAFETY.

(4.1.1)

"SCREENING BY UTILITY ADMINISTRATIVE PROCESS"

- UTILITIES EMPLOY A NUMBER OF DIFFERENT ADMINISTRATIVE MECHANISMS TO IMPLEMENT FACILITY CHANGES. EXAMPLES INCLUDE PLANT MODIFICATIONS, TEMPORARY ALTERATIONS, "MINOR MODIFICATIONS", "ENGINEERED WORK REQUESTS," AND FUEL RELOADS.
- THESE MECHANISMS OFTEN HAVE BEEN DEVELOPED BY DIFFERENT UTILITY DEPARTMENTS AT DIFFERENT POINTS IN TIME AND MAY CONTAIN CONFLICTING GUIDANCE REGARDING SAFETY EVALUATIONS.
- EACH MECHANISM THAT HAS THE POTENTIAL FOR CHANGING THE FACILITY AS DESCRIBED IN THE SAR SHOULD BE CHECKED TO ENSURE THE FOLLOWING:
  - 1) THAT IT INCLUDES CONSIDERATION OF THE NEED TO PERFORM A 50.59 SAFETY EVALUATION.
  - 2) THAT IT PROVIDE GUIDANCE FOR PERFORMING SAFETY EVALUATIONS THAT MEETS INDUSTRY AND NRC EXPECTATIONS.

SUCCESSFUL SCREENING EXAMPLE: PROCEDURE CHANGES

- FOR OLDER VINTAGE PLANTS, RELATIVELY FEW PROCEDURES ARE DESCRIBED IN THE SAR. HOWEVER, IN RESPONSE TO CHANGING EXPECTATIONS, THE NUMBER OF PROCEDURES IN USE AT THE PLANT HAS GREATLY INCREASED.
- THE COMPLETE LIST OF PROCEDURES IN USE AT THE PLANT CAN BE PRE-REVIEWED TO IDENTIFY CERTAIN PROCEDURES WHICH WILL NOT REQUIRE A SAFETY EVALUATION FOR EVERY CHANGE. EXAMPLES INCLUDE CERTAIN CHEMISTRY PROCEDURES, CERTAIN ADMINISTRATIVE PROCEDURES, ETC.
- THE TECHNICAL SPECIFICATIONS MAY CONTAIN A SEPARATE REQUIREMENT STATING WHICH PROCEDURES REQUIRE ON-SITE REVIEW.
- NSAC 105 PROVIDES ADDITIONAL GUIDANCE.

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**10CFR50.59 - THE REGULATORY CHALLENGE OF  
MANAGING CHANGE**

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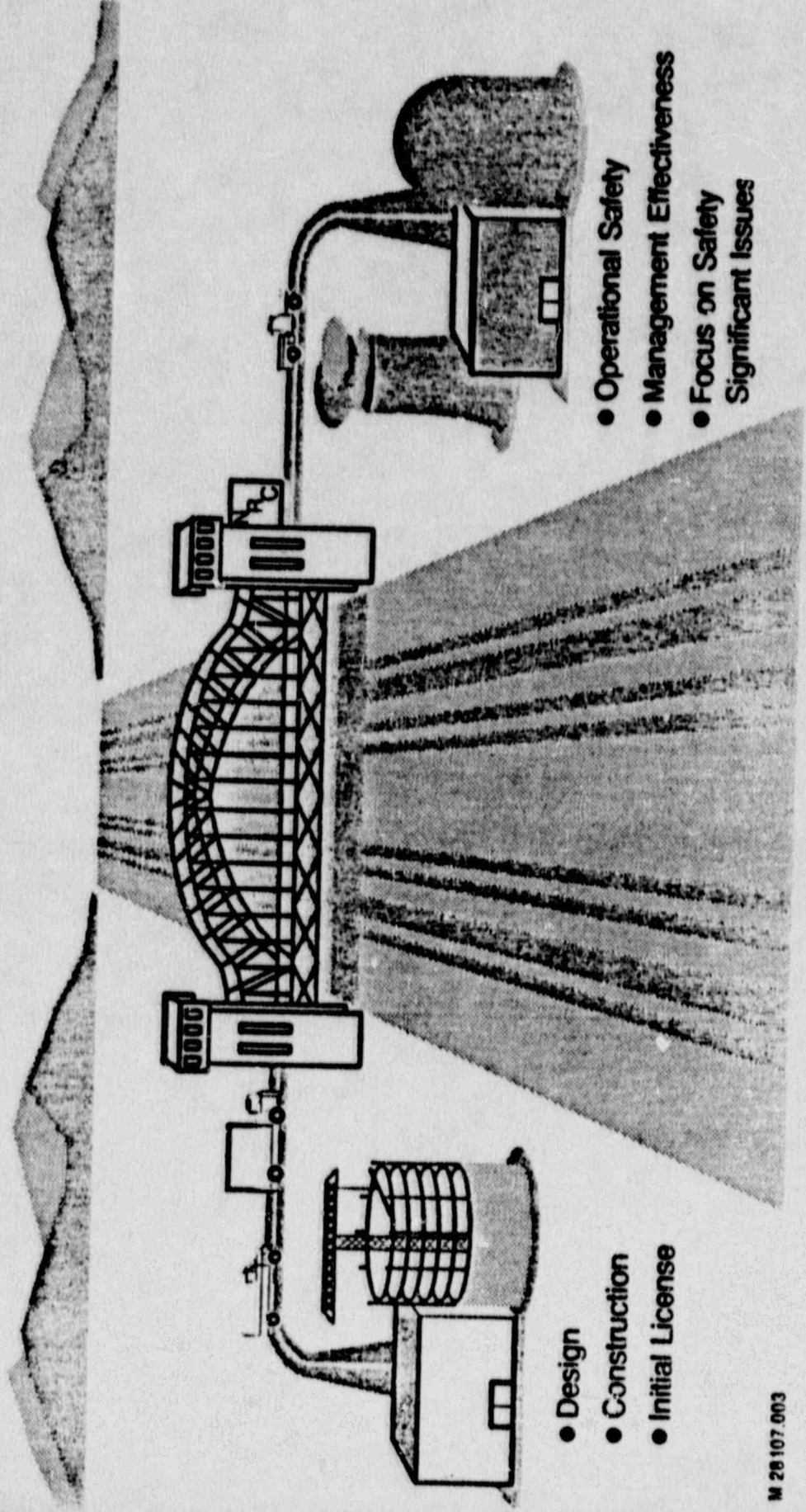
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**PAT LOFTUS  
WESTINGHOUSE**

