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Report

Comparison of predicted properties of Ekofisk oils based on Crude Assay data

Evaluation of the predicted behaviour of satellites relative to previous studies.

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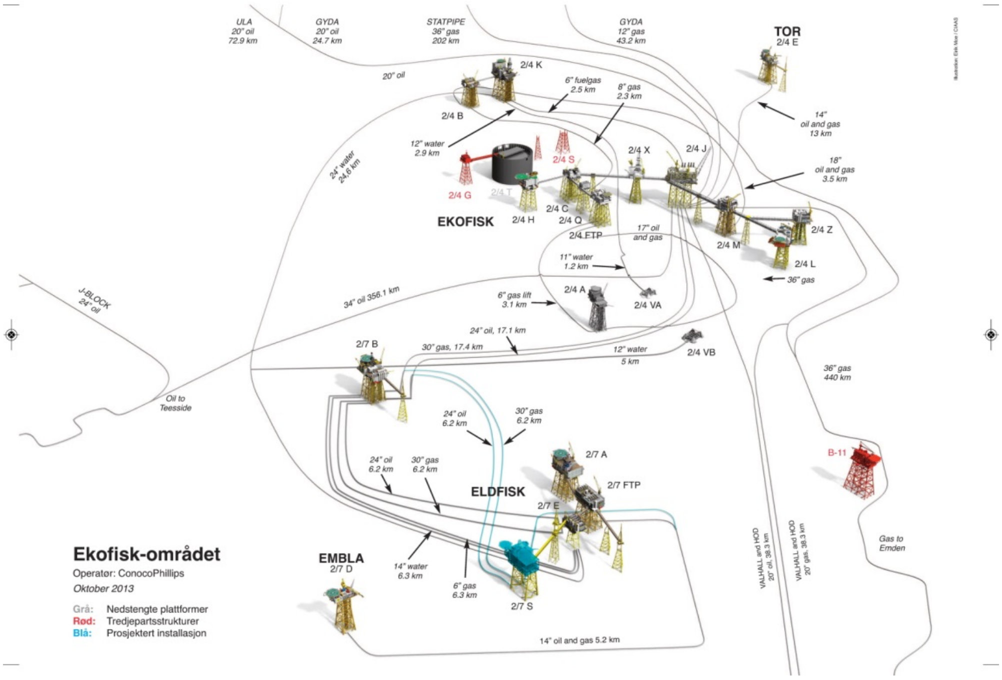

SINTEF Materials and Chemistry

Oil Spills Research

2015-12-03

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Report

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Harald Lura

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ABSTRACT

The weathering properties of three oil blends, Ekofisk J, Eldfisk B and Eldfisk Kompleks, were compared with the existing model oil, Ekofisk Blend 2000, using the Crude Assay module in the SINTEF Oil Weathering Model, supplemented with a limited laboratory study (on the 250 °C+ residues).

The observed variations between the tree oil blends and Ekofisk Blend 2000 were small. The continued use of Ekofisk Blend 2000 as model oil for environmental risk assessment and contingency analysis was assessed, and deemed valid.

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APPENDICES

1 Executive summary

The Ekofisk Field is the largest oil field in the North Sea and has been in production since the early 1970's. The field is under continuous development, with new production sites being connected to existing infrastructure regularly. This, in addition to natural variations with time, result in changes of properties in the produced blends at the field, and this must be considered with respect to risk assessment and contingency planning. SINTEF performed an extensive study on a selection of oils from the Ekofisk field in 2000, and Ekofisk Blend 2000 has been used as model oil at the Ekofisk field since. In 2011, another study on the properties of oil from the Ekofisk field was conducted by Unilab Analyse AS, which concluded that the Ekofisk Blend 2000 was still a valid model oil.

In this study, the use of Ekofisk Blend 2000 as model oil for three blends (Ekofisk J, Eldfisk B, and Eldfisk Kompleks) has been studied. The weathering properties of these blends have been predicted based on a crude assay data (using the Crude Assay module in OWM) with a limited supplemental laboratory study for each oil blend. The predicted and analysed properties of the blends were compared to those of Ekofisk Blend 2000. In addition, comparisons with Ekofisk Blend and Eldfisk Blend from the 2011 study have been included.

Of the predicted properties, the largest variations were observed in emulsion viscosities and pour point. Compared to Ekofisk Blend 2000, Eldfisk B and Eldfisk Kompleks showed lower predicted pour point, while Ekofisk J had a pour point surpassing that of Ekofisk Blend 2000 after six hours on the sea surface (15°C and 10 m/s). The predicted viscosities of Ekofisk J, Eldfisk B and Eldfisk K showed similarities, but were lower than the viscosities of Ekofisk Blend 2000. However, viscosities measured in the laboratory study were within the same range. Less variation was observed between the analysed oils and the model oil for evaporative loss and water uptake and maximum water content.

In general, Ekofisk J, Eldfisk B and Eldfisk Kompleks were considered to be similar to each other and have similar weathering properties. The difference between the three blends and Ekofisk Blend 2000 were not deemed large enough to justify new weathering studies. Ekofisk Blend 2000 is considered to be a representative model oil for the three tested oil blends.

2 Introduction

This study was performed in response to a request from Conoco Philips, represented by Harald Lura, regarding the comparison of weathering properties of three blends at the Ekofisk field and the model oil Ekofisk Blend 2000. The main objective was to assess the use of this model oil for further environmental risk assessment and contingency analysis. In addition, an evaluation of the changes in the oil blend over the last years was wanted.

The three blends in question are:

- Ekofisk J
- Eldfisk Kompleks (Eldfisk K)
- Eldfisk B

For simplicity these blends have occasionally been referred to as the 2015 blends throughout the report.

SINTEF has developed a Crude Assay (CA)-module in the Oil Weathering Model (OWM) that enables the prediction of weathering properties of a crude oil based on multivariate analysis of a limited selection of physical-chemical properties, usually available in an oil's Crude Assay. This Crude Assay-module uses values for pour point, viscosity, density, wax and asphaltene content as well as a true boiling point curve (TBP) for these predictions. The Figure 2-1 below describes the method for obtaining a dataset for weathering properties by using the CA module to the left, compared to the more traditional full scale weathering approach to the right. The Crude Assay module was developed at SINTEF in 2004/5 and has been used in previous studies (Brandvik *et al.*, 2005; Strøm *et al.*, 2010). The Crude Assay module is also an important tool in SINTEF's new and simplified approach to weathering studies.

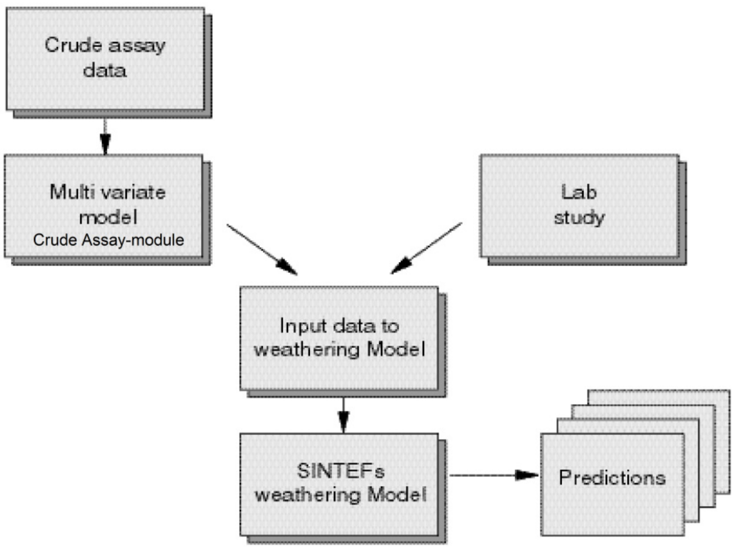

Figure 2-1: Different approaches to development of weathering predictions

Along with the request from Conoco Philips, SINTEF received a selection of historical data of the three blends for use in the evaluation of the oils. However, these data did not contain all data required for the CA module and analyses of the necessary parameters were distributed between SINTEF and Intertek Westlab. The latter provided TBP up to 450°C and pour point values for each of the three blends, while viscosity, density, and wax and asphaltene content were analysed at SINTEF. In addition, SINTEF recommended investigating the emulsifying properties of the three blends for verification of the predicted behaviour, and Conoco Philips agreed to this supplement. The combination of analysis of chemical and physical properties and study of emulsifying properties are also used in re-check studies at SINTEF.

3 Objectives

The main objective of this project was to compare the weathering properties of the three blends with the existing model oil, Ekofisk Blend 2000, and assess the use of this model oil for further environmental risk assessment and contingency analysis.

4 Comparing properties of Ekofisk oils with Ekofisk blend based on Crude Assay (CA) data

This chapter describes a new approach for monitoring changes in oil properties as a function of time, and also presents the predicted weathering properties of the tested oils.

By using predictions based on crude assay (CA), SINTEF is able to describe the changes in important weathering properties as a function of oil properties (see Figure 2-1). The weathering properties of most oil types are documented by a weathering study and by using these simplified predictions, the changes in properties compared to the original weathering study can be monitored. A principal sketch of this approach is indicated in Figure 4-1, where two properties are compared to the original weathering study (solid line). As long as the yearly predicted values only show random variation (shaded areas), the original weathering study can be said to reflect the oil weathering properties and be suitable for further use as basis for the oil spill contingency. However, if systematic changes are detected, a revision of the weathering study should be considered.

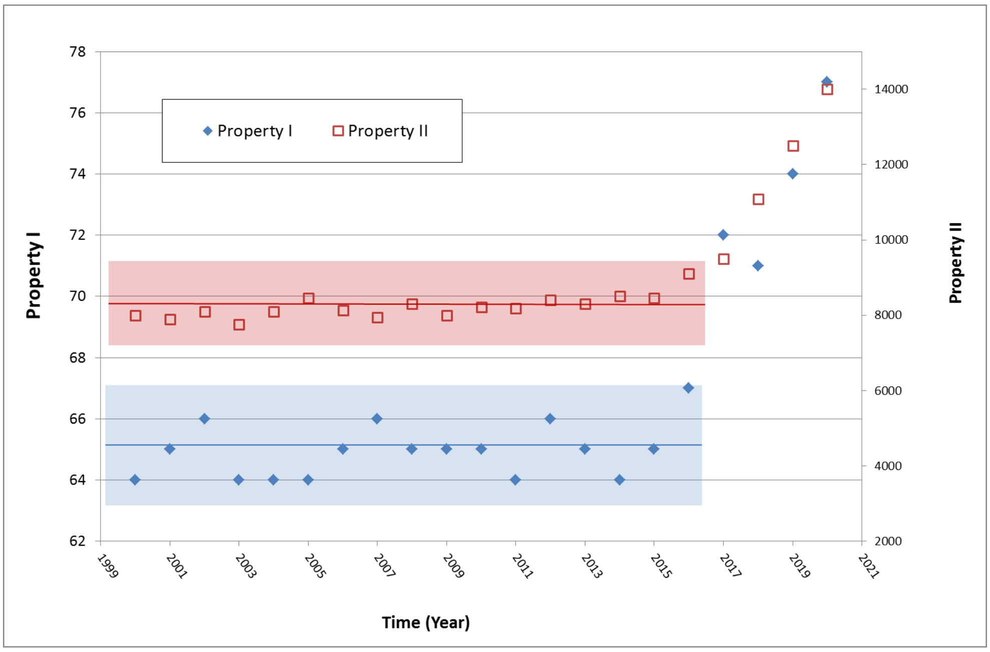

Figure 4-1: Principle sketch of how weathering properties can be monitored over time and how significant changes can be detected.

Properties such as viscosity, density, wax/asphaltene content, pour point, and evaporative loss (TBP) curve are all suitable for this type of monitoring, and are usually found in an oil's crude assay. A figure like Figure 4-1 is then dependant on availability of an oil's CA data to make the comparison with the original weathering study (centre line in the shaded areas).

In this study for Conoco Philips we have received CA data for three individual oils at the Ekofisk area:

- Ekofisk J blend
- Eldfisk B blend
- Eldfisk Kompleks (K) blend

These CA data have been used to create a synthetic weathering data set for each 2015 oil blend, which have been supplemented with laboratory data for the 250°C+ residue, equivalent to a re-check study.

The properties of these blends are compared to Ekofisk Blend, based on the weathering study from 2000 (Moldestad *et al.*, 2001). In addition, data from two other weathering studies are included in the figures; Ekofisk blend 2011 and Eldfisk blend 2011 (Wasbotten *et al.*, 2012).

Unfortunately, extended time series with CA data for the three oil types listed above, were not available during this project. Of the weathering parameters used in the CA module, only data for fresh oil density was available for the period from 2000 to 2014. This was not sufficient to predict oil weathering properties like maximum water content and emulsion viscosity as shown in Figure 4-1.

Complete CA datasets for the three blends were only available for 2015. To supplement these data additional parameters (water content, viscosity and uptake rate) were measured on the 250°C+ residue of each oil, based on oil samples sent to SINTEF. These measured weathering properties have been used for validation of the predicted values.

4.1 Predicted weathering properties for selected Ekofisk oils versus Ekofisk Blend

Predicted weathering properties based on CA data for Ekofisk J, Eldfisk B and Eldfisk K are compared with the Ekofisk Blend, based on the weathering study from 2000 (Moldestad *et al.*, 2001). In addition, predictions for Ekofisk Blend 2011 and Eldfisk Blend 2011 have been included. Ekofisk Blend 2011 was based on a complete laboratory data set (excluding flash point) while Eldfisk Blend 2011 was based on available Crude Assay data (Wasbotten *et al.*, 2012) using the Crude Assay-module.

Comparisons of the three 2015 blends to Ekofisk blend 2000 are presented in Figure 4-2 to Figure 4-5 below and discussed in relation to the physical chemical properties presented in Appendix A.

4.1.1 Water content

The predicted water uptakes presented in Figure 4-2 below reveal more rapid water uptake for the 2015 blends compared to the Ekofisk blend 2000, but express similar maximum water content. However, the results from the laboratory testing of the emulsifying properties (Appendix A.1.3, Table A-6 to Table A-8) of the 2015 blends revealed slower water uptake (higher $T_{1/2}$) for Ekofisk J and Eldfisk B compared to Ekofisk Blend 2000, while Eldfisk K was seen to have a faster water uptake (lower $T_{1/2}$).

In the laboratory testing the maximum water content of the 2015 blends ranged from 75-77 vol. % and were similar to Ekofisk blend 2000 (78 vol. %), which correspond well with the predictions.

The study of Ekofisk Blend from 2011 predicts faster water uptake compared to all other presented oils. The Eldfisk blend 2011 had predicted water content similar to Eldfisk K.

The variations observed in the predictions and the laboratory results for the 2015 blends compared to Ekofisk Blend 2000 appear to be less than the variations between the Ekofisk Blend 2011 and Ekofisk Blend 2000. Based on this, it can be concluded that no significant change in water uptake and water content has been revealed for the 2015 blend oils compared to previous studies.

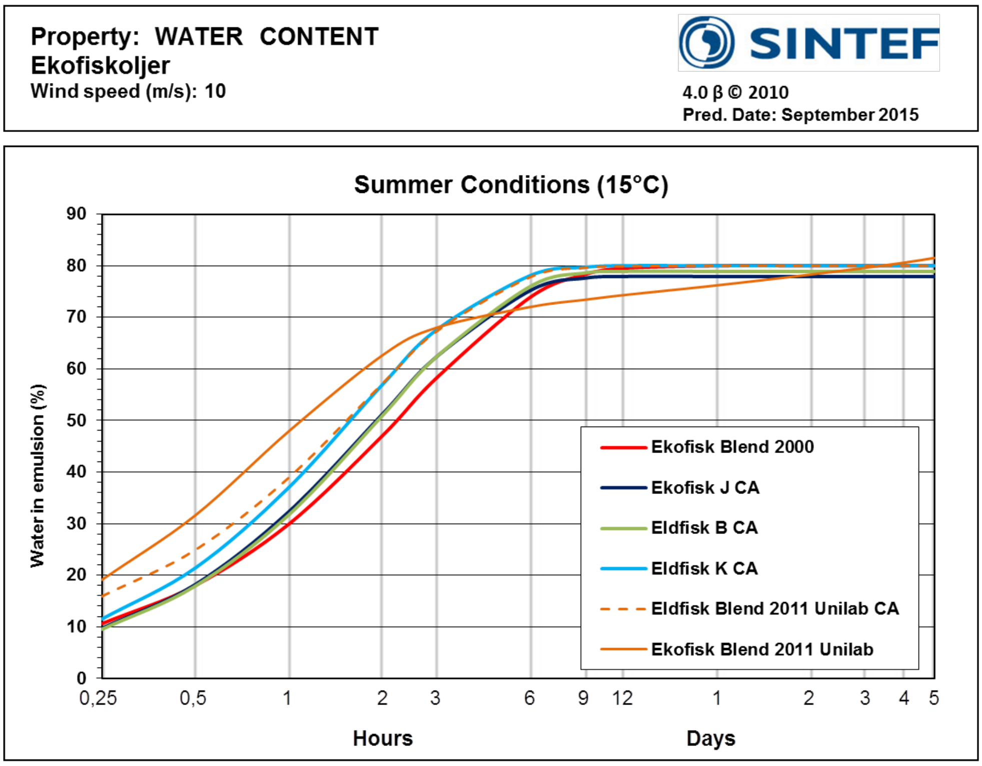

Figure 4-2: Water Content: comparison of predicted values for selected Ekofisk oils with Ekofisk Blend 2000

4.1.2 Emulsion viscosity

The predicted emulsion viscosities of the 2015 oil blends, presented in Figure 4-3 below, were lower than the viscosities found for Ekofisk Blend 2000, reaching a viscosity of approximately 6000-8500 mPa·s. In comparison, after 5 days at sea, the viscosity of Ekofisk Blend 2000 was 15000 mPa·s. The predicted emulsion viscosities for the 2015 blends were overall higher than Ekofisk Blend 2011.

The differences in emulsion viscosities were not reflected in the laboratory data (Appendix A.1.3, Table A-6 to Table A-8) where Ekofisk J and Eldfisk B had emulsion viscosities similar to Ekofisk Blend 2000 (10000-11000 mPa·s), while Eldfisk Kompleks expressed lower viscosity (7500 mPa·s). However, the 2015 oil blends do have lower fresh oil viscosities compared to Ekofisk Blend 2000. The variations between laboratory data and predicted values for emulsion viscosity can be explained by a tendency of predicting too low viscosities when only CA data are used. The observed difference in predicted emulsion viscosity for the 2015 oil blends and Ekofisk Blend 2000 may not cause negative consequences in a spill situation, as it could prolong the window of opportunity for the use of chemical dispersants. Both predictions and laboratory data show emulsion viscosities more similar to Ekofisk Blend 2000 than those found for Ekofisk Blend in 2011.

The viscosities of water free and emulsified residues as well as fresh oil are given in the Appendix A.

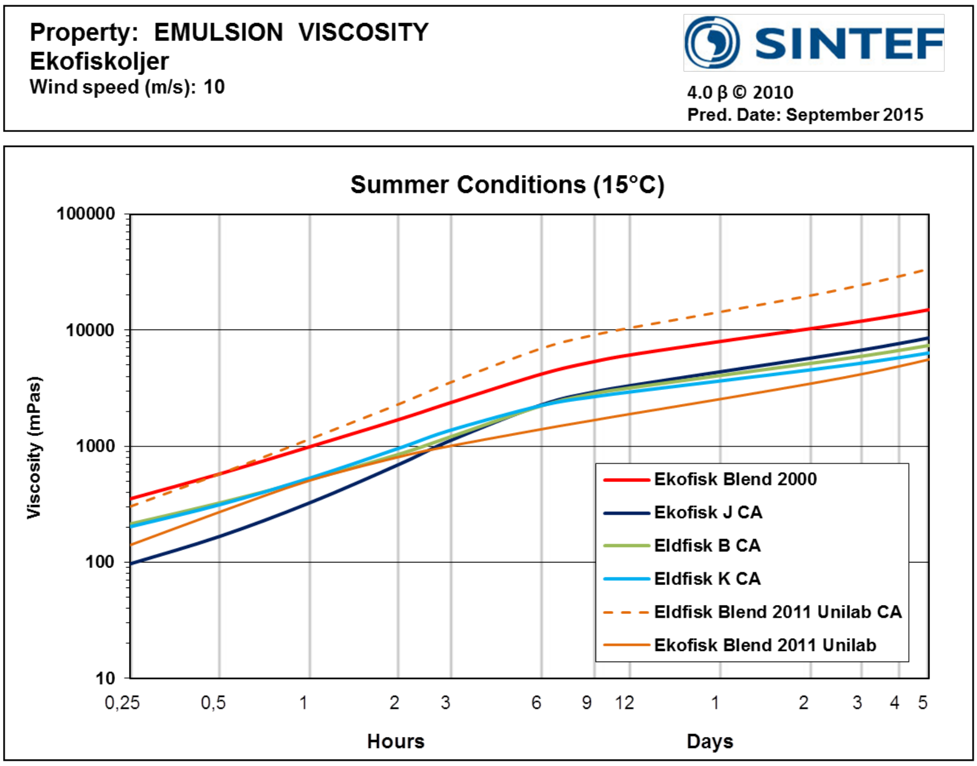

Figure 4-3: Viscosity: comparison of predicted values for selected Ekofisk oils with Ekofisk Blend 2000

4.1.3 Evaporative loss

The predicted evaporative loss of Ekofisk J and Eldfisk B were similar to Ekofisk Blend 2000 as well as Eldfisk Blend 2011 and Ekofisk Blend 2011. Eldfisk K expressed a slightly higher predicted evaporative loss compared to the other Ekofisk oils. However, the higher evaporative loss is not deemed to be significant for contingency planning.

The predictions are based on true boiling point curves adjusted to the laboratory data obtained during topping where deemed necessary (Appendix A.1.2 and 0, Figure A-5 and Table B-1).

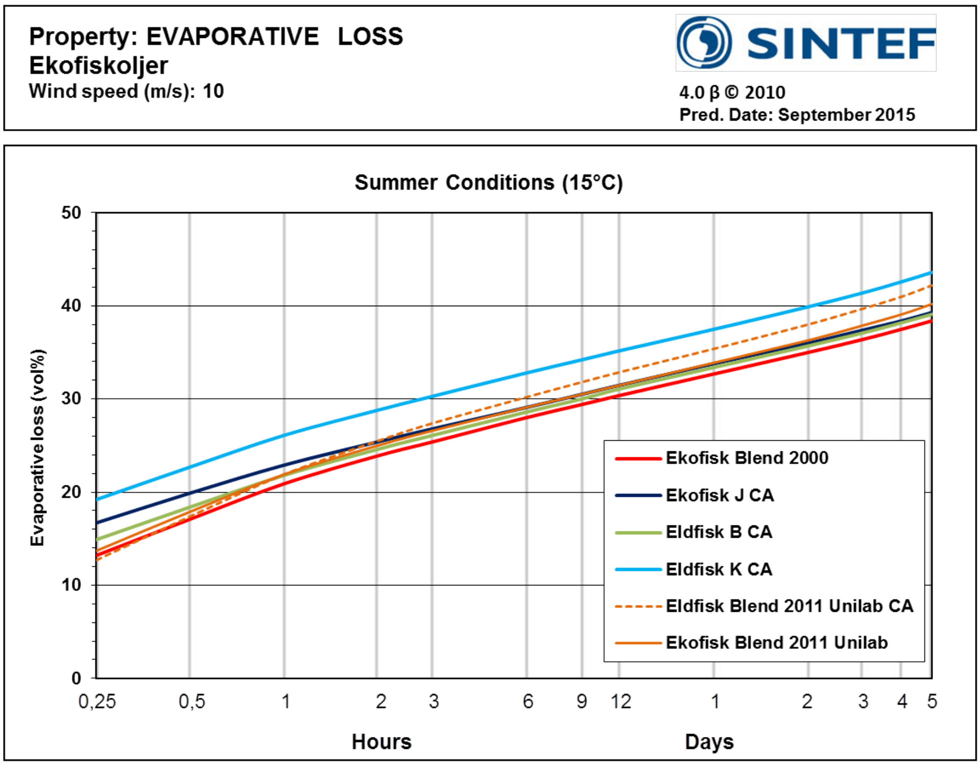

Figure 4-4: Evaporative loss: comparison of predicted values for selected Ekofisk oils with Ekofisk Blend 2000

4.1.4 Pour point

Figure 4-5 shows the predicted pour point for the three 2015 blends, the 2011 blends and Ekofisk Blend 2000. Eldfisk B and Eldfisk K have lower pour points compared to Ekofisk Blend 2000 while Ekofisk J has a predicted pour point that will surpass Ekofisk Blend 2000 after approximately 6 hours at sea. The predictions reveal that Ekofisk J may solidify on the sea surface after 2 days of weathering under the given conditions.

The laboratory data for the pour point of fresh oil for the three 2015 blends show that Ekofisk J had a lower fresh oil pour point compared to Ekofisk Blend 2000 (Appendix A.1.1, Table A-5). Eldfisk B and Eldfisk K had similar pour points as Ekofisk Blend 2000.

Figure 4-5 shows that Ekofisk Blend 2011 and Eldfisk Blend 2011 are predicted to have the lowest and highest pour points, respectively. The combination of low pour point in fresh oil and relatively high evaporation explain why the Crude Assay module predicts a rapid increase in pour point for Eldfisk Blend 2011.

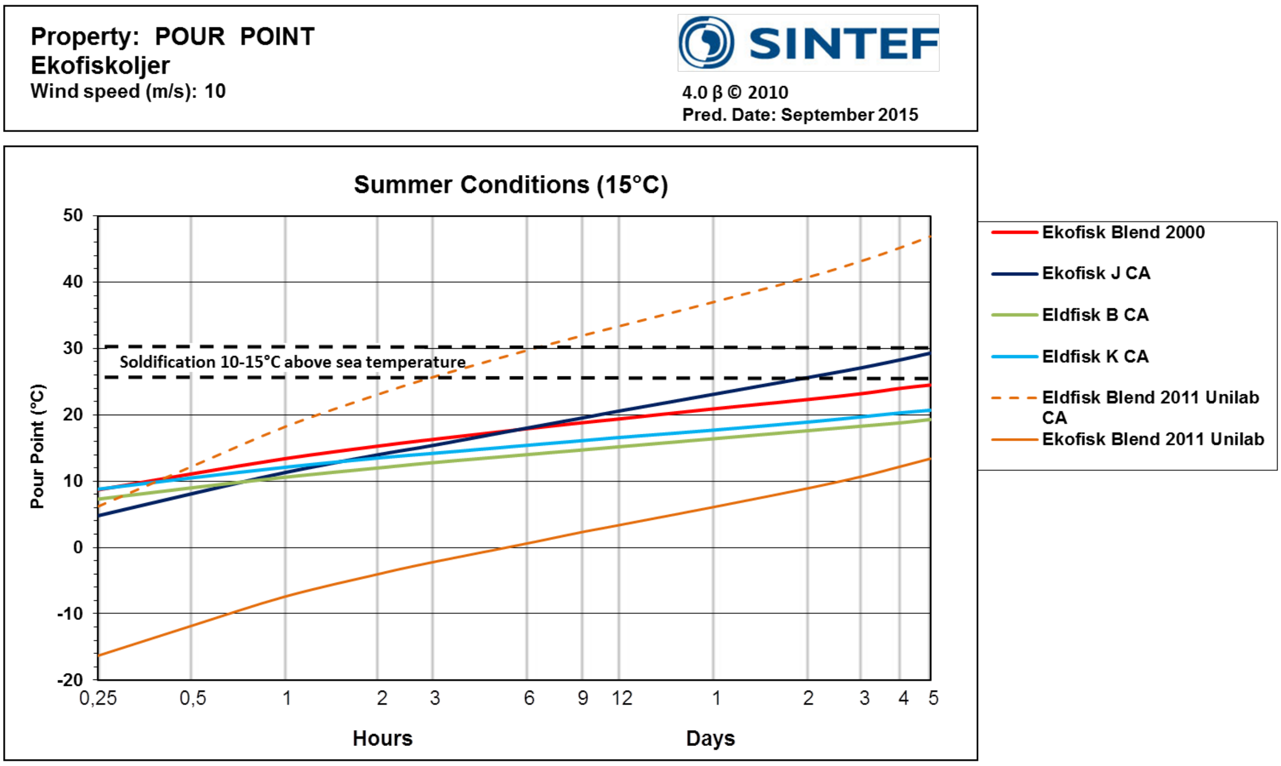

Figure 4-5: Pour point: comparison of predicted values for selected Ekofisk oils with Ekofisk Blend 2000

4.2 Evaluation of received historical data

SINTEF received historical data for the three blends in order to evaluate the changes that have occurred over time. Unfortunately, of the received parameters only density was suitable for evaluation with regard to behavioural changes. In the figures below the variation in density between 2000, 2005, 2010 and 2014 have been evaluated for trends over the years.

