



Risk-Based In-Line Inspection

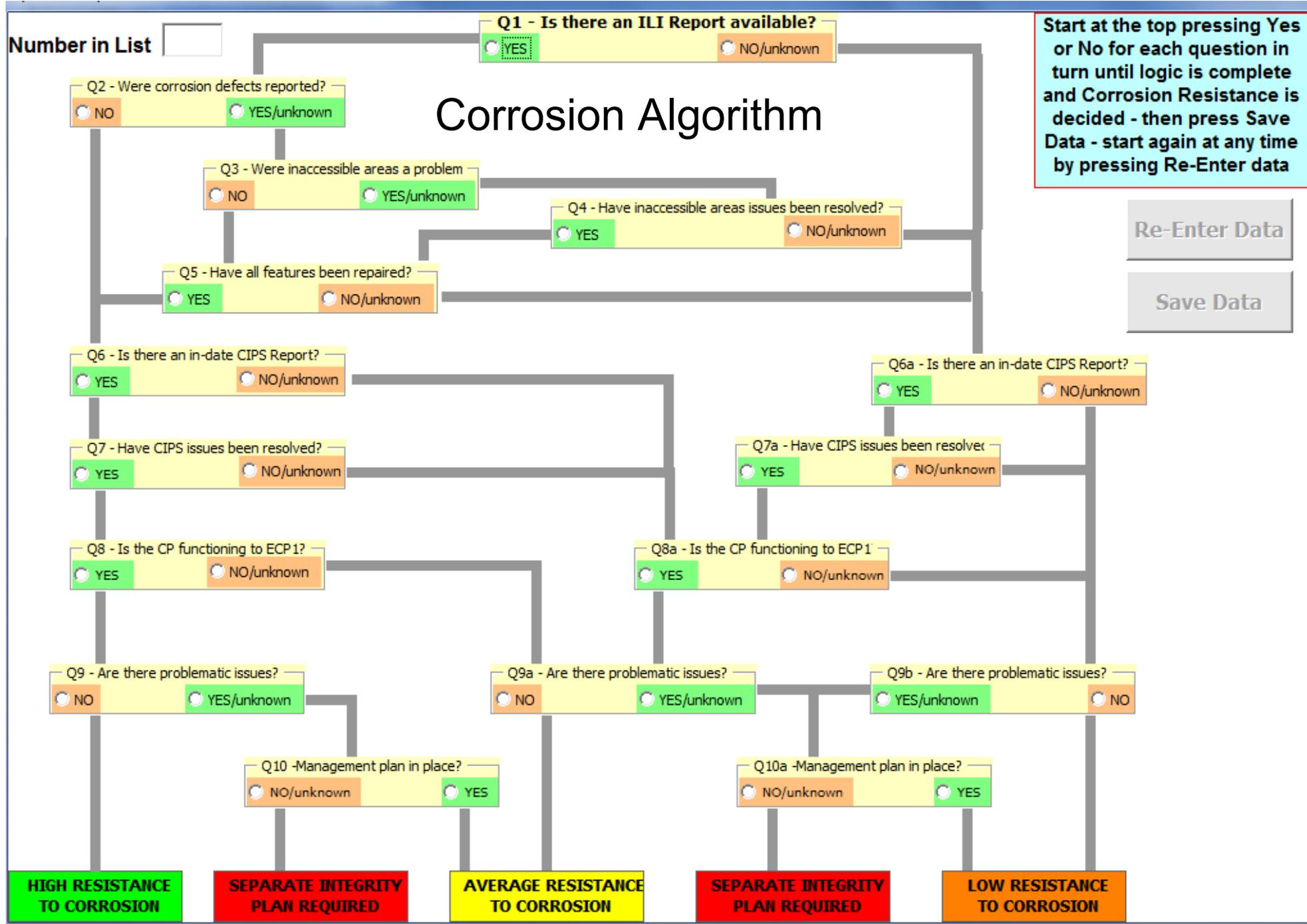
Rod McConnell

Introduction

- ❑ PIE Project for National Grid Transmission started in March 2008
- ❑ Replacement of 1992 British Gas “Intervals” model for assessing in-line inspection (ILI) frequency
- ❑ Assesses corrosion probability for increasing interval between in-line inspections
- ❑ Issues with “Intervals” model:-
 - ❑ assessed through-wall corrosion event – not acceptable today
 - ❑ balanced cost of ILI inspection against cost of loss of supply due to gas leak – no longer appropriate
- ❑ New model called “Intervals 2”
- ❑ Revised and updated for NG UKD, NGN, Scotia & W&W

