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Surveillance of Water Quality in the Songhua River System in Heilongjiang Province, P.R. of China, CHN 017

Input to the Annual Report 1998

Norwegian Institute for Water Research

REPORT

Main Office
P.O. Box 173, Kjelsås
N-0411 Oslo
Norway
Phone (47) 22 18 51 00
Telefax (47) 22 18 52 00
Internet: www.niva.no

Regional Office, Sørlandet
Televeien 3
N-4879 Grimstad
Norway
Phone (47) 37 29 50 55
Telefax (47) 37 04 45 13

Regional Office, Østlandet
Sandvikaveien 41
N-2312 Ottestad
Norway
Phone (47) 62 57 64 00
Telefax (47) 62 57 66 53

Regional Office, Vestlandet
Nordnesboder 5
N-5008 Bergen
Norway
Phone (47) 55 30 22 50
Telefax (47) 55 30 22 51

Akvaplan-NIVA A/S
N-9005 Tromsø
Norway
Phone (47) 77 68 52 80
Telefax (47) 77 68 05 09

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Abstract

This report describes status of the project work performed during 1998 on "Surveillance of Water Quality in the Songhua River System in Heilongjiang Province, P.R. of China". Main topics are status for data collection for preparing the abatement strategy and the ENSIS system, a laboratory inter-comparison, a project workshop held in March 1998, development of the ENSIS system, project costs in 1998 and the project budget for 1999.

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1. ENSIS	1. ENSIS
2. Overvåking	2. Surveillance
3. Vannressursforvaltning	3. Water resources management
4. Årsrapport	4. Annual Report

Bente M. Wathne
Bente M. Wathne
Project manager/Head of research department

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Merete Johannessen Ulstein
Merete Johannessen Ulstein
Research director

Surveillance of Water Quality in the Songhua River System in the Heilongjiang Province, P.R. of China

CHN 017

Input to the 1998 Annual Report

Preface

The project "Surveillance of the Water Quality in the Songhua River System in Heilongjiang Province, P.R. of China" was launched in November 1996, when an agreement was signed between the Norwegian Agency for Development Co-operation (NORAD) and The Chinese State Science and Technology Commission (SSTC).

The executive institutions of the project are from China, the Heilongjiang Environmental Protection Bureau (H/EPB) and the Heilongjiang Environmental Monitoring Central Station (HEMCS). From Norway the co-operative institutions are the Norwegian Institute for Water Research (NIVA) and the NORGIT Centre.

Being amongst the first projects under the agreement between China and Norway for co-operation on environmental matters, this project, in addition to the normal project activities, has contributed in establishing management routines for project handling. These activities have taken both time and consideration, but are important activities that hopefully will be of benefit for the future co-operative projects between China and Norway.

The project team from the Norwegian side has in this report described their main efforts for the project through 1998, which was the second full working year of the project. The document provides input information to the Annual Report to be prepared by the Chinese partners of the project

Oslo, 8. March 1999

Bente M. Wathne

Summary

The project "Surveillance of the Water Quality in the Songhua River System in Heilongjiang Province, P.R. of China" was launched in November 1996, when an agreement was signed between the Norwegian Agency for Development Co-operation (NORAD) and The Chinese State Science and Technology Commission (SSTC).

The executive institutions of the project are from China, the Heilongjiang Environmental Protection Bureau (H/EPB) and the Heilongjiang Environmental Monitoring Central Station (HEMCS). From Norway the co-operative institutions are the Norwegian Institute for Water Research (NIVA) and the NORGIT Centre.

The year 1998 was the second full working year of the project. This document provides input information to the Annual Report to be prepared by the Chinese partners of the project.

Project work 1998

Main events

Project work has been carried out both in China and Norway throughout 1998, and the following main events have taken place:

- March 1998, Workshop and project meeting in Harbin
- June 1998, short visit of the Chinese project leader in Oslo (Norway) in order discuss the project plans for 1998
- September 1998, Digitising of paper copy maps
- September-December 1998, Configuration of the ENSIS system
- September- December 1998, Input of data and maps into the ENSIS system
- September-December 1998, Preparation for the training on the ENSIS system in Oslo
- October - November 1998, Delivery of the water quality monitoring equipment in Harbin

Data collection

NIVA has taken stock of the following information on activities in the Songhua River Catchment provided by HEPB: industry, waste water treatment and population, agriculture, land coverage, and user interests. In addition H/EPB will provide more data on industry, waste water treatment and population as required by 15 March 1999. NIVA has also received monitoring data covering water chemistry and monitoring sites, rivers and catchments, water flow and biological monitoring. Based on the map of the Songhua river catchment NIVA has digitised all the rivers in the system and entered these into the ENSIS system. The Mundangjiang River catchment has been selected, in agreement with H/EPB, for abatement strategy purposes. This means that the sub-project 'Abatement strategy' will focus on the Mundanjiang catchment only, but that the procedures applied are valid for any other catchment in the Songhua River catchment.

Quality Control Procedures and Water Quality classification

H/EPB has informed NIVA about their instructions and methods for sampling and analysis at laboratories, which have been adopted by H/EPB to increase quality of the analysed

parameters. The ENSIS version to be demonstrated in Harbin in April 1999 will contain a functionality to classify water quality data according to the Chinese water quality classification criteria.

Installation of Water Monitoring equipment
Due to delays in the ordering process, the monitoring instruments were only delivered lately in 1998. At that time installation was not possible due to climatic factors. The installation is therefore planned to take place during spring 1999. This represents a considerable delay in this part of the project. The monitoring instruments should, according to the original plan, have been installed during summer 1997.

Water Quality Workshop 23– 26 March 1998
A workshop was held in Harbin 23 – 26 March 1998, covering the following issues: Data collection, Biological monitoring, Instrument list, Quality assurance procedures, Laboratory Intercomparison, and Future co-operation.

Laboratory Inter-comparison
A laboratory inter-comparison was organised in 1998 between NIVA and the co-operative laboratories in and Harbin and Yantai, Shandung Province The inter comparison results indicate that it would be very important to carry out a more comprehensive inter-comparison during 1999, which would encompass all major components.

Information technology
The procedure regarding procurement and import of necessary equipment in the project was unclear in the first phase of the project and it was only defined one year after the project started. To obtain progress and fulfil the time plan in the project, NORGIT has borrowed the necessary hardware. This makes it possible for NORGIT to accomplish both the "Factory acceptance test" (FAT) and part of the "Site acceptance test" (SAT) in Norway.

Training in Norway
The education and training of the Chinese experts were planned to take place in Norway in August 1998. The training was postponed to January 1999 due to the delay in the delivery of the computers.

Data handling
In the ENSIS database the following themes have been entered:

- ✓ Administrative Regions
- ✓ Monitoring Stations
- ✓ Rivers (river nodes, river links and river chains)
- ✓ Lakes
- ✓ Roads (road nodes, road links)
- ✓ Stacks

Furthermore, the original maps NIVA got from H/EPB, have been applied to create the following shapes:

- ✓ Land Use (agricultural area, mountain area and forest)
- ✓ User interests (points for irrigation and groundwater abstraction)
- ✓ Coastal area

During the planned Workshop and visit to Harbin in April 1999, further work on these issues will be performed.

Project Cost in 1998

Phase 2 (planned for April 1997–December 1998) will run from April 1997 until June 1999, due to the delay in the project work. The installation of the water quality monitoring instruments was planned for summer season 1997 but will be accomplished during spring 1999. During 1998 there was no agreed project budget for the total project work. The Norwegian side made a note on this, based on the signed budget from 1997. According to the note, the 1998 reduced Norwegian budget, as agreed by the Chinese side, was as **NOK 2 000 415.** Due to the delay in the project work, only **NOK 775 751** was spent in 1998. The saved money for phase 2 in 1998 is transferred to 1999 for finalisation of phase 2.

An allocation of **NOK 4.829.800** was agreed to the Chinese side within phase 2. Of this allocation a total amount of **NOK 4.600.000** was transferred directly to China in 1997, leaving NOK 229.800 from the pase 2 budget to be transferred at a later stage

Project Budget for 1999

NOK 250.000 from phase 2 budget is not allocated, and it is suggested from the Norwegian side to grant NOK 200.000 for the Chinese side for extra instruments and NOK 50.000 to the Norwegian side to partly cover the rental fee for IT equipment. The resulting phase 2 budget for the Norwegian side for 1999 will then be **NOK 1 274 664**. The phase 3 budget for 1999 will be **NOK 640 000**, leaving **NOK 851 000** for the year 2000. More details for the part of the project planned for 2000 will be discussed during 1999.

The total project budget for 1999 for CHN 017 for the Norwegian side is **NOK 1 914 664**.

Contents

1. Background

The project "Surveillance of the Water Quality in the Songhua River System in Heilongjiang Province, P.R. of China" was launched in November 1996, when an agreement was signed between the Norwegian Agency for Development Co-operation (NORAD) and The Chinese State Science and Technology Commission (SSTC). SSTC is now the Ministry of Science and Technology (MOST). The year 1998 was the second full working year of the project.

