



Project no. INCO-CT-2007-043690

EnRiMa ConMa

Environmental risk Management for contaminated marsh land in Khanty-Mansiysk

Instrument: Specific Support Action

Thematic Priority: International Cooperation

Deliverable D4.3

Final project report including seminar report and future cooperation

Period covered: from April 2007 to September 2008

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Start date of project: April 2007

Duration: September 2008

Project coordinator name: Karin Eliaeson

Project coordinator organization name: IVL Swedish Environmental Research Institute Ltd

Other partners: Siberian Scientific & Projecting Institute of Rational Nature Management (Sibnipirp) and Center of recultivation (Rusecosystem)

| Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006) | | |
|--|--|---|
| Dissemination Level | | |
| PU | Public | X |
| PP | Restricted to other programme participants (including the Commission Services) | |
| RE | Restricted to a group specified by the consortium (including the Commission | |
| CO | Confidential, only for members of the consortium (including the Commission Services) | |

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1 Publishable summary

1.1 Background

The EnRiMaConMa-project is funded by the European Commission under the 6th framework program. The project acronym is the short version of the project title: “Environmental Risk Management for Contaminated Marsh land in Khanty Mansiysk” and the project contract number is 043690. The project is a Specific Support Action, started up in April 2007 and completed in September 2008.

Khanty-Mansiysk Autonomous Okrug (KMAO) in Russia faces a strong demand for efficient remediation strategies for oil-contaminated marshes. KMAO has important oil producers as well as regions that have extensive contaminated sites resulting from oil production and transportation. The project aimed to establish a strong research network with partners from Europe and Russia in order to identify gaps in existing knowledge, and to transfer the appropriate background for the improvement and development of a regional risk assessment strategy for oil- contaminated marshes. The core activities in the project have been:

- Knowledge mapping and exchange
- Development of Research and Innovation strategy
- Networking and information
- Project management

The consortium consists of three partners; IVL Swedish Environmental Research Institute Ltd (European), Siberian Scientific Research and Projecting Institute of Rational Nature Management “Sibnipirp” (Russian), and the Centre of Recultivation “RusEcosystem”(Russian).

1.2 Work performed

Since the project started in April 2007, three major meetings have been carried out. Firstly, an initial meeting in Russia included a visit to oil contaminated marshlands and introduction to most widely used remediation technologies in the region of Khanty Mansiysk. Secondly, one work-shop meeting in Sweden was devoted to a discussion of problems in the region, current knowledge and the identification of gaps in existing knowledge. Thirdly, the final seminar in Russia took place during the environmental week that gathered many stakeholders that could benefit from the results of the EnRiMaConMa-project.

Prior to the work-shop in Sweden, detailed mapping was carried out and this was compiled into a knowledge mapping report. The report introduced the current situation and related environmental problems of oil contaminated sites in the Khanty-Mansiysk Autonomous Okrug (KMAO) in Russia. The natural characteristics of the area have been described, as well as the current Russian legislation. In addition, the Russian partners (Sibnipirp and RusEcosystem) presented current knowledge on the ecological impact resulting from the application of different remediation techniques used in the region. Widely used remediation techniques for oil contaminated soils in Europe were presented as well as the resulting information of a literature survey made by the European partner (IVL).

The weakness of the currently used monitoring, risk assessment and remediation system can be summarized:

- inefficient monitoring system controlling polluted and recultivated areas;
- present remediation techniques and criteria are not in conformity with good environmental practice
- limited resources for surveillance of the number and spatial distribution of oil spills

- absence of recultivation techniques applicable to oil-contaminated marshes adapted to local conditions
- absence of differentiated guideline values for oil pollution and related ecological risks assessment
- absence of objective criteria for inspection of recultivated areas, ranked according to ecological risks
- poor knowledge of plant species that are optimal for bioremediation of oil-contaminated peat and harmonized with the native flora
- weak assessment of oil spill impact from a river basin perspective
- weak assessment of oil spill impact from a long-term perspective
- weak understanding of the full impact of high salinity water (formation water) discharged from oil-drilling activities

Two major activities have been in focus during the second period of the project, the development of a strategy for research and development in the area and the disseminating activities during the final workshop of the project.

