



An example of applying the
HOIS non-intrusive inspection
guidance document

Andrew Menmuir
CEng MIMechE



Agenda

- Introduction
- Non-intrusive inspection philosophy
- Slugcatcher deferment
- Subsequent slugcatcher internal examination
- Lessons learned
- Conclusion

Non-intrusive inspection philosophy

- We use the Internationally recognised NII guidance document DNV-RP-G103 developed by HOIS
- The document gives us a framework for
 - The correct selection of NII verses IVI
 - Defining a suitable & sufficient NII workscope
 - Assessing results
- Utilising NII as part of the risk optimisation process can
 - Avoid personnel risk associated with opening vessels
 - Avoid damage to linings etc during intrusive inspection
 - Have an enhanced probability of detection where access poor
 - Reduce shut-down durations
 - May reduce cost (but note can be time consuming & high day rates for specialist NDT)

Deferment of slugcatchers - why



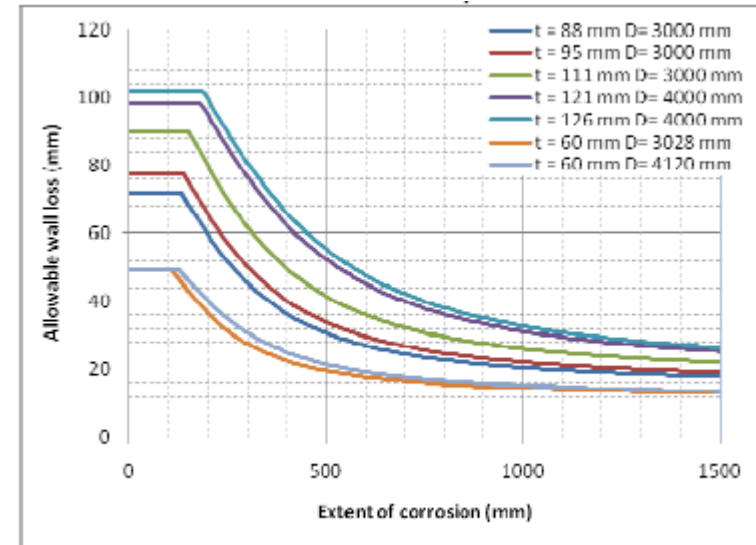
Length = 30m & Ø= 3m



- Due for examination in 2008 as part of WSE under PSSR 2000
- But, desire to align intrusive visual examination with 2009 worksopes

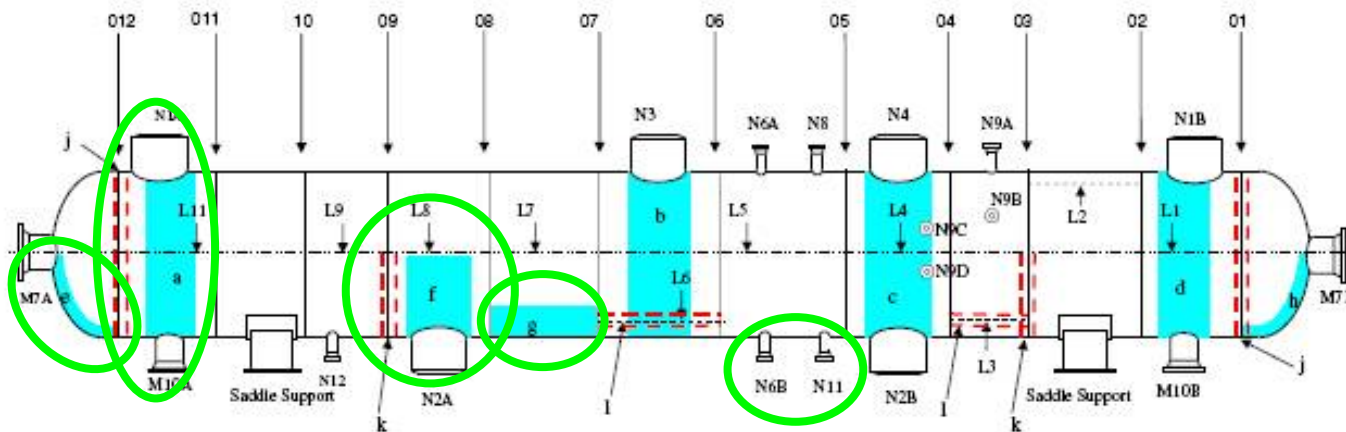
Deferment of slugcatchers – initial assessment