The executive institutions of the project are:

- from China, the Heilongjiang Environmental Protection Bureau (H/EPB) and the Heilongjiang Environmental Monitoring Central Station (HEMCS).
- from Norway, the co-operative institutions the Norwegian Institute for Water Research (NIVA) and the NORGIT Centre.

This document provides input information to the Annual Report to be prepared by the Chinese partners of the project.

2. Project work 1998

2.1 Main events

Project related work has been carried out both in China and Norway throughout 1998, and the following main events have taken place:

- March 1998, Workshop and project meeting in Harbin (see Appendix B)
- June 1998, short visit of the Chinese project leader in Oslo (Norway) in order discuss the project plans for 1998
- September 1998, Digitising of paper copy maps
- September-December 1998, Configuration of the ENSIS system
- September- December 1998, Input of data and maps into the ENSIS system
- September-December 1998, Preparation for the training on the ENSIS system in Oslo
- October - November 1998, Delivery of the water quality monitoring equipment in Harbin

2.2 Administration

A general feature as regards this project is that the administration activities have been considerably more time consuming than originally predicted. This is due to project reorganising and budget revisions e.g. removal of the air monitoring part of the project. An addendum to the contract between SSTC and NORAD was signed in September 1997. This addendum approved i.a. the final project budgets, listing also in more detail the allocations for 1997 and 1998. The Chinese side still has some questions to the 1998 budget to be solved

based on the financial details from 1997. Detailed financial details from 1997 and 1998 are needed to conclude the remaining budget for the project.

The 6 months delay in 1997 work plan also affects the further time scedule of the project, i.e. the agreed work plan needed to be revised.

2.3 Data collection

NIVA has taken stock of the following information provided by HEPB.

2.3.1 Activities in the Songhua River Catchment

Industry
H/EPB has provided paper copy maps for the preliminary presentation of industrial pollution sources, data on discharges and other relevant information from the industrial plants in the catchment area of the Songhua river. The Excel tables of industries contain considerable information, although some are not relevant for the ENSIS system. H/EPB has been given the task to reorganise the data according to the specification in ENSIS. H/EPB will also geo-reference the sources with help of ENSIS.
Further work depend on provision of data from H/EPB by 15 March 1999. The data specification for industries is at Appendix E. More information, specific to the Mundanjiang catchment, may be needed at a later stage during the abatement strategy development.

Waste water treatment and Population
H/EPB has provided paper copy maps for the preliminary presentation of personal equivalents per administrative statistical unit from each of the 11 main cities. On the basis of the information provided to date NIVA, in collaboration with H/EPB, will calculate the organic load and the load of phosphorus and nitrogen from domestic and industrial sewage. H/EPB has informed NIVA that it cannot provide information about domestic waste water discharges per sub-catchment, only per administrative district. The estimated average discharge of waste water is estimated to 75 litres per person and day.

NIVA has asked H/EPB to organise the data for municipal waste water treatment plants and for the treatment areas as described in Appendix F.
Further work depend on provison from H/EPB by 15 March 1999. The data will be entered into the ENSIS data base and serve as a basis for the training in Harbin in April 1999. More information, specific to the Mundanjiang catchment, may be needed at a later stage during the abatement strategy development.

Agriculture
H/EPB has provided data on:
- the use of pesticides and artificial fertiliser,
- agriculture coverage,
- type and coverage of cereals and vegetable production
- number of 7 different domestic animals in 11 administrative areas.

On the basis of the information provided to date NIVA will endeavour, in collaboration with H/EPB, to quantify the organic load and the load of phosphorus, nitrogen and pesticides from agricultural activities in the Mundanjiang catchment.

Land coverage
The issue of relevant maps needs to be revisited. H/EPB has indicated that the data collection is ongoing.

User interests
NIVA has received a map scale 1:1000 000, indicating the Songhua river catchment and three types of user interests. NIVA has prepared the ENSIS system on the basis of this information. The user interests will be visualised as a river link dataset. More information, specific to the Mundanjiang catchment, may be needed at a later stage during the abatement strategy development.

2.3.2 Monitoring data

Water chemistry and monitoring sites
NIVA has received the results of the monitoring carried out in 1996 at 46 monitoring sites and the data will be entered into the ENSIS system together with the 1995 data. NIVA has prepared the ENSIS system for the data and digitised all 46 monitoring stations.

This issue can now be developed by NIVA and H/EPB with the aim of assessing:
- the water quality of the Songhua river and its tributaries, at least in the Mundanjiang catchment
- the current chemical monitoring programme.

If appropriate, changes to the monitoring programme will be suggested .

Rivers and Catchments
NIVA has received a paper map with scale 1:1.000 000, where the Songhua river catchment, lakes and tributaries to the Songhua river and the monitoring stations are indicated. NIVA has, based on the map, digitised all the rivers in the system and entered these into the ENSIS system. The catchment of Songhua River is also visualised. The Mundangjiang River catchment has been selected, in agreement with H/EPB, for abatement strategy purposes. This means that the sub-project 'Abatement strategy' will focus on the Mundanjiang catchment only, but that the procedures applied are valid for any other catchment in the Songhua River catchment. NIVA has expressed concern about the low resolution of the maps made available for the project (1: 1000000 only). This will undoubtedly influence the outcome of the Abatement strategy activities.

Water flow
Water flow data is essential in pollution load calculations and the development of an abatement strategy. It is understandable that such data is difficult to obtain in view of the considerable seasonal differences in river water flow (river bed changes). The data provided on monthly averages for the years 1995 and 1996 represent a good starting point, but more information, specific to the Mundanjiang catchment, may be needed at a later stage during the

abatement strategy development.

Biological Monitoring
NIVA has received biomass data from the flooding season in the Nei river for 1996, i.e. data on zooplankton, phytoplankton and benthic organisms. H/EPB has informed NIVA that the 1995 biomonitoring data will be made available as soon as possible.

Quality Control Procedures
H/EPB has informed NIVA about their instructions and methods for sampling and analysis at laboratories, which have been adopted by H/EPB to increase quality of the analysed parameters.
Any special requirements that H/EPB might have for quality assurance cannot be implemented in the ENSIS system before phase 3 of the project. However, some standard quality assurance procedures have been entered into the ENSIS system and they were shown during the workshop in Norway January1999.

NIVA has carried out a preliminary intercomparison exercise with the participation of the laboratories in Harbin, Yantai and NIVA. The results of this exercise show that some improvements are needed. It is hoped that a more comprehensive exercise can be carried out during 1999. This second exercise should provide an even better basis for improving Quality Control Procedures.

Water Quality classification
The ENSIS version to be demonstrated in Harbin in April 1999 will contain a functionality to classify water quality data according to the Chinese water quality classification criteria (based on yearly average).

2.4 Installation of Water Monitoring equipment

Due to delays in the ordering process, the monitoring instruments were only delivered lately in 1998. At that time installation was not possible due to climatic factors. The installation is therefore planned to take place during spring 1999. This represents a considerable delay in this part of the project of almost two years. The monitoring instruments should, according to the original plan, have been installed during summer 1997.

2.5 Water Quality Workshop 23– 26 March 1998

A workshop was held in Harbin 23 – 26 March 1998, covering the following issues:

Data collection
Biological monitoring
Instrument list
Quality assurance procedures
Laboratory Intercomparison
Future co-operation

Participants from Heilongjiang Environmental Protection Bureau and Monitoring Central Station were Mr. Li Weixiang, Mr. Guo Yuan, Mr. Li Xiangju, Ms. Chen Aifeng, Mr. Chen Jiahou, Mr. Dong Xianfeng and Ms. Wu Yuehui.

Mr Haakon Thaulow (only the first day), Mr. Håvard Hovind and Mr. Stig A. Borgvang from NIVA were present. A Summary report from the Workshop was prepared by Mr. Stig A. Borgvang and agreed between the project partners (Appendix B). There was one outstanding issue at the end of theWorkshop (cf agenda item 3 of the report), which needed consultation with the director of NIVA, Mr Haakon Thaulow. The report was amended accordingly.

2.6 Laboratory Inter-comparison

A laboratory inter-comparison was organised in 1998 between NIVA and the co-operative laboratories in and Harbin and Yantai, Shandung Province (CHN014). The inter comparison results indicate that it would be very important to carry out a more comprehensive inter-comparison during 1999, which would encompass all major components. It is also of utmost importance to organise a meeting between the experts in Harbin, Yantai and Mr Hovind of NIVA, either before or after a possible comprehensive intercomparison exercise in 1999, in order to assess the results of the 1998 exercise(s) and to find the means for improving the results (Quality Assurance Procedures (sampling and laboratores), new intruments (see also section: Quality Control Procedures above)). The results of the preliminary intercomparison exercise are at Appendix C.

2.7 Information technology

An important part of the project is to establish a computer platform and adapt and install the ENSIS system in Heilongjiang. This part of the project is NORGIT's responsibility.

