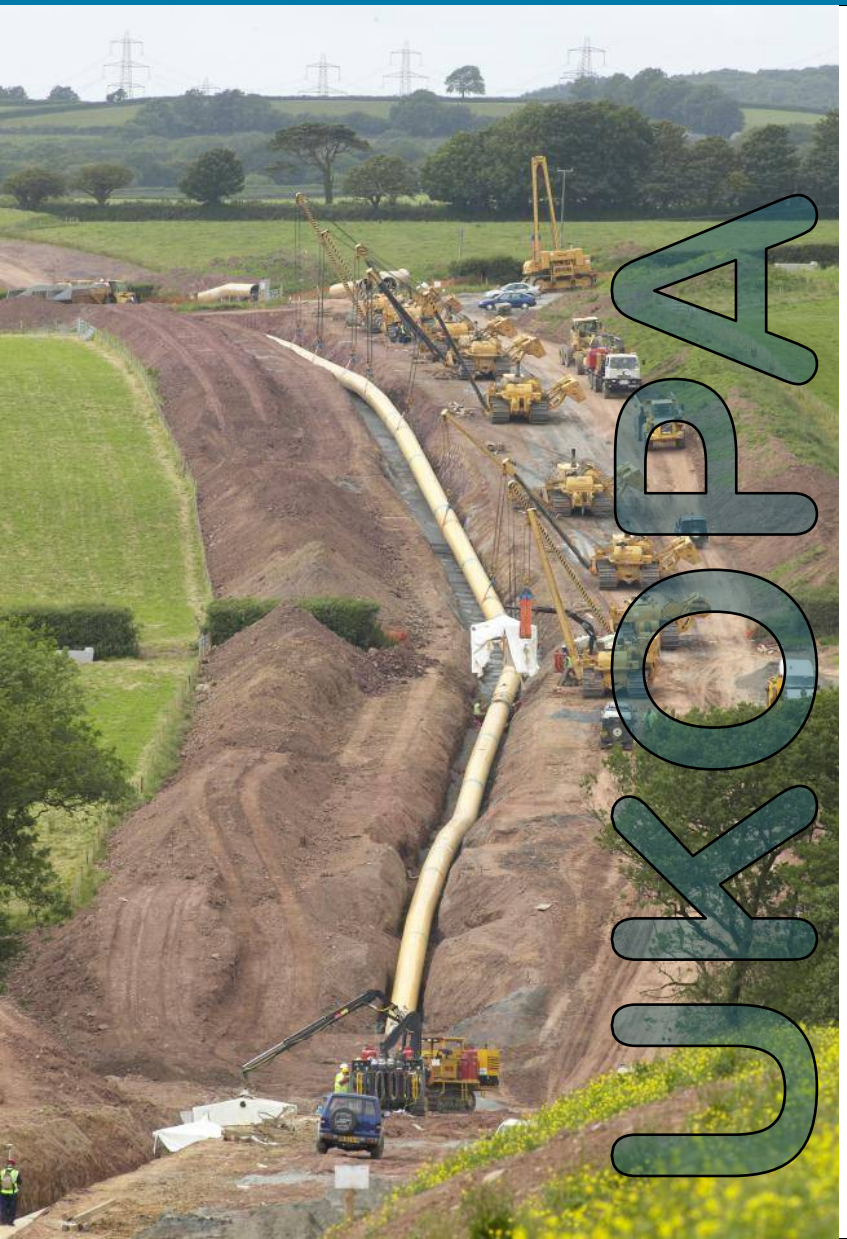

Dent Assessment of UKOPA Pipelines

Jane Haswell

UKOPA Study - Dent assessment of UKOPA pipelines

- The dent assessment tool has been used to carry out a fatigue analysis of UKOPA pipelines
- Data was compiled from responses to a questionnaire circulated to UKOPA members
- Data was returned by 8 gas and liquid pipeline operators