Vessel	Diameter [m]	Length [m]	Shell area [m ²]	Number of strikes per nominal:					Area per nominal [m ²]:				
				88 mm	95 mm	111 mm	121 mm	total	88 mm	95 mm	111 mm	121 mm	
C-301A	3	29.70	279.90	6	5			11	152.7	127.2	0.0	0.0	
C-301B	3	29.70	279.90	7	3			10	195.9	84.0	0.0	0.0	
C-301C	3	4	29.65	20.69	4	2	1	2	9	134.6	67.3	33.6	67.3
C-301D	3	29.70	279.90	7	3			10	195.9	84.0	0.0	0.0	
C-301E	3	29.70	279.90	9	1			10	251.9	28.0	0.0	0.0	
C-301F	3	29.70	279.90	8	2			10	223.9	56.0	0.0	0.0	
C-301G	4.45	21.30	297.75					0	*	*	*	*	



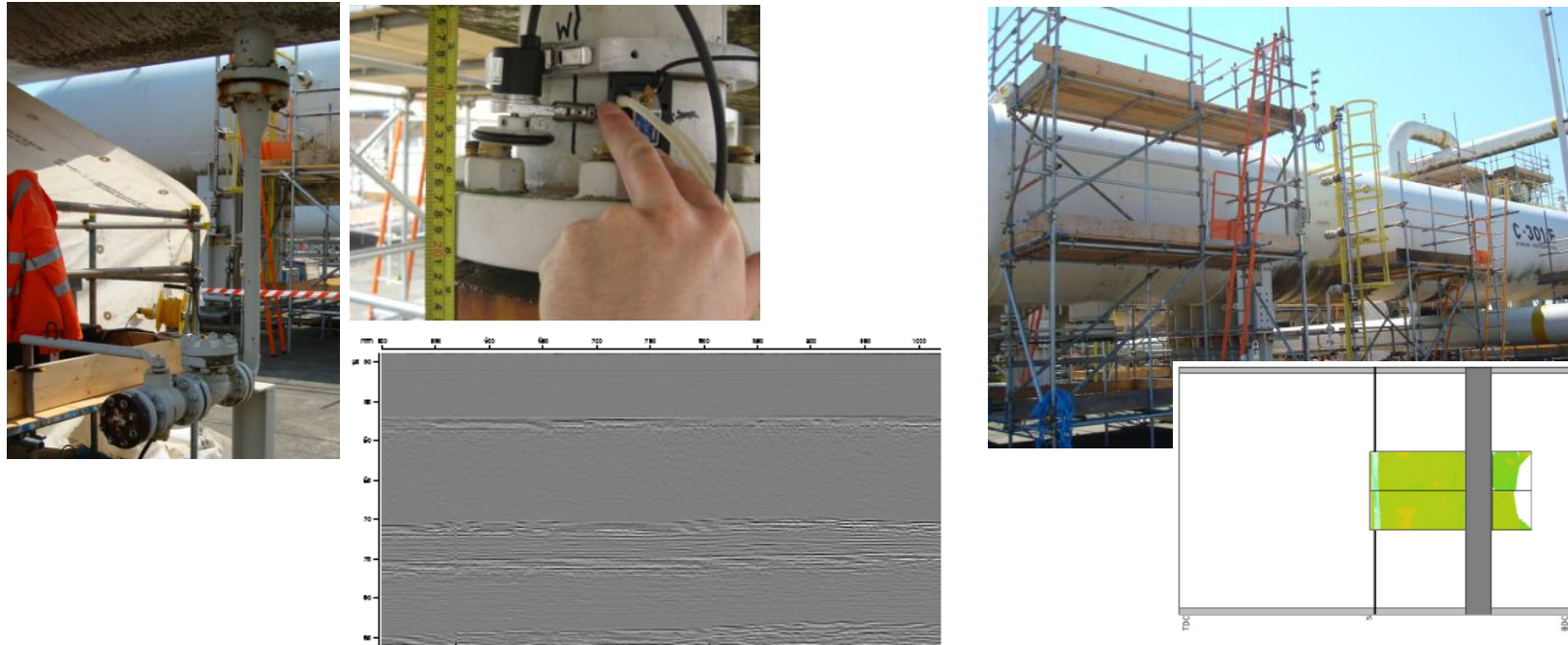
- NII verses IVI applicability assessment to HOIS NII guidance document
 - Vessel design and operating data
 - Corrosion assessment
 - Degradation mechanism review
 - Inspection history & capability