# The Bridge to Operational Excellence

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- Design
- Construction
- Initial License

- Operational Safety
- Management Effectiveness
- Focus on Safety Significant Issues

# Industry Focus

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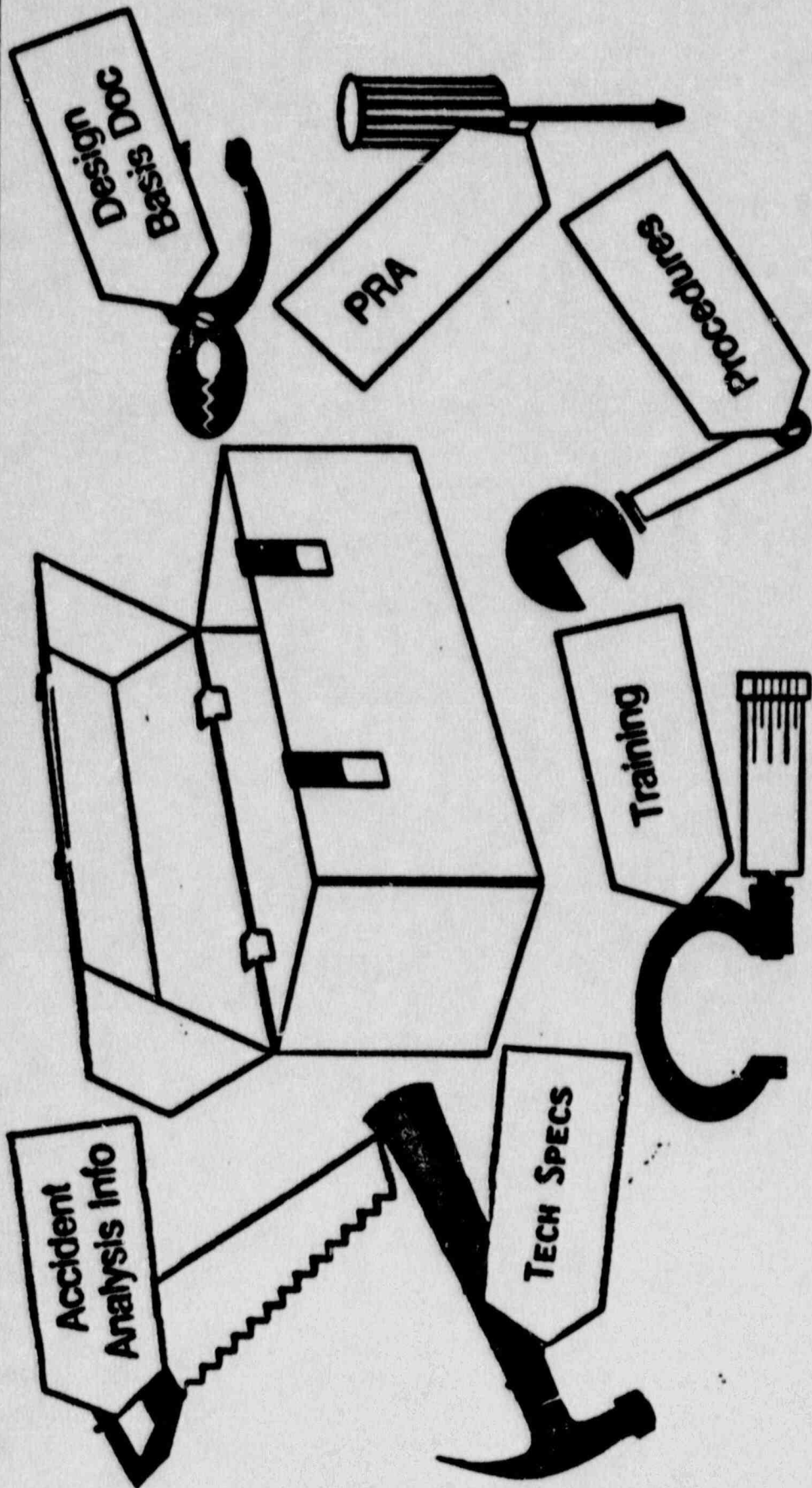
## 10CFR50.59 Safety Evaluation Quality



