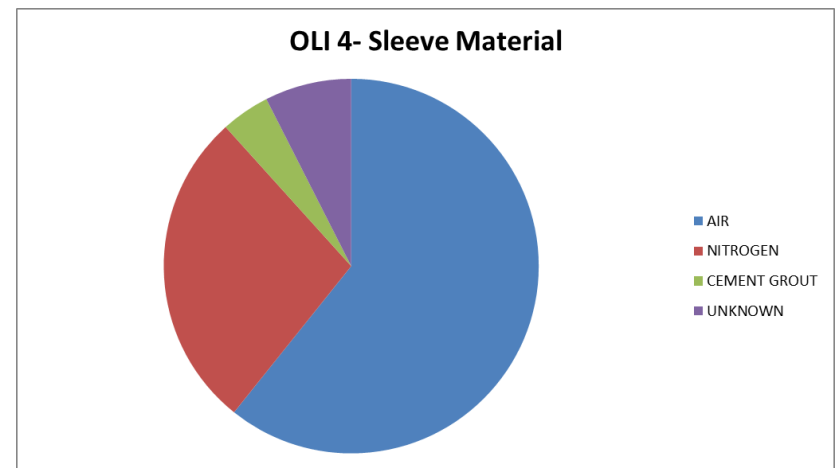
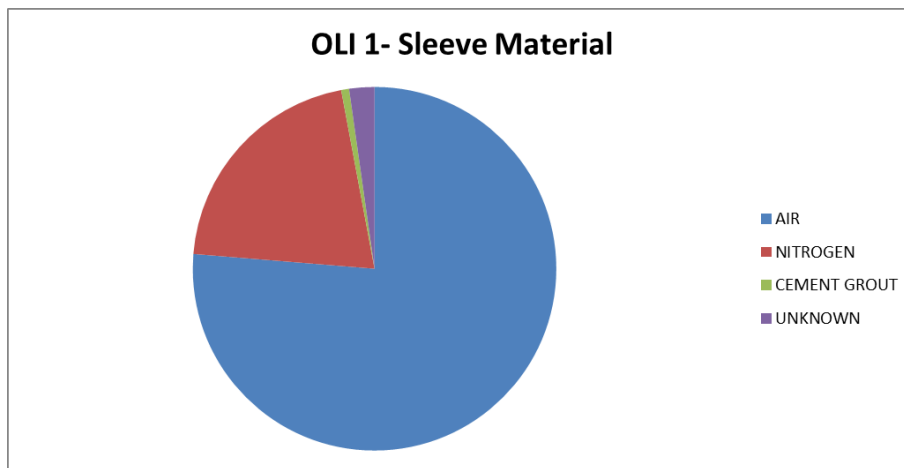




## **Sleeve/Casing Corrosion ILI Data Assessment Tool**

# Background

- ❑ UKOPA members operate a number of pipelines with external sleeves/casings
  - ❑ Road, rail, river crossings
- ❑ Located on both piggable OLI1 pipelines and non-piggable OLI4 pipelines

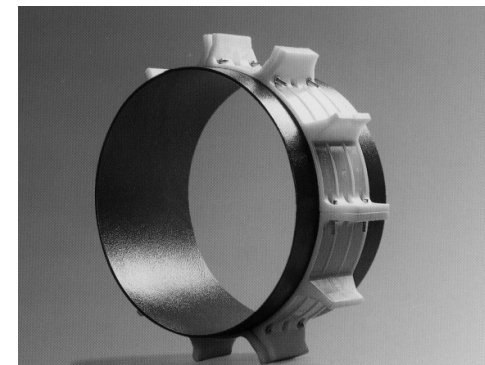


# Background

- ❑ Sleeves prone to corrosion
  - ❑ End seals break down
  - ❑ Water and soil enters annular space
  - ❑ Corrosive environment created
  - ❑ Electrical contact - sleeve and pipeline
  - ❑ CP system affected



[www.iksonic.com](http://www.iksonic.com)



# Background

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- ❑ Operators concerned about possibility of localised corrosion issues associated with sleeves/casings
- ❑ In particular, interested if the prevalence of corrosion associated with sleeves exceeds unsleeved pipeline sections
- ❑ This information would help inform where to concentrate future inspection and maintenance efforts
  - ❑ Especially important wrt OLI4 pipelines which cannot be internally inspected

