GE Hitachi Nuclear Energy

# BWR Operating Plants: TSTF-493 Implementation Discussion

With USNRC

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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

# 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)**

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# 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 ($NTSP_1$); includes all uncertainties**
    - **$NTSP_1$ - Minimum margin from AL**
    - **$NTSP_1$ - 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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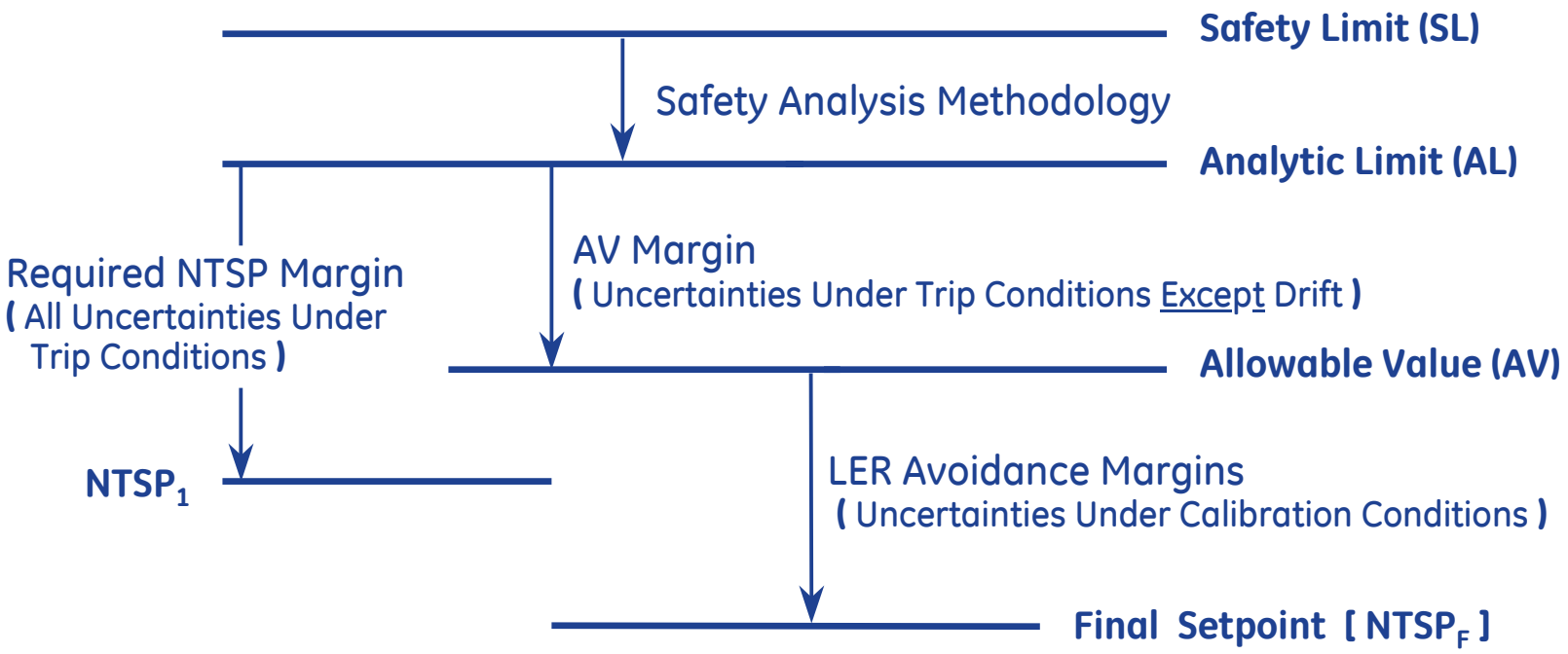
# GEH Setpoint Current Methodology - Simplified




LER = Licensee Event Report

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# 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 $NTSP_F$ ±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.