Dent Questionnaire

1	**Operator**
2	**Pipeline reference**
3	**Date of Commissioning**
4	**Diameter**
5	**Wall thickness**
6	**Length**
7	**Material**
	Type
	Grade
8	**Weld Quality**
	Seam weld
	Girth weld
9	**Precommissioning hydrotest details**
	Test pressure
	Duration
10	**Pressure:**
	Design Pressure
	Operating pressure (if different)
11	**Operating pressure drop:**
	Inlet pressure
	Delivery pressure
12	**Max pressure cycle:**
	Max pressure
	Min pressure
	Frequency
	Estimate of pressure cycle history
	Estimate of future pressure cycling

13	**ILI**
	Date of last inspection
	Inspection tool (inc resolution)
14	**MFL tool dent data**
	Number of dent indications
	Number of dents associated with welds
	Number of TOL dents
	Number of TOL dents associated with welds
	Number of BOL dents
	Number of BOL dents associated with welds
15	**Geometric tool dent data**
	Number of dent indications
	Max depth
	Number of dents associated with welds
	Number of TOL dents
	Max depth
	Number of TOL dents associated with welds
	Max depth
	Number of BOL dents
	Max depth
	Number of BOL dents associated with welds
	Max depth
16	**Dent Investigations**
	ILI dent indications investigated
	Investigation details
	Investigation of dents detected by other means
	Investigation details

Dent assessment of UKOPA pipelines

- Data was returned by 8 gas and liquid pipeline operators representing the maximum size dents on 2,300 kms of gas and oil pipelines
- 29 cases for analysis were selected and presented in terms of priority for further investigation or confirming no further action

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Analysis of UKOPA Pipelines - Input

Pipeline Reference	Year of Commissioning	Diameter (mm)	Wall Thickness (mm)	Length (km)	Material Grade	Operating Pressure (barg)	Dent ID Number	Orientation (hh:mm)	Depth at Pressure (%OD)	Weld Quality	Cycle Min Pressure	Cycle Max Pressure	Cycle History
Case 1	1966	711	7.14	14	X52	50.5	Dent 1	12:00	2.2	N/A	15	32	11880
Case 2	1966	711	7.14	14	X52	50.5	Dent 2	6:00	5.6	N/A	15	32	11880
Case 3	1966	711	7.14	14	X52	50.5	Dent 3	6:00	2.38	Probably Good			
Case 4	1964	457.2	10.31	17	X46	38	Dent 4	12:00	N/A	Poor			
Case 5	1964	457.2	10.31	17	X46	38	Dent 5	12:00	3	N/A	0	50.6	348
Case 6	1960	219.1	7.04	114	B	49.5	Dent 6	12:00	N/A	Poor			
Case 7	1940	273	7.8	116	B	49.5	Dent 7	12:00	N/A	Poor			
Case 8	1940	323.8	7.14	140	X42	80	Dent 8	12:00	N/A	Poor			
Case 9	1967	219.1	7.04	145	X42	90	Dent 9	6:00	6.9	N/A	65	90	17155
Case 10	1979	273	7.09	250	X52	90	Dent 10	12:00	6.9	N/A	65	95	12775
Case 11	1991	273	7.92	233	X52	90	Dent 11	12:00	1.9	Good	0	100	7084
Case 12	1973	406.4	6.35	229	X52	90	Dent 12	12:00	2.84	N/A	35	70	10250
Case 13	1973	406.4	6.35	229	X52	90	Dent 13	12:00	2.7	Probably Good			
Case 14	1973	406.4	6.35	229	X52	90	Dent 14	6:00	2.85	Probably Good			
Case 15	1973	406.4	6.35	229	X52	90	Dent 15	6:00	3.98	N/A	35	70	10250
Case 16	1975	914.4	9.52	213	X65	69	Dent 16	12:00	5.7	N/A	30	50	9750
Case 17	1975	914.4	9.52	213	X52	69	Dent 17	6:00	2	N/A	30	50	9750
Case 18	1975	762	7.92	19.2	X52	49	Dent 18	12:00	4.2	Probably Good			
Case 19	1975	1066.8	12.7	4.2	X42	50	Dent 19	6:00	7	Probably Good			
Case 20	1975	323.8	10.31	25.2	X42	70	Dent 20	12:00	2	N/A	30	50	9750
Case 21	1992	323.8	5.56	53.45	X60	88.5	Dent 21	6:00	2.1	N/A	28.5	88.5	191
Case 22	1992	323.8	5.56	53.45	X60	88.5	Dent 22	12:00	2.1	N/A	28.5	88.5	191
Case 23	1969	273	6.35	99.5	X52	82.7	Dent 23	12:00	3.4	N/A	22.7	82.7	846
Case 24	1972	219.1	9.52	2.5	B	82.7	Dent 24	12:00	1.7	N/A	22.7	82.7	735.3
Case 25	1981	273	4.78	115.6	X52	79	CHECK	12:00	2	N/A	24	79	2074
Case 26	1962	323.8	6.35	50	X42	76	CHECK	12:00	2	N/A	0	76	3620
Case 27	1963	168.3	5.56	133	B	99.3	Dent 25	12:00	2.7	N/A	13.3	99.3	3074
Case 28	1962	168.3	5.56	133	B	99.3	Dent 26	12:00	3.4	N/A	13.3	99.3	3074
Case 29	1985	355.6	5.56	185.5	X60	88.5	Dent 27	12:00	2.8	N/A	0	88.5	666