Features of New Model 1

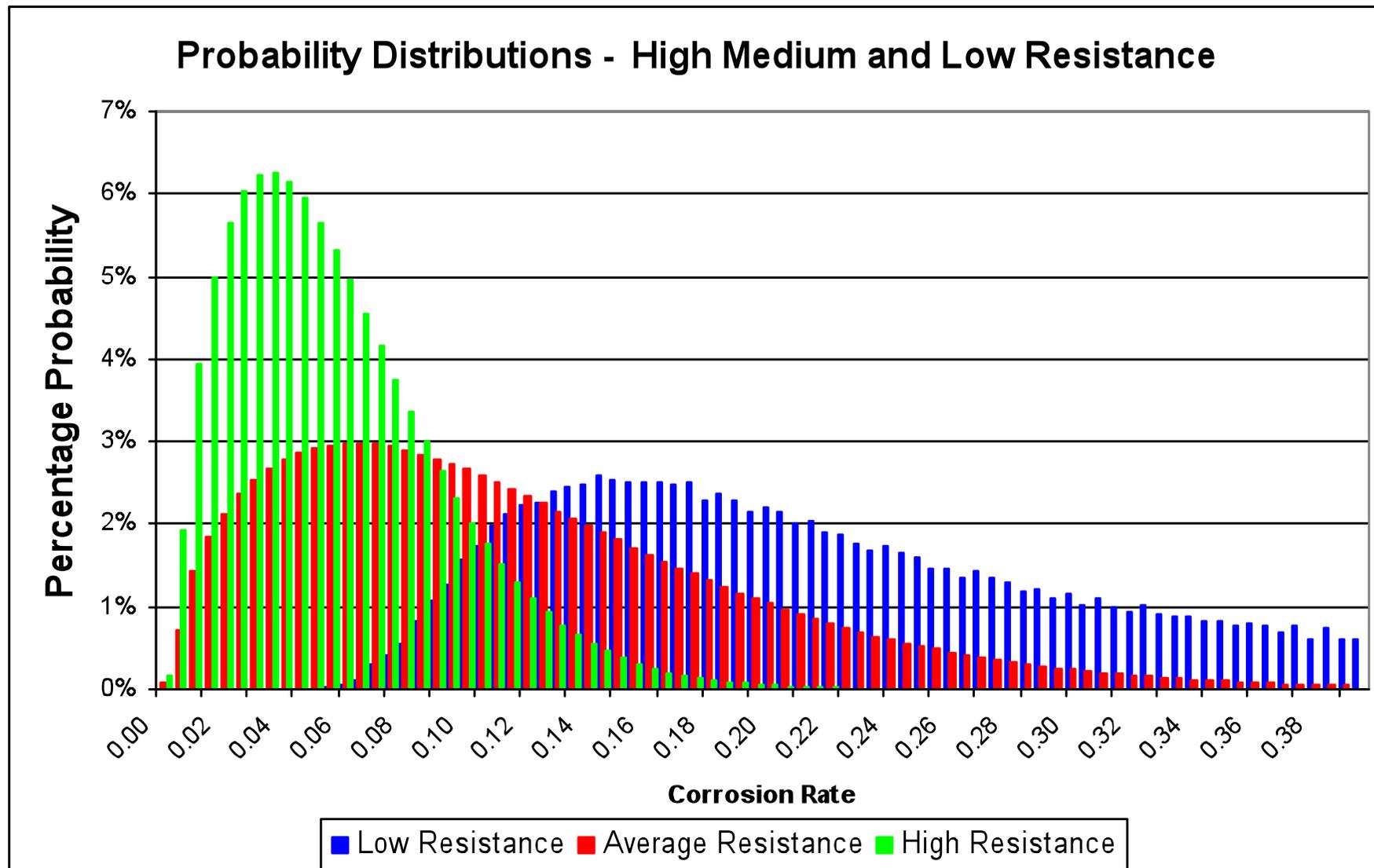
- ❑ Uses pipeline parameters to assess probability of corrosion – age, wall thickness, coating, pressure
- ❑ Sets allowable wall thickness for corrosion based on 90% of B(31)G depth criterion (safe wall thickness for infinitely long defect) or max. 70% wall thickness
- ❑ Allows for periods of high corrosion (e.g. CP not working)
- ❑ Assesses corrosion resistance based on newly-developed decision algorithm based on previous ILI inspection, CIPS surveys, CP performance etc.
- ❑ Pipelines categorised into HIGH, AVERAGE or LOW resistance to corrosion