1.3 Research and knowledge exchange platform

As was outlined in the knowledge mapping report, improvements of the environmental situation in the area are needed. The area is economically very important for Russia and is under fast and strong exploration. The environmental legislation falls behind and is too weak to prevent sensitive areas for exploration. The negative influence on the nature is today a well known consequence but the full impact on the environment in a larger perspective is not known and remains to be investigated. A long term exploration plan where infrastructural, social, economical and environmental aspects are taken into consideration would help the area to develop in a sustainable way. Such a plan requires research efforts over several disciplines and an organizer/institution that compiles and evaluates all the results. During spring 2008 the project summarized the identified problems and made a preliminary identification of needed improvement. After discussions with the Russian stakeholders during the final seminar in may 2008 the concept was revised and developed into a “research and knowledge exchange platform” including suggestions for future research projects. The program is made up of 8 main research topics:

- Prevention
- Surveillance
- Unknown impact
- Risk assessment
- Remediation
- Guidelines
- Permit process
- Longterm exploration plan

The different research topics are closely related and all topics can be linked to each other. Approximately 40 potential research projects have been proposed in the research program. Many stakeholders active in the region would gain on such a research and knowledge exchange platform. Above all, the oil companies will have a coordinated research that will strengthen the cooperation with authorities and regulators. Also, other oil exploration countries could benefit from all the research and expertise that is gathered by this research and knowledge exchange platform, especially as the situation in this area is difficult due to its size, climate and geography/hydrology. Exchange of expertise between countries by environmental technology companies and consults (SMEs) will also be strengthened by such a cooperative research. A possible financing model for the research and knowledge exchange platform and its subsequent research program, could be financing cooperation by oil exploration companies and the Russian state.

1.4 Future ideas and needs

The final seminar was held during the environmental week in Nizhnevartovsk in May 2008. Members of the project presented results and made also a talk about waste management, which could be another cooperative area of future research. The seminar was successful with fruitful discussions with stakeholders during the second day. The third day was spent in field visiting an oil spill area. 116 people joined the seminar and the trade fair that was arranged in relation to the seminar.

Several ideas for future research and cooperation both at an international and national level between stakeholders have been developed during the networking activities of the project. Based on the discussions of needed research on oil contaminated marsh lands, a project focusing on investigation of degradation of oil in peat have been suggested. Furthermore, a concrete proposal on waste management in Nizhnevartovsk city is partly financed by regional government. To start up the two projects and to progress with the strategy for research and development, national funding from the Russian state and Russian industry will be required.

Information about the project can be found at:

www.baltic21institute.org

<http://www.sibnipirp.ru/?part=proj&c=proj-ru>

For more information contact: karin.eliaeson@ivl.se

2 Background and problem description

Khanty-Mansiysk Autonomous Okrug (KMAO) in Russia faces a strong demand for efficient remediation strategies for oil-contaminated marshes. The region has extensive contaminated sites resulting from oil production and transportation. At present there are 278 oil-fields under development in KMAO. Annual oil production at 53 of them exceeds 1 million tons. In 2006 average daily oil production reached 755 thousand tons. The techniques used for oil extraction lead to substantial damage of environment in the territory of KMAO-Ugra. Most oil spills are the result of pipeline rupture with 96 cases from 100 caused by corrosion processes. Analysis of the oil spills from pipelines due to corrosive wear made by oil-and-gas companies of KMAO indicated that the average operating life of field pipes before the first incident is 2–3 years. Analysis of official data over 14 years shows that the average number of oil spills in oilfield system over the period 1991–2004 is 1600–2000 failures per year. The peak levels of the oil spill rate were in the middle of 90s and in 2004. Number of oil spills shows steady and increasing tendency during last few years.

The climate of the region is extremely continental, with long and inclement winters, wanton springs, brief summers and short autumns. The period when the temperature is below 0°C lasts for 7 months – from October till April. Mean January temperature in the region varies from – 18°C (in the south) to – 24°C (in the north). The hydrographic network of KMAO refers to the Kara Sea basin. It includes a great number (19.6 thousand) of water passages, lakes, swamp lands, which is caused by the overmoistening of land, flat surface pattern and close occurrence of impervious horizons. Easy gradients of the land cause slow river flow and a high degree of sinuosity of the rivers. Big rivers have wide valleys with two-sided sharply meandering flood-plains. River channels abound in branches, creeks and lakes. A weak drainage effect of the rivers is one of the most important factors of overmoistening and bogginess. The degree of bogginess of some gathering grounds is more than 50-70%. Thus soil and weather conditions of the region are extremely severe for the process of oil biodegradation. Soil overmoistening on the one hand hampers deep penetration of oil, but on the other hand it complicates recultivation from the point of technical and agrobiological operations.