# New Tool

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- ☐ Spreadsheet macro has been developed which allows sets of ILI data to be assessed quickly wrt sleeve corrosion
- ☐ Macro can assess ILI data sets from different vendors
  - ☐ PII, Rosen, Baker Hughes
- ☐ Macro has been developed to determine:
  - ☐ Total no. of corrosion defects on pipeline
  - ☐ Total no. of sleeves on pipeline
  - ☐ No. of corrosion defects beneath sleeves
  - ☐ No. of corrosion defects on un-sleeved sections
  - ☐ Length of sleeved pipeline (% total)
  - ☐ Length of un-sleeved pipeline (% total)
  - ☐ Details of sleeves
  - ☐ Details of defects beneath sleeves
  - ☐ Details of defects on un-sleeved sections
  - ☐ Average corrosion depth beneath sleeves
  - ☐ Average corrosion depth on un-sleeved sections
  - ☐ How many sleeves are eccentric, close to or touching pipeline
  - ☐ How many corrosion defects within  $\pm 12$  m of sleeve



# Tool Use – Front Page

1Instructions

2Copy Data into the Data Sheet, so column titles are in row 1

3(Ie remove any blank or information cells at top of spreadsheet)

4Run relevant macro by selecting button below - corresponding to the data origin

5Or Instead use the large button if unsure of data origin

6Results automatically produced on the table on the right

7List of corrosion incidents appear on Corrosion Incidents Sheet

8

9

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11

12

13Notes for reuse - needs three worksheets

14Labelled: Title Page (this one)

15Data with just the raw data (and column headings)

16Corrosion Incidents

17The In Casing/Out of Casing can be deleted or left before reuse

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Run Corrosion Separation Macro (Will Attempt to guess Data Source)

Run Corrosion Separation (for PII Data)

Run Corrosion Separation (for ROSEN Data)

Run Corrosion Separation (for Baker Hughes Data)

Title Page

Corrosion Incidents

Data

Results Overview

In Casing

Out of Casing

Total

Length of Pipe (km)