The previously measured densities of Ekofisk J are presented in Figure 4-6 below along with the overall average density and the average ± 2 standard deviation. Similar data are shown for Eldfisk B and Eldfisk Kompleks in Figure 4-7 and Figure 4-8, respectively. The data points are shown in chronologic sequence from left to right (2000-2014).

For Ekofisk J, there are no apparent differences between the years of sampling, and the variation in measured densities is small.

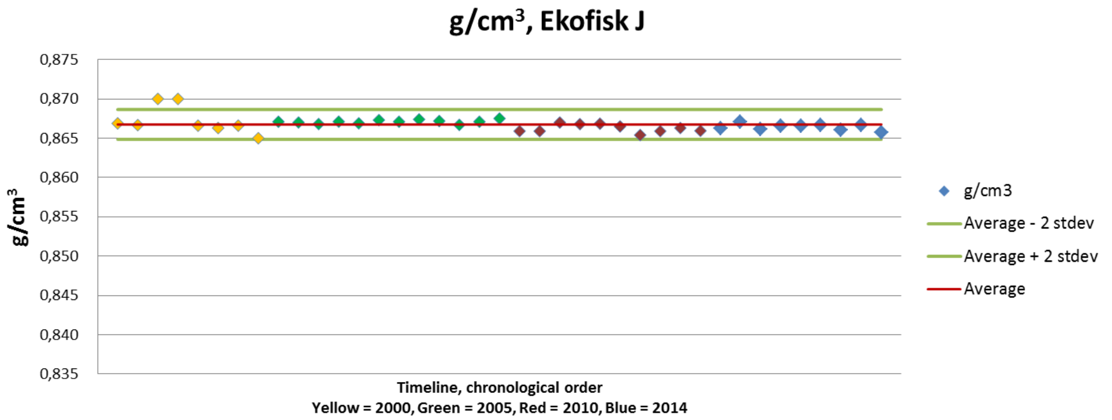

Figure 4-6: Time series for the density of Ekofisk J based on historical data

For Eldfisk B the measured densities have varied more over the years, being low in 2000, high in 2005 and similar in 2010 and 2014. Due to the differences between years, the standard deviation is high.

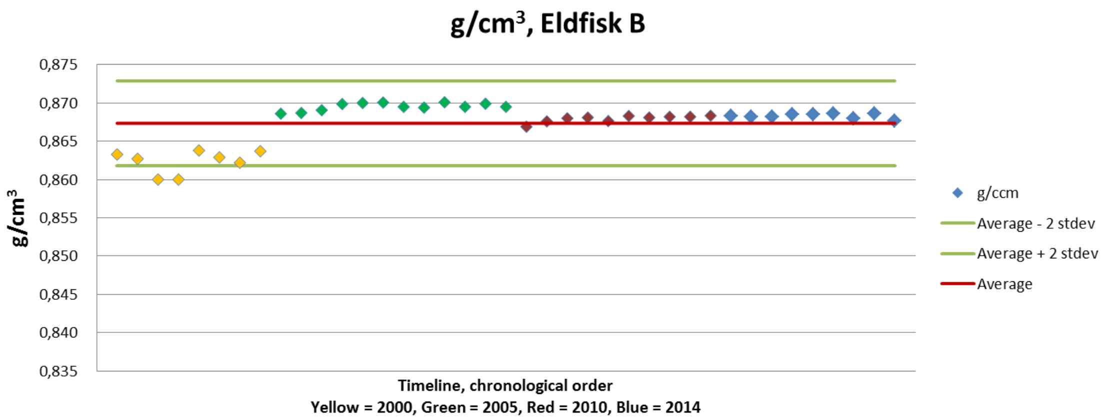

Figure 4-7: Time series for the density (g/cm^3) for Eldfisk B

Similarly to Eldfisk B, Eldfisk Kompleks had lower densities in 2000, but has remained relatively stable between 2005, 2010 and 2014. The variations in density are bigger than seen for Eldfisk B, and Ekofisk J.

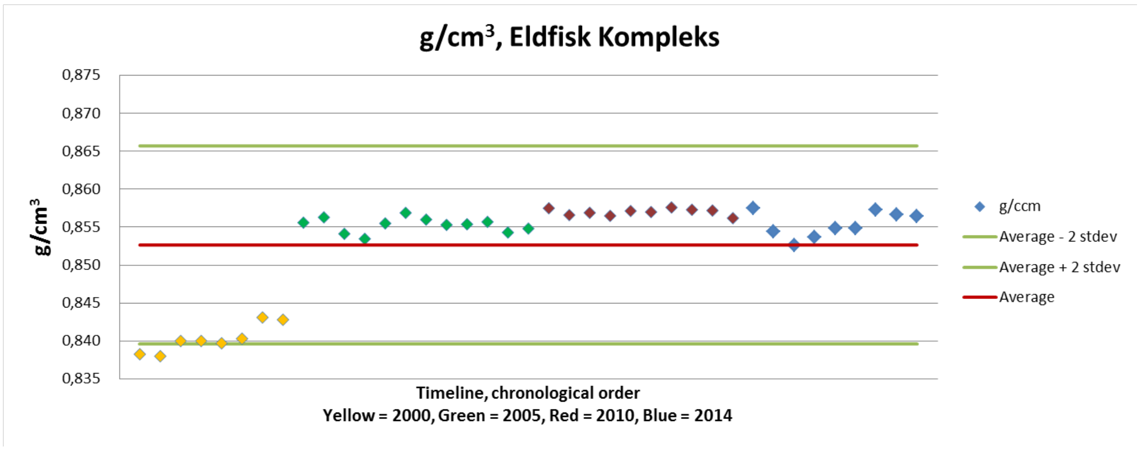

Figure 4-8: Time series for the density (g/cm^3) for Eldfisk Kompleks

Continuous logging of oil density in this type of graph will enable a rapid detection of significant changes, and can be a tool for determining if additional analysis will be required. Logging of additional parameters will also aid in a similar way.

The densities presented in the figures above are higher than those measured in SINTEF's laboratory in this study on fresh crude oil. The historical data are based on density measured at 15 °C on a "true C7+ fraction" at a different laboratory. Both variations in the sample type and different instrumentation can explain the observed differences in density between the historical data and densities presented in this study. When using comparisons as shown above it is vital to use data obtained by the same method and on similar samples.

5 Summary and conclusions

This section summarises the comparisons of the three Ekofisk oils with Ekofisk blend 2000 based on the figures in the in the previous sections and the limited supplemental weathering data in Appendix A. Each of the oils are summarised separately based on their predicted behaviour and measured properties.

Ekofisk J

Ekofisk J has similar predicted evaporative loss and water uptake compared to Ekofisk Blend 2000. The laboratory data indicate slightly higher evaporative loss and a slower water uptake compared to Ekofisk Blend 2000. The predicted pour point is initially lower than Ekofisk Blend 2000, harmonising well with the laboratory results. However, the predicted pour point of Ekofisk J surpasses the pour point of Ekofisk Blend after six hours under the given conditions. Ekofisk J is also the only one of the 2015 oils that has a potential for semi-solidification. Despite this difference, Ekofisk J is considered to be similar to Ekofisk Blend 2000, based on the predictions and physical measurements. The predicted variations appear less than those observed between the 2011 blends and Ekofisk Blend 2000.

Eldfisk B

Of the 2015 oil blends, Eldfisk B shows the closest similarity to Ekofisk blend 2000 in many of the physical-chemical properties presented in the appendix, including the true boiling point curve, wax content, pour point, and viscosity, as well as rate of water uptake ($T_{1/2}$) and emulsion stability ratio. These similarities are also reflected in the predicted behaviour for evaporative loss and water uptake, while the predicted emulsion viscosities and pour point are somewhat lower than Ekofisk Blend 2000. However, as for Ekofisk J, the deviation from Ekofisk Blend 2000 in the predicted behaviour is generally less than those observed for Ekofisk Blend 2011 and Eldfisk Blend 2011.

Eldfisk Kompleks

Eldfisk Kompleks has the highest predicted evaporative loss of all presented oils, and a predicted water uptake similar to Eldfisk Blend 2011; quicker than Ekofisk blend 2000 and the other two 2015 oil blends. The laboratory results also show a high evaporative loss and rapid water uptake (low $T_{1/2}$). The predicted pour point and emulsion viscosities are lower than Ekofisk Blend 2000, and the low viscosities are also seen in the laboratory data.

Conclusion

The similarities and differences between Ekofisk J, Eldfisk B and Eldfisk Kompleks and Ekofisk Blend 2000 have been studied by comparing predictions of weathering properties and data from a limited supplemental laboratory study. The 2015 blends are considered to have similar weathering properties to each other. In addition, they do not differ significantly from Ekofisk Blend 2000 in behaviours vital for the contingency planning (volume increase through emulsification, emulsion viscosity and stability, and pour point). Thus, it is deemed that the use of the existing model oil, Ekofisk Blend 2000, can be continued, and that there is no need for further, more extensive, weathering studies on the 2015 blends (Ekofisk J, Eldfisk B and Eldfisk Kompleks).

Recommendation

For future assessment of the changes in weathering properties in oils from the Ekofisk field, SINTEF proposes to use visual comparisons (such as those shown in Figure 4-1 and Figure 4-6 to Figure 4-8) of central weathering properties (for example emulsification, viscosity and pour point) predicted by the Crude Assay module, with supplemental data from a limited laboratory study, similar to the studies performed in this project. This should be done annually or semi-annually, in order to track changes in these properties.

6 References

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A. Experimental results

A.1 Small scale laboratory testing results

The results from small-scale weathering of the received Ekofisk oils are compared with similar data from previous studies performed on various Ekofisk oils, which are listed in Table A-1. The study on Ekofisk Blend 2000 was performed by SINTEF in 2000-2001. The studies on Ekofisk Blend 2011 and Eldfisk Blend 2011 were performed by Unilab in 2011, and all presented results from these two oils are based on the Unilab report.

Table A-1: List of previous studies on Ekofisk oils used for comparison in this report

Oil	ID	Report number	Reference
Ekofisk Blend 2000	SINTEF-ID: 2000-0624	STF66 A01090	Moldestad *et al.*, 2001
Ekofisk Blend 2011	-	UA 1020.03	Wasbotten *et al.*, 2011
Eldfisk Blend 2011	-	UA 1020.03	Wasbotten *et al.*, 2011

The three Ekofisk crude oils that are subject in this study (Ekofisk J, Eldfisk B and Eldfisk Kompleks) were given individual ID-numbers, as presented in the Table A-2 below.

Table A-2: Individual ID-numbers given to the tested Ekofisk oils

Oil	SINTEF-ID
Ekofisk J	2015-0474
Eldfisk B	2015-0475
Eldfisk Kompleks	2015-0476

A.1.1 Chemical composition and physical properties

The chemical compositions of the three received oils (Ekofisk J, Eldfisk B and Eldfisk Kompleks) as well as Ekofisk Blend 2000 are shown in Figure A-1 to Figure A-4 as GC/FID chromatograms. Chromatograms of the fresh oils and the respective 250°C+ weathered residues are presented for each.

Gas chromatographic flame ionization detector (GC/FID) characterization

The chemical compositions of the received oils, as characterized by gas chromatography (GC/FID), are shown in Figure A-1 to Figure A-3.

The gas chromatograms show the n-alkenes as systematic narrow peaks and the peaks to the left in the chromatogram represent the components with the lowest boiling point. As can be seen for all the presented oils, these components are gradually removed with higher distillation temperature. More complex components, such as resins and naphthenes, are not as easily separated as *n*-alkanes and form a broad and poorly defined bump below more pronounced peaks. The bump is often described as "Unresolved Complex Mixture", or UCM. Heavier compounds such as asphaltenes (> nC_{40}) are not possible to analyse with this technique.

All Ekofisk oil are characterised as paraffinic crude oils and have similar chromatograms, as shown in the comparison of the chromatograms of fresh oil in Figure A-4. Please note that the chromatogram for fresh Ekofisk oil 2000 has been adjusted to match the timeframe of the 2015 oil.

Gas chromatography (GC/FID) is an important tool for oil characterisation and for oil spill identification as an initial step. Common screening parameters used for identification, as well as for the degree of biodegradation, are the nC_{17}/Pristane and nC_{18}/Phytane ratios. These parameters are given in Table A-3 for all presented Ekofisk oil.

The Ekofisk J (2015) oil express nC_{17}/Pristane and nC_{18}/Phytane ratios intermediate those of Ekofisk Blend 2000 and Ekofisk Blend 2011; they are higher than the ratios measured in 2011 but not as high as the ratios measured in 2000.

Both Eldfisk B and Eldfisk Kompleks express higher nC_{17}/Pristane and nC_{18}/Phytane ratios than those measured for Eldfisk Blend in 2011, but are lower than the ratios of Ekofisk Blend from 2000.

The 2015-oils show similar nC_{17}/Pristane and nC_{18}/Phytane ratios, with Eldfisk Kompleks showing slightly lower ratios.

Table A-3: nC_{17}/Pristane and nC_{18}/Phytane ratios for fresh Ekofisk oils

Oil	**nC_{17}/Pristane**	**nC_{18}/Phytane**
Ekofisk J	2.2	2.6
Eldfisk B	2.2	2.5
Eldfisk Kompleks	2.0	2.1
Ekofisk Blend 2000	2.9	3.1
Ekofisk Blend 2011	1.5	2.0
Eldfisk Blend 2011	1.5	1.6

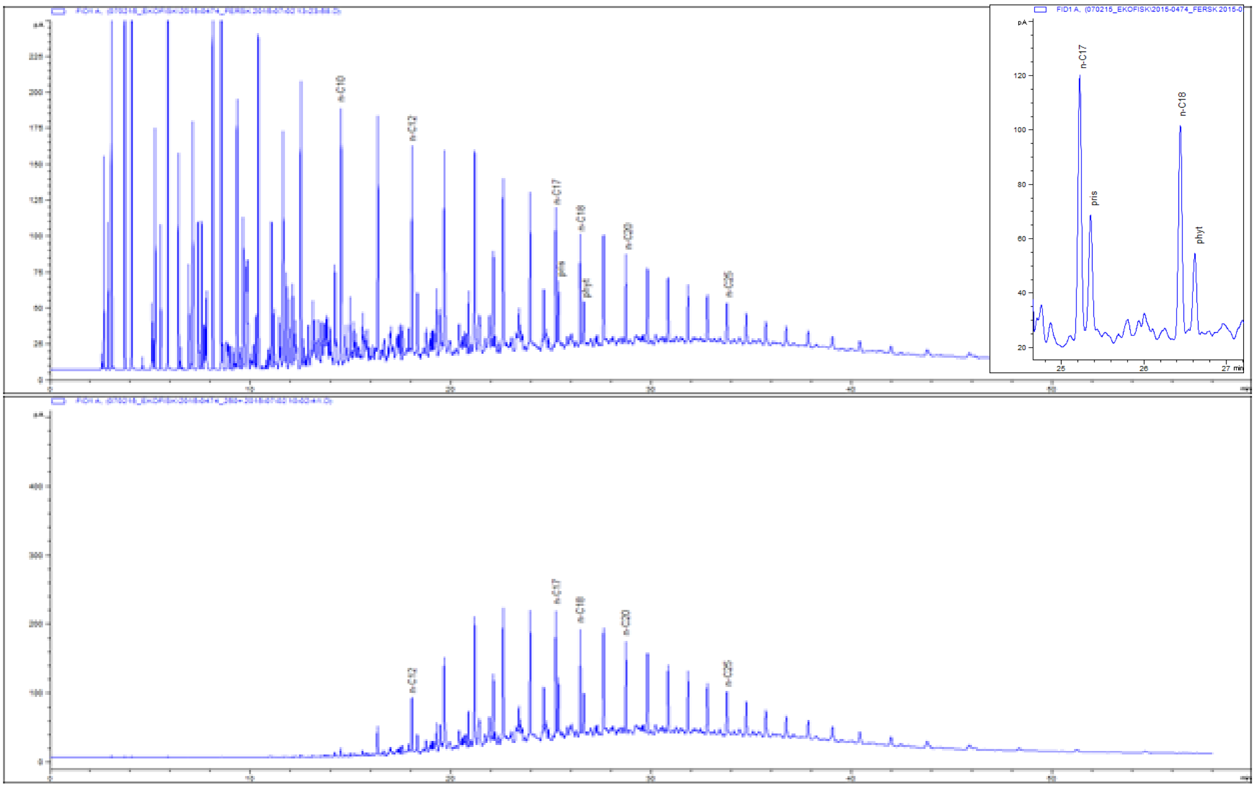


Figure A-1: GC/FID chromatograms of fresh sample and evaporated residue of Ekofisk J crude oil

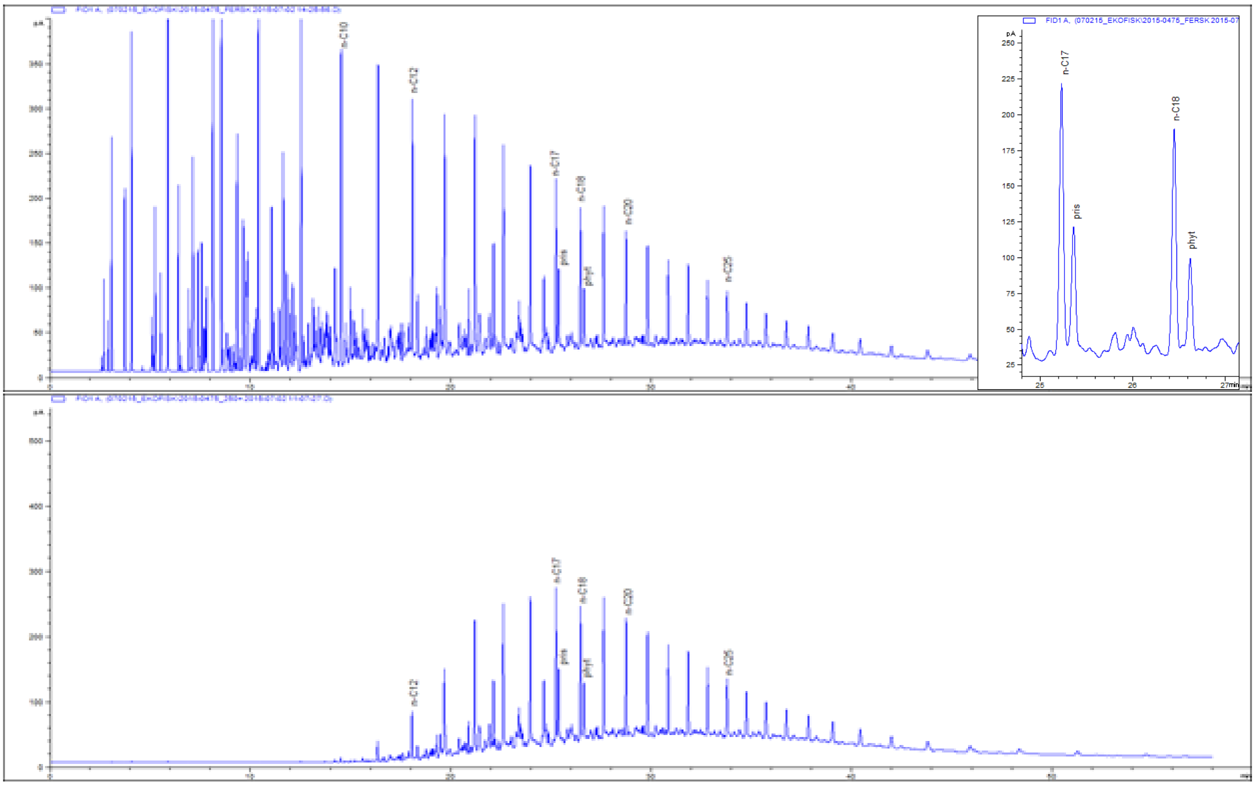


Figure A-2: GC-FID chromatograms of fresh sample and evaporated residue of Eldfisk B crude oil

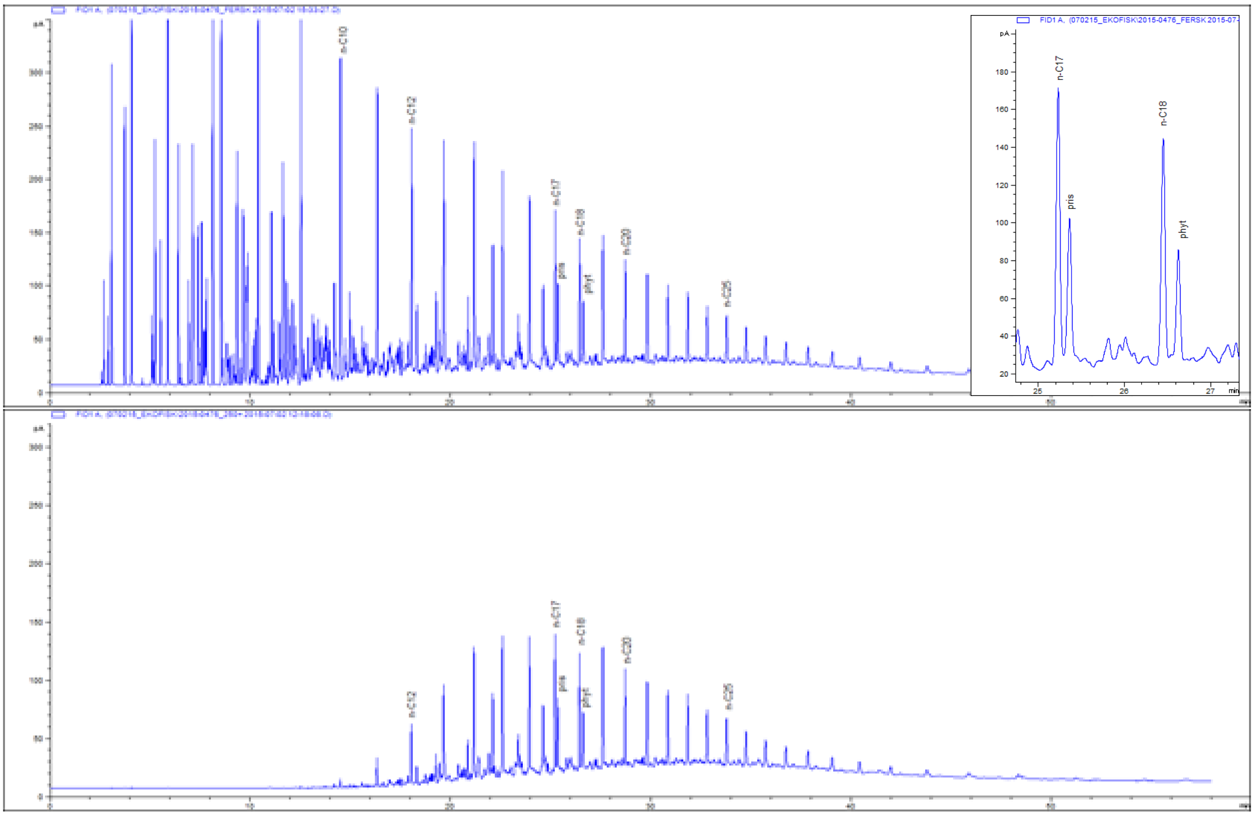


Figure A-3: GC-FID chromatograms of fresh sample and evaporated residue of Eldfisk Kompleks crude oil

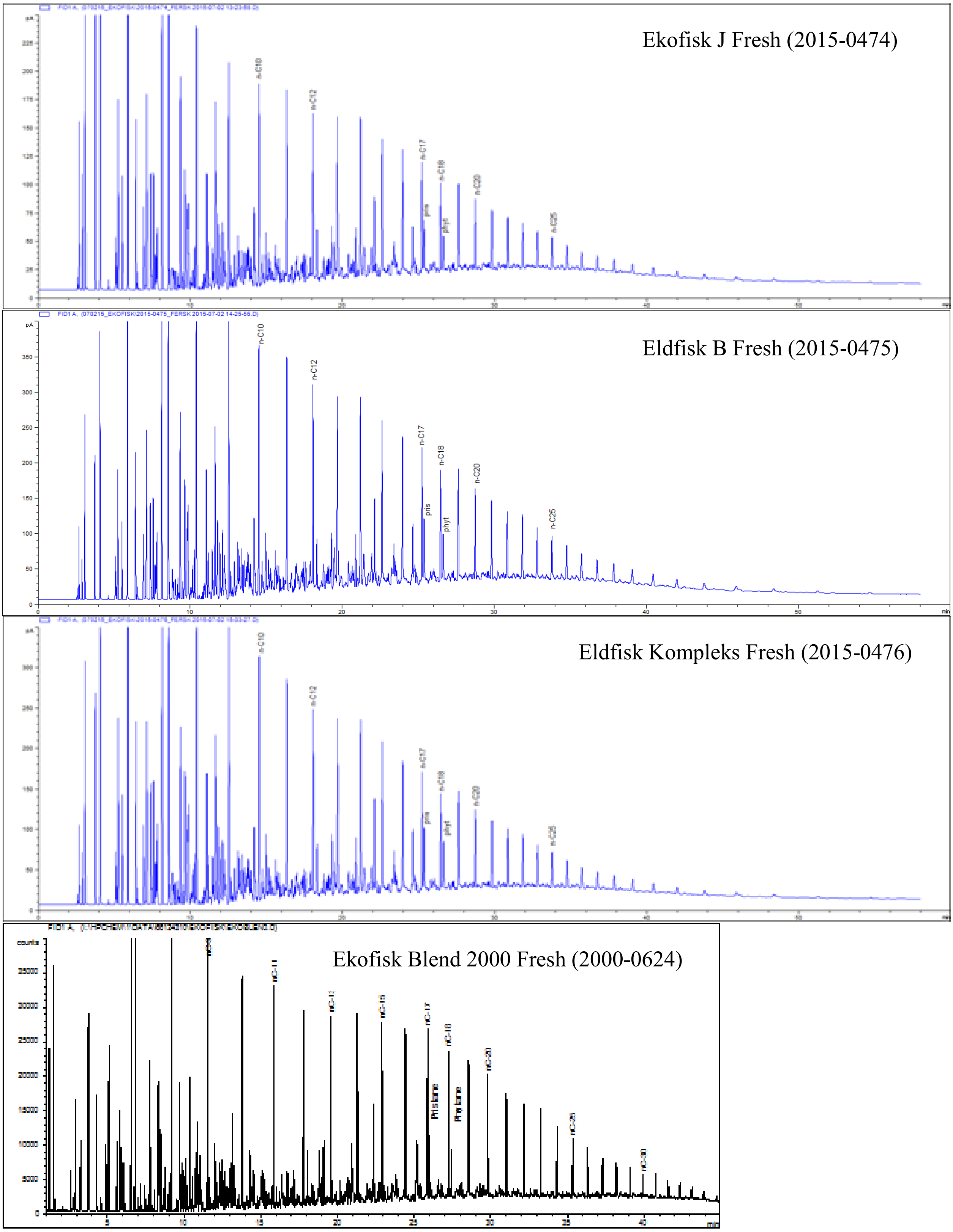


Figure A-4: GD/FID chromatograms for fresh oil for the 2015-oils and the Ekofisk Blend 2000

Asphaltene and wax content

The content of asphaltene and wax for the newly analysed oils as well as the values reported in previous studies, are given in Table A-4.

Of the 2015 oils Eldfisk Kompleks was found to have the highest content of asphaltene, measured at 0.08 weight % in fresh oil. This is similar to the levels measured for Ekofisk Blend in 2000 but higher than the measurements done in 2011 for both Ekofisk Blend and Eldfisk Blend. Ekofisk J and Eldfisk B were found to have similar asphaltene contents comparable to Ekofisk Blend 2011 and Eldfisk Blend 2011.

The wax analysis performed in 2011 revealed a significant decrease of wax in Ekofisk Blend compared to the analysis done in 2000. The results for the 2015 reveal a new significant increase of wax content, now closer to the 2000 levels than 2011 for all three oils. Of the three newly analysed, oils Eldfisk B show the highest wax content of 4.3 weight % wax, but this was still lower than Ekofisk Blend 2000 (4.9 wt. %).

Table A-4: Asphaltene ("hard") and wax content for Ekofisk oils and their residues

Oil	Residue	Asphaltenes "hard" (wt. %)	Wax (wt. %)
Ekofisk J	Fresh	0.02	3.69
	250°C+	0.03	5.62
Eldfisk B	Fresh	0.02	4.30
	250°C+	0.02	6.42
Eldfisk Kompleks	Fresh	0.08	3.55
	250°C+	0.12	5.66
Ekofisk Blend 2000	Fresh	0.07	4.93
	150°C+	0.08	5.87
	200°C+	0.09	6.57
	250°C+	0.10	7.36
Ekofisk Blend 2011	Fresh	0.03	2.90
Eldfisk Blend 2011	Fresh	0.01	2.79

Physical properties of fresh and weathered residues

Physical properties of the presented oils are listed in Table A-5. Between the studies performed in 2000 and 2011 a decrease in in pour point was observed, corresponding with the decrease wax and asphaltene contents. The recent oils tested in this study showed in general increased pour points compared to the 2011 study, and are intermediate of the pour points from the studies from 2000 and 2011.