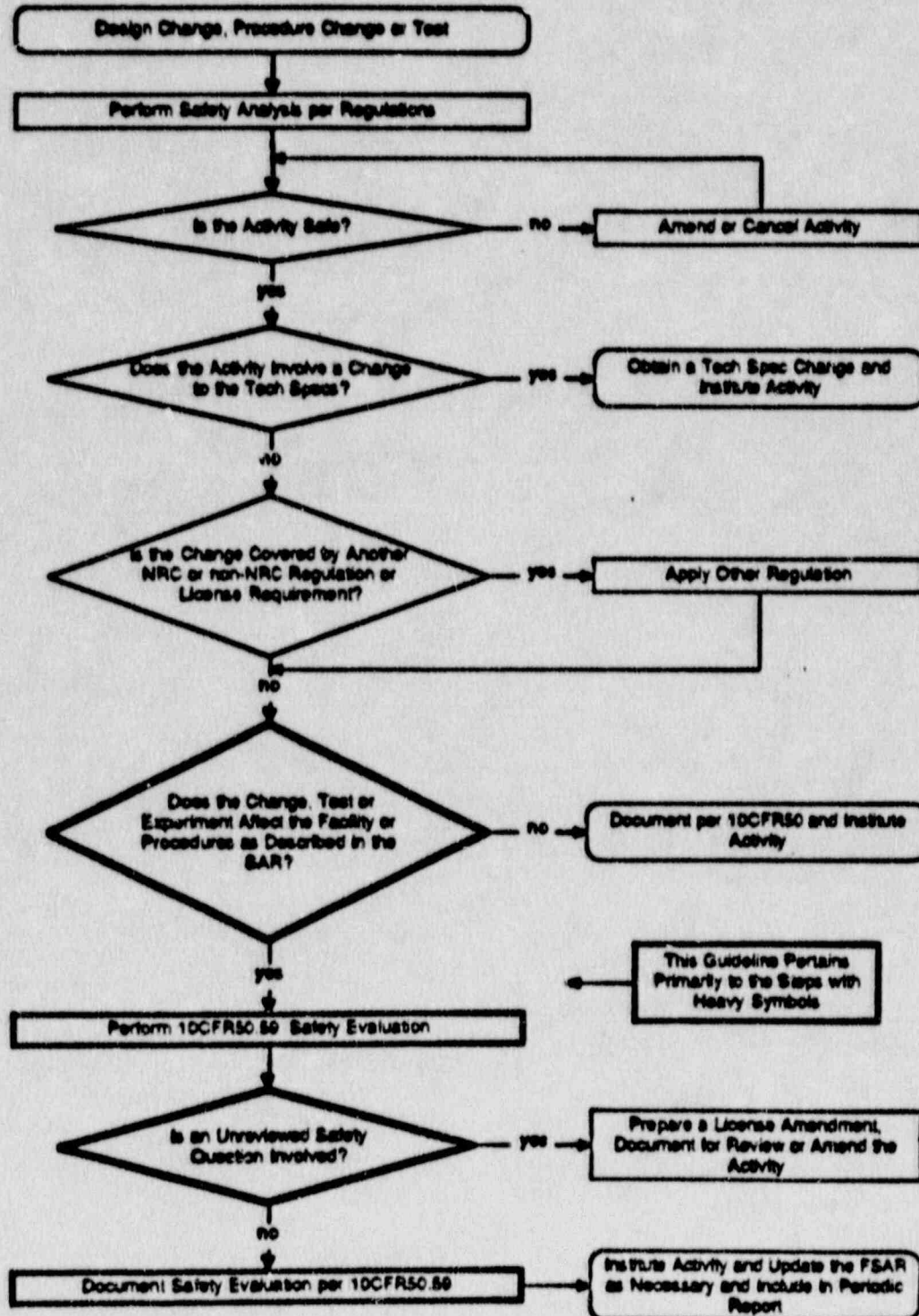
- NRC Inspections/Audits
- Industry Technical Specification Improvement Program Implementation
- NRC Focus on Operational Safety and Streamlined Licensing
  - Generic Letter 88-16
  - Fuel Licensing Criteria Documents
- NUMARC 10CFR50.59 Guidance
- Design Basis Reconstitution



# Tools to Manage Change



# SAFETY REVIEW PROCESS



# 10CFR50.59 GUIDANCE PRINCIPLES

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## • INTEGRATED APPROACH TO ASSURE COMPATABILITY / CONSISTENCY WITH REGULATIONS

Section	Analysis or Evaluation	Notification	Reporting	Record Keeping	Applying for Amendment
21	X	X	X	X	
50.9		X			
50.36	X	X	X	X	
50.59	X		X	X	X
50.71	X		X	X	
50.72	X	X	X		
50.73	X		X		
50.90	X				X

# **10CFR50.59 GUIDANCE PRINCIPLES (CONTINUED)**

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## **CONDITIONS/BASIS FOR ACCEPTANCE LIMITS**

- 1. WITHIN TECHNICAL SPECIFICATION LIMITS**
- 2. ACCEPTED METHODS**
- 3. SPECIFIC ACCEPTANCE CONDITIONS, CRITERIA, AND LIMITS ARE DEFINED (INCLUDING MODELS, TESTS, UNCERTAINTIES, PENALTIES, METHODOLOGY, ETC.)**
- 4. ANALYSIS PERFORMED CONSISTENT WITH #1 & #2 TO MEET #3**

# **10CFR50.59 GUIDANCE PRINCIPLES**

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## **ACCEPTANCE LIMIT CATEGORIES**

- 1. FOR CHANGES TO QUANTITATIVE ACCEPTANCE CRITERIA AND LIMITS, THE NRC HAS PREVIOUSLY GRANTED EITHER GENERIC OR CASE-SPECIFIC APPROVAL. THUS, PROVIDED THAT THE FOUR CONDITIONS ARE MET, THERE IS NO UNREVIEWED SAFETY QUESTION INVOLVED.**

# **10CFR50.59 GUIDANCE PRINCIPLES**

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## **ACCEPTANCE LIMIT CATEGORIES**

- 2. FOR CHANGES WHICH ARE COMPARED TO QUALITATIVE ACCEPTANCE CRITERIA OR LIMITS (E.G. WELL BELOW 10CFR100 GUIDELINES) IT MAY BE NECESSARY TO REQUEST PRIOR NRC REVIEW AND APPROVAL FOR ANY CHANGE IN A NON-CONSERVATIVE DIRECTION UNLESS THE NRC HAS GRANTED PRIOR APPROVAL ON EITHER A CASE-SPECIFIC OR GENERIC BASIS.**

# **10CFR50.59 GUIDANCE PRINCIPLES**

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## **ACCEPTANCE LIMIT CATEGORIES**

**SOME UTILITIES HAVE ESTABLISHED CRITERIA ACCEPTABLE TO THE NRC TO DEFINE WHAT CHANGES WOULD NOT INVOLVE AN UNREVIEWED SAFETY QUESTION.**

**IT SHOULD BE NOTED THAT PRIOR ACCEPTANCE ON ANOTHER DOCKET IS NOT GENERIC UNLESS THERE IS EXPLICIT NRC STATEMENTS TO THAT EFFECT.**

#### **15.4.8.1 RUPTURE OF A CONTROL ROD DRIVE MECHANISM HOUSING (ROD CLUSTER CONTROL ASSEMBLY EJECTION)**

**THE MECHANICAL FAILURE OF A CONTROL ROD MECHANISM PRESSURE HOUSING WOULD RESULT IN THE EJECTION OF A ROD CLUSTER CONTROL ASSEMBLY. FOR ASSEMBLIES INITIALLY INSERTED, THE CONSEQUENCES WOULD BE A RAPID REACTIVITY INSERTION, TOGETHER WITH AN ADVERSE CORE POWER DISTRIBUTION, POSSIBLY LEADING TO LOCALIZED FUEL ROD DAMAGE. ALTHOUGH MECHANICAL PROVISIONS MAKE THIS ACCIDENT EXTREMELY UNLIKELY, THE APPLICANT HAS ANALYZED THE CONSEQUENCES OF SUCH AN EVENT.**