The area is unique and as far as this project knows there is no other such large wetland system with extensive oil exploration in the rest of the world. Similar nature exists at many places but not as such huge and remote areas. The environmental problems are demanding due to:

- 1) Huge and remote peat-land area
- 2) Rapid exploration rate of the area
- 3) Cold climate

The weaknesses of the currently used monitoring, risk assessment and remediation system have been summarized in (see also knowledge mapping report, **appendix 1**):

- absence monitoring system controlling polluted and recultivated areas;
- present remediation techniques and criteria are not in conformity with good environmental practice
- limited resources for surveillance of the number and spatial distribution of oil spills
- absence of remediation techniques applicable to oil-contaminated marshes adapted to local conditions
- absence of differentiated guideline values for oil pollution of peat and related ecological risks assessment
- absence of objective criteria for inspection of recultivated areas, ranked according to ecological risks
- poor knowledge of plant species that are optimal for bioremediation of oil-contaminated peat and harmonized with the native flora
- weak assessment of oil spill impact from a river basin perspective

- weak assessment of oil spill impact from a long-term perspective
- weak understanding of the full impact of high salinity water (formation water) discharged from oil-drilling activities

As outlined above, improvements of the environmental situation in the area are needed. The area is economically very important for Russia and is under fast and strong exploration. The environmental legislation and control falls behind and is too weak to prevent sensitive areas for exploration. The negative influence on the nature is today a well known consequence but the full impact on the environment in a larger perspective is not known and remains to be investigated.

3 The EnRiMaConMa project

The EnRiMaConMa-project is funded by the European Commission under the 6th framework program. The project acronym is the short version of the project title: “Environmental Risk Management for Contaminated Marsh land in Khanty Mansiysk” and the project contract number is 043690. The project is a Specific Support Action, started up in April 2007 and has been completed in September 2008. The project aims to establish a strong research network with partners from Europe and Russia in order to identify gaps in existing knowledge of oil contaminated marsh lands, and to transfer the appropriate background for the improvement and development of a regional risk assessment strategy for oil- contaminated marshes. The core activities in the project are:

- Knowledge mapping and exchange
- Development of Research and Innovation strategy
- Networking and information
- Project management

The consortium consists of three partners; IVL Swedish Environmental Research Institute Ltd (European), Siberian Scientific Research and Projecting Institute of Rational Nature Management “Sibnipirp” (Russian), and the Centre of Recultivation “RusEcosystem”(Russian).

3.1 Project structure

The project has been divided into four work packages based on the core activities.

- WP1 covers all project management activities. (Responsible for performance: IVL)
- WP2 will focus on mapping of knowledge necessary for sustainable risk management of contaminated marsh land, especially in the Khanty-Mansiysk region (responsible RusEcosystem)
- WP 3 will focus development of a research and innovation strategy identifying the needs for future work in the field of research and technological innovation. (Responsible IVL)
- WP 4 will focus dissemination of results and establishment of a network for future work with these questions and co-operation. (Responsible for performance SibNIPIRP)

The structure of the different work packages and their interlinking is given in figure 1 and an overview of the project progress and deliverables is given in table 1.

