

Oskarshamn site investigation

Photographs of drill core in core boxes from the boreholes KSH01A, KSH01B, KSH02, KSH03A, KSH03B, KAV01, KAV04A, KAV04B, KLX01, KLX02, KLX03, KLX04, KLX05, KLX06, KLX07A, KLX07B, KLX08, KLX09, KLX09B, KLX09C, KLX09D, KLX09E, KLX09F, KLX09G, KLX10, KLX10B, KLX10C, KLX11A, KLX11B, KLX11C, KLX11D, KLX11E, KLX11F, KLX12A, KLX13A, KLX14A, KLX15A, KLX16A, KLX17A, KLX18A, KLX19A, KLX20A, KLX21B, KLX22A, KLX22B, KLX23A, KLX23B, KLX24A, KLX25A, KLX26A, KLX26B, KLX27A, KLX28A and KLX29A

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Keywords: Photographs, Drill core.

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.

Data in SKB's database can be changed for different reasons. Minor changes in SKB's database will not necessarily result in a revised report. Data revisions may also be presented as supplements, available at www.skb.se.

A pdf version of this document can be downloaded from www.skb.se.

Abstract

The site investigation in Oskarshamn yielded 54 core-drilled boreholes. This report describes the digital photographing of the drill-core taken of these boreholes and how this data was transferred to the SKB's database, SICADA.

Sammanfattning

Platsundersökningen i Oskarshamn producerade 54 kärnborrhål. Denna rapport beskriver den digitala fotograferingen av borrhålen som gjordes av dessa borrhål och hur denna data blev överförd till SKB:s databas SICADA.

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1 Introduction

SKB, the Swedish Nuclear Fuel and Waste Management Company, performs site investigations in order to evaluate the feasibility of locating a deep repository for spent nuclear fuel /1/. The investigations are performed in the Swedish municipalities Östhammar and Oskarshamn.

Drilling and investigations in boreholes are fundamental activities in order to facilitate characterisation of rock and groundwater properties at depth. In the Oskarshamn site investigation a total of 54 core drilled boreholes were investigated in detail.

This document reports the photographing of drill cores from the boreholes: KSH01A, KSH01B, KSH02, KSH03A, KSH03B, KAV01, KAV04A, KAV04B, KLX01, KLX02, KLX03, KLX04, KLX05, KLX06, KLX07A, KLX07B, KLX08, KLX09, KLX09B, KLX09C, KLX09D, KLX09E, KLX09F, KLX09G, KLX10, KLX10B, KLX10C, KLX11A, KLX11B, KLX11C, KLX11D, KLX11E, KLX11F, KLX12A, KLX13A, KLX14A, KLX15A, KLX16A, KLX17A, KLX18A, KLX19A, KLX20A, KLX21B, KLX22A, KLX22B, KLX23A, KLX23B, KLX24A, KLX25A, KLX26A, KLX26B, KLX27A, KLX28A and KLX29A. The location of these boreholes is shown in Figure 1-1.

The work was carried out in accordance with activity plan AP PS 400-07-054. The photographing is done in accordance with method instruction SKB MD 143.007 (SKB internal document) and the photos are stored in the primary data base SICADA for Oskarshamn as stipulated by the controlling document SDK-508 (SKB internal document), finally the P-report is written according to the controlling document SDK-107 (SKB internal document). Table 1-1 lists the controlling documents for this activity. Activity plan, method instruction and controlling documents are SKB internal controlling documents.

Table 1-1. Controlling documents for the performance of the activity.

Activity plan	Number	Version
Överföring fotografier av samtliga borrhävar till SICADA	AP PS 400-07-054 ¹	1.0
Method instruction	Number	Version
Instruktion för hantering och provtagning av borrhävar	SKB MD 143.007	2.0
Controlling documents	Number	Version
Hantering av primärdata vid platsundersökningarna	SDK-508	2.0
Framtagande och hantering av P-rapporter	SDK-107	6.0

¹ An amendment including the photographing of KLX27A is included in activity plan AP PS 400-07-054.