**METHODS USED IN THE ANALYSIS ARE REPORTED IN WCAP-7588, REVISION 2, "AN EVALUATION OF THE ROD EJECTION ACCIDENT IN WESTINGHOUSE REACTORS USING SPATIAL KINETICS METHODS," WHICH HAS BEEN REVIEWED AND ACCEPTED BY THE STAFF IN A LETTER DATED AUGUST 28, 1973. THIS REPORT DEMONSTRATED THAT THE MODEL USED IN THE ACCIDENT ANALYSIS IS CONSERVATIVE RELATIVE TO A THREE-DIMENSIONAL KINETICS CALCULATION.**

**THE APPLICANT'S CRITERIA FOR GROSS DAMAGE OF FUEL ARE A MAXIMUM CLAD TEMPERATURE 2700°F AND AN ENERGY DEPOSITION OF 200 OR 225 CALORIES PER GRAM IN THE HOTTEST PELLET. THESE CRITERIA ARE MORE CONSERVATIVE\* THAN THOSE PROPOSED IN RG 1.77, "ASSUMPTIONS USED FOR EVALUATING A CONTROL ROD EJECTION ACCIDENT FOR PRESSURIZED WATER REACTOR." THEREFORE, THEY ARE ACCEPTABLE.**

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**\*RG 1.77 HAS AN ACCEPTANCE CRITERION OF 280 CALORIES PER GRAM ENERGY DEPOSITION AND NO CRITERION FOR CLAD TEMPERATURE OTHER THAN THAT IMPLICIT IN REQUIREMENTS FOR FUEL AND PRESSURE VESSEL DAMAGE.**



FOUR CASES WERE ANALYZED: BEGINNING-OF-CYCLE AT 102% AND ZERO POWER AND END-OF-CYCLE AT 102% AND ZERO POWER. THE HIGHEST CLAD TEMPERATURE, 2422<sup>0</sup>F, AND THE HIGHEST FUEL ENTHALPY, 179 CALORIES PER GRAM, WERE REACHED IN THE END-OF-CYCLE ZERO-POWER AND BEGINNING-OF-CYCLE FULL-POWER CASES, RESPECTIVELY. THE ANALYSIS ALSO SHOWS THAT LESS THAN 10% OF THE FUEL EXPERIENCES DNB AND LESS THAN 10% OF THE HOT PELLET MELTS. ANALYSES HAVE BEEN PERFORMED TO SHOW THAT THE PRESSURE SURGE PRODUCED BY THE ROD EJECTION IS MILD AND WILL NOT APPROACH THE RCS EMERGENCY LIMITS. FURTHER ANALYSES HAVE SHOWN THAT A CASCADE EFFECT (THE EJECTION OF A FURTHER ROD BECAUSE OF THE EJECTION OF THE FIRST ONE) IS NOT CREDIBLE.

THE STAFF CONCLUDES THAT THE ANALYSIS OF THE ROD EJECTION ACCIDENT IS ACCEPTABLE AND MEETS GDC 28.

# 10CFR50.59 GUIDANCE PRINCIPLES

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## DNBR

### CRITERION EXAMPLE

AN EXAMPLE IS PROVIDED BY THE DNBR CRITERION CHOSEN AS THE POINT BELOW WHICH CONFIDENCE IN CLADDING INTEGRITY IS DECREASED (ASSUMED TO BE 1.3 IN THIS EXAMPLE). IF IN THE SAR THE LICENSEE HAD CALCULATED A DNBR OF 1.9, AND THE NRC IN ITS SER HAD CONCLUDED THAT THIS VALUE WAS ACCEPTABLE "BECAUSE IT IS ABOVE 1.30," THE ACCEPTANCE LIMIT IS 1.3.

CHANGES IN MINIMUM DNBR SUCH AS FROM 2.0 TO 1.9 OR 1.35 TO 1.3 DO NOT REPRESENT A REDUCTION IN THE MARGIN OF SAFETY. ALL OF THE ABOVE CHANGES REFLECT AN EQUAL CONFIDENCE IN THE INTEGRITY OF THE FUEL CLADDING, IN THAT THE NEW VALUE IS ABOVE THE ACCEPTANCE LIMIT OF 1.3.

HOWEVER, IF THE SER SIMPLY STATES THAT A DNBR LIMIT OF 1.9 IS ACCEPTABLE WITHOUT PROVIDING ANOTHER LIMIT AS THE ACCEPTANCE LIMIT, 1.9 IS THE ACCEPTANCE LIMIT.

# 10CFR50.59

## GUIDANCE

### PRINCIPLES

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#### ● 10CFR100 GUIDELINES

FOR OTHER ACCIDENT ANALYSES, ACCEPTANCE CONDITIONS ARE BASED ON 10CFR100 DOSE GUIDELINES. TWO CASES SHOULD BE CONSIDERED:

- IF THE ACCEPTANCE LIMIT IS BASED ON AN UNSPECIFIED MARGIN TO THE PART 100 GUIDELINES AND NO SPECIFIC ACCEPTANCE CONDITIONS HAVE BEEN PRE-APPROVED, THE ACCEPTANCE LIMIT MAY BE DEFINED AS THE DOSE THAT WAS REPORTED IN THE SAR.
  
- IF THE ACCEPTANCE LIMIT IS BASED UPON MEETING SPECIFIC ACCEPTANCE CONDITIONS PRE-APPROVED BY THE NRC, AN INCREASE IN CALCULATED OFF-SITE DOSES RESULTING FROM A CHANGE, TEST OR EXPERIMENT DOES NOT REPRESENT AN INCREASE IN RADIOLOGICAL CONSEQUENCES AS LONG AS THE ACCEPTANCE LIMIT AND CORRESPONDING ACCEPTANCE CONDITIONS FOR THE ACCIDENT CONTINUE TO BE MET.

# 10CFR50.59 GUIDANCE PRINCIPLES

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## ● EXAMPLES

- A CHANGE THAT AFFECTS THE RADIOLOGICAL CONSEQUENCES OF A MAIN STEAMLINE BREAK WITH COINCIDENT IODINE SPIKE FOR THE PLANT.