The procedure regarding procurement and import of necessary equipment in the project was unclear in the first phase of the project and it was only defined one year after the project started. The process started in November 1996 with an agreed project plan, signed by NORAD and SSTC. This plan was based on very definite conditions with regard to time schedules and availability of equipment.

2.7.1 Data equipment

NORGIT needs data equipment to modify the ENSIS applications, test the equipment to be sent to China, and for training Chinese colleagues in Norway.

In December 1996 an agreement was made between China and Norway about the data equipment necessary for the project. The hardware list was sent to China for approval in December 1996. Technical discussions between NILU, NIVA, NORGIT and H/EPB took place. NORGIT also discussed the equipment issues with various companies.

To obtain progress and fulfil the time plan in the project, NORGIT has borrowed the necessary hardware. This makes it possible for NORGIT to accomplish both the "Factory acceptance test" (FAT) and part of the "Site acceptance test" (SAT) in Norway. The installation can easily be compared with the basic ENSIS-system, which is an important task in quality assurance of the system. Installation and testing in Norway will also be more efficient since several people with different competence can combine other obligation with the installation and testing of ENSIS. Installation and testing done by different people are also important tasks in quality assurance of the system.

2.7.2 Configuration and training in Norway

Configuration and testing in Norway is the basis for the existing project plan and budget. Installation in China would have enhanced the project costs considerably and new allocations for this activity would be needed. The project plan would also had to be revised according to the extra time and costs consumption.

Education and training of Chinese experts is planned to take place in Norway. When the training can be carried out using Chinese hard-/software, the quality will increase. It is easier for the users to start using "ENSIS" in China when they already are familiar with part of their own system from training in Norway.

The education and training were planned to take place in Norway in August 1998. Instead the training was postponed to January 1999 due to the delay in the delivery of the computers.

In 1998 NIVA used a lot of time to configure the ENSIS database to Chinese contions and to enter the data received from the Chinese partners.

2.7.3 Adjustment of "ENSIS version-2.0" to Chinese conditions

The ENSIS-data model had to be modified to satisfy the Chinese requirements. The analysed data from the Chemical Laboratory had to be entered into the system through a Manual Data Acquisition System (MDACS). This application makes it possible for the user to record data manually. The examples from laboratory data have been used to modify the MDACS according to H/EPBs requirements. In co-operation with NIVA and NILU, NORGIT has finished the ENSIS 2.0 system. The work has focused on the development of the main module and some technical co-ordination of the model work.

2.7.4 Data handling

In the ENSIS database the following themes have been entered:

- ✓ Administrative Regions
- ✓ Monitoring Stations
- ✓ Rivers (river nodes, river links and river chains)
- ✓ Lakes
- ✓ Roads (road nodes, road links)
- ✓ Stacks

Furthermore, the original maps NIVA got from H/EPB, have been applied to create the following shapes:

- ✓ Land Use (agricultural area, mountain area and forest)
- ✓ User interests (points for irrigation and groundwater abstraction)
- ✓ Coastal area

During the planned Workshop and visit to Harbin in April 1999, further work on these issues will be performed.

3. Revised Summary Work Plan

The project plan is described in detail in the Project Proposal: "Surveillance of Water Quality in the Songhuajiang River System in the Heilongjiang Province, P.R. of China", dated January 1996. Based on the plans for the different tasks on surveillance of water quality and development of the information technology, the project work is delayed from six months to almost two years. The installation of monitoring instruments for water quality is almost two years delayed, but intensive work will be performed during spring 1999 to minimise the potentialproblems due to this delay.

3.1 Phase 1 (November 1996–March 1997)

Phase 1 has been carried out according to plans. The following tasks were completed during the first phase of the project:

1. Project start-up seminar in Harbin
2. Detailed planning and preparations for the water monitoring and surveillance programme
3. Planning of the discharge data base, the basis of the pre-feasibility study
4. Start of discharge data inventory
5. Collection of other relevant available information on water quality
6. Evaluate existing monitoring network
7. Institutional assessment, man power, infrastructures, equipment
8. Evaluation of laboratory equipment
9. Data model adaptation

All activities were completed as planned during phase 1, and by the end of the first phase, preparations for phase 2 were performed.

3.2 Phase 2 (April 1997–May 1999)

Phase 2 was planned as a continuation of activities from phase 1, with the addition of new activities as shown below. Phase 2 project work is delayed from six months to almost two years compared to the original plan. The following tasks are planned for phase 2:

1. Start sampling and continuos monitoring at the river stations
    a. system for automatic sampling, analysis and data handling
    b. system for manual sampling, analysis and data handling
    c. quality control
2. Installation of 1 server and 2 workstations
3. Make the telecommunication operative
4. First data for the river model for the Songhuajiang River system systematised and main discharge points located
5. Visit of the Chinese delegation in Norway (4 key operators and 2 key administrative staff)
6. Local training in:
    a. operation and maintenance of monitoring instruments
    b. maintenance of computer system
    c. system operation
7. Evaluation of the existing monitoring system, considering a possible need for extensions
8. Abatement strategy planning, 1st step

A workshop was held in Harbin 23. – 26. March 1998, covering the following issues; Data collection, Biological monitoring, Water Quality Instrument list, Quality assurance procedures, Laboratory Inter-comparison and Future co-operation.

A Workshop for training on the first version of the ENSIS system was planned to take place in Norway in autumn 1998. Due to late arrival of computers and the delay in installations of water monitors, the training Workshop was held in Oslo in January 1999.

In March 1999, the first version of the ENSIS system will be installed in Harbin, Heilongjiang One more workshop will be organised at the end of Phase 2, in April 1999, in order to further familiarize H/EPB with the ENSIS procedures.

The workshop will include:

- Local training and presentation of the ENSIS system
- Abatement strategy discussions
- Description of the water model
- Preparation of status reports
- Revised planning for phase 3

3.3 Phase 3 (June 1999–June 2000)

Phase three contains mainly improvements and finalisation of the tasks described in phase 2. A full version of the integrated ENSIS system, containing measurements, quality control, model, statistics and GIS presentations will be installed and adapted to the local environment. A final training will be performed in Harbin in the year 2000 to ensure that the system is fully understood and learned by local personnel.

The following tasks are preliminary listed for phase 3:

1. Make the model operational
2. Installation of a full ENSIS in the Heilongjiang Province
3. Train Chinese staff in the Heilongjiang Province to operate the whole water system
4. Make plans for extensions of the water monitoring and surveillance programme
5. Plan an integrated strategy for optimal water pollution abatement in the Song Hua Jiang River System

In addition to work performed by ENSIS personnel in Heilongjiang, a final workshop will be organised containing:

- Presentation of the ENSIS surveillance system
- Discussion on needs for local personnel for further operating and maintenance of the monitoring and data system
- Discussion of further needs for collaboration
- Preparations of the content of the final report, distribution of responsibilities

The final report should be finalised and sent to NORAD no later than three months after the final workshop.