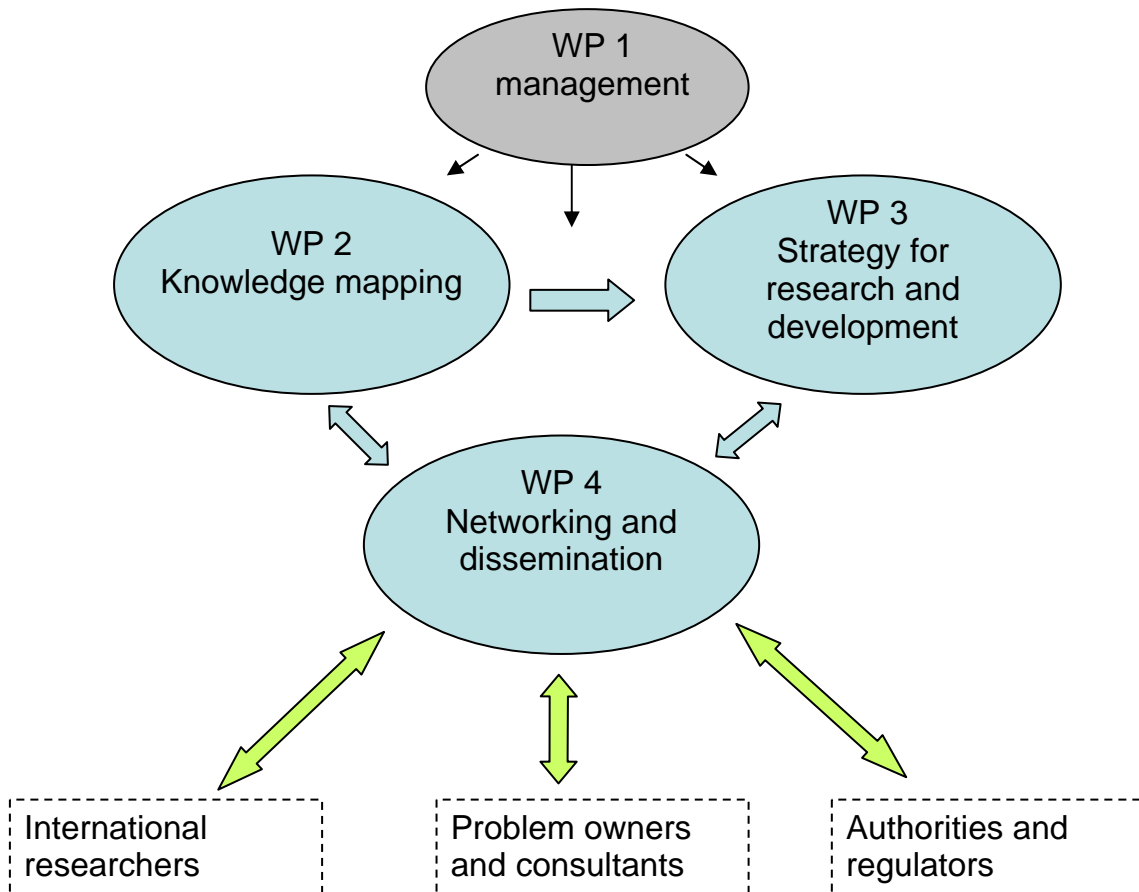


Figure 1. Schematic overview of the project structure.

Table 1. Gant chart over the project.

| Year | 2007 | | | | | | | | | 2008 | | | | | | | | |
|------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Month | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| WP 1 | [Activity bar] | | | | | | | | | | | | | | | | | |
| D1.1 | [Activity bar] | | | | | | | | | | | | | | | | | |
| D1.2 | [Activity bar] | | | | | | | | | | | | | | | | | |
| WP2 | [Activity bar] | | | | | | | | | | | | | | | | | |
| D2.1 | [Activity bar] | | | | | | | | | | | | | | | | | |
| D2.2 | [Activity bar] | | | | | | | | | | | | | | | | | |
| WP3 | [Activity bar] | | | | | | | | | | | | | | | | | |
| D3.1 | [Activity bar] | | | | | | | | | | | | | | | | | |
| WP4 | [Activity bar] | | | | | | | | | | | | | | | | | |
| D4.1 | [Activity bar] | | | | | | | | | | | | | | | | | |
| D4.2 | [Activity bar] | | | | | | | | | | | | | | | | | |
| D4.3 | [Activity bar] | | | | | | | | | | | | | | | | | |
| Deliverable list | | | | | | | | | | | | | | | | | | |
| D1.1 | Periodic activity report period 1 (including economy, management and dissemination) | | | | | | | | | | | | | | | | | |
| D2.1 | Final project report including seminar report and future activities (including economy, management and dissemination) | | | | | | | | | | | | | | | | | |
| D2.1 | Workshop held on state of the art in risk management issues | | | | | | | | | | | | | | | | | |
| D2.2 | Knowledge mapping report for risk management issues on contaminated marsh land | | | | | | | | | | | | | | | | | |
| D3.1 | Document on strategy for research and development | | | | | | | | | | | | | | | | | |
| D4.1 | Information material about the project available on internet | | | | | | | | | | | | | | | | | |
| D4.2 | Seminar presenting results of the project performed | | | | | | | | | | | | | | | | | |
| D4.3 | Report on future cooperation including seminar report, networking and work items | | | | | | | | | | | | | | | | | |

3.2 Work performed

3.2.1 From April 2007 till September 2008

The project started up in April 2007 with planning of the kick-off meeting in June 2007. The meeting was held in Russia where European researchers got the chance to visit the oil contaminated marshlands in KMAO and met the Russian scientists that participated in the project. During the visit, the European partner also visited the Environmental committee of the region, representatives of oil companies working in the Samotlor oilfield and the Chamber of Commerce in Khanty Mansiysk in cooperation with Sibnirip and the Environmental committee.