The densities of the fresh oils and their respective residues were within the same range for the 2015-oils and previously studied oils, with fresh oil ranging from 0.841-0.854 g/ml and the 250°C+ weathered residue ranging between 0.899-0.905 g/ml.

Between 2000 and 2011 a reduction in viscosity was observed for Ekofisk Blend for both the fresh oil and the weathered residues. For the fresh 2015-Ekofisk oils the viscosities were found to be similar to the viscosities measured in 2011, ranging from 14-50 mPa·s at 13 °C and 10 s^{-1}. However, comparing the viscosities of the weathered residues between these years, show that the 2015 oil blends had lower viscosities compared to the 2011 oil blends. Ekofisk J 250°C+ was found to have the lowest viscosity of the three 2015-oils, with a viscosity of 1310 mPa·s, while Eldfisk Kompleks 250°C+ had the highest viscosity of 2258 mPa·s, compared to the 2011 low, Ekofisk Blend 2011 250°C+, which had a viscosity of 2880 mPa·s.

Table A-5: Physical parameters of the oils from the Ekofisk field in comparison

Oil type	Residue	Evap. (vol. %)	Residue (wt. %)	Density (g/ml)	Pour point (°C)	Viscosity (mPa·s) 13°C (10 s^{-1})
Ekofisk J	Fresh	0	100	0.846	-12	14
	250°C+	39	66	0.902	-	1310
Eldfisk B	Fresh	0	100	0.854	0	50
	250°C+	37	67	0.905	-	2258
Eldfisk Kompleks	Fresh	0	100	0.842	0	36
	250°C+	41	63	0.899	-	1599
Ekofisk Blend 2000	Fresh	0	100	0.851	0	93
	150°C+	18	84	0.876	12	374
	200°C+	28	75	0.888	15	1380
	250°C+	37	67	0.899	21	3800
Ekofisk Blend 2011	Fresh	0	100	0.841	-33	22
	150°C+	17	81	0.876	-6	160
	200°C+	25	73	0.890	0	580
	250°C+	39	61	0.902	9	2880
Eldfisk Blend 2011	Fresh	0	100	0.846	-12	50
	250°C+	37	64	0.902	-9	3410

-: No data available

A.1.2 True boiling point curves

True boiling point curves (TBP) for the three tested oils were delivered by Intertek Westlab. These boiling point curves were compared to their respective laboratory data for evaporative loss, and adjustments were made for Ekofisk J and Eldfisk Kompleks. The 450 °C value of vol. % evaporation was estimated based on data received for wt. % evaporation for the three tested oils.

The boiling point curves are presented in the Figure A-5 below.

A misprint in the reported boiling point curve of Ekofisk Blend 2000 has been discovered and corrected. The misprint in question was limited to the written report, and has, to our knowledge, not been included in previous modelling of the Ekofisk Blend 2000 behaviour and properties.

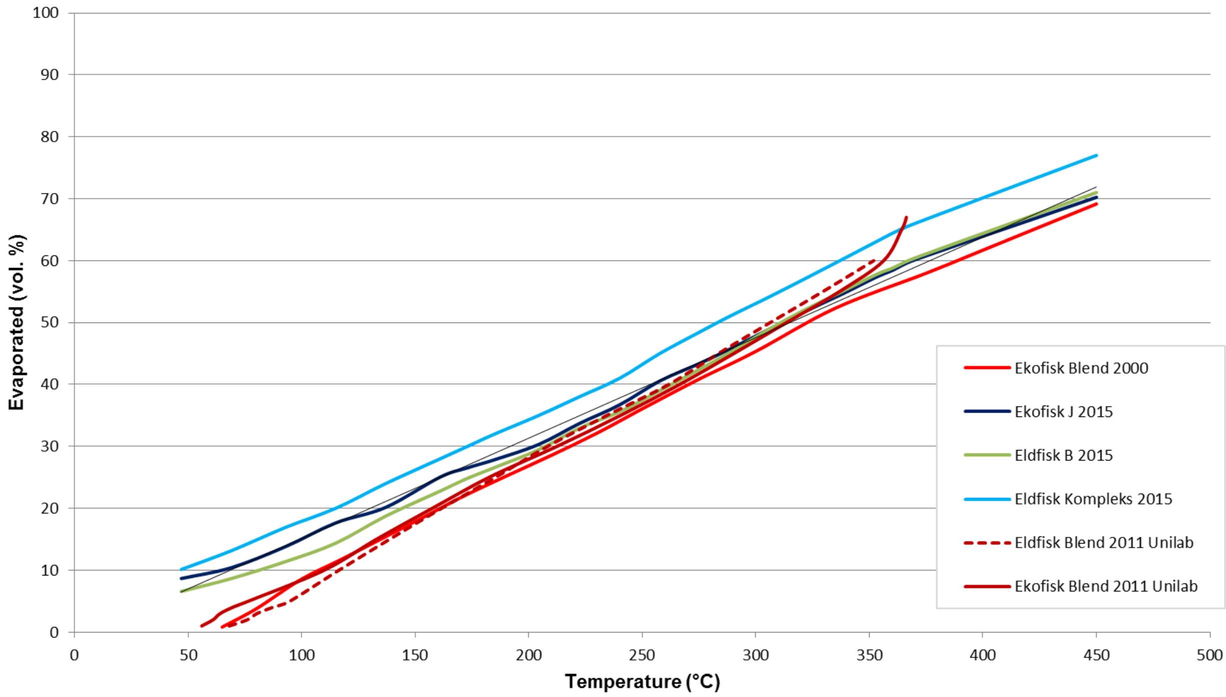


Figure A-5: True Boiling point curve for Ekofisk J, Eldfisk B, and Eldfisk Kompleks and oils used for comparison

A.1.3 Emulsifying properties of Ekofisk oils

The emulsifying properties of Ekofisk J, Eldfisk B and Eldfisk Kompleks were studied by use of the rotating cylinders (Hokstad et al., 1993).

Figure A-6 below shows the rotating cylinders for all three oils before the initiation of the test and after 24 hours of rotation. From left to right are the Ekofisk J, Eldfisk B and Eldfisk Kompleks oils, four cylinder of each. After 24 hours of rotation, no significant visible difference can be seen between the different oils, the total volume of emulsion appear very similar. The four cylinders were each used for further analysis, and the variations in water content in the following presented tables reflect the variations between the cylinders. $T_{1/2}$ was calculated using the average of the four parallel cylinders, while stability ratio and viscosity were measured on individual cylinders.

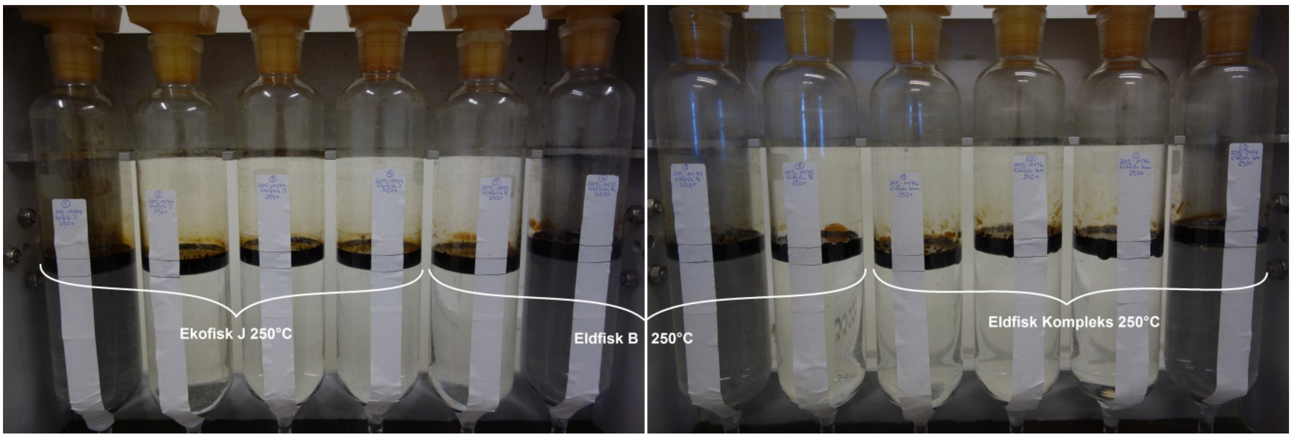


Figure A-6: The rotating cylinders at start (above) and after 24 hours of rotation at 13 °C

Water uptake and maximum water content

The parameters for kinetics (rate of water uptake) and maximum water uptake were studied by use of the rotating cylinders, similar to the emulsifying properties. The water contents in the water-to-oil emulsions as a function of time are shown in Table A-6, in comparison to Ekofisk Blend 2000. $T_{1/2}$ is a constant defined as the time (hours) required to incorporate half the maximum water quantity and is derived from the tabulated data for each residue. These constants are also presented in the table below, and reveal Eldfisk Kompleks as having the most rapid water uptake ($T_{1/2}$ = 0.35), while Ekofisk J has a slower water uptake ($T_{1/2}$ = 1.90).

Table A-6: Water uptake for the evaporated residues of the three tested oils crude oil at 13 °C

Mixing time	**Ekofisk J 250°C+ (Vol. % water)**	**Eldfisk B 250°C+ (Vol. % water)**	**Eldfisk Kompleks 250°C+ (Vol. % water)**	**Ekofisk Blend 2000 250°C+ (Vol. % water)**
Start	0	0	0	0
5 min	10	9	2	13
10 min	14	11	15	22
15 min	15	11	31	32
30 min	18	23	55	39
1 hour	26	50	71	49
2 hours	41	71	73	64
4 hours	53	73	75	72
6 hours	59	74	76	77
24 hours	75	75	77	78
$T_{1/2}$	1.90	0.70	0.35	0.53

Stability and efficiency of emulsion breaker

The stability of the emulsions from the weathered residues of the 2015 blend oils was tested by quantifying the amount of water released from the emulsion during 24 hours of settling after 24 hours of rotation. In addition, the efficiency of the emulsion breaker (Alcopol O 60 %) was evaluated. The results are given in Table A-7, as are historical results for Ekofisk Blend 2000. All the formed emulsions showed high stability ratio similar to Ekofisk Blend 2000, and responded also well to the application of emulsion breaker.

Table A-7: Stability of emulsion and the effect of emulsion breaker on the tested oils, at 13 °C

Oil	Emulsion breaker	Water-in-oil emulsion (vol. %) at 13 °C		
		Reference	24 hours *	Stability ratio**
Ekofisk J 250°C+	none	75	76	1.00
	Alc. O 60 % 500 ppm	75	61	0.52
	Alc. O 60 % 2000 ppm	75	17	0.07
Eldfisk B 250°C+	none	75	75	0.97
	Alc. O 60 % 500 ppm	75	33	0.16
	Alc. O 60 % 2000 ppm	75	14	0.05
Eldfisk Kompleks 250°C+	none	77	78	1.00
	Alc. O 60 % 500 ppm	77	45	0.24
	Alc. O 60 % 2000 ppm	77	19	0.07
Ekofisk Blend 2000 250°C+	none	78	78	0.97
	Alc. O 60 % 500 ppm	78	40	0.19
	Alc. O 60 % 2000 ppm	78	0	0.00

ppm: parts per million

**: w/o emulsion after 24 hours rotation and 24 hours settling*

*** Stability ratio of 0 implies a totally unstable emulsion after 24 hours settling; all the water is settled out during 24 hours of settling. Stability ratio of 1 implies a totally stable emulsion*

Emulsion viscosities

The measured emulsion viscosities along with the viscosity of fresh oil and water-free residues are given in Table A-8 for the 2015 blends as well as for Ekofisk Blend 2000, Ekofisk blend 2011, and Eldfisk Blend 2011.

In general, the 2015 blends have lower fresh oil and residue viscosities compared to the previously studied Ekofisk blends and Eldfisk blend. The emulsion viscosities for the 2015 blends are similar to the corresponding emulsion viscosity of Ekofisk blend 2000, but significantly higher than those previously measured for Ekofisk Blend 2011 and Eldfisk Blend 2011.

Table A-8: Viscosities of Ekofisk oils for water free oil and maximum water emulsions

Oil	Residue	Water content (vol. %)	Viscosity (mPa·s) 13 °C	
			10 s^{-1}	100 s^{-1}
Ekofisk J	Fresh	0	14	13
	250°C+	0	1310	672
	250°C+	73	11461	2669
Eldfisk B	Fresh	0	50	33
	250°C+	0	2258	993
	250°C+	76	10492	706
Eldfisk Kompleks	Fresh	0	36	23
	250°C+	0	1599	644
	250°C+	78	7564	926
Ekofisk Blend 2000	Fresh	0	92	38
	250°C+	0	3800	885
	250°C+	78	11132	1929
Ekofisk Blend 2011	Fresh	0	22	-
	250°C+	0	2880	-
	250°C+	82	3260	-
Eldfisk Blend 2011	Fresh	0	50	-
	250°C+	0	3410	-
	250°C+	77	2010	-

B Input to OWM and predictions

B.1 Input to OWM

The data presented in the following tables were used for the predictions of weathering behaviour based on the Crude Assay module in the OWM.

The true boiling point curves of Ekofisk J and Eldfisk Kompleks were adjusted to better match the laboratory results. The applied boiling point curves are given in Table B-1 below. Physical-chemical data used for the formation of synthetic data set for the three oils are given in Table B-2.

Table B-1: Boiling point curves used in OWM. Received from Intertek Westlab via ConocoPhillips, and adjusted to laboratory results

C°	Evaporative loss (vol. %)		
	Ekofisk J	Eldfisk B	Eldfisk Kompleks
47	9	7	10
69	10	9	13
93	14	11	17
115	18	14	20
137	20	19	24
161	25	23	28
173	27	25	30
185	28	27	32
204	30	29	35
222	34	33	38
240	37	36	41
258	41	39	45
275	43	43	49
288	46	45	51
305	49	49	54
321	52	52	57
337	54	55	60
353	57	58	63
361	59	59	65
370	60	60	66
450	70	71	77

Table B-2: Data used for the formation of synthetic weathering data, by the use of the Crude Assay module in OWM

Oil	Density	Viscosity (mPa·s, 13°C)	Pour point	Wax content	Asphaltene content
Ekofisk J	0.846	14	-12	3.69	0.02
Eldfisk B	0.854	50	0	4.30	0.02
Eldfisk Kompleks	0.842	36	0	3.55	0.08

B.2 Predicted weathering behaviour

B.2.1 Ekofisk J

Property: EVAPORATIVE LOSS
Oil Type: EKOFISK J 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatheri

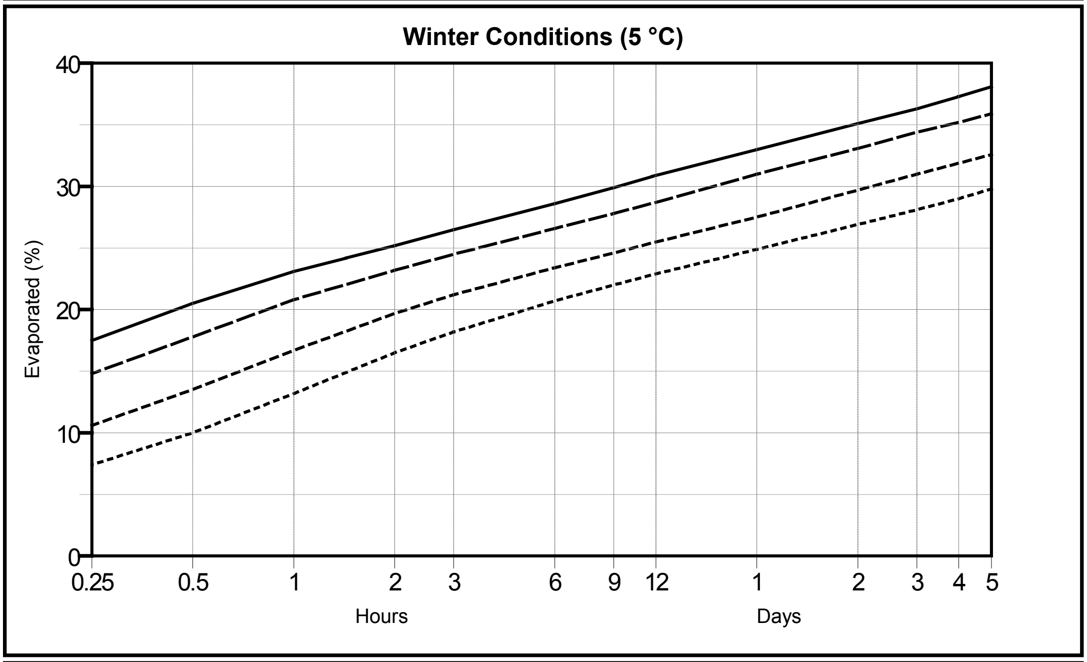
SINTEF

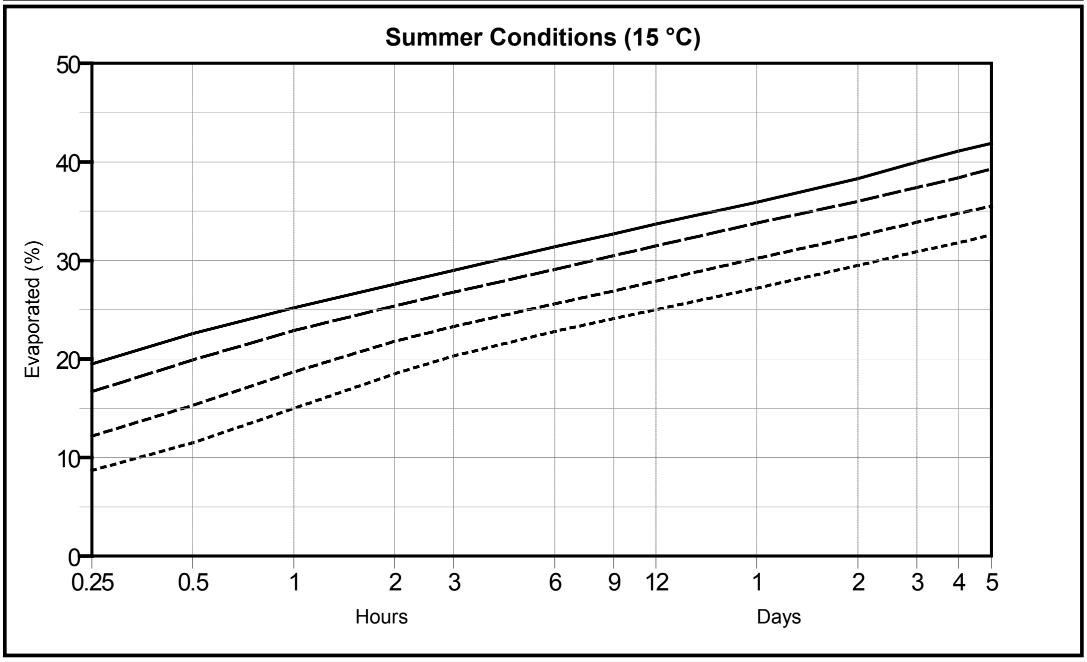
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Wind Speed (m/s): 15
Wind Speed (m/s): 10
Wind Speed (m/s): 5
Wind Speed (m/s): 2





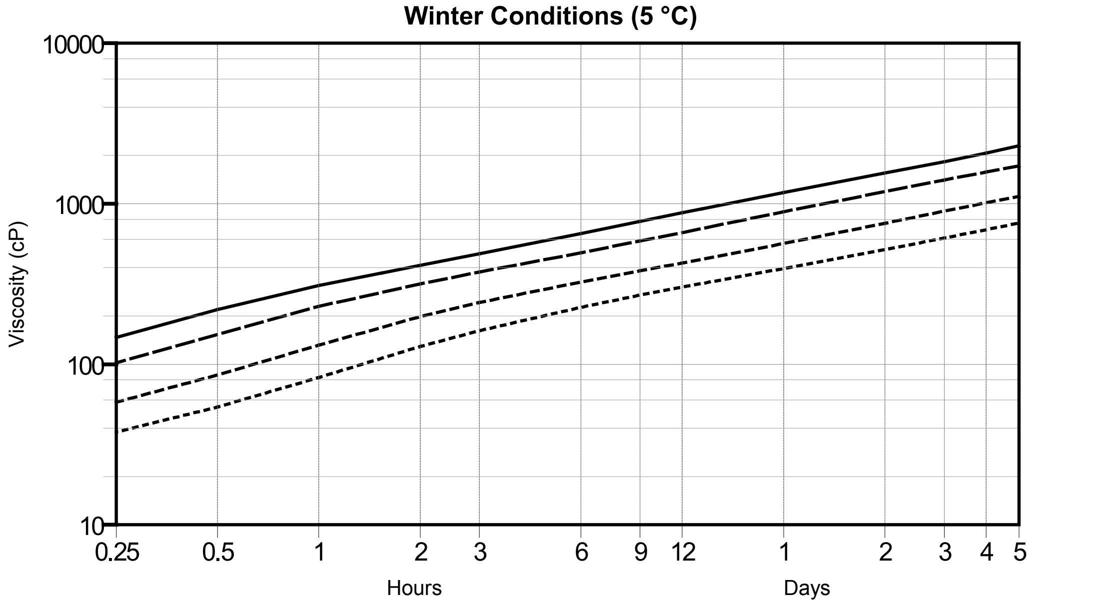
Property: VISCOSITY FOR WATER-FREE OIL
Oil Type: EKOFISK J 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

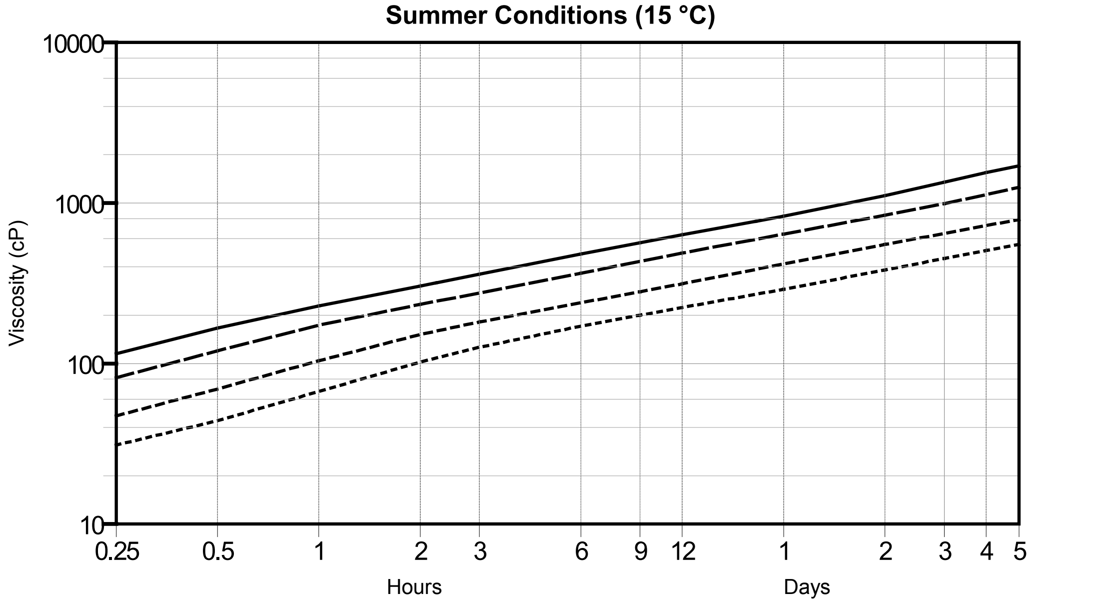
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

- Wind Speed (m/s): 15
- Wind Speed (m/s): 10
- Wind Speed (m/s): 5
- Wind Speed (m/s): 2





Based on viscosity measurements carried out at a shear rate of 10 reciprocal seconds.

Property: VISCOSITY OF EMULSION
Oil Type: EKOFISK J 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

SINTEF

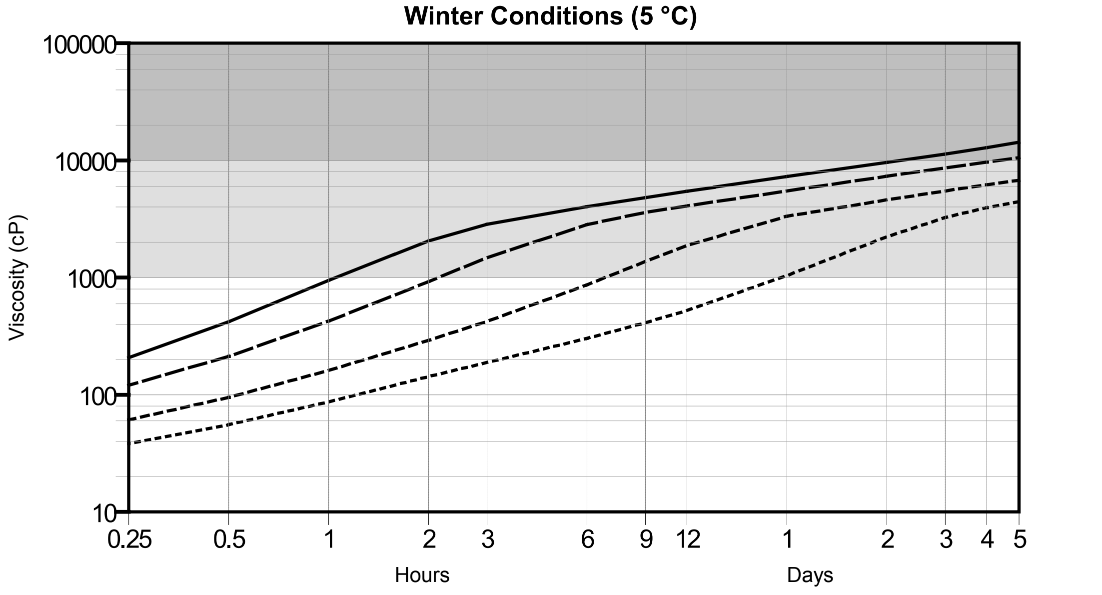
OWModel

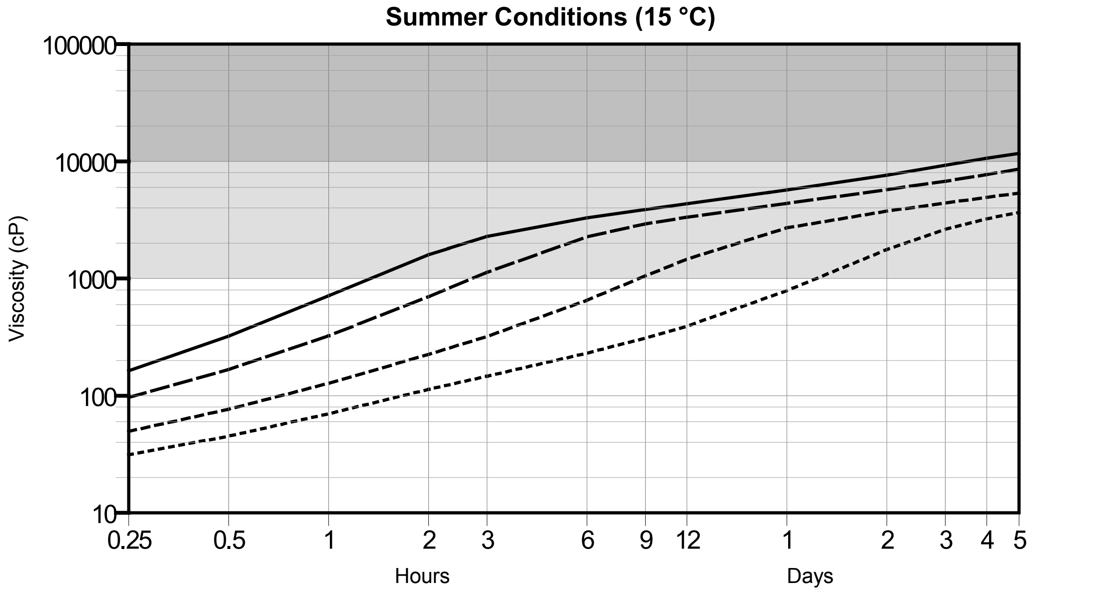
Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Dec. 03, 2015

Wind Speed (m/s): 15
Wind Speed (m/s): 10
Wind Speed (m/s): 5
Wind Speed (m/s): 2

Chemically dispersible (<1000 cP)
Reduced chemical dispersibility
Poorly / slowly chemically dispersible (>10000 cP)





Based on viscosity measurements carried out at a shear rate of 10 reciprocal seconds.
Chemical dispersability information based on experiments under standard laboratory conditions.