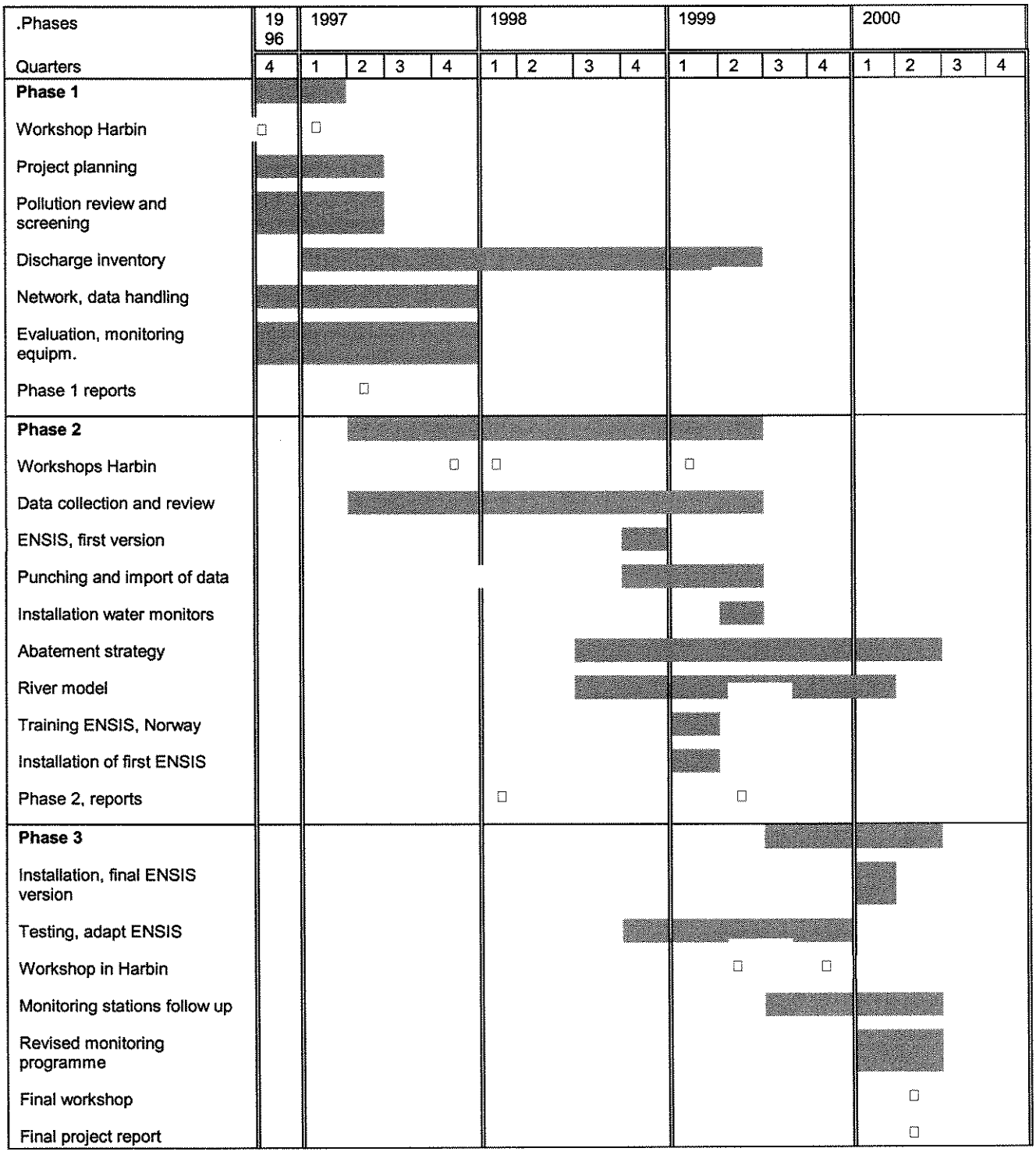
3.4 Activity plan for 1999

The 1999 activities are summarised in the table below.

Activity	Date
Training in Norway	January 18 – 27, 1999
Adaptation and testing of the Chinese version of ENSIS in Norway	February 1 – 15, 1999
Installation of the first Chinese version of ENSIS in Harbin	March 1999
Delivery of agreed data (Industry, Waste water treatment etc.) from Chinese side	March 15., 1999
Workshop in Harbin • Project status • Training in the use of ENSIS • Description of the water model • Abatement strategy planning Revised planning for phase 3	April 11 – 16, 1999
Installation of, and training on, water quality instruments	April 11 – 24, 1999
Project meeting • Work on the ENSIS system • Abatement Stratgy Planning	June 1999
Workshop in Harbin • Project status • Abatement Strategy Planning	October 1999

3.5 Revised Summary Time Schedule

The plans for the total project will then be as given in the following table.



4. Project costs and budget

4.1 General overview

The total budget for the project, which also was the budget for the Norwegian side, was in the original Project Plan **NOK 11.590.007.** (See Annex II in the Agreement between NORAD and SSTC signed Nov. 8. 1996). The project budget was divided into three phases:

Project Phases	**Period**	**Costs**
Phase 1	(November 1996 – March 1997)	NOK 1.500.000.
Phase 2	(April 1997 – September 1998)	NOK 8.244.007.
Phase 3	(October 1998 – September 1999).	NOK 1.551.000
Project expenses		NOK 295.000
Total		**NOK 11.590.007**

Phase 1 was carried through according to plans, and the costs spent were **NOK 1.500.102.** After the Annual Meeting between MOST (MSTC/SSTC) and NORAD in 1997 the Project was changed, as the air part was removed from the plans. This change was followed by discussions of the belonging budget allocations.

In 1997 it was agreed between NORAD and MOST that the Chinese side should purchase data equipment and water monitors for the project. It was later also agreed that installation of the ENSIS system should be performed in Norway due to practicle reasons. An agreed budget for Phase 2 showing in detail the allocations between the H/EPB and NIVA was signed in June 1997 (Appendix A). After elimination of a fee to SSTC of NOK 250.000, not acceptable for NORAD, this budget includes an allocation of **NOK 4.829.800 to the Chinese side** and **NOK 3.132.000 to the Norwegian side** within phase 2. Of this allocation a total amount of **NOK 4.600.000,-** was transferred directly to China in 1997, leaving NOK 229.800 from the pase 2 budget to be transferred at a later stage. There was no transfer of money to Chinese side in 1998.

The total remuneration to the Norwegian experts in phase 2 in 1998 will be **NOK 775.751.** A budget overview is given in Appendix A.

- The budget signed by H/EPB and NIVA in June 1997, after reallocation of the funds for the air part of the project
- A note prepared by NIVA July 3rd and September 3rd 1998, including the budgets prepared by H/EPB and NIVA

4.2 Project Cost in 1998

Phase 2 (planned for April 1997–December 1998) will run from April 1997 until June 1999 due to the delay in the project work. The installation of the water quality monitoring instruments was planned for summer season 1997 but will be accomplished during spring

1999. A general feature as regards this project is that the administration activities have been considerably more time consuming than originally predicted. This is due to project reorganising and budget revisions e.g. removal of the air monitoring part of the project.

During 1998 there was no agreed project budget for the total project work. The Norwegian side made a note on this, based on signed budget from 1997. This note is shown in Annex A. According to the note, the 1998 reduced Norwegian budget, as agreed by the Chinese side, was as follows:

Table 1. Reduced Norwegian budget (see Annex A) and actual project costs for phase 2, 1998. All amount are given in NOK.

No	Activity	*Budget Phase 2 for 1998*		*Costs Phase 2 for 1998*	
1	**Administration**	**535 797**		**227 740**	
1.1	Consulting services		344 007		179 935
1.2	Travelling expenses		191 790		47 805
1.3	Final report				
2	**River Water Quality**	**52 129**		**24 050**	
3	**Inventory**	**55 541**		**14 950**	
4	**Monitoring**	**406 540**		**42 720**	
4.1	Consulting services		406 540		42 720
4.2	Transport of instruments				
5	**River Modelling**	**120 000**		**1 950**	
6	**Abatement strategy**	**301 742**		**29 768**	
7	**ENSIS application**	**86 653**		**86 653**	
8	**Software**	**385 000**		**347 920**	
9	**IT consultancy**	**57 013**			
	Total	**2 000 415**		**775 751**	

Of the total amount of **NOK 775 751,** an amount of **NOK 83 623** was spent in the fourth. quarter of 1998.

4.3 Project Budget for 1999

NOK 250.000 from phase 2 budget is not allocated, and it is suggested from the Norwegian side to grant NOK 200.000 for the Chinese side for extra instruments (to be discussed with NIVA) and NOK 50.000 to the Norwegian side to partly cover the rental fee for IT equipment. The rental fee for IT equipment became necessary after the decision was taken to buy IT equipment in China. It would then not be available in Norway for development of the Chinese version of ENSIS, as originally planned. The resulting phase 2 budget for the Norwegian side for 1999 will then be **NOK 1 274 664**.

Table 2. Transfer of phase 2 budget to 1999. All amount are given in NOK

Nr	Taskt	*Phase 2* For 1999	
1	**Administration**	**308 057**	
1.1	Consulting services		164 072
1.2	Travelling expenses		143 985
2	**River Water Quality**	**28 079**	
3	**Inventory**	**40 591**	
4	**Monitoring**	**363 820**	
4.1	Consulting services and installation		363 820
5	**River Modeling**	**118 050**	
6	**Abatement strategy**	**271 974**	
7	**ENSIS application**		
8	**Software and IT rental fee**	**87 080**	
9	**IT consultancy**	**57 013**	
	Totalt	**1 274 664**	

The phase 3 budget for 1999 will be **NOK 640 000**, and for the year 2000 **NOK 851 000**. More details for the part of the project planned for 2000 will be discussed during 1999. Due to the general delay in the project work and an extension of the running project time, possible supplementary allocation may be necessary for the year 2000.

Table 3. Phase 3 activities in 1999. Phase 3 budget is reduces with NOK 60.000 on Norwegian side and allocated to Chinese side to arrange a Workshop in Harbin

Nr	Taskt	*Phase 3* For 1999	
1	**Administration**	**220 000**	
1.1	Consulting services		120 000
1.2	Travelling expenses		100 000
2	**Data management**	**40 000**	
3	**IT Consultancy**	**220 000**	
3.1	Verification of solution telecommunications		15 000
3.2	Design		25 000
3.3	Implementation of use of manual data		30 000
3.4	Implementation of River Model		100 000
4	**Monitoring**	**60 000**	
	Consulting service and training		60 000
5	**Installation**	**50 000**	
6	**Abatement strategy plan**	**50 000**	
9	**Configuration and Test**	**30 000**	
10	**Intercalibration** including specific report	**20 000**	
	Totalt	**640 000**	

The total project budget for 1999 for CHN 017 for the Norwegian side is **NOK 1 914 664**, and the details of the budget are shown in table 4 below.

Table 4 Total project budget for Norwegian side for 1999 (summary of phase 2 and 3 budgets).

