

# Human Factors in Nondestructive Examination: Results Based on Examiner Interviews

ASME BPV Code Week, July 31, 2018

Research conducted as part of MOU between U.S. NRC and EPRI



1

## Outline

- Introduction
- Research Approach
- Discussion Questions
- Results from Interviews with Examiners
- Interactive Discussion

2

## Introduction

- NRC and EPRI are working together to coordinate human factors research efforts in NDE.
- Research goals:
  1. Systematically evaluate the human factors that can affect UT examiners
  2. Identify future actions to address human factors challenges in NDE
- Multi-method approach:
  - Review of Previous Research
  - Review of Operating Experience
  - Field Observations
  - Interviews with Examiners
- Today we will present the highlights of the results from interviews with UT examiners.

3

## Research Approach

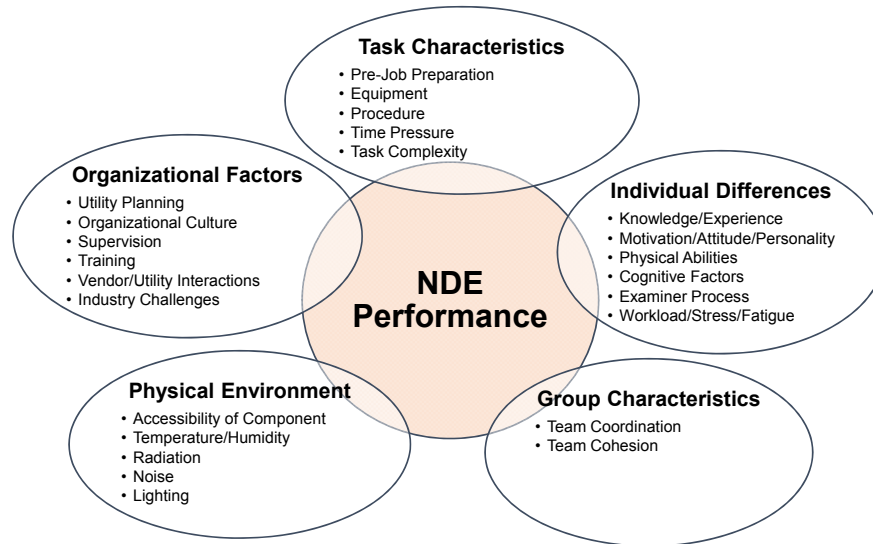
- NRC and EPRI independently interviewed 61 ultrasonic examiners
  - Mix of interview techniques
    - In-person, phone, focus groups
  - Mix of Utility and Vendor
  - Mix of UT Level II and III
  - Mix of geographic regions

	Level II	Level III	Total
<b>Vendor Employee</b>	19	14	33
<b>Utility Employee</b>	9	19	28
<b>Total</b>	28	33	61

- Questions included:
  - What tasks are most important to get right and why?
  - What factors can influence how well these tasks are performed?
- Interviews provide examiners' perspectives on factors that are important to the reliability of manual UT NDE

4

## Factors That Can Influence Human Performance\*

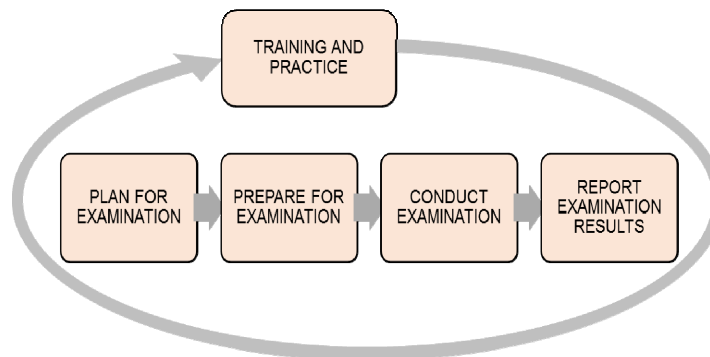


\*Also referred to as “performance influencing factors”

5

## Manual UT Functions – Organization of Results

- Research results are organized by the major functions involved in performing manual UT (Planning, Preparing, Conducting, Reporting)
- Functions represent groups of activities performed together to accomplish an overall goal
- Training and Practice is a function that occurs across the UT lifecycle



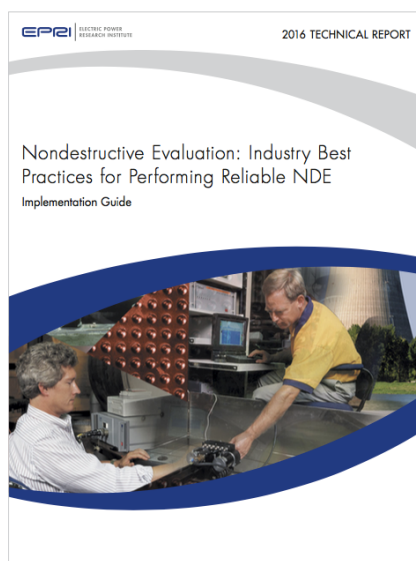
6

## Discussion Questions

- As we discuss the results please consider:
  1. What are your thoughts about what is working well now?
  2. What could potentially be improved and how?
  3. Are there already best practices that would address this factor?

