

GE Hitachi Nuclear Energy

BWR Operating Plants: TSTF-493 Implementation Discussion

With USNRC

GEH:

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Agenda

- Overall Approach
- GEH Setpoint Methodology Overview
- Proposed GEH Supplemental Methodology for TSTF-493 Requirements
 - ALT Implementation
 - AFT Implementation
- Example GEH Setpoint Calculation Results
- Proposed Implementation Schedule



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Setpoint Calculation - Overall Approach

- Use Approved GEH Methodology as defined in Licensing Topical Report (LTR) NEDC-31336P-A
- Supplemental Methodology for TSTF-493 Requirements - separate document being developed
 - As Left Tolerances (ALTs) & As Found Tolerances (AFTs)
- Provide Technical Support for Customer License Amendment Requests (LARs)



Overall Approach – Setpoint Methodology

GEH Methodology (NEDC-31336P-A)

- Setpoint calculations based on GEH methodology approved by USNRC
- Establishes margins from Analytical Limit (AL):
 - ✓ to Technical Specifications Allowable Value (AV) ; includes all uncertainties except Drift
 - ✓ to Nominal Trip Setpoint 1 (NTSP₁); includes all uncertainties
 - NTSP₁ - Minimum margin from AL
 - NTSP₁ - Equivalent to Limiting Trip Setpoint (LTSP)
- Establishes margin from AV to Final NTSP (NTSP_F)

NTSP_F More Conservative than LTSP



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Overall Approach - GEH Supplemental Methodology for TSTF-493 Requirements

Supplemental Methodology - separate document being developed

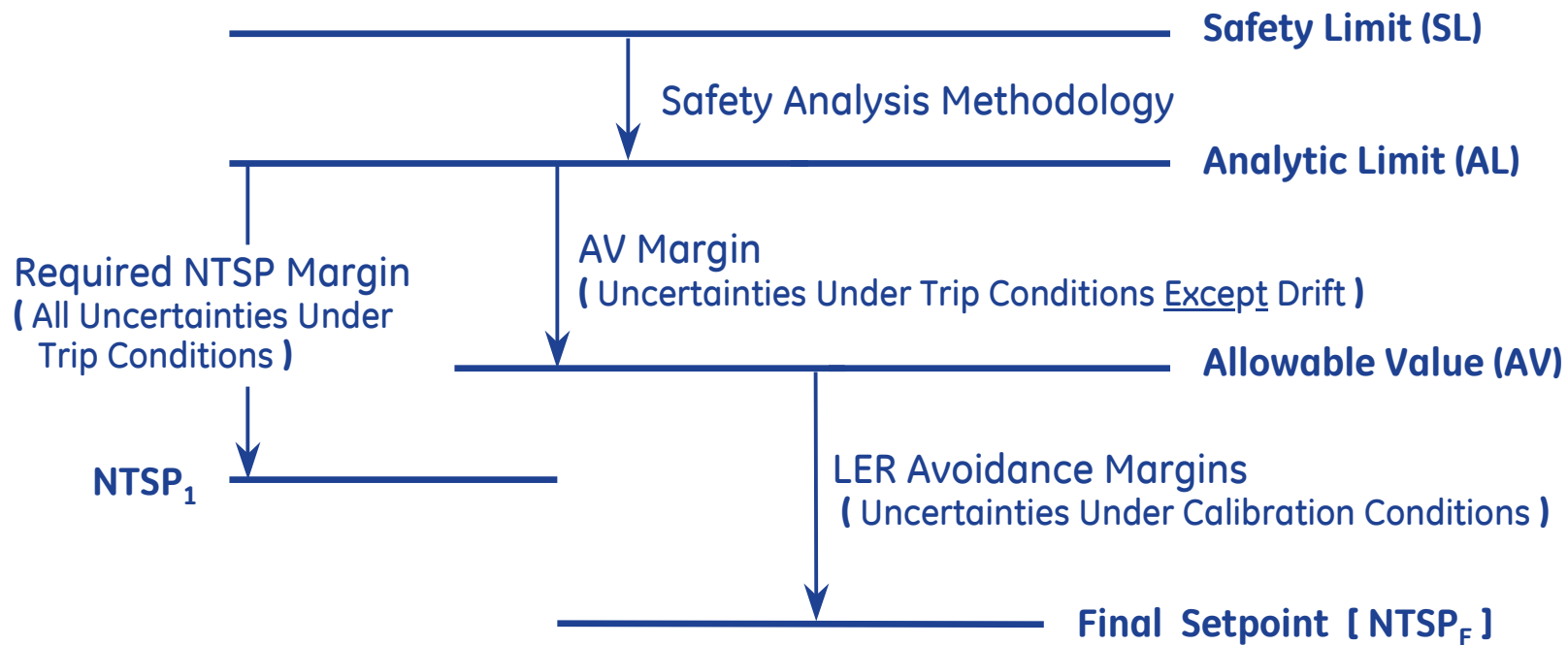
- Check customer's input As Left Tolerance (**ALT**) to meet ALT_{TSTF}
- Establish As Found Tolerance (**AFT**)
- ALT & AFT tolerances calculated
 - ✓ Assures $ALT_{GEH} \leq ALT_{TSTF}$
 - ✓ Assures $AFT_{GEH} \leq AFT_{TSTF}$
- ALT & AFT anchored around $NTSP_F$