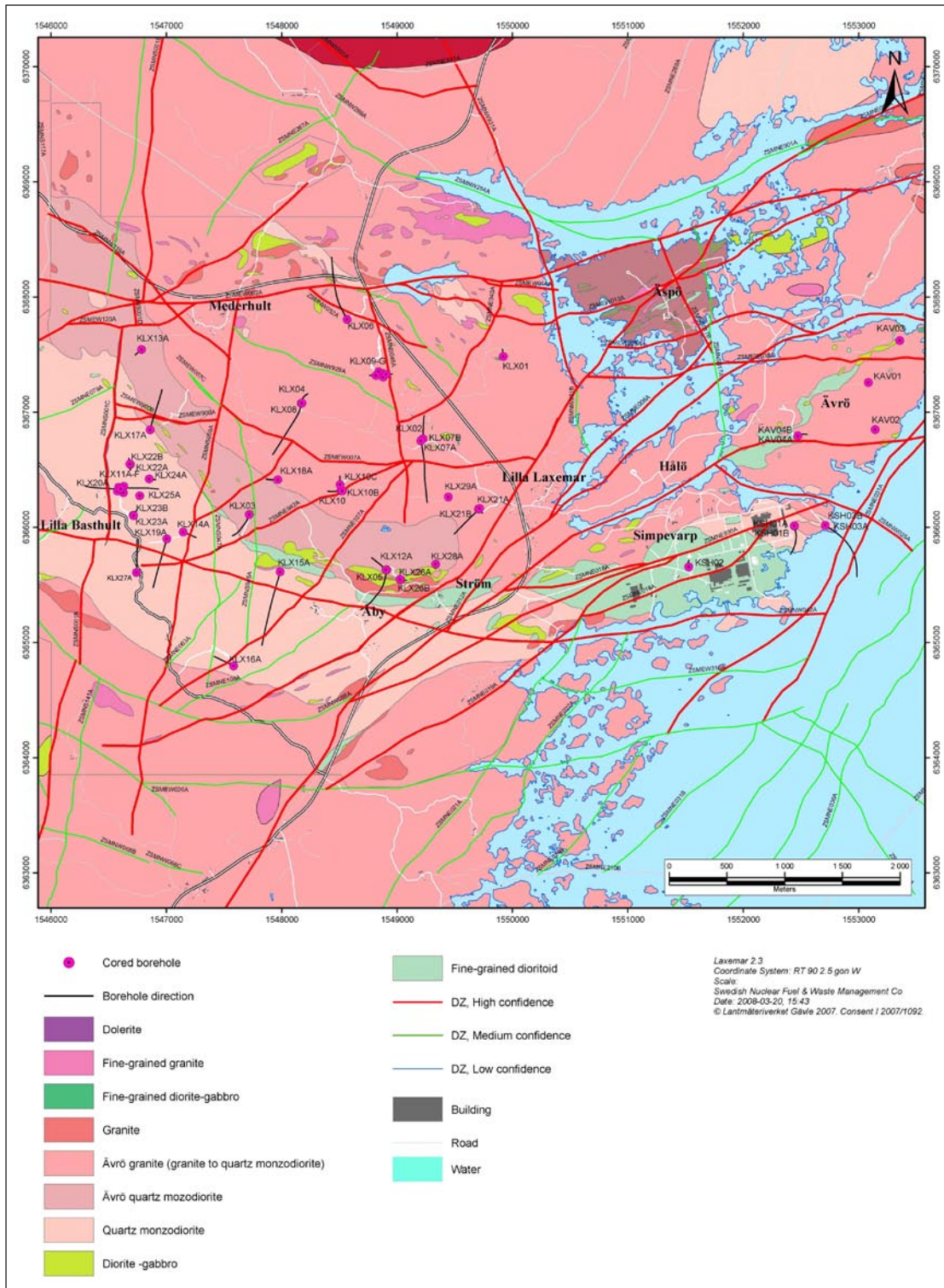


Figure 1-1. Location of boreholes KSH01A, KSH01B, KSH02, KSH03A, KSH03B, KAV01, KAV04A, KAV04B, KLX01, KLX02, KLX03, KLX04, KLX05, KLX06, KLX07A, KLX07B, KLX08, KLX09, KLX09B, KLX09C, KLX09D, KLX09E, KLX09F, KLX09G, KLX10, KLX10B, KLX10C, KLX11A, KLX11B, KLX11C, KLX11D, KLX11E, KLX11F, KLX12A, KLX13A, KLX14A, KLX15A, KLX16A, KLX17A, KLX18A, KLX19A, KLX20A, KLX21B, KLX22A, KLX22B, KLX23A, KLX23B, KLX24A, KLX25A, KLX26A, KLX26B, KLX27A, KLX28A and KLX29A in the Oskarshamn site investigation. The map shows the bedrock geology, linked lineaments, power lines, roads and houses.

2 Objective and scope

The digital photographs along with the overview mapping cover the immediate need for information while drilling. The photographs are delivered to SKB's internal database SICADA. The information is also distributed to those authorized that have requested it from the person responsible for sampling and sample preparations, all according to the method instruction SKB MD 143.007 (SKB internal document).

3 Equipment

The core boxes are photographed on a gravity roller conveyor which is inclined and consisting of two parallel rows, with flow rails on the lower side to hold the core boxes in place. The boxes are placed on the inclined roller conveyor and the lids are removed for photographing and other investigations. Each photograph shows two core boxes when possible.

The photographic equipment consists of a Canon Power Shot G3, with a “G3’s Wireless Remote Control” and a “Vari-Angled LCD monitor”. The camera is adjusted so that the images will have the appropriate resolution and size, consistent with the method instruction SKB MD 143.007 (SKB internal document).

The camera is mounted on a Manfrotto 161 MK2 Super Pro Tripod with a maximum height of 2.67 m, which is placed on marked spots on the floor in front of the core boxes, where the operator can zoom and aim the camera and then take the photographs with the IR remote control, see Figure 3-1.

