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## **Oskarshamn site investigation**

### **Drilling and installation of two monitoring wells, SSM 000006 and SSM 000007 in the Simpevarp subarea**

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August 2004

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*Keywords:* Auger drilling, Monitoring well, Water, Soil, Environment.

This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the author and do not necessarily coincide with those of the client.

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# Summary

The drilling and installation of two wells, SSM000006 and SSM000007, for environmental monitoring was made close to core drill sites KSH03 and KAV04 respectively.

The drilling was made by contractor WSP AB, Kalmar.

The monitoring wells were auger drilled with a Geotech 202D rig with a 72 mm auger. Probing with 22 mm rods was made prior to auger drilling. Inner pipes of inert PE-plastic material were installed to facilitate water sampling and future monitoring.

Soil samples were collected over half metre intervals from hole SSM000007 and were stored for future reference.

A ground water reference sample from SSM000006 was collected, frozen and stored.

Due to a very shallow installation depth in SSM000006 and the lack of water in SSM000007 no monitoring equipment was installed in the wells.

The core hole corresponding to each well is shown in table 3-1. A summary of well data is given in table 3-2. Observations of encountered soil types are given in the geological summary in table 3-3.

In addition to the above a composite reference soil sample was taken by digging by hand at each core drilling site and stored for future reference.

# Sammanfattning

Två stycken brunnar för miljökontroll borrades och installerades vid kärnborrhålen KSH03 och KAV04. Arbetet utfördes av WSP AB i Kalmar. Brunnarna utfördes genom att först sondera med en 22 mm sond och därefter borra med en 72 mm skruv. Ett inre stigrör i inert PE-plast installerades i hålen för att möjliggöra vattenprovtagning och mätningar.

Jordprov togs över en halvmeters längd från SSM000007 och sparades.

Ett referensprov av grundvatten från SSM000006 sparades och frystes.

Utrustning för mätning av vattennivå installerades inte i SSM000006 eftersom hålet var mycket grunt eller i SSM000007 eftersom vatten saknades.

Tabell 3-1 visar vilken brunn som ligger vid vilket kärnborrhål. Tabell 3-2 ger en överblick av brunnsdata. Observationer av jordarter återges i den geologiska sammanställningen i tabell 3-3.

Från varje kärnborrhål har dessutom ett samlingsprov av material från marken tagits och lagrats för eventuellt framtida bruk.

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# 1 Introduction

SKB performs site investigations to locate a deep repository for high level radioactive waste /1/. The investigations are performed in two Swedish municipalities: Östhammar and Oskarshamn. The investigation area in Oskarshamn is situated close to the nuclear power plant at Simpevarp /2/, see Figure 1-1.

Drilling is an important activity performed within the frame of the site investigations. Three main types of boreholes are produced: core drilled boreholes, percussion drilled boreholes in hard rock and boreholes drilled through unconsolidated soil.

Before the start of core drilled holes, shallow wells in unconsolidated soil are needed to comply with SKB environmental monitoring procedures (SDP-301 and SKB MD 300.003, internal documents). The environmental control procedure requires that at least one monitoring well is installed and that reference samples for water and soil are collected.



**Figure 1-1.** Location of ground water monitoring wells SSM000006 and SSM000007.

## 2 Equipment and methods

Drilling was done in accordance with SKB Method description for soil drilling, SKB MD 630.003, internal document.

The procedure for environmental sampling at core drill sites (a reference sample for ground water, soil samples from soil drilling of monitoring wells and a composite soil sample from the core drill site) and monitoring in soil wells is described by the SKB Instruction for environmental control of shallow groundwater and soil while drilling and pumping from bedrock, SKB MD 300.003, internal document.

The drilling, sampling and all related on-site operations were performed according to a specific Activity Plan, AP PS 400-03-047, SKB internal document and consisted of:

- Preparations
- Probing
- Auger drilling and excavation
- Sampling and measurements
- Borehole completion
- Data handling
- Environmental control

Monitoring was not initialized for the following reasons:

Well SSM000006 was only installed to very shallow depth (0.7 m below ground surface) and the installation of monitoring equipment was not deemed necessary.

In well SSM000007 no water was encountered and no monitoring equipment could be installed.

### 2.1 Preparations

The preparation stage included the contractor's functional control of his equipment with particular attention given to potential fuel leaks or leakage of hydraulic oil. The machinery and chemicals used have to comply with SKB MD 600.006, Version 1.0 (Method Instruction for Chemical Products and Materials), SKB internal document.

The equipment has to be cleaned in accordance with SKB MD 600.004, Version 1.0 (Method Instruction for Cleaning Borehole Equipment and certain Ground-based Equipment) SKB internal document.

## 2.2 Probing

Probing from the Geotech 202D drill rig with 22 mm rods was made to find a suitable location before auger drilling.

## 2.3 Auger drilling and excavation

### 2.3.1 Auger drilling

Monitoring wells SSM000006 and SSM000007 were drilled with a Geotech 202D rig with a 72 mm auger.

