THE HANFORD SITE

WRPS Engineering Survival Guide: A Best Practice from DOE/EA assessment of Contractors Management of Safety Issues

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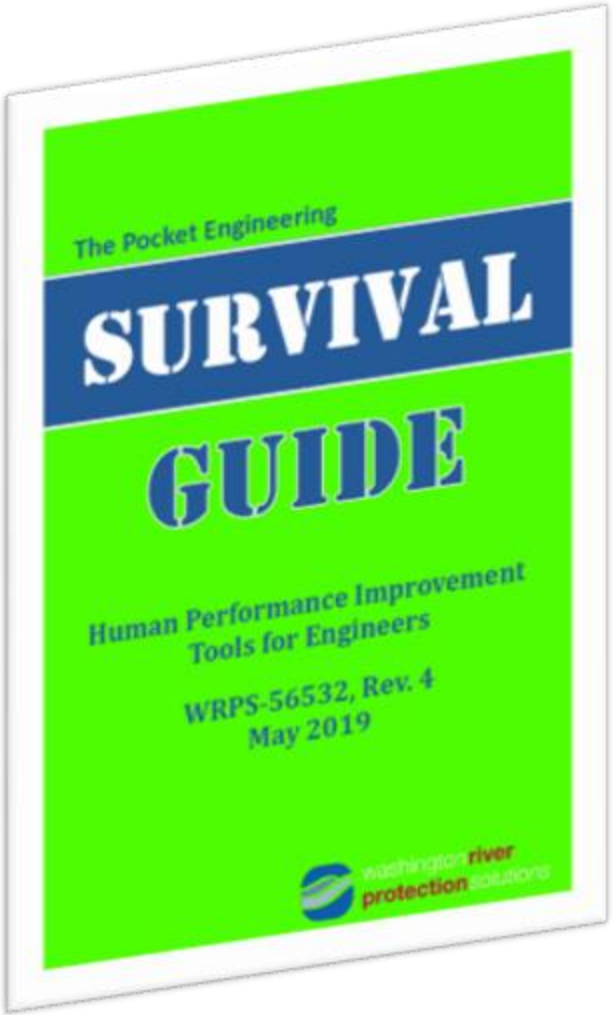
October 22, 2024

Engineering Survival Guide



This Pocket Engineering Survival Guide contains the information to implement selected Department of Energy Human Performance Tools adapted from Volume 2 of the Human Performance Improvement Handbook (DOE-HDBK-1028-2009). The selections were chosen to form a suite of tools that are most applicable to Tank Farm Engineering situations. Rigorous use of these Tools has been shown to reduce engineering errors and the associated risk. Use of the tools will also minimize the stress and improve the effectiveness of decision making.

Foundational Principle

- There are several main principles of Human Performance
  - People are fallible
  - Error situations are predictable
  - Organization influence behavior
  - Reinforcement effect performance
  - Understand past events helps avoid future events

Common Error Precursors

Task Demands	Individual Capabilities
• Time pressure (in a hurry)	• Unfamiliarity with task/first time
• High workload (large memory)	• Lack of knowledge (faulty mental model)
• Simultaneous, multiple actions	• New techniques not used before
• Repetitive actions/monotony	• Imprecise communication habits
• Irreversible actions	• Lack of proficiency/inexperience
• Interpretation requirements	• Indistinct problem-solving skills
• Unclear goals, roles, or responsibilities	• Unsafe attitudes
• Lack of or unclear standards	• Illness or fatigue; general poor health
Work Environment	**Human Nature**
• Distractions/interruptions	• Stress
• Changes/departure from routine	• Habit patterns
• Confusing displays or controls	• Assumptions
• Work-arounds/OOS instrumentation	• Complacency/overconfidence
• Hidden system/equipment response	• Mind-set (intentions)
• Unexpected equipment conditions	• Inaccurate risk perception
• Lack of alternative indication	• Mental shortcuts or biases
• Personality conflict	• Limited short-term memory

Human Performance Tools

- The Tools for Engineers and Managers are broken into **Fundamental Tools** and **Conditional Tools**.
  - **Fundamental Human Performance Tools** – Human Performance Tools that are used regularly for any work activity, regardless of the risk or complexity of the task, and without prompting.
  - **Conditional Human Performance Tools** – Human Performance Tools that depend on the situation, the needs of the task or job, or the risk involved.
- Now includes **The Standard for Acceptable Technical Rigor** and **HPI Tools for Managers**.

