ERMS Users Group – Testing

ERMS Users Group was started as part of the ERMS joint industry project.

The objective of the ERMS users group has been to:

- Test and verify new software versions and to identify strengths and weaknesses with the model (inter-user tests, sensitivity analyses)
- Recommend improvements of model
- Prepare and test user guidelines
- Plan training courses

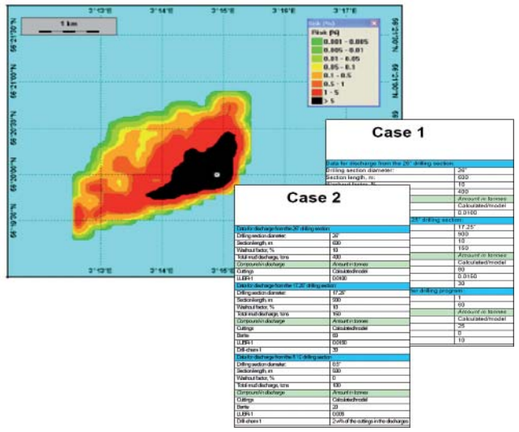
It is also a forum for discussion and sharing of experiences.

A number of inter-user tests and sensitivity analyses have been performed and has led to improvements of model and model set-up. Users have been trained through courses and guidelines have been prepared.

All the industrial partners in the JIP currently fund also continued users group activities in 2007.

It is the intention that the user group will continue its activities in the coming years.
The oil companies as well as the research institutes are actively involved in the ongoing activities.

Contactperson: Anne Mette Hilmen, Shell



Comparison of the model results to field observations

Since 2006 Statoil has been involved in the Serpent project (Scientific and Environmental ROV Partnership Using Existing iNdustrial Technology). Serpent is a collaborative research project between National Ocenaography Centre, Southampton, Statoil and other partners.

The objective of Serpent is to get a better understanding of the environmental impacts from drilling discharges occurring in new areas. This is achieved through extensive biological, chemical and physical measuring and observations before, during and after the drilling operation. Last year, four of Statoils exploration wells were studied by Serpent.

For two of these wells EIF_{DD} calculations were also carried out. Based on these results a comparison between field observations / measurements and corresponding EIF_{DD} calculations can be performed. At this time, too few results are available to draw conclusions. Since the EIF_{DD} model is primarily a generic environmental risk management's tool, it is not the objective of the model to exactly predict what will happen in the environment. However, predictions made by the model should be realistic. More comparison studies to evaluate the realism in the EIF_{DD} results will be performed in the future.

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newsletter ERMS
Environmental Risk Management System
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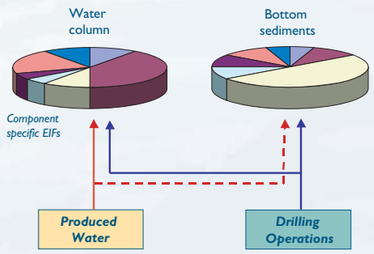
Program participants: - Agip - Conoco Phillips - Exxon Mobil - Hydro - Petrobras - Shell - Statoil - Total

Final ERMS seminar in Oslo 27. September 2007

The overall objective of the ERMS program, initiated in 2002, was to develop an environmental risk-based decision support tool with focus on drilling discharges.



Three important tasks in the program have been:

- Development of a concept for evaluation of an Environmental Impact Factor for drilling discharges – EIF_{DD}
- Literature study to assess the potential effects from the stressors identified.
- Further development of the DREAM (Dose-Related Risk and Effects Assessment Model) model to include discharges from drilling operations.

In the final seminar in Oslo 27. September 2007, the main tasks and findings from the program will be presented and discussed.
More information about the program, including reports, presentations and a brochure, can be found on our web-site: www.sintef.com/erms.

Ivar Singsaas
Coordinator

The oil companies financing the ERMS program are acknowledged for financial support as well as scientific contribution during the program.

Thanks also to the cooperating R&D institutions for a good cooperation, scientific contribution and many interesting workshops scientifically as well as socially.

These are: Akvamiljø, Akvaplan-niva, Battelle, Must, SINTEF, TNO-IMARES and the University of Oslo.

Concept development

Compared to produced water discharges, the environmental evaluation of drilling discharges is much more complex. Due to the high content of particulate matter, both toxic and non-toxic stressors needed to be evaluated. As (contaminated) particulates might end up on the seafloor, both the water column and the seafloor needed to be included. Also the timescale for potential impacts is different in the sediment compared to the water column. Two stressors in the water column (toxic compounds and suspended clay particles) and four stressors in the sediment (toxic compounds, burial of biota, and change in sediment structure and oxygen depletion) were incorporated in the $EIF_{DD.}$ The main challenge was the application of existing protocols for environmental risk assessment to non-toxic stressors, and combining risks arising from these stressors with risk from toxicants.

Principles for environmental risk assessment described in the EU-Technical Guidance Document were used as a basis, in order to enhance acceptance of the tool.

By using accepted guidelines for risk assessment from the EU-TGD together with the well documented principles for probabilistic risk assessment, the EIF_{DD} provides a sound basis for the evaluation of drilling discharges.