0.8

11.4

12.2

No. of Corrosions

0

16

16.0

Corrosions per km of Pipe

0.0

1.4

1.3

Average Depth

N/A

31.8%

Casing Summary

No. of Casing Segments\*

13

No of "Eccentric" Segmen

0

No. of Touching Segments

0

No. of Not Touching

0

No of Corrosions within 12m of a casin

0

\*Segments include Casings

Ready

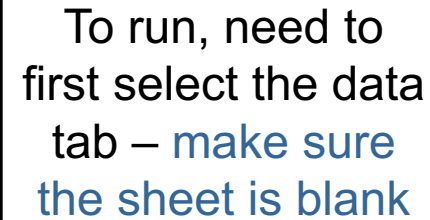
Spreadsheet front  
page

Instructions:  
Top left

Buttons to run:  
Bottom

Boxes for output:  
Top right

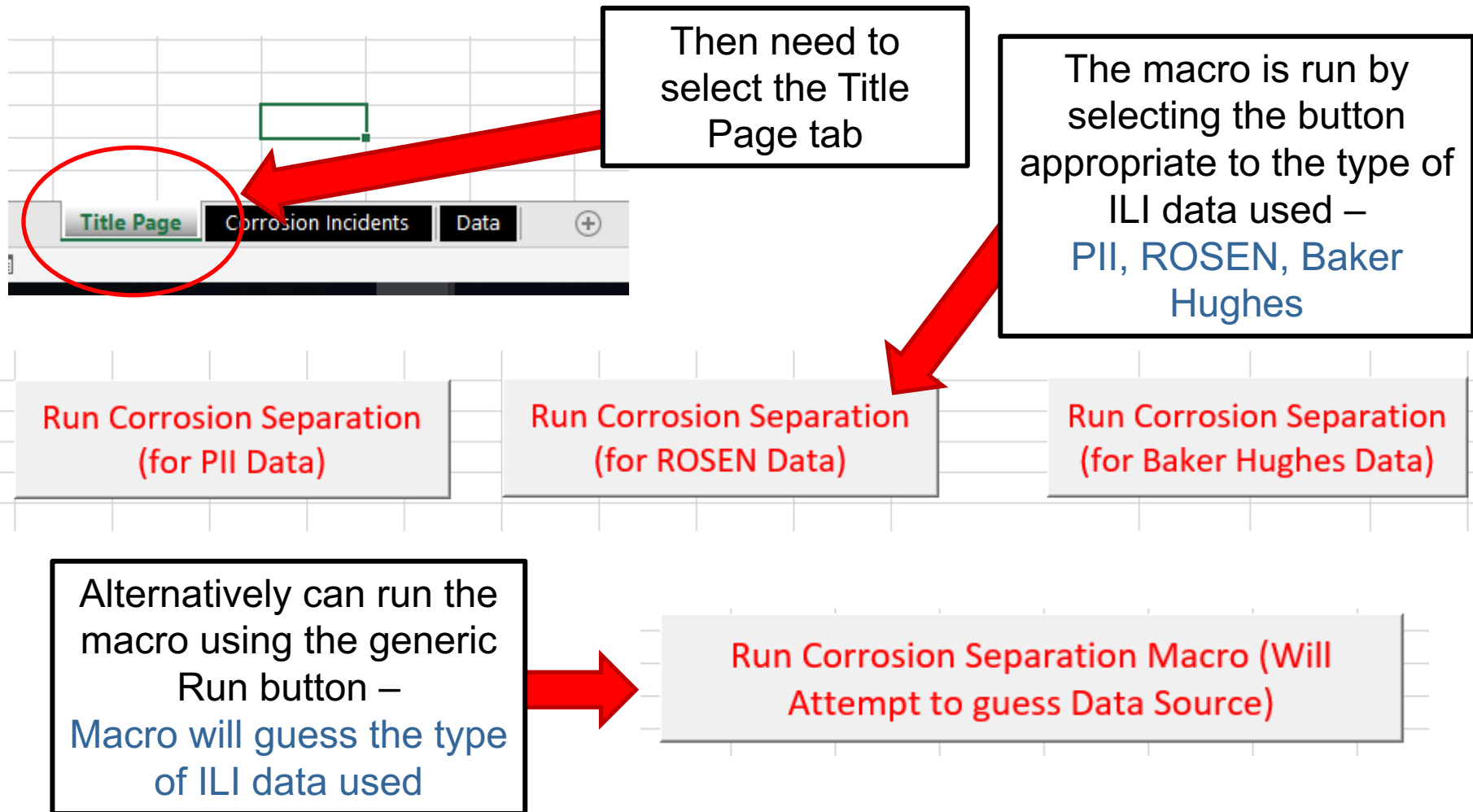
Three Tabs:  
Title page  
Corrosion Incidents  
Data



Then paste in the pipe tally data – first column header must be in cell A1

7

# Tool Use – Running the Macro





# Tool Use – Summary Output

Results Overview				
	In Casing	Out of Casin	Total	
Length of Pipe (km)	0.2	5.9	6.1	
No. of Corrosions	1	26	27.0	
Corrosions per km of Pipe	6.1	4.4	4.4	
Average Depth	13.0%	15.0%		

Casing Summary				
No. of Casing Segments*	5			
No of "Eccentric" Segmen	1			
No. of Touching Segments	Not Available in Data			
No. of Not Touching	Not Available in Data			

No of Corrosions within 12m of a casin	0			
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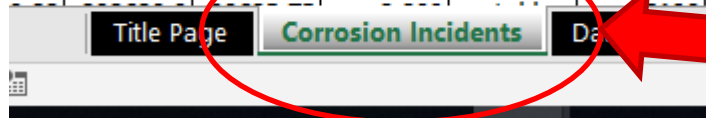
After running a data summary will be shown on the Title Page

Table gives summary of sleeves and corrosion defects within a single ILI data set, such as:

- ☐ Length of sleeved and unsleeved pipe
- ☐ Total no. of defects in sleeved and unsleeved sections
- ☐ Average depth of defects in sleeved and unsleeved sections
- ☐ Total no. of sleeves and which are eccentric

# Tool Use – Additional Tabs

7.33	292021.2	90025.34	2.307	metal loss	5130
9.42	292621.1	90625.41	2.305	metal loss	5130
9.42	292621.1	90625.42	2.305	metal loss	5130
9.53	292621.1	90625.51	2.301	metal loss	5130