THE NEW DOSE REMAINS WITHIN THE SRP 15.1.5 APPENDIX A CRITERION FOR THE PLANT (WHERE THE NRC HAS DEFINED "SMALL FRACTION OF 10CFR100 LIMIT" AS 30 REM THYROID AND 2.5 REM WHOLE BODY), THEN THE ACCEPTANCE LIMIT IS STILL MET.

- WHERE A CHANGE IN CONSEQUENCES IS SO SMALL OR THE UNCERTAINTIES IN DETERMINING WHETHER A CHANGE IN CONSEQUENCES HAS OCCURRED ARE SUCH THAT IT CANNOT BE REASONABLY CONCLUDED THAT THE CONSEQUENCES HAVE ACTUALLY CHANGED (I.E. THERE IS NO CLEAR TREND TOWARDS INCREASING THE CONSEQUENCES)

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THERE IS NO INCREASE IN CONSEQUENCES  
THAT WOULD INVOLVE AN UNREVIEWED  
SAFETY QUESTION

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**EXCERPT FROM SAFETY EVALUATION REPORT  
TORNADO MISSILE PROTECTION FOR**

**ISOLATION VALVE CUBICLE  
AUXILIARY SYSTEMS BRANCH**

**I. INTRODUCTION**

NUCLEAR POWER PLANTS MUST BE DESIGNED TO WITHSTAND THE EFFECTS OF TORNADO AND HIGH WIND GENERATED MISSILES SO AS NOT TO IMPACT THE HEALTH AND SAFETY OF THE PUBLIC IN ACCORDANCE WITH THE REQUIREMENTS OF GENERAL DESIGN CRITERIA 2 AND 4. THE CURRENT LICENSING CRITERIA GOVERNING TORNADO MISSILE PROTECTION ARE CONTAINED IN STANDARD REVIEW PLAN (SRP SECTION 3.5.1.4 AND 3.5.2). THESE CRITERIA GENERALLY SPECIFY THAT SAFETY-RELATED SYSTEMS BE PROVIDED POSITIVE TORNADO MISSILE PROTECTION (BARRIERS) FROM THE MAXIMUM CREDIBLE TORNADO THREAT. HOWEVER, SRP SECTION 3.5.1.4 INCLUDES GUIDANCE ON USE OF PROBABILISTIC RISK ASSESSMENT (PRA) METHODOLOGY IN LIEU OF THE DETERMINISTIC APPROACH FOR ASSESSING TORNADO MISSILE PROTECTION. THE ACCEPTANCE CRITERION IN THIS REGARD IS SIMILAR TO THAT IDENTIFIED IN SRP SECTION 2.2.3 WHICH DEALS WITH IDENTIFICATION OF DESIGN BASIS EVENTS USING PROBABILISTIC METHODS. THE TORNADO MISSILE ACCEPTANCE CRITERION IS AS FOLLOWS:

"THE PROBABILITY OF SIGNIFICANT DAMAGE TO STRUCTURES, SYSTEMS AND COMPONENTS REQUIRED TO PREVENT A RELEASE OF RADIOACTIVITY IN EXCESS OF 10 CFR PART 100 FOLLOWING A MISSILE STRIKE, ASSUMING, LOSS OF OFFSITE POWER, SHALL BE LESS THAN OR EQUAL TO A MEDIAN VALUE OF  $10^{-7}$  PER YEAR OR A MEAN VALUE OF  $10^{-6}$  PER YEAR."...

...THE APPLICANTS ELECTED TO DEMONSTRATE COMPLIANCE WITH THE TORNADO MISSILE PROTECTION CRITERION FOR THE IVCs BY PRA METHODOLOGY RATHER THAN PROVIDE POSITIVE PROTECTION FOR THE ROOF OPENING....

## **II. EVALUATION**

AS PREVIOUSLY STATED, THE (           NAME           ) PLANT IS DESIGNED WITH FOUR SEPARATE IVCs, EACH OF WHICH IS MISSILE PROTECTED FROM ALL SIDES BY HEAVY CONCRETE WALLS. EACH CUBICLE IS COMPLETELY PROTECTED EXCEPT FOR THE ROOF WHICH IS OPEN. THE HEIGHT OF THE IVC WALLS IS 55 FEET ABOVE PLANT GRADE.

THE APPLICANTS' PRA CONSIDERED ALL OF THE SRP SECTION 3.5.1.4, NOVEMBER 24, 1975 MISSILE SPECTRUM A AS POTENTIAL MISSILES INCLUDING THE UTILITY POLE AND THE AUTOMOBILE. REVISION 2 OF THE SRP HOWEVER, ALLOWS THE EXCLUSION OF THE UTILITY POLE AND THE CAR AT ELEVATIONS UP TO 30 FEET ABOVE ALL GRADE LEVELS WITHIN 1/2 MILE OF THE FACILITY STRUCTURES UNDER REVIEW. AS THE HEIGHT OF THE IVC WALL IS 55 FEET ABOVE PLANT GRADE THE MISSILES WHICH WE CONSIDER TO APPLY FROM MISSILE SPECTRUM A ARE THE WOOD PLANK, THE STEEL ROD AND THE STEEL PIPES. OUR EXAMINATION OF ELEVATED AREAS WITHIN 1/2 MILE OF THE FACILITY STRUCTURES DISCLOSED ONLY THE DIKE AREA AROUND THE ULTIMATE HEAT SINK WHICH COULD BE CONSIDERED AS A POSSIBLE LAUNCH POINT FOR THE AUTOMOBILE OR THE UTILITY POLE. THE APPLICANTS HAVE ASSURED US THAT THERE WILL BE NO UTILITY POLE STORAGE ALONG THE DIKE AREA. ADDITIONALLY, THE ONLY VEHICULAR TRAFFIC ALONG THE DIKE WOULD BE TRANSIENT IN NATURE IN ORDER TO CONDUCT INSPECTION, AND THIS TRAFFIC WILL BE CONTROLLED.

