



WP1 - Background

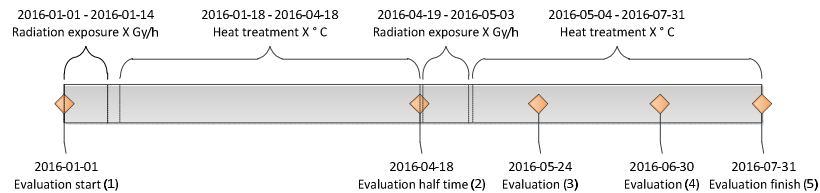
- Develop test methods that can be used by the power plants for condition monitoring through a material property. The material property will be correlated to the function of the component.
- Performing experimental tests to validate the method
- Develop a theoretical model that can be used to calculate acceptance criteria for components with different geometries
- Deployment of the results into daily operations at the NPPs

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- O-rings in EPDM with 2 different cord sizes
- O-rings Nitrile
- O-rings Silicone or Viton
- All subjected to low dose radiation (21 Gy/h for 28 days) and heat. Evaluate material properties with 0-sample and 4 additional tests throughout the ageing process



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WP1 - Background

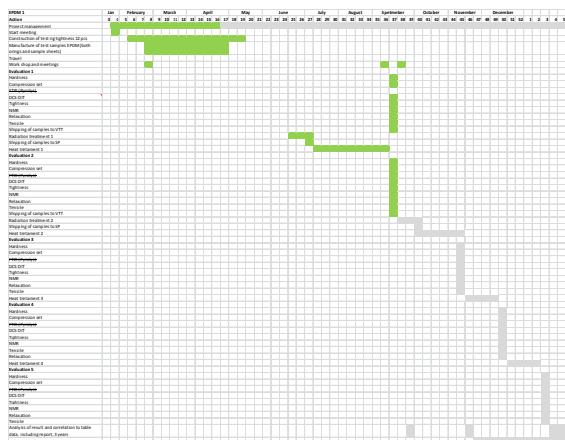
Prov	Temperatur	Heat treatment		Radiation 22-28/6 + 29/6-5/7	
		Start	Finish	Total dose	Bundle
0	0	0	0	0	0
1	90	2016-07-11	2016-09-09	7-9,06	
2	90	2016-07-11		7-9,06	
3	90	2016-07-11		7-9,06	
4	90	2016-07-11		7-9,06	
5	120	2016-07-11	2016-09-09	7-9,06	
6	120	2016-07-11		7-9,06	
7	120	2016-07-11		7-9,06	
8	120	2016-07-11		7-9,06	
9	140	2016-07-11	2016-09-09	7-9,06	
10	140	2016-07-11		7-9,06	
11	140	2016-07-11		7-9,06	
12	140	2016-07-11		7-9,06	
13	90	2016-07-11	2016-09-09	0	
14	90	2016-07-11		0	
15	90	2016-07-11		0	
16	90	2016-07-11		0	
17	120	2016-07-11	2016-09-09	0	
18	120	2016-07-11		0	
19	120	2016-07-11		0	
20	120	2016-07-11		0	
21	140	2016-07-11	2016-09-09	0	
22	140	2016-07-11		0	
23	140	2016-07-11		0	
24	140	2016-07-11		0	

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- Sample matrix showing o-rings.
- There are 24 dubble samples of dogbones in addition to these o-rings.
- All samples from same batch



WP1 – Project plan



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- More discussions relating to size of o-ring, design of test block and so forth lead to late start up of radiation/heat treatment
- Key dates
 - Evaluation 3 November 7th
 - Evaluation 5 January 16th
 - Analysis and compilation of final report January 18th – 25th.
 - Start up of test o-rings larger cord diameter October



