Technical Report

TR-14-12

Input data report for the safety assessment SR-PSU

Svensk Kärnbränslehantering AB

December 2014

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Update notice

The original report, dated December 2014, was found to contain factual errors which have been corrected in this updated version. The corrected factual errors are presented below

Updated 2017-04

Location	Original text	Corrected text
Page 22, Section 2.3.1, paragraph 3	The concentration of complexing agents governs a reduction in the sorption capacity of the concrete, further described in the Data report, Chapter 7. The concentrations are used as input in the high concentrations of complexing agents calculation case to set the sorption reduction factors, see the Radionuclide transport report.	The concentration of complexing agents governs a reduction in the sorption capacity of the concrete, further described in the Data report, Chapter 7. The concentrations are used as input in all calculation cases where sorption is accounted for to set the sorption reduction factors, see the Section 3.15.1 and the Radionuclide transport report. A further reduction with a factor of 10 for all radionuclides that are potentially affected by complexing agents (i.e. all radionuclides but C, Ca, Cl, I, Cs, and Mo) are used in the high concentrations of complexing agents calculation case.
Page 45, Section 3.15.1, paragraph 4, after the heading Concrete	*Link missing*	svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/NearfieldKd(AMF75).xlsx

Updated 2015-10

Location	Original text	Corrected text
Page 23, Section 2.4.1, paragraph 2	…Inventory report (SKB 2013a).	…Inventory report (SKB 2013a, SKBdoc 1481419 (Mo-93)).
Page 24, Section 2.4.3, paragraph 2	…Inventory report (SKB 2013a)...	…Inventory report (SKB 2013a, SKBdoc 1481419 (Mo-93))...
Page 24, Section 2.4.4, paragraph 2	…Inventory report (SKB 2013a).	…Inventory report (SKB 2013a, SKBdoc 1481419 (Mo-93)).
Page 25, Section 2.4.5, paragraph 2, last sentence	The estimated high radionuclide inventory in each waste-type package in the waste vault is given in Appendix B in SKBdoc 1427105.	This sentence is deleted
Page 135, updated reference	1427105 ver 1.0	1427105 ver 4.0
Page 135, new reference		SKBdoc 1481419 ver 1.0. Ny beräkning av Mo-93 i normkolli till PSU 2015-05 (In Swedish.) SKB, 2015.

Preface

This report provides data or references to where data can be found that are used in the assessment of the long-term radiation safety of the low-and intermediate level waste repository SFR. The report forms part of the SR-PSU safety assessment, which supports the application for a licence to extend SFR.

The report has been edited by Mikael Asperö, Kemakta Konsult AB. Numerous experts with responsibility for specific scientific topics have contributed to the report.

The report has been reviewed by Sara Grolander, Sara Grolander Miljökonsult AB and the undersigned.

Stockholm, December 2014

Fredrik Vahlund

Project leader SR-PSU

Summary

This report is a compilation of input data and references to input data used in the many different activities in the post-closure safety assessment SR-PSU. The report uses the Assessment Model Flowchart (AMF) to map the data flows between each SR-PSU activity. For each data flow there is a section in this report describing the dataset, its usage and giving a reference to the originating report. Therefore the report can be seen as a complete reference to all input data used in SR-PSU.

The **Input data report** differs from the **Data report** in that the former is a compilation of all the data used in the safety assessment, and the latter is a qualification of selected data deemed as important to the safety assessment. No data qualification is performed in the **Input data report**.

Sammanfattning

Denna rapport är en sammanställning av alla data som används av de olika delprojekten och aktiviteterna inom den långsiktiga säkerhetsanalysen SR-PSU. Rapporten tar hjälp av en Assessment Model Flowchart (AMF) för att kartlägga dataflödena mellan varje aktivitet, och för varje dataflöde återfinns ett kapitel i rapporten som beskriver dataset, vad de används till och med en referens till ursprungsrapport. Denna rapport kan alltså ses som ett referensverk till alla inputdata inom SR-PSU.

Denna rapport skiljer sig från **Datarapporten** i det att den sistnämnda väljer ut och kvalificerar användandet av ett antal dataset som anses vara av stor betydelse för säkerhetsanalysen. I denna rapport sker ingen sådan kvalificering av data.

Contents

1 Introduction

1.1 Background

The final repository for short-lived radioactive waste (SFR) located in Forsmark, Sweden is used for the final disposal of short-lived low- and intermediate-level operational waste from Swedish nuclear facilities. SKB plans to extend SFR to host waste from the decommissioning of the nuclear power plants and other nuclear facilities. Additional disposal capacity is needed also for operational waste from nuclear power units in operation since their operation life-times have been extended compared with what was originally planned.

The SFR repository includes waste vaults underground together with buildings above ground that include a number of technical installations. The underground part of the existing facility (SFR 1) is situated at 60 metres depth in the rock and is located below the Baltic Sea. SFR 1 comprises five waste vaults with a disposal capacity of approximately 63,000 m^3. The extension (SFR 3[1]) will be built at 120 metres depth and will have a disposal capacity of 108,000 m^3 in five new waste vaults plus one new vault for nine boiling water reactor pressure vessels, see Figure 1-1.

The long-term post closure safety of the whole SFR has been assessed and documented in the SR-PSU Main report with supporting documents, see Section 1.2. The Main report is part of SKB´s licence application to extend and continue to operate SFR. This report is a main reference and presents, references to the large amounts of data that have been used in SR-PSU safety assessment to calculate and assess the system.

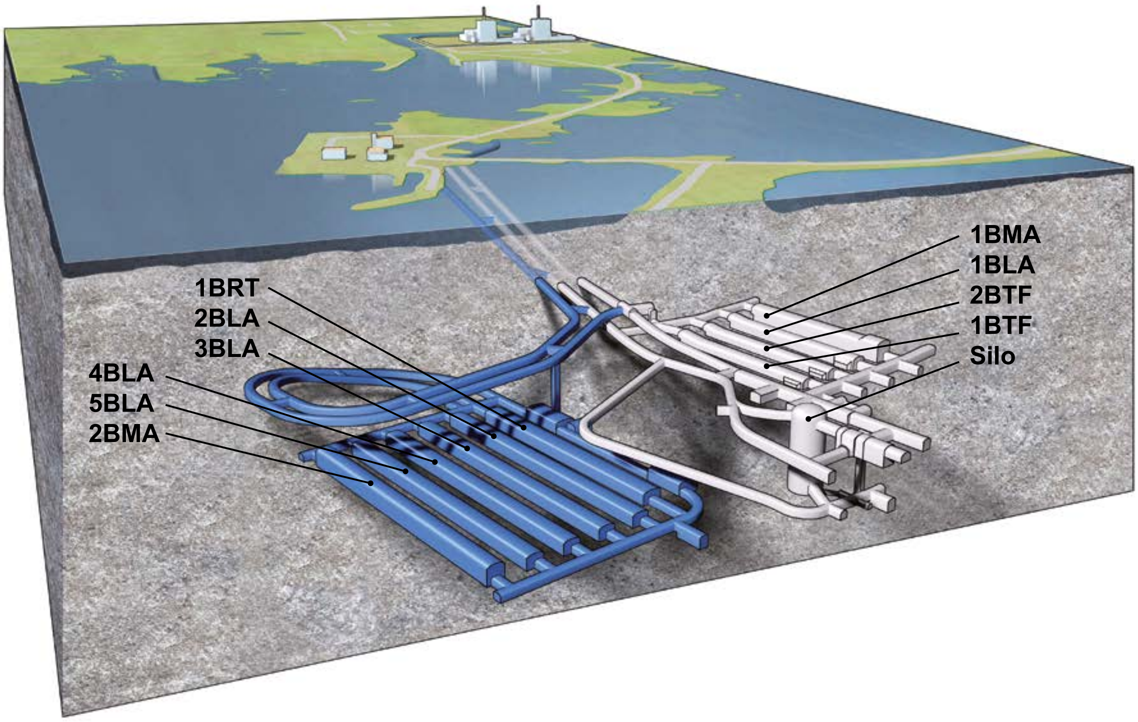

Figure 1-1. *Schematic illustration of SFR. The grey part is the existing repository (SFR 1) and the blue part is the planned extension (SFR 3). The waste vaults in the figure are the silo for intermediate-level waste, 1–2BMA vaults for intermediate-level waste, 1–2BTF vaults for concrete tanks, 1BLA and 2–5BLA vaults for low-level waste and the BRT vault for reactor pressure vessels.*

[1] The extension is called SFR 3 since the name SFR 2 was used in a previous plan to build vaults adjacent to SFR 1 for disposal of reactor core components and internal parts. The current plan is to dispose of this waste in a separate repository.

1.2 Report hierarchy in the SR-PSU safety assessment

The applied methodology for the long-term safety comprises ten steps and is described in Chapter 2 of the **Main report**. Several of the steps carried out in the safety assessment are described in more detail in supporting documents, so called main references that are of central importance for the conclusions and analyses in the **Main report**. The full titles of these reports together with the abbreviations by which they are identified in the following text **(abbreviated names in bold font)** together with short comments on the report contents are given in Table 1-1.

There are also a large number of additional references. The additional references include documents compiled within SR-PSU, but also documents compiled outside of the project, either by SKB or equivalent organisations as well as in the scientific literature. Additional publications and other documents are referenced in the usual manner.

A schematic illustration of the safety assessment documents is shown in Figure 1-2.

1.3 This report

The Input data report provides data or references to where data can be found for data that are used in the long-term safety assessment SR-PSU of the SFR repository. SR-PSU is performed according to a developed methodology including ten steps (see Chapter 2 in the Main report). This report focuses on Step 6 – Compilation of input data.

Within the SR-PSU safety assessment there are two reports regarding the data handling. This report that gives references to the data used in the safety assessment and the Data report that qualifies the data. The Data report concern the data connected to the SR-PSU safety functions, as defined in assessment Step 5, and their longevity through the repository life time. Data are provided for a selection of relevant conditions and are qualified through traceable standardised procedures. Together these two reports form a data package which both qualifies and motivates important data as well as documents used input data in assessment Step 9 – Analysis of the selected scenarios.

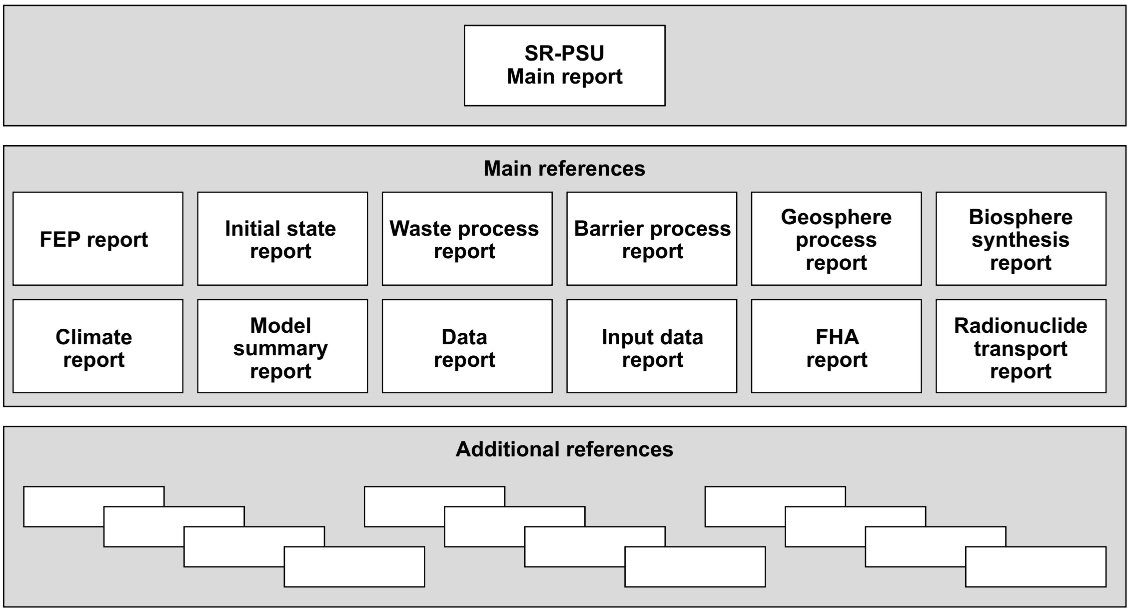

Figure 1-2. *The hierarchy of the Main report, main references and additional references in the SR-PSU long-term safety assessment. The additional references either support the Main report or any of the main references.*

Table 1-1. Main report and Main references in the SR-PSU long term safety assessment. All reports are available at www.skb.se

Abbreviation used when referenced in this report	Full reference	Comment on content
Main report	**Main report, 2014**. Safety analysis for SFR. Long-term safety. Main report for the safety assessment SR-PSU. SKB TR-14-01, Svensk Kärnbränslehantering AB.	This document is the main report of the SR-PSU long-term post-closure safety assessment for SFR. The report is part of SKB´s licence application to extend and continue to operate SFR.
Barriers process report	**Engineered barriers process report**, **2014**. Engineered barrier process report for the safety assessment SR-PSU. SKB TR-14-04, Svensk Kärnbränslehantering AB.	Describes the current scientific understanding of the processes in the engineered barriers that have been identified in the FEP processing as potentially relevant for the long-term safety of the repository. Reasons are given in the process report as to why each process is handled a particular way in the safety assessment.
Biosphere synthesis report	**Biosphere synthesis report**, **2014**. Biosphere synthesis report for the safety assessment SR-PSU. SKB TR-14-06, Svensk Kärnbränslehantering AB.	Describes the handling of the biosphere in the safety assessment. The report summarises site description and landscape evolution, FEP handling, exposure pathway analysis, the radionuclide model for the biosphere, included parameters, biosphere calculation cases and simulation results.
Climate report	**Climate report**, **2014**. Climate and climate-related issues for the safety assessment SR-PSU. SKB TR-13-05, Svensk Kärnbränslehantering AB.	Describes the current scientific understanding of climate and climate-related processes that have been identified in the FEP processing as potentially relevant for the long-term safety of the repository. The report also describes the climate cases that are analysed in the safety assessment.
Data report	**Data report, 2014.** Data report for the safety assessment SR-PSU. SKB TR-14-10, Svensk Kärnbränslehantering AB.	Qualifies data and describes how data, including uncertainties, that are used in the safety assessment are quality assured.
FEP report	**FEP report, 2014.** FEP report for the safety assessment SR-PSU. SKB TR-14-07, Svensk Kärnbränslehantering AB.	Describes the establishment of a catalogue of features, events and processes (FEPs) that are of potential importance in assessing the long-term functioning of the repository.
FHA report	**FHA report**, **2014**. Handling of future human actions in the safety assessment SR-PSU. SKB TR-14-08, Svensk Kärnbränslehantering AB.	Describes radiological consequences of future human actions (FHA) that are analysed separately from the main scenario, which is based on the reference evolution and less probable evolutions.
Geosphere process report	**Geosphere process report**, **2014**. Geosphere process report for the safety assessment SR-PSU. SKB TR-14-05, Svensk Kärnbränslehantering AB.	Describes the current scientific understanding of the processes in the geosphere that have been identified in the FEP processing as potentially relevant for the long-term safety of the repository. Reasons are given in the process report as to why each process is handled a particular way in the safety assessment.
Initial state report	**Initial state report**, **2014**. Initial state report for the safety assessment SR-PSU. SKB TR-14-02, Svensk Kärnbränslehantering AB.	Describes the conditions (state) prevailing in SFR after closure. The initial state is based on verified and documented properties of the repository and an assessment of the evolution during the period up to closure.
Input data report	**Input data report**, **2014**. Input data report for the safety assessment SR-PSU. SKB TR-14-12, Svensk Kärnbränslehantering AB.	Describes the activities performed within the SR-PSU safety assessment and the input data used to perform these activities.
Model summary report	**Model summary report**, **2014**. Model summary report for the safety assessment SR-PSU. SKB TR-14-11, Svensk Kärnbränslehantering AB.	Describes the calculation codes used in the assessment.
Radionuclide transport report	**Radionuclide transport report**, **2014**. Radionuclide transport and dose calculations for the safety assessment SR-PSU. SKB TR-14-09, Svensk Kärnbränslehantering AB.	Describes the radionuclide transport calculations carried out for the purpose of demonstrating fulfilment of the criterion regarding radiological risk.
Waste process report	**Waste process report, 2014.** Waste form and packaging process report for the safety assessment SR-PSU. SKB TR-14-03, Svensk Kärnbränslehantering AB.	Describes the current scientific understanding of the processes in the waste and its packaging that have been identified in the FEP processing as potentially relevant for the long-term safety of the repository. Reasons are given in the process report as to why each process is handled in a particular way in the safety assessment.

1.4 Structure of report

This section explains how the report is structured and how data identification was performed.

1.4.1 The Assessment Model Flowchart

To be able to identify all the SR-PSU activities and the data flow between these activities an Assessment Model Flowchart (AMF) was created with boxes representing modelling activities and lines between the boxes representing data flow, see Appendix B.

The AMF aims to be as complete as possible regarding the data flow occurring within the SR -PSU safety assessment but there are some limitations that need to be highlighted. References to older methodology and software usage e.g. from earlier safety assessments are not included as data, which also includes references to mathematical expressions and deductions.

Oval shapes in the AMF signify that they do not have any input connections. These oval shapes symbolise data taken either from the **Initial state report**, previous long-term safety assessments (SR Site (SKB 2011) or SAR-08/SAFE reports (SKB 2001, 2008)), or peer reviewed literature taken from outside the SR-PSU safety assessment.

To be able to map the data going between the different activities each of the lines connecting the boxes are assigned a unique number as seen in Appendix B. This box number corresponds to a section in this report, and the sections are ordered by these numbers within the areas: Waste (yellow), Near-field, excluding waste (blue), Geosphere (red), Climate (grey) and Biosphere (green).

As the sections are sorted by the AMF numbers in an ascending order the report might seem unstructured from a quick browsing perspective. To avoid this it is recommended to print out the AMF in Appendix B and use it as guide when reading the report.