7

## Best Practices



### CONTENTS

1 PRE-EXAMINATION PREPARATION .....	1-1
2 SCHEDULING EXAMINATIONS .....	2-1
3 NDE STAFFING .....	3-1
4 NDE STAFF INDOCTRINATION .....	4-1
5 EXAMINER PREPARATION, TRAINING, AND PRACTICE .....	5-1
6 PRE-JOB BRIEFING .....	6-1
7 USE OF TEAM SCANNING .....	7-1
8 OVERSIGHT .....	8-1
9 POST-JOB DEBRIEFING .....	9-1
10 NDE DATA REVIEW .....	10-1
11 EXAMINATION/OUTAGE CLOSEOUT .....	11-1
12 REFERENCES .....	12-1

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8

## Guidelines for Discussion

- Results will be presented in groups based on manual UT functions:
  1. Training and Practice
  2. Planning for NDE
  3. Preparing for NDE
  4. Conducting NDE
  5. Reporting Results
- When commenting, please:
  - Introduce yourself and your organization
  - Keep each comment to about 15 seconds or less
  - Allow others to speak before contributing again
- Write down additional comments on notecards and submit them to the presenters if time runs out

9

## Results from UT Examiner Interviews

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10

## 1. Training and Practice

- Access to samples to practice detecting flaws
- Opportunities for feedback
- Opportunities for gaining practical on-the-job experience

- 1.) What are your thoughts about what is working well now?
- 2.) What could potentially be improved and how?
- 3.) Are there already best practices that would address this factor?

11

## 2. Planning for NDE

- Timely communications between utility and vendor
- Completeness and accuracy of work package
- Adequate preparation of component
- Availability of work opportunities and personnel

- 1.) What are your thoughts about what is working well now?
- 2.) What could potentially be improved and how?
- 3.) Are there already best practices that would address this factor?

12

### 3. Preparing for NDE

- Variations in standards and expectations across organizations
- Adequate time for preparation
- Equipment selection, setup, and usability
- Proper calibration
- Calculation of exam coverage
- Procedure usability
- Last minute changes or delays during preparation
- Quality of pre-job brief

- 1.) What are your thoughts about what is working well now?
- 2.) What could potentially be improved and how?
- 3.) Are there already best practices that would address this factor?

13

### 4. Conducting NDE

- Disruptions or delays in conducting exam
- Identification of correct component
- Awareness when conditions do not match expectations
- Accessibility of component
- Distractions from external sources during exam
- Distractions due to physical environment
- Time pressure during scanning
- Field conditions affect signal interpretation (relevant vs. non-relevant)
- Working in pairs

- 1.) What are your thoughts about what is working well now?
- 2.) What could potentially be improved and how?
- 3.) Are there already best practices that would address this factor?

14

## 5. Reporting Results

- Adequate time for documentation
- Lack of standardized process for documentation

- 1.) What are your thoughts about what is working well now?
- 2.) What could potentially be improved and how?
- 3.) Are there already best practices that would address this factor?

15

## Open Discussion and Feedback

Thinking about any of the factors discussed:

1. What are your thoughts about what is working well now?
2. What could potentially be improved and how?
3. Are there already best practices that would address this factor?

16



## Additional Information

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Publicly available EPRI and NRC reports on this research:

**NRC Report on Phase 1 Literature Review: *Review of Human Factors Research in Nondestructive Evaluation*.** Available in ADAMS at [ML17059D745](#).

**NRC/PNNL Report on Phase 2 Examiner Interviews: *Human Factors in Nondestructive Examination: Manual Ultrasonic Testing Task Analysis and Field Research*.** Available in ADAMS at [ML18176A055](#) (PNNL-27441).

**EPRI Report: *Human Factors in Nondestructive Evaluation (NDE): A Literature Review and Field Observations*.** Available at [www.epri.com](http://www.epri.com), Report No. [3002010462](#).

17

# Thanks!

18