The Corrosion Incidents tab lists details of all corrosion defects within sleeves followed by details of all corrosion defects on un-sleeved sections

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Casing Segments including Corrosion Incidents																	
2																		
3	log dist.	reasting [m]	northing	heighting	event / co	joint-num	J. len [m]	t [mm]	to u/s w.	o'clock / L	depth [%]	ERF_085	length [m]	width [m]	internal	Start/End	Corrosion	Segment Len
4	4525.45	292761.4	90327.62	1.608	Area Start	Casing										Start	No	
5	4527.06	292762.7	90328.56	1.586	Girth Well	4760	11.77	9.5								-	No	
6	4529.56	292764.7	90330.01	1.571	metal loss	4760		9.5	-2.5	4:28	6		32	18	YES	-	No	
7	4533.37	292767.8	90332.23	1.57	metal loss	4760		9.5	-6.31	7:49	13		26	29	NO	-	Yes	
8	4538.83	292772.3	90335.42	1.595	Girth Well	4770	11.61	9.5								-	No	
9	4550.44	292781.7	90342.2	1.571	Girth Well	4780	11.85	9.5								-	No	
10	4561.46	292790.6	90348.63	1.292	Area End	Casing										End	No	36.01
11																		
12																		
13	Corrosion Incidents Occurring Outside Casing Segments																	
14																		
15	log dist.	reasting [m]	northing	heighting	event / co	joint-num	J. len [m]	t [mm]	to u/s w.	o'clock / L	depth [%]	ERF_085	length [m]	width [m]	internal	Start/End	Corrosion	Segment Len
16	131.83	292288.4	86553.12	97.494	metal loss	280		7.9	-11.61	1:24	9		39	54	NO	-	Yes	
17	609.09	292166.5	86911.45	92.791	metal loss	730		7.9	-5.52	3:37	11		14	17	NO	-	Yes	
18	1168.11	292524.4	87302.68	57.873	metal loss	1220		7.9	-10.86	11:40	9		50	51	NO	-	Yes	
19	1584.21	292548.2	87641.69	47.737	metal loss	1680		7.9	-3.86	3:56	9		45	45	NO	-	Yes	
20	3215.98	292818.9	89101.26	5.835	metal loss	3270		7.9	-11.83	7:17	14		20	31	NO	-	Yes	
21	3696.99	292844.9	89534.2	1.961	metal loss	3870		9.5	-11.85	8:57	11		43	50	NO	-	Yes	
22	3766.55	292832.4	89602.6	2.172	metal loss	3940		9.5	-2.49	12:11	10		45	51	NO	-	Yes	
23	4095.46	292773.1	89925.95	1.92	metal loss	4230		9.5	-7.25	9:34	9		17	17	NO	-	Yes	
24	4095.75	292773	89926.23	1.918	metal loss	4230		9.5	-7.53	11:16	5		16	171	NO	-	Yes	
25	4095.75	292773	89926.24	1.918	metal loss	4230		9.5	-7.54	10:15	11		14	15	NO	-	Yes	
26	4293.19	292737.8	90119.15	2.544	metal loss	4450		9.5	-10.02	3:26	23	0.41	11	15	NO	-	Yes	
27	4648.11	292748.4	90420.8	3.205	metal loss	4920		9.5	-0.45	11:32	8		73	78	NO	-	Yes	
28	4855.73	292638.9	90596.9	3.355	metal loss	5100		9.5	-10.4	5:00	67	0.44	26	35	NO	-	Yes	
29	4886	292622.9	90622.51	2.404	metal loss	5130		9.5	-7.56	12:02	9		14	15	NO	-	Yes	
30	4889.18	292621.3	90625.21	2.312	metal loss	5130		9.5	-10.74	10:53	15		66	15	NO	-	Yes	
31	4889.31	292621.2	90625.32	2.308	metal loss	5130		9.5	-10.87	11:50	9		28	33	NO	-	Yes	
32	4889.33	292621.2	90625.34	2.307	metal loss	5130		9.5	-10.9	9:37	10		36	52	NO	-	Yes	
33	4889.42	292621.1	90625.41	2.305	metal loss	5130		9.5	-10.98	9:32	13		15	17	NO	-	Yes	
34	4889.42	292621.1	90625.42	2.305	metal loss	5130		9.5	-10.98	11:21	8		59	70	NO	-	Yes	
35	4889.53	292621.1	90625.51	2.301	metal loss	5130		9.5	-11.1	12:42	24	0.42	31	15	NO	-	Yes	