Analysis of UKOPA Pipelines - Results

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Pipeline Reference	EPRG Fatigue Life	SN + Dent SCF Fatigue Life	Kinked	Interacts with metal loss or other defects	Corrosion <20% wall thickness	Interacts with weld or weld not visible	Weld in "poor" category	Weld in "probably good" category	Depth <2% or strain <2%	Depth <2% or strain <4%	Evidence of external interference or coating damage?	Depth <7% or Strain <6%	Fatigue Analysis EPRG or FEA Life exceeded	Constrained?	Priority
Case 1	11711	169466	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 2	1576.96	38913.3	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 3			No	No	N/A	Yes	No	Yes	No	N/A	N/A	N/A	N/A	Yes	11
Case 4			No	No	N/A	Yes	Yes	No	N/A	N/A	N/A	N/A	N/A	No	4
Case 5	930.889	N/A	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 6			No	No	N/A	Yes	Yes	No	N/A	N/A	N/A	N/A	N/A	No	4
Case 7			No	No	N/A	Yes	Yes	No	N/A	N/A	N/A	N/A	N/A	No	4
Case 8			No	No	N/A	Yes	Yes	No	N/A	N/A	N/A	N/A	N/A	No	4
Case 9	14285.6	648354	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 10	3874.83	133444	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 11	90.6686	12626.1	No	No	N/A	Yes	No	No	N/A	Yes	No	Yes	No	N/A	No Further Action
Case 12	2045.84	36225.9	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 13			No	No	N/A	Yes	No	Yes	No	N/A	N/A	N/A	N/A	No	5
Case 14			No	No	N/A	Yes	No	Yes	No	N/A	N/A	N/A	N/A	Yes	11
Case 15	991.617	21182.1	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 16	715.88	22873.4	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 17	2828.05	119997	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Ac
Case 18			No	No	N/A	Yes	No	Yes	No	N/A	N/A	N/A	N/A	Yes	11
Case 19			No	No	N/A	Yes	No	Yes	No	N/A	N/A	N/A	N/A	Yes	11
Case 20	320581	N/A	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 21	1753.11	N/A	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 22	1753.11	N/A	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 23	1117.4	N/A	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 24	20639	N/A	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 25	2437.42	N/A	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 26	479.162	7244.71	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 27	1643.82	21571.7	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 28	1002.32	14865.5	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action
Case 29	180.262	909.371	No	No	N/A	No	N/A	N/A	N/A	N/A	No	Yes	No	N/A	No Further Action

Results of dent assessment of UKOPA pipelines

- Of the 29 cases assessed, 18 require no further action, 9 require further investigation and 2 were check cases (analysed with an assumed dent of 2% OD depth)
- Fatigue assessment was carried out for 19 cases, of these 13 exceeded the EPRG fatigue life assessment but were acceptable using the calculated SCF and BS 7608 Class B SN Curve