Property: WATER CONTENT
Oil Type: EKOFISK J 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

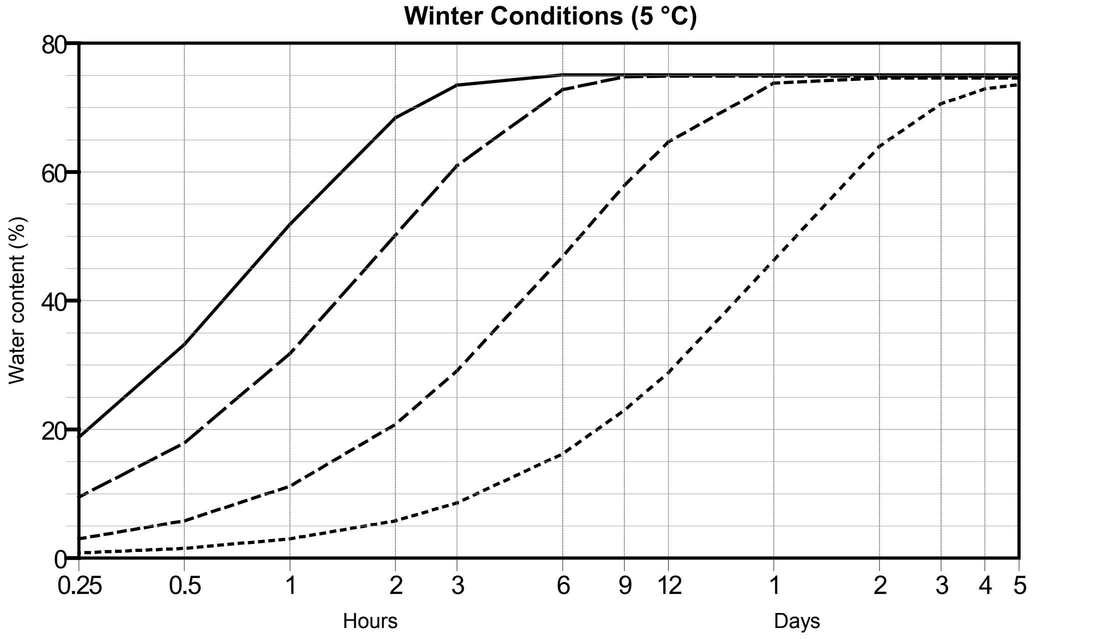
SINTEF

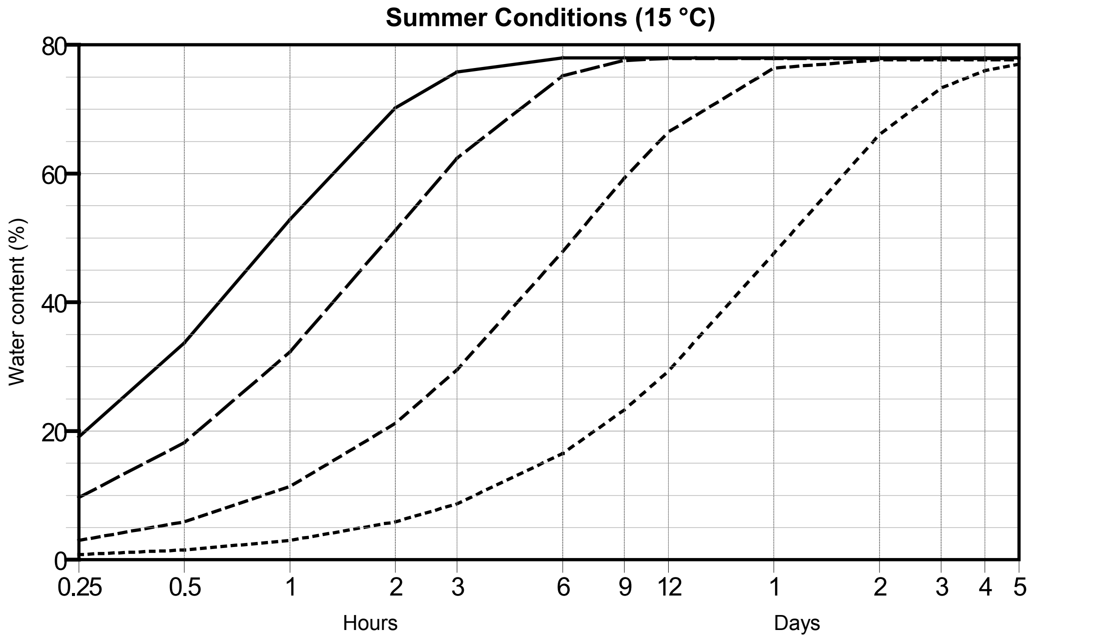
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

- Wind Speed (m/s): 15
- Wind Speed (m/s): 10
- Wind Speed (m/s): 5
- Wind Speed (m/s): 2





Property: POUR POINT FOR WATER-FREE OIL
Oil Type: EKOFISK J 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

SINTEF

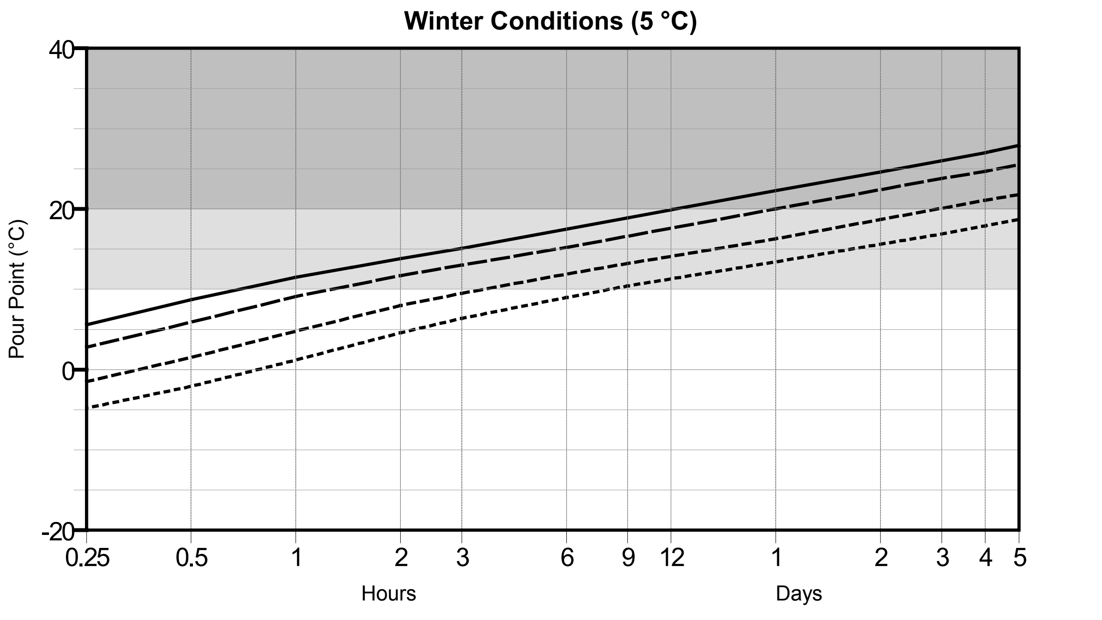
OWModel

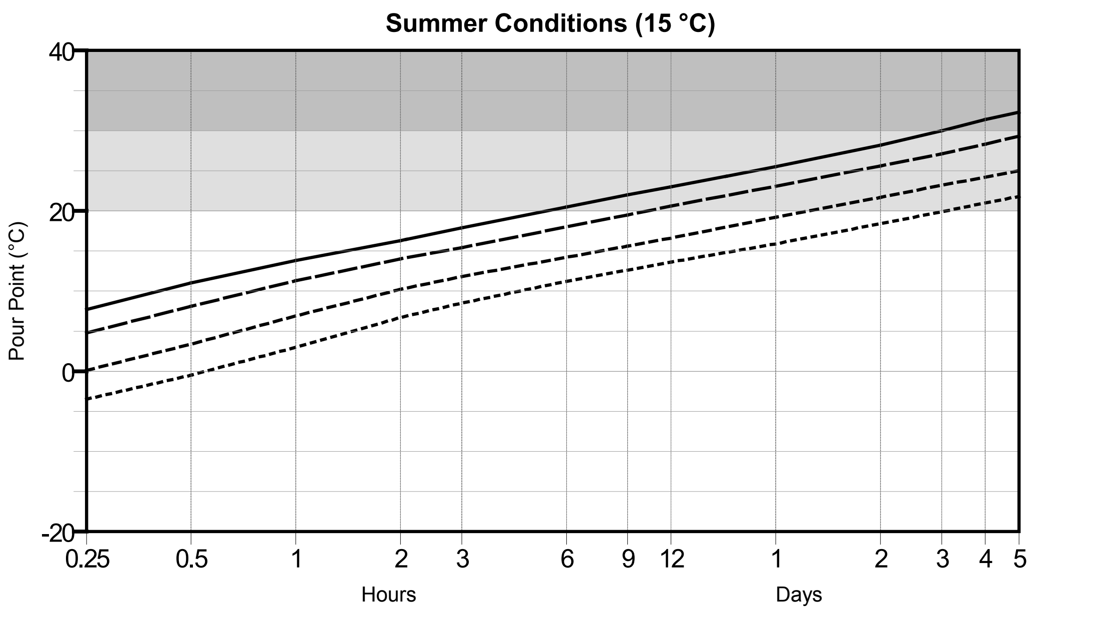
Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

- Wind Speed (m/s): 15
- Wind Speed (m/s): 10
- Wind Speed (m/s): 5
- Wind Speed (m/s): 2

- Chemically dispersible
- Reduced chemical dispersibility
- Poorly / slowly chemically dispersible





Based on pour point measurements of weathered, water-free oil residues.

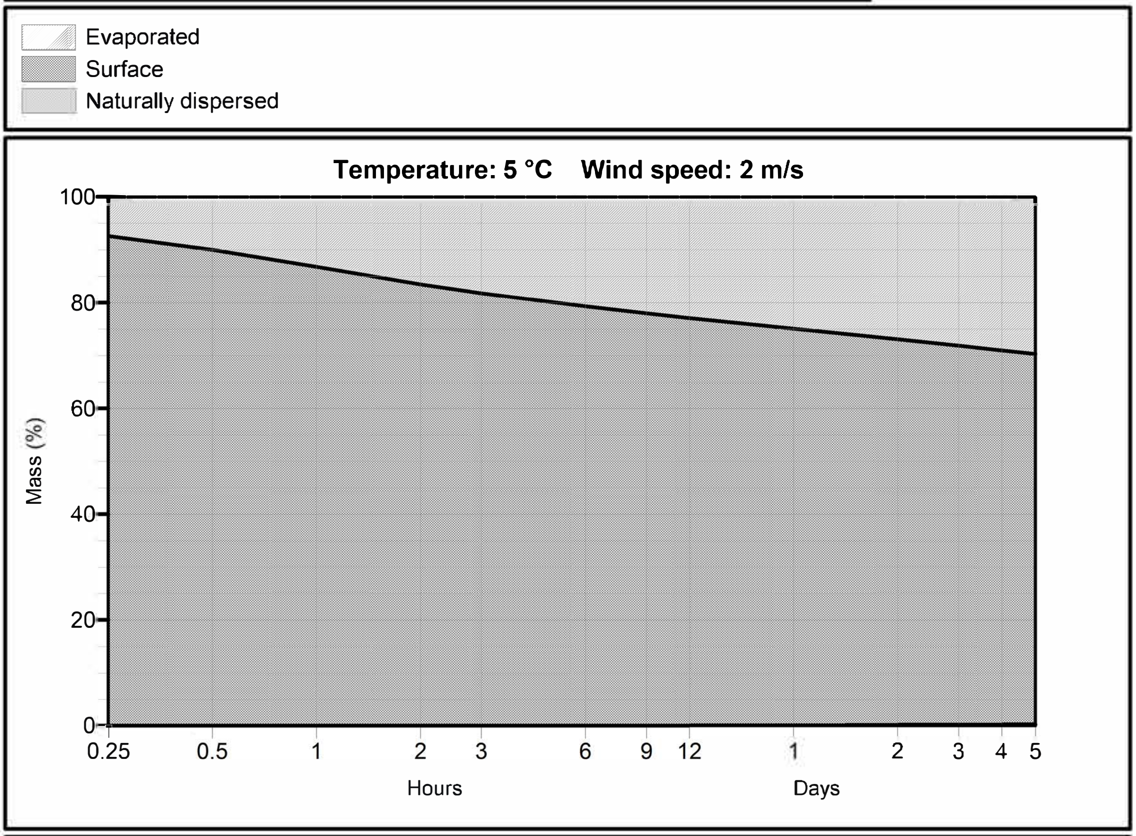
Property: MASS BALANCE
Oil Type: EKOFISK J 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

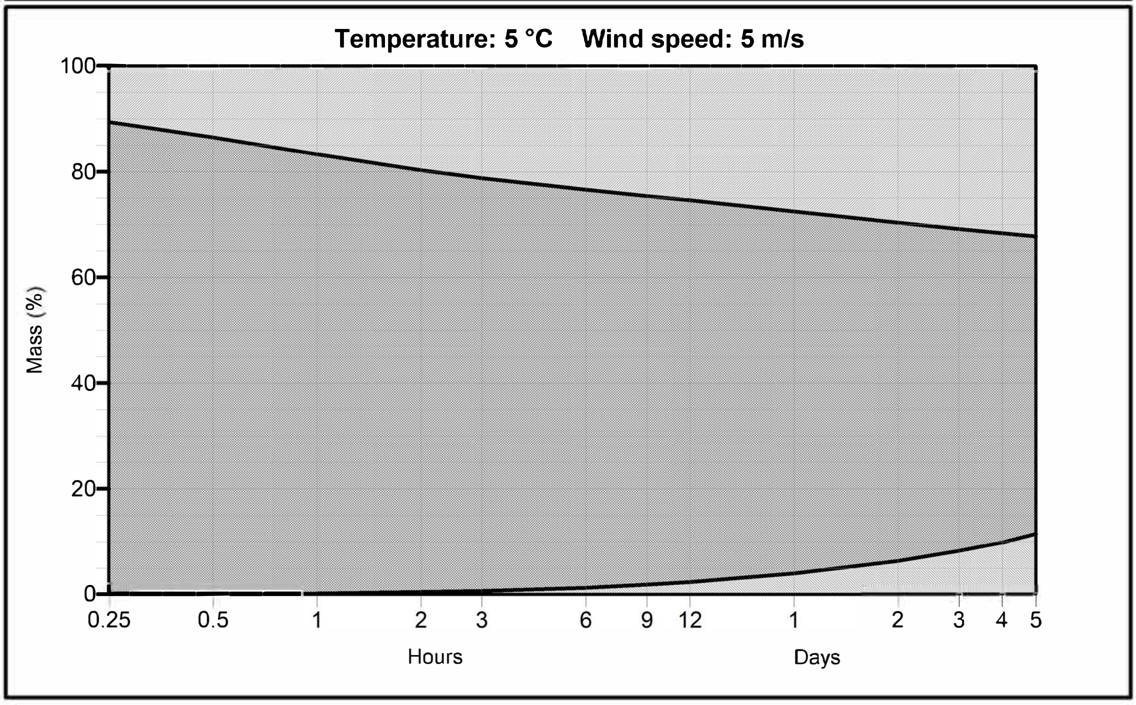
SINTEF

OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015





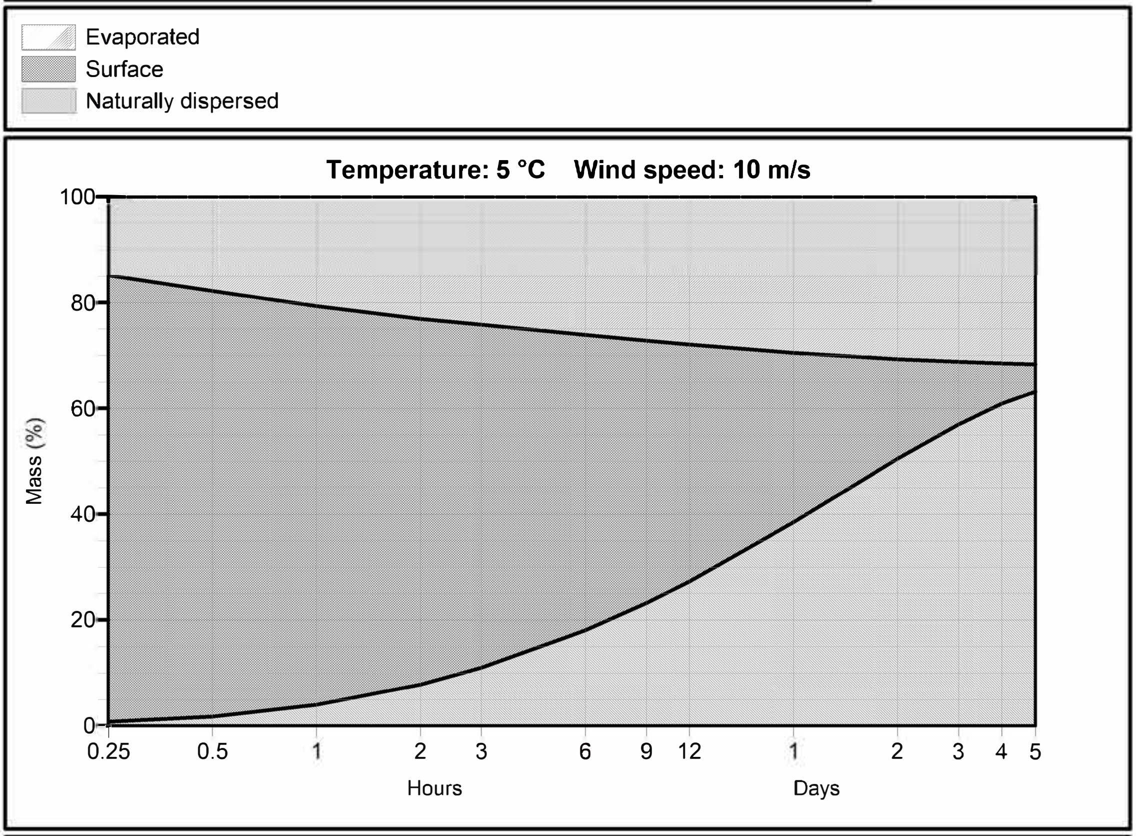
Property: MASS BALANCE
Oil Type: EKOFISK J 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

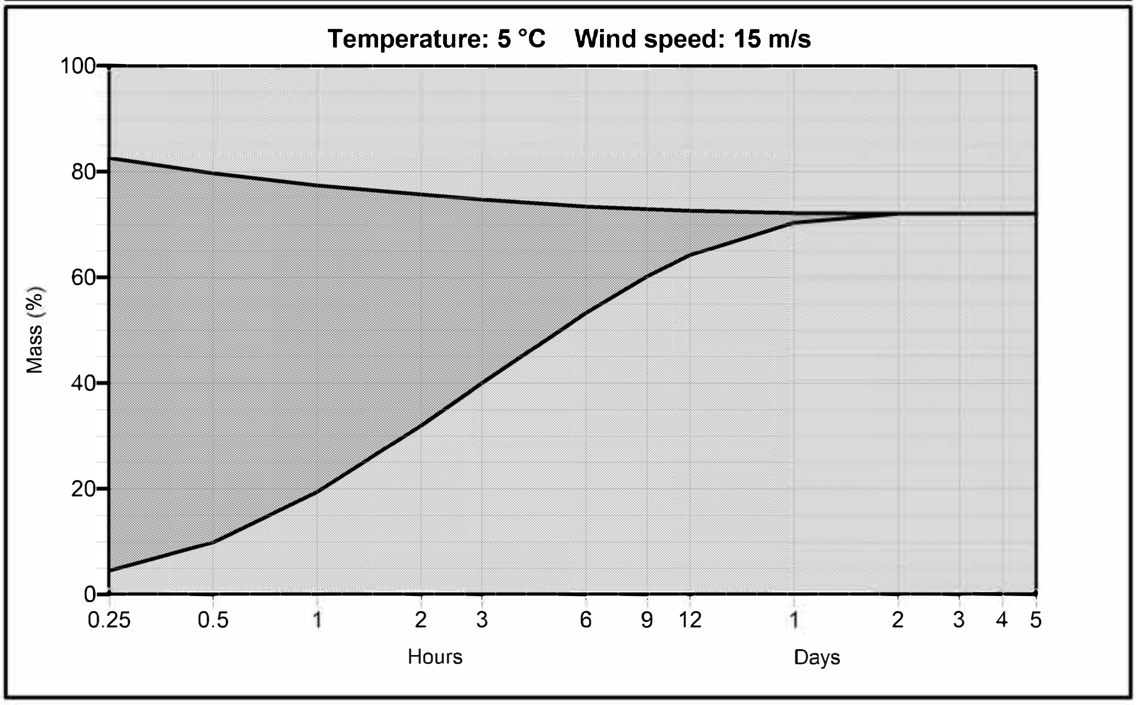
SINTEF

OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015





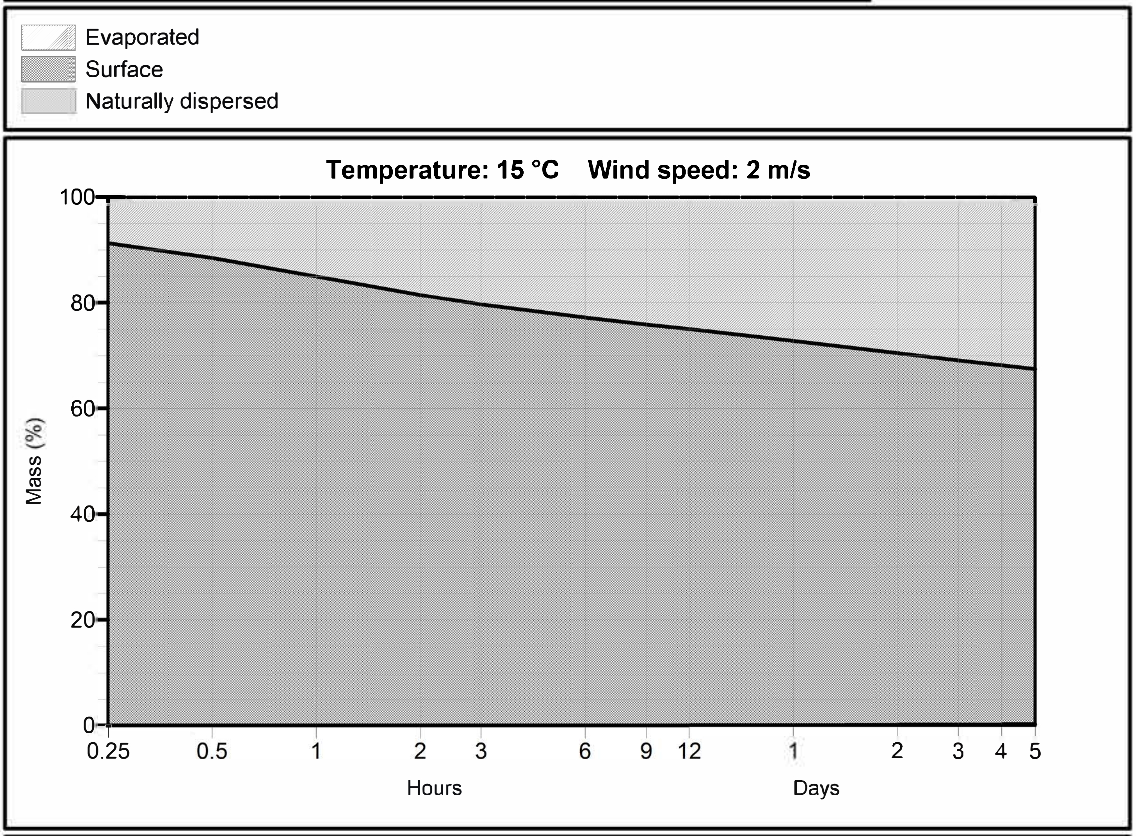
Property: MASS BALANCE
Oil Type: EKOFISK J 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

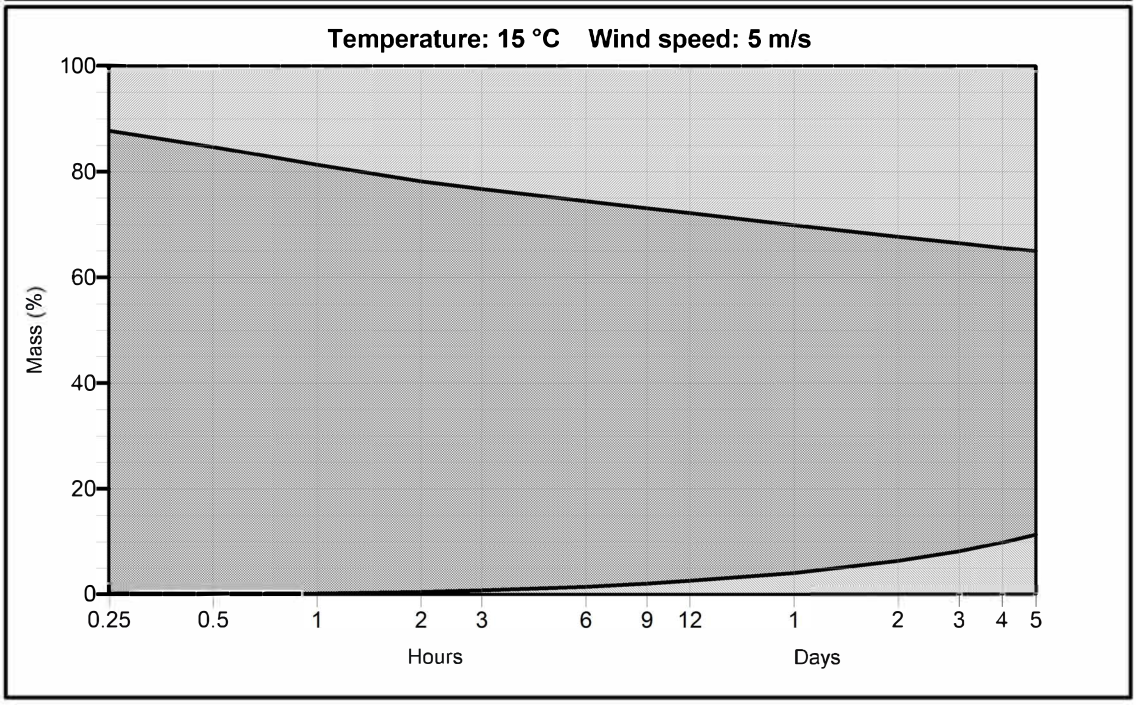
SINTEF

OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015





Property: MASS BALANCE
Oil Type: EKOFISK J 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

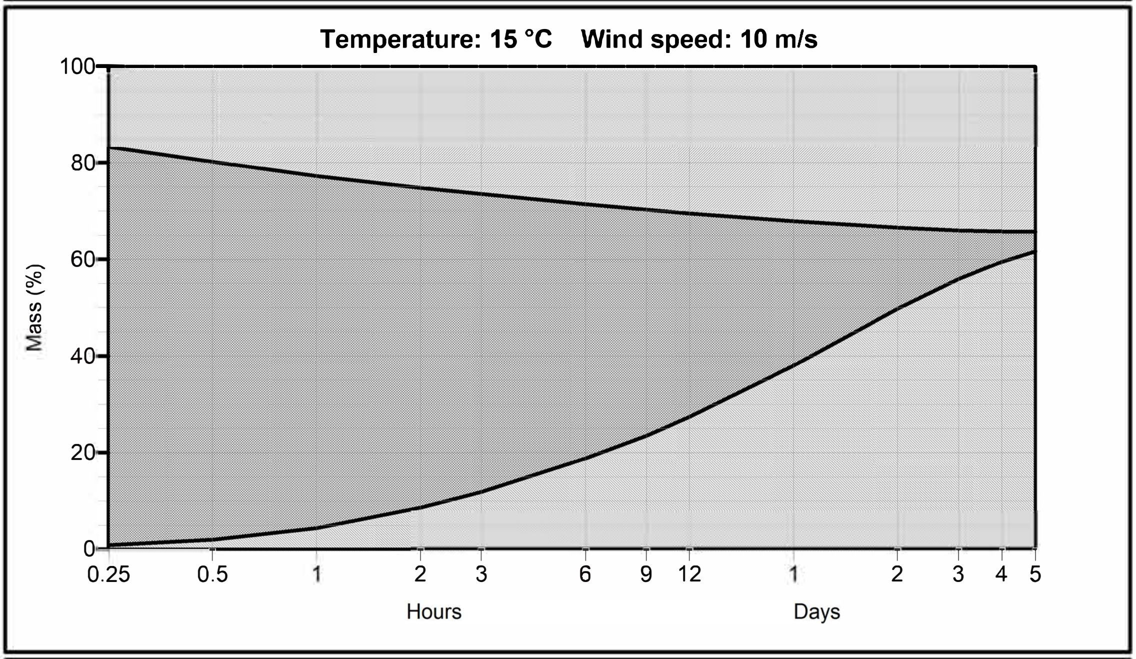
SINTEF

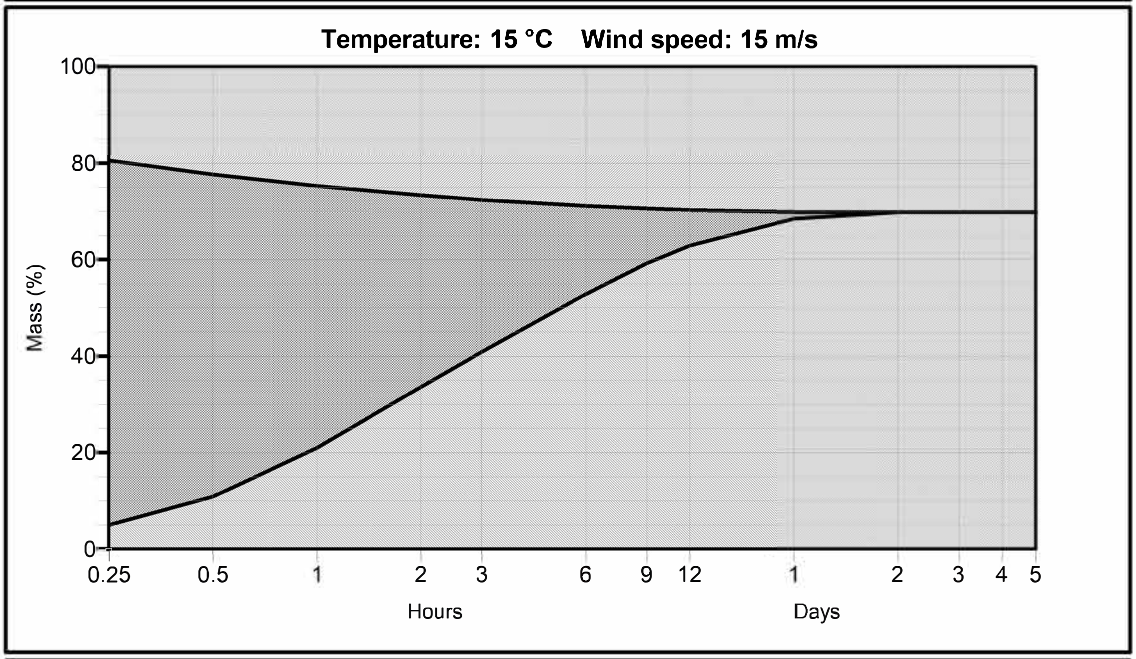
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Evaporated
Surface
Naturally dispersed





The algorithm for prediction of natural dispersion is preliminary and is currently under improvement.Model predictions have been field-verified up to 4-5 days.