Each section is made from a section template which is designed to be easily readable and easily understandable for someone looking for information regarding particular data flows.

1.4.2 Section template

As written above each section in this report follows the same template. This template is described below with text under each heading describing what is supposed to be found there. Therefore this section can be seen both as a guide for the reader and as an instruction for the writing by the data supplier. Each section starts with an overview table detailing the datasets included in it, see below.

Dataset name **(**Just the name of the dataset, for readability and Microsoft Word indexing. No text is written below the header.**)**

Output from AMF activity	**Input to AMF activity**
Originating AMF Activity	AMF Activity where data will be used
Dataset	
Dataset 1 name	
Dataset 2 name	

Short description of data

Here a short description of the dataset is given. The focus in this section is the data itself and not what is used for, which is described further in a section below. For instance, if the dataset contains possible concentrations of complexing agents in repository vaults it is sufficient to describe what the complexing agents consists of. The description need not be longer than a couple of lines and use of references to underlying reports are encouraged.

Source of data

This section should give a description of how the data were produced. Was it a result from for example a modelling activity, assessment, experiment, site investigation or a literature survey? The text should be short but a reference to the underlying assessment (a chapter in the **Data report**) or modelling activity is required. If the data are taken from a SR-Site report or from the **Initial state report** it is sufficient to reference to them, preferably not only to the report but also to the table the data have been taken from.

Used in model or assessment activity

This section should describe how and for what purpose the dataset is used. If the dataset is used in a model a short description of the purpose of the modelling activity should be supplied along with a reference to the underlying report. If the data are used in an assessment the purpose of the latter should be described along with a reference (which can be a **Data report** chapter).

Data used

In this section a link or reference to where the complete dataset can be found is given. The reference can be to a table in a published report and/or if applicable with a SVN-link or SKBdoc-number to where the dataset can be found.[2]

TortoiseSVN is a Subversion (SVN) client, implemented as a Windows shell extension. TortoiseSVN is an Open Source project developed under the GNU General Public License (GPL) and has a wide-spread use all over the world (http://tortoisesvn.net/). It provides a user friendly interface for Subversion (http://subversion.apache.org/). Subversion is a widespread version handler for files and open source project under The Apache Software Foundation, licensed under the Apache License, Version 2.0. Subversion provides flexible and traceable environment for modelling results, parameter data, model and documents.

All GIS (Geographical Information System) related data at SKB are stored in the SDE (Spatial Database Engine) database. The SDE-database is a server-software sub-system and managed by ESRI (http://www.esri.com/software/arcgis/arcsde).

[2] The data stored as SVN-files, documents in SKBdoc, and in the GIS database can be made available upon request.

2 Waste

2.1 AMF Number 47

Output from AMF activity	Input to AMF activity
Production of gas	RN transport due to gas pressure
Dataset	
Gas formation rates and total gas volumes formed in each waste vault	

2.1.1 Gas formation rates and total gas volumes formed in each waste vault

Short description of data

The dataset contains rates of gas formed from corrosion of metals in waste packages and structures, and from microbial degradation of cellulose and other organic material. The gases produced are mainly H_2 from the metallic corrosion and CH_4 and CO_2 from the microbial degradation.

Source of data

The data are taken from calculations given in Moreno and Neretnieks (2013, Appendix A).

Used in model or assessment activity

The data are used in modelling activities that assess the consequences of the formed gas pressuring out the radionuclides from the vaults. This is further described in Moreno and Neretnieks (2013).

Data used

The gas formation rates due to metallic corrosion and microbial degradation for the silo and the waste vaults are given in Moreno and Neretnieks (2013, Table A-12). Initially, the gas formation rate is totally dominated by the corrosion of aluminium and the total amount of gas is dominated by the corrosion of steel. Total gas volumes formed in the repository are given in Moreno and Neretnieks (2013, Table A-13).

2.2 AMF Number 79

Output from AMF activity	Input to AMF activity
Initial state – Waste	Production of gas
Dataset	
Amounts and surface area of metals in each waste vault	
Amounts and type of organic material in each waste vault	

2.2.1 Amounts and surface area of metals in each waste vault

Short description of data

The datasets contain amounts and corroding surface areas of aluminium/zinc and stainless/carbon steel found in the waste packages in the repository.

Source of data

In Moreno and Neretnieks (2013, Appendix A) references are given to where the datasets are taken from.

Used in model or assessment activity

The datasets are used in the calculations of gas formation in SFR due to metal corrosion. This is further described in Moreno and Neretnieks (2013, Appendix A, Section 2).

Data used

See Source of data.

2.2.2 Amounts and type of organic material in each waste vault

Short description of data

The datasets contain amounts and types of organic material found in the repository.

Source of data

In Moreno and Neretnieks (2013, Appendix A) references are given to where the datasets are taken from.

Used in model or assessment activity

The datasets are used in the calculations of gas formation in SFR due to microbial degradation of organic material. This is further described in Moreno and Neretnieks (2013, Appendix A, Section 3).

Data used

See Source of data.

2.3 AMF Number 81

Output from AMF activity	**Input to AMF activity**
Concentration of complexing agents	Non-flow related RN transport properties
Dataset	
Molar concentration of complexing agents in the Silo, BMA, and BTF	

2.3.1 Molar concentration of complexing agents

Short description of data

The datasets contain estimates of the total concentrations of complexing agents in waste packages and other relevant units for the Silo, 1–2BMA and 1–2BTF. High concentrations of complexing agents can reduce radionuclide sorption to concrete.

Source of data

The concentrations of ISA (Isosaccharinic Acid) are calculated for different time periods and are given in Keith-Roach et al. (2014, Tables C-1 to C-3). The calculated concentrations of the complexing agents (EDTA, NKP, NTA, Citrate and Oxalate) are given in Keith-Roach et al. (2014, Table C-4).

Used in model or assessment activity

The concentration of complexing agents governs a reduction in the sorption capacity of the concrete, further described in the Data report, Chapter 7. The concentrations are used as input in all calculation cases where sorption is accounted for to set the sorption reduction factors, see the Section 3.15.1 and the Radionuclide transport report. A further reduction with a factor of 10 for all radionuclides that are potentially affected by complexing agents (i.e. all radionuclides but C, Ca, Cl, I, Cs, and Mo) are used in the high concentrations of complexing agents calculation case.

Data used

See Source of data.

2.4 AMF Number 86

Output from AMF activity	Input to AMF activity
Initial state – Waste	RN transport in water phase
Dataset	
Average radionuclide inventory in each waste-type package (Silo, BMA, BTF)	
Number of waste packages in each waste vault (Silo, BMA, BTF)	
Total radionuclide inventory in each waste vault (BLA)	
Radionuclide inventory in each reactor pressure vessel in BRT	
Uncertainties in the radionuclide inventory	

2.4.1 Average radionuclide inventory in each waste-type package (Silo, BMA, BTF)

Short description of data

The dataset contains the estimated average radionuclide inventory in each waste-type package in the waste vaults (Silo, 1–2BMA and 1–2BTF).

Source of data

The average radionuclide inventory in each waste-type package is given in Appendix E in the Inventory report (SKB 2013a, SKBdoc 1481419 (Mo-93)).

Used in model or assessment activity

The average radionuclide inventory in the operational and decommissioning waste packages is together with the information on the number of waste packages in the waste vaults used to define the best estimate radionuclide inventory. This inventory is used in all calculation cases except the *high inventory calculation case*, see the **Radionuclide transport report**.

Data used

The data used are stored in the file:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/TIA (AMF86).xlsx

2.4.2 Number of waste packages in each waste vault (Silo, BMA, BTF)

Short description of data

The dataset contains the number of different waste-type packages allocated to the Silo, 1–2 BMA and 1–2BTF vaults.

Source of data

The allocation of different waste types to the waste vaults is given in the **Initial state report (**Table A-1). In addition, the allocation of waste-type packages to different shafts in the Silo and compartments in 1BMA is described in the **Initial state report** (Section 3.7).

Used in model or assessment activity

See Section 2.4.1.

Data used

The data used are stored in the files:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/Silo/Silo_NRWP (AMF86).xlsx svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA1/BMA1_NRWP(AMF86).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA2/BMA2_NRWP(AMF86).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF1/BTF1_NRWP(AMF86).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF2/BTF2_NRWP(AMF86).xlsx

2.4.3 Total radionuclide inventory in each waste vault (BLA)

Short description of data

The dataset contains the total radionuclide inventory in the waste vaults 1BLA and 2–5BLA.

Source of data

The best estimate radionuclide inventory in 1BLA and 2–5BLA is given in the **Initial state report** (Table 3-16). The inventory is based on the average radionuclide inventory in each waste-type package given in Appendix E in the Inventory report (SKB 2013a, SKBdoc 1481419 (Mo-93)) and the number of different waste-type packages allocated to the waste vaults given in the **Initial state report** (Table A-1).

Used in model or assessment activity

The best estimate radionuclide inventory is used in all calculation cases except the *high inventory calculation case*, see the **Radionuclide transport report**.

Data used

The data used are stored in the files:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BLA1/BLA1_TotalInitialAmount(AMF86).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BLA2 5/BLA2-5_TotalInitialAmount(AMF86).xlsx

2.4.4 Radionuclide inventory in each reactor pressure vessel in BRT

Short description of data

The dataset contains the best estimate radionuclide inventory in the nine reactor pressure vessel. The inventory is given as induced and surface activity for each reactor pressure vessel.

Source of data

The radionuclide inventory in each reactor pressure vessel in the waste vault BRT is given in Appendix E in the Inventory report (SKB 2013a, SKBdoc 1481419 (Mo-93)).

Used in model or assessment activity

The best estimate radionuclide inventory is used in all calculation cases except the *high inventory calculation case*, see the **Radionuclide transport report**.

Data used

The data used are stored in the file:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BRT_InitialAmount(AMF86).xlsx

2.4.5 Uncertainties in the radionuclide inventory

Short description of data

The dataset contains the radionuclide inventory in each waste vault calculated from the best estimate inventory including uncertainties.

Source of data

The uncertainties in the radionuclide inventory are discussed in Chapter 4 in the **Data report**. The detailed description of the uncertainties considered in the estimates of this inventory is described in SKBdoc 1427105.

Used in model or assessment activity

This radionuclide inventory is used in the *high inventory calculation case*, see the **Radionuclide transport report**.

Data used

The data used are stored in the files[3]:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/OtherScenarios/CC20_Silo_InitialAmountUncFactor(AMF86).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/OtherScenarios/CC20_BMA1_InitialAmountUncFactor(AMF86).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/OtherScenarios/CC20_BMA2_InitialAmountUncFactor(AMF86).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/OtherScenarios/CC20_BTF1_InitialAmountUncFactor(AMF86).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/OtherScenarios/CC20_BTF2_InitialAmountUncFactor(AMF86).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/OtherScenarios/CC20_BLA1_InitialAmountUncFactor(AMF86).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/OtherScenarios/CC20_BLA2-5_InitialAmountUncFactor(AMF86).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/OtherScenarios/CC20_BRT_InitialAmountUncFactor(AMF86).xlsx

2.5 AMF Number 94

Output from AMF activity	Input to AMF activity
Corrosion rates	Production of gas
Dataset	
Corrosion rates of Al and Zn, carbon steel and stainless steel	

2.5.1 Corrosion rates of Al and Zn, carbon steel and stainless steel

Short description of data

The dataset contains corrosion rates of aluminium/zinc and steel during saturated conditions used in the calculations of gas production.

[3] A CC-number is included in the name of the file, the corresponding CC-name used in the reporting of the PSU safety assessment can be found in Appendix A.

Source of data

The data are taken from a literature survey further described in Chapter 5 in the **Data report**. The literature survey focused on possible corrosion rates of metals under repository conditions.

Used in model or assessment activity

The data are used in a modelling activity to estimate possible hydrogen gas amounts in the repository stemming from the corrosions of the metals present in the waste and the concrete barriers. The modelling activity is further described in Moreno and Neretnieks (2013, Appendix A).

Data used

The corrosion rate used in the gas production calculations for aluminium and zinc is 1 (mm/year) and for carbon and stainless steel 0.05 (µm/year) (Moreno and Neretnieks 2013, Appendix A).

2.6 AMF Number 95

Output from AMF activity	Input to AMF activity
Corrosion of reactor presure vessels	RN transport in water phase
Dataset	
Reactor pressure vessel thickness and corrosion rates as a function of time	

2.6.1 Reactor pressure vessel thickness and corrosion rates as a function of time

Short description of data

The dataset contains the assumed thickness of the reactor pressure vessels, corrosion rates for carbon steel, as well as the point in time when the corrosion rate changes due to changed pH of the surroundings.

Source of data

The corrosion rates are given in AMF number 120 (Section 2.8), the dimensions of the reactor pressure vessels are given in AMF number 122 (Section 2.9) and the evolution of pH is given in AMF number 121 (Section 3.23).

Used in model or assessment activity

The data are used in the radionuclide transport calculations. The corrosion rate of the reactor pressure vessels determines the release rate of induced activity, see Chapter 9 in the **Radionuclide transport report**.

Data used

The data used are stored in the file:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BRT/CorrosionTime(AMF95).xlsx

2.7 AMF Number 118

Output from AMF activity	Input to AMF activity
Initial state – Waste	Concentration of complexing agents

Amounts of complexing agents (gluconate, EDTA, NTA) in waste packages
Amounts of cellulose in waste packages
Amounts of hydrated cement in waste packages
Pore and void volume in waste packages

2.7.1 Amounts of complexing agents in waste packages

Short description of data

The dataset contains the estimated amounts of gluconate, EDTA and NTA present in the waste packages. Gluconate, EDTA and NTA are complexing agents that can reduce radionuclide sorption to the concrete and bentonite barriers.

Source of data

The estimated amounts of complexing agents per waste package are given in Keith-Roach et al. (2014, Table 3-2).

Used in models, assessments, scenarios, and calculation cases

The amounts of existing complexing agents are used in the calculations of the expected concentration of complexing agents in waste packages and waste vault. The calculations are further described in Keith-Roach et al. (2014).

Data used

See Source of data.

2.7.2 Amounts of cellulose in waste packages

Short description of data

The dataset contains the estimated amounts of cellulose present in the waste packages. Under repository conditions cellulose can degrade to isosaccharinate (ISA), a complexing agent that can reduce radionuclide sorption.

Source of data

The estimated amounts of cellulose in relevant waste packages are given in Keith-Roach et al. (2014, Table 3-1).

Used in model or assessment activity

The amounts of cellulose are used to calculate the concentration of the ISA complexing agent in waste packages and waste vaults. The calculations are further described in Keith-Roach et al. (2014).

Data used

See Source of data.

2.7.3 Amounts of hydrated cement in waste packages

Short description of data

The dataset contains the amount of hydrated cement in conditioned waste and waste packaging is used to assess the sorption of the complexing agents.

Source of data

The estimated amounts of hydrated cement are given in Keith-Roach et al. (2014, Table B-4).

Used in model or assessment activity

The data are used in Keith-Roach et al. (2014) to assess the concentration of complexing in the aqueous phase in waste packages and other defined repository parts.

Data used

See Source of data.

2.7.4 Pore and void volume in the waste packages

Short description of data

The dataset contains the total pore volume in conditioned waste and packaging that will be saturated after closure.

Source of data

The void volumes are given in Appendix E in the Inventory report (SKB 2013a) and the pore volumes are calculated directly in Keith-Roach et al. (2014, Table B-4) and compared with information given in Appendix A in the **Initial state report**.

Used in model or assessment activity

The data are used in Keith-Roach et al. (2014) to assess the concentration of complexing agents in waste packages and other defined repository parts.

Data used

See Source of data.

2.8 AMF Number 120

Output from AMF activity	**Input to AMF activity**
Corrosion rates	Corrosion of reactor pressure vessels
Dataset	
Corrosion rate of steel	

2.8.1 Corrosion rate of steel

Short description of data

The dataset contains the corrosion rates of the reactor pressure vessels during saturated conditions.

Source of data

The corrosion rates are taken from a literature survey that focused on possible corrosion rates of metals under saturated conditions, see the **Data report** (Chapter 5). Corrosion rates for carbon and stainless steel for different repository conditions are given in Table 5-3 and Table 5-4 respectively in the **Data report**, where the data are qualified.

Used in model or assessment activity

The data are used for corrosion of the reactor pressure vessels in the radionuclide transport calculations.

Data used

See AMF number 95, Section 2.6.

2.9 AMF Number 122

Output from AMF activity	Input to AMF activity
Initial state – Waste	Corrosion of reactor pressure vessels
Dataset	
Reactor pressure vessel dimensions and materials	

2.9.1 Reactor pressure vessel dimensions and materials

Short description of data

To estimate the corrosion of the reactor pressure vessel the thickness and surface area available for corrosion are required as well as amounts of steel materials.

Source of data

Detailed information on the nine reactor pressure vessels can be found in Appendix E in the Inventory report (SKB 2013a).

Used in model or assessment activity

The data are used to describe the corrosion of the reactor pressure vessels in the radionuclide transport calculations, see the **Radionuclide transport report**.

Data used

See AMF number 95, Section 2.6.

2.10 AMF Number 125

Output from AMF activity	Input to AMF activity
Bitumen swelling Pressure	Bitumen swelling assessment
Dataset	
Possible swelling pressures of bitumen conditioned waste packages in Silo and 1BMA	

2.10.1 Possible swelling pressures of bitumen conditioned waste packages in Silo and 1BMA

Short description of data

The data contain estimated swelling pressures (Pa) from packages with waste conditioned in bitumen. The swelling pressure is given as a function of available expansion volume.

Source of data

The dataset is a result of a literature survey of available swelling pressure data. The data are given in Table 6-7 in the **Data report** where the data also are qualified.

Used in model or assessment activity

The pressures are used in modelling work to assess the mechanical impact of swelling waste in the Silo and 1BMA (see von Schenck and Bultmark 2014).