TSTF-493 Requirements Will be Met



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GEH Setpoint Current Methodology - Simplified



LER = Licensee Event Report

Proposed GEH Supplemental Methodology

Calibration Tolerance Definitions

- **As Left Tolerance (ALT)**

- The tolerance within which device calibration reading is left after calibration
- Instrument setting must be reset to $NTSP_F \pm ALT$ at each calibration

- **As Found Tolerance (AFT)**

- The tolerance around $NTSP_F$ to monitor **instrument performance**
- Represents tolerance with which instrument loop setpoint can be found during setpoint verification (i.e., calibration), without being classified as out-of-tolerance.
- Ensures that channel operation is consistent with assumptions or design inputs used in setpoint calculations and that there is high confidence in future acceptable channel performance.



GEH Supplemental Methodology for TSTF-493 Requirements – As Left Tolerance

Calculate As Left Tolerance (ALT)

$$ALT_{GEH} \leq ALT_{TSTF}$$

Where:

$$ALT_{TSTF} = SRSS(A_C, C_{Tools})$$

ALT_{GEH} = Vendor Accuracy of Device (typically)

SRSS = Square Root of the Sum of the Squares

A_C = Instrument Accuracy under Calibration Conditions

C_{Tools} = Calibration Uncertainty = $[(M\&TE)^2 + (M\&TE)_r^2]^{1/2}$

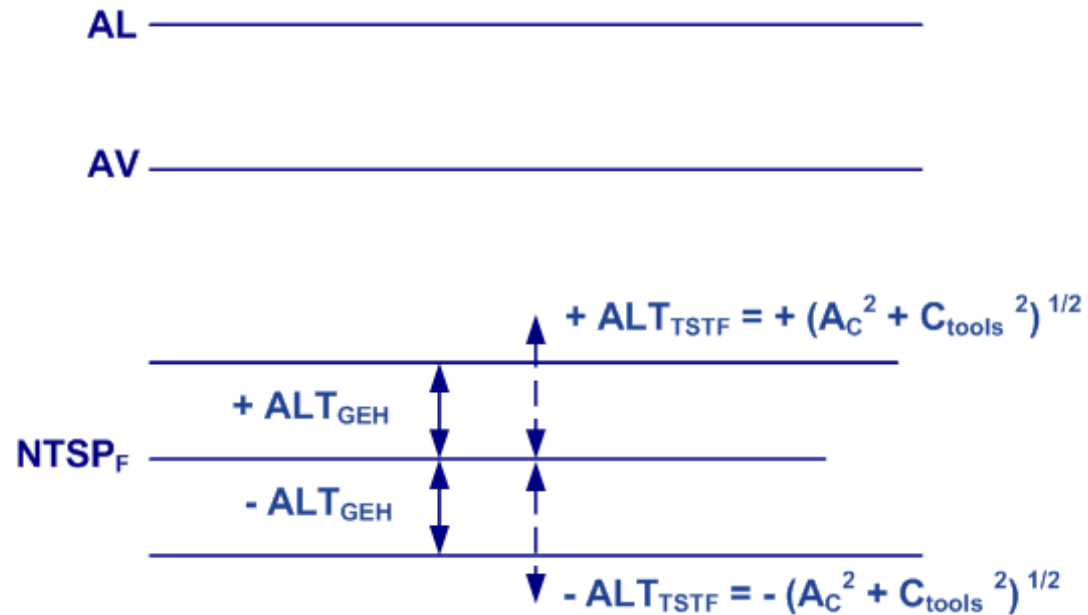
= Error of Tools, Standards, & Readability

