

Quarterly Report – Public Page

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Prepared for: DOT

Project Title: Human Centric Approach to Improve Pipeline Non-Destructive Evaluation (NDE) Performance and Reliability

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Non-destructive evaluation (NDE) is critical to the efficient and safe operation of pipelines. These inspections, however, often contain unintentional human error, with proven collateral damage to property and persons. The objective of this project is to pilot both technology and human solutions that will address this critical deficiency.

Battelle experts in human factor evaluations are leading the investigation, and are collaborating with partnering NDE vendors Mistras Group, Inc, JENTEK Sensors, Inc, and Applus RTD. Extensive interviews, protocol reviews, field observations, and control tests with field pipe defects will be conducted and systematically analyzed to identify and prioritize detrimental human shaping factors in the first 12 months. For the most effective analysis, Battelle experts will optimize the well-established Saba™ Peak Performance System accompanied by Human Performance Technology Front-end Analysis. In the following one to two years, solutions will be developed and piloted, with Phase 2 dedicated to human interventions and Phase 3 to technology interventions.

Results and Conclusions:

The Principal Investigator conducted 20 of 24 interviews of “Accomplished Performers” (APs) of NDE of pipelines. APs were posed questions regarding:

- The job accomplishment (primary output)
- Critical skills associated with accomplishment
- Major accomplishments associated with overall accomplishment
- Outputs associated with major accomplishments

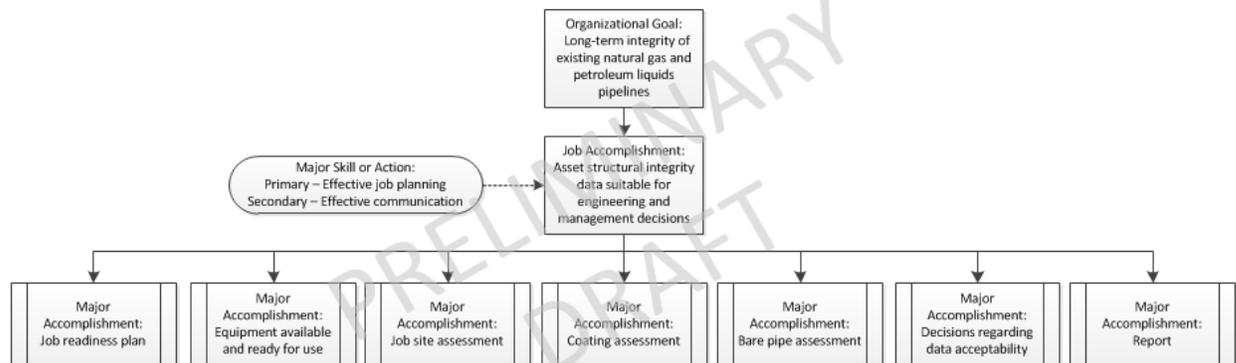
Inspectors were asked to describe their workflow and accomplishments. Collection of the major accomplishments concluded when the inspector indicated that the inspection and

any associated reporting was complete. The inspectors were explicitly asked to define the end of the inspection effort.

Questions were posed regarding the relative importance and difficulty of accomplishments, as well as interactions and time associated with each accomplishment.

After completing the structured data collection, we engaged inspectors in a conversation with several open-ended questions. The questions included, but were not limited to, the following: “What are positive influences on your inspection performance?”, “What are negative influences on your inspection performance?”, and “What are common mistakes that new and novice inspectors make?” The conversation also provided the inspector an opportunity to revisit any comments made during the structured interview that were not inspection-specific, such as those related to work motivation and career development.

A preliminary review of the interview data to identify and summarize overall job and major accomplishments as perceived by the APs suggests the following hierarchy:



A preliminary review of the interview data and research literature suggests the following broad taxonomy of performance shaping factors (PSF) influencing the inspection process. Note that PSF numbering does not suggest priority or strength of influence.

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| <ul style="list-style-type: none"> PSF1. Environmental <ul style="list-style-type: none"> a. Temperature b. Humidity c. Air quality d. Lighting e. Noise f. Vibration g. Degree of general cleanliness h. Movement constriction PSF2. Organizational <ul style="list-style-type: none"> a. Organizational structure (authority, communication channel(s)) b. Actions by supervisors, coworkers c. Rewards, recognitions, benefits d. Team structure and communication e. Plant policies f. Feedback of results g. Threats (of failure, loss of job) PSF3. Work Task <ul style="list-style-type: none"> a. Work hours/breaks b. Work methods c. Task speed d. Task load e. Task frequency and repetitiveness f. Task complexity | <ul style="list-style-type: none"> g. Work risk h. Monotonous work i. High vigilance j. Distractions PSF4. Physiological/Cognitive <ul style="list-style-type: none"> a. Long- and short-term memory b. Calculating requirements c. Interpretation requirements d. Stress (onset and duration) e. Fatigue f. Pain or discomfort PSF5. Operational <ul style="list-style-type: none"> a. Procedures required b. Work methods c. Plant policies d. Training provided PSF6. Personality <ul style="list-style-type: none"> a. Intelligence b. Motivation and attitude c. Emotional state d. Group identification PSF7. Technology <ul style="list-style-type: none"> a. Availability and adequacy of equipment/tools b. Man-machine interface factors |
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Plans for Future Activity:

The final four interviews associated with this effort are expected to be completed in July of 2016. Analysis of data and report writing will be the focus of the fourth quarter of this effort.