Data used

See Source of data.

2.11 AMF Number 126

Output from AMF activity	Input to AMF activity
Initial state – Waste	Bitumen swelling pressures
Dataset	
Amounts of bitumen, ion-exchange resins and salts in waste packages (B05, B06, F17 and F18)	

2.11.1 Amounts of bitumen, ion exchange resins and salts in waste packages

The amounts of bitumen, ion exchange resins and salts in waste packages have been compiled for the waste types B05, B06, F17 and F18.

Source of data

The data are given in Appendix E in the Inventory report (SKB 2013a).

Used in model or assessment activity

The amounts are used to estimate the potential swelling pressures of bituminised waste packages in the Silo and 1BMA, as outlined in Chapter 6 of the **Data report**.

Data used

See Source of data.

2.12 AMF Number 134

Output from AMF activity	Input to AMF activity
Microbial activity	Production of gas
Dataset	
Microbial degradation rates	

2.12.1 Microbial degradation rates

Short description of data

The dataset contains the microbial degradation rates for cellulose and other organics (e.g. bitumen, ion-exchange resins and other plastics) during saturated conditions used in the calculations of gas production.

Source of data

The degradation rates used in the gas production calculations for cellulose and for other organic material are given in Moreno and Neretnieks (2013, Appendix A).

Used in model or assessment activity

The data are used in a modelling activity to estimate gas formation in the repository. The modelling activity is further described in Moreno and Neretnieks (2013, Appendix A).

Data used

See Source of data.

2.13 AMF Number 137

Output from AMF activity	Input to AMF activity
Initial state – Waste	Bitumen swelling assessment
Dataset	
Amount and allocation of waste packages B05, B06, F17 and F18 in Silo and BMA vaults.	

2.13.1 Amount and allocation of waste packages B05, B06, F17 and F18 in Silo and BMA vaults

Short description of data

Amount and allocation of waste packages with bitumen solidified waste to shafts in the Silo and compartments in 1BMA.

Source of data

The waste packages with bitumen are allocated to the nine interior shafts in the Silo, see the **Initial state report** (Figure 7-2). In 1BMA the waste packages with bitumen are allocated to separate compartments. The distribution of waste types between the different compartments in 1BMA is described in the **Initial state report** (Table 3-14). The number of waste packages with bitumen solidified waste (B05, B06, F17 and F18) in the Silo and 1BMA is given in the **Initial state report** (Table A-1).

Used in model or assessment activity

The amount and allocation are used to assess the mechanical impact of swelling waste in the Silo and 1BMA (von Schenck and Bultmark 2014)

Data used

See Source of data.

2.14 AMF Number 154

Output from AMF activity	**Input to AMF activity**
Bitumen litterature data	Bitumen swelling pressures
Dataset	
Bitumen litterature data	

Short description of data

This is a list of the references reviewed in a literature survey, performed to support the estimation of possible swelling pressures in bituminised waste.

Source of data

The literature review is presented in Chapter 6 in the **Data report** where the data also are qualified. The literature references are given in Table 6-5 in the **Data report**.

Used in model or assessment activity

The literature data are used to estimate the possible swelling pressures in bituminised waste. The assessment is described in detail in Chapter 6 of the **Data report**.

Data used

See Source of data.

2.15 AMF Number 156

Output from AMF activity	**Input to AMF activity**
Corrosion rates literature data	Corrosion rates
Dataset	
Corrosion rates of Al and Zn, carbon steel and stainless steel	

2.15.1 Corrosion rates

Short description of data

Compilation of corrosion rates for aluminium/zinc, carbon steel and stainless steel for different repository conditions.

Source of data

The corrosion rates are taken from a literature survey that focused on possible corrosion rates of metals under repository conditions. The suggested data for carbon and stainless steel are given in Table 5-3 and Table 5-4 and for aluminium/zinc in Table 5-5 in the **Data report**, where the data also are qualified.

Used in model or assessment activity

The corrosion rates are used in the gas production calculations.

Data used

See AMF number 94, Section 2.5.

2.16 AMF Number 161

Output from AMF activity	Input to AMF activity
Initial state – Waste	RN transport due to gas pressure
Dataset	
Radionuclide inventory	

2.16.1 Radionuclide inventory

Short description of data

The dataset contains the inventory of the selected radionuclides in Becquerel.

Source of data

The data are given in Moreno and Neretnieks (2013, Appendix B.4).

Used in model or assessment activity

The radionuclide inventory is used for assessing gas driven transport of radionuclides, further described in Moreno and Neretnieks (2013).

Data used

See Source of data.

2.17 AMF Number 177

Output from AMF activity	Input to AMF activity
Initial state – Waste	Evolution of repository pH
Dataset	
Amounts of materials in different vaults	

2.17.1 Amounts of materials in different vaults

Short description of data

Content of various components identified as having a potential impact in the pH evolution in the different waste vaults.

Source of data

The data are given in Cronstrand (2014, Table 3-10).

Used in model or assessment activity

The data are used in the assessment activity to evaluate the pH evolution in the waste domain. It is concluded that the content of cement and concrete has the major impact on the pH evolution for all waste vaults except 1BLA (Cronstrand 2014, Figure 3-1). The pH evolution in the repository is described in Cronstrand (2014) and in the **Main report** (Chapter 6, Chemical evolution of the waste domain and Evolution of engineered barriers).

Data used

See Source of data.

2.18 AMF Number 178

Output from AMF activity	Input to AMF activity
Waste characterisation	Evolution of repository redox
Dataset	
Amounts of materials such as metals and organic matter	

2.18.1 Amounts of materials such as metals and organic matter

Short description of data

After repository closure, the reducing capacity is initially provided by the content of organic material and by the steel and its corrosion products.

Source of data

The amounts of steel and organic material in waste types representative for the different repository parts have been selected for the modelling of the evolution of redox conditions (Duro et al. 2012, Chapter 4).

Used in model or assessment activity

The data are used in modelling of the redox evolution of the SFR repository. The redox-evolution affects the speciation of redox-sensitive radionuclides hence the results in Duro et al. (2012) is used in the radionuclide transport calculations. In one of the residual calculation cases changed repository redox conditions are considered.

Data used

See Source of data.

2.19 AMF Number 208

Output from AMF activity	Input to AMF activity
Initial state – Waste	Concrete degradation due to sulphate attack
Dataset	
Sodium sulphate, Monosulphate and Katoite amounts in waste	

2.19.1 Sodium sulphate, mono sulphate and Katoite amounts in waste

Short description of data

Some waste types, e.g. the bitumen conditioned ion-exchange resins F.17, contains evaporator concentrates and these concentrates contains a significant amount of highly soluble salts. Sodium sulphate may be released from the salts and potentially affect adjacent cement waste matrices and concrete packaging in the repository through the formation of the expanding mineral ettringite.

Source of data

The dataset contains the amount of sodium sulphate in evaporate concentrates in the waste packages in the compartments containing F.17 in 1BMA and the content of Katoite (C3AH6) and mono sulphate in cement and concrete The data are taken from the inventory of evaporate concentrates (SKB 2013a, Table E24-2), amounts of cement and concrete in the compartments containing F.17 in 1BMA given in the **Initial state report** (Table A-3), and the composition of the evaporate concentrates given in SKBdoc 1417785.

Used in model or assessment activity

The dataset is used in an assessment of concrete degradation due to sulphate attack. The assessment is further described in the **Main report** (Chapter 6, Chemical evolution of the waste domain and Evolution of engineered barriers).

Data used

The data used on the inventory of cement and evaporate concentrate in the compartments containing the waste type F.17 in 1BMA are given in the **Main report** (Table 6-2).

3 Near-field excluding waste

3.1 AMF Number 25

Output from AMF activity	Input to AMF activity
Seismic load	Mechanical degradation of concrete due to load
Dataset	
Possibility of concrete degradation due to seismic activity	

3.1.1 Possibility of concrete degradation due to seismic activity

Short description of data

Data here is an assessment of the possibility of the concrete barriers and structures, mainly in the Silo vault, being damaged by seismic activity.

Source of data

The assessment is performed in Georgiev (2013).

Used in model or assessment activity

The assessment is used as supporting data in the reference evolution of the repository, see the **Main report** (Chapter 6).

Data used

The assessment presented in Georgiev (2013) gives a probability for damaging the concrete barriers and structures.

3.2 AMF Number 33

Output from AMF activity	Input to AMF activity
Initial state – Concrete barriers	Production of gas
Dataset	
Amounts and dimensions of steel in each waste vault	

3.2.1 Amounts and dimensions of steel in each waste vault

Short description of data

The dataset contains amounts and dimensions of steel found in the concrete barriers such as reinforcement in concrete structures.

Source of data

In Moreno and Neretnieks (2013, Appendix A) references are given to where the datasets are taken from.

Used in model or assessment activity

The datasets are used in the calculations of gas formation in SFR due to metal corrosion. This is further described in Moreno and Neretnieks (2013, Appendix A, Section 2).

Data used

See Source of data.

3.3 AMF Number 35

Output from AMF activity	Input to AMF activity
Mechanical degradation of concrete due to load	Evolution of concrete barriers
Dataset	
Assessment of the impact of mechanical processes on the concrete during the assessment time-period	

3.3.1 Assessment of the impact of mechanical processes on the concrete during the assessment time-period

Short description of data

This assessment compiles the information from investigations regarding Bitumen swelling (AMF 150, Section 3.29), Seismic Load (AMF 25, Section 3.1) and Rock Fallout and EDZ (AMF 26, Section 4.13) to give a general assessment regarding the influence of mechanical processes on the concrete barriers and structures during the assessment time-period.

Source of data

The sources of data are given in sections above.

Used in model or assessment activity

The general assessment is used in describing the reference evolution of the concrete barriers and structures in the **Main report** (Chapter 6).

Data used

See Source of data.

3.4 AMF Number 36

Output from AMF activity	Input to AMF activity
Freezing of concrete	Evolution of concrete barriers
Dataset	
Concrete freezing temperature	

3.4.1 Concrete freezing temperature

Short description of data

In concrete with pores completely filled with water, internal freezing may cause penetrating macro-cracks resulting in serious structural deterioration of the concrete so that it cannot be considered to be intact after freezing and thawing.

Source of data

The freezing temperature of the concrete in SFR is based on the results of an experimental study of the freezing properties of existing concrete in 1BMA (Thorsell 2013).

Used in model or assessment activity

The freezing temperature of the concrete in SFR is used in the assessment of the future evolution of the concrete barriers in SFR.

Data used

See Source of data.

3.5 AMF Number 38

Output from AMF activity	Input to AMF activity
Rebar corrosion and chemical degradation of concrete	Evolution of concrete barriers
Dataset	
Assessment of the impact of chemical processes on the concrete during the assessment time-period	

3.5.1 Assessment of the impact of chemical processes on the concrete during the assessment time-period

Short description of data

This assessment investigates the impact of chemical processes on the concrete barriers and structures, as well as on the rebar irons in the concrete, during the assessment time-period.

Source of data

The assessment is performed in Höglund (2014).

Used in model or assessment activity

The assessment conclusions are used both when describing the future evolution of the concrete in the repository (**Main report**, Chapter 6), when selecting concrete hydraulic properties in the near-field hydraulic modelling (Abarca et al. 2013), and when selecting concrete diffusion properties in the radionuclide transport modelling (**Radionuclide transport report)**.

Data used

See conclusions in Höglund (2014).

3.6 AMF Number 41

Output from AMF activity	Input to AMF activity
Freezing of bentonite	Evolution of bentonite barrier and plug
Dataset	
Assessment of the consequences on ice lens formation in the Silo	

3.6.1 Assessment of the consequences on ice lens formation in the Silo

Short description of data

This is an assessment of the possible consequences of an ice lens forming in the bentonite barrier in the Silo.

Source of data

The assessment is reported in Birgersson and Andersson (2014).

Used in model or assessment activity

The assessment is used as supporting data in when describing the reference evolution of the bentonite barriers in the **Main report** (Chapter 6).

Data used

See Birgersson and Andersson (2014, Section 4.1).

3.7 AMF Number 44

Output from AMF activity	Input to AMF activity
Initial state – Bentonite barrier and plug	Evolution of bentonite barrier and plug
Dataset	
Silo vault and waste dimensions	

3.7.1 Silo vault and waste dimensions

Short description of data

The dataset contains dimensions of the Silo vault, the Silo structure and the waste packages within the Silo.

Source of data

The data are derived from the **Initial state report** (Appendix A).

Used in model or assessment activity

The dimensions are used in a modelling study of several different H-M-processes in the Silo bentonite and sand/bentonite barriers (Börgesson et al. 2014)

Data used

See Börgesson et al. (2014, Appendix B).

3.8 AMF Number 45

Output from AMF activity	Input to AMF activity
Evolution of concrete barriers	Near-field hydrology
Dataset	
The physical porosities of concrete materials used in SFR. The hydraulic conductivities of the installed concrete/cement types present in SFR.	

3.8.1 The physical porosities of the concrete materials used in SFR

Short description of data

The physical porosity is a measurement of the volume of void (m^3) per volume (m^3) of mass. It affects transport processes through the barriers.

Source of data

The data are qualified in the **Data report (**Chapter 10) and given in Table 10-4 (called Total Porosity) in the report.

Used in model or assessment activity

The data are used in the modelling of the near-field hydrology to calculate the groundwater flow through different components (Abarca et al. 2013).

Data used

See Source of data.

3.8.2 The hydraulic conductivities of the installed concrete/cement types present in SFR

Short description of data

The hydraulic conductivity (m/s) of a material is a property which describes the ease with which water can flow through it, through pore spaces and fractures.

Source of data

The data are qualified in the **Data report (**Chapter 10) and given in Table 10-4 in the report.

Used in model or assessment activity

The hydraulic conductivities are used in the modelling of the near-field hydrology to calculate the groundwater flow through different components (Abarca et al. 2013).

Data used

See Source of data.

3.9 AMF Number 46

Output from AMF activity	**Input to AMF activity**
Evolution of bentonite barrier and plug	Near-field hydrology
Dataset	
The physical porosities of bentonite barrier and plug materials The hydraulic conductivities of bentonite barrier and plug materials	

3.9.1 The physical porosities of bentonite barrier and plug materials

Short description of data

The physical porosity is a measurement of the volume of void (m^3) per volume (m^3) of mass. It affects transport processes in and through the barriers.

Source of data

Physical porosities for bentonite and other plug materials are given in the **Initial state report** (Section 12.5) as well as in Börgesson et al. (2014).

Used in model or assessment activity

Here, the porosities are used to assess barrier saturation (Börgesson et al. 2014).

Data used

See Source of data.

3.9.2 The hydraulic conductivities of bentonite barrier and plug materials

Short description of data

The hydraulic conductivity (m/s) of a material is a property that describes the ease with which water can flow through it.

Source of data

Hydraulic conductivities for bentonite and plug materials are given in the **Initial state report** (Section 12.5) as well as in Börgesson et al. (2014).

Used in model or assessment activity

The data are used to calculate the groundwater flow in the repository near-field as function of the hydraulic properties of the bentonite barriers and plugs (Abarca et al. 2013). The data are further used to assess barrier saturation (Börgesson et al. 2014).

Data used

See Source of data.

3.10 AMF Number 49

Output from AMF activity	**Input to AMF activity**
Evolution of repository redox	Non-flow related RN transport properties
Dataset	
Redox conditions	

3.10.1 Redox conditions

Short description of data

The data describes the redox-conditions in SFR1 due to corrosion/degradation of materials present in the repository. The derived redox conditions come from thermodynamic modelling of the corrosion/degradation processes. The influence of penetrating oxidants, oxygen, due to intrusion of glacial melt water is modelled.

Source of data

The results from the modelling of the redox conditions are found in Duro et al. (2012, Chapter 6). The results are displayed as reductive capacity (RDC) which is the amount of electrons available. A positive amount means reducing conditions.

Used in model or assessment activity

The results are used when deriving K_d-values for redox-sensitive elements. Reduced species are used in the main scenario and oxidised species are used in the Changed repository redox conditions scenario.

Data used

See Source of data.

3.11 AMF Number 50

Output from AMF activity	Input to AMF activity
Near-field hydrology	RN transport in water phase
Dataset	
Water flows and flow directions (x, y, z) for each vault and concrete degradation state during relevant time steps.	

3.11.1 Water flows and flow directions (x, y, z) for each vault and concrete degradation state during relevant time steps.

Short description of data

The hydrological dataset contains water fluxes across surfaces of control volumes specified for the waste vault. Further description of the data can be found in the **Radionuclide transport report** (Appendix A) and in Abarca et al. (2013, Section 3.3).

Source of data

The data were assembled from near-field hydrology calculations performed by Abarca et al. (2013).

Used in model or assessment activity

The data are used for the radionuclide transport calculations in the Near-field.

Data used

The raw-data delivered from the hydrological calculations as well as the data pre-processed for use in the radionuclide transport calculations are stored in a subversion repository hosted at SKB.

The releases for each degradation state and vault can be found at a location like:

svn://svn.skb.se/kalkyl/SFR/SR-PSU/Indata/Release2Biosphere/[CC]/[MODEL].ear

svn:// svn.skb.se /projekt/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/[MODEL]/Water fluxes (AMF 50)/ [MODEL]_WaterFluxes_[DEG_STATE].xlsx

Where:

[DEG_STATE]: is the concrete degradation state (see Abarca et al. 2013).

[MODEL]: is the name of the model for each repository, i.e. one of {BLA1, BLA2, BLA3, BLA4, BLA5, BMA1, BMA2, BRT, BTF1, BTF2, Silo} (With an exception for the data for 2–5BLA which are stored in the same directory)

3.12 AMF Number 51

Output from AMF activity	Input to AMF activity
Evolution of repository pH	Geochemical evolution
Dataset	
Speciation of fresh concrete porewater	

3.12.1 Speciation of fresh concrete porewater

Short description of data

The dataset describes the speciation of the concrete porewater that exist in the repository.