The cores are first photographed dry and then wet. The core is made wet with tap water, either with a pressure sprayer, a 5 litre “Florabest pressure sprayer with mist nozzle” or a 1 litre “Gloria, Typ 89 Spezial”.

4 Execution

4.1 General

The core photographing takes place in a core shed situated on the Simpevarp peninsula. Data is delivered to SKB's internal network and then to SICADA.

4.2 Preparations

The drill core is placed in the core boxes at the drill site. The core boxes are transported to the core shed at appropriate intervals. At the core shed the core boxes are placed on the two parallel rows of the gravity roller conveyor and the lids of the core boxes on the lower row is removed and put to the side and the lids of the upper row are opened so the core can dry.

4.3 Execution of field work

The core is photographed in the core boxes after they have dried. Then the core is made wet and photographed again. The photographed pair of boxes is then pushed onwards on the roller conveyor and the next two core boxes are positioned for drying and photographing, see Figure 4-1 for arrangement. This continues until all core boxes from the actual transport from the drill site have been photographed.

The contents of the camera's "Compact Flash" memory card is downloaded to a SKB computer where the images are labelled and stored on the internal SKB computer net as jpg-files at G:\p\po\Gemensamt\Bilddokumentation\Borring\Borrkärnor. The photographs are later copied to DVD+R discs for delivery to SICADA.

4.4 Data handling

The digital photographs of the core consist of a minimum of $2,832 \times 2,128$ points, saved on the .jpg format and about 2 Mbytes in size.

Two core boxes are photographed on each picture when possible, one photograph of dry core and one of wet core. The pictures are stored on SKB's internal network (the G-disc).