B.2.2 Predicted behaviour for Eldfisk B

Property: EVAPORATIVE LOSS
Oil Type: ELDFISK B 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

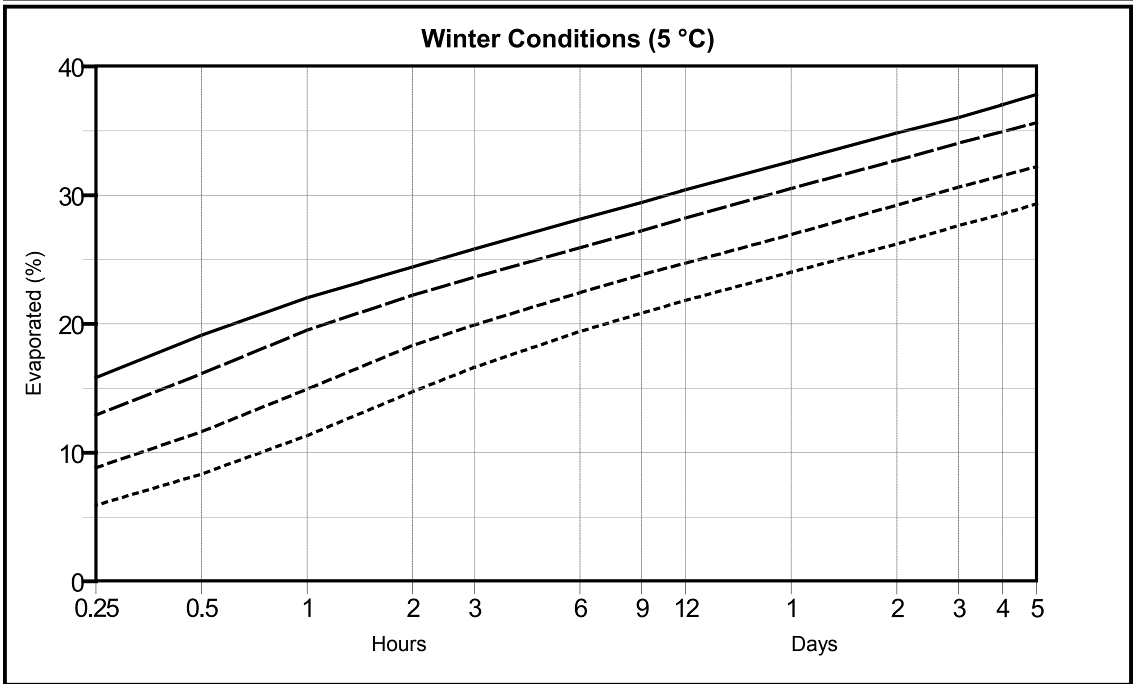
SINTEF

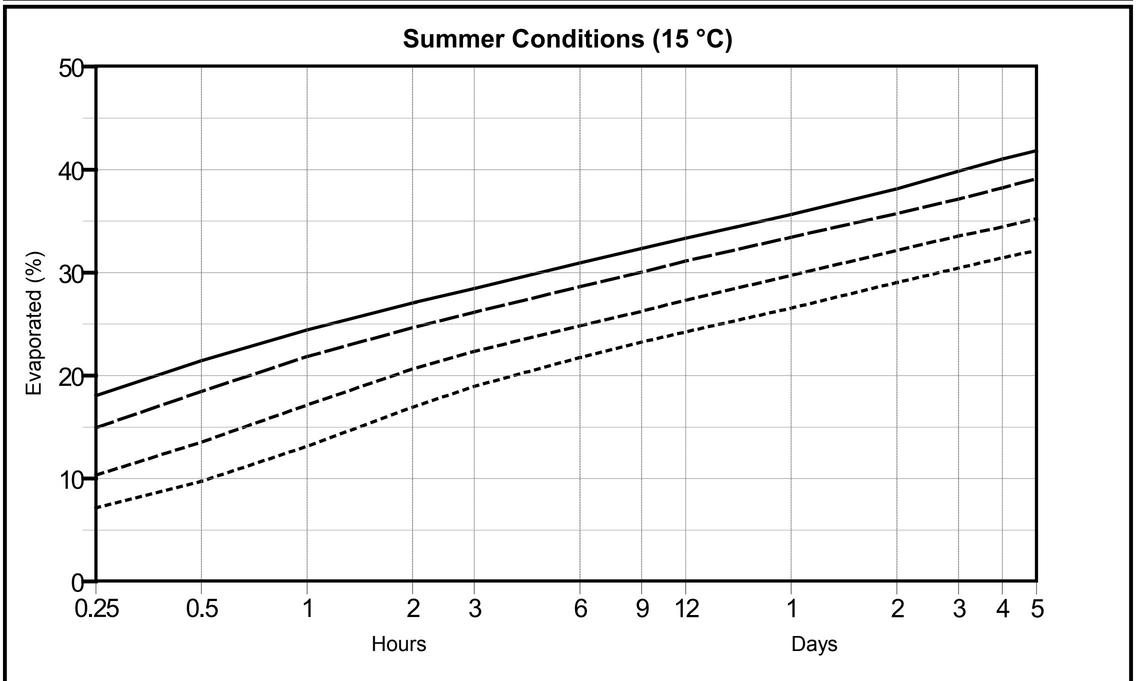
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Wind Speed (m/s): 15
Wind Speed (m/s): 10
Wind Speed (m/s): 5
Wind Speed (m/s): 2





Property: VISCOSITY FOR WATER-FREE OIL
Oil Type: ELDFISK B 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

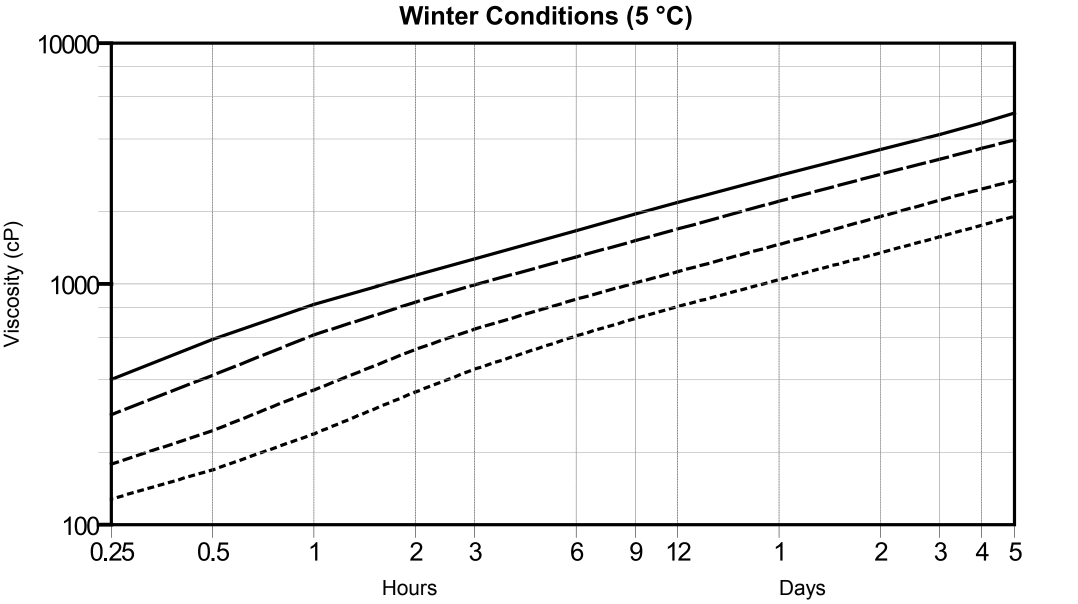
SINTEF

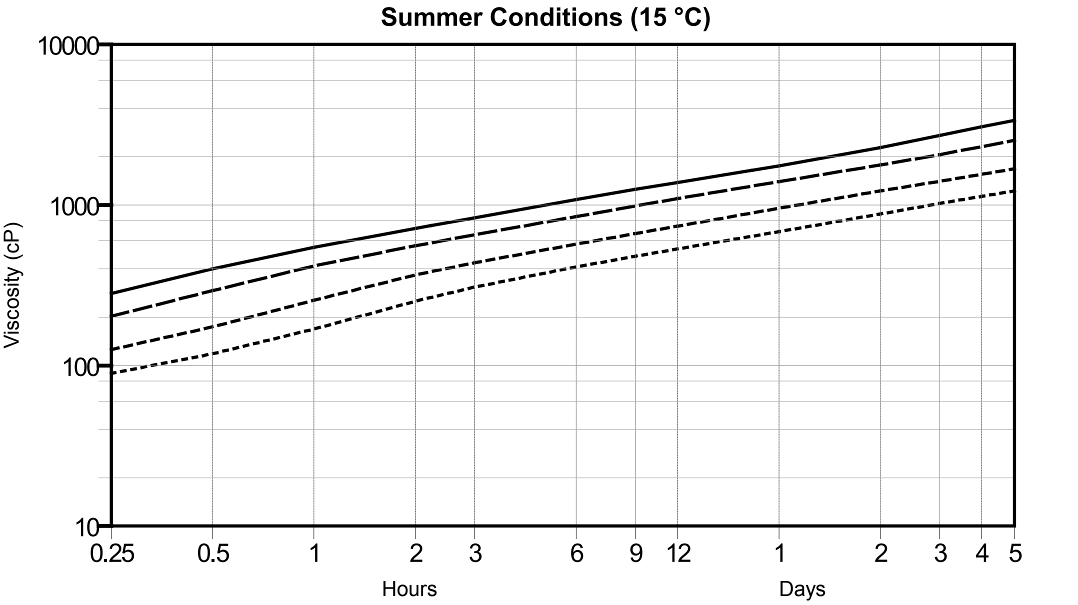
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Wind Speed (m/s): 15
Wind Speed (m/s): 10
Wind Speed (m/s): 5
Wind Speed (m/s): 2





Based on viscosity measurements carried out at a shear rate of 10 reciprocal seconds.

Property: VISCOSITY OF EMULSION
Oil Type: ELDFISK B 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

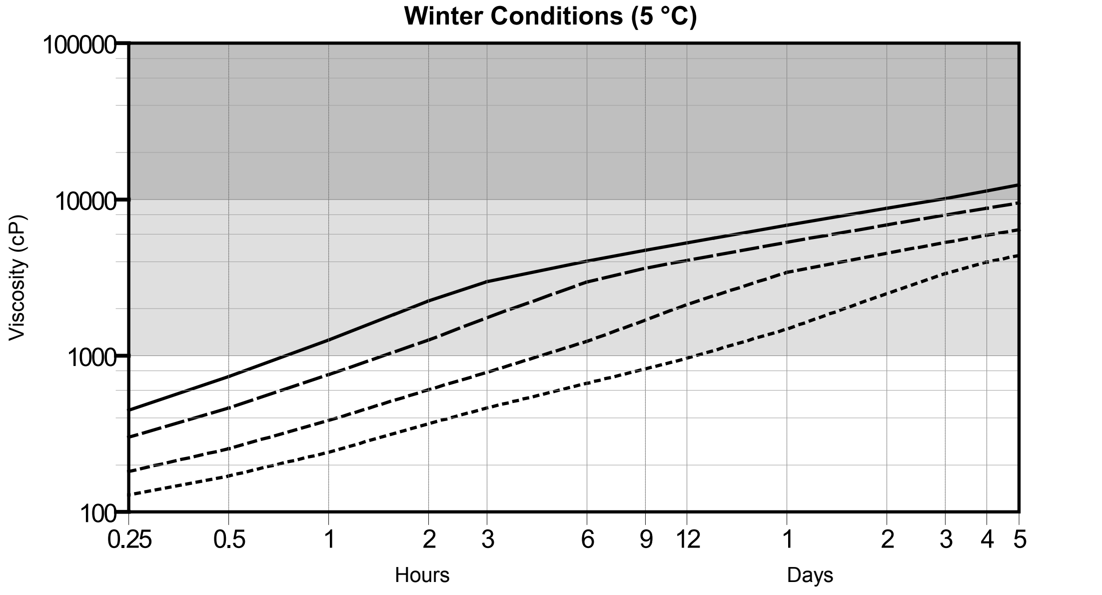
SINTEF

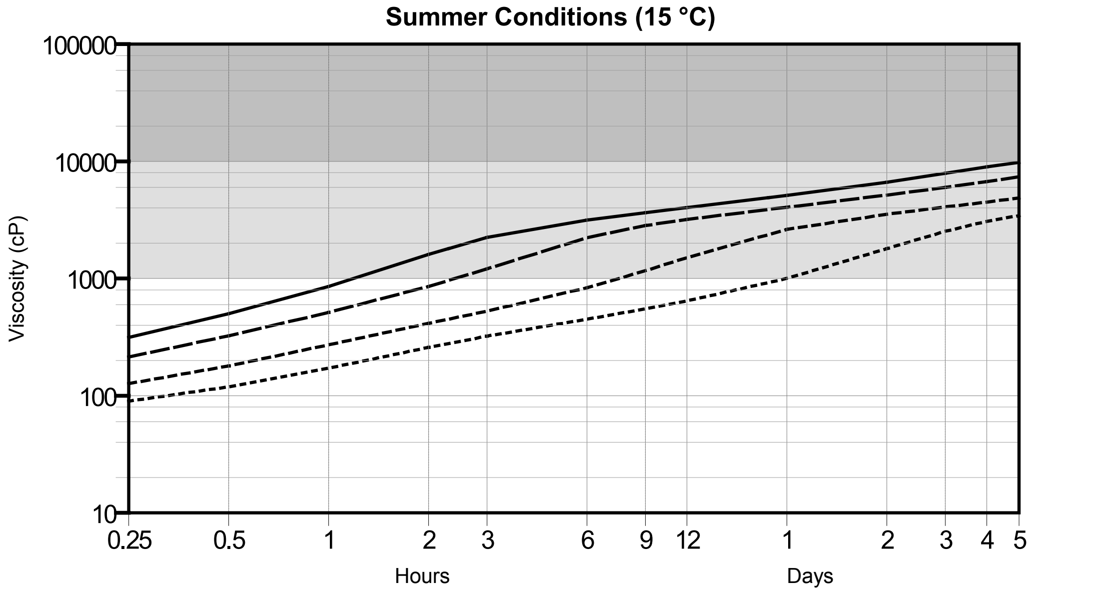
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Dec. 03, 2015

- Wind Speed (m/s): 15
- Wind Speed (m/s): 10
- Wind Speed (m/s): 5
- Wind Speed (m/s): 2
- Chemically dispersible (<1000 cP)
- Reduced chemical dispersibility
- Poorly / slowly chemically dispersible (>10000 cP)





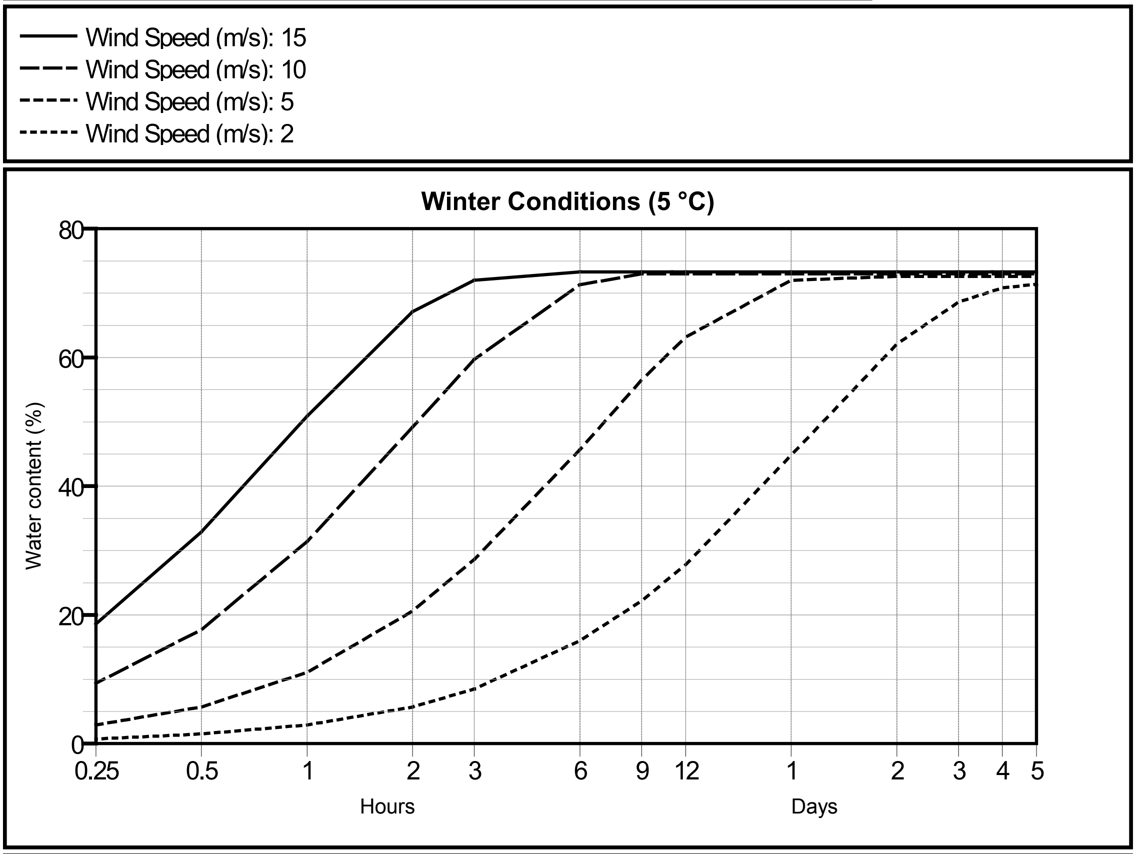
Based on viscosity measurements carried out at a shear rate of 10 reciprocal seconds.
Chemical dispersability information based on experiments under standard laboratory conditions.

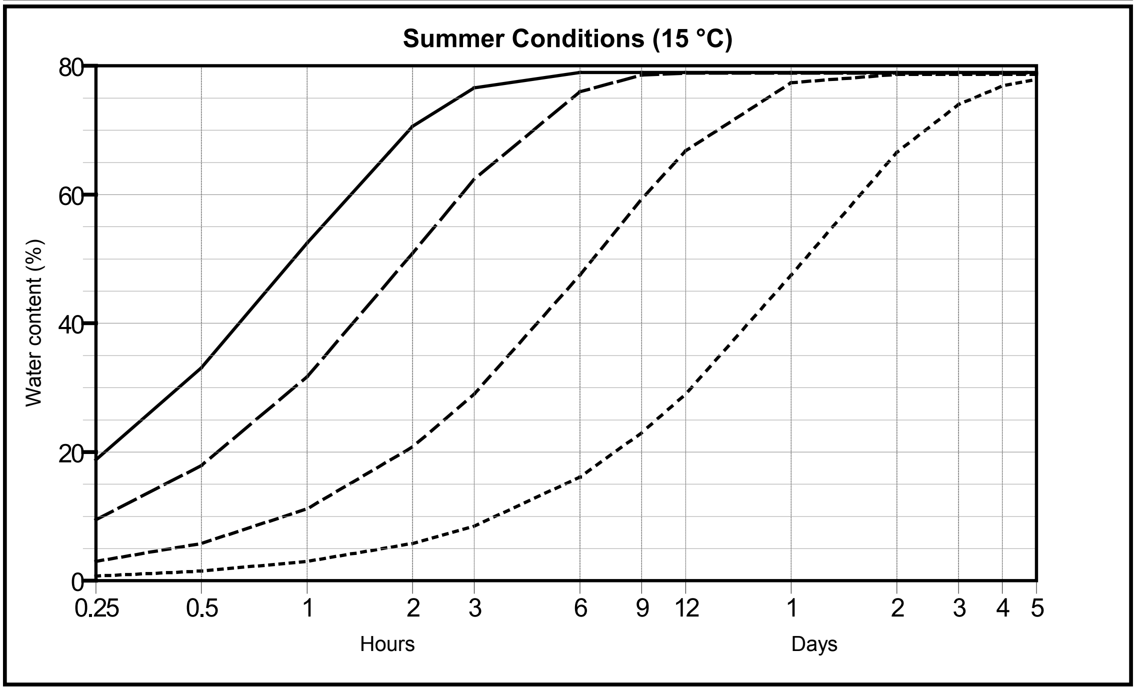
Property: WATER CONTENT
Oil Type: ELDFISK B 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015





Property: POUR POINT FOR WATER-FREE OIL
Oil Type: ELDFISK B 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

SINTEF

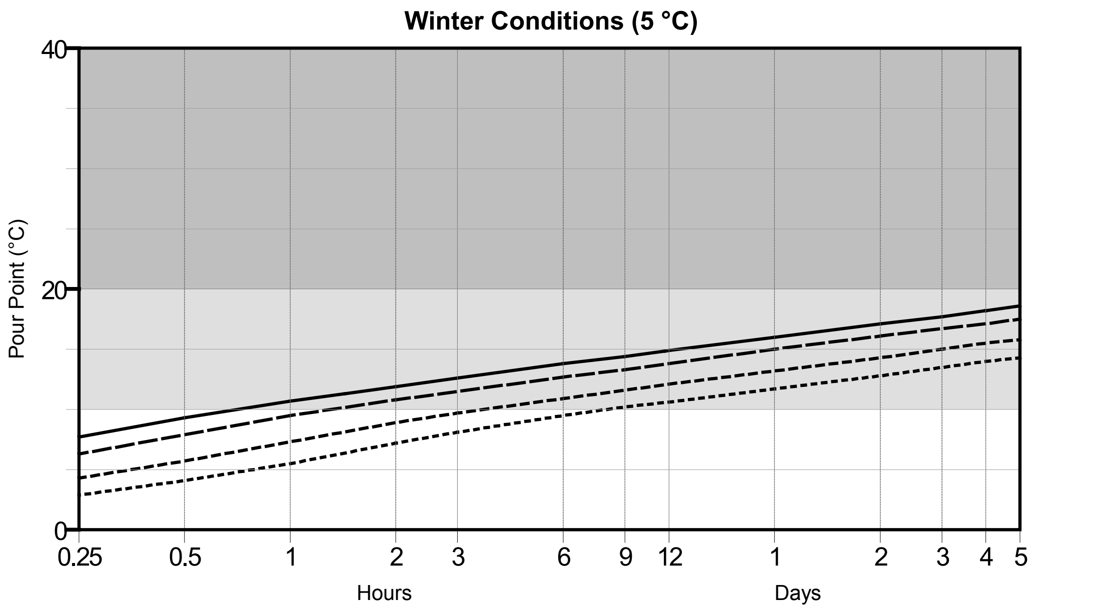
OWModel

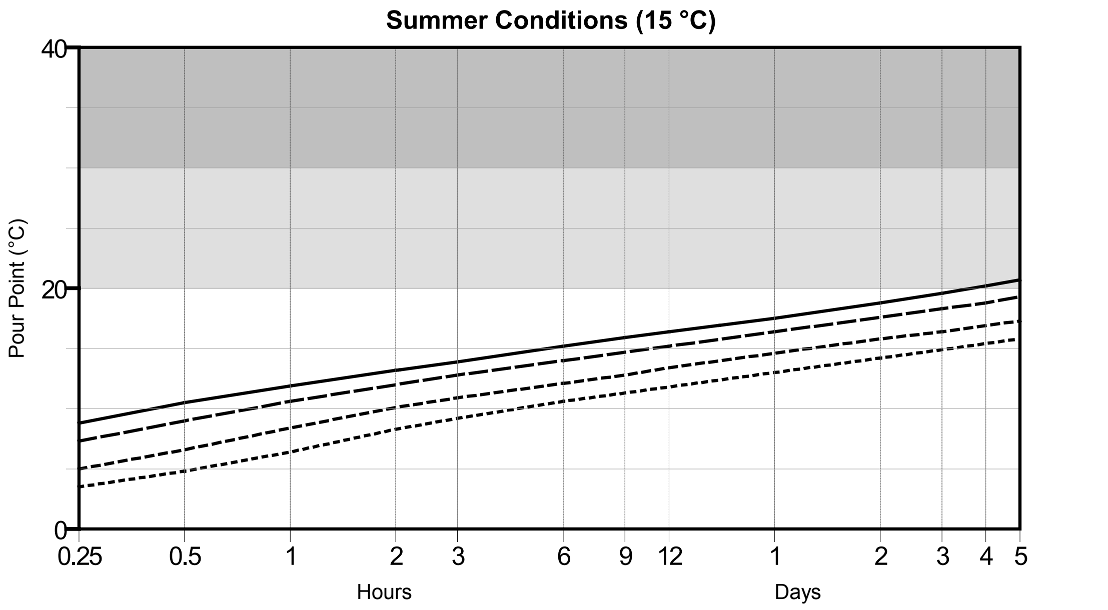
Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Wind Speed (m/s): 15
Wind Speed (m/s): 10
Wind Speed (m/s): 5
Wind Speed (m/s): 2

Chemically dispersible
Reduced chemical dispersibility
Poorly / slowly chemically dispersible





Based on pour point measurements of weathered, water-free oil residues.