Source of data

The speciation is modelled and presented in Cronstrand (2014).

Used in model or assessment activity

The speciation is used when assessing the possibility of repository water influencing (see also AMF number 109, Section 3.20) the chemical composition of the groundwater surrounding the repository, see the **Main report** (Chapter 6).

Data used

See Source of data.

3.13 AMF Number 61

Output from AMF activity	Input to AMF activity
Evolution of concrete barriers	Non-flow related RN transport properties
Dataset	
Assessment regarding state of the concrete barriers during assessment time-period	

3.13.1 Assessment regarding the state of concrete barriers during assessment time-period

Short description of data

An assessment that describes the states of mechanical and chemical condition the concrete barriers and structures will be during the assessment time-period.

Source of data

The assessment is performed in the reference evolution, **Main report** (Chapter 6).

Used in model or assessment activity

The assessment is used as supporting data when selecting sorption partitioning coefficients and effective diffusion constants for the concrete materials in the repository (**Data report**, Chapters 7 and 9).

Data used

See Source of data.

3.14 AMF Number 63

Output from AMF activity	Input to AMF activity
Evolution of bentonite barrier and plug	Non-flow related RN transport properties
Dataset	
Assessment regarding state of the bentonite barriers and plugs during assessment time-period	

3.14.1 Assessment regarding state of the bentonite barriers and plugs during assessment time-period

Short description of data

An assessment that describes the states of mechanical and chemical condition of bentonite barriers and plugs during the assessment time-period.

Source of data

The reference evolution is reported in the **Main report** (Chapter 6).

Used in model or assessment activity

The assessment is used when selecting sorption partitioning coefficients and effective diffusion constants for the bentonite materials in the repository (**Data report**, Chapter 7).

Data used

See Source of data.

3.15 AMF Number 75

Output from AMF activity	Input to AMF activity
Non-flow related RN transport properties	RN transport in water phase
Dataset	
Sorption partitioning constants for the different materials present in the repository Effective diffusivites for the different materials present in the repository Diffusion available porosities of the different materials present in the repository Densities of the different matrials present in the repository	

3.15.1 Sorption partitioning constants for the different materials present in the repository

Short description of data

The data are sorption partitioning constants, K_d, in m^3/kg for the concrete, bentonite and gravel materials present in the repository. The constants are time dependent due to changes in degradations states of the materials and changes in pH for some repository vaults. The concrete datasets are also variable dependent on the amount of cement present in the concrete, see the **Data report** (Chapter 7).

Source of data

The datasets are presented, qualified in the **Data report** (Chapters 7 and 8).

Used in model or assessment activity

Sorption partitioning constants are used in the radionuclide transport calculations, see the **Radionuclide transport report**.

Data used

The data used are stored in the files listed below:
1BLA: no sorption
2–5BLA: no sorption

Concrete

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/NearfieldKd(AMF75).xlsx

1BMA:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA1/BMA1_KdFactor (AMF75).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA1/BMA1_KdSelector(AMF75).xlsx

2BMA:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA2/BMA2_KdFactor(AMF75).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA2/BMA2_KdSelector (AMF75).xlsx

1BTF:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF1/BTF1_KdFactor(AMF75).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF1/BTF1_KdSelector(AMF75).xlsx

2BTF:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF2/BTF2_KdFactor(AMF75).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF2/BTF2_KdSelector(AMF75).xlsx

BRT:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BRT/BRT_KdFactor(AMF75).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BRT/BRT_KdSelector(AMF75).xlsx

Silo:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/Silo/Silo_KdFactor(AMF75).xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/Silo/Silo_KdSelector(AMF75).xlsx

Cement portion of the different concretes and waste matrices:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/MixingFractions(AMF75).xlsx

Bentonite materials

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/NearfieldKd(AMF75).xlsx

Sand/Gravel

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/NearfieldKdGravel(AMF75).xlsx

3.15.2 Effective diffusivities for the different materials present in the repository

Short description of data

Effective diffusivities are given for the different concrete, bentonite, and gravel materials in the repository. Diffusivities for concrete and grout are time dependent to reflect the degradation of the materials.

Source of data

The datasets for concrete and for bentonite materials are qualified in the **Data report** (Chapters 7 and 9). Diffusivities for other materials are taken from the SAFE project (SKB 2001).

Used in model or assessment activity

Effective diffusivities are used in the radionuclide transport calculations, see the **Radionuclide transport report**.

Data used

Concrete

1BLA:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BLA1/BLA1_De(AMF75).xlsx

2–5BLA:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BLA1/BLA1_De(AMF75).xlsx

1BMA:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA1/BMA1_De(AMF75).xlsx

2BMA:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA2/BMA2_De(AMF75).xlsx

1BTF:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF1/BTF1_De(AMF75).xlsx

2BTF:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF2/BTF2_De(AMF75).xlsx

Silo:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/Silo/Silo_De(AMF75).xlsx

Other materials

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/NearfieldDe(AMF75).xlsx

3.15.3 Diffusion available porosities of the different materials present in the repository

Short description of data

Diffusion available porosities are given for the different materials in the repository. The porosities for concrete materials are time dependent to reflect degradation.

Source of data

The datasets for concrete and for bentonite materials are qualified in the **Data report** (Chapter 7 for bentonite and Chapter 10 for concrete materials as Total Porosity). Porosities for other materials are taken from the SAFE project (SKB 2001) and presented in the **Initial state report**.

Used in model or assessment activity

The diffusion available porosities are used in the radionuclide transport calculations, see the **Radionuclide transport report**.

Data used

Concrete

1BLA:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BLA1/BLA1_ConcretePorosity(AMF75).xlsx

2–5BLA:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BLA1/BLA1_ConcretePorosity(AMF75).xlsx

1BMA:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA1/BMA1_ConcretePorosity(AMF75).xlsx

2BMA:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA2/BMA2_ConcretePorosity(AMF75).xlsx

1BTF:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF1/BTF1_ConcretePorosity(AMF75).xlsx

2BTF:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF2/BTF2_ConcretePorosity(AMF75).xlsx

Silo:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/Silo/Silo_ConcretePorosity(AMF75).xlsx

Other materials
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/NearfieldPorosity(AMF75).xlsx

3.15.4 Densities of the different materials present in the repository

Short description of data

Densities are given for the different materials in the repository.

Source of data

Densities correspond to those used in the SAFE safety assessment (SKB 2001).

Used in model or assessment activity

Densities are used in the radionuclide transport calculations, see the **Radionuclide transport report**.

Data used

The used data are stored in the file:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/NearfieldRho(AMF75).xlsx

3.16 AMF Number 76

Output from AMF activity	Input to AMF activity
RN transport in water phase	RN transport in water phase (Geosphere)
Dataset	
Radionuclide release from the near-field to the geosphere	

3.16.1 Radionuclide release from the near-field to the geosphere

Short description of data

Data consists of the release of radionuclides released from the waste vaults and into the geosphere.

Source of data

Radionuclide transport calculations for the near-field, see the **Radionuclide transport report** for details.

Used in model or assessment activity

The data are used as input to the calculations of radionuclide transport in the geosphere.

Data used

The data used are saved in the same files as the corresponding releases from geosphere to biosphere, see Section 4.10.1.

3.17 AMF Number 85

Output from AMF activity	Input to AMF activity
Initial state – Concrete barriers	RN transport in water phase
Dataset	
Dimensions of concrete barriers in Silo, BMA, BRT and BTF vaults	

3.17.1 Dimensions of concrete barriers in Silo, BMA, BRT and BTF vaults

Short description of data

The dataset contain dimensions (height and width) of the different concrete barriers present in the Silo, the BMA, the BRT and the BTF waste vaults.

Source of data

Data are taken from the **Initial state report** (Tables 4-1, 5-1, 6-1, 6-2, 7-3, 8-1, 9-1 and 10-1).

Used in model or assessment activity

The dimensions are used in the **Radionuclide transport report** to calculate the release of radionuclides from the SFR repositories.

Data used

Data are stored in the following files:

1BLA:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BLA1/BLA1_Dimensions(AMF85).xlsx

2–5BLA:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BLA2-5/BLA2-5_Dimensions(AMF85).xlsx

1BMA:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA1/BMA1_Dimensions(AMF85).xlsx

2BMA:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BMA2/BMA2_Dimensions(AMF85).xlsx

BRT:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BRT/BRT_Dimensions(AMF85).xlsx

1BTF:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF1/BTF1_Dimensions(AMF85).xlsx

2BTF:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/BTF2/BTF2_Dimensions(AMF85).xlsx

3.18 AMF Number 100

Output from AMF activity	Input to AMF activity
Initial state – Bentonite barriers	RN transport in water phase
Dataset	
Dimensions of bentonite and bentonite/sand barriers in Silo	

3.18.1 Dimensions of bentonite and bentonite/sand barriers in Silo.

Short description of data

The dataset contain dimensions (height, width and radius) of the different bentonite barriers in the silo.

Source of data

The data are taken from the **Initial state report** (Table 7-3).

Used in model or assessment activity

The dimensions are used in the **Radionuclide transport report** to calculate the release of radionuclides from the Silo repository.

Data used

Data are stored in the following file:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Near-field/Indata/Ecolego/Silo/Silo_Dimensions(AMF85).xlsx

3.19 AMF Number 104

Output from AMF activity	Input to AMF activity
Near-field hydrology	Non-flow related RN transport properties
Dataset	
Assessment of the impact of the repository water flow on sorption and diffusion	

3.19.1 Assessment of the impact of the repository water flow on sorption processes

Short description of data

This assessment regards the impact of the water flows through the repository barriers and waste packages on the sorption processes.

Source of data

The assessment is performed in the **Main report** (Chapter 6) with supporting data taken from Abarca et al. (2013).

Used in model or assessment activity

The assessment is used as support when selecting sorption partitioning constants (**Data report** Chapters 7 and 8) for use in the **Radionuclide transport report**.

Data used

See Source of data.

3.20 AMF Number 109

Output from AMF activity	Input to AMF activity
Near-field hydrology	Geochemical evolution
Dataset	
Outflow of water from the repository	

3.20.1 Outflow of water from the repository

Short description of data

The dataset is an estimate of the amount of repository water flowing into the surrounding geosphere.

Source of data

The estimate is taken from Abarca et al. (2013).

Used in model or assessment activity

The estimate is used together with an estimate of concrete porewater speciation (see AMF Number 51, Section 3.12) to assess the impact of repository water on the geochemical evolution in the surrounding geosphere.

Data used

See Source of data.

3.21 AMF Number 113

Output from AMF activity	Input to AMF activity
Initial state – Backfill	Hydrogeology
Dataset	
Backfill hydraulic conductivity	

3.21.1 Backfill hydraulic conductivity

Short description of data

The dataset describes the hydraulic conductivity of the backfill used in the SFR repository.

Source of data

Data are taken from SKBdoc 1358612.

Used in model or assessment activity

The conductivity is used in the regional hydrogeological model when assessing the regional hydraulic gradient surrounding the repository (Odén et al. 2014).

Data used

See Source of data.

3.22 AMF Number 116

Output from AMF activity	Input to AMF activity
Layout Underground Openings	Hydrogeology
Dataset	
Geometries of SFR 1 and SFR 3 repositories	

3.22.1 Geometries of SFR 1 and SFR 3 repositories

Short description of data

The data consists of CAD-files describing the geometries of the different parts of the repository. The files use the RT90 coordinate system.

Source of data

The original data are taken from the **Initial state report** (Chapter 11).

Used in model or assessment activity

The geometries are used in the regional hydrogeological model when assessing the regional hydraulic gradient surrounding the repository (Odén et al. 2014).

Data used

The geometry files are stored in the following SKBdoc documents:

- SFR1 geometries (SKBdoc 1373072)[4]
- SFR3 geometries (SKBdoc 1372987)[5]

[4] Internal document, Svensk Kärnbränslehantering AB.

[5] Internal document, Svensk Kärnbränslehantering AB.

3.23 AMF Number 121

Output from AMF activity	Input to AMF activity
Evolution of repository pH	Corrosion of reactor pressure vessels
Dataset	
pH evolution in BRT vault during assessment time-period	

3.23.1 pH evolution in BRT vault during assessment time-period

Short description of data

The dataset represents an assessment of the evolution of pH in the BRT waste vault.

Source of data

The assessment is described in Cronstrand (2014).

Used in model or assessment activity

The assessment is used when selecting corrosion rates (see AMF Number 120, Section 2.8) that govern the release of radionuclides from the reactor pressure vessels in the BRT vault.

Data used

See Source of data.

3.24 AMF Number 127

Output from AMF activity	Input to AMF activity
Initial state – Repository layout	Near-field hydrology
Dataset	
Geometries of SFR 1 and SFR 3 in RT90 coordinate system.	

3.24.1 Geometries of SFR 1 and SFR 3 repositories

Short description of data

The data consists of CAD-files describing the geometries of the different parts of the repository. The files use the RT90 coordinate system.

Source of data

The original data are taken from the **Initial state report** (Chapter 11).

Used in model or assessment activity

CAD data was imported and used as geometry input for assessment of the near-field hydrology calculations. The geometry data are further described in Abarca et al. (2013, Section 3.1).

Data used

The used data are stored in SKBdoc documents (1428528, 1428206, 1428207 and 1428208)[6].

[6] Internal document, Svensk Kärnbränslehantering AB.

3.25 AMF Number 132

Output from AMF activity	**Input to AMF activity**
Initial state – Concrete barriers	Concentration of complexing agents

Dataset

Amounts of hydrated cement present in construction concrete and grout
Pore and void volume in vaults

3.25.1 Amounts of hydrated cement present in construction concrete and grout

Short description of data

The dataset contains the estimated amounts of hydrated cement present in construction concrete and grout in whole vaults but estimates are also given for smaller units e.g. compartments in 1BMA and caissons in 2BMA.

Source of data

The amounts in (kg) are given in Keith-Roach et al. (2014, Table B-4) and are based on information given in the **Initial state report** (Appendix A).

Used in model or assessment activity

The amounts of hydrated cement are used for calculating how much of the complexing agents that will sorb and therefore not add to the complexing agents' concentration in the vaults. The calculations are further described in Keith-Roach et al. (2014).

Data used

See Source of data.

3.25.2 Pore and void volume in vaults

Short description of data

The dataset contains the estimated pore and void volume (m^3) in whole vaults but estimates are also given for smaller units e.g. compartments in 1BMA and caissons in 2BMA.

Source of data

The pore and void volumes are given in Keith-Roach et al. (2014, Table B-4) and are based on information given in the **Initial state report** (Appendix A).

Used in model or assessment activity

The pore and void volumes are used in the calculations of the concentration of complexing agents' in the waste vaults. The calculations are further described in Keith-Roach et al. (2014).

Data used

See Source of data.

3.26 AMF Number 133

Output from AMF activity	Input to AMF activity
Evolution of repository pH	Microbial activity
Dataset	
pH evolution in vaults during assessment time-period	

3.26.1 pH evolution in vaults during assessment time-period

Short description of data

The pH in the engineered barriers and the waste will change over time due to leaching of concrete minerals. This is assessed in Cronstrand (2014) and further evaluated in the **Main report** (Chapter 7).

Source of data

The data are given in Cronstrand (2014, Table 5-1) and further evaluated in the **Main report** (Chapter 7).

Used in model or assessment activity

The data are used to evaluate the abundance of microbial activity in the waste and engineered barriers, see the **Main report** (Chapter 6).

Data used

See Source of data.

3.27 AMF Number 140

Output from AMF activity	Input to AMF activity
Freezing of concrete study	Freezing of concrete
Dataset	
Subzero temperature at which concrete disintegrates	

3.27.1 Subzero temperature at which concrete disintegrates.

Short description of data

The data originate from an experimental study regarding the consequences on concrete due of freezing. The study suggests that concrete will fracture at temperatures somewhere between –3°C to –10°C.

Source of data

The data are presented in Thorsell (2013, Table 3-2).

Used in models, assessments, scenarios, and calculation cases

The results are used to assess when in time the concrete in the repository can be expected to have lost its hydraulic resistance. This is used in the radionuclide transport calculations main scenario, see the **Radionuclide transport report**.

Data used

See Source of data.

3.28 AMF Number 146

Output from AMF activity	**Input to AMF activity**
Generic concrete porewater composition	Non-flow related transport properties
Dataset	
Concrete porewater composition	

3.28.1 Concrete porewater composition

Short description of data

The dataset contains a chemical composition of concrete porewater. The dataset is described as generic as the SFR specific composition presented by Cronstrand (2014) was not ready when this dataset was used. Therefore a generic composition was assumed.

Source of data

The composition is assumed in Crawford (2013, Section 4.2.1).

Used in model or assessment activity

The composition is used in the same report (Crawford 2013) when assessing the possibility of a high pH plume affecting the sorption partitioning constants used for the geosphere radionuclide transport calculations.

Data used

See Source of data.

3.29 AMF Number 150

Output from AMF activity	**Input to AMF activity**
Bitumen swelling assessment	Mechanical degradation of concrete due to load
Dataset	
Grouting assessment for bitumen containing waste packages	

3.29.1 Grouting assessment for bitumen containing waste packages

Short description of data

The assessment regards the possibility to grout around the waste packages containing evaporator concentrates moulded in bitumen in the 1BMA and Silo repositories.

Source of data

The assessment is performed using the software COMSOL Multiphysics (see the **Model summary report**) to test the 1BMA and Silo structural strength (von Schenck and Bultmark 2014).

Used in models, assessments, scenarios, and calculation cases

The conclusion of this assessment is used when describing the reference evolution of the engineered barriers in the **Main report** (Chapter 6).

Data used

See the conclusions in von Schenck and Bultmark (2014).

3.30 AMF Number 151

Output from AMF activity	Input to AMF activity
Initial state – Concrete barriers	Bitumen swelling assessment

Dataset

Allocation of bitumen conditioned waste packages in 1BMA
Structural strength data for Silo structural concrete and grout
Structural strength data for 1BMA structural concrete, grout, and floor gravel

3.30.1 Allocation of bitumen conditioned waste packages in 1BMA

Short description of data

The dataset contains the planned locations of waste packages B05, B05:2, F05, F17, F15, F99 and R01 in the 1BMA compartments.