# Tool Use – Additional Tabs

5	Girth Weld	3900	11.8
5	Area End Sleeve		

Incidents | Data | **In Casing** | Out of Casing

The In Casing and Out of Casing tabs are created as part of the output

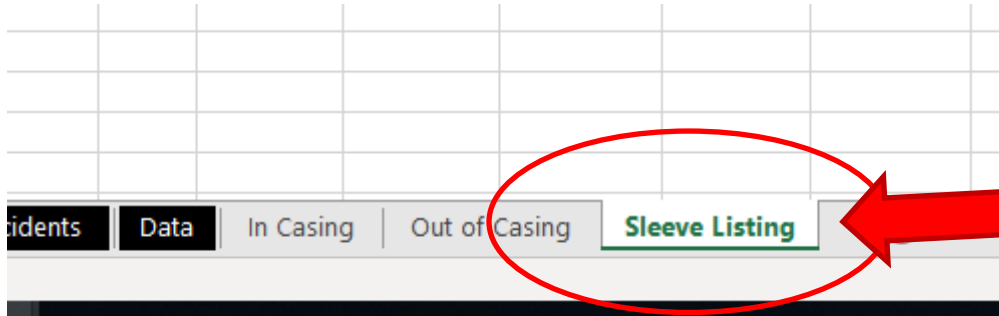
In Casing shows the parts of the full pipe tally which are beneath sleeves

1	1437.33	292483.1	87552.87	36.916	Girth Weld	1540	12.
2	1449.59	292478.7	87564.26	37.333	Girth Weld	1550	12.
3	1462.28	292474	87576.04	37.77	Girth Weld	1560	11.
4	1462.61	292473.9	87576.35	37.78	metal loss-milling feature	1560	
5	1474.18	292469.6	87587.07	38.183	Girth Weld	1570	12.
6	1486.06	292465.2	87598.09	38.692	Area End_Casing / eccentricity at 06:00		
7	2241.13	292670.7	88171.88	33.892	Area Start_Casing		
8	2251.19	292678.8	88177.93	33.791	Girth Weld	2390	11.
9	2255.09	292681.9	88180.27	33.736	metal loss-milling feature	2390	
10	2256.54	292683	88181.14	33.715	metal loss-milling feature	2390	
11	2257.55	292683.8	88181.75	33.705	metal loss-milling feature	2390	
12	2262.41	292687.7	88184.67	33.655	Girth Weld	2400	11.
13	2274.26	292697.2	88191.78	33.703	Girth Weld	2410	12.
14	2279.57	292701.4	88194.96	33.774	metal loss-milling feature	2410	
15	2280.2	292701.9	88195.33	33.782	metal loss-milling feature	2410	
16	2286.8	292707.2	88199.3	33.853	Area Start_Bend	2420	1.
17	2287.82	292708	88199.91	33.931	Bend / R:7.0D A:22.50° sag		
18	2288.77	292708.7	88200.45	34.258	Area End_Bend	2430	11.
19	2297.57	292715.3	88205.3	37.589	metal loss-milling feature	2430	
20	2300.49	292717.5	88206.92	38.682	metal loss-milling feature	2430	
21	2300.6	292717.6	88206.97	38.721	Girth Weld	2440	5.
22	2304.57	292720.6	88209.16	40.209	Area End_Casing		

Out of Casing shows the parts of the full pipe tally which are un-sleeved sections