Deferment of slugcatchers – workscope



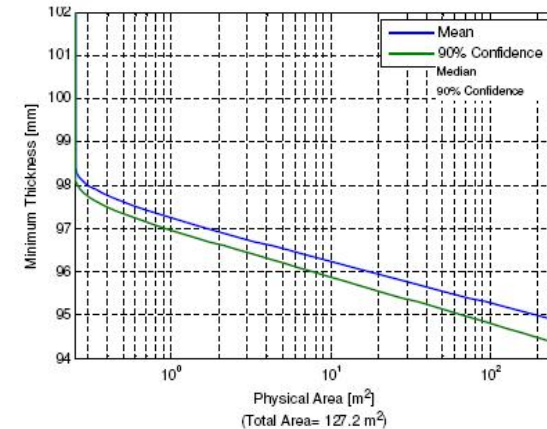
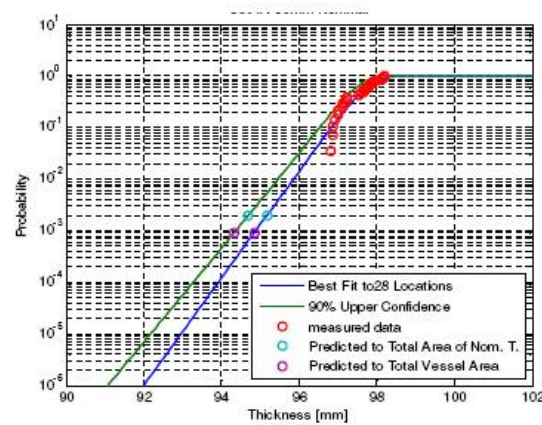
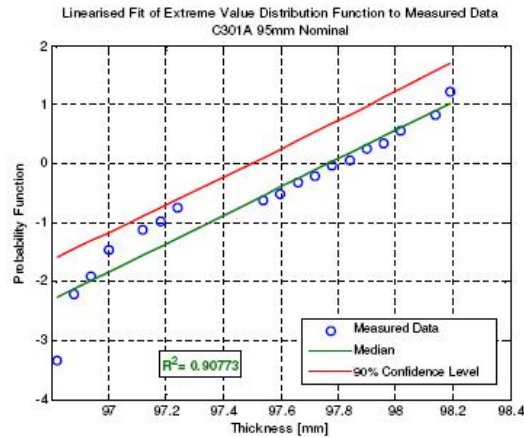
- Inspection workscope based on HOIS NII guidance document
 - External CVI
 - Shell, nozzles and end-caps via manual & automated ultrasonics
 - Construction welds via TOFD
 - Nozzle flange faces via shear wave ultrasonics
 - Vessel trim via radiography