Source of data

The allocation data are given in the **Initial state report** (Table 3-13).

Used in model or assessment activity

The data are used in an assessment to estimate possible structural damages on the 1BMA and Silo structures due to swelling waste packages. The assessment is further described in von Schenck and Bultmark (2014).

Data used

See Source of data.

3.30.2 Structural strength data for Silo structural concrete and grout

Short description of data

The dataset contains material strength properties for the structural concrete used in the Silo and the presumed grouting around the waste packages.

Source of data

The data are taken from SKBdoc 1209128[7], Noguchi et al. (2009) and Boverket (2004).

Used in models, assessments, scenarios, and calculation cases

The data are used in an assessment to estimate possible structural damages on the 1BMA and Silo structures due to bitumen swelling waste packages. The assessment is further described in von Schenck and Bultmark (2014).

Data used

See von Schenck and Bultmark (2014, Tables 1-1 and 1-2).

3.30.3 Structural strength data for 1BMA structural concrete, grout and floor gravel

Short description of data

The dataset contains material strength properties for the structural concrete used in the 1BMA, the presumed grouting around the waste packages, and the gravel beneath the 1BMA concrete floor.

[7] Internal document, Svensk Kärnbränslehantering AB.

Source of data

The data are taken from Noguchi et al. (2009) and Boverket (2004), and reproduced in the **Initial state report**.

Used in models, assessments, scenarios, and calculation cases

The data are used in an assessment to estimate possible structural damages on the 1BMA and Silo structures due to bitumen swelling waste packages. The assessment is further described in von Schenck and Bultmark (2014).

Data used

See von Schenck and Bultmark (2014, Tables 1-1 and 1-2).

3.31 AMF Number 152

Output from AMF activity	Input to AMF activity
Initial state – Concrete barriers	Rebar corrosion and chemical degradation of concrete
Dataset	
Geometry of vaults, backfill and concrete barriers Hydraulic conductivities of backfill and concrete barriers Physical porosities of backfill and concrete barriers	

3.31.1 Geometries of the 1BMA and 2BMA vaults, backfill and concrete barriers

Short description of data

The dimensions (length, height and width) of the different vaults and the concrete barriers present in the 1BMA and 2BMA repository vaults.

Source of data

The 1BMA and 2BMA layouts are derived from the **Initial state report** (Tables 4-1 and 5-1).

Used in models, assessments, scenarios, and calculation cases

The dimensions are used in the assessment of the impact of corrosion of reinforcing bars and other embedded steel components on the integrity of the concrete barriers, as well as in the modelling of the chemical degradation of concrete barriers in the 1BMA and 2BMA vault (Höglund 2014).

Data used

See Source of data.

3.31.2 Hydraulic conductivities of backfill and concrete barriers

Short description of data

Hydraulic conductivity is a material property that describes the ease in which water can pass through the material.

Source of data

The hydraulic conductivities for macadam backfill and the concrete barriers are taken from Höglund (2014).

Used in models, assessments, scenarios, and calculation cases

The hydraulic conductivities are used for calculation of the water flow rates and the flow distribution between macadam backfill and different concrete barriers in the 1BMA and 2 BMA vaults, further described in Höglund (2014).

Data used

See Source of data.

3.31.3 Physical porosities of backfill and concrete barriers

Short description of data

The physical porosity parameter is a material property giving the amount of void space in a cubic meter of the material, shortened to (–).

Source of data

The physical porosities for concrete and cement are taken from Höglund (2014, Tables 7-5 and 7-7)

Used in models, assessments, scenarios, and calculation cases

The physical porosities are used for calculation of the water flow rates in the macadam backfill and different concrete barriers in the 1BMA and 2BMA vaults, further described in Höglund (2014).

Data used

See Source of data.

3.32 AMF Number 153

Output from AMF activity	**Input to AMF activity**
Near-field hydrogeology	Rebar corrosion and chemical degradation of concrete
Dataset	
Total water flows and water flow patterns within the vaults, backfill and the concrete barrriers	

3.32.1 Water flow and flow patterns within the vaults, backfill and concrete barriers

Short description of data

The dataset contains calculated water flows through the 1BMA and 2BMA vaults in throughout the assessment period.

Source of data

The data are taken from the following sources:

- Water flow in the 1BMA: Höglund (2014, Figures 7-7 and 7-12, and Table 7-7), based on the hydrogeological modelling performed in the SAFE safety assessment (Holmén and Stigsson 2001).
- Water flow in the 2BMA: Höglund (2014, Figure 7-7 and Table 7-6), based on hydrogeological modelling presented by Abarca et al. (2013).

Used in models, assessments, scenarios, and calculation cases

The water flow into the vault are used for calculation of the water flow rates and the flow distribution between macadam backfill and different concrete barriers in the 1BMA and 2BMA vaults, further described in Höglund (2014).

Data used

See Source of data.

3.33 AMF Number 157

Output from AMF activity	Input to AMF activity
Bentonite and concrete material properties	RN transport due to gas pressure
Dataset	
Effective diffusivites Physical porosities Particle densities Hydraulic conductivites Concrete/Cement Sorption distribution coefficients	

3.33.1 Effective diffusivities

Short description of data

Effective diffusivity is a material property which describes the ease for gases and dissolved species to diffuse through the material media.

Source of data

The effective diffusivity for concrete and cement is taken from the **Data report** (Table 9-5) where the data are also qualified. The other diffusivities are taken from the SAFE data report for the radionuclide transport calculations (SKB 2001).

Used in model or assessment activity

The effective diffusivities are used for assessing gas driven transport of radionuclides, further described in Moreno and Neretnieks (2013).

Data used

See Source of data.

3.33.2 Physical porosities

Short description of data

The physical porosity parameter is a material property giving the amount of void space in a cubic metre of the material, which is shortened to (–).

Source of data

The physical porosity for concrete and cement is taken from the **Data report** (Table 10-4, column Total Porosity) where the data are also qualified. The other porosities are taken from the compilation of data for the SAFE radionuclide transport calculations (SKB 2001).

Used in model or assessment activity

The effective diffusivities are used for assessing gas driven transport of radionuclides, further described in Moreno and Neretnieks (2013).

Data used

See Source of data.

3.33.3 Particle densities

Short description of data

The particle density parameter gives the weight of a cubic metre of material without considering porosity hydrogeological.

Source of data

The particle densities data are taken from the compilation of data for the SAFE radionuclide transport calculations (SKB 2001).

Used in model or assessment activity

The particle densities are used for assessing gas driven transport of radionuclides, further described in Moreno and Neretnieks (2013).

Data used

See Source of data.

3.33.4 Hydraulic conductivities

Short description of data

Hydraulic conductivity is a material property that describes the ease in which water can pass through the material. This property is a function of the materials density and physical porosity.

Source of data

The hydraulic conductivities for concrete and cement are taken from the **Data report** (Table 10-4) where the data are also qualified. The other hydraulic conductivities are taken from the compilation of data for the SAFE radionuclide transport calculations (SKB 2001).

Used in model or assessment activity

The hydraulic conductivities are used for assessing gas driven transport of radionuclides, further described in Moreno and Neretnieks (2013).

Data used

See Source of data.

3.33.5 Concrete/Cement Sorption distribution coefficients.

Short description of data

The dataset contains partitioning constants (K_d) used to calculate the impacts of radionuclide release due to gas driven advection.

Source of data

The sorption distribution coefficients are given in the **Data report** (Tables 7-7, 7-8, 7-9 and 7-12).

Used in model or assessment activity

The sorption distribution coefficients are used for assessing gas driven transport of radionuclides, further described in Moreno and Neretnieks (2013)

Data used

See Source of data.

3.34 AMF Number 158

Output from AMF activity	Input to AMF activity
Near-field water flows	RN transport due to gas pressure
Dataset	
Near-field water flows during set points in time	

3.34.1 Near-field water flows during set points in time

Short description of data

The dataset contains calculated data flows through the different SFR1 vaults and waste packages at set points in the assessment time-period.

Source of data

The data are taken from the hydrogeological modelling performed by Abarca et al. (2013).

Used in model or assessment activity

The Near-field water flows are used for assessing gas driven transport of radionuclides, further described in Moreno and Neretnieks (2013).

Data used

The used data are given in Moreno and Neretnieks (2013, Table 3-14).

3.35 AMF Number 160

Output from AMF activity	Input to AMF activity
Sorption coefficients and diffusion constants	Non-flow related RN transport properties
Dataset	
Sorption distribution coefficients for Near-field materials Effective diffusivites for Near-field materials Diffusion available porosities for Near-field materials	

3.35.1 Sorption distribution coefficients for near-field materials

Short description of data

The datasets contain the sorption partition coefficients for the near-field, e.g. for cement, bentonite and crushed rock (gravel) that have been produced for the SR-PSU safety assessment.

Source of data

Bentonite and Concrete/Cement

Data are given in the **Data report** where the data are qualified. The distribution coefficients for hydrated cement paste are given in the **Data report** (Tables 7-7 to 7-10) and the content of hydrated cement paste in different cement/concrete types is given in the **Data report** (Table 7-12). The distribution coefficients for bentonite are given in the **Data report** (Table 7-6).

Crushed rock/Macadam backfill

Data are given in the **Data report** (Table 8-7) where they are qualified. Note that the data originated from Crawford (2013).

Used in model or assessment activity

The dataset is used in an assessment to select the sorption partition coefficients to use in the radionuclide transport (see AMF Number 75, Section 3.15.1). The sorption coefficients are adjusted in the radionuclide transport modelling to reflect sorption on concrete by using the cement ratio in the concrete. The assessment is further described in the **Radionuclide transport report**.

Data used

See Source of data.

3.35.2 Effective diffusivities for near-field materials

Short description of data

The dataset contains the effective diffusivities for the near-field materials.

Source of data

The concrete/cement and bentonite diffusivities are taken from the **Data report** where the data are qualified. The other diffusivities are taken from SKB (2001).

The concrete/cement diffusivities are given in the **Data report** (Table 9-4). The Bentonite diffusivities are given in the **Data report** (Table 7-5).

Used in model or assessment activity

The dataset is used in an assessment to select the effective diffusivities to use in the radionuclide transport modelling (see AMF Number 75, Section 3.15.2). The assessment is further described in the **Radionuclide transport report**.

Data used

See Source of data.

3.35.3 Diffusion available porosities for Near-field materials

Short description of data

The dataset contains the diffusion available porosities for near-field materials.

Source of data

The concrete/cement and bentonite diffusion available porosities are taken from the **Data report** where the data are also qualified. The other porosities are taken from SKB (2001).

The concrete/cement diffusion available porosities are given in the **Data report** (as Total Porosities, Table 10-4). The Bentonite diffusion available porosities are given in the **Data report** (Table 7-4).

Used in model or assessment activity

The dataset is used in an assessment to select the effective diffusivities to use in the radionuclide transport modelling (see AMF Number 75, Section 3.15.3). The assessment is further described in the **Radionuclide transport report**.

Data used

See Source of data.

3.36 AMF Number 174

Output from AMF activity	**Input to AMF activity**
Evolution of repository pH	Non-flow related RN transport properties
Dataset	
pH evolution in vaults during assessment time-period	

3.36.1 pH evolution in vaults during assessment time-period

Short description of data

The data consists of calculated pH evolutions in the different repository vaults during assessment time-period.

Source of data

The pH datasets are calculated and presented in Cronstrand (2014).

Used in model or assessment activity

The pH datasets are used as supporting data when selecting sorption distribution coefficients for the Near-field radionuclide transport (see AMF Number 75, Section 3.15.1). The selection is performed in the **Data report** (Chapters 7 and 8).

Data used

See Source of data.

3.37 AMF Number 175

Output from AMF activity	**Input to AMF activity**
Bentonite and Concrete material properties	Evolution of repository pH
Dataset	
Void and pore volumes in repository vaults Cement and concrete amounts in repository vaults	

3.37.1 Void and pore volumes in repository vaults

Short description of data

The data consists of void and pore volumes in the materials found in 1BLA, 1BTF, 2BTF, 1BMA and the Silo.

Source of data

The data are derived from the **Initial state report** (Appendix A).

Used in model or assessment activity

The data are used in Cronstrand (2014) to calculate an overall pH evolution in the repository vaults throughout the assessment time-period.

Data used

See Cronstrand (2014, Sections 3.1.1–3.1.5).

3.37.2 Cement and concrete amounts in repository vaults

Short description of data

The data consists of amounts of Cement and concrete (kg) in the materials found in 1BLA, 1BTF, 2BTF, 1BMA and the Silo.

Source of data

The data are derived from the **Initial state report** (Appendix A).

Used in model or assessment activity

The data are used in Cronstrand (2014) to calculate an overall pH evolution in the repository vaults throughout the assessment time-period.

Data used

See Cronstrand (2014, Section 3.6)

3.38 AMF Number 176

Output from AMF activity	Input to AMF activity
Near-field hydrology	Evolution of repository pH
Dataset	
Near-field water flows	

3.38.1 Near-field water flows

Short description of data

The data represents the water flow (m^3/year) infiltrating the waste in the repository vaults.

Source of data

The data are taken from Abarca et al. (2013).

Used in model or assessment activity

The data are used in Cronstrand (2014) to calculate an overall pH evolution in the repository vaults throughout the assessment time-period.

Data used

See Cronstrand (2014, Section 3.7).

3.39 AMF Number 179

Output from AMF activity	Input to AMF activity
Near-field water flows	Evolution of repository redox
Dataset	
Near-field water flows	

3.39.1 Near-field water flows

Short description of data

The data represents the water flow (m^3/year) in the repository vaults.

Source of data

The water flow data are taken from Holmén and Stigsson (2001).

Used in model or assessment activity

The data are used in the calculations of the repository redox-evolution (Duro et al. 2012).

Data used

See Duro et al. (2012, Table 6-7).

3.40 AMF Number 181

Output from AMF activity	Input to AMF activity
Generic concrete porewater composition	Evolution of repository redox
Dataset	
Concrete porewater compositions	

3.40.1 Concrete porewater composition

Short description of data

The data are generic chemical concrete porewater compositions.

Source of data

The composition is taken from SKB (2008)

Used in models, assessments, scenarios, and calculation cases

The data are used in modelling the repository redox-evolution (Duro et al. 2012).

Data used

The used data are reproduced in Duro et al. (2012, Table 5-3).

3.41 AMF Number 182

Output from AMF activity	**Input to AMF activity**
Bentonite and Concrete material properties	Seismic load
Dataset	
Bentonite properties Concrete properties	

3.41.1 Bentonite properties

Short description of data

Bentonite and Sand/Bentonite mechanical properties:

- Young's Modulus
- Poisson ratio
- Density
- Tensile Strength
- Compression strength

Source of data

Data are derived from Börgesson et al. (2010) and Pusch (2003).

Used in model or assessment activity

The data are used in an evaluation of the consequence of seismic load on the Silo (Georgiev 2013).

Data used

See Georgiev (2013, Section 2.4.2).

3.41.2 Concrete properties

Short description of data

Silo concrete mechanical properties:

- Young Modulus
- Poisson's ratio
- Density
- Tensile Strength
- Compression strength

Source of data

Data are taken from Boverket (2004).

Used in model or assessment activity

The data are used in an evaluation of the consequence of seismic load on the Silo (Georgiev 2013).

Data used

See Georgiev (2013, Section 2.4.1)

3.42 AMF Number 183

Output from AMF activity	Input to AMF activity
Initial state – Repository layout	Seismic load
Dataset	
Silo layout	

3.42.1 Silo layout

Short description of data

The dataset contains dimensions of the different parts of the Silo.

Source of data

The data are derived from the **Initial state report**.

Used in model or assessment activity

The data are used in an evaluation of seismic load on the Silo (Georgiev 2013).

Data used

See Source of data.

3.43 AMF Number 185

Output from AMF activity	Input to AMF activity
Silo freezing study	Freezing of bentonite
Dataset	
Assessment on bentonite ice lens formation.	

3.43.1 Assessment on bentonite ice lens formation.

Short description of data

Data is an assessment on if the possibility that an ice lens will be formed in the Silo barriers.

Source of data

The assessment is performed in Birgersson and Andersson (2014).

Used in model or assessment activity

The assessment is used when assessing the general reference evolution of the bentonite barriers in the Silo, see the **Main report** (Chapter 6).

Data used

See the conclusions of Birgersson and Andersson (2014).

3.44 AMF Number 205

Output from AMF activity	Input to AMF activity
Bentonite material properties	Evolution of bentonite barrier and plug
Dataset	
Bentonite and sand/bentonite hydrualic properties	

3.44.1 Bentonite material properties

Short description of data

Data consist of hydraulic conductivities and physical porosities for the bentonite and sand/bentonite barriers present in the Silo repository.

Source of data

The data are taken from Holmén and Stigsson (2001).

Used in model or assessment activity

The data are used as supporting data in the assessment of the state of the current Silo bentonite barriers (Börgesson et al. 2014).

Data used

See Source of data.

3.45 AMF Number 206

Output from AMF activity	Input to AMF activity
Evolution of repository pH	Corrosion rates
Dataset	
Evolution of pH in the repository vaults	

3.45.1 Evolution of pH in the repository vaults

Short description of data

The dataset contains calculated evolutions of pH in the different repository vaults throughout the assessment time-period.

Source of data

The full dataset as well as the calculations performed to produce it is given in Cronstrand (2014).

Used in model or assessment activity

The datasets are used as supporting data when selecting corrosions rates in the **Data report** (Chapter 5).

Data used

See Source of data.

3.46 AMF Number 207

Output from AMF activity	Input to AMF activity
Concrete literature data	Rebar corrosion and chemical degradation of concrete
Dataset	
Literature data	

3.46.1 Literature data

Short description of data

This is a list of all the references used in the concrete literature survey further described in the **Barrier process report** and in Höglund (2014).