Fundamental Tools

The Fundamental tools apply to any task and are engrained in the Engineering culture

- ❑ Technical Task Pre-Job Briefing
- ❑ Self-Checking
- ❑ Questioning Attitude
- ❑ Validate Assumptions
- ❑ Peer Review
- ❑ Signature

FUNDAMENTAL TOOLS

Task / Tool	TT Pre-job Brief	Self-Checking	Question-ing Attitude	Validate Assump-tions	Peer Review	Signa-ture
Involvement in a Calculation	✓	✓	✓	✓	✓	✓
Involvement in a Design Modification	✓	✓	✓	✓	✓	✓
Involvement in a Process Control Plan	✓	✓	✓	✓	✓	✓
Involvement in a USQ/D	✓	✓	✓	✓	✓	✓
Involvement in a Technical Review	✓	✓	✓	✓	✓	✓
Involvement in a Procedure	✓	✓	✓	✓	✓	✓
Involvement in a Work Package	✓	✓	✓	✓	✓	✓
Involvement in a Mod Traveler	✓	✓	✓	✓	✓	✓
Involvement in a Design Review Meeting	✓	✓	✓	✓		
Involvement in a Specification	✓	✓	✓	✓	✓	✓
Involvement in a Walkdown	✓	✓	✓	✓		
Involvement in a PrHA	✓	✓	✓	✓		✓
Involvement in Functional Acceptance	✓	✓	✓	✓	✓	✓
Involvement in a Technical Report	✓	✓	✓	✓	✓	✓
Involvement in a Redline Revision	✓	✓	✓	✓	✓	✓
Involvement in a Flow Sheet	✓	✓	✓	✓	✓	✓
Involvement in a Temp Mod	✓	✓	✓	✓	✓	✓
Involvement in a NCR	✓	✓	✓	✓		✓
Involvement in a SDD Revision	✓	✓	✓	✓	✓	✓
Involvement in a Safety Basis Change	✓	✓	✓	✓	✓	✓
Involvement in a System Health Report	✓	✓	✓	✓	✓	✓
Involvement in Startup/Testing	✓	✓	✓	✓	✓	✓
Involvement in Turnover	✓	✓	✓	✓		✓
Involvement In Software Development	✓	✓	✓	✓	✓	✓
Repurposing of Design	✓	✓	✓	✓	✓	✓
Flammable Gas Checklist	✓	✓	✓	✓	✓	✓
Review of Vendor Submittals	✓	✓	✓	✓		✓
WRPS Engineering Special Project	✓	✓	✓	✓	✓	✓

Conditional Tools

- Situationally dependent
- Require a graded approach in application
  - ❑ Project Planning
  - ❑ Vendor Oversight
  - ❑ Do Not Disturb Sign
  - ❑ Problem Solving
  - ❑ Decision Making
  - ❑ Turnover
  - ❑ Product Review Meeting
  - ❑ Technical Task Post Job Review
  - ❑ Work Product Review
  - ❑ Complete & Clear Engineering Products
  - ❑ Repurposing of Engineering Documents