Inner tubes of inert polyethylene plastic were installed. The lowermost section of the tubes were slotted to allow water infiltration in the well.

A bentonite seal was inserted from surface to prevent water influx.

## 2.4 Sampling and measurements

Sampling and measurements done by the contractor or SKB field coordinator included:

- Soil samples from drilling.
- Initial ground water sample.
- Composite soil samples from core drill site.

### 2.4.1 Soil samples from drilling

Soil samples were collected over three intervals from hole SSM000007, see table 2-1. The samples were frozen and stored for future reference.

No soil samples could be collected from SSM000006 due to the presence of coarse grained soil.

**Table 2-1. Soil samples from drilling.**

SSM000006		SSM000007	
Interval	Sample ID	Interval	Sample ID
	N/A	0.1- 0.7	SSM000007:1
	N/A	0.7-0.9	SSM000007:2
	N/A	0.9-1.2	SSM000007:3



## **2.4.2 Initial ground water sample**

A ground water sample was collected from well SSM000006 and frozen for future reference. This sample is called SKB nr 5720.

No water sample was collected from SSM000007 because no water was encountered at the time of drilling.

## **2.4.3 Composite soil samples from core drill sites**

One composite sample for future reference was collected and stored from each of the drill sites KSH03 and KAV04, ie not from the drill hole. The samples are stored in sealed buckets in cold storage. The samples have been registered in the Sicada database as sample PO 9000 (KSH03) and sample PO 9001 (KAV04).

## **2.5 Borehole completion**

The boreholes have been fitted with a plastic cap. They have however not been fitted with steel hoods since no pressure transducers for ground water level monitoring have been installed.

## **2.6 Data handling**

The daily logs from the contractor's field work and the duties performed by SKB field coordinators were forwarded to the Activity Leader and subsequently entered into the SKB database, SICADA.

## **2.7 Environmental control**

The SKB routine for environmental control (SDP-301) was followed to an applicable extent throughout the activity. A checklist was filled in and signed by the Activity Leader and filed in the SKB archive. A field inspection was made prior to drilling by the SKB Site Ecologist to ensure that the drill site is located so that environmental impact is minimized.

### 3 Results

The installation of two wells for environmental monitoring was made close to the core drilled holes KSH03 and KAV04.

**Table 3-1. Monitoring well and corresponding cored hole.**

Environmental monitoring well	Core hole
SSM000006	KSH03
SSM000007	KAV04

The data for the wells are stored in the Sicada database under the following field note numbers:

SSM 000006: Sicada field note number 110

SSM 000007: Sicada field note number 146

The installations were made by contractor WSP AB, Kalmar. Supportive means to the drilling operations were supplied by SKB personnel regarding planning, coordination, infrastructure, sampling and on-site measurements.

**Table 3-2. Technical summary.**

	SSM000006	SSM000007
Easting RT90	1552713	1552517
Northing RT90	6366037	6366795
Elevation of top of inner tube (m.a.s.l) RH70	2,688	7,005
Depth (m) (below surface)	0,7	1,2
Construction method	Auger drilled	Auger drilled
Auger drill diameter	72	72
Inner tube diameter (mm)	50/40	63/50
Inner tube length (m)	1.1 m (0.6 m slotted)	2,2 m ( 1 m slotted)
Azimuth (0-360)	199	309
Dip (0-90)	-89	-87
Groundwater level (masl)	2,3	N/A
Transducer Serial No	N/A	N/A
Transducer type	N/A	N/A
Transducer depth (in-hole)	N/A	N/A

### 3.1 Borehole design

Schematic cross-sections showing elevation, depth to ground water and total depth of the wells are given in appendix 1.

### 3.2 Geological summary

Geological observations from drilling or excavation are given in table 3-3.

**Table 3-3. Geological summary. Sections (from-to) are measured from ground surface down.**

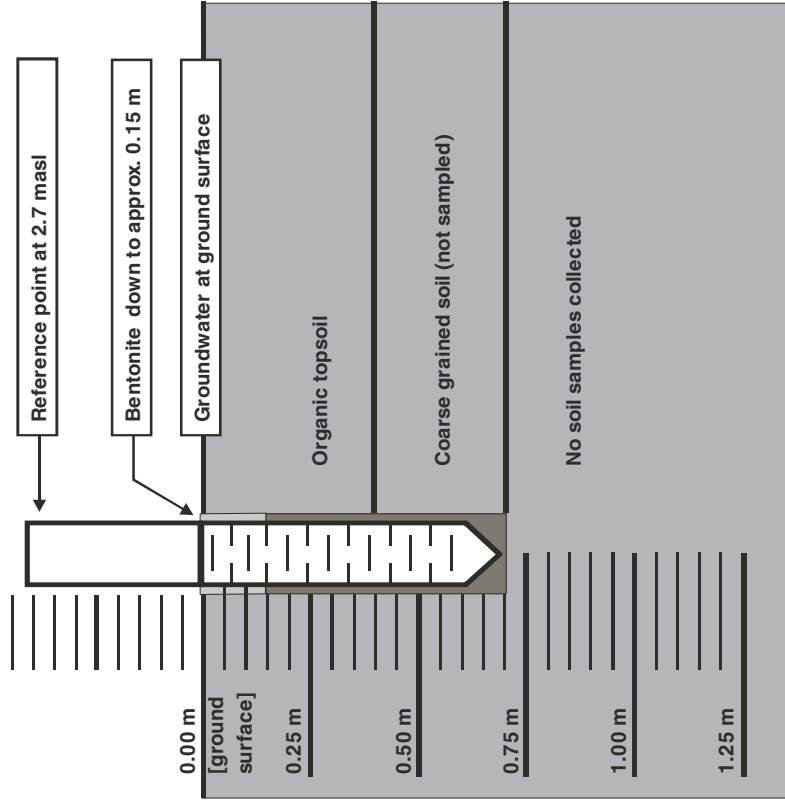
Well ID	Date	From (m)	To (m)	Soil
SSM000006	2003-07-04	0.00	0.4	Organic topsoil
		0.4	0.70	Coarse grained soil
SSM000007	2003-10-07	0.00	0.10	Organic topsoil
		0.10	0.70	Sand-silty, pebbly
		0.70	0.90	Clay-blue to grey
		0.90	1.20	Till- clayey, silty. Boulder at 1.20 m.