1	-4.28	292399.3	86476.58	103.733	WT_Change	10	0.33	12.7	
2	-4.11	292399.2	86476.67	103.735	Flange				
3	-3.95	292399.1	86476.75	103.738	Girth Weld	20	0.91	12.7	
4	-3.54	292398.7	86476.96	103.745	Offtake / 25 mm				12:
5	-3.5	292398.7	86476.98	103.745	Support				6:
6	-3.04	292398.3	86477.23	103.753	Area Start	30	0.44	12.7	
7	-2.83	292398.1	86477.33	103.756	Bend / R:3.0D A:22.50° sag				
8	-2.6	292397.9	86477.46	103.76	Area End	40	0.84	12.7	
9	-1.76	292397.2	86477.9	103.774	Area Start	50	0.43	12.7	
10	-1.54	292397	86478.02	103.778	Bend / R:3.0D A:22.50° over				
11	-1.32	292396.8	86478.13	103.781	Area End	60	0.46	12.7	
12	-1.11	292396.7	86478.24	103.785	Offtake / 25 mm				12:
13	-0.86	292396.5	86478.37	103.789	Girth Weld	70	0.54	12.7	
14	-0.64	292396.3	86478.49	103.792	Offtake / 50 mm				9:
15	-0.32	292396	86478.66	103.798	Girth Weld	80	0.66	12.7	
16	0	292395.7	86478.82	103.803	Valve				
17	0.34	292395.4	86479	103.809	Girth Weld	90	0.54	12.7	
18	0.88	292395	86479.29	103.817	Girth Weld	100	0.42	12.7	
19	1.05	292394.8	86479.37	103.819	Above Ground Marker / [MFL] launcher @ MM				
20	1.07	292394.8	86479.38	103.819	Magnet Marker				12:
21	1.3	292394.6	86479.5	103.823	Girth Weld	110	1.01	12.7	
22	1.51	292394.4	86479.61	103.826	Attachment				6:

# Tool Use – Detailed Output



A more detailed results sheet is created and is found in the tab Sleeve Listing

- ❑ Sleeve Listing extracts similar data to overall summary table – but for each individual sleeve
- ❑ Sleeve Listing contains 23 different columns
  - ❑ 10 are populated by the tool using the ILI data
  - ❑ Remaining 13 must be completed manually by the operator using their records

# Sleeve Listing – Populated Columns

Start Distance (m)	End Distance (m)	ILI Sleeve Description	ILI Sleeve Length (m)	No. of Corrosion Defects	No. of Corrosion Defects per km.	Average Corrosion Depth (%wt)	Sleeve Eccentric?	Sleeve Touching?	Corrosion Within 12m?
912.326	932.554	ROAD CROSSING	20.228	None	N/A	N/A	No	No	No
1611.429	1637.086	ROAD CROSSING	25.657	None	N/A	N/A	Yes	No	Yes
4347.77	4370.537	ROAD CROSSING	22.767	None	N/A	N/A	Yes	No	No
4419.501	4433.377	RIVER LEVEN CROSSING	13.876	None	N/A	N/A	No	No	No
4901.348	4935.341	A911 ROAD CROSSING	33.993	None	N/A	N/A	Yes	No	Yes
5826.616	5845.323	ROAD CROSSING	18.707	None	N/A	N/A	No	No	No
7795.893	7801.313	LOTHRIE BURN	5.42	None	N/A	N/A	No	No	No
8042.325	8062.581	ROAD CROSSING	20.256	None	N/A	N/A	Yes	No	No
11149.651	11155.199	COUL BURN CROSSING	5.548	None	N/A	N/A	No	No	No

- ❑ Each sleeve is listed in order of log distance
- ❑ Description of sleeve (road crossing etc.) is extracted from the ILI data
- ❑ No. of corrosion defects, average corrosion depth, eccentricity for each sleeve included
- ❑ No. of corrosion defects per km is also included at present although this can give strange values due to the short length of sleeves

- ❑ Remaining columns to be filled in by operator from their records



# Things to Note

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- ☐ Sleeve descriptions dependent upon ILI data
  - ☐ Sufficient information may not be included for identification (e.g. road crossing vs. A911 road crossing)
  - ☐ No description data will leave a blank in the output
- ☐ Rosen data does not include a description of the sleeve
  - ☐ Identification must be done using distance
  - ☐ Exception: repair sleeves are noted
- ☐ Sheet developed using mainly PII data, only one set of Rosen and one set of Baker Hughes data
  - ☐ Certain categories may not work correctly in all cases, particularly eccentricity
  - ☐ Need to keep an eye on this and report any bugs

## Next Step

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- ☐ Tool to be distributed within UKOPA so operators can test it with their own ILI data
- ☐ Feedback:
  - ☐ Bugs
  - ☐ Errors
  - ☐ Suggestions for further inclusions or refinements