IN ORDER FOR A MISSILE TO STRIKE ANY OF THE COMPONENTS IN A GIVEN IVC, IT MUST APPROACH THE ROOF OPENING AT A STEEP ANGLE WITHIN A GIVEN SOLID ANGLE. THE ROOF OPENING OF EACH IVC IS APPROXIMATELY 745 SQUARE FEET THUS PRESENTING A RELATIVELY SMALL TARGET. ADDITIONALLY, THE SAFETY-RELATED TARGET AREAS WITHIN THE IVCs ARE MUCH SMALLER THAN THE IVC OPEN ROOF AREAS. THE FACT THAT THERE ARE FOUR SEPARATE CUBICLES SUBSTANTIALLY DECREASES THE PROBABILITY OF SINGLE MISSILE BEING CAPABLE OF DAMAGING MORE THAN THE COMPONENTS IN ONE CUBICLE. MULTIPLE MISSILES HOWEVER, COULD ENTER SEPARATE CUBICLES. WE CONSIDER THIS A LOW PROBABILITY EVENT, AS DISCUSSED FURTHER BELOW....

...OUR CONSULTANT'S EVALUATION OF THE APPLICANTS' PRA CONSIDERED THE VALIDITY AND CONSERVATISM OF THE APPROACH, ASSUMPTIONS, AND DATA USED IN THE APPLICANTS' ANALYSIS TO ESTABLISH THE PROBABILITY OF TORNADO AND HURRICANE-BORNE MISSILE DAMAGE TO THE IVC EQUIPMENT. ALSO INCLUDED IN THE EVALUATION IS AN ASSESSMENT OF THE CORRECTNESS OF THE RESULTS OBTAINED IN THE STUDY.

WE HAVE REVIEWED OUR CONSULTANT'S TER AND HIS SUPPLEMENT THERETO CONTAINED IN LETTER DATED ( \_\_\_\_\_ DATE \_\_\_\_\_ ) WHICH RESOLVED THE OPEN ITEMS IDENTIFIED IN THE TER.

WE CONCUR WITH THE FINDINGS AND RESULTING ESTIMATE OF THE PROBABILITY OF DAMAGE TO ESSENTIAL EQUIPMENT IN IVC OF  $3 \times 10^{-9}$ . WE FURTHER AGREE THAT THIS VALUE IS CORRECT TO WITHIN AT LEAST ONE ORDER OF MAGNITUDE UNCERTAINTY THEREFORE, ADDITIONAL POSITIVE TORNADO MISSILE PROTECTION NEED NOT BE PROVIDED FOR THE IVCs SINCE THE PROBABILITY OF EXCEEDING 10 CFR 100 DOSE CRITERIA DUE TO TORNADO MISSILES IS LESS THAN THE  $10^{-7}$  PER YEAR ACCEPTANCE CRITERION.

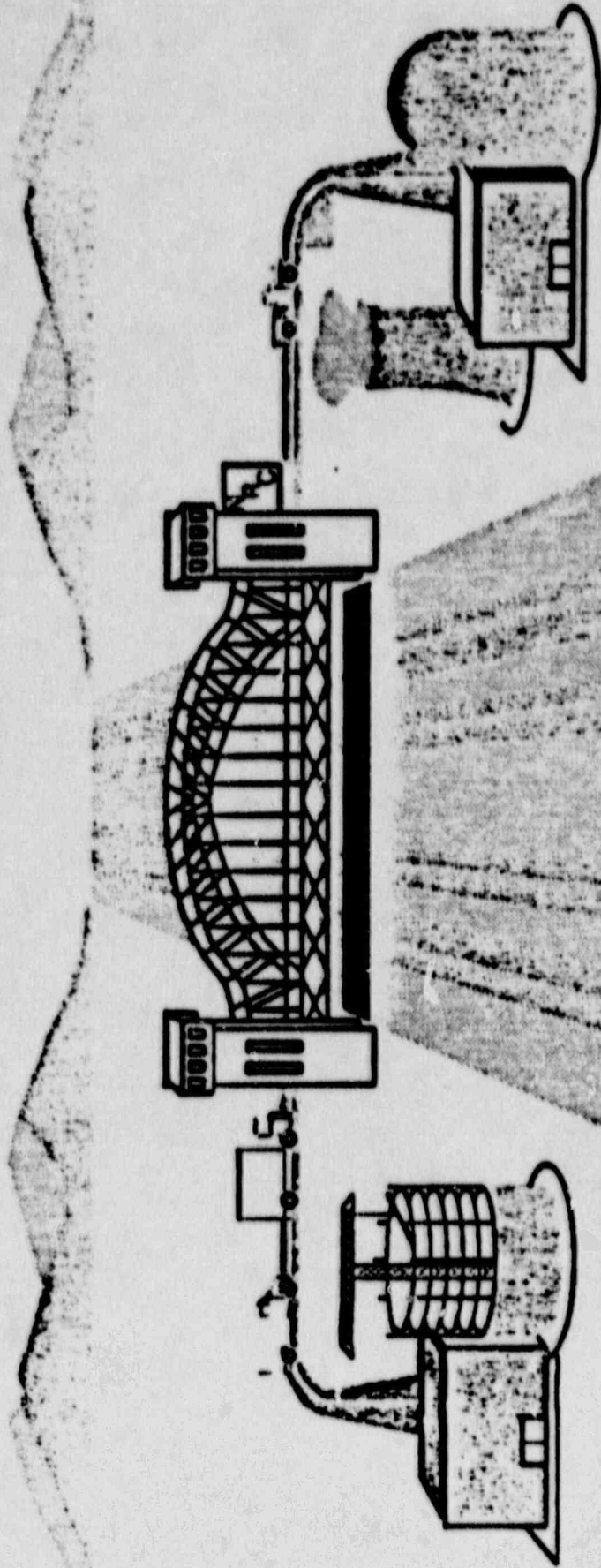
BASED ON THE ABOVE, WE CONCLUDE THAT THE APPLICANTS HAVE SATISFACTORILY DEMONSTRATED COMPLIANCE WITH GENERAL DESIGN CRITERIA 2 AND 4 WITH RESPECT TO TORNADO MISSILE PROTECTION FOR THE IVCs. THE DESIGN OF THE IVCs IS THEREFORE ACCEPTABLE WITHOUT THE ADDITION OF FURTHER PROTECTION FOR THE ROOF AREA.