Task	Budget 1999	
Administration	**528 057**	
Consulting services		284 072
Travelling expenses		243 985
Intercalibration	**20 000**	
River Water Quality	**28 079**	
Inventory	**40 591**	
Monitoring	**423 820**	
Consulting services and training	**423 820**	
River Modeling	**218 050**	
Abatement strategy	**321 974**	
Software and IT rental fee	**87 080**	
Data management	**40 000**	
Installation	**50 000**	
Configuration and test	**30 000**	
IT consultancy	**127 013**	
Totalt	**1 914 664**	

Appendix A.

- A note prepared by NIVA July 3rd and September 3rd 1998, including the budgets prepared by H/EPB and NIVA
- The budget signed by H/EPB and NIVA in June 1997, after reallocation of the funds for the air part of the project

NOTE

3. juli 1998

To: Mr. Guo Yuan

From: Bente M. Wathne

Copy: NORAD v/Tori Tveit, Mr. Luo Delong, HTH, ARV, KDA, THB, SAB, NRS

Subject: Budget for Surveillance of WaterQuality in the Songhua River System in Heilongjiang Province P.R. of China, CHN 017, for phase 2 1998

General comments
First of all I am very happy to hear that the instruments will be delivered in September this year. This information I will pass on at once to Mr. Arne Veidel, who will be responsible for the installation from Norwegian side.

The second task is commissioning of the budget for 1998, which is an urgent matter. NORAD needs an agreed total budget as soon as possible, where the means used in 1997, including audited statement of accounts from Chinese side are shown. The balancing budget will be the possible budget for 1998.

I have spoken to NORAD on the phone today, and have their full support on the statement that the signed budget from June 1997 was a total solution for both sides, and must be the basis for the budget agreement for 1998.

There is not much time to discuss changes, and we face the fact that if we cannot agree within short time, NORAD may rather withdraw the disputable budget parts and expect a disposal of that amount to other projects.

The total budget for Chinese side in the signed budget from June 1997 was NOK 5.079.800 including the fee of NOK 250.000 for MSTC. NORAD did not accept the MSTC fee, which gives a resulting sum of NOK 4.829.800 to the Chinese side. This leaves the following:

Budget for Chinses side for phase 2	NOK 4.829.800
Transferred in 1997 from NORAD	NOK 4.600.000
Original rest to 1998 budget for phase 2	**NOK 229.800**

To reallocate the NOK 250.000 put up for MSTC, we suggest to use NOK 200.000 for instruments bought by Chinese side and NOK 50.000 for transport and unforeseen expenses handled by Norwegian side. This means you have a total of NOK 429.000 for the 1998 budget in addition to the reallocated means from the 1997 budget. The reallocated means will be money which you have not spent in 1997. That amount is unknown to me. After reallocation of NOK 200.000 we have the following:

Total rest to Chinese 1998 budget for phase 2	**NOK 429.800**

In your budget for 1998 you have put up a total amount of NOK 1.020.000 for Chinese side. This is only possible if you reallocate from your 1997 budget an amount (NOK 590.200 – NOK 60.000) which is the difference between the total rest for your 1998 budget for phase 2 and the NOK 4.6 mill. allocated in 1997. (The minus NOK 60.000 is for the Workshop on Abatement strategy where we have reallocated money from phase 3. But as I mentioned in my last mail, with all the delays we are facing it will be necessary to postpone the Workshop to next year. Then also the budget for phase 3 will balance.)

Comments to the budget in your fax

1. It is not possible for me to sign the budget because I have no information on the total budget for the Chinese side.

2. The Norwegian part of the budget we suggest to keep the way it is given below:

Nr	Task	Phase 1998
1	**Administration**	
1.1	Consulting services	344 007
1.2	Travelling expenses	191 790
1.3	Final report	
2	**River Water Quality**	52 129
3	**Inventory**	55 541
4	**Monitoring**	
4.1	Consulting services	406 540
4.2	Transport of intruments	50 000
5	**River Modeling**	120 000
6	**Abatement strategy**	301 742
7	**ENSIS application**	86 653
8	**Software**	385 000
9	**IT consultancy**	57 013
	Total	**2 050 415**

3. The total amount for Chinese side will depend on the reallocated means from 1997. (It will be NOK 429.000 + reallocated means from 1997)

4. The Harbin Workshop on Abatement Strategy will have to be postponed to 1999, and belong also to the phase 3 budget. Remove from the 1998 budget.

5. The final report is defined in the project proposal as the report to be prepared by NIVA by the end of the project. This report belongs to the phase 3 budget. Remove from the 1998 budget.

I hope you can prepare your budget for 1998 for NORAD within short time. As I mentioned, I have informed NORAD that we are working on the budget, and hope to send them the resulting project budget within short time.

Yours truly

Bente M Wathne

Revised Budget for Surveillance of Water Quality in the Songhua River System in Heilongjiang Province P.R. of China, CHN 017, for phase 2 1998

In a note from NIVA dated 3. July 1998, a budget for the above mentioned project for phase 2 1998 was presented. An e-mail sent July 19. 1998 from our Chinese project leader Mr. Guo Yuan, confirmed that all budget posts were accepted, apart from post 4.2 where NOK 50.000 was allocated to the Norwegian side for "Transport of instruments and unforeseen expenses". Reallocation of NOK 200.000 to Chinese side was agreed. The following revised budget is based on the budget in the note from July 3rd. The only alteration is the removal of NOK 50.000 (from budget post 4.2), which may be postponed to the 1999 budget. The resulting budget should therefor represent an agreed version from both Chinese and Norwegian side.

Budget for Chinese side for phase 2	NOK 4.829.800
Transferred in 1997 from NORAD	NOK 4.600.000
Original rest to 1998 budget for phase 2	**NOK 229.800**

After reallocation of NOK 200.000 we have the following:

Total rest to Chinese 1998 budget for phase 2 **NOK 429.800**

The amount will i.a. cover the Chinese visit to Norway for training and exchange of knowledge between the project partners.

The Norwegian part of the budget will be as given below:

Nr	Task	Phase 1998
1	**Administration**	
1.1	Consulting services	344 007
1.2	Travelling expenses	191 790
1.3	Final report	
2	**River Water Quality**	52 129
3	**Inventory**	55 541
4	**Monitoring**	
4.1	Consulting services	406 540
5	**River Modeling**	120 000
6	**Abatement strategy**	301 742
7	**ENSIS application**	86 653
8	**Software**	385 000
9	**IT consultancy**	57 013
	Total	**2 000 415**

Bente M. Wathne NIVA 3.09.98

Head of Research Department

03-JUL-98 10:29 GUO YUAN 86 451 2331019 P.01

Facsimile

To : Mrs. Bente.Wathne
NIVA
Fax : + 47 22 18 52 00
From: Guo Yuan
H/EPB
Fax : + 86 451 233 1019
Date : July 3,1998 **Pages: 3**

Dear Mrs. Wathne,

I have been trying to answer your last email by email, but there seems to be an unrecoverable error. So always it was sent back. Now it is attached with this fax.

Thank you for your latest email about the instruments. The procurement has been in the process, the instruments will be arriving in China around the beginning of September,1998, if everything goes well.

I hope that you will have a pleasant summer holiday!

Best regards,

Guo Yuan

Sino-Norway Cooperative Project

Surveillance of Water Quality in the Songhuajiang River System in Heilongjiang Province, P.R.China

Budget for 1998, Phase II

Currency:NOK

Nr.	Activity	NIVA	H/EPB
1	Administration		
1.1	Consulting services	344,007	
1.2	Travelling expenses	191,790	
1.3	Final Report		
2	River Water Quality	52,129	
3	Inventory of Discharge	55,541	
4	Monitoring		
4.1	Consulting services	406,540	
5	River Modeling	120,000	
6	Pollution Abatement Strategy	301,742	
7	ENSIS application	86,653	
8	Software	385,000	
9	IT consultancy	57,013	
10	Chinese experts for training in Norway		200,000
11	Local expenses in China for arranging Norwegian visits		50,000
12	Transport for instruments in China		20,000
13	MC		440,000
14	2 YSI 6820 multi-monitors for water quality		200,000
15	Harbin Workshop on Abatement Strategy		60,000
16	Final report		50,000
Subtotal		**2,000,415**	**1,020,000**
Total		**3,020,415**	