Features of New Model 2

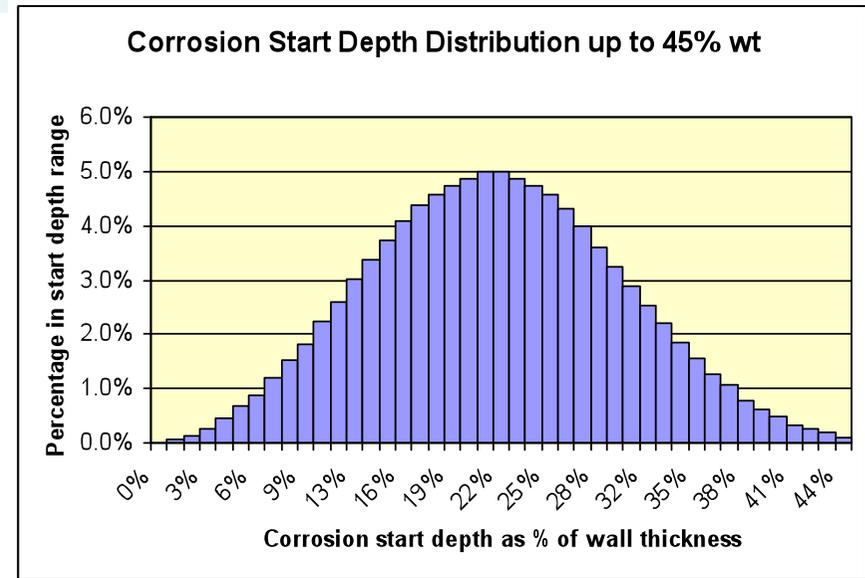
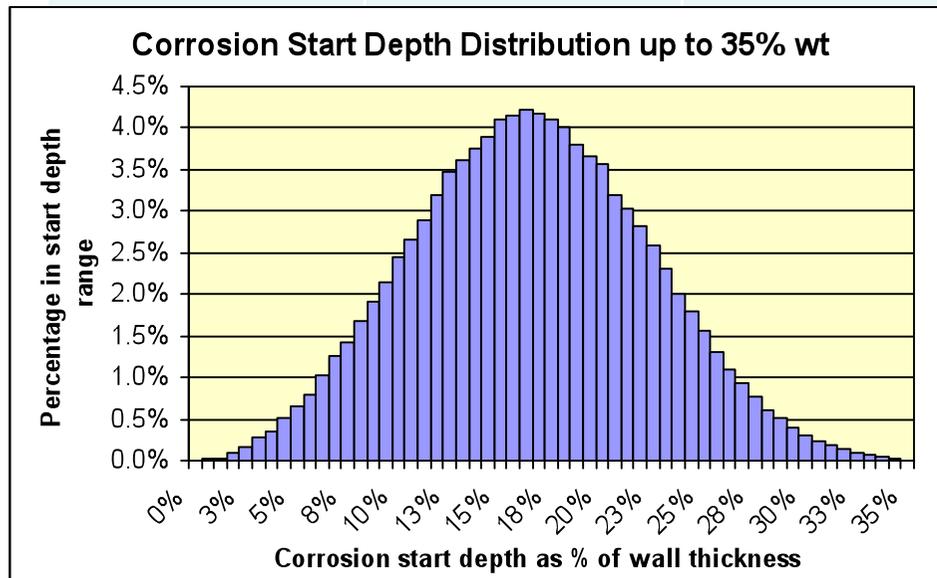
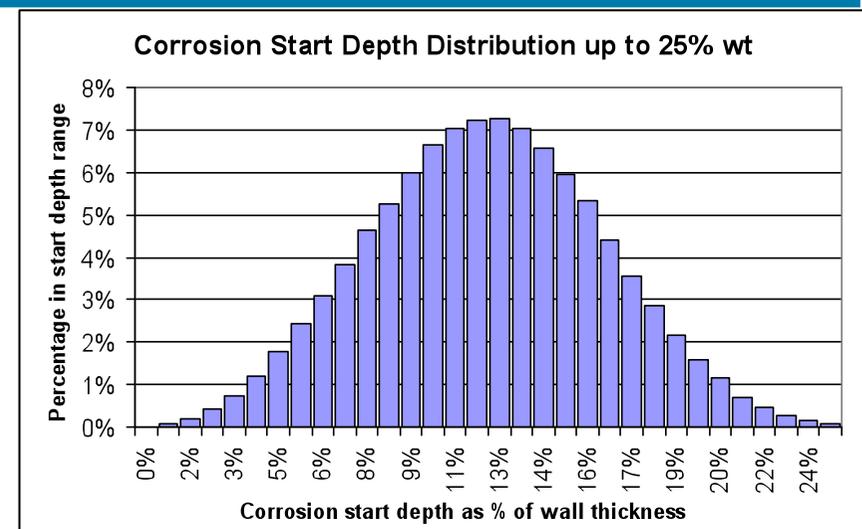
- ❑ New corrosion rate distributions based on assessment of UK corrosion rates – Dr Julia Race, Newcastle University
- ❑ Corrosion start depth based on pipeline stress level
- ❑ Uses Monte Carlo modelling to assess probability of exceeding 90% B31(G) (or 70%) wall thickness
- ❑ Presents results as probability of exceeding limit for 1,2,3,...up to 15 years – 15 year cap maintained
- ❑ Operator defines criticality of pipeline – HIGH, AVERAGE and LOW – set at 1%, 2%, and 5% probability of exceeding limit