Each photograph is marked with

- Borehole ID-code
- SecUp (whole numbers)
- Dry/Wet core

Example: 'KLX19A,dry,560-571 m.jpg' and 'KLX19A,wet,560-571 m.jpg' respectively.



Figure 4-1. Photographing core in core boxes at the core shed in Simpevarp. Photographer is the person responsible for sampling and sample preparations Thomas Kiesel.

The photographing is an activity that is registered in SICADA, through the activity diary (see SKB MD 143.006) and the photographic computer files are delivered on CD's or DVD's to SICADA to be archived.

Editing and inspection of photos and filenames on the G-disk is done with the program: Bulk Rename Utility.

The transfer and verification of the photographs of each borehole to DVD+R discs is done with the program Nero 6 for later delivery to SICADA.

4.5 Nonconformities

No formal nonconformities have been registered during the activity.

5 Results

5.1 Core diameters and core boxes

The core boxes that the cores are stored in are made of wood. They are of somewhat various sizes although one size dominates, see Table 5-1. The core is fitted into the core boxes and where necessary, empty spaces are filled up with Polyethylen foam tubes to minimize movement in transport of the core in the core boxes, see Figure 5-2.

Cores with diameter 7.2 cm are stored in boxes with external measurements ca $122 \times 42 \times 9$ cm (length-width-height), with space for four rows of core, each core slot measuring ca $117 \times 8 \times 4$ cm (length-width-depth), resulting in a maximum of ca $115 \times 4 = 460$ cm core in each box, see Figure 5-1.

Most of the cores have a diameter of 5 cm (see Table 5-1 and Tables 5-2 to 5-5), they are fitted into core boxes that have external measurements ca $122 \times 42 \times 7$ cm (length-width-height), with space for five rows of core, each core slot measuring ca $117 \times 6 \times 3$ cm (length-width-depth), resulting in a maximum of ca $115 \times 5 = 575$ cm core in each box, see Figure 5-2.

The lid of the core boxes is on hinges that can easily be taken apart. Each core box and lid is marked with borehole ID, length of core in the box and number of box, according to the method instruction SKB MD 143.007 (SKB internal document).

The core boxes for hole KAV01 is different. External measurements are ca $92 \times 57 \times 6$ cm, with space for 7 rows of core with internal measurements ca $88 \times 5.5 \times 3$ cm (resulting in a maximum of ca $0.86 \times 7 \approx 6$ m core in each box), or alternatively with space for 9 rows of core with internal measurements ca $88 \times 4.5 \times 3$ cm (resulting in a maximum of ca $0.86 \times 9 \approx 7.7$ m core in each box), see Figures 5-3 and 5-4.

The core boxes for hole KLX01 (until 702.11 m length) have external measurements ca $92 \times 57 \times 6$ cm, with space for 7 rows of core with internal measurements ca $88 \times 6.5 \times 3$ cm (resulting in a maximum of ca $0.86 \times 7 \approx 6$ m core in each box), see Figure 5-5. While the core boxes for holes KLX01 (after 702.11 m length) and KLX02 have external measurements ca $122 \times 42 \times 7$ cm, with space for 6 rows of core with internal measurements ca $117 \times 5 \times 3$ cm (resulting in a maximum of ca $1.15 \times 6 \approx 6.9$ m core in each box), see Figures 5-6.

Table 5-1. Core boxes and core, approximate measurements.

Rows of core in box	Outer measurements (Length-Width-Height) in cm	Inner measurements of each row (Length-Width-Height) in cm	Approximate core diameter (cm)	Number of core boxes	Ca maximum core length per core box (m)
5	122-42-7	117-6-3	5	1,941	5.8
4	122-42-9	117-8-4	7.2	14	4.6
3	122-42-9	117-8-4	7.2	5	3.5
6	122-42-7	117-5-3	4.6	143	6.9
9	92-57-6	88-4.5-3	4.2	87	7.7
7	92-57-6	88-6.5-3.5	6.2	112	6
7	92-57-6	88-5.5-3	5	2	6



Figure 5-1. Core photographs of KLX21B, dry, 99–108 m and KLX21B, wet, 99–108 m showing a 4 row core box and a 5 row core box.