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

## Calculate As Left Tolerance (ALT)

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

**Where:**

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

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

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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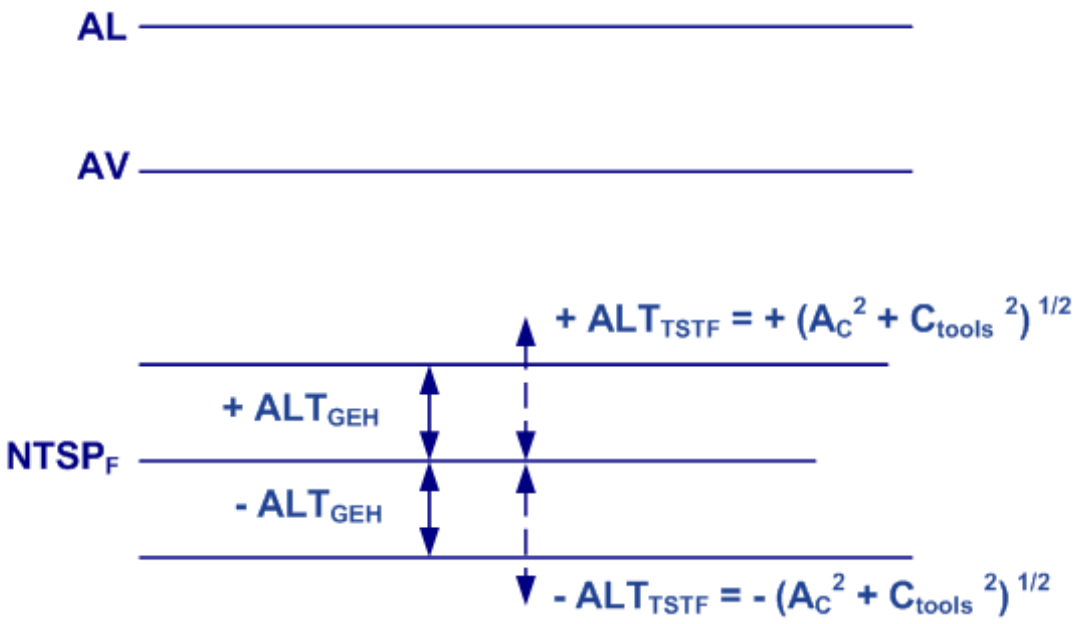
# ALT Implementation – Typical




**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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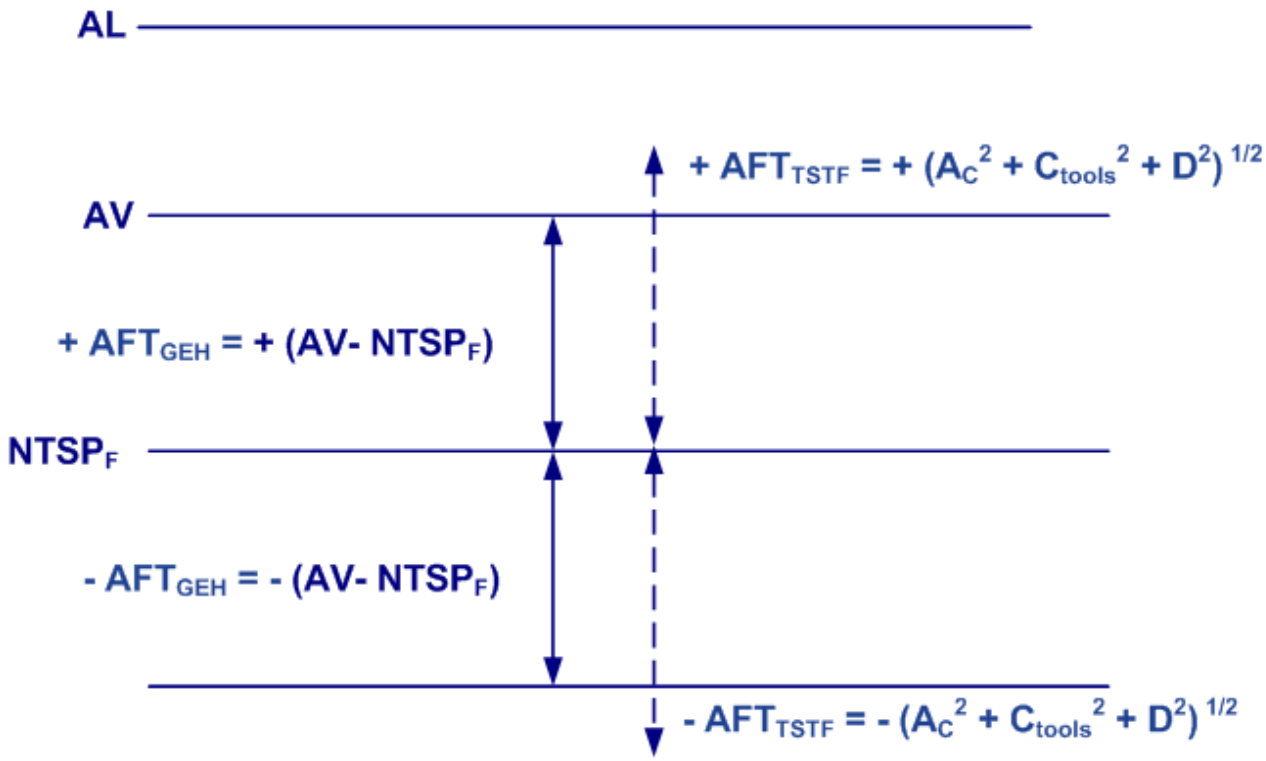
# AFT Implementation – Typical