WP1 – Results

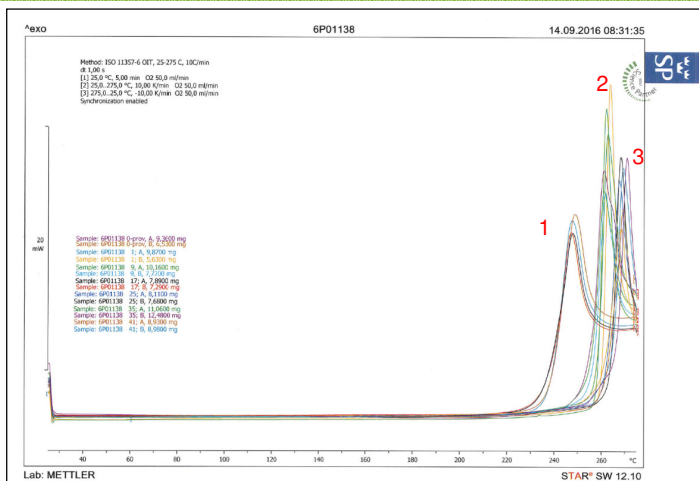
- Tested
 - DSC
 - Tensile
 - Compression set
 - Tightness test
 - Hardness
- To be tested
 - NMR
 - Relaxation



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WP1 – Results DSC



- 3 more clear peaks
- Peak 1 – 140 C
- Peak 2 – 3 mixture of peaks for 0 sample to 120 C.
- Zoom in on peak 1 – Little difference on radiation or no radiation so far.



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WP1 – Results Tensile (ISO 37-2)

Sample no.	Temp. (°C)	Heat treat. (Days)	Radiation (total dose kGy)	Tensile strength (MPa)	Elongation at break (%)
0	-	-	-	12.8	182
1 + 2	90	60	7-9.06	15.1	193
9 + 10	120	60	7-9.06	14.8	176
17 + 18	140	60	7-9.06	10.8	110
25 + 26	90	60	-	15.5	193
33 + 34	120	60	-	15.2	176
41 + 42	140	60	-	11.5	114

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WP1 – Results Compression set (O-ring, ISO 815)

Sample no.	Temp. (°C)	Heat treat. (Days)	Radiation (total dose kGy)	Compression set (%)
1	90	60	7-9,06	13
5	120	60	7-9,06	33
9	140	60	7-9,06	86
13	90	60	-	12
17	120	60	-	33
21	140	60	-	77



WP1 – Results Tightness test

Prov	Temperatur	Heat treatment		Radiation 22-28/6 + 29/6-5/7		Tightness
		Start	Finish	Total dose	Bundle	
0	0	0	0	0	0	Tight
1	90	2016-07-11	2016-09-09	7-9,06		Tight
2	90	2016-07-11		7-9,06		
3	90	2016-07-11		7-9,06		
4	90	2016-07-11		7-9,06		
5	120	2016-07-11	2016-09-09	7-9,06		Tight
6	120	2016-07-11		7-9,06		
7	120	2016-07-11		7-9,06		
8	120	2016-07-11		7-9,06		
9	140	2016-07-11	2016-09-09	7-9,06		Tight
10	140	2016-07-11		7-9,06		
11	140	2016-07-11		7-9,06		
12	140	2016-07-11		7-9,06		
13	90	2016-07-11	2016-09-09	0		Tight
14	90	2016-07-11		0		
15	90	2016-07-11		0		
16	90	2016-07-11		0		
17	120	2016-07-11	2016-09-09	0		Tight
18	120	2016-07-11		0		
19	120	2016-07-11		0		
20	120	2016-07-11		0		
21	140	2016-07-11	2016-09-09	0		Tight
22	140	2016-07-11		0		
23	140	2016-07-11		0		
24	140	2016-07-11		0		

- Tightness test. Tesblocks submitted to a increase in water preassure from 0 to 110 bar during 30 seconds. Slight pulzation at the top from test rig. Preasure kept during leakage check.
- No sample show risk of leakage.