Figure 5-2. Core photographs of KLX19A, dry, 560–571 m and KLX19A, wet, 560–571 m showing 5 row core boxes.

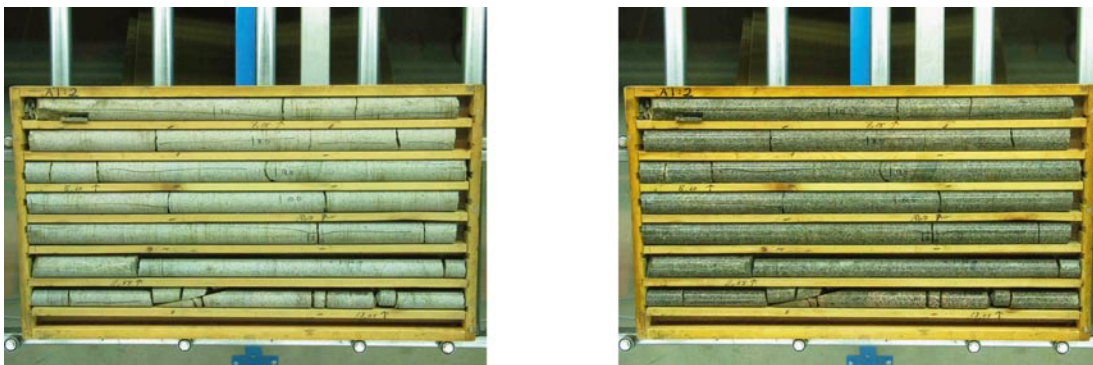


Figure 5-3. Core photographs of KAV01, dry, 7–13 m and KAV01, wet, 7–13 m showing 7 row core boxes.

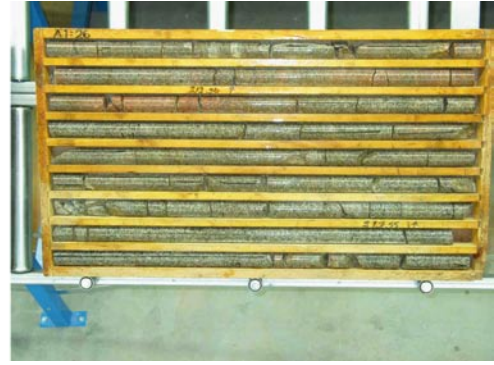


Figure 5-4. Core photographs of KAV01, dry, 211–219 m and KAV01, wet, 211–219 m showing 9 row core boxes.

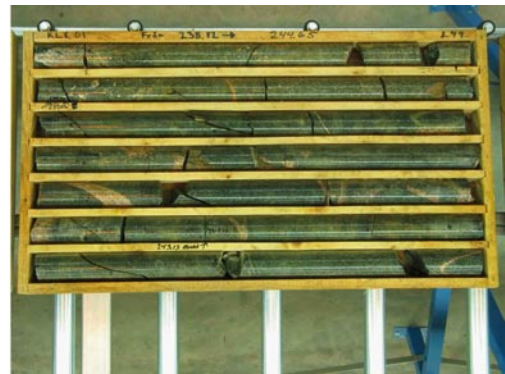


Figure 5-5. Core photographs of KLX01, dry, 238–244 m och KLX01, wet, 238–244 m showing 7 row core boxes.