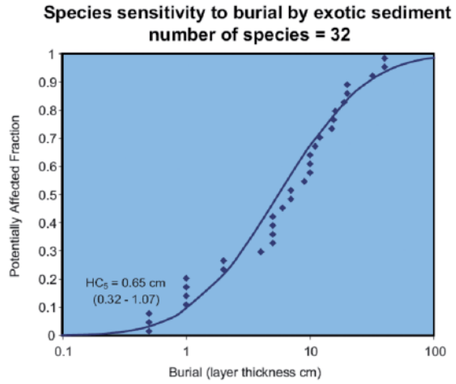
Contactperson: Mathijs Smit, TNO

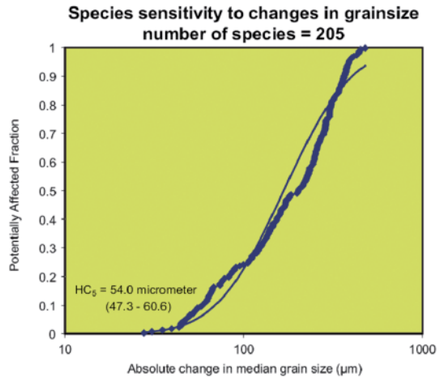
Toxic and non-toxic disturbances - PNEC estimation and validation

Both toxic and non-toxic stressors have been taken into account in the effect assessment in the EIF drilling discharges. For the non-toxic stressors (physical disturbance of suspended particles, burial and change in grain size) derivation of PNEC values were based on the Species Sensitivity Distributions (SSDs) of the effect data.

For the toxic stressors a combination of PNEC approaches (including assessment factor, SSD and equilibrium partitioning approach) were selected due to scarcity of data.

Contactperson: Tone Karin Frost, StatoilHydro





Modelling of exposure - Further development of the DREAM model

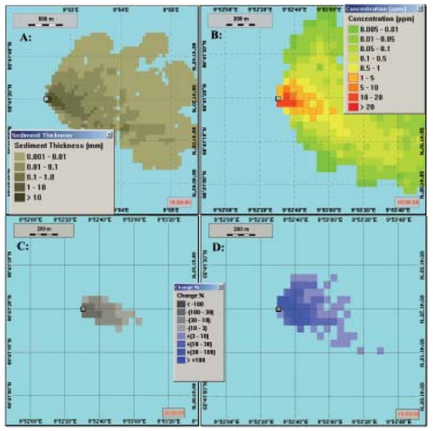
The DREAM model, originally developed as a biology-based exposure and effect assessment model for fish and zooplankton, can be applied to calculate the potential risk on the sediment in addition to potential risk in the water column from discharges from production and drilling activities. It includes calculation procedures for both the EIF_{PW} and the EIF_{DD}, which are based on scientifically sound and internationally agreed principles for hazard and risk assessment. Both EIFs are developed along the same lines, defining water volumes and sediment areas with risk > 5%.

DREAM calculates the physical-chemical fates of the various compounds in the discharges in three spatial dimensions and time. The model includes processes like near-field mixing, dilution in the sea due to currents and turbulence, and biodegradation of organic compounds in the discharge.

The model can include hundred compounds simultaneously in the discharge and multiple release locations.

The model also computes deposition of particulate matter on the sea floor, including chemicals that are attached or adsorbed to particulates. In the sediment, the deposited matter is subject to bioturbation and biodegradation.

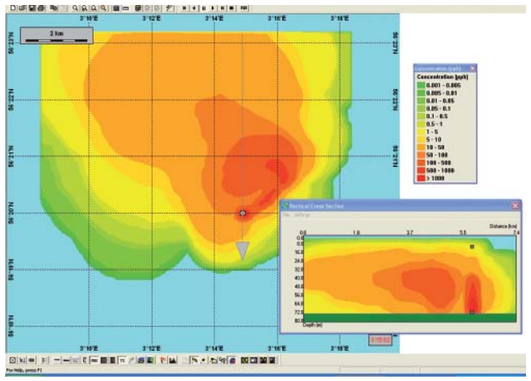
Contactperson: Henrik Rye, SINTEF

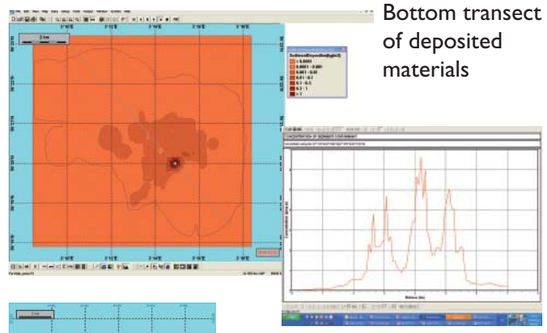


DREAM: The ERMS Model for Risk Assessment of Offshore Produced Water and Drilling Releases

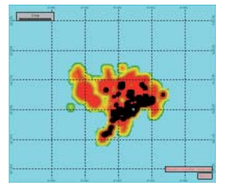
The Dose-Related Exposure Assessment Model represents a cumulative development that can be traced back to 1985.

Financial support along the way has been provided by the US Department of the Interior, Statoil, Eni, Norsk Hydro, Total, Shell, Conoco-Phillips, Petrobras, Exxon-Mobil, and SINTEF.





Bottom transect of deposited materials



Time series of risk fields in the water column and sediments

Left: 3-D time series of concentrations and risks resulting from complex mixtures of chemical substances and particle materials

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