Source of data

The literature survey is presented in the **Barrier process report** and in Höglund (2014).

Used in models, assessments, scenarios, and calculation cases

The references are mainly used as background data in Höglund (2014).

Data used

See Source of data.

3.47 AMF Number 209

Output from AMF activity	Input to AMF activity
Concrete degradation due to sulphate attack	Evolution of concrete barriers
Dataset	
Capacity of waste to absorbe sulphate	

3.47.1 Capacity of cement and waste to absorb sulphate

Short description of data

The dataset contains the capacity of the cement to absorb sulphate.

Source of data

The data are given in SKBdoc 1417785 as well as in the **Main report** (Table 6-2).

Used in model or assessment activity

The dataset is used in an assessment of concrete degradation due to sulphate attack. The assessment is further described in the **Main report** (Chapter 6).

Data used

See Source of data.

4 Geosphere

4.1 AMF Number 2

Output from AMF activity	Input to AMF activity
Site specific bedrock transport properties	Non-flow related transport properties
Dataset	
Sorption partitioning coefficients Effective diffusivity, Rock matrix porosity	

4.1.1 Sorption partitioning coefficients

Short description of data

The data concern the sorption partitioning coefficients for different elements of the selected inventory in the crystalline host rock surrounding the SFR repository. The data represent present day conditions and a rock mass and groundwater/porewater that are undisturbed by interactions with materials in the repository (e.g. cementitious materials and complexing agents). It should be noted that different data are given for different redox states of the elements.

Source of data

The data are taken from, and justified in, a dedicated SR-PSU report on sorption coefficients (Crawford 2013) in the geosphere, which in turn is an update of Crawford (2010).

Used in model or assessment activity

The data are used in an assessment of which K_d values to use in different scenario or calculation case in the radionuclide transport modelling, see Section 4.18.

Data used

See Source of data.

4.1.2 Effective diffusivity

Short description of data

The data concern the effective diffusivity of the crystalline host rock surrounding the SFR repository. The data are valid for all flow paths, depths, and rock volumes. The data are valid for the groundwater chemistry expected at all flow paths, depths, and rock volumes. One dataset is provided for cations and non-charged solutes, and another dataset is provided for anions.

Source of data

The data are taken from, and justified in, a dedicated report on site specific effective diffusivities (Löfgren and Sidborn 2010). The data are based on site specific in situ measurements at the Forsmark area in Sweden.

Used in model or assessment activity

The data are used in an assessment of which D_e values to use in different scenario or calculation case in radionuclide transport modelling, see Section 4.18.

Data used

The diffusivities used in the assessment are given Löfgren (2014, Table 6-1).

4.1.3 Rock matrix porosity

Short description of data

These data concerns the rock matrix porosity of the crystalline host rock surrounding the SFR repository. The data are valid for all flow paths, depths, and rock volumes.

Source of data

No porosity measurements have been made on rock from the SFR site. Therefore, the rock porosity measurements provided for SR-Site, based on the Forsmark site investigations, are used (SKB 2010b, Table 6-90).

Used in model or assessment activity

The data are used in an assessment of which ε values to use in different scenario or calculation case in radionuclide transport modelling, see Section 4.18.

Data used

See Source of data.

4.2 AMF Number 3

Output from AMF activity	Input to AMF activity
Site specific groundwater compositions	Non-flow related transport properties
Dataset	
SR-PSU Groundwater types	

4.2.1 SR-PSU Groundwater types

Short description of data

The data consists of groundwater compositions representative for different time domains in the SR PSU safety assessment.

Source of data

The groundwater types are produced and presented in Auqué et al. (2013).

Used in model or assessment activity

The groundwater types are used in an assessment selecting sorption partitioning coefficients, K_d-values, for use in the SR-PSU radionuclide transport calculations for the geosphere rock matrix (Crawford 2013), and for the crushed rock backfill used in some repository vaults (**Data report**, Chapter 8).

Data used

See Source of data.

4.3 AMF Number 4

Output from AMF activity	Input to AMF activity
Site specific data – Bedrock hydrogeology	Hydrogeology
Dataset	
Hydrogeological model from SDM-PSU	

4.3.1 Hydrogeological model from SDM-PSU

Short description of data

The site descriptive model (SDM-PSU) is an integrated model for bedrock geology, rock mechanics, bedrock hydrogeology, and bedrock hydrogeochemistry. The data described here consists of the hydrogeological part of the model.

Source of data

The model is presented in SKB (2013b). The files are stored in SKBdoc document 1385714[8].

Used in model or assessment activity

The information on the hydrogeological conditions given in SDM-PSU is used in the description of the reference evolution, see the **Main report** (Section 4.7 and Chapter 6).

Data used

See Source of data.

4.4 AMF Number 6

Output from AMF activity	Input to AMF activity
Rock fallout and EDZ	Hydrogeology
Dataset	
Presence or non-presence of extensive rock fallout and EDZ, affecing hydraulic properties in rock mass.	

4.4.1 Presence or non-presence of extensive rock fallout and EDZ

Short description of data

The data consists of an assessment of the consequences of rock fallout and EDZ occurring in the bedrock in and around the repository throughout the assessment time-period.

Source of data

The assessment is presented in Mas Ivars et al. (2014).

Used in model or assessment activity

The assessment was used when setting up the regional hydrogeological model (see Odén et al. 2014).

Data used

The conclusions of the assessment are presented in Mas Ivars et al. (2014).

[8] Internal document, Svensk Kärnbränslehantering AB.

4.5 AMF Number 7

Output from AMF activity	Input to AMF activity
Hydrogeology	Near-field hydrology
Dataset	
Pressure at rock volume boundaries Groundwater velocities in rock volume Permeability of rock volume	

4.5.1 Pressure at rock volume boundaries

Short description of data

The dataset contains the hydraulic pressure field (Pa) of the groundwater in the bedrock at the SFR location. The data are used to consistently connect the regional and near-field hydrology models. Data corresponding to the hydrogeological states at 2000 AD, 3000 AD and 5000 AD of the *global warming climate case* were used, as well as data for the periglacial climate domain with shallow permafrost.

Source of data

The data are given in Chapter 11 in the **Data report** where the data also are qualified.

Used in model or assessment activity

The pressure data was used in the assessment of the near-field hydrology as presented by Abarca et al. (2013).

Data used

The data are presented in the **Data report** (Chapter 11). The data files used can be found at:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/Geohydro/AMF7

4.5.2 Groundwater velocities in rock volume

Short description of data

The dataset contains the groundwater velocity field (m/s) in the bedrock at the SFR location. The data are used to consistently connect the regional and near-field hydrology models. Data corresponding to the hydrogeological states at 2000 AD, 3000 AD and 5000 AD of the Global warming climate case were used, as well as data for the periglacial climate domain with shallow permafrost.

Source of data

The data are presented in Chapter 11 in the **Data report** where the data are qualified.

Used in model or assessment activity

The groundwater velocity data was used in the assessment of the near-field hydrology as presented by Abarca et al. (2013).

Data used

The data are presented in the **Data report**, Chapter 11. The data files used can be found at:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/Geohydro/AMF7

4.5.3 Permeability of rock volume

Short description of data

The dataset contains the anisotropic hydraulic conductivity (m/s) field of the bedrock. The data are used to consistently connect the regional and near-field hydrology models. Data corresponding to the bedrock realisations Base_Case1_DFN_R85, nc_DEP_R07_DFN_R85 and nc_NoD_R01_DFN_R18 were used (Odén et al. 2014).

Source of data

The data are presented in Chapter 11 in the **Data report** where the data are qualified.

Used in model or assessment activity

The hydraulic conductivity data was used in the modelling of the near-field hydrology as presented by Abarca et al. (2013).

Data used

The data are presented in the **Data report**, Chapter 11. The data files used can be found at: svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/Geohydro/AMF7

4.6 AMF Number 9

Output from AMF activity	**Input to AMF activity**
Hydrogeology	Geochemical evolution
Dataset	
Particle tracks to and from the SFR repositories	

4.6.1 Particle tracks to and from the SFR repositories

Short description of data

Particle trajectories describing the different pathways between the repositories and the surrounding rock.

Source of data

The data are generated with the code DarcyTools, see the **Model summary report** and reported in Odén et al. (2014, Sections 4.5.6 and 4.5.7) and Vidstrand et al. (2014, Section 8.6).

Used in model or assessment activity

The particle trajectories are used in an assessment of the hydrogeochemical see the **Main report** (Chapter 6).

Data used

See Source of data.

4.7 AMF Number 10

Output from AMF activity	Input to AMF activity
Site specific data – Bedrock geology	Rock fallout and EDZ
Dataset	
Fracture stress test data Fracture mapping data	

4.7.1 Fracture stress test data

Short description of data

The dataset contains tilt test data from experiments performed on the bedrock during the site characterisation of Forsmark for the spent fuel repository.

Source of data

The experimental data were reported in Glamheden et al. (2007).

Used in model or assessment activity

The fracture stress test data are used in an assessment of the consequences of possible future Rock fallout and EDZ in the SFR repositories. The assessment is presented in Mas Ivars et al. (2014).

Data used

See Mas Ivars et al. (2014, Table 2-4).

4.7.2 Fracture mapping data

Short description of data

The fracture mapping is a digital presentation of the fractures occurring in the bedrock surrounding the SFR tunnels. The fracture mapping is used to estimate for instance average distances between fractures.

Source of data

The fracture mapping was performed in Christiansson and Bolvede (1987).

Used in model or assessment activity

The fracture mapping data are used in an assessment of the consequences of possible future Rock fallout and EDZ in the SFR repositories. The assessment is presented in Mas Ivars et al. (2014).

Data used

See Source of data.

4.8 AMF Number 11

Output from AMF activity	Input to AMF activity
Hydrogeology	RN transport in water phase
Dataset	
F-factors for travel paths from each repository vault to the surface Travel time for travel paths from each repository vault to the surface Peclet number applicable for entire rock volume	

4.8.1 F-factors for travel paths from each repository vault to the surface

Short description of data

The flow-related transport resistance in rock is an entity, integrated along flow paths, that quantifies the flow-related (hydrodynamic) aspects of the possible retention of solutes transported in a fractured medium.

Source of data

The data results from particle tracking in the hydrogeological calculations (Odén et al. 2014).

Used in model or assessment activity

The F-factors are used in the radionuclide transport calculations when calculating residence times in the geosphere, see the **Radionuclide transport report**.

Data used

For the base case (used in all calculation cases except CCL_FH):

svn://svn.skb.se\project\SFR \SR-PSU-Data\Geosphere\Indata\Ecolego\[MODEL]\[MODEL]_BASE_CASE1_DFN_R18_L1B.txt"

Where: [MODEL]: is the name of the model for each repository, i.e. one of {BLA1, BLA2, BLA3, BLA4, BLA5, BMA1, BMA2, BRT, BTF1, BTF2, Silo}

(Note: An exception to this naming convention is the files for 2–5BLA, which are stored in the same directory, this directory is named BLA2–5)

For the *high flow in the bedrock calculation case* (CCL_FH) another dataset was used, the location of these files can be obtained from the ones above if the sub-string "BASE_CASE1_DFN_R18_L1B" is replaced with "nc_DEP_R07_DFN_R85_L1B"

4.8.2 Travel time for travel paths from each repository vault to the surface

Short description of data

Hydrogeological calculations for the geosphere are performed with the code DarcyTools, see the **Model summary report**. These calculations results in a flow field used for particle tracking from which one result is the travel-times. The results are used to calculate the retention of radionuclides in the geosphere.

Source of data

The data results from particle tracking in the hydrogeological calculations (Odén et al. 2014).

Used in model or assessment activity

Travel time was used for the radionuclide transport calculations for the geosphere, see the **Radionuclide transport report.**

Data used

Data used are stored in same files as the corresponding flow wetted surface areas, see Section 4.8.1.

4.8.3 Peclet number applicable for entire rock volume

Short description of data

The Peclet number determines the ratio between advective and dispersive transport in fractured or porous media.

Source of data

The Peclet number from earlier assessments within SKB was used, see SKB (2001)

Used in model or assessment activity

The Peclet number was used in the calculations for radionuclide transport in the geosphere, see the **Radionuclide transport report**.

Data used

The used Peclet number is stored at:
svn.skb.se/project/SFR/SR-PSU-Data/Geosphere/Indata/Ecolego/FarfieldOther (AMF11&87).xlsx

4.9 AMF Number 12

Output from AMF activity	Input to AMF activity
Hydrogeology	Biosphere object identification
Dataset	
Exit locations (coordinates) for defined time steps/events	

4.9.1 Exit locations (coordinates) for defined time steps/events

Short description of data

Exit locations in x y z coordinates, with 15 columns of data including travel time, path length, flow-related transport resistance, tunnel-wall passage location, etc.

Source of data

The exit locations are presented in SKBdoc 1395214 and in Öhman et al. (2014).

Used in models, assessments, scenarios, and calculation cases

The exit points TD-08 (SKBdoc 1395214) and water fluxes were used in the identification and delineation of biosphere objects (further described in the **Biosphere synthesis report**). The same biosphere objects are used for all scenarios and climate cases. TD-11 (Öhman et al. 2014) was a later delivery of exit locations and the delineation of biosphere has been checked against the new exit locations.

Data used

The coordinate data are stored at SVN:

TD-08:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Synthesis/Leveranser/geohydroleveranser/Td8a_Exit_locations_2012-09-18.zip

TD-11:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/ReleasePoints/TD11

Talik exit locations are described in:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Synthesis/Leveranser/geohydroleveranser/talik_exit_locations

4.10 AMF Number 16

Output from AMF activity	**Input to AMF activity**
RN transport in water phase	RN transport and dose
Dataset	
Radionuclide release from the geosphere to the biosphere	

4.10.1 Radionuclide release from the geosphere to the biosphere

Short description of data

The data are the result of probabilistic radionuclide transport calculations for the geosphere. The data consists of 100 time series of releases for each radionuclide. The data has a resolution of 50 years for the whole simulated time span of 100,000 years.

Source of data

The data are the result of radionuclide transport calculations for the geosphere, see further details in the **Radionuclide transport report.**

Used in model or assessment activity

The data are used as input to the calculations of radionuclide transport in the surface systems, for calculations of environmental concentrations, which are used for calculations of doses to humans and non-human biota.

Data used

The data are stored at the subversion repository hosted at SKB.

The releases for each calculation case and vault model can be found at a location like:
svn://svn.skb.se/kalkyl/SFR/SR-PSU/Indata/Release2Biosphere/[CC]/[MODEL].ear

Where:
[CC]: is the calculation case number corresponding to the calculation case (see Appendix B),
[MODEL]: is the name of the model for each repository, i.e. one of {BLA1, BLA2, BLA3, BLA4, BLA5, BMA1, BMA2, BRT, BTF1, BTF2, Silo}

4.11 AMF Number 17

Output from AMF activity	Input to AMF activity
Site specific data	Weichselian permafrost development

Dataset

2D profile at Forsmark
Topography and soil types
Rock domains and deformation zones
Hydraulic properties for rock domains and soil types
Thermal properties for different rock domains and soil types
Ionic composition of groundwater
Geothermal heat flow

4.11.1 2D profile at Forsmark

Source of data

The 2D profile was determined by Hartikainen et al. (2010).

Used in model or assessment activity

Weichselian permafrost development at Forsmark during the period from 115,000 years ago to 70,000 years ago was modelled with a numerical permafrost model in a 2D vertical cross-section (Hartikainen et al. 2010 and **Model summary report**), as described in the **Climate report** (Section 2.1.4).

The results of these 2D permafrost model simulations were utilised, together with the 1D permafrost simulations that were made for the full glacial cycle, in the definition and description of the *Weichselian glacial cycle climate case* representing natural variability, see the **Climate report (**Section 4.5).

Data used

The 2D profile is described in Hartikainen et al. (2010, Appendix A).

4.11.2 Topography and soil types

Source of data

The topography is based on a 20 m grid Digital Elevation Model (DEM) prepared for the safety assessment SR-Site (Strömgren and Brydsten 2008). The description of soil cover along the profile originates from the regolith depth model in the Site Descriptive Model, version 2.2 for the spent fuel repository (Hedenström et al. 2008).

Used in model or assessment activity

See Section 4.11.1.

Data used

The topography and soil types along the 2D profile are described in Hartikainen et al. (2010, Appendix B).

4.11.3 Rock domains and deformation zones

Source of data

The data were taken from SDM 2.2 for the spent fuel repository (Stephens et al. 2007).

Used in model or assessment activity

See Section 4.11.1

Data used

The rock domains and deformation zones along the 2D profile are described in Hartikainen et al. (2010, Appendix C).

4.11.4 Hydraulic properties for rock domains and soil types

Source of data

The data were taken from Follin (2008).

Used in model or assessment activity

See Section 4.11.1.

Data used

Hydraulic properties for rock domains and soil types in Forsmark are described in Hartikainen et al. (2010, Appendix D).

4.11.5 Thermal properties for rock domains and soil types

Source of data

The data were calculated by Sundberg et al. (2009) and Hartikainen et al. (2010, Appendix E) based on site descriptive modelling for the spent fuel repository.

Used in model or assessment activity

See Section 4.11.1.

Data used

Thermal properties for rock domains and soil types are described in Hartikainen et al. (2010, Appendix E).

4.11.6 Ionic composition of ground water

Source of data

The data were based on the hydrogeochemical site descriptive work carried out for SR-Site (Laaksoharju et al. 2008).

Used in model or assessment activity

See Section 4.11.1.

Data used

Thermal properties for rock domains and soil types are described in Hartikainen et al. (2010, Appendix F).

4.11.7 Geothermal heat flow

Source of data

The data was calculated by Hartikainen et al. (2010), based on Sundberg et al. (2009).

Used in model or assessment activity

See Section 4.11.1

Data used

The geothermal heat flow used is given in Hartikainen et al. (2010, Table 2-3).