Deferment of slugcatchers – NII output



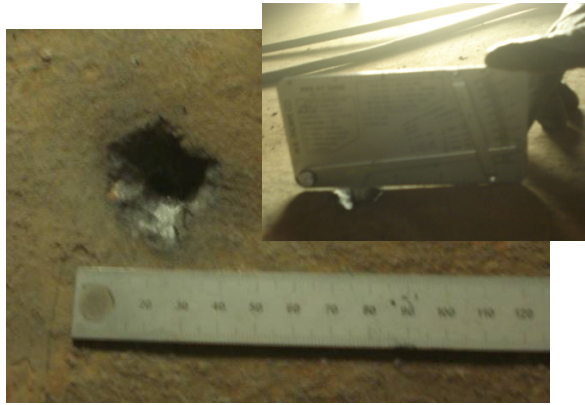
- Inspection results review based on HOIS NII guidance document
 - Minor external corrosion on flanges
 - Minor internal corrosion noted to shell and welds (< 6mm corrosion allowance & << API 579 limits)
 - Flange faces & trim clear

Deferment of slugcatchers - assessment



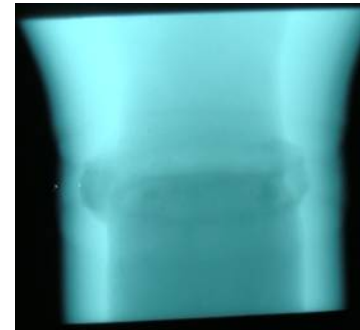
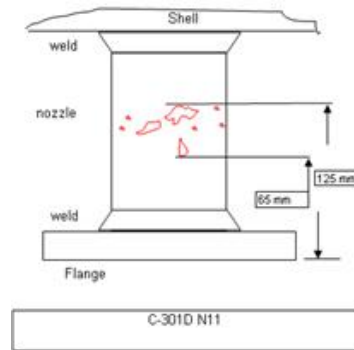
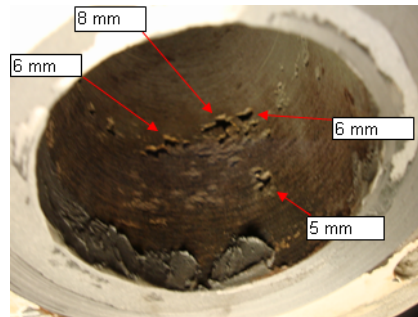
- Deferment assessment based on HOIS NII guidance document
 - Included extreme value analysis of shell ultrasonic thickness checks
 - Risk assessed as part of Safety Critical Element Deferment Risk Assessment process