Property: MASS BALANCE
Oil Type: ELDFISK B 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

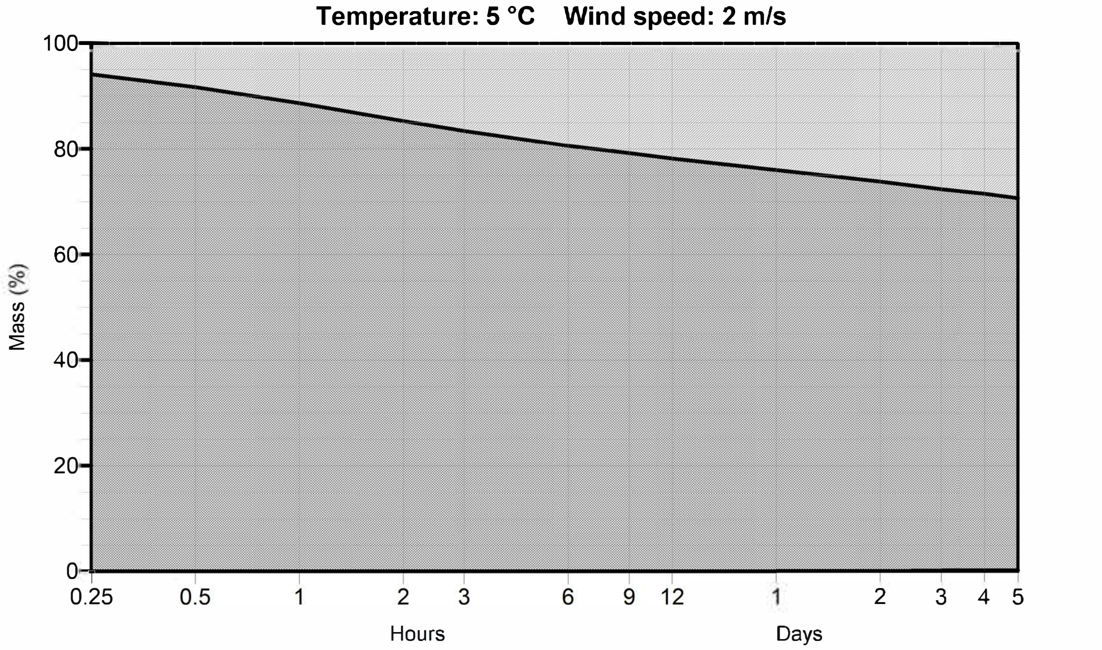
SINTEF

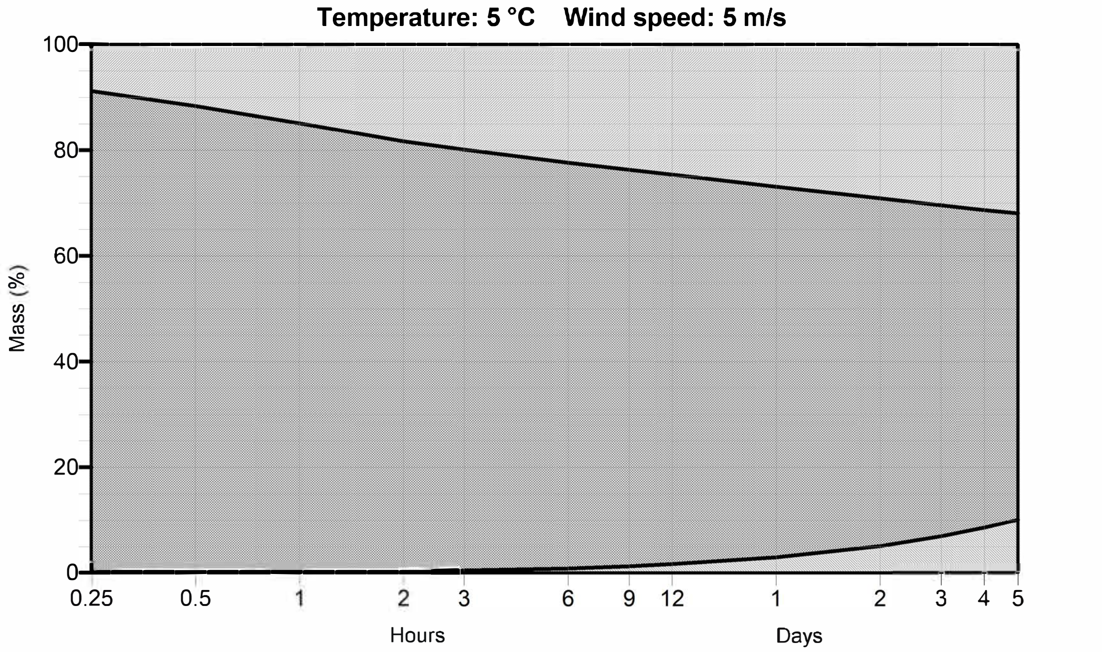
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Evaporated
Surface
Naturally dispersed





Property: MASS BALANCE
Oil Type: ELDFISK B 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

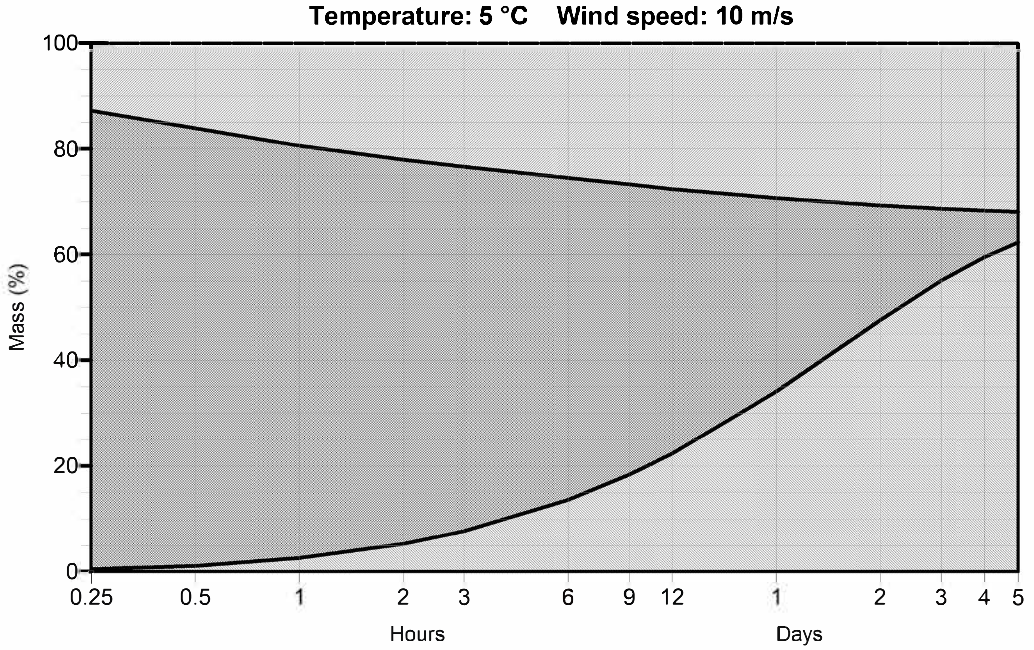
SINTEF

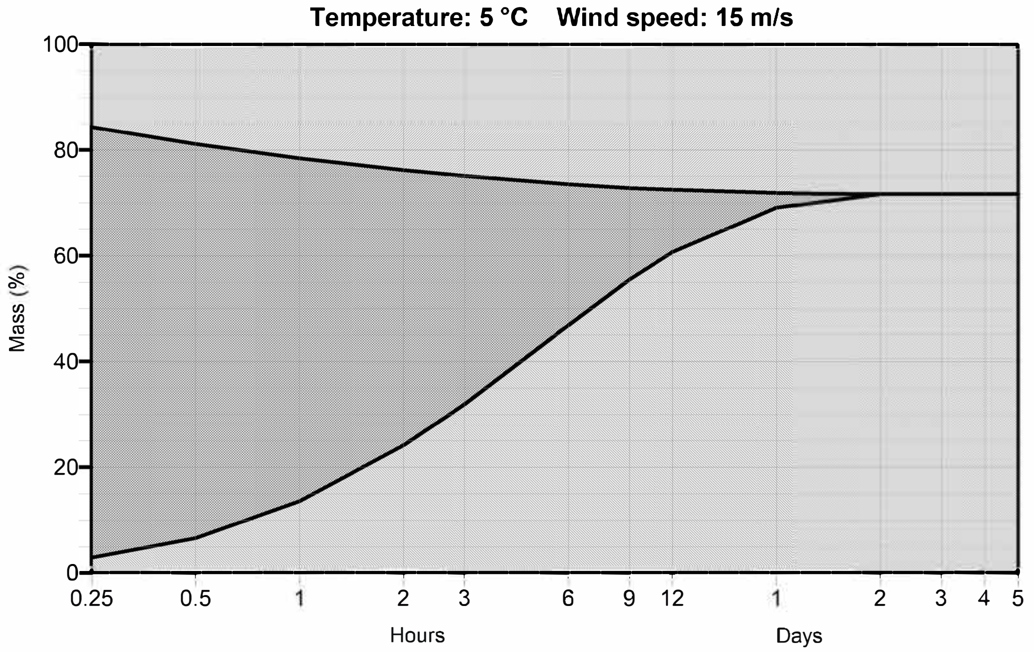
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Evaporated
Surface
Naturally dispersed





Property: MASS BALANCE
Oil Type: ELDFISK B 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

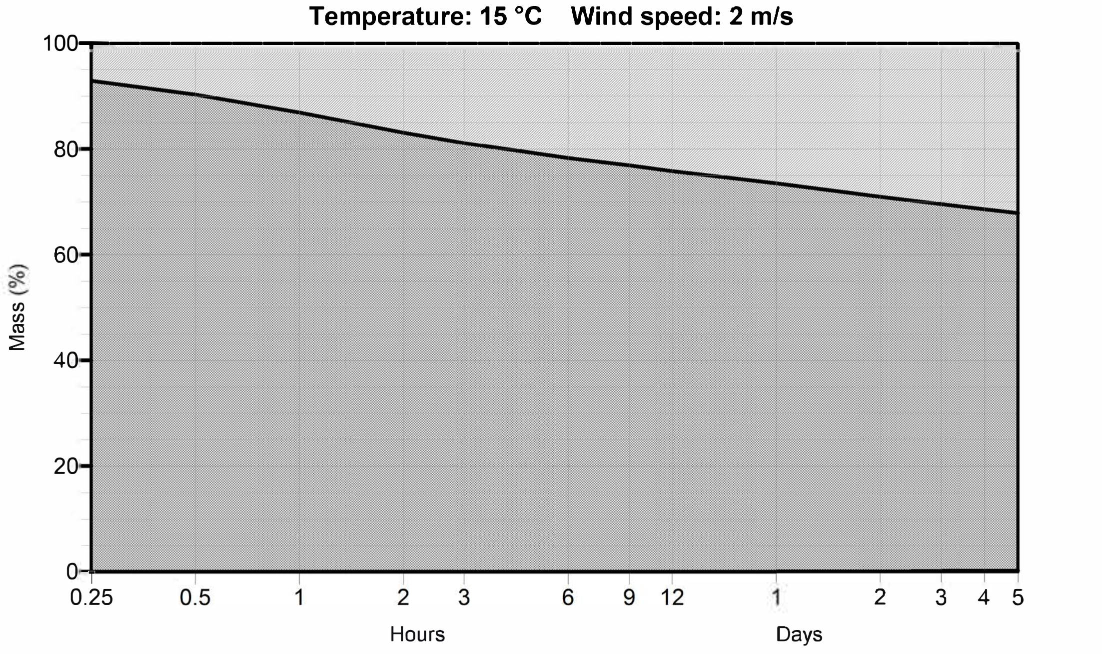
SINTEF

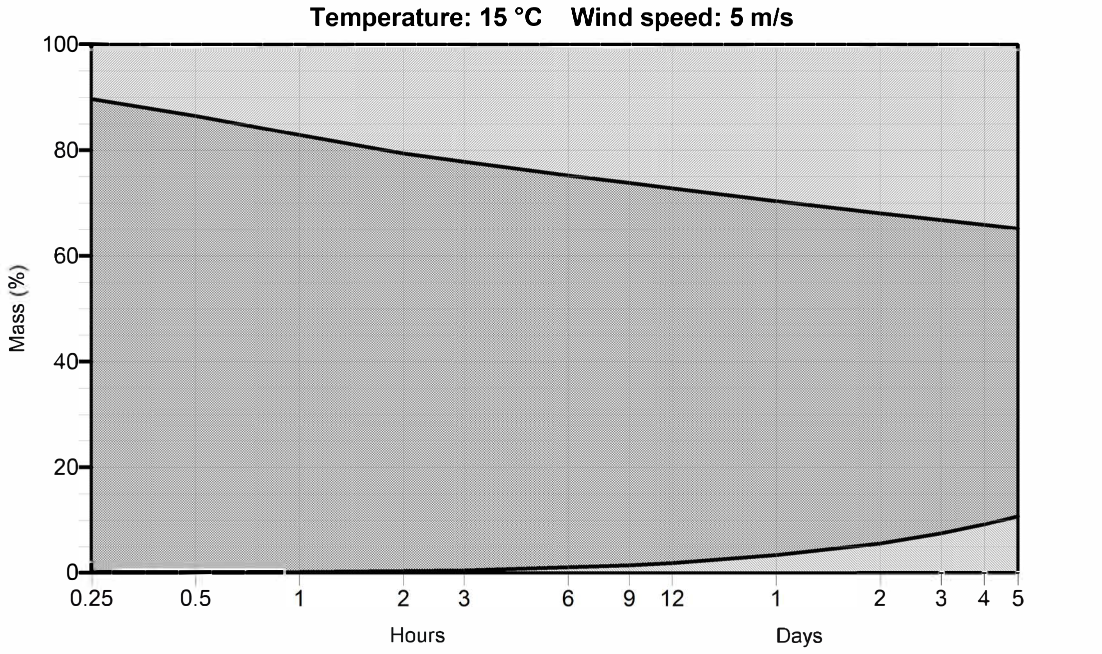
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Evaporated
Surface
Naturally dispersed





Property: MASS BALANCE
Oil Type: ELDFISK B 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

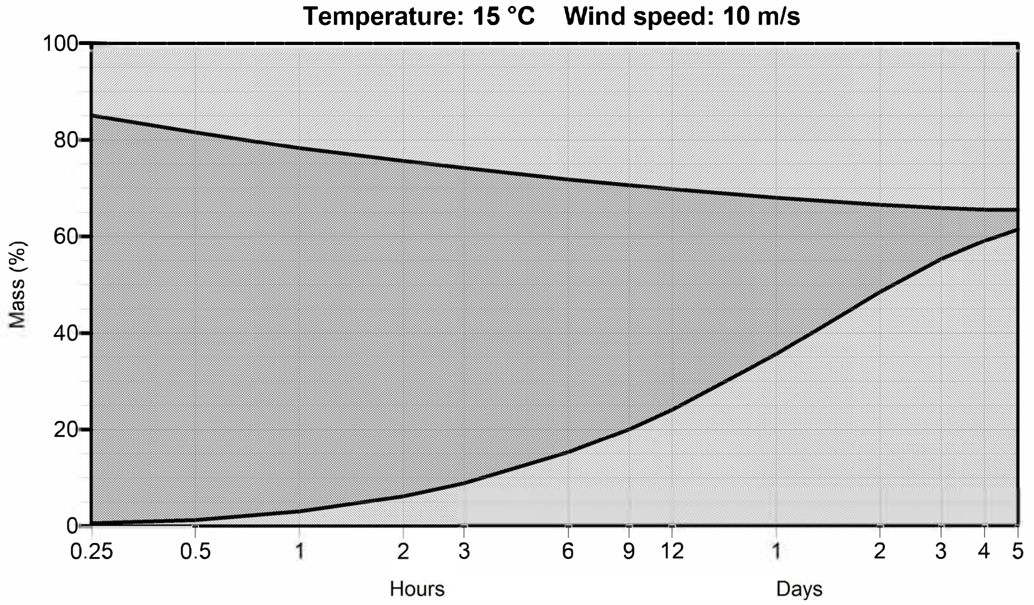
SINTEF

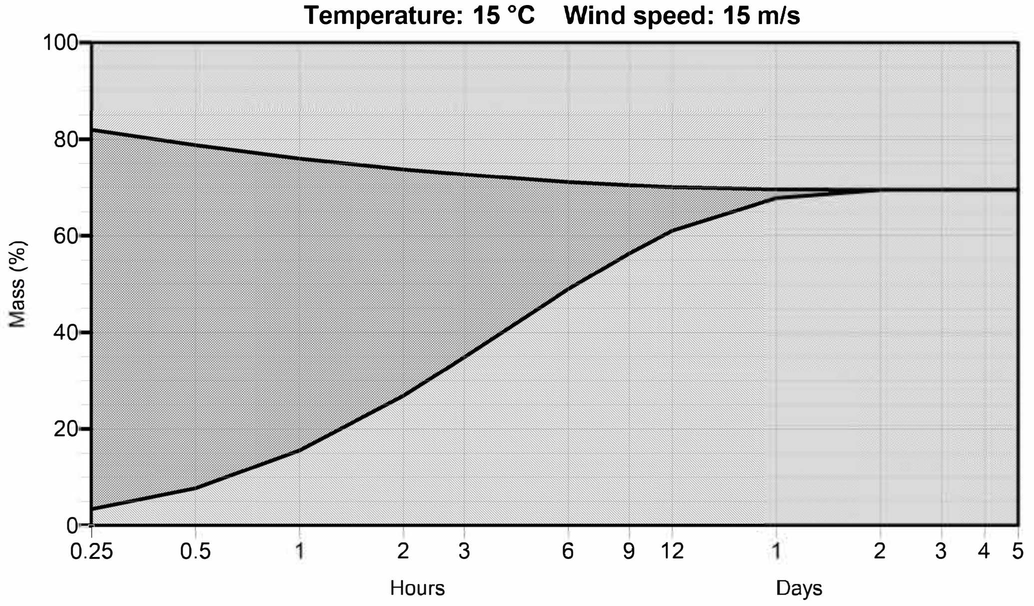
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Evaporated
Surface
Naturally dispersed





The algorithm for prediction of natural dispersion is preliminary and is currently under improvement.Model predictions have been field-verified up to 4-5 days.

B.2.3 Predicted behaviour for Eldfisk Kompleks

Property: EVAPORATIVE LOSS
Oil Type: ELDFISK KOMPLEKS 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatheri

SINTEF

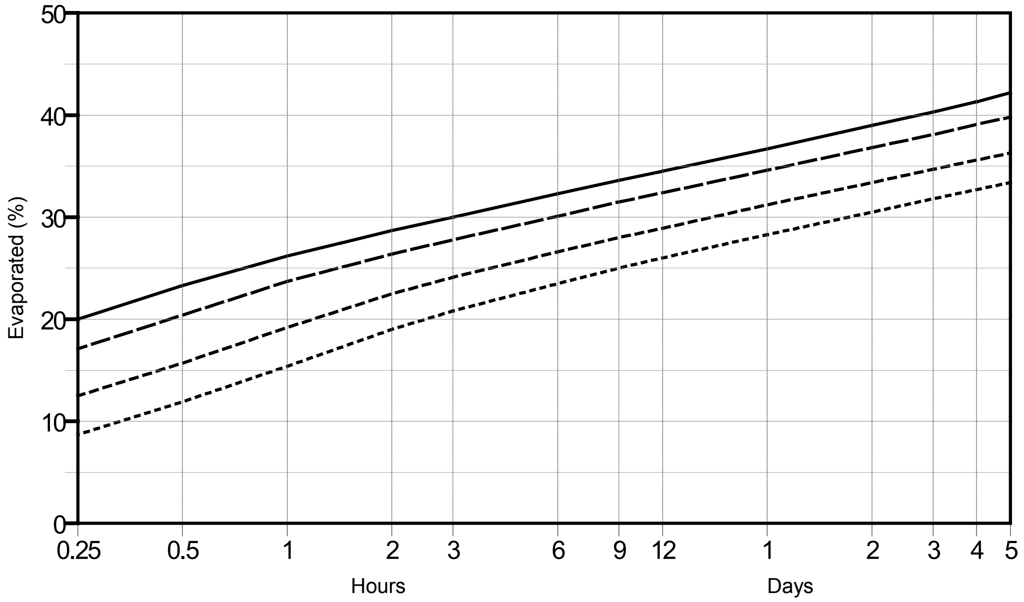
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

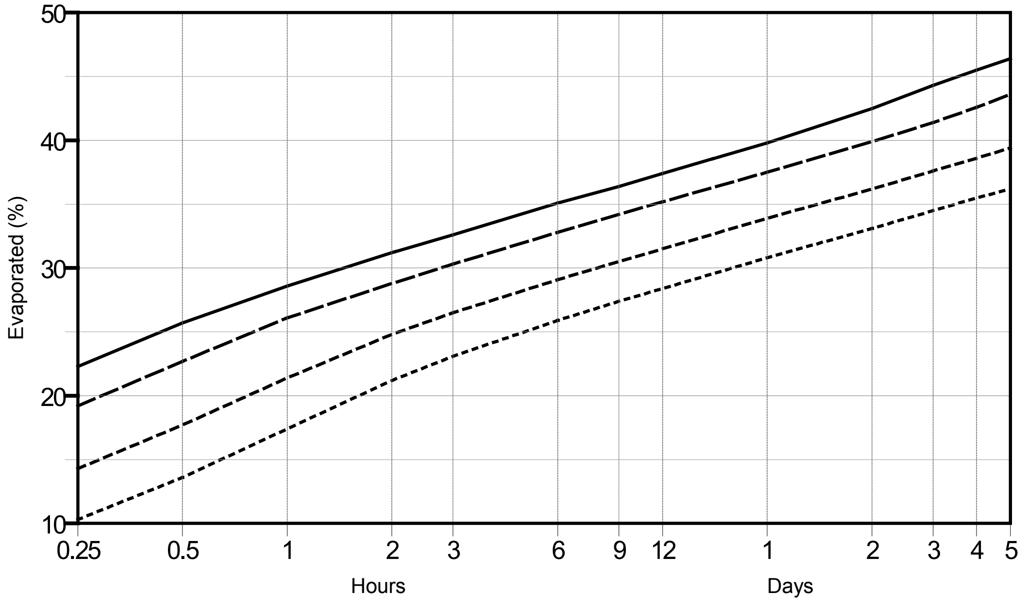
Pred. date: Nov. 20, 2015

- Wind Speed (m/s): 15
- Wind Speed (m/s): 10
- Wind Speed (m/s): 5
- Wind Speed (m/s): 2

Winter Conditions (5 °C)



Summer Conditions (15 °C)



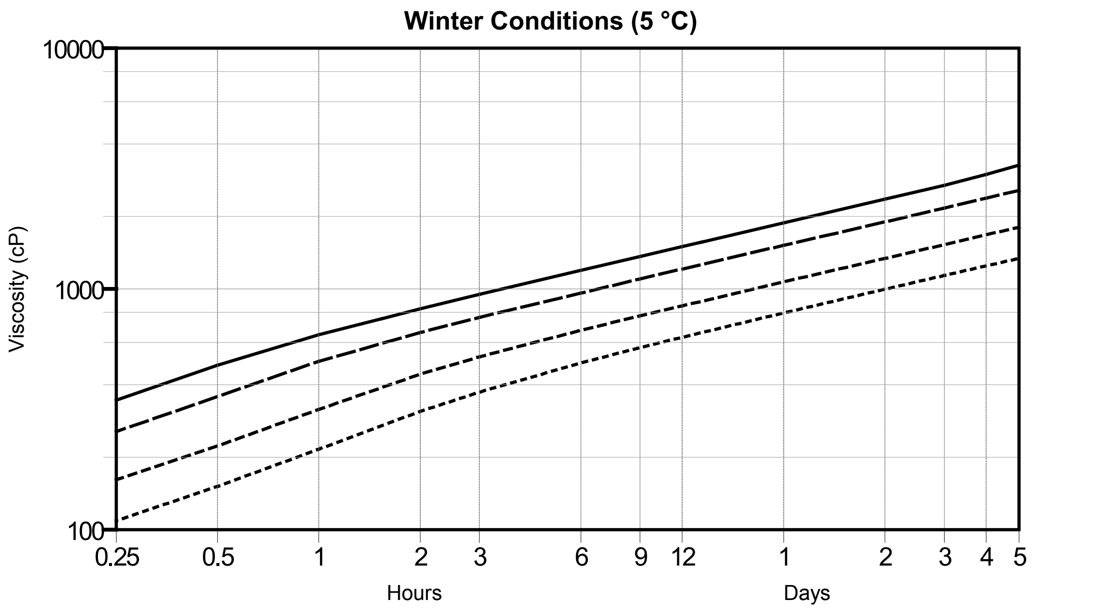
Property: VISCOSITY FOR WATER-FREE OIL
Oil Type: ELDFISK KOMPLEKS 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

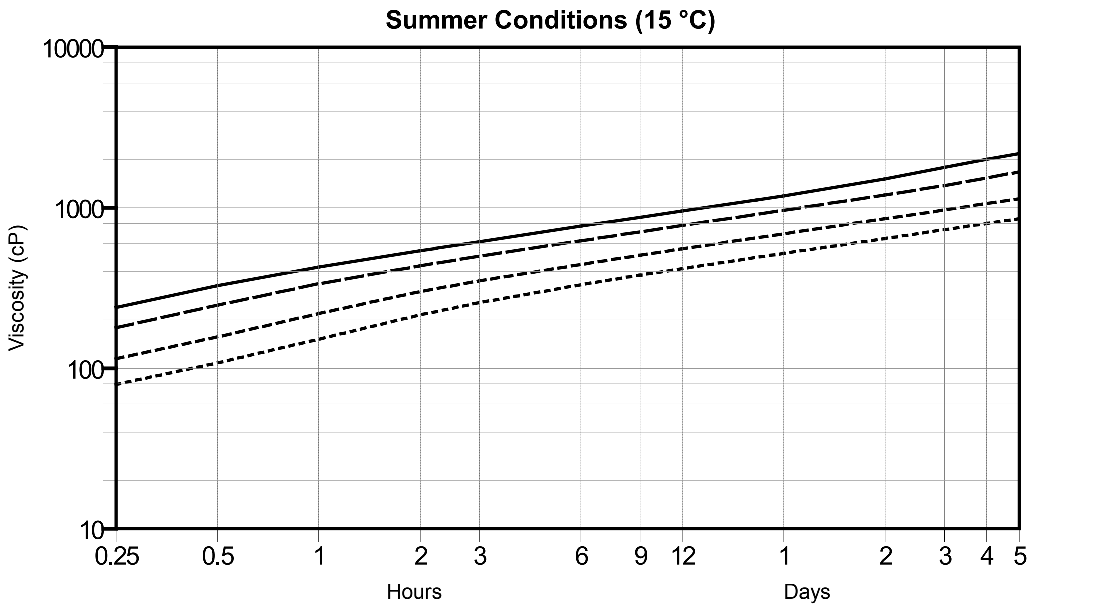
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Wind Speed (m/s): 15
Wind Speed (m/s): 10
Wind Speed (m/s): 5
Wind Speed (m/s): 2





Based on viscosity measurements carried out at a shear rate of 10 reciprocal seconds.

Property: VISCOSITY OF EMULSION
Oil Type: ELDFISK KOMPLEKS 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

SINTEF

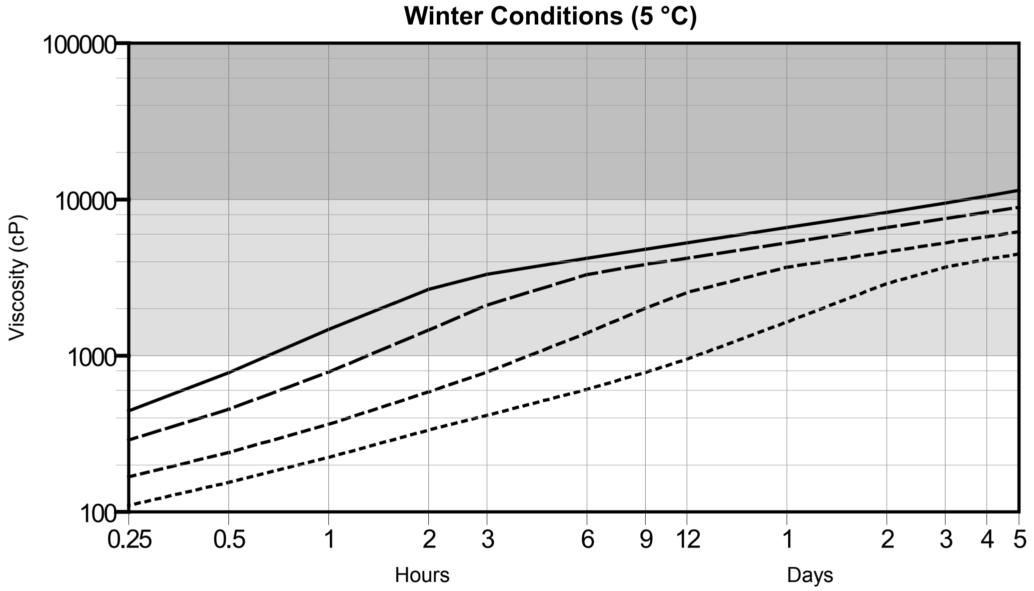
OWModel

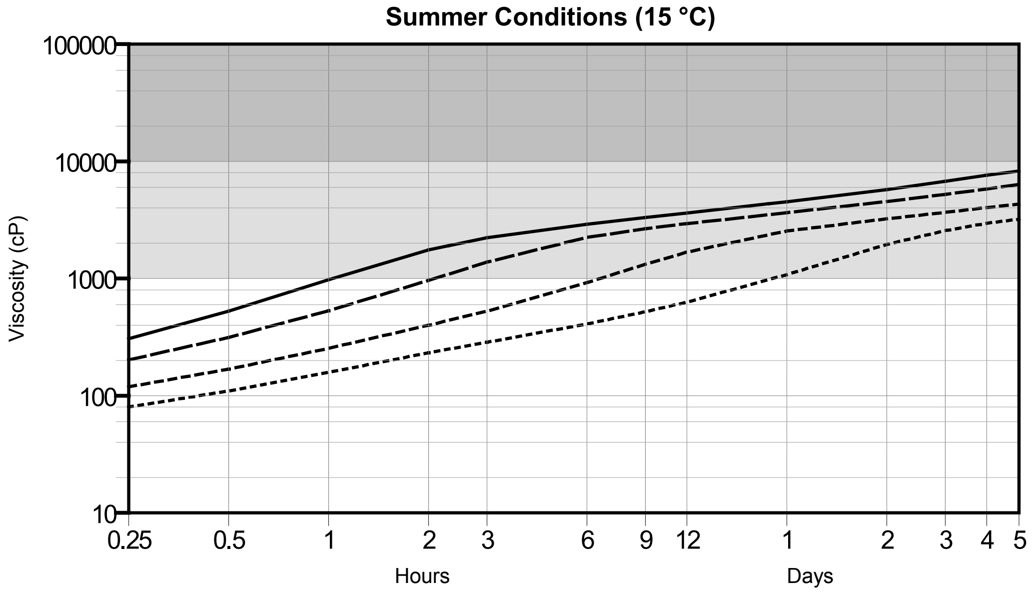
Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Dec. 03, 2015

Wind Speed (m/s): 15
Wind Speed (m/s): 10
Wind Speed (m/s): 5
Wind Speed (m/s): 2

Chemically dispersible (<1000 cP)
Reduced chemical dispersibility
Poorly / slowly chemically dispersible (>10000 cP)





Based on viscosity measurements carried out at a shear rate of 10 reciprocal seconds.
Chemical dispersability information based on experiments under standard laboratory conditions.