4.12 AMF Number 24

Output from AMF activity	Input to AMF activity
Site specific data – Bedrock geology	Seismic load
Dataset	
Seismic response spectrum load of Silo	

4.12.1 Seismic response spectrum load of Silo

Short description of data

The seismic load is represented by an acceleration response spectrum. It essentially specifies the level of the seismic force acting on a structure based on the structure's natural frequency and damping.

Source of data

The seismic load spectrum was presented in a Seismic safety report produced by Swedish Nuclear Power Inspectorate (SKI 1992).

Used in model or assessment activity

The spectrum is used in an evaluation of seismic load on the Silo structure (Georgiev 2013).

Data used

The spectrum is displayed in Georgiev (2013, Figures 2-3 and 2-4).

4.13 AMF Number 26

Output from AMF activity	Input to AMF activity
Rock fallout and EDZ	Mechanical degradation of concrete due to load
Dataset	
Analysis of the consequence of rock fallout	

4.13.1 Analysis of the consequence of rock fallout

Short description of data

The dataset is an assessment of the consequence of future rock fallout.

Source of data

The assessment is presented in Mas Ivars et al. (2014).

Used in model or assessment activity

The assessment conclusion is used in another assessment regarding the state of the concrete/bentonite barriers and concrete structures during the repository evolution. This is further described in the **Main report**.

Data used

The assessment conclusions are presented in Mas Ivars et al. (2014).

4.14 AMF Number 28

Output from AMF activity	Input to AMF activity
Geochemical evolution	Non-flow related RN transport properties
Dataset	
Assessment of groundwater influence on repository water.	

4.14.1 Assessment of groundwater influence on repository water

Short description of data

The dataset is an assessment regarding influence of the surrounding groundwater on the repository water.

Source of data

The assessment is performed in the **Main report** (Chapter 6) regarding the reference evolution.

Used in model or assessment activity

The assessment is used when selecting sorption partitioning coefficients, see the **Data report** (Chapter 7).

Data used

See Source of data.

4.15 AMF Number 29

Output from AMF activity	Input to AMF activity
Site specific data – Hydrogeochemistry	Site specific groundwater compositions
Dataset	
Conceptual hydrogeochemical model	

4.15.1 Conceptual hydrogeochemical model

Short description of data

A conceptual model used to describe the current hydrogeochemical system in the bedrock surrounding the area where SFR is located.

Source of data

The model is described in the site descriptive modelling report for SR-PSU (SKB 2013b).

Used in model or assessment activity

The hydrogeochemical model is used to estimate four different reference groundwater types that are valid during the assessment time-period. This is done in Auqué et al. (2013).

Data used

Data used are stored in SKBdoc 1429537[9].

[9] Internal document, Svensk Kärnbränslehantering AB.

4.16 AMF Number 62

Output from AMF activity	**Input to AMF activity**
Site specific data – Well/borehole inventory	Site specific groundwater compositions
Dataset	
Chemical composition of Well/borehole samples	

4.16.1 Site specific data

Short description of data

The dataset contains chemical analyses from well and borehole samples taken at and around the SFR Site. The dataset contains samples taken between 1984 and 2011.

Source of data

The dataset is compiled and presented in Nilsson et al. (2011).

Used in model or assessment activity

The dataset is used to estimate four different reference groundwater types that are valid during the assessment time-period. This is done in Auqué et al. (2013)

Data used

Data used are stored in SKBdoc 1429537[10].

4.17 AMF Number 84

Output from AMF activity	**Input to AMF activity**
Hydrogeology	Surface hydrology
Dataset	
Hydrogeological properties of the rock	

4.17.1 Hydrogeological properties of the rock

Short description of data

Data for the hydrogeological properties of the rock (horizontal and vertical hydraulic conductivities, effective porosity) down to –634 m elevation (RHB70).

Source of data

The dataset is calculated using the DarcyTools groundwater-flow modelling tool. The dataset is divided into two deliveries, one down to –170 m elevation and one down to –634 m elevation. The dataset (BASE_CASE1_DFN_R85) is further described in Odén et al. (2014).

Used in model or assessment activity

The dataset is used in MIKE SHE models run for present-day conditions, and in MIKE SHE models run for 3000, 5000 and 11,000 AD. For further details, see Werner et al. (2013).

Data used

The delivered dataset is stored on:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/Hydrology/MIKESHE/AMF84

[10] Internal document, Svensk Kärnbränslehantering AB.

4.18 AMF Number 87

Output from AMF activity	Input to AMF activity
Non-flow related migration properties	RN transport in water phase

Dataset

Sorption partitioning coefficients, applicable for entire rock volume
Effective diffusivity, applicable for entire rock volume
Rock matrix porosity, applicable for entire rock volume

4.18.1 Sorption partitioning coefficients applicable for entire rock volume

Short description of data

These data contains the sorption partitioning coefficients of the crystalline host rock surrounding the repository. The data are valid for all flow paths, depths, and rock volumes. The data are valid for the groundwater chemistry expected at all flow paths, depths, and rock volumes.

Source of data

The data are taken from AMF number 2 (Section 4.1.1) which is an assessment of K_d values used in **SR-Site**. The assessment is performed in Crawford (2013). Data are also qualified for use as crushed rock gravel in the **Data report** (Chapter 8).

Used in model or assessment activity

The dataset is used when calculating the time it takes for radionuclides to travel through the geosphere from the repository to geosphere exit locations, see the **Radionuclide transport report**.

Data used

The used dataset is stored at:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Geosphere/Indata/Ecolego/FarfieldKd(AMF87).xlsx

4.18.2 Effective diffusivity applicable for entire rock volume

Short description of data

The dataset contains the effective diffusivity, D_e, of the crystalline host rock surrounding the repository. The data are valid for the groundwater chemistry expected at all flow paths, depths, and rock volumes.

Source of data

The D_e data are taken from AMF number 2 (Section 4.1.2) which is an assessment of the D_e data used in SR-Site. The assessment is reported in Löfgren (2014).

Used in models, assessments, scenarios, and/or calculation cases

The dataset is used when calculating the time it takes for radionuclides to travel through the geosphere from the repository to geosphere exit locations, see the **Radionuclide transport report**.

Data used

The used data are stored at:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Geosphere/Indata/Ecolego/FarfieldDe(AMF87).xlsx

4.18.3 Rock matrix porosity applicable for entire rock volume

Short description of data

These data concerns the rock matrix porosity of the crystalline host rock surrounding the SFR repository. The data are valid for all flow paths, depths, and rock volumes.

Source of data

The ε data are taken from AMF number 2 (Section 4.1.2) which is an assessment of the ε data used in SR-Site (SKB 2010b, Table 6-90).

Used in model or assessment activity

The data are used in the **Radionuclide transport report** when calculating the time it takes for radionuclides to travel through the geosphere from the repository to geosphere exit locations.

Data used

See Source of data.

4.19 AMF Number 105

Output from AMF activity	**Input to AMF activity**
Site specific data – Mineralogy	Geochemical evolution
Dataset	
Fracture mineral types and occurrences.	

4.19.1 Fracture mineral types and occurrences.

Short description of data

The data consist of the different fracture minerals found, and their abundance, during the site investigation programme SDM-PSU (SKB 2013b).

Source of data

The data are taken from the site descriptive modelling performed around the Forsmark area, see Sandström and Tullborg (2011), Sandström et al. (2014) and Nilsson et al. (2011).

Used in model or assessment activity

The data are used in an assessment of the hydrogeochemical evolution around the Forsmark area, see the **Main report** (Chapter 6).

Data used

See Source of data.

4.20 AMF Number 110

Output from AMF activity	Input to AMF activity
Site specific data – Rock mechanics	Rock fallout and EDZ
Dataset	
Mechanical rock properties	

4.20.1 Mechanical rock properties

Short description of data

The dataset contains mechanical properties of the bedrock surrounding the SFR repository. The dataset concerns both intact rock between fractures and weakness zones with fractures.

Source of data

The mechanical properties are taken from the Site descriptive modelling Forsmark stage 2.1 (Glamheden et al. 2007)

Used in model or assessment activity

The mechanical properties are used in an assessment of the consequence of rock fallout and EDZ in the SFR repositories. The assessment is presented in Mas Ivars et al. (2014).

Data used

See Mas Ivars et al. (2014, Tables 2-2 and 2-3).

4.21 AMF Number 135

Output from AMF activity	Input to AMF activity
Hydrogeology	Well related flow data
Dataset	
Fraction of repository water reaching probable well locations	

4.21.1 Fraction of repository water reaching well locations

Short description of data

The data are calculated by means of DarcyTools particle tracking, and quantify the fraction of particles released from SFR repository parts that reach specified wells drilled in rock.

Source of data

The data are described and presented in Öhman and Vidstrand (2014) and also summarised in Werner et al. (2014, Chapter 6 and Appendix 3).

Used in model or assessment activity

The data are used to estimate radiological risk, related to water usage, to future, self-sufficient inhabitants using water-supply wells in rock. These include wells associated to settlements in the vicinity of future arable-land areas and wells in the well-interaction area, i.e. the area in which wells drilled in the rock may have the highest concentrations of radionuclides originating from SFR.

Data used

See Source of data.

4.22 AMF Number 136

Output from AMF activity	Input to AMF activity
Well related flow data	RN transport in water phase
Dataset	
Dose to well	

4.22.1 Dose to well

Short description of data

The data are used to estimate radiological risk, related to water usage, to future, self-sufficient inhabitants using water-supply wells in rock.

Source of data

The data are presented in Öhman and Vidstrand (2014) and also summarised in Werner et al. (2014, Chapter 6 and Appendix).

Used in model or assessment activity

The data are used to estimate radiological risk, related to water usage, to future, self-sufficient inhabitants using water-supply wells in rock. These include wells associated to settlements in the vicinity of future arable-land areas and wells in the well-interaction area, i.e. the area in which wells drilled in the rock may have the highest concentrations of radionuclides originating from SFR.

Data used

See Source of data.

4.23 AMF Number 139

Output from AMF activity	Input to AMF activity
Site specific groundwater compositions	Geochemical evolution
Dataset	
Groundwater compositions	

4.23.1 Groundwater compositions

Short description of data

The data consists of groundwater compositions representative for different time domains considered in the SR-PSU safety assessment.

Source of data

The groundwater types are produced and presented in Auqué et al. (2013, Tables 5-1 to 5-3).

Used in model or assessment activity

The data are used in an assessment of the hydrogeochemical evolution around the Forsmark area, see the **Main report** (Chapter 6).

Data used

See Source of data.

4.24 AMF Number 145

Output from AMF activity	Input to AMF activity
Site specific groundwater compositions	Rebar corrosion and chemical degradation of concrete
Dataset	
Groundwater compositions	

4.24.1 Groundwater compositions

Short description of data

The dataset describes the site specific chemical composition of groundwater used in the evaluation of the rebar corrosion and chemical degradation of concrete in the SR-PSU safety assessment.

Source of data

Data have been taken from Höglund (2014, Tables 3-1 and 3-2). These data are based on proposed groundwater compositions presented in Höglund (2001).

Used in model or assessment activity

The site specific groundwater compositions are used in the assessment of the impact of corrosion of reinforcement bars and other embedded steel components on the integrity of the concrete barriers, as well as in the modelling of the chemical degradation of concrete barriers in the 1BMA and 2BMA vault, see Höglund (2014). In the calculations, based on shoreline changes, a stepwise transition from the initial Salt water period to the Fresh water period has been assumed to take place at 2000 years after closure. This is reflected in a stepwise change in the site specific groundwater composition.

Data used

See Source of data.

4.25 AMF Number 184

Output from AMF activity	Input to AMF activity
Initial state – Repository layout	Rock fallout and EDZ
Dataset	
BMA and BLA vault dimensions	

4.25.1 BMA and BLA vault dimensions

Short description of data

Data consists of 3D dimensions of the BMA and BLA repository vaults.

Source of data

The dimensions are taken from Christiansson and Bolvede (1987).

Used in model or assessment activity

The dimensions are used in an assessment of the consequences of rock fallout and EDZ within the repository (Mas Ivars et al. 2014).

Data used

See Source of data.

4.26 AMF Number 197

Output from AMF activity	Input to AMF activity
Site specific data	Permafrost development

Dataset

2D profile at Forsmark
Topography and soil types
Rock domains and deformation zones
Hydraulic properties for rock domains and soil types
Thermal properties for different rock domains and soil types
Ionic composition of groundwater
Geothermal heat flow

4.26.1 2D profile at Forsmark

Source of data

The 2D profile was determined by Hartikainen et al. (2010).

Used in model or assessment activity

Permafrost development at Forsmark was modelled with a numerical permafrost model in a 2D vertical cross-section (Brandefelt et al. 2013), as described in the **Climate report** and the **Model summary report**.

The results of these 2D permafrost model simulations were utilised in the definition of two of the climate cases representing prolonged interglacial conditions, i.e. the *global warming* and *early periglacial* climate cases (see **Climate report**, Sections 4.2 and 4.3).

Data used

The 2D profile is described in Hartikainen et al. (2010, Appendix A).

4.26.2 Topography and soil types

Source of data

The topography is based on a 20 m grid Digital Elevation Model (DEM) prepared for the safety assessment SR-Site (Strömgren and Brydsten 2008). The description of soil cover along the profile originates from the regolith depth model in the Site Descriptive Model, version 2.2 prepared for the safety assessment SR-Site (Hedenström et al. 2008).

Used in model or assessment activity

See under Section 4.26.1.

Data used

The topography and soil types along the 2D profile are described in Hartikainen et al. (2010, Appendix B).

4.26.3 Rock domains and deformation zones

Source of data

The data were taken from site investigations for the spent fuel repository, SDM 2.2 (Stephens et al. 2007).

Used in model or assessment activity

See under Section 4.26.1.

Data used

The rock domains and deformation zones along the 2D profile are described in Hartikainen et al. (2010, Appendix C).

4.26.4 Hydraulic properties for rock domains and soil types

Source of data

The data were taken from Follin (2008).

Used in model or assessment activity

See under Section 4.26.1.

Data used

Hydraulic properties for rock domains and soil types in Forsmark are described in Hartikainen et al. (2010, Appendix D).

4.26.5 Thermal properties for rock domains and soil types

Source of data

The data were calculated by Sundberg et al. (2009) and Hartikainen et al. (2010, Appendix E) based on site descriptive modelling of Forsmark.

Used in model or assessment activity

See under Section 4.26.1.

Data used

Thermal properties for rock domains and soil types are described in Hartikainen et al. (2010, Appendix E).

4.26.6 Ionic composition of ground water

Source of data

The data were based on the hydrogeochemical site descriptive work carried out for SR-Site (Laaksoharju et al. 2008).

Used in model or assessment activity

See under Section 4.26.1.

Data used

Thermal properties for rock domains and soil types are described in Hartikainen et al. (2010, Appendix F).

4.26.7 Geothermal heat flow

Source of data

The data were calculated by Hartikainen et al. (2010), based on Sundberg et al. (2009).

Used in model or assessment activity

See under Section 4.26.1.

Data used

The geothermal heat flow used is given in Hartikainen et al. (2010, Table 2-3).

4.27 AMF Number 211

Output from AMF activity	Input to AMF activity
Peclet number	RN transport in water phase
Dataset	
Péclet number	

4.27.1 Péclet number

Short description of data

The Péclet number is defined to be the ratio of the rate of advection of a physical quantity by the flow to the rate of diffusion of the same quantity driven by an appropriate gradient.

Source of data

The Péclet number used in **SR-PSU** is taken from the **SR-Site** safety assessment (SKB 2010b, Section 6.7).

Used in model or assessment activity

The Péclet number is used when calculating the time it takes for radionuclides to travel through the geosphere from the repository to geosphere exit locations (**Radionuclide transport report)**.

Data used

Used data are stored at:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU-Data/Geosphere/Indata/Ecolego/FarfieldOther(AMF1187).xlsx

5 Climate

5.1 AMF Number 13

Output from AMF activity	Input to AMF activity
Climate cases representing prolonged interglacial conditions	Landscape modelling
Dataset	
Shore-level evolution	

5.1.1 Shore-level evolution

Short description of data

The dataset contains relative shore-level evolution at Forsmark for the next 100,000 years in Forsmark. Relative shore-level is defined as the vertical distance between the shore-level at a specific time and the average shore level at present.

Source of data

Relative shore-level for the climate cases representing prolonged interglacial conditions were defined based on global isostatic model simulations, extrapolations of up-to-present Holocene isostatic uplift rates at the Forsmark site, and peer-review-published data on future sea-level rise, see details in the **Climate report** (Sections 2.2.4, 4.1.3 and 4.3.3).

Used in model or assessment activity

The data are used in the landscape development model (Brydsten and Strömgren 2013).

Data used

Data on the evolution of relative shore-level for the *global warming, early periglacial* and *extended global warming* climate cases are illustrated in the **Climate report** (Figure 4-6). The numerical data used can be found in SKBdoc 1359616, 1359610 and 1433163.

5.2 AMF Number 18

Output from AMF activity	Input to AMF activity
Climate cases representing prolonged interglacial conditions	Hydrogeology
Dataset	
Maximum permafrost depth (m) Shore-level evolution	

5.2.1 Maximum permafrost depth

Short description of data

The dataset contains maximum permafrost depth for the period of periglacial climate domain in the *early periglacial climate case* from 17,500 AD to 20,500 AD.

Source of data

Brandefelt et al. (2013) combined climate modelling and permafrost modelling to investigate the potential for permafrost at Forsmark in the next 60,000 years. The study focuses on the expected periods of minimum in the summer insulation at high northern latitudes at around 19,000 years AD and 56,000 years AD. The study is described in the **Climate report** (Sections 2.1.4 and 4.2.4)

Used in model or assessment activity

The result that frozen ground cannot be excluded in Forsmark around 19,000 AD was used to guide the choice of hydro-geological simulations performed for Forsmark, see Odén et al. (2014) and Vidstrand et al. (2014).