Environmental Protection Bureau of Heilongjiang Province

Guo Yuan

Date: July 2,1998

Norwegian Institute for Water Research

Bente.Wathne

Date: July 2, 1998

Nr	Activity	Total PHASE 2		1997	1998	NIVA	HEPB
1	**Norwegian expenses in the technical aid and travelling**	**2257000**		**1263500**	**993500**	2257000	
2	**ENSIS**	**955000**		955000			
2.1	Hardware		570000				570000
2.2	Software		385000			385000	
3	**Monitoring equipment for the Songhua River System**	**3239800**		3239800			3239800
3.1	5 complete instrumentation packages		1495000				
3.2	5 dataloggers		120000				
3.3	5 filters		84000				
3.4	2 pumps 6 kg. 30 l/min		23000				
3.5	8 pumps 1.5 kg. 20 l/min		42000				
3.6	1000 m electrical cables		27000				
3.7	1000 m rubber tubing 25m/34m		35800				
3.8	12 water taps		7000				
3.9	5 batteries with charger and converter		53000				
3.10	5 compressors with tube		15000				
3.11	Fittings		15000				
3.12	2 water level sensors 0-10 m		13000				
3.13	Trailer		250000				
3.14	ISCO sampler		50000				
3.15	Spare parts		37000				
3.16	Atomic Absorption Chromaphotometer		700000				
3.17	Ion Chromatograph		253000				
3.18	Mobile telephone		20000				
4	**Norwegian travel expenses, two annual consultation meeti**	**60000**		30000	30000	60000	
5	**Funds for Chinese experts for training in Norway**	**200000**			200000		200000
6	**Local expenses in China for arranging Norwegian visits**	**100000**		50000	50000		100000
7	**Supplementary funds for purchasing data necessary for th**	**300000**		300000			300000
7.1	Hydrological data and						
	Data for industrial discharge/ emissions						
7.2	Statistical population data						
7.3	Digitalised maps						
7.4	Forestry, grassland, runoff						

7.5	Monitoring avtivities						
7.6	Local use of pesticides and fertilizer						
7.7	Local agricultural land use						
8	**Supplementary investigations**	**320000**		300000	20000		320000
8.1	3 boats		180000				
8.2	2 ISCO samplers		100000				
8.3	Operation of samplers		40000				
9	**Funds for long range communication**	**100000**		100000			100000
10	**Abatement strategy, 1st step**	**430000**		230000	200000	430000	
11	**Administration fee to the SSTC**	**250000**		250000			250000
	TOTAL	**8211800**		**6718300**	1493500	**3132000**	**5079800**
	The Project partners have agreed that the amount of NOK 60.000 from the phase 3 budget should be allocated to the organisation of an abatement strategy workshop in Harbin at the end of the year 1998						

Appendix B.

PROJECT MEETING IN HARBIN 23-26 MARCH 1998

SUMMARY REPORT

Participation

HEPB

Mr. Li Weixiang
Mr. Guo Yuan
Mr. Li Xiangju
Ms. Chen Aifeng
Mr. Chen Jiahou
Mr. Dong Xianfeng
Ms. Wu Yuehui

NIVA

Mr Haakon Thaulow (only the first day)
Mr Stig A. Borgvang
Mr Håvard Hovind

Agenda item 1: Opening
Mr Li Weixiang opened the project meeting and welcomed the Norwegian visitors to Harbin.

Agenda item 2: Purchase of Instruments

HEPB and NIVA agreed on the Water Quality Instrumentation Package during NIVA's mission to Harbin 26 February- 3 March 1997 (see Annex 3 of Summary Report from the Project Meeting in Harbin 26 February-3 March 1997). The purchase procedure was started after the meeting between SSTC and NORAD 4-5 March 1997. During the present NIVA mission in Harbin, HEPB explained to NIVA that more detailed information was required on some items outlined in the signed budget of 22 June 1997. After discussion, Mr. Thaulow, Director of NIVA, and Mr.Guo, Chinese project leader, signed the Memo (see Annex 1). This Memo will be presented to the French supplier of the instruments, who will send the required information to HEPB as soon as possible.

NIVA expressed the wish that the next steps in the instrumentation procedure took place as swiftly as possible as both NIVA and HEPB had considered that the installation should take place in second half

of May 1998 (see Summary Report from the Project Meeting in Harbin 25-29 November 1997). HEPB explained that as soon as they had the information needed, the next steps would be taken, i.e. contact with the Chinese export-import company with which SSTC and HEPB would need to sign a contract and which will carry out the further steps in the instrument purchasing procedure.

Because of the above mentioned, HEPB and NIVA could not fix a new date for the installation of the instruments.

Agenda item 3: Outstanding issues as regards the budget for phase 2

HEPB reviewed the budget for phase 2, which had been discussed in the project meeting in Harbin in November 1997 and referred to in the Summary Report from the Project Meeting in Harbin 25-29 November 1997. HEPB stressed that, in their view, both budget provisions, 430000 NOK of fund originally allocated for air monitoring and 250000 NOK of administration fee, should be used to enhance the water quality monitoring capacity of the Heilongjiang province and mainly be used for purchase of monitoring equipment.

NIVA recalled that SSTC had not accepted the phase 2 budget provisions related to Abatement Strategy (430 000 NOK) in the budget for 1998, although it had been signed by HEPB and NIVA in Oslo in June 1997. The reason for SSTC's refusal to accept the budget provisions for the Abatement Strategy part (430 000 NOK) of the budget for 1998 was that, in SSTC's view, that amount of the original budget was originally allocated to air monitoring, and should therefore not be used for technical aid purposes. SSTC held the view that the above mentioned funds should be used to improve the water quality monitoring capacity of the Heilongjiang province. HEPB had agreed with the comments from SSTC on this issue.

NIVA had expressed the view that a successful development of the abatement strategy would be enhanced considerably by increasing the resources allocated for this task, see the agreed budget between HEPB and NIVA and the comments related to the development of an Abatement Strategy in the Summary Report from the Project Meeting in Harbin 25-29 November 1997.

HEPB and NIVA agreed to communicate all the above mentioned comments concerning the 1998 budget to SSTC and NORAD for further consideration.

Agenda item 4: Data collection and information of water flow

- HEPB agreed to provide NIVA, by 1 July 1998, with water flow data for 1995 of monthly average from four sampling sites, namely Qiqihaer city, Harbin city, Mudanjiang city, Jiamusi city , and monthly average water flow data for the period 1985-1995 from the main stream of the Songhua River at about 10 sampling sites. Furthermore HEPB undertook to investigate the possibility of providing water flow data for the second Songhujiang.

- Further to a request from NIVA to obtain water quality data for 1996 and 1997, HEPB explained that this was impossible to comply with due to Chinese regulations. However, as the project progresses, this situation may change.
- HEPB explained that due to Chinese regulations, only a map of scale one to one million could be provided for the project, as decided by SSTC in March 1997. HEPB also takes the view that this scale of map is sufficient for the present project.
- HEPB provided NIVA with information about Forest and Grassland in the Catchment of the Songhua River System (see Annex 2).

Agenda item 5: Intercomparison Exercise

The principal of performing an intercomparison exercise was discussed. It was pointed out that this could be a valuable addition to a project involving two different countries with different history and culture. It is a very important asset to be able to benefit from the knowledge and experience of the other party. One aspect of this possible mutual share of experience and knowledge is the exchange of information about analytical methods and the comparability of the results produced by applying these methods. In order to be able to achieve such an exchange, it is necessary to have relevant procedures of comparing the said results.

HEPB and NIVA agreed to carry out a "mini-intercomparison exercise" in 1998. The exercise may also involve some of the other projects NIVA has in China, such as the YanTai project. Pending the results of this year's intercomparison exercise, both NIVA and HEPB will contact NORAD concerning a comprehensive exercise in 1999.

As there are no budget provisions for such an exercise in 1998, it will be funded by NIVA as regards the preparations and reporting of the results.

HEPB and NIVA agreed that the following analytical parameters should be included in 'the mini-intercomparison exercise': Total phosphorous, nitrate, ammonium, nitrogen, pH and chemical oxygen demand ($COD\text{-}_{Mn}$). NIVA supplied four samples, preserved with mercury chloride and also supplied information about the concentration levels.

HEPB undertook to send the results to NIVA by 15 June 1998, together with information about the analytical methods used.

NIVA undertook to compile the results submitted and to send, by 1 July 1998, a draft report to the participants for comments and amendments by 1 August 1998. NIVA will finalise the report with the comments from the co-operating laboratories within 15 August 1998 and send the final report to the participating laboratories. NIVA ensured HEPB that the results of the 'mini-intercomparison exercise' would only be known to co-operating partners..

HEPB and NIVA agreed that the participating laboratories would be referred to in the report with a code.

Agenda Item 6: Invoices

HEPB explained that according to Chinese financial regulations the invoice should be much more explicit in order to show all details. NIVA explained that the invoice had been developed according to normal NORAD requirements.

NIVA invited HEPB to inform about their requirements. HEPB explained that the invoices should include transport expenses, accommodation expenses and 'activities'. The activities should include information about each person working on the project, time spent, type of activity, results, and the price.

Harbin 26 March 1998

For NIVA

Mr Stig A.Borgvang

For HEPB

Mr Guo Yuan

Appendix C.

Report on the preliminary intercomparison of chemical analyses, 1998, between Harbin, Yantai and Norway (NIVA)

Håvard Hovind, Norwegian Institute for Water Research, Oslo, Norway

1. General

1.1. Introduction

NIVA considers that in projects involving two different countries with different history and culture, it is a very important asset to be able to benefit from the knowledge and experience of the other party. One aspect of this possible mutual share of experience and knowledge is, in NIVA's view, the exchange of information about analytical methods and the comparability of the results produced by applying these methods. In order to be able to achieve such an exchange, it is necessary to have relevant procedures of comparing the said results.