# Regulatory Management Challenge

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**Timely, Consistent, Resource Efficient  
Systematic 10FR50.59 Safety Evaluation Process**

## THE REGULATION

- (e) (2) "A PROPOSED CHANGE, TEST, OR EXPERIMENT SHALL BE DEEMED TO INVOLVE AN UNREVIEWED SAFETY QUESTION (i) IF THE PROBABILITY OR OCCURRENCE OR THE CONSEQUENCES OF AN ACCIDENT OR MALFUNCTION OF EQUIPMENT IMPORTANT TO SAFETY PREVIOUSLY EVALUATED IN THE SAFETY ANALYSIS REPORT MAY BE INCREASED; OR (ii) -- OR (iii) IF THE MARGIN OF SAFETY AS DEFINED IN THE BASIS FOR ANY TECHNICAL SPECIFICATION IS REDUCED." (EMPHASIS ADDED)

## THE GUIDANCE

- 3.1(2) "MAY THE PROPOSED ACTIVITY INCREASE THE CONSEQUENCES OF AN ACCIDENT PREVIOUSLY EVALUATED IN THE SAR?"
- 3.1(4) "MAY THE PROPOSED ACTIVITY INCREASE THE CONSEQUENCES OF A MALFUNCTION OF EQUIPMENT IMPORTANT TO SAFETY PREVIOUSLY EVALUATED IN THE SAR?"
- 3.1(7) "DOES THE PROPOSED ACTIVITY REDUCE THE MARGIN OF SAFETY AS DEFINED IN THE BASIS FOR ANY TECHNICAL SPECIFICATION?"

## CONSEQUENCE AND MARGIN OF SAFETY

- "CONSEQUENCES" AND "MARGIN OF SAFETY" INTERPRET THE RESULTS OF THE SAR ACCIDENT ANALYSES IN TERMS OF PUBLIC HEALTH AND SAFETY.
- THE ACCIDENT ANALYSES ARE THOSE OF CHAPTER 6 AND 15 (OR EQUIVALENT CHAPTERS) AND OTHER EVENTS WITH WHICH THE PLANT IS DESIGNED TO COPE AND ARE DESCRIBED IN THE SAR.

## ACCEPTANCE CRITERIA

- THE SAR, BASED ON LOGIC SIMILAR TO ANSI STANDARDS, PROVIDES ACCEPTANCE CRITERIA AND FREQUENCY RELATIONSHIP FOR CONDITIONS FOR DESIGN.
- THE UNDERLYING OBJECTIVE IS THAT:
  - 1- IF THE PLANT IS OPERATED WITHIN THE ASSUMED INITIAL CONDITIONS, AND
  - 2- IF IMPLEMENTATION SAFEGUARDS OPERATE AS ASSUMED IN SAR, THENTHE POSTULATED ACCIDENTS OR CONDITIONS WILL BE CONTAINED WITHIN THE APPROPRIATE ACCEPTANCE CRITERIA.
- ACCEPTANCE CRITERIA OR LIMITS DEFINE THE LEVEL OF DEGRADATION OF (OR CHALLENGE TO) IMPLEMENTED FISSION PRODUCT BARRIERS ALLOWED BY REGULATION.

## DOSE RELEASES AND MARGINS TO DOSE RELEASES

- FOR ACCIDENTS RESULTING IN DOSE RELEASES, DOSES REPRESENT CONSEQUENCES. CONSEQUENCES (DOSES) ARE REGULATED WITHIN ACCEPTABLE LIMITS.
- FOR ACCIDENTS NOT CAUSING DOSE RELEASES, THE MARGINS TO FAILURE OF FISSION PRODUCT BARRIERS REPRESENT THE MARGIN OF SAFETY.
- MARGIN OF SAFETY IN THE BASIS OF ANY TECHNICAL SPECIFICATION MAY BE EXPLICITLY IDENTIFIED IN THE T.S. BASES, OR MAY BE IMPLICIT AS IDENTIFIED IN SAR OR SER.

## CONSEQUENCES

- OF ACCIDENTS OR MALFUNCTIONS OF EQUIPMENT IMPORTANT TO SAFETY.
- CONSEQUENCES = DOSE
- LIMITS IN SAR OR SER
- DOSE LIMITS
  - REGULATORY
    - 10 CFR 100
    - 10 CFR 20
  - PLANT SPECIFIC (SAR AND/OR SER)
  - GENERIC: SER + SRP

## **NO INCREASE IN CONSEQUENCES**

- **INDETERMINANT CHANGE**
- **WITHIN ACCEPTANCE LIMIT**

## INDETERMINANT CHANGE

WHERE A CHANGE IN CONSEQUENCES IS SO SMALL OR THE UNCERTAINTIES IN DETERMINING WHETHER A CHANGE IN CONSEQUENCES HAS OCCURRED ARE SUCH THAT IT CANNOT BE CONCLUDED REASONABLY THAT THE CONSEQUENCES HAVE ACTUALLY CHANGED (I.E., THERE IS NO CLEAR TREND TOWARD INCREASING THE CONSEQUENCES), THE CHANGE NEED NOT BE CONSIDERED AN INCREASE IN CONSEQUENCES.



## ACCEPTANCE LIMIT

ACCEPTANCE LIMIT IS  
THAT VALUE PROPOSED  
BY LINCENSEE IN SAR AS  
CLARIFIED BY THE SER.

EXAMPLE 1:

SER STATES: "CALCULATED DOSE IS ACCEPTABLE", THEN  
THE CALCULATED DOSE IS THE LIMIT. (PLANT SPECIFIC LIMIT)

EXAMPLE 2:

SER STATES: "CALCULATED DOSE IS ACCEPTABLE BECAUSE  
IT IS BELOW SRP VALUE OF 25 mrem", THEN 25 mrems IS THE  
LIMIT. (PLANT SPECIFIC BOUNDING LIMIT)

## RELATIONSHIP BETWEEN ACCIDENT ANALYSIS AND TECH. SPECS.

- T.S. INITIAL CONDITIONS (CRITERION 2, PROPOSED POLICY STATEMENT TECH. SPEC. IMPROVEMENT):

"THOSE PROCESS VARIABLES THAT HAVE INITIAL VALUES ASSUMED IN DBAs AND TAs, WHICH ARE MONITORED AND CONTROLLED DURING POWER OPERATION SUCH THAT PROCESS VALUES REMAIN WITHIN THE ANALYSIS BOUND".