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

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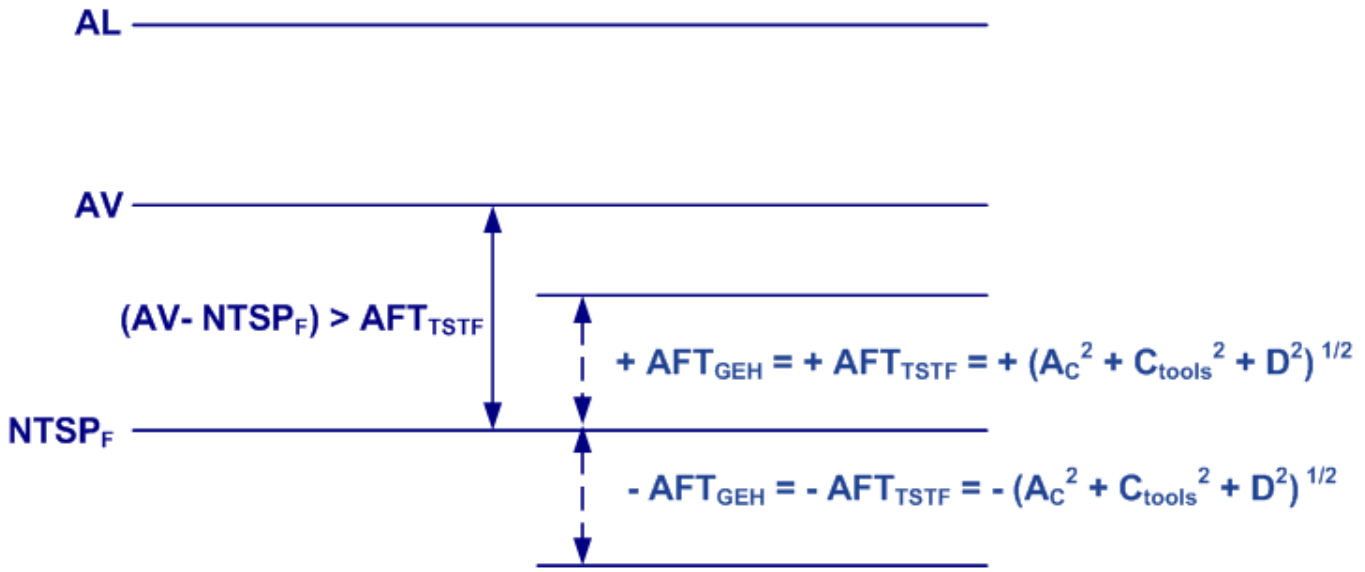
# AFT Implementation – for Setpoints with Additional Conservatism




**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

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# Example GEH Setpoint Calculation – Results Comparison

## Steam Dome High Pressure Scram

Analytical Limit (AL) = 1075.0 psig

Allowable Value (AV) = 1067.6 psig

| NTSP | Results |
|---|---|
| $NTSP_1$ = LTSP | 1060.3 |
| **$NTSP_F$** | **1056.2** |

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# Example GEH Setpoint Calc. – ALT & AFT

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

- **TSTF-493 Tolerances**
  - ALT (TSTF) = SRSS($A_C$, $C_{Tools}$) = **7.12** psig
  - AFT (TSTF) = SRSS($A_C$, $C_{Tools}$, D) = **17.02** psig
- **GEH Tolerances**
  - ALT (GEH) = **6.5** psig
  - AFT (GEH) = AV – $NTSP_F$ = **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**
  - ALT (TSTF) = SRSS($A_C$, $C_{Tools}$) = **7.12** psig
  - AFT (TSTF) = SRSS($A_C$, $C_{Tools}$, D) = **17.02** psig
- **GEH Tolerances**
  - ALT (GEH) = **6.5** psig; **< ALT (TSTF)**
  - AFT (GEH) = AV – $NTSP_F$ = **11.4** psig; **< 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**

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