Zephyr® - Advanced Acquisition System
Field Performance Update

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Overview – Zephyr® Advanced Acquisition System

• Performance Results Summary
• Challenges
  – Plant 1
  – Plant 5
  – Plant 7
• Additional Benefits
  – Plant 4
  – All Plants
### Performance Results – Zephyr® Advanced Acquisition System

<table>
<thead>
<tr>
<th>Plant</th>
<th>Previous Scope</th>
<th>Scope</th>
<th>Delivery</th>
<th>Schedule Δ</th>
<th>Personnel Dose Δ</th>
<th>Probe Consumption Δ</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant 1</td>
<td>100%</td>
<td>Large Pilot R10↑</td>
<td>Pegasys®</td>
<td>-46 Hours</td>
<td>-43%</td>
<td>-9</td>
<td>Row 10 and higher w/pilot of low rows. 2 extra robots used from previous outage. Previous outage was 1/2 tubes. All bobbin inspections from one plenum</td>
</tr>
<tr>
<td>Plant 2</td>
<td>NA</td>
<td>Small Pilot 1 SG</td>
<td>ROSA™</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Stopped after ~50% of 1 SG due to ventilation location not in HRA</td>
</tr>
<tr>
<td>Plant 3</td>
<td>100%</td>
<td>100%</td>
<td>Pegasys®</td>
<td>-20 Hours</td>
<td>-25%</td>
<td>-5</td>
<td>All bobbin inspections from one plenum</td>
</tr>
<tr>
<td>Plant 4</td>
<td>50% + 3 R Periph</td>
<td>50% + 3 R Periph</td>
<td>Pegasys®</td>
<td>+0.5 Hours</td>
<td>NA</td>
<td>-18</td>
<td>Previous dose data unavailable. Several power outages and additional SI testing caused delays.</td>
</tr>
<tr>
<td>Plant 5</td>
<td>100%</td>
<td>100%</td>
<td>Pegasys®</td>
<td>-43 Hours</td>
<td>-7%</td>
<td>-13</td>
<td>General area dose rates were higher than previous outage. All bobbin inspections from one plenum</td>
</tr>
<tr>
<td>Plant 6</td>
<td>100%</td>
<td>100%</td>
<td>Pegasys®</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Zephyr work stopped to clarify signal question</td>
</tr>
<tr>
<td>Plant 7</td>
<td></td>
<td>Zephyr cancelled due to question about signal at another plant. Within 48 hours of project start.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Zephyr has reduced schedule time, person dose and project costs.
Challenges – Zephyr® Advanced Acquisition System

• Plant 1 – Two RP technicians received an uptake while changing HEPA filters
  – Unexpected high contamination levels
  – Need to brief RP team of high contamination potential

• Plant 5 – Containment airborne contamination
  – Containment was evacuated
  – Two SG workers received uptakes
  – Root cause – “The set-up, control and monitoring of the portable air filtration and vacuum system used to control airborne contaminants during Steam Generator #1 and #2 eddy current testing was not commensurate with the radiological conditions encountered during the task.”
Challenges – Zephyr® Advanced Acquisition System

• Plant 6 – Zephyr pilot program with ROSA had to shut down because the HEPA filter was not set up in a high-radiation area
  – Pilot program was about 50% complete
  – No RP support available to relocate HEPA
  – Communication of the importance of HEPA location was substandard

Ventilation configuration and team understanding of the risks are critical when employing Zephyr
Challenges – Zephyr® Advanced Acquisition System

• Plant 6 and 7 – Signal anomaly
  – When ASME flaw is set at 40° the dent is not horizontal
  – Causal analysis concluded that lack of probe centering was occurring in the calibration standard once the probe had been in service for awhile
    • The reasons could include: probe petal wear, conduit path bends, calibration standard alignment, debris in probe petals and others
    • To prevent this from occurring in the future, additional training has been/will be provided to operators and analysts to prevent a large number of retests due to this condition
  – Because plant 7 was within 48 hours of starting their inspection program and the plant 6 issue was not completely understood, the lead made the decision to revert back to the conventional probe

Signal anomaly was a probe issue, not a Zephyr issue
Benefits – Zephyr® Advanced Acquisition System

• Plant 4 – Previous inspections experienced probe snap through the low row u-bends
  – Corrective action written
  – After testing the Zephyr probe in the low row u-bends, it was decided that the Zephyr probe provided an excellent chance to eliminate the issue
  – Site implementation proved that the probe snap issue had been eliminated through the use of the Zephyr probe
Benefits – Zephyr® Advanced Acquisition System

• All plants – Ability to collect SG contamination in a preplanned and desirable location
  – Reduced dose to platform workers
  – Reduced general area dose
  – Ability to locate HEPA units in an out-of-the-way location

• All plants – High speed insert/retract
  – 120 ips insert
  – Up to 120 ips retract
    • No impact to data quality

The project teams from the plant and Westinghouse need to thoroughly understand and plan SG ventilation
Summary – Zephyr® Advanced Acquisition System

• Zephyr has been very successful, but has experienced challenges, as with most new technology
  – Ventilation
    • Easily resolved through preplanning and training
  – Signal
    • Ensure end users understand “probe wobble” in the standard and adequately address it before many retests are required
  – Benefits:
    • Schedule improvement up to 40 hours
    • Cost improvement
      – Less probe consumption
      – Less radioactive waste
    • Dose improvement
    • Elimination of “probe snap” in low row u-bends
    • Perform entire bobbin inspection program from one plenum
    • Ability to collect contamination in a more desirable location

When used with automated analysis, many benefits provided with minimal risk
Delivering the Nuclear Promise – Zephyr® Advanced Acquisition System

• Overall it is estimated that the U.S. nuclear industry will execute 107 steam generator inspection outages through 2020
  – Zephyr system savings, if applied to all:
    • Schedule and probe costs
      – Approximately $225 million
    • Person dose
      – 107 REM
    • Radioactive waste
      – Conduit, platform decontamination materials, spent probes
      – Difficult to quantify, but very significant
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