CONDITIONAL TOOLS*

Task / Tool	Project Planning	Vendor Over-sight	Do Not Disturb Sign	Problem-Solving	Decision-Making	Turn-over	Product Review Meeting	TT Post-job Review	Work Product Review	Complete and Clear	Repur-posing
Involvement in a Calculation		✓	✓	✓			✓	✓	✓	✓	✓
Involvement in a Design Modification		✓	✓		✓		✓	✓	✓		✓
Involvement in a Process Control Plan			✓	✓	✓		✓	✓	✓	✓	✓
Involvement in a USQ/D			✓					✓	✓	✓	✓
Involvement in a Technical Review		✓	✓						✓		✓
Involvement in a Procedure			✓	✓	✓		✓	✓	✓	✓	✓
Involvement in a Work Package			✓	✓	✓		✓	✓	✓	✓	✓
Involvement in a Mod Traveler	✓		✓	✓	✓		✓		✓	✓	✓
Involvement in a Design Review Meeting				✓	✓		✓				✓
Involvement in a Specification		✓	✓				✓	✓	✓	✓	✓
Involvement in a Walkdown		✓									✓
Involvement in a PrHA				✓				✓	✓	✓	✓
Involvement in Functional Acceptance		✓		✓			✓	✓	✓	✓	✓
Involvement in a Technical Report			✓	✓			✓	✓	✓	✓	✓
Involvement in a Redline Revision				✓	✓		✓	✓	✓		✓
Involvement in a Flow Sheet			✓	✓	✓		✓	✓	✓	✓	✓
Involvement in a Temp Mod			✓	✓	✓	✓	✓	✓	✓	✓	✓
Involvement in a NCR				✓	✓			✓	✓	✓	✓
Involvement in a SDD Revision		✓		✓			✓	✓	✓	✓	✓
Involvement in a Safety Basis Change			✓	✓		✓	✓	✓	✓	✓	✓
Involvement in a System Health Report							✓		✓	✓	✓
Involvement in Startup/Testing		✓		✓	✓	✓				✓	✓
Involvement in Turnover						✓				✓	
Involvement In Software Development	✓	✓		✓	✓		✓	✓	✓	✓	✓
Repurposing of Design		✓					✓	✓	✓		✓
Flammable Gas Checklist					✓			✓	✓	✓	✓
Review of Vendor Submittals		✓	✓		✓			✓	✓		✓
WRPS Engineering Special Project	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓

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VALIDATE ASSUMPTIONS

WHY

Assumptions are a necessary part of engineering work so that a problem can be bounded. For situations such as these, engineers devote additional effort to justify why the assumption is conservative, providing detailed evidence that supports it. Engineers can inadvertently treat an assumption as fact or can forget that they made the assumption. Engineering judgment is applied and documented only when all uncertainties are bounded by the margins in the analysis and when inputs cannot be further substantiated. All assumptions are documented, tracked, and verified, leading to their closure before the product is delivered to the customer or placed into service.

WHEN

- During the conceptual phase of design
- In product review meetings
- Prior to delivery of the product to the customer
- During verification of output document
- During calculations
- During procurement
- Prior to use of preliminary or invalidated vendor data
- When answering technical questions in support of operations.

Remember the mnemonic DEFT (Documentation, Evidence, Field walkdown, and Track and close out).

HOW

1. **Documentation** – Write down the assumption, citing the following:
   - Applicability to the engineering issue
   - Critical attributes affected by the assumption
   - Reasoning and logic
   - Extent of condition and worst-case outcomes
   - Level of certainty, consistency, and conservatism.
2. **Evidence** – Is there objective evidence to support/justify the assumption?
   - Past success(es)
   - Operating experience
   - Expert opinion
   - Reference documents (e.g., prints, drawings, procedures)
   - Alternative techniques or computer simulations
   - Technical rationale for accuracy of assumption.
3. **Field walkdown** – Were in-field factors considered? Perform a hands-on/eyes-on review of the physical environment.
4. **Track and close out** – Close out all unverified assumptions as valid or otherwise before delivering the product to the customer.

Avoid These At-Risk Practices

- Not documenting an assumption
- Not verifying assumptions because of the perceived competence of the preparer/source
- Relying on assumptions as factual
- Not formally tracking closure of unverified assumptions
- Not recognizing that an assumption has been made
- Not recognizing conflicting input data in two or more design documents
- Not verifying assumptions before delivering an engineering product to a customer
- Not documenting the basis of engineering judgment
- Not reconciling contradictory or disconfirming sources of information
- Relying too heavily on past successes to justify current assumptions.

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PERFORMANCE MODE RECOGNITION CHART