Through years of experience with the organisation and evaluation of intercomparisons, NIVA has learned that different laboratories very often use different analytical methods, or use different versions of the same analytical method for chemical analysis of water samples (as well as sediments and biological materials). There may be different reasons for the laboratories' choice of analytical method, but once a method works on a routine basis, our experience is that there is reluctance to change the method.

All analysts working with chemical methods know that different methods or different versions of methods, may lead to different analytical results. Therefore, by comparison of chemical data from several laboratories, it is very important to have a documentation of the comparability between laboratories. One way to obtain such documentation of the comparability between two or more laboratories in a simple way, is to perform parallel analysis or intercomparison tests.

Intercomparisons of analytical methods are easily carried out by analysing sample aliquots taken from the same sample and sent to all the participating laboratories. If only two laboratories are involved in the comparison, it is usually called parallel analysis. The best way to select samples is to take a series of samples from the water bodies in the monitoring area. Therefore, such a set of samples should be sent to the laboratories involved in the intercomparison test. However, if this is difficult to organise, samples may, as an alternative, be sent from the organising laboratory, which endeavours to select samples being comparable with the samples in the relevant water bodies.

1.2. Intercomparison of analytical methods

The analytical variables to be determined in the intercomparison should be the same as the ones included in the monitoring programme. There are two different ways to handle the results. For water samples, the most commonly used method is to produce one analytical result for each variable in each sample. For sediments and biological materials, very often three or more aliquots of each sample are analysed.

2. Current Project

2.1 Background

As an introduction to a comprehensive intercomparison exercise in the future for the analytical programmes connected to the NORAD projects in China, the NIVA laboratory together with laboratories in Harbin and Yantai, performed a preliminary intercomparison exercise in 1998. The results of this intercomparison will be a good basis for the proposed 1999 exercise. The 1998 intercomparison exercise was partly funded by NIVA.

2.2. Preparation of samples

Stock solutions were prepared by weighing exact quantities of stoichiometric compounds into volumetric flasks, dissolving the compounds and diluting to the mark. Given volumes of these stock solutions were pipetted into 5 litre volumetric flasks and diluted to the mark with deionised water. The concentration of these synthetic samples were calculated from the weighed amount of compound and the dilution factors. These "true values" are given in the tables on the following pages, together with the results received from the participating laboratories. The samples were delivered at the laboratories during the visit to China in March 1998.

2.3. Treatment of data

The analytical results were sent to NIVA, which recorded all the results into the computer for statistical calculations. For water samples where only one result is reported for each variable and sample, and three or more laboratories are participating, it is normal to calculate the median value, the arithmetic mean and the standard deviation between the laboratories. As the exact true value of the natural samples used for this intercomparison are not known, it is suggested that the median value is used as basis for the comparability tests, as this value is normally less affected by outliers than the mean value. However, in this case where only three laboratories are involved, this is not the case, and this problem needs to be discussed. When only three laboratories are compared, the differences between the laboratories are calculated, and so are the relative differences.

Some plots of the results have been made as bar diagrams where the analytical results of the participating laboratories are plotted along the y-axis, and the sample number along the x-axis.

The laboratories are represented by the columns marked series 1, 2 and 3, respectively. For some figures the series 4 is representing the calculated "true value". This visualises the comparability between the laboratories. When only three laboratories are compared, it is possible to prepare correlation plots between two and two laboratories. However, this type of plot is more valuable if several samples, with varying concentration of the determinant, have been analysed at the laboratories involved.

Some time after this compilation of data, a meeting should be organised for the participating laboratories to discuss the results and try to find explanations to the varying results. Criteria to be used for establishing acceptance limits for comparability should also be discussed.

2.4. Analytical results from the participating laboratories

The analytical results reported by the participating laboratories are compiled in the tables below, together with the calculated mean value, standard deviation, and the calculated "true value" of the synthetic samples. In cases where the results from one laboratory are deviating very much from the other two laboratories, the results from this laboratory are excluded from the calculation of the mean value. Results excluded are given in parentheses.

2.4.1. pH

There are slight differences between the three laboratories as regards reported pH values. The differences are within acceptable limits. It should also be noticed that the samples were analysed at rather different periods of the month at the three laboratories, and this different storage time may also have affected the pH determination.

Sample no.	**1**	**2**	**3**	**4**
Lab. No. 1	5,12	4,44	6,82	7,28
Lab. No. 2	5,09	4,45	6,74	7,22
Lab. No. 3	5,27	4,50	6,64	7,19
Mean value	5,16	4,46	6,73	7,23
Standard deviation	0,096	0,032	0,090	0,046
True value				

2.4.2. Total phosphorous, mg/l

For total phosphorous, theoretical true values for the four samples were calculated, and the results reported by the laboratories may be compared with these values. Laboratory number 2 has lower results than the two other laboratories. Two of the samples have low concentrations, being close to the detection limit of the method for at least one of the laboratories. In general,

the results of the two other laboratories are comparable and are also comparable to the "true value".

Sample no.	1	2	3	4
Lab. No. 1	0,016	0,041	0,221	0,178
Lab. No. 2	(<0,025)	(0,028)	(0,097)	(0,146)
Lab. No. 3	0,026	0,044	0,218	0,176
Mean value	0,020	0,043	0,220	0,177
Standard deviation	(0,007)	(0,002)	(0,002)	(0,001)
True value	0,027	0,044	0,222	0,177

2.4.3. Nitrate-nitrogen, mg/l

For this analytical variable, laboratory number 1 has reported too high values, both compared to the two other laboratories and to the "true values". Except for sample number 1, the other laboratories have comparable results for nitrate-nitrogen. More detailed information about the methods used for the determination at the different laboratories is necessary to find a reasonable explanation to the observed differences.

Sample no.	1	2	3	4
Lab. No. 1	(0,709)	(0,513)	(2,44)	(2,31)
Lab. No. 2	0,019	0,071	0,492	0,571
Lab. No. 3	0,049	0,075	0,475	0,570
Mean value	0,034	0,069	0,484	0,571
Standard deviation	(0,021)	(0,003)	(0,012)	(0,001)
True value	0,049	0,069	0,490	0,588

2.3.4. Ammonium-nitrogen, mg/l

For this analytical variable, the results differ much more. Compared to the calculated "true value", the reported results are nearly always higher, and it is NIVA's experience that contamination may represent a severe problem for ammonium determination, especially in the very low concentration range.

Sample no.	1	2	3	4
Lab. No. 1	0,028	(< 0,025)	0,126	0,158
Lab. No. 2	(< 0,025)	0,079	0,148	0,136
Lab. No. 3	0,054	0,047	0,128	0,156
Mean value	0,037	0,050	0,134	0,150
Standard deviation	(0,018)	(0,023)	0,012	0,012
True value	0,022	0,031	0,106	0,132

2.4.5. Chemical oxygen demand, COD-Mn

Sample no.	1	2	3	4
Lab. No. 1	1,12	1,01	1,35	1,42
Lab. No. 2	0,80	0,65	0,98	1,41
Lab. No. 3	0,5	0,5	1,0	0,5
Mean value	0,81	0,72	1,11	1,11
Standard deviation	0,31	0,26	0,21	0,53
True value	-	-	-	-

It appears as if the permanganate oxidation is performed under rather different conditions at the three laboratories, as the results are varying considerably. A complicating factor is the fact that the concentrations are very low. The addition of potassium phthalate as a carbon source was discussed during NIVA's visit to China in March 1998, and it was agreed that this compound might represent some problems as it is not completely digested during the oxidation process. A mixture with glucose, for instance, would probably be more suitable for synthetic samples in the future.

2.4.6. Total organic carbon, mg/l

Measured	3,5	2,0	9,9	8,2
Calculated	3,2	1,9	9,7	7,7

As an independent control of the content of organic carbon in the prepared samples, NIVA determined the concentration of total organic carbon in the four samples, based on a catalytic combustion at 680 °C, and with NDIR detector. The measured content of total organic carbon was comparable to the calculated values.

3. Future line of action

The participating laboratories were asked to comment on the first version of the report. To date, no comments have been received. Therefore this report was finalised, as suggested, in accordance to the plan.

The first follow up step should be an evaluation meeting between representatives of the three laboratories involved, to discuss the results. In order to find possible explanations to the discrepancies between some of the results, it is necessary to have a detailed description of the analytical methods used at each of the participating laboratories.

On the basis of the conclusion drawn after the explanations have been found, it would be very useful to carry out a more comprehensive intercomparison, including all the major components, such as conductivity, alkalinity, chloride, sulphate, calcium, magnesium, sodium, potassium, and possibly some metals such as iron, aluminium, manganese, lead, copper, zinc, cadmium, mercury. The samples should cover a wider range of concentrations, because this gives better information about the reasons for observed differences, and because the water quality of the water bodies in the monitoring programme may vary considerably.