Property: WATER CONTENT
Oil Type: ELDFISK KOMPLEKS 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

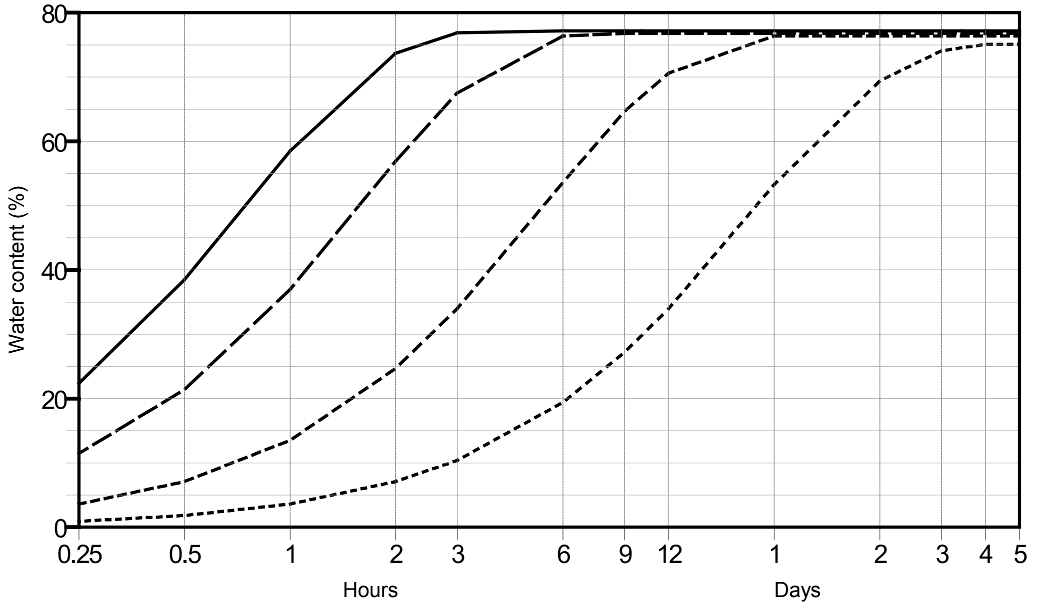
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

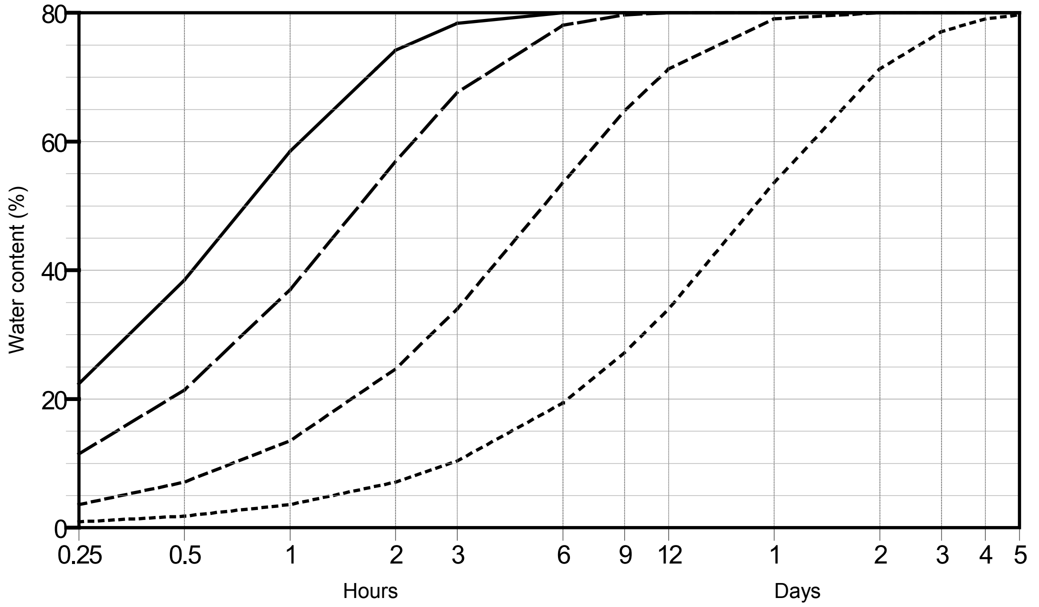
Pred. date: Nov. 20, 2015

Wind Speed (m/s): 15
Wind Speed (m/s): 10
Wind Speed (m/s): 5
Wind Speed (m/s): 2

Winter Conditions (5 °C)



Summer Conditions (15 °C)



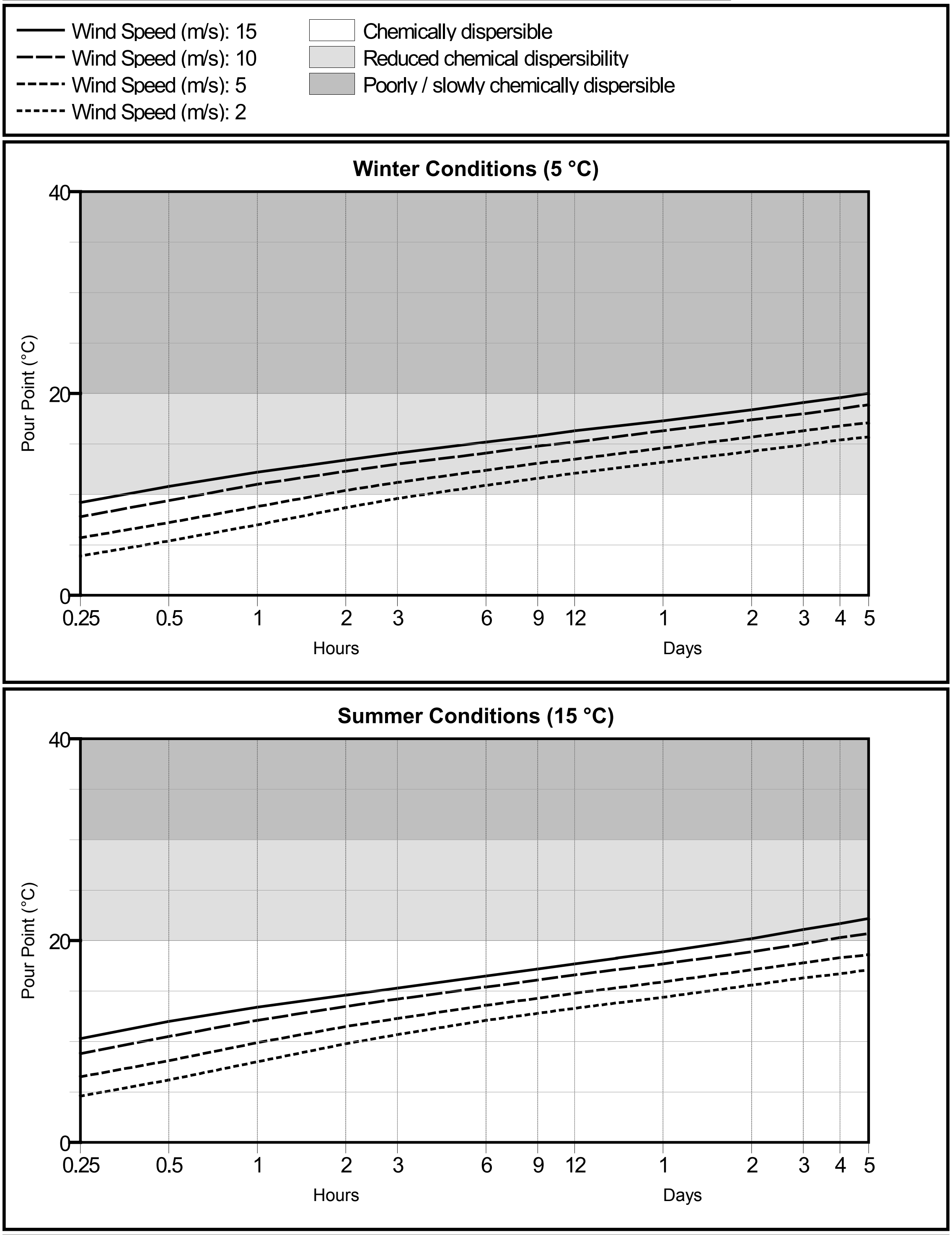
Property: POUR POINT FOR WATER-FREE OIL
Oil Type: ELDFISK KOMPLEKS 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

SINTEF

OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015



Based on pour point measurements of weathered, water-free oil residues.

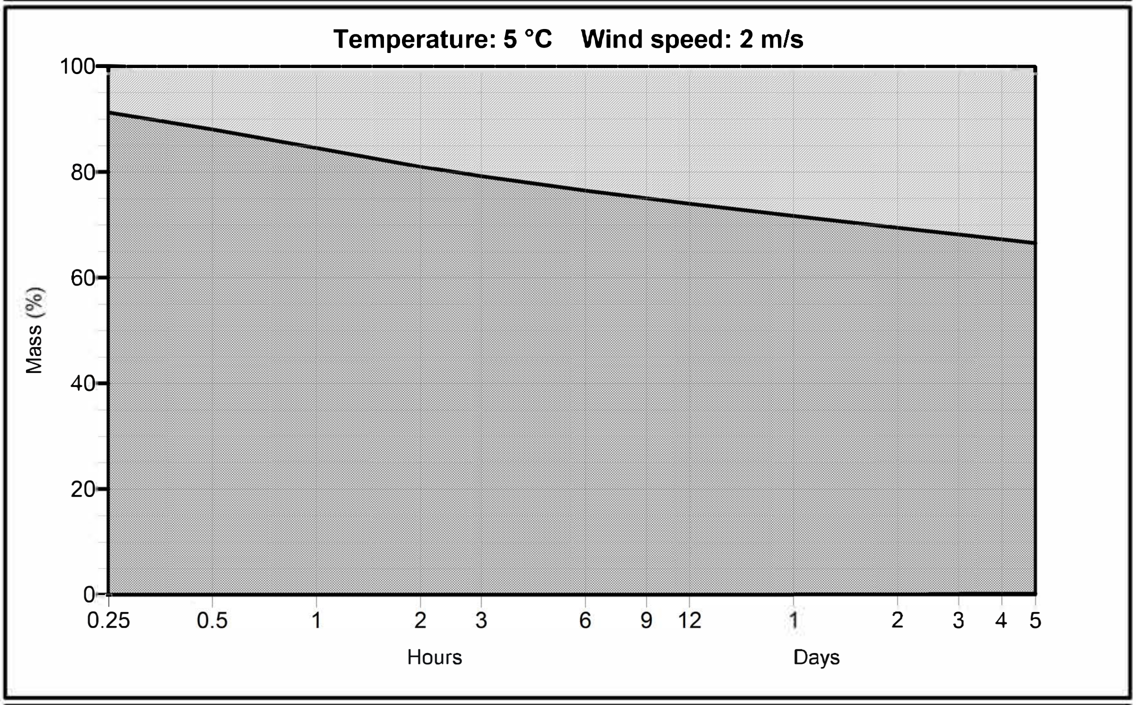
Property: MASS BALANCE
Oil Type: ELDFISK KOMPLEKS 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

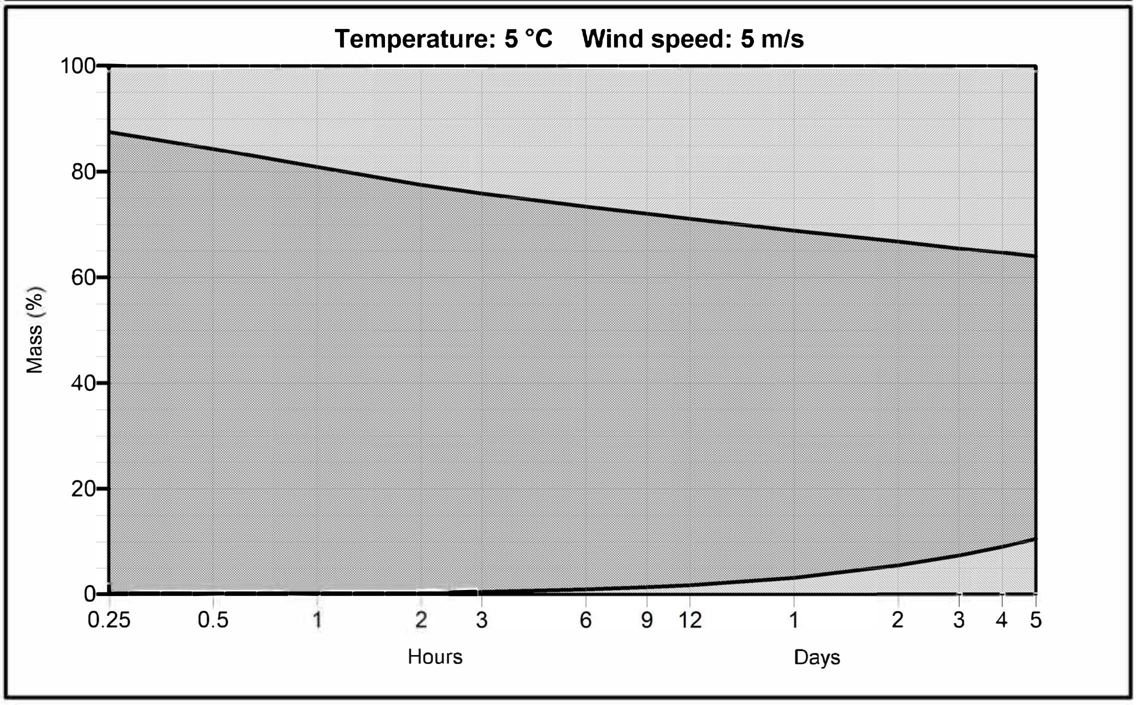
SINTEF

OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015





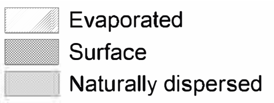
Property: MASS BALANCE
Oil Type: ELDFISK KOMPLEKS 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

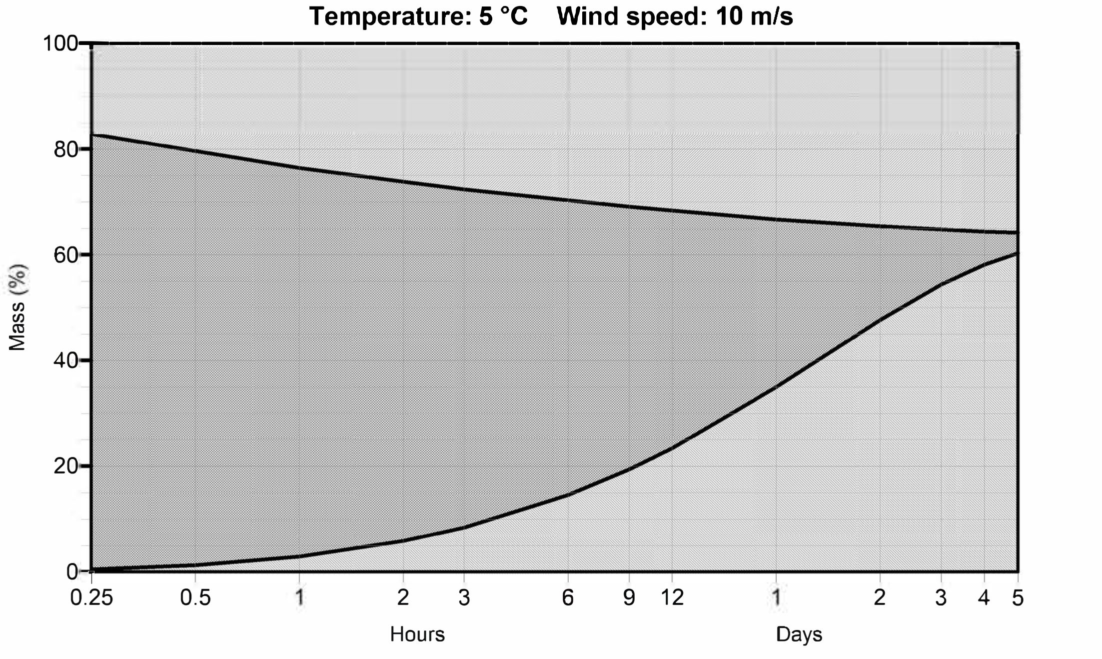
SINTEF

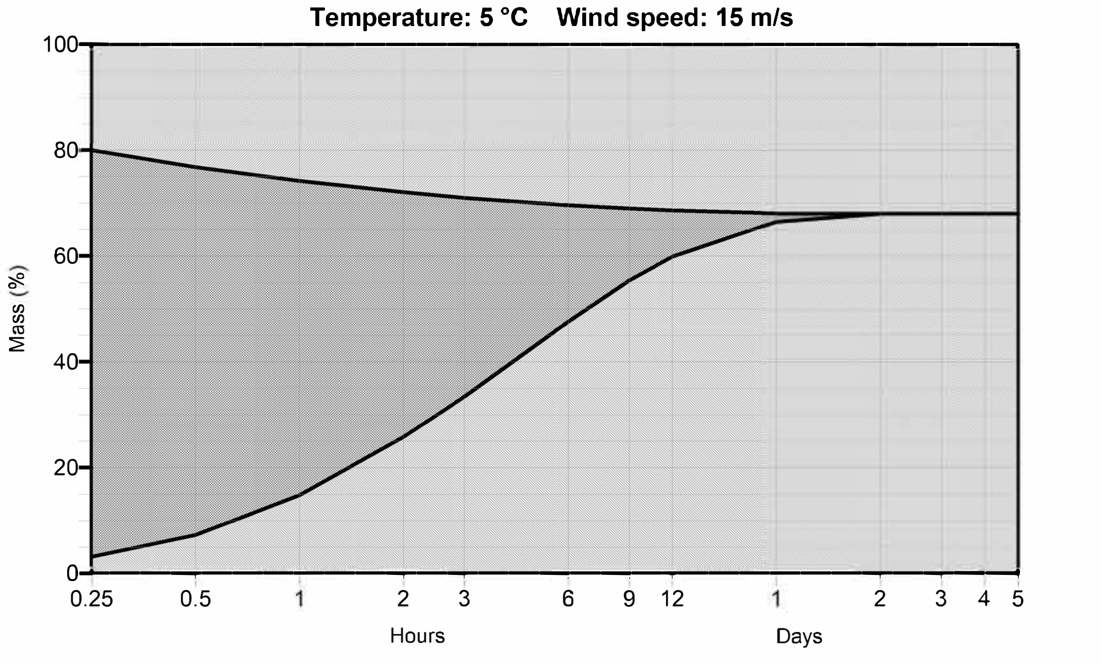
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015







Property: MASS BALANCE
Oil Type: ELDFISK KOMPLEKS 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

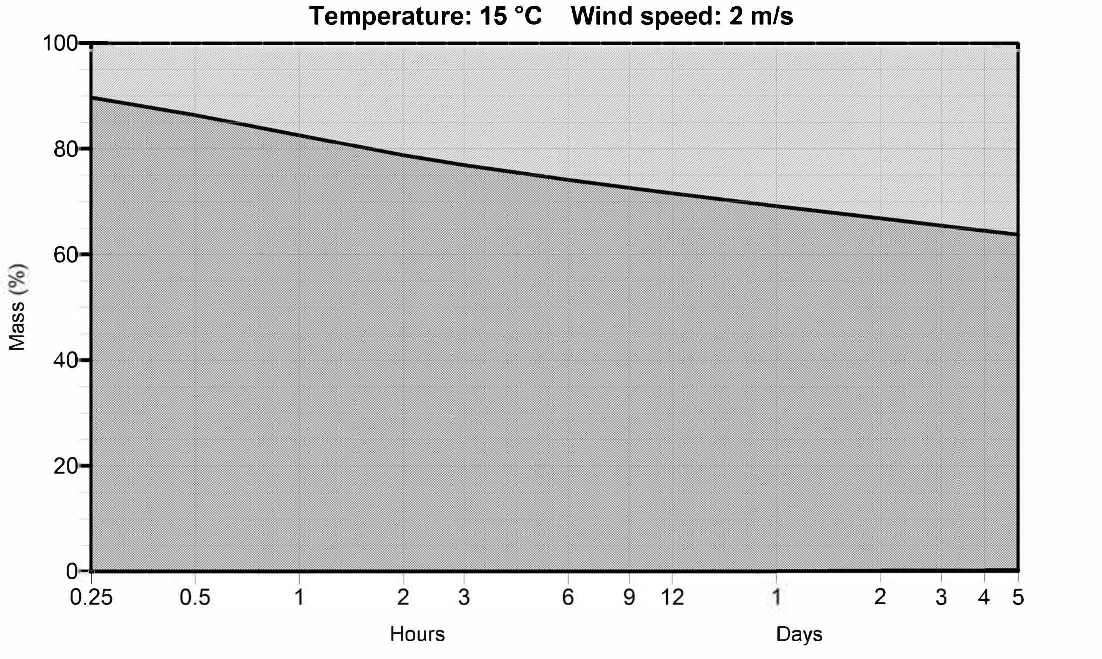
SINTEF

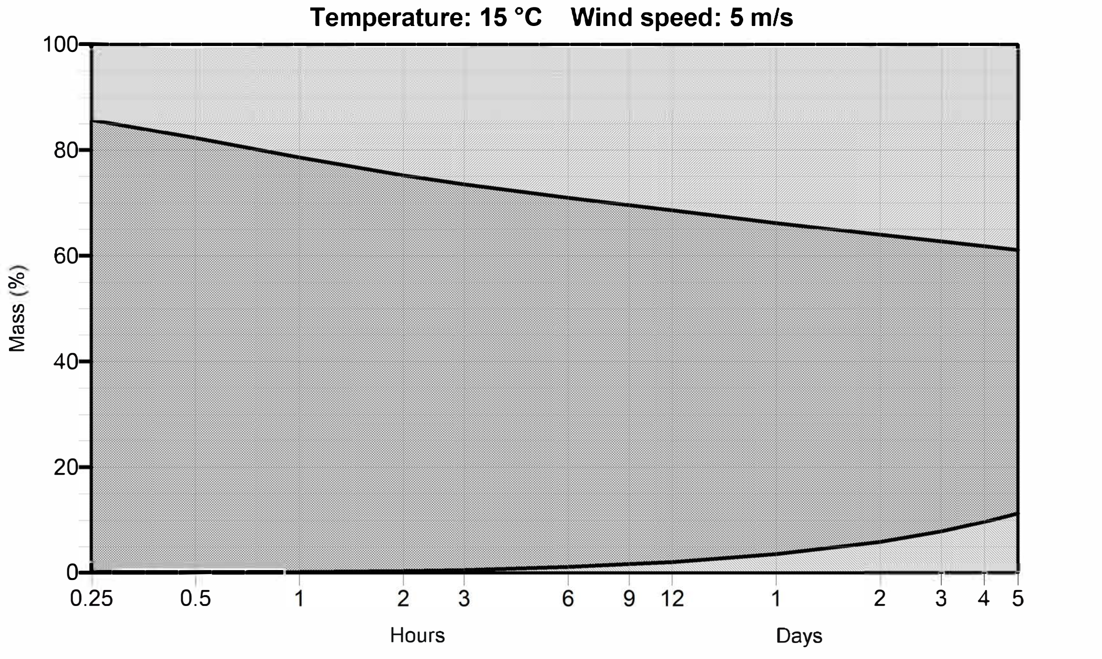
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Evaporated
Surface
Naturally dispersed





Property: MASS BALANCE
Oil Type: ELDFISK KOMPLEKS 2015
Description:
Data Source: SINTEF Materials and Chemistry (2015), Weatherir

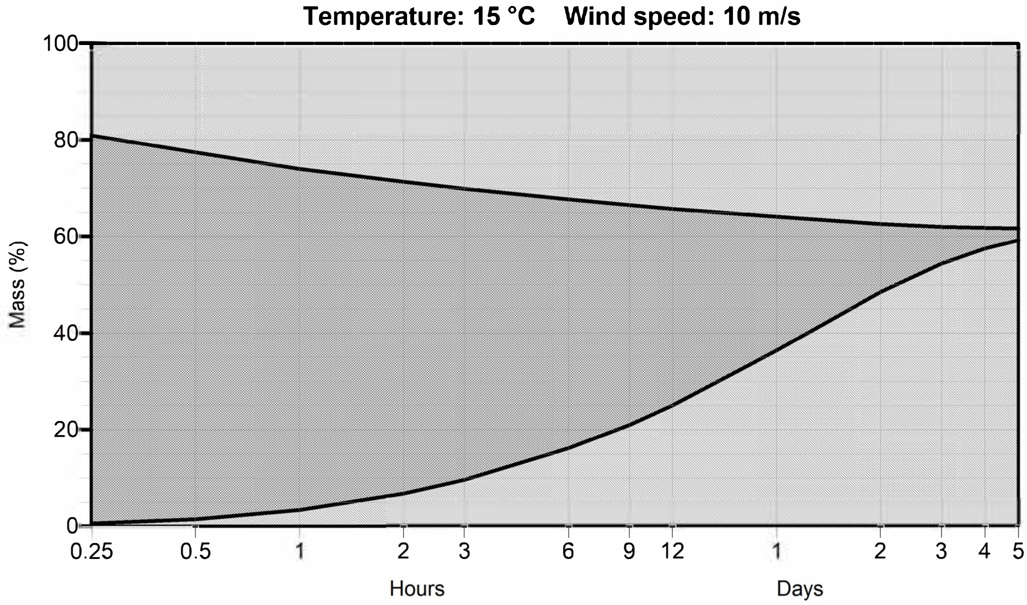
SINTEF

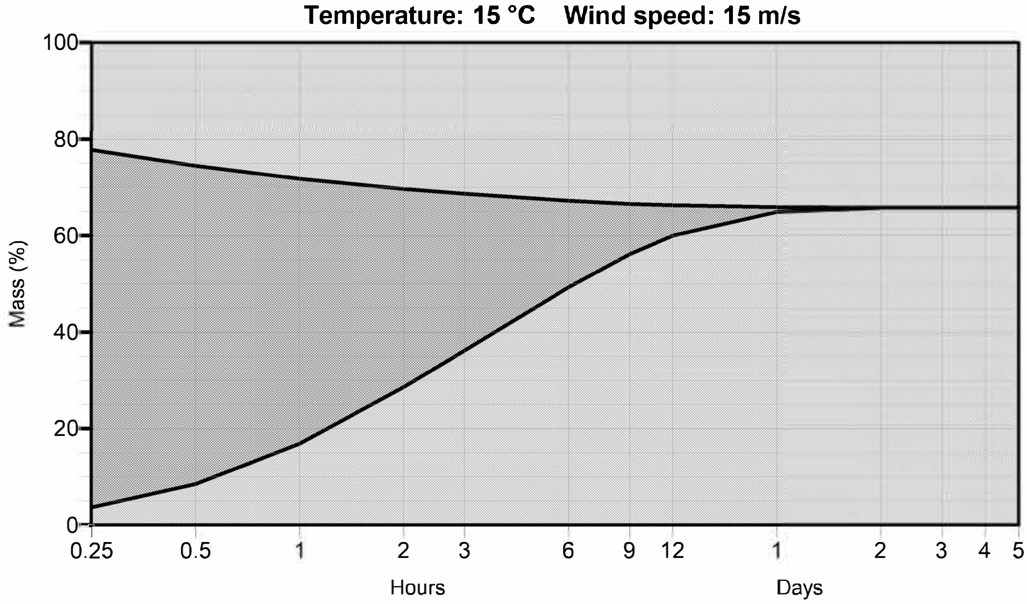
OWModel

Surface release - Terminal Oil film thickness: 1 mm
Release rate/duration: 1.33 metric tons/minute for 15 minute(s)

Pred. date: Nov. 20, 2015

Evaporated
Surface
Naturally dispersed





The algorithm for prediction of natural dispersion is preliminary and is currently under improvement.Model predictions have been field-verified up to 4-5 days.

B.3 Prediction values

The tables below present the prediction values for the three oil blends at summer and winter temperatures and at four different wind speeds. Due to the lack of flash point values for the three 2015 oil blends, this parameter has not been predicted and has been excluded from the tables.