The next workshop was held in Stockholm between the 13th and 16th of November 2007. During the meeting the Russian partners reported the situation of oil spill contamination in Khanty Mansiysk region and the European partner reported performed knowledge mapping of oil contamination and remediation techniques common in rest of the world. A lot of time was spent on understanding the problems of oil contamination in the area and to which extent it is going on. The workshop focused on discussions about fractionation of oil and analyzing techniques as well as the adaptation of guideline values, which is a main issue for the region. Also, the group discussed the role of sorbents in oil contamination. The meeting was very fruitful, despite that interpretation between Swedish and Russian language was needed. A number of new project ideas covering needs for further development and research related to the project were identified. An overall conclusion from WP 2 is that there are insufficient knowledge and techniques to prevent and to treat oil spills occurring in cold climate marshland areas. Future work need to focus on development of techniques for prevention of oil spills and on best strategy for remediation of the marshland once the spill has occurred. The technique used to day destroys the function of the wetland and the dependent ecosystems. The knowledge mapping report is attached as **appendix 1**.

In February 2008 a first draft of a strategy for research and development was developed, discussed and revised. This work was the main building block of WP3. After discussions with the Russian partners and stakeholders a second phase of the strategy was developed. It refined the needed improvements into research topics and suggested specific research projects for the different research areas. The project has identified that a strategy for research and development of the environmental problems addressed in relation to the oil activities in the KMAO region is to create a base for exchange of knowledge both on a national level and on an international level. The strategy that we have developed is a first step of how such a research platform could be structured. This strategy is probably the most important achievement of the project. It is attached in this report as **appendix 2**.

The aim for WP 4 has been to work on dissemination of the compiled knowledge and to point out the way forward for oil companies, authorities and other stakeholders. The strategy developed in WP3 became an important block for WP4, especially during the final seminar of the project that was held in relation to the environmental week in Nizhnevartovsk in May 2008. A seminar report has been created where all lectures of the different speakers has been compiled. Also, the discussions that where held with stakeholders after the first day of the conference, are part of the seminar report. The report is produced both in English and in Russian and it is included in this final report of the EnRiMaConMa-project as **appendix 3**.

The periodic activity report covering period 1 is attached as **appendix 4**.

The periodic activity report covering period 2 is attached as **appendix 5**.

The plan for disseminating the knowledge is attached as **appendix 6**.

4 Way forward on cooperation

There is a need for more research and developing activities in the region and many ideas exist as can be seen in the strategy document. The knowledge exchange platform and its subsequent

research program will require funding from the oil companies, the Russian state and possibly also international funds.

Our project results and further cooperation were discussed during the seminar in May. The final conclusion from the Forum together with the suggestions from IVL builds up a strong base for two new projects. One project will help local decision makers to find out the result from the ongoing **remediation** projects and answering the following questions: Are the projects successful? Do we get trustful long-term results? Can we improve the methods? How can we develop a better risk strategy for the remediation work? How can we explain that projects outfall differ between places? A concrete project proposal is dedicated to better understand and optimize the degradation of oil in peat. IVL will run experimental work where we in pilot scale can study the optimization of oil degradation in peat and change the following parameters:

- Nitrogen addition
- Phosphorus addition
- Co-substrate addition
- Temperature
- Water content
- O₂ pressure

The results from the IVL study will be compared with pilot studies in field. Together will those results build up a strong scientific understanding how to optimize the degradation and thereby outline the best future treatment methods.

A project like this will meet the need from many cities in Siberia. We will therefore together try to get financing from other European organizations but also from national funding and Eureka.

Waste is an increasing problem in developed countries as well as in developing countries. A general tendency is that the amounts of waste are increasing – it is a coupling between the waste generation growth and the economical growth. Because of this it is to expect an increased generation of waste in the project region. In order to prevent this, it is necessary to get control of the waste from the beginning.

The plan of the project is to transfer experience and competence within the municipal waste handling sectors. The overall goal is to develop the waste management towards more sustainability and to strength the local government in waste issues (i.e. institutional development) as well as practical solutions regarding waste handling (i.e. capacity building and technology transfer). IVL will assist with knowledge, experience, information, supervision, and material about what/ how is needed regarding waste planning and source sorting.

A special topic in the project is to use computerized system analysis models as a tool in the waste management planning. IVL has since 1993 been involved in the development and use of the simulation model WAMPS, where environmental impact and life cycle costs for different waste management systems can be assessed. A variation of WAMPS will be used in this project.

In the meetings in May 2008 the discussion was very much focused on the possibility to recover energy from waste. The Russian side is eager to learn more about the Swedish experience in this field. Sweden incinerates more than 50% of the household waste and recovers a lot of energy. Most of the energy will be used for district heating but 25% will be produced as electricity.

In the project we will work with a few regions in Siberia with focus on Nizhnevartovsk. The project can be seen as a number of pilot projects, where we start the development in chosen limited areas, from which the results later can be transferred to other areas. See **appendix 7**.