**ALT_{GEH} Conservative Compared to
TSTF Requirements**



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ALT Implementation – Typical



Typical ALT_{GEH} Conservative Relative to ALT_{TSTF}



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GEH Supplemental Methodology for TSTF-493 Requirements – As Found Tolerance

Calculate As Found Tolerance (AFT)

AFT_{GEH} is Lesser of $[AV - NTSP_F]$ or AFT_{TSTF}

Where:

$$AFT_{TSTF} = SRSS (A_C, C_{Tools}, D)$$

A_C = Instrument Accuracy under Calibration Conditions

C_{Tools} = Calibration Uncertainty = $[(M\&TE)^2 + (M\&TE)_r^2]^{1/2}$
= Error of Tools, Standards, & Readability

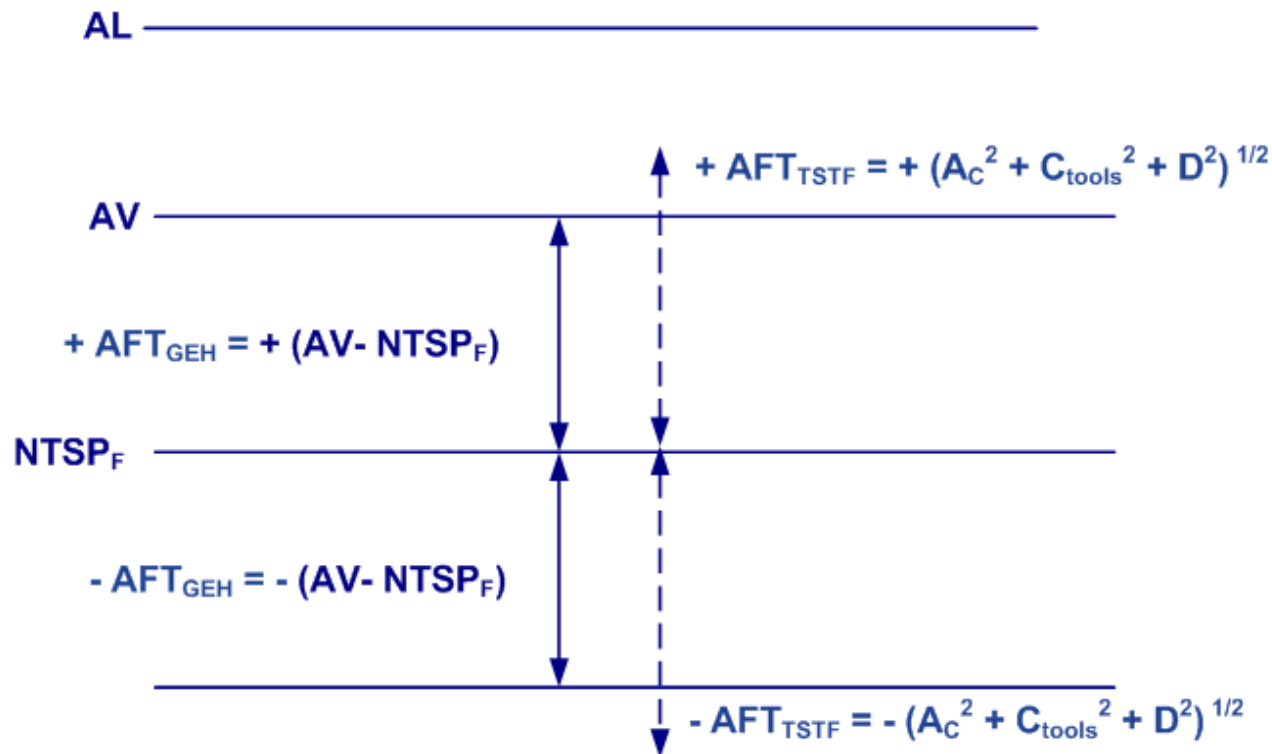
D = Instrument Drift

AFT_{GEH} Conservative Compared to
TSTF Requirements



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AFT Implementation – Typical

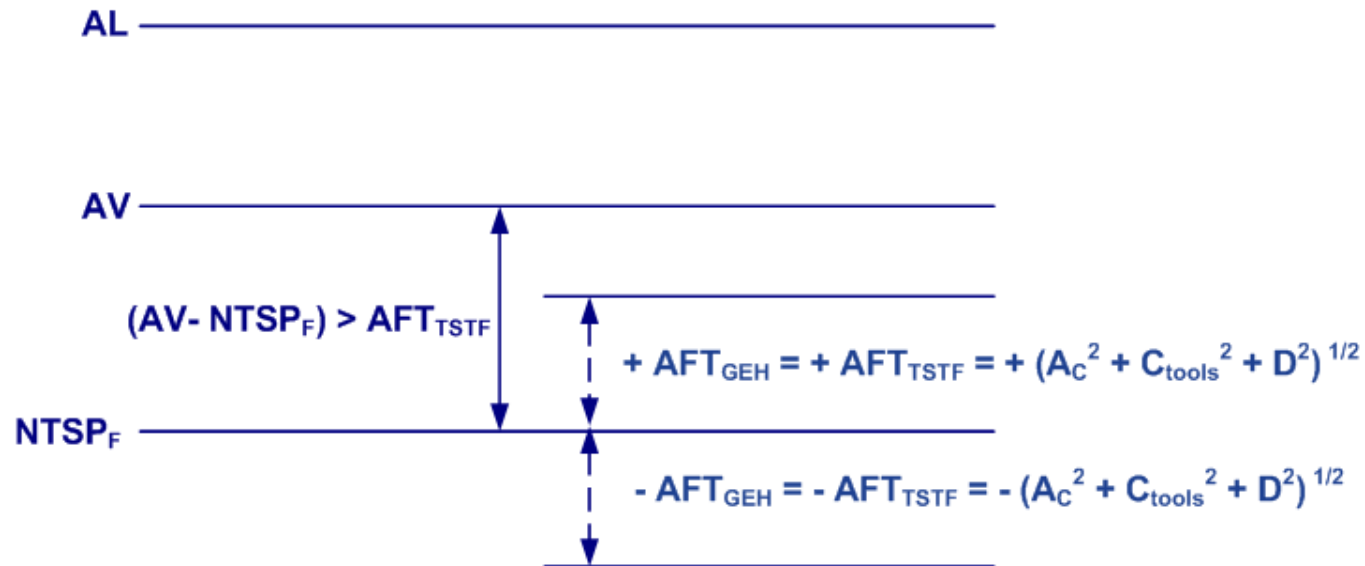


- Typical AFT_{GEH} Conservative Relative to AFT_{TSTF}
- $(NTSP_F + AFT_{GEH})$ Has Significant Safety Margin to AL



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AFT Implementation – for Setpoints with Additional Conservatism



**For Setpoints with Additional Conservatism,
where $(AV - NTSP_F) > AFT_{TSTF}$, Then $AFT_{GEH} = AFT_{TSTF}$**



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Example GEH Setpoint Calculation Results

Example GEH Setpoint Calculation

Steam Dome High Pressure Scram - for Pressure Switch instrument

Inputs used: Errors all random; all in units of **psig**

- Analytical Limit $AL = 1075.0$
- Calibration As Left Tolerance $ALT = 6.5$

Example GEH Setpoint Calculation – Results Comparison

Steam Dome High Pressure Scram

Analytical Limit (AL) = 1075.0 psig

Allowable Value (AV) = 1067.6 psig

<u>NTSP</u>	<u>Results</u>
$NTSP_1 = LTSP$	1060.3
$NTSP_F$	1056.2

Example GEH Setpoint Calc. – ALT & AFT

Tolerance Calculations (per GEH Supplemental Methodology for TSTF-493 Requirements)