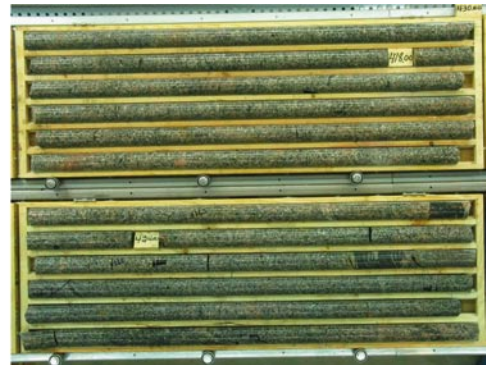


Figure 5-6. Core photographs of KLX02, dry, 416–429 m and KLX02, wet, 416–429 m showing 6 row core boxes.

5.2 Primary storage of digital photographs

The digital photographs of the cores are stored as 4,612 jpg-files, making up 9.7 Gb, on SKB's internal network, at the address: 'G:\p\po\Gemensamt\Bilddokumentation\Borrning\Borrkärnor'.

Boreholes where samples for pore-matrix were taken were photographed at the drill site, before sampling and a length of Polyethylen foam tubes of approximately 5 cm in diameter are put in the place of the core. These core boxes are then photographed in a normal fashion at the core shed in Simpevarp, but now with PE-foam tubes where the pore-matrix samples were taken. This results in a separate folder of core photographs, taken at the drill site just prior to sampling. The pore-matrix core photographs consist of 65 jpg-files, making up 75 Mb, at: 'G:\p\po\Gemensamt\Bilddokumentation\Borrning\Porematrix borrkärnebilder'.

Editing and inspection of the photographs and filenames on the G-disk is done with the program: 'Bulk Rename Utility'.

5.3 Transfer and storage in SICADA

The transfer and verification of the photographs of each borehole to DVD+R discs is done with the program 'Nero 6' for delivery to SICADA.

The photos are stored in SICADA according to the method instruction SKB MD 143.007 (SKB internal document).

All cores photographed and stored in SICADA are presented in Tables 5-2, 5-3 and 5-4.

Table 5-2. Diameter and length of cores from boreholes drilled before the site investigation Oskarshamn KAV01, KLX01 and KLX02 from core photos. Core drilling periods from SICADA.

Borehole ID	Core drilling period	Diameter of core (m)	Length of core (m)	Diameter of core (m)	Length of core (m)
KAV01	770421–040110	0.05	0–11.55	0.042	11.55–744
KLX01	871205–900804	0.062	1–702.11	0.046	702.11–1,077.99
KLX02	920815–921129	0.046	201–1,700.50	–	–

Table 5-3. Diameter and length of cores from boreholes with strongly varying core diameters KLX07A and KLX12A from core photos. Core drilling periods from SICADA.

Borehole ID	Core drilling period	Diameter of core (m)	Length of core (m)	Diameter of core (m)	Length of core (m)
KLX07A	050106–050504	0.050	100.46–447.70 and 552.63–844.73	0.032	447.70–552.63
KLX12A	051110–060304	0.072	100.57–101.07	0.048–0.062	101.07–602.29

Table 5-4. Diameter and length of cores from long boreholes KXH01A, KSH02, KSH03A, KAV04A, KLX03, KLX04, KLX05, KLX06, KLX08, KLX09, KLX10, KLX11A, KLX13A, KLX15A, KLX16A, KLX17A, KLX18A, KLX19A, KLX20A KLX21B and KLX27A from core photos. Core drilling periods from SICADA.