Since there were no individual study of the dispersibility limits for the three 2015-oil blends, the limits for the model oil Ekofisk Blend 2000 has been used; at emulsions viscosities above 1000 mPa·s Ekofisk Blend 2000 is considered to have reduced chemical dispersibility, while emulsions with a viscosity above 10,000 mPa·s are not considered to be dispersible.

B.3.1 Ekofisk J

Oil type	Season	Temperature (°C)	Wind (m/s)	Hour at sea	Water content (vol. %)	Emulsion viscosity (mPa·s)	Dispersibility	Evaporated (%)	Remaining on surface (%)	Natural dispersion (%)	Pour point (°C)
Ekofisk J	Summer	15	2	1	3	70	Dispersible	15	85	0	3
Ekofisk J	Summer	15	2	2	6	113	Dispersible	19	82	0	7
Ekofisk J	Summer	15	2	3	9	147	Dispersible	20	80	0	9
Ekofisk J	Summer	15	2	6	17	231	Dispersible	23	77	0	11
Ekofisk J	Summer	15	2	9	23	310	Dispersible	24	76	0	13
Ekofisk J	Summer	15	2	12	29	393	Dispersible	25	75	0	14
Ekofisk J	Summer	15	2	24	48	788	Dispersible	27	73	0	16
Ekofisk J	Summer	15	2	48	66	1764	Reduced dispersibility	30	70	0	18
Ekofisk J	Summer	15	2	72	73	2633	Reduced dispersibility	31	69	0	20
Ekofisk J	Summer	15	2	96	76	3247	Reduced dispersibility	32	68	0	21
Ekofisk J	Summer	15	2	120	77	3669	Reduced dispersibility	33	67	0	22
Ekofisk J	Summer	15	5	1	11	128	Dispersible	19	81	0	7
Ekofisk J	Summer	15	5	2	21	225	Dispersible	22	78	1	10
Ekofisk J	Summer	15	5	3	30	321	Dispersible	23	76	1	12
Ekofisk J	Summer	15	5	6	48	655	Dispersible	26	73	2	14
Ekofisk J	Summer	15	5	9	59	1053	Reduced dispersibility	27	71	2	16
Ekofisk J	Summer	15	5	12	67	1468	Reduced dispersibility	28	70	3	17
Ekofisk J	Summer	15	5	24	76	2714	Reduced dispersibility	30	66	4	19
Ekofisk J	Summer	15	5	48	78	3761	Reduced dispersibility	32	61	6	22
Ekofisk J	Summer	15	5	72	78	4407	Reduced dispersibility	34	58	8	23
Ekofisk J	Summer	15	5	96	78	4928	Reduced dispersibility	34	56	10	24
Ekofisk J	Summer	15	5	120	78	5371	Reduced dispersibility	35	54	11	25
Ekofisk J	Summer	15	10	1	32	325	Dispersible	23	73	4	11
Ekofisk J	Summer	15	10	2	51	699	Dispersible	25	66	9	14
Ekofisk J	Summer	15	10	3	62	1133	Reduced dispersibility	27	62	12	15
Ekofisk J	Summer	15	10	6	75	2275	Reduced dispersibility	29	53	19	18
Ekofisk J	Summer	15	10	9	78	2932	Reduced dispersibility	30	47	24	20
Ekofisk J	Summer	15	10	12	78	3337	Reduced dispersibility	31	42	27	21
Ekofisk J	Summer	15	10	24	78	4390	Reduced dispersibility	32	30	38	23

Oil type	Season	Temperature (°C)	Wind (m/s)	Hour at sea	Water content (vol. %)	Emulsion viscosity (mPa·s)	Dispersibility	Evaporated (%)	Remaining on surface (%)	Natural dispersion (%)	Pour point (°C)
Ekofisk J	Summer	15	10	48	78	5747	Reduced dispersibility	33	17	50	26
Ekofisk J	Summer	15	10	72	78	6772	Reduced dispersibility	34	10	56	27
Ekofisk J	Summer	15	10	96	78	7705	Reduced dispersibility	34	6	60	28
Ekofisk J	Summer	15	10	120	78	8578	Reduced dispersibility	34	4	62	29
Ekofisk J	Summer	15	15	1	53	715	Dispersible	25	54	21	14
Ekofisk J	Summer	15	15	2	70	1599	Reduced dispersibility	27	40	34	16
Ekofisk J	Summer	15	15	3	76	2287	Reduced dispersibility	28	32	41	18
Ekofisk J	Summer	15	15	6	78	3299	Reduced dispersibility	29	18	53	21
Ekofisk J	Summer	15	15	9	78	3883	Reduced dispersibility	29	11	59	22
Ekofisk J	Summer	15	15	12	78	4347	Reduced dispersibility	30	7	63	23
Ekofisk J	Summer	15	15	24	78	5693	Reduced dispersibility	30	1	69	26
Ekofisk J	Summer	15	15	48	78	7617	Reduced dispersibility	30	0	70	28
Ekofisk J	Summer	15	15	72	78	9274	Reduced dispersibility	30	0	70	30
Ekofisk J	Summer	15	15	96	78	10652	Not dispersible	30	0	70	31
Ekofisk J	Summer	15	15	120	78	11735	Not dispersible	30	0	70	32
Ekofisk J	Winter	5	2	1	3	87	Dispersible	13	87	0	1
Ekofisk J	Winter	5	2	2	6	143	Dispersible	17	84	0	5
Ekofisk J	Winter	5	2	3	9	189	Dispersible	18	82	0	6
Ekofisk J	Winter	5	2	6	16	304	Dispersible	21	79	0	9
Ekofisk J	Winter	5	2	9	23	414	Dispersible	22	78	0	10
Ekofisk J	Winter	5	2	12	29	526	Dispersible	23	77	0	11
Ekofisk J	Winter	5	2	24	46	1039	Reduced dispersibility	25	75	0	13
Ekofisk J	Winter	5	2	48	64	2232	Reduced dispersibility	27	73	0	16
Ekofisk J	Winter	5	2	72	71	3253	Reduced dispersibility	28	72	0	17
Ekofisk J	Winter	5	2	96	73	3970	Reduced dispersibility	29	71	0	18
Ekofisk J	Winter	5	2	120	74	4470	Reduced dispersibility	30	70	0	19
Ekofisk J	Winter	5	5	1	11	161	Dispersible	17	83	0.2	5
Ekofisk J	Winter	5	5	2	21	292	Dispersible	20	80	0.5	8
Ekofisk J	Winter	5	5	3	29	424	Dispersible	21	78	0.7	10
Ekofisk J	Winter	5	5	6	47	870	Dispersible	23	75	1.3	12

Oil type	Season	Temperature (°C)	Wind (m/s)	Hour at sea	Water content (vol. %)	Emulsion viscosity (mPa·s)	Dispersibility	Evaporated (%)	Remaining on surface (%)	Natural dispersion (%)	Pour point (°C)
Ekofisk J	Winter	5	5	9	58	1378	Reduced dispersibility	25	74	1.9	13
Ekofisk J	Winter	5	5	12	65	1887	Reduced dispersibility	25	72	2.4	14
Ekofisk J	Winter	5	5	24	74	3347	Reduced dispersibility	28	69	4	16
Ekofisk J	Winter	5	5	48	75	4613	Reduced dispersibility	30	64	6.4	19
Ekofisk J	Winter	5	5	72	75	5490	Reduced dispersibility	31	61	8.3	20
Ekofisk J	Winter	5	5	96	75	6191	Reduced dispersibility	32	59	9.9	21
Ekofisk J	Winter	5	5	120	75	6784	Reduced dispersibility	32	56	11.5	22
Ekofisk J	Winter	5	10	1	32	426	Dispersible	21	75	4	9
Ekofisk J	Winter	5	10	2	50	925	Dispersible	23	69	8	12
Ekofisk J	Winter	5	10	3	61	1480	Reduced dispersibility	24	65	11	13
Ekofisk J	Winter	5	10	6	73	2845	Reduced dispersibility	26	56	18	15
Ekofisk J	Winter	5	10	9	75	3597	Reduced dispersibility	27	50	23	17
Ekofisk J	Winter	5	10	12	75	4076	Reduced dispersibility	28	45	27	18
Ekofisk J	Winter	5	10	24	75	5496	Reduced dispersibility	30	32	39	20
Ekofisk J	Winter	5	10	48	75	7325	Reduced dispersibility	31	19	51	22
Ekofisk J	Winter	5	10	72	75	8639	Reduced dispersibility	31	12	57	24
Ekofisk J	Winter	5	10	96	75	9694	Reduced dispersibility	32	8	61	25
Ekofisk J	Winter	5	10	120	75	10596	Not dispersible	32	5	63	26
Ekofisk J	Winter	5	15	1	52	945	Dispersible	23	58	19	12
Ekofisk J	Winter	5	15	2	68	2054	Reduced dispersibility	24	44	32	14
Ekofisk J	Winter	5	15	3	74	2863	Reduced dispersibility	25	35	40	15
Ekofisk J	Winter	5	15	6	75	4045	Reduced dispersibility	27	20	53	18
Ekofisk J	Winter	5	15	9	75	4820	Reduced dispersibility	27	13	60	19
Ekofisk J	Winter	5	15	12	75	5460	Reduced dispersibility	27	8	64	20
Ekofisk J	Winter	5	15	24	75	7284	Reduced dispersibility	28	2	70	22
Ekofisk J	Winter	5	15	48	75	9647	Reduced dispersibility	28	0	72	25
Ekofisk J	Winter	5	15	72	75	11356	Not dispersible	28	0	72	26
Ekofisk J	Winter	5	15	96	75	12859	Not dispersible	28	0	72	27
Ekofisk J	Winter	5	15	120	75	14294	Not dispersible	28	0	72	28

B.3.2 Eldfisk B

Oil type	Season	Temperature (°C)	Wind (m/s)	Hour at sea	Water content (vol. %)	Emulsion viscosity (mPa·s)	Dispersibility	Evaporated (%)	Remaining on surface (%)	Natural dispersion (%)	Pour point (°C)
Eldfisk B	Summer	15	2	1	3	171	Dispersible	13	87	0.0	6
Eldfisk B	Summer	15	2	2	6	259	Dispersible	17	83	0.0	8
Eldfisk B	Summer	15	2	3	9	322	Dispersible	19	81	0.0	9
Eldfisk B	Summer	15	2	6	16	452	Dispersible	22	78	0.0	11
Eldfisk B	Summer	15	2	9	23	553	Dispersible	23	77	0.0	11
Eldfisk B	Summer	15	2	12	29	644	Dispersible	24	76	0.0	12
Eldfisk B	Summer	15	2	24	48	1005	Reduced dispersibility	27	73	0.1	13
Eldfisk B	Summer	15	2	48	67	1798	Reduced dispersibility	29	71	0.1	14
Eldfisk B	Summer	15	2	72	74	2535	Reduced dispersibility	30	69	0.2	15
Eldfisk B	Summer	15	2	96	77	3077	Reduced dispersibility	31	68	0.2	15
Eldfisk B	Summer	15	2	120	78	3446	Reduced dispersibility	32	68	0.3	16
Eldfisk B	Summer	15	5	1	11	272	Dispersible	17	83	0	8
Eldfisk B	Summer	15	5	2	21	416	Dispersible	21	79	0	10
Eldfisk B	Summer	15	5	3	29	528	Dispersible	22	77	1	11
Eldfisk B	Summer	15	5	6	48	838	Dispersible	25	74	1	12
Eldfisk B	Summer	15	5	9	59	1167	Reduced dispersibility	26	72	2	13
Eldfisk B	Summer	15	5	12	67	1513	Reduced dispersibility	27	71	2	13
Eldfisk B	Summer	15	5	24	77	2631	Reduced dispersibility	30	67	3	15
Eldfisk B	Summer	15	5	48	79	3546	Reduced dispersibility	32	63	6	16
Eldfisk B	Summer	15	5	72	79	4081	Reduced dispersibility	33	59	8	16
Eldfisk B	Summer	15	5	96	79	4507	Reduced dispersibility	34	57	9	17
Eldfisk B	Summer	15	5	120	79	4866	Reduced dispersibility	35	54	11	17
Eldfisk B	Summer	15	10	1	32	516	Dispersible	22	75	3	11
Eldfisk B	Summer	15	10	2	51	856	Dispersible	24	69	6	12
Eldfisk B	Summer	15	10	3	62	1215	Reduced dispersibility	26	65	9	13
Eldfisk B	Summer	15	10	6	76	2232	Reduced dispersibility	28	57	15	14
Eldfisk B	Summer	15	10	9	79	2840	Reduced dispersibility	29	51	20	15
Eldfisk B	Summer	15	10	12	79	3193	Reduced dispersibility	30	46	24	15
Eldfisk B	Summer	15	10	24	79	4074	Reduced dispersibility	32	32	36	16

Oil type	Season	Temperature (°C)	Wind (m/s)	Hour at sea	Water content (vol. %)	Emulsion viscosity (mPa·s)	Dispersibility	Evaporated (%)	Remaining on surface (%)	Natural dispersion (%)	Pour point (°C)
Eldfisk B	Summer	15	10	48	79	5177	Reduced dispersibility	33	18	49	18
Eldfisk B	Summer	15	10	72	79	5991	Reduced dispersibility	34	11	55	18
Eldfisk B	Summer	15	10	96	79	6719	Reduced dispersibility	34	6	59	19
Eldfisk B	Summer	15	10	120	79	7396	Reduced dispersibility	35	4	62	19
Eldfisk B	Summer	15	15	1	53	857	Dispersible	24	60	16	12
Eldfisk B	Summer	15	15	2	71	1607	Reduced dispersibility	26	47	27	13
Eldfisk B	Summer	15	15	3	77	2246	Reduced dispersibility	27	38	35	14
Eldfisk B	Summer	15	15	6	79	3165	Reduced dispersibility	29	22	49	15
Eldfisk B	Summer	15	15	9	79	3660	Reduced dispersibility	30	14	56	16
Eldfisk B	Summer	15	15	12	79	4045	Reduced dispersibility	30	9	61	16
Eldfisk B	Summer	15	15	24	79	5141	Reduced dispersibility	30	2	67.8	18
Eldfisk B	Summer	15	15	48	79	6660	Reduced dispersibility	31	0	69.5	19
Eldfisk B	Summer	15	15	72	79	7942	Reduced dispersibility	31	0	69.5	20
Eldfisk B	Summer	15	15	96	79	9003	Reduced dispersibility	31	0	69.5	20
Eldfisk B	Summer	15	15	120	79	9838	Reduced dispersibility	31	0	69.5	21
Eldfisk B	Winter	5	2	1	3	242	Dispersible	11	89	0.0	6
Eldfisk B	Winter	5	2	2	6	367	Dispersible	15	85	0.0	7
Eldfisk B	Winter	5	2	3	9	463	Dispersible	17	83	0.0	8
Eldfisk B	Winter	5	2	6	16	668	Dispersible	19	81	0.0	10
Eldfisk B	Winter	5	2	9	22	823	Dispersible	21	79	0.0	10
Eldfisk B	Winter	5	2	12	28	962	Dispersible	22	78	0.0	11
Eldfisk B	Winter	5	2	24	45	1480	Reduced dispersibility	24	76	0	12
Eldfisk B	Winter	5	2	48	62	2500	Reduced dispersibility	26	74	0	13
Eldfisk B	Winter	5	2	72	69	3361	Reduced dispersibility	28	72	0	14
Eldfisk B	Winter	5	2	96	71	3970	Reduced dispersibility	29	71	0	14
Eldfisk B	Winter	5	2	120	71	4394	Reduced dispersibility	29	70	0	14
Eldfisk B	Winter	5	5	1	11	385	Dispersible	15	85	0	7
Eldfisk B	Winter	5	5	2	21	607	Dispersible	18	81	0	9
Eldfisk B	Winter	5	5	3	29	782	Dispersible	20	80	1	10
Eldfisk B	Winter	5	5	6	46	1240	Reduced dispersibility	22	77	1	11

Oil type	Season	Temperature (°C)	Wind (m/s)	Hour at sea	Water content (vol. %)	Emulsion viscosity (mPa·s)	Dispersibility	Evaporated (%)	Remaining on surface (%)	Natural dispersion (%)	Pour point (°C)
Eldfisk B	Winter	5	5	9	57	1692	Reduced dispersibility	24	75	1	12
Eldfisk B	Winter	5	5	12	63	2131	Reduced dispersibility	25	74	2	12
Eldfisk B	Winter	5	5	24	72	3417	Reduced dispersibility	27	70	3	13
Eldfisk B	Winter	5	5	48	73	4539	Reduced dispersibility	29	66	5	14
Eldfisk B	Winter	5	5	72	73	5304	Reduced dispersibility	30	63	7	15
Eldfisk B	Winter	5	5	96	73	5904	Reduced dispersibility	31	60	9	16
Eldfisk B	Winter	5	5	120	73	6403	Reduced dispersibility	32	58	10	16
Eldfisk B	Winter	5	10	1	31	759	Dispersible	19	78	3	10
Eldfisk B	Winter	5	10	2	49	1263	Reduced dispersibility	22	73	5	11
Eldfisk B	Winter	5	10	3	60	1754	Reduced dispersibility	23	69	8	12
Eldfisk B	Winter	5	10	6	71	2963	Reduced dispersibility	26	61	14	13
Eldfisk B	Winter	5	10	9	73	3638	Reduced dispersibility	27	55	18	13
Eldfisk B	Winter	5	10	12	73	4068	Reduced dispersibility	28	50	22	14
Eldfisk B	Winter	5	10	24	73	5320	Reduced dispersibility	29	37	34	15
Eldfisk B	Winter	5	10	48	73	6868	Reduced dispersibility	31	22	48	16
Eldfisk B	Winter	5	10	72	73	7949	Reduced dispersibility	31	14	55	17
Eldfisk B	Winter	5	10	96	73	8808	Reduced dispersibility	32	9	60	17
Eldfisk B	Winter	5	10	120	73	9534	Reduced dispersibility	32	6	62	18
Eldfisk B	Winter	5	15	1	51	1264	Reduced dispersibility	22	65	14	11
Eldfisk B	Winter	5	15	2	67	2246	Reduced dispersibility	24	52	24	12
Eldfisk B	Winter	5	15	3	72	2976	Reduced dispersibility	25	43	32	13
Eldfisk B	Winter	5	15	6	73	4043	Reduced dispersibility	27	27	47	14
Eldfisk B	Winter	5	15	9	73	4733	Reduced dispersibility	27	17	56	14
Eldfisk B	Winter	5	15	12	73	5291	Reduced dispersibility	28	12	61	15
Eldfisk B	Winter	5	15	24	73	6839	Reduced dispersibility	28	3	69	16
Eldfisk B	Winter	5	15	48	73	8776	Reduced dispersibility	28	0	72	17
Eldfisk B	Winter	5	15	72	73	10147	Not dispersible	28	0	72	18
Eldfisk B	Winter	5	15	96	73	11330	Not dispersible	28	0	72	18
Eldfisk B	Winter	5	15	120	73	12446	Not dispersible	28	0	72	19

B.3.3 Eldfisk Kompleks

Oil type	Season	Temperature (°C)	Wind (m/s)	Hour at sea	Water content (vol. %)	Emulsion viscosity (mPa·s)	Dispersibility	Evaporated (%)	Remaining on surface (%)	Natural dispersion (%)	Pour point (°C)
Eldfisk Kompleks	Summer	15	2	1	4	158	Dispersible	17	83	0	8
Eldfisk Kompleks	Summer	15	2	2	7	232	Dispersible	21	79	0	10
Eldfisk Kompleks	Summer	15	2	3	10	286	Dispersible	23	77	0	11
Eldfisk Kompleks	Summer	15	2	6	19	411	Dispersible	26	74	0	12
Eldfisk Kompleks	Summer	15	2	9	27	521	Dispersible	27	73	0	13
Eldfisk Kompleks	Summer	15	2	12	34	630	Dispersible	28	72	0	13
Eldfisk Kompleks	Summer	15	2	24	54	1081	Reduced dispersibility	31	69	0	14
Eldfisk Kompleks	Summer	15	2	48	71	1952	Reduced dispersibility	33	67	0	16
Eldfisk Kompleks	Summer	15	2	72	77	2568	Reduced dispersibility	35	65	0	16
Eldfisk Kompleks	Summer	15	2	96	79	2958	Reduced dispersibility	36	64	0	17
Eldfisk Kompleks	Summer	15	2	120	80	3225	Reduced dispersibility	36	64	0	17
Eldfisk Kompleks	Summer	15	5	1	14	254	Dispersible	21	78	0	10
Eldfisk Kompleks	Summer	15	5	2	25	399	Dispersible	25	75	0	12
Eldfisk Kompleks	Summer	15	5	3	34	528	Dispersible	27	73	1	12
Eldfisk Kompleks	Summer	15	5	6	54	923	Dispersible	29	70	1	14
Eldfisk Kompleks	Summer	15	5	9	65	1321	Reduced dispersibility	30	68	2	14
Eldfisk Kompleks	Summer	15	5	12	71	1679	Reduced dispersibility	31	67	2	15
Eldfisk Kompleks	Summer	15	5	24	79	2548	Reduced dispersibility	34	63	4	16
Eldfisk Kompleks	Summer	15	5	48	80	3247	Reduced dispersibility	36	58	6	17
Eldfisk Kompleks	Summer	15	5	72	80	3684	Reduced dispersibility	37	55	8	18
Eldfisk Kompleks	Summer	15	5	96	80	4032	Reduced dispersibility	38	52	10	18
Eldfisk Kompleks	Summer	15	5	120	80	4325	Reduced dispersibility	39	50	11	19
Eldfisk Kompleks	Summer	15	10	1	37	531	Dispersible	26	71	3	12
Eldfisk Kompleks	Summer	15	10	2	57	964	Dispersible	29	65	7	14
Eldfisk Kompleks	Summer	15	10	3	68	1384	Reduced dispersibility	30	60	10	14
Eldfisk Kompleks	Summer	15	10	6	78	2245	Reduced dispersibility	32	52	16	15
Eldfisk Kompleks	Summer	15	10	9	80	2669	Reduced dispersibility	34	46	21	16
Eldfisk Kompleks	Summer	15	10	12	80	2945	Reduced dispersibility	34	41	25	17

Oil type	Season	Temperature (°C)	Wind (m/s)	Hour at sea	Water content (vol. %)	Emulsion viscosity (mPa·s)	Dispersibility	Evaporated (%)	Remaining on surface (%)	Natural dispersion (%)	Pour point (°C)
Eldfisk Kompleks	Summer	15	10	24	80	3660	Reduced dispersibility	36	28	36	18
Eldfisk Kompleks	Summer	15	10	48	80	4556	Reduced dispersibility	37	14	49	19
Eldfisk Kompleks	Summer	15	10	72	80	5221	Reduced dispersibility	38	8	54	20
Eldfisk Kompleks	Summer	15	10	96	80	5816	Reduced dispersibility	38	4	58	20
Eldfisk Kompleks	Summer	15	10	120	80	6365	Reduced dispersibility	38	3	59	21
Eldfisk Kompleks	Summer	15	15	1	59	977	Dispersible	28	55	17	13
Eldfisk Kompleks	Summer	15	15	2	74	1759	Reduced dispersibility	30	41	29	15
Eldfisk Kompleks	Summer	15	15	3	78	2239	Reduced dispersibility	31	33	36	15
Eldfisk Kompleks	Summer	15	15	6	80	2913	Reduced dispersibility	33	18	49	17
Eldfisk Kompleks	Summer	15	15	9	80	3310	Reduced dispersibility	33	10	56	17
Eldfisk Kompleks	Summer	15	15	12	80	3621	Reduced dispersibility	34	6	60	18
Eldfisk Kompleks	Summer	15	15	24	80	4508	Reduced dispersibility	34	1	65	19
Eldfisk Kompleks	Summer	15	15	48	80	5743	Reduced dispersibility	34	0	66	20
Eldfisk Kompleks	Summer	15	15	72	80	6776	Reduced dispersibility	34	0	66	21
Eldfisk Kompleks	Summer	15	15	96	80	7613	Reduced dispersibility	34	0	66	22
Eldfisk Kompleks	Summer	15	15	120	80	8257	Reduced dispersibility	34	0	66	22
Eldfisk Kompleks	Winter	5	2	1	4	224	Dispersible	15	85	0	7
Eldfisk Kompleks	Winter	5	2	2	7	334	Dispersible	19	81	0	9
Eldfisk Kompleks	Winter	5	2	3	10	417	Dispersible	21	79	0	10
Eldfisk Kompleks	Winter	5	2	6	19	611	Dispersible	24	77	0	11
Eldfisk Kompleks	Winter	5	2	9	27	782	Dispersible	25	75	0	12
Eldfisk Kompleks	Winter	5	2	12	34	952	Dispersible	26	74	0	12
Eldfisk Kompleks	Winter	5	2	24	53	1647	Reduced dispersibility	28	72	0	13
Eldfisk Kompleks	Winter	5	2	48	69	2893	Reduced dispersibility	31	69	0	14
Eldfisk Kompleks	Winter	5	2	72	74	3690	Reduced dispersibility	32	68	0	15
Eldfisk Kompleks	Winter	5	2	96	75	4153	Reduced dispersibility	33	67	0	15
Eldfisk Kompleks	Winter	5	2	120	75	4470	Reduced dispersibility	33	66	0	16
Eldfisk Kompleks	Winter	5	5	1	14	365	Dispersible	19	81	0.1	9
Eldfisk Kompleks	Winter	5	5	2	25	587	Dispersible	23	77	0.3	10
Eldfisk Kompleks	Winter	5	5	3	34	788	Dispersible	24	75	0.5	11

Oil type	Season	Temperature (°C)	Wind (m/s)	Hour at sea	Water content (vol. %)	Emulsion viscosity (mPa·s)	Dispersibility	Evaporated (%)	Remaining on surface (%)	Natural dispersion (%)	Pour point (°C)
Eldfisk Kompleks	Winter	5	5	6	54	1402	Reduced dispersibility	27	72	1	12
Eldfisk Kompleks	Winter	5	5	9	65	2014	Reduced dispersibility	28	71	1.4	13
Eldfisk Kompleks	Winter	5	5	12	71	2535	Reduced dispersibility	29	69	1.8	14
Eldfisk Kompleks	Winter	5	5	24	76	3683	Reduced dispersibility	31	66	3.2	15
Eldfisk Kompleks	Winter	5	5	48	76	4616	Reduced dispersibility	33	61	5.5	16
Eldfisk Kompleks	Winter	5	5	72	76	5272	Reduced dispersibility	35	58	7.4	16
Eldfisk Kompleks	Winter	5	5	96	76	5787	Reduced dispersibility	35	56	9	17
Eldfisk Kompleks	Winter	5	5	120	76	6218	Reduced dispersibility	36	53	10.6	17
Eldfisk Kompleks	Winter	5	10	1	37	788	Dispersible	24	74	3	11
Eldfisk Kompleks	Winter	5	10	2	57	1460	Reduced dispersibility	26	68	6	12
Eldfisk Kompleks	Winter	5	10	3	68	2111	Reduced dispersibility	28	64	8	13
Eldfisk Kompleks	Winter	5	10	6	76	3315	Reduced dispersibility	30	56	15	14
Eldfisk Kompleks	Winter	5	10	9	77	3838	Reduced dispersibility	31	50	19	15
Eldfisk Kompleks	Winter	5	10	12	77	4215	Reduced dispersibility	32	45	23	15
Eldfisk Kompleks	Winter	5	10	24	77	5293	Reduced dispersibility	33	32	35	16
Eldfisk Kompleks	Winter	5	10	48	77	6626	Reduced dispersibility	35	18	48	17
Eldfisk Kompleks	Winter	5	10	72	77	7562	Reduced dispersibility	35	10	54	18
Eldfisk Kompleks	Winter	5	10	96	77	8304	Reduced dispersibility	36	6	58	19
Eldfisk Kompleks	Winter	5	10	120	77	8935	Reduced dispersibility	36	4	60	19
Eldfisk Kompleks	Winter	5	15	1	59	1477	Reduced dispersibility	26	59	15	12
Eldfisk Kompleks	Winter	5	15	2	74	2663	Reduced dispersibility	28	46	26	13
Eldfisk Kompleks	Winter	5	15	3	77	3315	Reduced dispersibility	29	38	33	14
Eldfisk Kompleks	Winter	5	15	6	77	4201	Reduced dispersibility	30	22	48	15
Eldfisk Kompleks	Winter	5	15	9	77	4798	Reduced dispersibility	31	14	55	16
Eldfisk Kompleks	Winter	5	15	12	77	5277	Reduced dispersibility	31	9	60	16
Eldfisk Kompleks	Winter	5	15	24	77	6609	Reduced dispersibility	32	2	67	17
Eldfisk Kompleks	Winter	5	15	48	77	8286	Reduced dispersibility	32	0	68	18
Eldfisk Kompleks	Winter	5	15	72	77	9478	Reduced dispersibility	32	0	68	19
Eldfisk Kompleks	Winter	5	15	96	77	10511	Not dispersible	32	0	68	20
Eldfisk Kompleks	Winter	5	15	120	77	11484	Not dispersible	32	0	68	20

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