One year on - internal examination



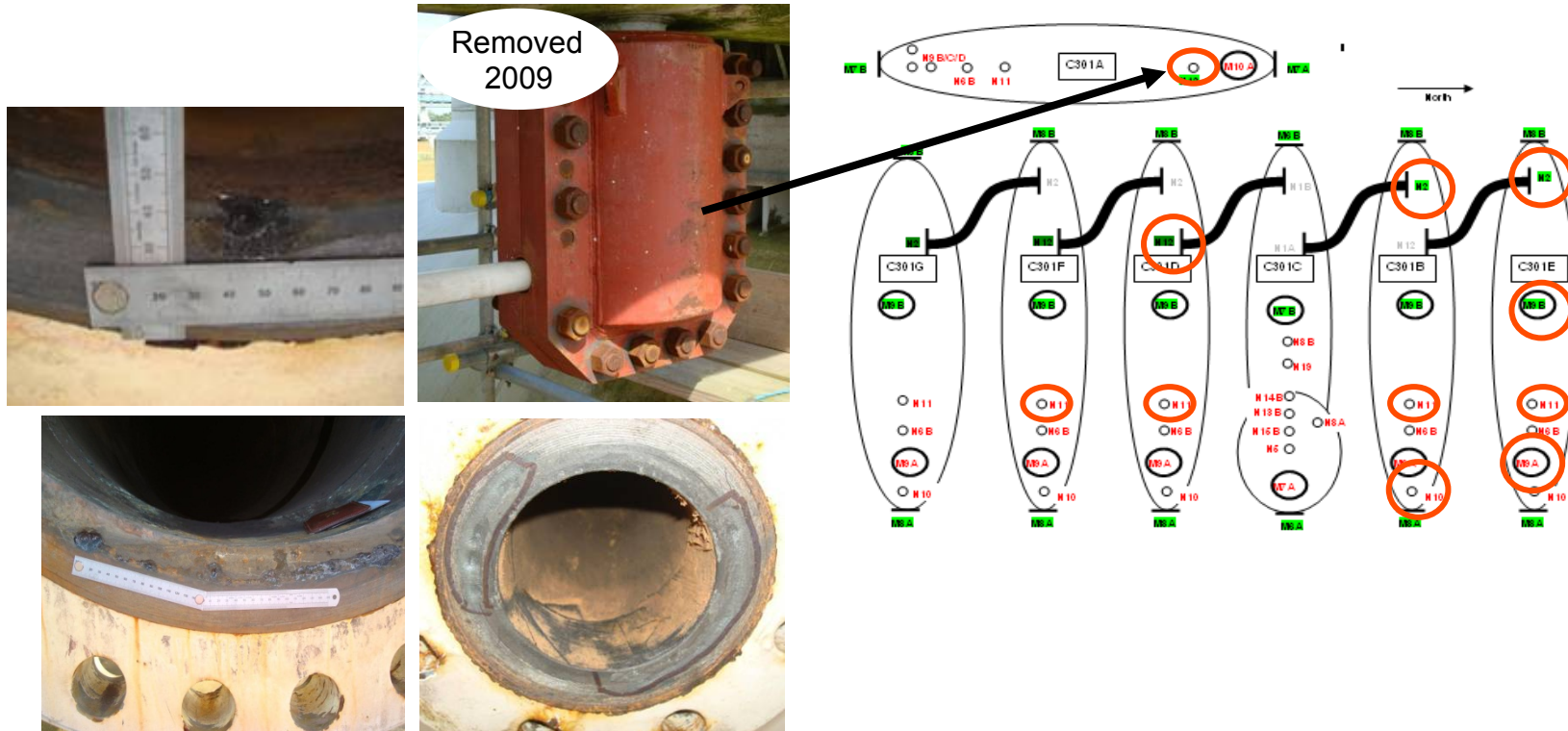
- Removal of a significant quantity of debris
- No linear indications on welds identified via ECI
- Most internal surfaces “pristine”
- Two areas of minor weld degradation & one minor pit on vessel shell
 - unexpected result, although within corrosion allowance less than one in a million according to NII EVA
 - negligible effect on vessel integrity (\ll MAWT from NII assessment)

One year on - internal examination



- One area of pitting on a nozzle bore at bottom of vessel
 - unexpected result, not covered by NII EVA / nozzle sampling exercise
 - repaired
- Weld corrosion on N2 purge lines
 - unexpected result, extensive radiography in 2008 did not identify weld issues on other types of trim
 - but, purge lines were not included in NII exercise as were covered by piping RBI
 - opportunity taken to blind off or replace

One year on - internal examination



➤ Flange face corrosion identified

- expected result, a defined life repair had been installed on a N2 purge line flange suggesting flange face corrosion may be an issue
- repaired

Lessons learned from slugcatchers

- Reinforced need to include the following as part of the RBI process
 - Optimisation of NII verses IVI decision via the HOIS NII guidance document
 - NII & IVI technique limitations (eg probability of detection)
 - Design improvement opportunities (for example, dead-leg elimination)
 - Link between pipework & vessel RBI

- Include all vulnerable nozzle bore as part of future NII exercises
 - Minimal cost impact
 - Vulnerable as typically thinner
 - May avoid need to include in extreme value analysis

- Resource allocation
 - Rigorous application of HOIS NII guidance document requires time and effort

Conclusions

- ConocoPhillips continue to successfully use the NII guidance document DNV-RP-G103 developed by HOIS
- Issues with access for inspection encountered as part of other vessel NII exercises addressed as part of the HOIS NII guidance document update
- At present, alternating NII and IVI is likely to be an optimal strategy
- Industry should continue to drive improvements in both RBI assessment techniques & inspection technologies to develop the NII process