Borehole ID	Core drilling period	Diameter of core (m)	Length of core (m)	Diameter of core (m)	Length of core (m)
KSH01A	021007–021218	0.072	100.28–100.81	0.05	100.81–1,003.00
KSH02	030128–030611	0.05	19.78–1,001.11	–	–
KSH03A	030911–031107	0.072	100.00–101.26	0.05	101.26–1,000.70
KAV04A	031210–040503	0.072	100–100.95	0.05	100.95–1,004.00
KLX03	040528–040907	0.072	100–101.40	0.05	101.40–1,000.42
KLX04	040313–040628	0.072	100.35–101.75	0.05	101.42–993.49
KLX05	041001–050122	0.072	75.10–76.48	0.05	100–1,000.16
KLX06	040825–041125	0.072	100.29–101.69	0.05	101.69–994.94
KLX08	050404–050613	0.072	100.33–101.01	0.05	101.01–1,000.41
KLX09	050826–051015	0.072	100.53–101.05	0.05	101.05–880.38
KLX10	050618–051015	0.072	100.90–101.13	0.05	101.13–1,001.20
KLX11A	051124–060302	0.072	100.03–100.53	0.05	100.53–992.29
KLX13A	060519–060816	0.072	99.86–100.41	0.05	100.36–594
KLX15A	070117–070225	0.05	76.10–1,000.43	–	–
KLX16A	061128–070109	0.05	0.30–433.55	–	–
KLX17A	060913–061023	0.072	65.42–65.85	0.05	65.85–701.08
KLX18A	060329–060502	0.072	99.93–100.80	0.05	100.80–611.28
KLX19A	060603–060920	0.072	99.33–100.23	0.05	100.23–800.07
KLX20A	060325–060424	0.072	99.91–100.40	0.05	100.40–457.92
KLX21B	061012–061129	0.072	99.41–100.00	0.05	100.00–858.69
KLX27A	071008–071121	0.072	75.60–76.12	0.05	76.12–650.56

Table 5-5. Diameter and length of cores from short boreholes KSH01B, KSH03B, KAV04B, KLX07B, KLX09B, KLX09C, KLX09D, KLX09E, KLX09F, KLX09G, KLX10B, KLX10C, KLX11B, KLX11C, KLX11D, KLX11E, KLX11F, KLX14A, KLX16A, KLX22A, KLX22B, KLX23A, KLX23B, KLX24A, KLX25A, KLX26A, KLX26B, KLX28A and KLX29A from core photos. Core drilling periods from SICADA.

Borehole ID	Core drilling period	Diameter of core (m)	Length of core (m)
KSH01B	030117–030127	0.05	1.25–100.25
KSH03B	031121–031126	0.05	0.00–100.86
KAV04B	040512–040518	0.05	0.10–101.03
KLX07B	050523–050603	0.05	0–200.13
KLX09B	060116–060126	0.05	2.48–100.22
KLX09C	060107–060115	0.05	0.9–120.05
KLX09D	051105–051117	0.05	0.30–121.09
KLX09E	051123–051205	0.05	0.30–120.00
KLX09F	051206–060106	0.05	0.30–152.30
KLX09G	060127–060203	0.05	0.30–100.10
KLX10B	060208–060214	0.05	0.95–50.25
KLX10C	060215–060228	0.05	0.03–146.25
KLX11B	060422–060428	0.05	0.95–100.20
KLX11C	060330–060405	0.05	0.00–120.15
KLX11D	060406–060413	0.05	0.3–120.35
KLX11E	060413–060421	0.05	0.30–121.30
KLX11F	060314–060317	0.05	0.3–120.05
KLX14A	060819–060904	0.05	3.20–176.27
KLX16A	061128–070109	0.05	0.30–433.55
KLX22A	060505–060512	0.05	0.30–100.45
KLX22B	060513–060518	0.05	0.30–100.25
KLX23A	060521–060527	0.05	0.30–100.15
KLX23B	060528–060531	0.05	0.30–50.27
KLX24A	060614–060629	0.05	0.30–100.17
KLX25A	060701–060704	0.05	0.30–50.24
KLX26A	060803–060811	0.05	0.5–101.14
KLX26B	060812–060817	0.05	0.30–50.37
KLX28A	060914–060920	0.05	2.85–80.23
KLX29A	060909–060913	0.05	0.30–60.25

6 References

- /1/ **SKB, 2001.** Platsundersökningar, Undersökningsmetoder och generellt genomförande-program. SKB R-01-10, Svensk Kärnbränslehantering AB.