- T.S SAFETY SYSTEM PERFORMANCE (CRITERION 3, P.P.S. ON T.S. IMPROVEMENT):

"STRUCTURES, SYSTEMS, OR COMPONENT... WHICH FUNCTION OR ACTUATE TO MITIGATE A DBA OR TA THAT EITHER ASSUMES THE FAILURE OF, OR PRESENTS A CHALLENGE TO THE INTEGRITY OF A FISSION PRODUCT BARRIER". PERFORMANCE TO BE INCLUDED IN TECH. SPECS, INCLUDES: CONSIDERATION OF ALL APPLICABLE EVENTS, WHETHER EXPLICITLY OR IMPLICITLY PRESENTED... TO LIMIT CONSEQUENCES TO WITHIN THE APPROPRIATE ACCEPTANCE CRITERIA.

## MARGIN OF SAFETY

- THE OBJECTIVE OF CRITERIA 2 & 3 IS TO ASSURE THAT ACCIDENT ANALYSES ACCEPTANCE CRITERIA WILL NOT BE EXCEEDED.
- ACCEPTANCE CRITERIA FOR SOME PARAMETERS ARE ENTERED AS SAFETY LIMITS IN TECHNICAL SPECIFICATIONS.
- ACCEPTANCE CRITERIA FOR THE OTHER PARAMETERS, WHETHER OR NOT IN TECH. SPECS., ARE TO BE FOUND IN SAR AND SER.
- ACCEPTANCE CRITERIA DEFINE THE MARGIN OF SAFETY.

Example of Margin of Safety  
Using Containment Pressure Transient

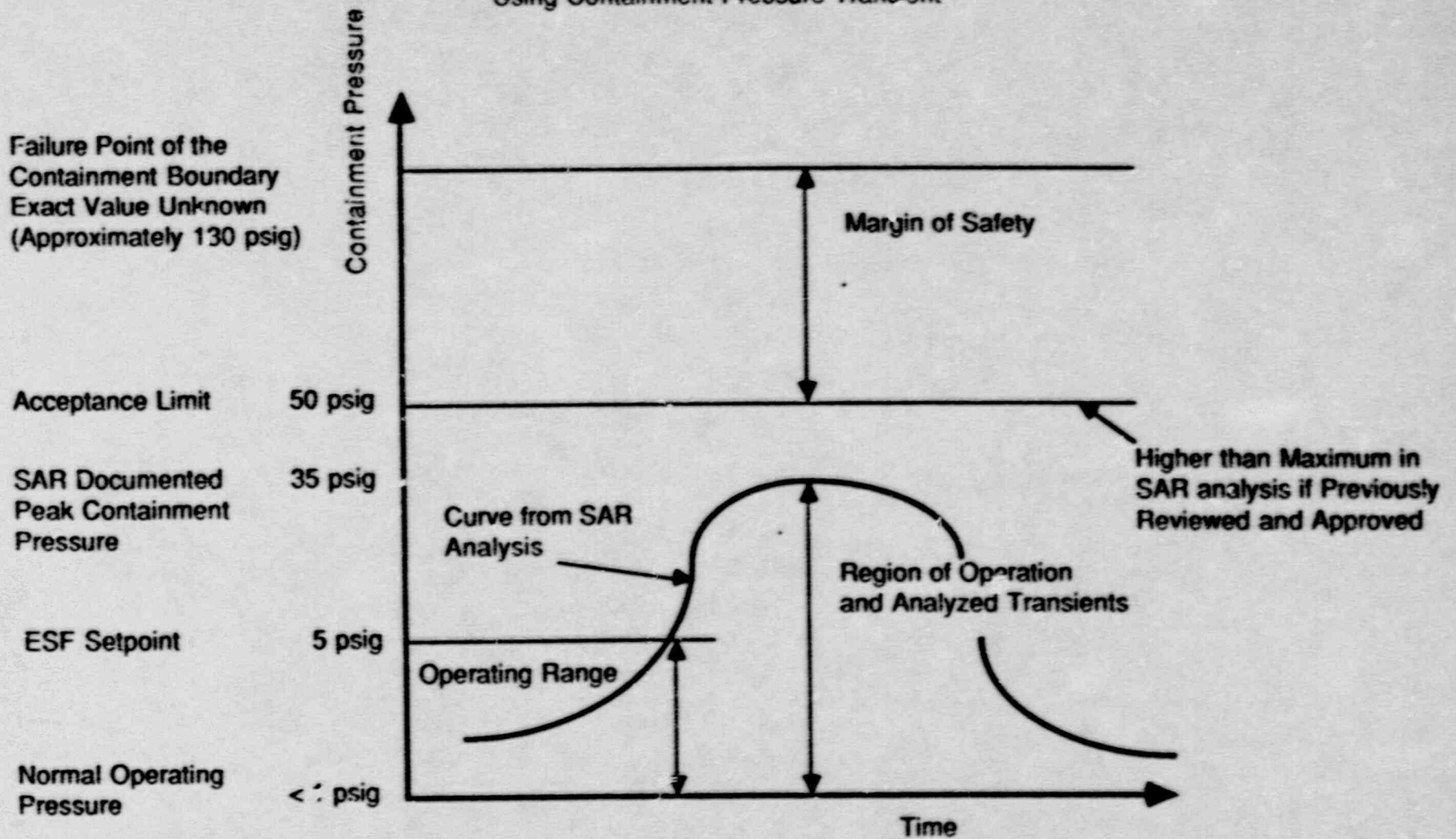


Figure 3-2

- IMPACT OF CHANGES IS EVALUATED IN TERMS OF THE RESULTS OF THE SAR ANALYSES.
- IF A CHANGE IN INITIAL CONDITIONS, MODEL, OR SAFETY SYSTEM PERFORMANCE DOES NOT INCREASE THE RESULTS ABOVE THE ACCEPTANCE LIMIT, THE CHANGE IS NOT A USQ.
- HOWEVER, IF NRC ACCEPTANCE SPECIFIED CONDITIONS ON A COMPUTER CODE, METHOD, INDUSTRY PRACTICE, OR PENALTY, CHANGES TO THESE CONDITIONS MAY INVOLVE A USQ REGARDLESS OF RESULTS.
- TREATMENT IS ANALOGOUS TO APP. K LOCA CRITERIA WHERE THE DETERMINATION OF WHETHER NRC REVIEW IS REQUIRED IS BASED ON ANALYSIS RESULTS:

0-49 F PCT INCREASE, NO NRC REVIEW

50 F OR MORE, NRC REVIEW