WP1 – Results Hardness (IRHD-m ISO 48)

Sample no.	Temp. (°C)	Heat treat. (Days)	Radiation (total dose kGy)	IRHD (average)
0	-	-	-	72
1 + 2	90	60	7-9,06	73
9 + 10	120	60	7-9,06	75
17 + 18	140	60	7-9,06	77
25 + 26	90	60	-	73
33 + 34	120	60	-	74
41 + 42	140	60	-	77

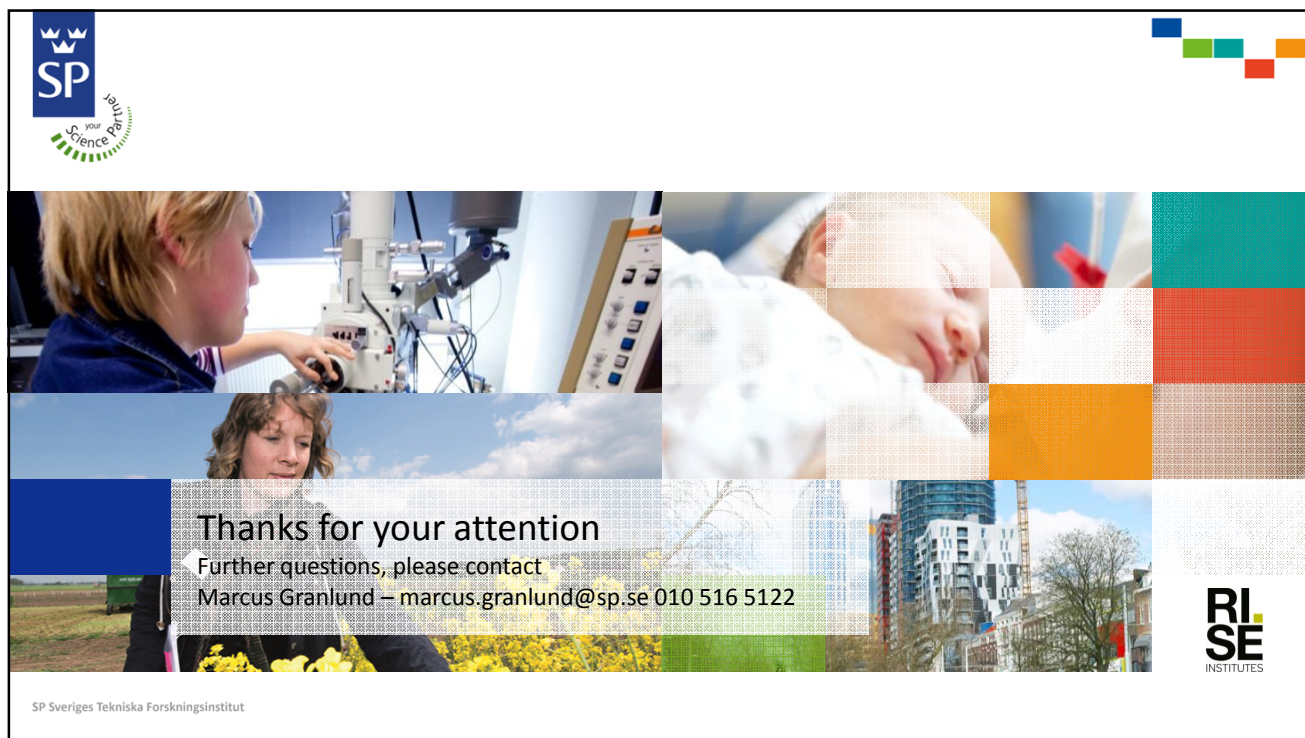
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WP1 – Next steps

- Data sheet from James Walker
- Study with microscope
- Start up of test for larger cord size orings
 - Learn from first test. How many samples needed?
- Complete the ongoing test
- Evaluate results and changes in materials
- Important to keep time schedule due to late start up.
- Master thesis proposal issued

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Thanks for your attention
Further questions, please contact
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