Corrosion Rate Probability Distributions

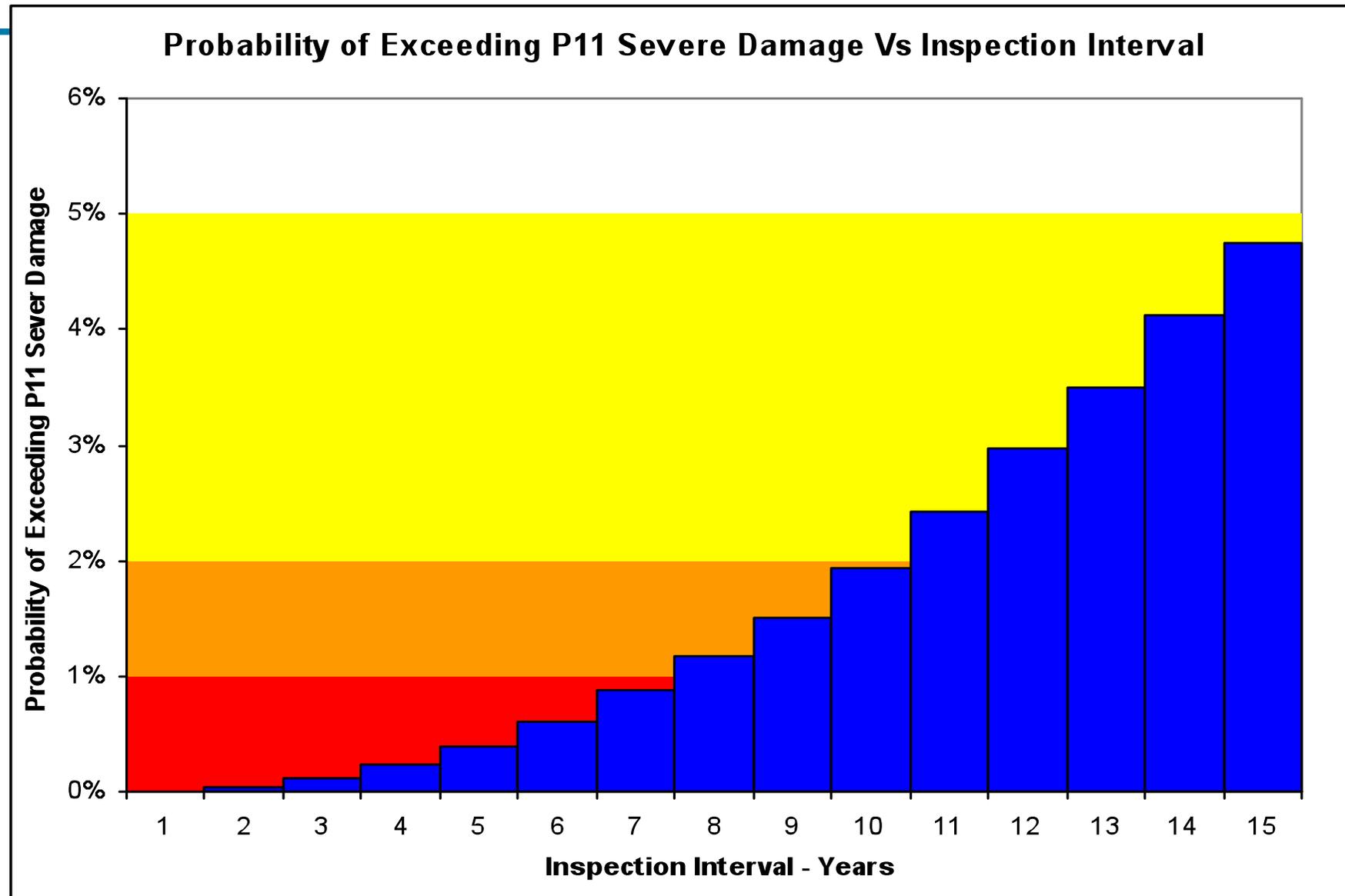


Corrosion Defect Start Distributions

Operating Stress (% SMYS)	P11 depth limit for Superficial Corrosion (%wt)	Methodology Starter Defect Distribution (% wt)
50% – 72%	20%	0 – 25%
30% – 50%	30%	0 – 35%
≤ 30	40%	0 – 45%



Results Presentation



Methodology - 1

- ❑ Assess probability of corrosion starting for inspection intervals 1,2,3....15 year, based on:-
 - ❑ Number of corrosion defects below and above reporting limit identified in last ILI inspection
 - ❑ Age of pipeline – older pipeline higher probability
 - ❑ Coating type – based on UKOPA data
- ❑ Calculate maximum allowable wall thickness available for corrosion, based on:-
 - ❑ B31(G) correlation (higher pressure = higher stress = lower available wall thickness)
 - ❑ Available wall thickness
 - ❑ Periods of higher rate corrosion

Methodology - 2

- ❑ Identify corrosion resistance from decision algorithm and assign corrosion rate distribution
- ❑ Define Corrosion Start Depth distribution based on pipeline stress level
- ❑ Apply Monte Carlo modelling to obtain probability that given corrosion defect exceeds limit
- ❑ Multiply [probability of corrosion starting] by [probability defect exceeds limit] to obtain overall probability
- ❑ Plot results for 1,2,3....15 years and define frequency based on Criticality level 1%, 2%, or 5%.

Acknowledgements

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- ❑ Robert Owen UKD, Barry Dalus NGN, and others...

Demonstration of “Intervals 2”