



Tubular Management Decision Tree

Zach Burnett

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Bio Slide

- Zach Burnett
- Partner / Marketing & Business Development Manager
- Pro-Surve Technical Services, LLC. / ProSource Radiography Services, LLC.
- 13 years in Non-Destructive Testing and Inspection Industry
- Field of Expertise: Non-Destructive Testing, Electromagnetics, Tubular Inspection
- Industry Involvement/Recognition: ASNT Level III

Tubular Management Decision Tree Advantages

- Decisions made during TAR activities cost on average 5x higher.
- Applying a Tubular Management Decision Tree saves both time and cost during TAR activities in both day / night shift owner user repair review meetings and contract inspection cost.

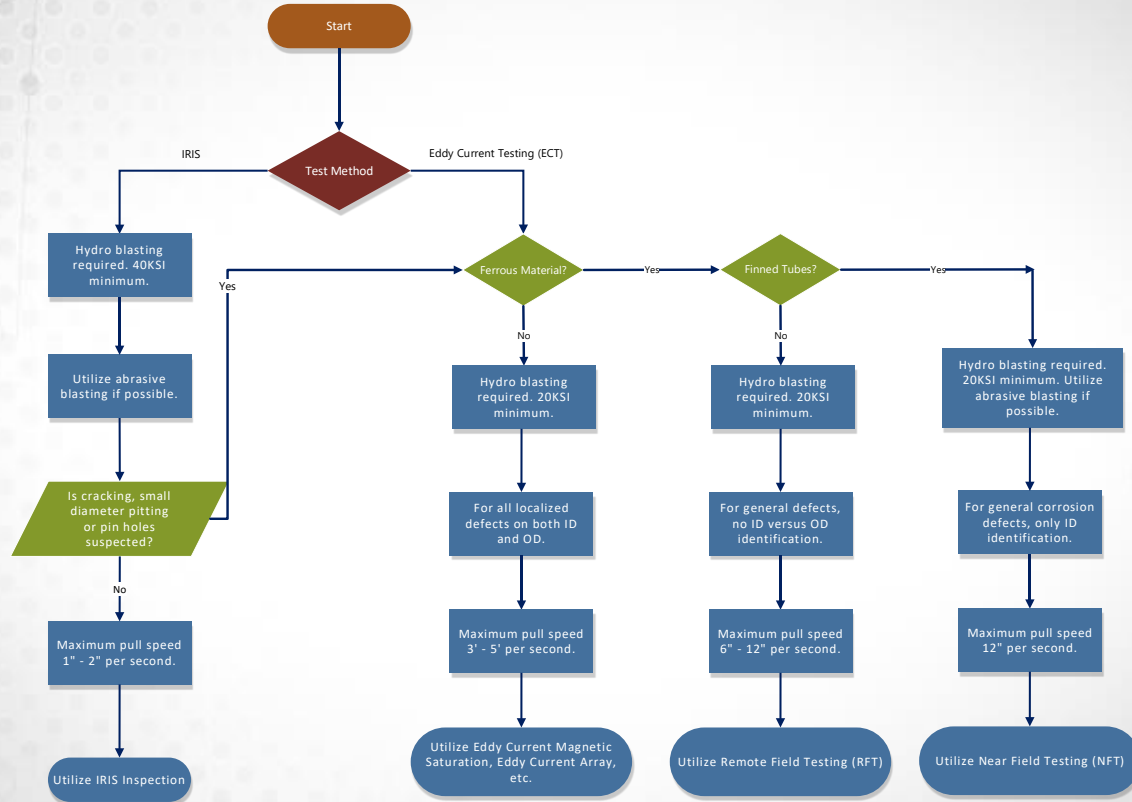
Data Needed for Tubular Management Tree

- Exchanger design and Tube specs:
 - Tube Material, Tube O.D., Tube Nominal Wall Thickness, Tube Length, Baffle Design, Baffle Thickness, etc.
- COF per PHA and Exchanger Efficiency Limit per Engineering Design.
- Anticipated Damage Mechanisms per process, design pressure, design temperature, etc.
- Limit of inspection scope and inspection pattern based on design and anticipated damage mechanisms (i.e. 10%, 25%, 50%, 100% / All peripheral tubes, X across tube sheet, every 5th row from top to bottom, etc.).
- Hold points (i.e. what level of wall loss needed to expand scope, what level of wall loss needed to plug tubes, what level of wall loss needed to re-tube).
- Decisions for path forward in each scenario of hold points.

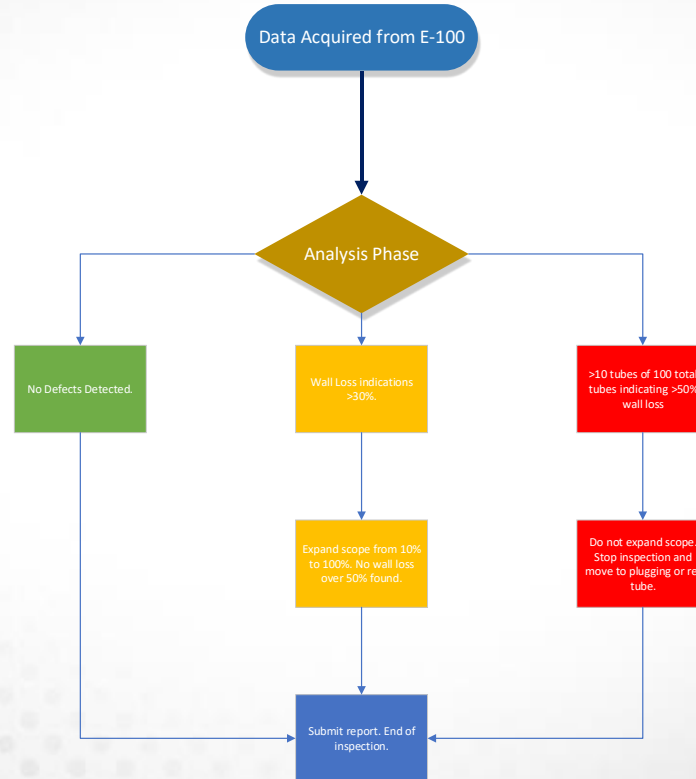
Tubular Inspection Recommendations

	IRIS	ECT-Mag. Sat. ECT – Array ECT	RFT	NFT – NFA
Materials	Both Ferrous and Non-Ferrous Materials.	Non-Ferrous Materials.	Ferrous Materials.	Ferrous Materials. Mainly Finned Carbon Steel Tubes.
Cleanliness	Recommend hydro-blasting with no less than 40K psi, abrasive blasting preferred.	Recommend hydro-blasting with no less than 20K psi.	Recommend hydro-blasting with no less than 20K psi.	Recommend hydro-blasting with no less than 40K psi, abrasive blasting preferred.
Damage Mechanisms	All damage mechanisms except cracking, small pitting and through wall holes.	Localized defects to include: small pitting, fretting, cracking, MIC attack, erosion, etc. Can determine ID from OD.	General defects to include: general corrosion, erosion, wear scars, fretting, thinning, etc. Cannot determine ID from OD.	General Corrosion, ID pitting (localized pitting must be NFA), erosion, etc. Cannot determine ID from OD.
Speed	1" – 2" per second.	3' – 5' per second.	6" – 12" per second.	12' per second.

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Example of Tube Inspection Workflow – Field Level



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