- **TSTF-493 Tolerances**

- ALT (TSTF) = $\text{SRSS}(A_C, C_{\text{Tools}})$ = **7.12 psig**
- AFT (TSTF) = $\text{SRSS}(A_C, C_{\text{Tools}}, D)$ = **17.02 psig**

- **GEH Tolerances**

- ALT (GEH) = **6.5 psig**
- AFT (GEH) = $AV - \text{NTSP}_F$ = **11.4 psig**

A_C = Instrument Accuracy under Calibration Conditions

C_{Tools} = Calibration Uncertainty = Error of Tools, Standards, & Readability

D = Drift



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Example GEH Setpoint Calc. – ALT & AFT

Tolerance Calculations (per GEH Supplemental Methodology for TSTF-493 Requirements)

- **TSTF-493 Tolerances**

- $\text{ALT (TSTF)} = \text{SRSS}(A_C, C_{\text{Tools}}) = 7.12 \text{ psig}$

- $\text{AFT (TSTF)} = \text{SRSS}(A_C, C_{\text{Tools}}, D) = 17.02 \text{ psig}$

- **GEH Tolerances**

- $\text{ALT (GEH)} = 6.5 \text{ psig}; < \text{ALT (TSTF)}$

- $\text{AFT (GEH)} = AV - \text{NTSP}_F = 11.4 \text{ psig}; < \text{AFT (TSTF)}$

A_C = Instrument Accuracy under Calibration Conditions

C_{Tools} = Calibration Uncertainty = Error of Tools, Standards, & Readability

D = Drift

**Calculated Setpoints Unaffected by TSTF-493;
Tolerances Will Meet Requirements**



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Methodology Summary

- **No Change to USNRC Approved GEH Setpoint Methodology & Calculated Setpoints**
 - Allowable Value (AV)
 - Nominal Trip Setpoint Final (NTSP_F)
- **Separate Supplemental Methodology for TSTF-493 Requirements calculates Tolerances (i.e., ALT & AFT)**
- **ALT & AFT results provided to Customer for use in Calibration Procedures**

GEH Calculated Setpoints not Changed
GEH Tolerances Will Satisfy TSTF-493 Requirements



Proposed Implementation Plan

Proposed Implementation Plan

Draft GEH TSTF-493 Implementation Plan		2010										2011			
Task	Activity	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
1	Identify Setpoints Affected by TSTF-493														
2	Develop Draft Methodology for As Left Tolerance														
3	Develop Draft Methodology for As Found Tolerance														
4	Identify Changes Required for Customer Supplied Information														
5	Develop Procedure for Tech. Spec. and Basis Markups (Draft)														
6	Identify Potential Calibration Procedure Changes (Draft)														
7	Prepare GEH Supplemental Methodology for TSTF-493														
8	Design Review and Verification														
9	Phase Zero Meeting with NRC TSTF-493 Implementation Group														
11	Submit GEH Supplemental Methodology for TSTF-493 to NRC														
12	Obtain NRC Approval of Supplemental Methodology for TSTF-493														
13	Perform TSTF-493 efforts for Customers														
Industry TSTF-493 Activities		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
1	TSTF-493 NRC Workshop with Owners' Groups - Dec. 2010														

	> Completed
	> In Progress
	> Planned



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Summary

- **Draft GEH Supplemental Methodology for TSTF-493 Requirements - Separate Report in Preparation**
- **GEH Supplemental Methodology for TSTF-493 Requirements Consistent with, and Equal or More Conservative than Requirements**
- **2010 Schedule:**
 - **USNRC Discussion 28 Sep; Request USNRC Feedback**
 - **TSTF-493 Workshop 6-7 Dec**
- **Application based on BWROG Recommendations & BWR Plant-Specific License Amendment Requests**