

Condition Assessment Manual

Pressurized Water Conveyance Inspection Form and Checklist



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Prepared by
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6283
managed by
UT-BATTELLE, LLC
for the
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and

MESA ASSOCIATES, INC.
Chattanooga, TN 37402

Penstocks, Tunnels, & Surge Tanks – Inspection Form

General Information:

Date of Site Visit: _____

Plant Name: _____

Source(s) of Data: _____

Number of Units: _____ Unit Inspected: _____

Description of General Arrangement (i.e., Group Shared Penstock): _____

General Construction Description: _____

Age of Conveyance (Tunnels or Penstocks): _____ Penstock Diameter (ft): _____

Exposed Length (ft): _____ Buried Length (ft): _____

Accessibility for Visual Inspection: _____

Previous Condition Assessment Date(s): _____

Chronic Issues or Maintenance (Routine and Corrective): _____

Description of Gate Types and Configuration: _____

Description of Liners (if applicable): _____

Age of Liner [Yrs]: _____

Liner Material: _____

Previous Maintenance Issues with Liner [If yes, describe]: _____

Estimated Life Remaining for Liner [Yrs]: _____

Tunnels:

Surge Tanks:

Penstocks:

Bifurcations:

Linings and Coatings:

Foundation and Supports:

Air Vent/Pressure Relief Valve:

Joints and Couplings:

Penstocks, Tunnels, & Surge Tanks Check List				
Topic	Yes	No	N/A	Comments/Details
A. General Information				
What are the plant specific life and serviceability needs for the pressurized water conveyance system?				
Identify the appropriate testing techniques to be used. <i>[This will depend on accessibility, construction materials, plant requirements, safety restrictions, etc.]</i>				
Identify any testing techniques or equipment required for the plant walk down. <i>[Depends on accessibility, plant requirements, safety restrictions, construction materials, etc.]</i>				
Have all plant records regarding maintenance repairs, operating conditions, performance data, etc. been requested/gathered?				

Penstocks, Tunnels, & Surge Tanks Check List - Continued				
Topic	Yes	No	N/A	Comments/Details
B. Interior Condition				
Is there evidence of previous repair work? <i>[If so, what type of repair and are they listed in previous reports? List any changes in condition and repair effectiveness.]</i>				
Is material buildup (protrusions) or debris present? If yes, what is the extent and severity of buildup? What is the type and apparent source of debris? <i>[Buildup could be due to organic growth, calcium deposits, liner degradation, marine organisms, etc. Large amounts of debris could indicate a trash rack failure.]</i>				
If concrete structure, is cracking visible? If so, create a crack map listing the location, severity, and type of cracking.				
If concrete structure, is spalling, erosion, cavitation, or other deterioration present? If so, list the location, severity, and potential causes. <i>[Causes can be surface irregularities, high flow at transition areas, high sediment, etc.]</i>				
If steel is present, is there visible damage from cavitation or abrasions to the surface? <i>[Causes can be surface irregularities, high flow at transition areas, high sediment, etc.]</i>				
If steel is present, is there evidence of corrosion, rust, shell thinning, or cracking? <i>[If so, use an ultrasonic thickness measuring device to determine thickness loss and document these results.]</i>				

Penstocks, Tunnels, & Surge Tanks Check List - Continued				
Topic	Yes	No	N/A	Comments/Details
B. Interior Condition - Continued				
For unlined tunnels, is rock/debris fallout or cavities in the tunnel walls present? <i>[If so, to what extent (i.e. localized or widespread) and how severe?]</i>				
Is there visible leakage occurring at gates? If yes, where and has it been previously documented? What are possible causes? <i>[At the seals, guides, gate assembly, etc.]</i>				
Is cracking of the liner visible (deep cracks or mud-cracking) <i>[Look for surface cracking or deep cracks which extend through the liner to the shell]</i>				
Is there apparent damage to the surface of the liner? <i>[Damage to liner may indicate loose debris in penstock or intake from either deteriorated liner/tunnel or issues with the trash racks]</i>				
Is there evidence of adhesion loss or de-lamination of the liner? <i>[Look for flaking or lifting of the liner or blistering. If present, it may be necessary to perform adhesion testing]</i>				

Penstocks, Tunnels, & Surge Tanks Check List - Continued				
Topic	Yes	No	N/A	Comments/Details
B. Interior Condition - Continued				
Are there any pin-holes, voids in the liner or areas where the liner is missing? <i>[Is the shell material visible?]</i>				
Are there any other indications of liner deterioration?				
C. Geometric Observations (Penstocks)				
Are there signs of ovalization (out-of-roundness), distortions, or flat spots? <i>[Measure diameter both horizontally and vertically at various increments along the penstock's length]</i>				
Are there signs of misalignment? <i>[Look for cracks in thrust blocks, cracks in the surrounding earth, ovaling, misalignments at joints/connections]</i>				
Is there evidence of localized buckling (circumferential buckling) of the penstock shell? <i>[Can result from inadequate provisions for expansion and contraction due to thermal changes]</i>				

Penstocks, Tunnels, & Surge Tanks Check List - Continued				
Topic	Yes	No	N/A	Comments/Details
D. Exterior Condition				
Is there evidence of previous repair work? <i>[If so, what type of repair and are they listed in previous reports? List any changes in condition and repair effectiveness.]</i>				
If concrete structure, is cracking visible? If so, create a crack map listing the location, severity, and type of cracking.				
Is the penstock under hydrostatic pressure and has all debris or slides covering the penstock been removed? <i>[This is the preferred method for exterior inspections of penstocks]</i>				
Are there areas of distress in the penstock coating? <i>[Look for stretching, cracking, or broken areas. This could indicate hidden problems in the base materials.]</i>				
Are there any signs of leakage or coating degradation?				

Penstocks, Tunnels, & Surge Tanks Check List - Continued				
Topic	Yes	No	N/A	Comments/Details
D. Exterior Coating/Surface Condition				
Are there any rust blisters, stains or other signs which could indicate corrosion of the steel base material?				
For bolted/riveted joints or connections, is there evidence of corrosion or rust, movement, missing or loose fasteners or leakage?				
For concrete penstocks, do the waterstops or gaskets at the joints show signs of deterioration or leakage?				
For welded joints, are the welds cracked or flawed and are there signs of leakage?				
Is there evidence of movement or settlement of the supports or excessive vibrations? <i>[Look for deformation or leaning of the supports]</i>				
Is there eroded soil or displaced rock at the bottom of the slopes near the penstock? <i>[Could indicate slope stability issues]</i>				
Is there concrete damage or deterioration of supports/foundations? <i>[Concrete spalling, cracking, erosion of supporting soil, etc.]</i>				

For overall questions
please contact:

Brennan T. Smith, Ph.D., P.E.
Water Power Program Manager
Oak Ridge National Laboratory
865-241-5160
smithbt@ornl.gov

or

Qin Fen (Katherine) Zhang, Ph. D., P.E.
Hydropower Engineer
Oak Ridge National Laboratory
865-576-2921
zhangq1@ornl.gov