In this context, NIVA proposed in March 1998, as an input to the annual report 1997, to perform an Intercomparison Exercise in 1999, involving the Chinese partners in Harbin and Yantai, in addition to other laboratories involved in NIVA work in China (see also Annex). The results of such an Intercomparison Exercise would enable a much better analysis of the data currently available for the said projects, and facilitate the further progress of the projects. NIVA has several years of experience in organising such Intercomparison Exercises both nationally and internationally, and has drawn valuable knowledge from these activities. NIVA would therefore be prepared to organise the outlined intercomparison.

Appendix D.

List of Line of Business

This is the list of lines of business the industries should be defined from. NIVA strongly encourages you to define industries on the lowest level (Line of business (child)). This will make search for data much more efficient.

Parent Line of Business	**Line of Business (child)**
Industry	Metal Plating and Surface Finishing
Industry	Iron and Steel
Industry	Smelting
Industry	Aluminium
Industry	Constructuction and demolition
Industry	Electric Utilities/Electric circuit Industries
Industry	Petrolium Exploration and Refining
Industry	Pharmaceuticals
Industry	Photholaboratories and x-ray laboratories
Industry	Graphic Industry-Printing Houses
Industry	Mechanical workshops
Industry	Chemical Laboratories
Industry	Gas stations
Industry	Mining
Industry	Mineral
Industry	Pulp and Paper
Industry	Food processing
Industry	Textile Industry
Industry	Tannery
Service Industry	Tourism
Service Industry	Restaurants
Institutions and households	Schools
Institutions and households	Medical and Health Care
Institutions and households	Households

Appendix E.

Data requirements industry

The table lists the required data related to industrial activities, needed by March 15. The data will be imported into ENSIS and be the first step towards the development of an abatement strategy. NIVA would strongly prefer to receive the data in an Excel file on the format shown below.

Data name	ID of Industry	Name of industry (1)	Administrative region	Main product	Volume of main product	Line of Business (2)	Name of discharge pipe (3)
Example		Yanatai Metal Plating Factory	Fushan	Galvanised metal plates	500 tonnes each year	Metal plating	Yantai Metal Plating Factory Discharge Pipe_1
							Yantai Metal Plating Factory Discharge Pipe_2

Data name	Eastern coordinate (4)	Northern coordinate (4)	Height above sea	Discharge depth (5)	The discharge pipe discharges to (6):	Measured parameters at outlet (7)	Included in NILU list (8)
Example	19500	18515	22	3	Lake Mashui	Cd, Pb, Flow	No
	19525	18523	25	0	Net node 1 Yantai/ Yantai WWTP	NTOT, PTOT, Flow	

Foot notes:

(1) This name must be identical to the name used on the industry list sent to NILU.

(2) The industry must be classified in type of industry (=line of business) according to the predefined ENSIS list. The list is enclosed.

(3) There can be several discharge pipes linked to the same industry. If two or more discharge pipes, these have to be entered under each other in the column. The discharge pipes should be named the following way: <Industry name>_Discharge Pipe_<number>. See example above.

(4) The coordinate system should be in line with the coordinate system on your installation of ENSIS. You can do this by pointing on the location with use of GIS. You cannot find these coordinates before Norgit has installed ENSIS in your province.

(5) This is the depth below average level of the recipient.

(6) This can be a lake, a river node or a net node. If net node is selected you also have to shall be The coordinates are identical to the outlet of the dicharge pipe.

(7) This column shall contain the parameter that is measured at theoutlet of the discharge pipe. The measurement shall be structured columnvise, and shall contail the following data:

(8) If data for the industry in question is already sent to NILU (air data), this should be notified in this column. This is done by writing Yes if the industry is on the NILU list and No if it is not. The name of the industry in present table has to be identical the industry name on the NILU list.

Data	Discharge Pipe	Parameter	Medium	Sampling method	Date and time	Value	Unit
Example	Yantai Metal Plating Factory_Discharge Pipe_1	PTOT in Outlet from Industry	Outlet from Industry	Grab sample	11.06.98 08.00.00	10	ug/l
	Yantai Metal Plating Factory_Discharge Pipe_1	PTOT in Outlet from Industry	Outlet from Industry	Grab sample	22.10.98 08.00.00	12	ug/l
	Yantai Metal Plating Factory_Discharge Pipe_1	PTOT in Outlet from Industry	Outlet from Industry	Grab sample	21.12.98 08.00.00	8	ug/l

Appendix F.

Municipal Waste water- Sewerage Network Maps

Digitised sewerage network that can be imported into ENSIS

A list over waste water net nodes with the following properties:

Eastern coordinate	Northern coordinate	Height above sea	Discharge depth	Net node name
19500	18515	22	3	Node 10

Overview over Municipal waste water treatment facilities/plants

The list below shows the data needed by March 15 regarding waste water treatment plants. The data will be imported into ENSIS and be the first step in the development of an abatement strategy. NIVA would strongly prefer the data in an Excel file on the format shown below.

A Municipal Waste Water Treatment Plant can be defined as:

- A waste water treatment plant (municipal or regional) with some sort of sewage treatment.
- A direct discharge of municipal waste water to a local waterbodys without any treatment.
- A collection point for waste water, where the waste water is transported via the network to a waste water treatment plant

Data name	Name of WWTP (0)	Treatment Method (1)	Sludge treatment method (2)	Name of discharge pipe (3)	Administrative Region (4)	Eastern coordinate (5)	Northern coordinate (5)	Height above sea	Discharge depth (6)	The discharge pipe discharges to (7):	Measured parameters at outlet (8)
Example	Yanatai WWTP	Direct Discharge (no treatment)	No treatment(direct discharge)	Yantai WWTP_Discharge pipe _1	Fushi	19500	18515	22	3	Lake Mashui	Tot P, Cd, Pb, Flow, etc.

Foot notes:

(0) Give the name of the waste water treatment plant

(1) The Waste Water Treatment plant must be classified according to type of treatment: The options are:

1 Direct Discharge, no treatment
2 To Inter-municipal WWTP (which means it is a collection point for waste water)
3 Primary
4 Secondary-Chemical
5 Secondary-Biological
6 Secondary-Biological/Chemical
7 Tertiary- nitrogen removal
8 Tertiary-Biological phosphorus removal
9 Tertiary-Advanced
10 Pond and stabilisation systems
11 Wetland systems
12 Other
13 Unknown

(2) The WWTP should be classified according to sludge treatment method, the options are:

1 Thickening
2 Stabilisation
3 Thermal Stabilisation
4 Dewatering
5 Heat Drying

6 Incineration
7 No treatment (direct discharge)
8 Unknown

(3) Enter the name of the discharge pipe from the WWTP.

(4) Enter the administrative region for the WWTP (Find the district/town by pointing on the map

(5) The coordinate system should be in line with the coordinate system on your installation of ENSIS. This can be done by pointing on the location with use of GIS. You cannot find these coordinates before Norgit has installed ENSIS in your.

(6) This is the discharge depth below average level of the recipient.

(7) This can be a lake, a river node or a net node. If net node is selected (only valid if it is a collection point and the treatment method is "to intermunicipal waste water treatment plant") The coordinates are identical to the outlet of the dicharge pipe.

(8) This column should contain the parameter that is measured at the outlet of the discharge pipe (if there are any measurments). The measurement should be structured columnvise, and should contain the following data:

Data	Parameter	Medium	Sampling method	Date and time	Value	Unit
Example	PTOT in Municipal Waste water		Grab sample	11.06.98 08.00.00	10	ug/l
	PTOT in Municipal Waste water	Municipal Waste Water	Grab sample	22.10.98 08.00.00	12	ug/l
	PTOT in Municipal Waste water	Municipal waste water	Grab sample	21.12.98 08.00.00	8	ug/l

Overview over Treatment Area

When measurements lacks theoretical discharge factors in combination with population is used to calculate the domestic waste water.

Please provide us with the total number of persons in the smallest administrative unit defined in the ENSIS project, and how many of these are 1) connected to the discharge pipes listed under municipal waste water treatment plants , 2) Not connected to the discharge pipes

Data name	Name of District/ Town (0)	Total Number of Persons in the District/ Town (1)	Total Number of Persons in the drainage area to the discharge pipe (2)	Total Numbers of persons connected to the indicated Discharge pipe (3)	Total Numbers of persons not connected to the indicated Discharge pipe (4)	Name of discharge pipe (5)	Maps: If possible draw the treatment area for each discharge pipe on a map. (6)
Example	Yantai	100 000	70 000	30.000	40.000	Yantai WWTP_Discharge pipe_1	
		100 000	30 000	10 000	20.000	Yantai WWTP_Discharge pipe_2	

(0) Use the smallest units defined in your ENSIS project

(1) Indicate the population of the district town

(2) Indicate the number of persons that are within the drainage are to the discharge pipe (alternatively the size of the area draining to the discharge pipe compared to the area of the whole district)

(3) Indicate the number of people that actually discharge to the discharge pipe (which are connected)

(4) Indicate the number of people in the drainage area to the pipe which are not connected to the pipe (the differance)

(5) Indicate the name of the discharge pipe listed under municipal waste water treatment plant

(6) The treatment area should be provided on a map. If you want you can use the ENSIS system and paste the picture in a word file.