## 4 References

- /1/ **SKB, 2001.** Platsundersökningar. Undersökningsmetoder och generellt genomförandeprogram SKB R-01-10, Svensk Kärnbränslehantering AB.
- /2/ **SKB, 2001.** Geovetenskapligt program för platsundersökning vid Simpevarp. SKB R- 01-44, Svensk Kärnbränslehantering AB.

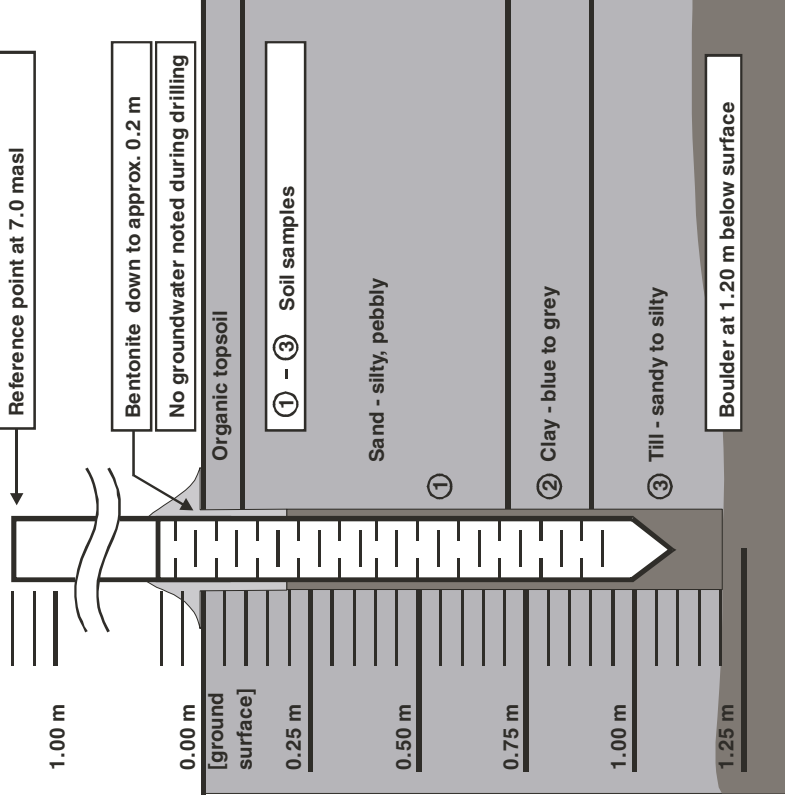
SSM000006 and SSM000007

SSM000006



<b>Date:</b>	2003-07-04
<b>Reference point</b>	Northing: 6366037.343 (m), RT90 2.5 gon V 0:-15 Easting: 1552713.627 (m), RT90 2.5 gon V 0:-15 Elevation: 2.688 (m), RHB 70
<b>Method:</b>	Auger drilled
<b>Orientation</b>	Diameter = 72 mm
<b>Inner tube:</b>	Azimuth: 199 (0-360 degrees, ref. north)
$\emptyset_o = 63$ mm	Dip: -89 (0 = horizontal, -90 = vertical)
$\emptyset_i = 50$ mm	

SSM000007



<b>Date:</b>	2003-10-07
<b>Reference point</b>	Northing: 6366794.814 (m), RT90 2.5 gon V 0:-15 Easting: 1552516.791 (m), RT90 2.5 gon V 0:-15 Elevation: 7.005 (m), RHB 70
<b>Method:</b>	Auger drilled
<b>Orientation</b>	Diameter = 72 mm
<b>Inner tube:</b>	Azimuth: 309 (0-360 degrees, ref. north)
$\emptyset_o = 63$ mm	Dip: -87 (0 = horizontal, -90 = vertical)
$\emptyset_i = 50$ mm	