Data used

Brandefelt et al. (2013) concluded that frozen bedrock conditions cannot be excluded at SFR repository depth at 19,000 years AD.

5.2.2 Shore-level evolution

Short description of data

The dataset contains relative shore-level evolution at Forsmark for the next 100,000 years in Forsmark. Relative shore-level is defined as the vertical distance between the shore-level at a specific time and the average shore level at present.

Source of data

Relative shore-level for the climate cases representing prolonged interglacial conditions were defined based on global isostatic model simulations, extrapolations of up-to-present Holocene isostatic uplift rates at the Forsmark site, and peer-review-published data on future sea-level rise, see details in the **Climate report (**Sections 2.2.4, 4.1.3 and 4.3.3).

Used in models, assessments, scenarios, and calculation cases

The data are used in the hydro-geological simulations performed for Forsmark, see Odén et al. (2014) and Vidstrand et al. (2014).

Data used

Data on the evolution of relative shore-level for the *global warming, early periglacial* and *extended global warming* climate cases are illustrated in the **Climate report** (Figure 4-6). The numerical data used can be found in SKBdoc 1359616, 1359610 and 1433163.

5.3 AMF Number 65

Output from AMF activity	**Input to AMF activity**
Climate cases representing prolonged interglacial conditions	Freezing of concrete
Dataset	
Lowest bedrock temperature at repository depth	

5.3.1 Lowest bedrock temperature at repository depth

Short description of data

The dataset contains maximum bedrock isotherm depths for the period of periglacial climate domain in the *early periglacial climate case* from 17,500 AD to 20,500 AD.

Source of data

Brandefelt et al. (2013) combined climate modelling and permafrost modelling to investigate the potential for permafrost at Forsmark in the next 60,000 years. The study focuses on the periods of minimum in the summer insulation at high northern latitudes that will occur at around 19,000 years AD and 56,000 years AD. The study is described in the **Climate report** (Sections 2.1.4 and 4.2.4).

Used in model or assessment activity

The data are used in the judgement of when the transport properties of concrete deteriorate due to internal freezing of the concrete barriers.

Data used

Brandefelt et al. (2013) concluded that frozen ground (a ground temperature of less than 0°C) cannot be excluded at SFR repository depth at 19,000 years AD. They further conclude that a ground temperature of –3°C or less is very unlikely to occur at repository depth during this period.

5.4 AMF Number 66

Output from AMF activity	Input to AMF activity
Minimum air temperature in next 60,000 years	Potential for permafrost
Dataset	
Monthly mean air temperature at 2 m height	

5.4.1 Monthly mean air temperature at 2 m height

Short description of data

The dataset contains the minimum monthly-mean air temperatures at 2 m height in Forsmark in the next 60,000 years.

Source of data

The Earth System Model of Intermediate Complexity LOVECLIM (**Model summary report**) was set up with forcing conditions representing the period 54,000 years after present and a glacial atmospheric CO_2 concentration of 180 ppmv (Brandefelt et al. 2013). With this setup, the model was run for 10,000 years. In the **Climate report**, monthly mean air temperature from this simulation is presented and justified as minimum temperatures for the coming 60,000 years.

Used in model or assessment activity

The data are used in assessing the potential for sub-freezing bedrock temperatures at repository depth. This is further described in the **Climate report**.

Data used

The numerical data used can be found in SKBdoc 1433269. The used dataset is displayed in Brandefelt et al. (2013, Figure 3-20).

5.5 AMF Number 67

Output from AMF activity	Input to AMF activity
Denudation modelling	Weichselian surface denudation
Dataset	
Weichselian surface denudation	

5.5.1 Weichselian surface denudation

Short description of data

The dataset contains estimates of surface denudation rates for the Forsmark site in a 100,000 year time perspective.

Source of data

The data originate from a Geographical Information System (GIS) modelling study of denudation in a large region surrounding the Forsmark site, see the **Climate report** (Sections 2.4.4–2.4.6) and Olvmo (2010).

Used in models, assessments, scenarios, and calculation cases

The estimates of future surface denudation are used to describe the potential surface denudation for the *Weichselian glacial cycle* climate case.

Data used

The estimated denudation rates for the repository location at Forsmark are given in the **Climate report** (Table 2-8).

5.6 AMF Number 68

Output from AMF activity	Input to AMF activity
Paleo air temperature evolution	Weichselian ice sheet development
Dataset	
Proxy paleo-air temperature evolution	

5.6.1 Proxy paleo-air temperature evolution

Short description of data

The dataset contains proxy paleo-air temperature for the last glacial cycle.

Source of data

The data were obtained from published results from the GRIP ice core (Dansgaard et al. 1993).

Used in models, assessments, scenarios, and calculation cases

The data were used for a model reconstruction of the ice sheet during the Weichselian glacial cycle. A detailed description of the dataset and its use in the ice sheet modelling procedure is found in the **Climate report** (Section 2.3.4) and in SKB (2010a, Section 3.1.4 and Appendix A).

Data used

The paleo-air temperature data are shown in the **Climate report (**Figures 2-49 and 2-51). The numerical data used can be found in SKB (2010a, Appendix A).

5.7 AMF Number 69

Output from AMF activity	Input to AMF activity
Weichselian ice sheet development	Weichselian shore-level evolution
Dataset	
Weichselian ice-sheet load development	

5.7.1 Weichselian ice-sheet load development

Short description of data

The dataset contains a time series of ice load data for the Weichselian glacial cycle over Fennoscandia.

Source of data

The data were obtained from the ice sheet reconstruction of the Weichselian ice sheet described in the **Climate report** (Section 2.3.4) and in SKB (2010a, Section 3.1.4).

Used in model or assessment activity

The dataset was used for GIA (Glacial isostatic Adjustment) model simulations of shore-level changes for the Weichselian glacial cycle described in the **Climate report** (Section 2.2.4) and in Whitehouse (2009).

Data used

Examples of the associated ice sheet configurations are given in the **Climate report (**Figure 2-52). The numerical data used for the Weichselian ice-sheet load development can be found in SKBdoc 1433654.

5.8 AMF Number 72

Output from AMF activity	Input to AMF activity
Climate cases representing prolonged interglacial conditions	Surface hydrology
Dataset	
Shore-level evolution Wet and warm climate, precipitation Wet and warm climate, potential evapotranspiration Wet and warm climate, near-surface air temperature	

5.8.1 Shore-level evolution

Short description of data

Relative shoreline displacement (m), due to the isostatic rebound, at 3000, 5000 and 11,000 AD, for the *global warming* and *early periglacial* climate cases.

Source of data

Details about the shore-level evolution are found in the **Climate report** (Sections 2.2.4, 4.1.3 and 4.3.3). The relative shore-level evolution for the complete 100,000 year assessment time-period is found in SKBdoc 1359616.

Used in model or assessment activity

Used to describe the location of the average sea shoreline at 3000, 5000 and 11,000 AD (MIKE SHE regional models) and at 3000 AD (MIKE SHE local model) (Werner et al. 2013).

Data used

See Source of data.

5.8.2 Wet and warm climate, precipitation

Short description of data

The dataset contains the maximum change in annual average precipitation rate in Forsmark for the initial interglacial period of the *global warming* and *extended global warming* climate cases. This period of temperate climate domain lasts for 50,000 years in the *global warming climate case* and for 100,000 years in the *extended global warming climate case*.

Source of data

The dataset is obtained from Kjellström et al. (2009) and it is detailed in Bosson et al. (2010, Section 2.3, Figure 2-5).

Used in model or assessment activity

The dataset is used as a sensitivity case in MIKE SHE models run for 5000 AD. For further details, see Werner et al. (2013).

Data used

The data files used are stored at:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/Hydrology/MIKESHE/AMF72

5.8.3 Wet and warm climate, potential evapotranspiration

Short description of data

Daily sums of potential evapotranspiration, representing a wet and warm climate.

Source of data

The dataset is obtained from Kjellström et al. (2009) and it is detailed in Bosson et al. (2010, Section 2.3, Figure 2-6).

Used in model or assessment activity

The dataset is used as a sensitivity case in MIKE SHE models run for 5000 AD. For further details, see Werner et al. (2013).

Data used

The data files used are stored at:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/Hydrology/MIKESHE/AMF72

5.8.4 Wet and warm climate, near-surface air temperature

Short description of data

Daily averages of near-surface air temperature, representing a wet and warm climate.

Source of data

The dataset is obtained from Kjellström et al. (2009) and it is detailed in Bosson et al. (2010, Section 2.3).

Used in model or assessment activity

The dataset is used as a sensitivity case in MIKE SHE models run for 5000 AD. For further details, see Werner et al. (2013).

Data used

The data files used are stored at:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/Hydrology/MIKESHE/AMF72

5.9 AMF Number 74

Output from AMF activity	Input to AMF activity
Climate cases representing prolonged interglacial conditions	Freezing of bentonite
Dataset	
Maximum permafrost depth	

5.9.1 Maximum permafrost depth

Short description of data

The dataset contains maximum permafrost depth for the period of periglacial climate domain in the *early periglacial climate case* from 17,500 AD to 20,500 AD.

Source of data

Brandefelt et al. (2013) combined climate modelling and permafrost modelling to investigate the potential for permafrost at Forsmark in the next 60,000 years. The study focuses on the expected periods of minimum in the summer insulation at high northern latitudes at around 19,000 years AD and 56,000 years AD. The study is described in the **Climate report** (Sections 2.1.4 and 4.2.4).

Used in model or assessment activity

The result that frozen ground cannot be excluded in Forsmark around 19,000 AD was used to guide the choice of Near-field simulations to be performed for Forsmark, see Abarca et al. (2013).

Data used

Brandefelt et al. (2013) concluded that frozen bedrock conditions cannot be excluded at SFR repository depth at 19,000 years AD.

5.10 AMF Number 128

Output from AMF activity	Input to AMF activity
Climate cases representing prolonged interglacial conditions	Ecosystem parameters and dose coefficients
Dataset	
Climate evolution	

5.10.1 Climate evolution

Short description of data

The dataset is a summary of projections of the future and shore level evolution at Forsmark. The dataset include maximum temperature increase, timing of maximum temperature increase, timing of return to present temperature and maximum precipitation for the climate cases global warming and extended global warming. This period of temperate climate domain lasts for 50,000 years in the *global warming climate case* and for 100,000 years in the *extended global warming climate case*. The relative shore-level evolution at Forsmark is described for the next 100,000 years in Forsmark. Relative shore-level is defined as the vertical distance between the shore-level at a specific time and the average shore level at present.

Source of data

The climate cases representing prolonged interglacial conditions, i.e. the *global warming*, *early periglacial* and *extended global warming* climate cases, were defined to span the uncertainty range in future climate evolution associated with low, medium and high human carbon emissions, see the **Climate report** (Chapters 3 and 4). The period 52,000 AD to 102,000 AD in the *global warming* and *early periglacial* climate cases was defined to represent gradual cooling with intermittent ice-sheet build up in the Northern Hemisphere. The associated variability at Forsmark was defined based on the reconstructed Weichselian glacial cycle, see the **Climate report** (Chapters 3 and 4).

Used in model or assessment activity

These data are used to predict the future landscape at the site and the ecosystems of relevance to the safety assessment. The climate development was used to infer alternative parameter sets to different climate cases in biosphere radionuclide transport modelling (Saetre et al. 2013).

Data used

The numerical data used can be found in SKBdoc 1338745.

5.11 AMF Number 141

Output from AMF activity	Input to AMF activity
Literature suvey – Future climate evolution	Climate cases representing prolonged interglacial conditions
Dataset	
Range of air temperature and precipitation change until 2100 AD Range of air temperature and precipitation evolution until 12,000 AD Range of climate evolution until 102,000 AD Minimum future projected atmospheric CO_2 concentration until 102,000 AD	

5.11.1 Range of air temperature and precipitation change until 2100 AD

Short description of data

The dataset contains a range of possible near-surface air temperature and precipitation rate change until 2100 AD for Forsmark.

Source of data

The data originate from a literature survey of current knowledge on the future climate evolution until 2100 AD presented in the **Climate report** (Section 3.3.3).

Used in model or assessment activity

The range of future temperature and precipitation in Forsmark was used in the definition of the climate cases representing prolonged interglacial conditions, i.e. the *global warming climate case* (**Climate report**, Section 4.1), *early periglacial climate case* (**Climate report**, Section 4.2) and *extended global warming climate case* (**Climate report**, Section 4.3). The range of possible near-surface air temperature changes until 2100 AD for low, medium and high human carbon emissions given in the **Climate report** (Section 3.3) were used to represent the *global warming*, *early periglacial*, and *extended global warming* climate cases respectively, see the **Climate report** (Sections 4.1–4.3.)

Data used

The change in near-surface air temperature and precipitation rate for 2081–2100 AD for Forsmark relative to the 1986–2005 AD reference period for low, medium and high human carbon emissions is given in the **Climate report** (Section 3.3.3) and in SKBdoc 1469758.

5.11.2 Range of air temperature and precipitation evolution until 12,000 AD

Short description of data

The dataset contains a range of possible near-surface air temperature and precipitation rate change until 2100 AD for Forsmark.

Source of data

The temperature and precipitation change data originate from a literature survey of current knowledge on the future climate evolution until 12,000 AD, see the **Climate report** (Section 3.3.4).

Used in model or assessment activity

See Section 5.11.1.

Data used

The change in near-surface air temperature and precipitation rate for Forsmark for 12,000 AD relative to the 1986–2005 AD reference period for low, medium and high human carbon emissions is given in SKBdoc 1469758.

5.11.3 Range of climate evolution until 102,000 AD

Short description of data

The dataset contains a range of possible climate evolution until 102,000 AD for Forsmark.

Source of data

The range of possible climate evolution originates from a literature survey of current knowledge on the future climate evolution until 102,000 AD, see the **Climate report** (Section 3.3.5). The survey focused on the timing of the next glacial inception, and the related question of when cold climate conditions may produce permafrost in the Forsmark region.

Used in model or assessment activity

See Section 5.11.1.

Data used

The timing of the next glacial inception in currently available scientific studies is given in the **Climate report** (Table 3-8 and Figure 3-30).

5.11.4 Minimum future projected atmospheric CO2 concentration until 102,000 AD

Short description of data

The dataset contains minimum future projected atmospheric CO_2 concentrations until 102,000 AD.

Source of data

The data originate from a literature survey of current knowledge on the future evolution of atmospheric CO_2 until 102,000 AD (see Section 3.3.1 in the **Climate report**).

Used in model or assessment activity

The estimates of minimum future projected atmospheric CO_2 concentrations, in combination with results of permafrost and climate model simulations (Brandefelt et al. 2013 and Section 2.1.4 of the **Climate report**), were used in the definition of permafrost conditions for the climate cases representing prolonged interglacial conditions (see Section 4.2.4 in the **Climate report**).

Data used

The minimum future projected atmospheric CO_2 concentration is given for 12,000 AD, 19,000 AD and 52,000 AD in SKBdoc 1469758.

5.12 AMF Number 142

Output from AMF activity	**Input to AMF activity**
Weichselian ice-sheet development	Weichselian permafrost development
Dataset	
Reconstructed Weichselian air temperature evolution	

5.12.1 Reconstructed Weichselian air temperature evolution

Short description of data

The dataset contains a time series of reconstructed air temperature for the last glacial cycle for Forsmark. For ice free periods, the temperature in the dataset constitutes air temperature whereas for ice covered periods the temperature constitutes basal ice temperatures.

Source of data

The data were obtained from the ice sheet reconstruction of the Weichselian ice sheet described in the **Climate report** (Section 2.3.4) and in SKB (2010a, Section 3.1.4). Both air temperatures and basal ice temperatures were obtained from the ice sheet model.

Used in model or assessment activity

The dataset was used for a reconstruction of geosphere temperatures (including permafrost and frozen ground conditions) from numerical permafrost modelling (**Climate report,** Section 2.1.4, SKB 2010a, Section 3.4.4, Hartikainen et al. 2010).

Data used

The time series of reconstructed air temperature for the Weichselian glacial cycle for the Forsmark region are displayed in SKB (2010a, Figure 3-55). The numerical data used can be found in SKBdoc 1436252.

5.13 AMF Number 144

Output from AMF activity	**Input to AMF activity**
Literature survey – Future sea-level evolution	Shore-level evolution
Dataset	
Range of future sea-level rise at Forsmark	

5.13.1 Range of future sea-level rise at Forsmark

Short description of data

The dataset contains a range of possible future sea-level rise for the next 10,000 years for Forsmark.

Source of data

The sea-level rise data originate from a literature survey of current knowledge on sea-level change associated with increased global average near-surface air temperature (**Climate report**, Section 3.3.4). To account for the uncertainty in future projected sea-level change, a maximum worst-case sea-level rise at Forsmark was calculated based on published estimates of the maximum contributions from ocean steric expansion, a complete melting of the Greenland and West Antarctic ice sheets and a complete melting of all glaciers and ice caps temperature (**Climate report**, Section 3.3.4).

Used in model or assessment activity

The uncertainty range associated with future sea-level rise was taken into account in the safety assessment in the *global warming climate case* and the *extended global warming climate case*, see the **Climate report** (Sections 4.1 and 4.3). The *global warming climate case* represents the lower end of the uncertainty range, with negligible effects of global sea-level rise, whereas the *extended global warming case* represents the upper end of the uncertainty range, see the **Climate report** (Sections 4.1.3 and 4.3.3). The two cases thus also represent a minimum length period of submerged conditions above SFR in the *global warming climate case* and a maximum length period of submerged conditions above SFR in the *extended global warming climate case*.

Data used

The maximum contributions to sea-level rise in the Baltic Sea are listed in the **Climate report** (Table 3-7).

5.14 AMF Number 188

Output from AMF activity	Input to AMF activity
Potential for permafrost	Climate cases representing prolonged interglacial conditions
Dataset	
Maximum depth of isotherms at repository location	

5.14.1 Maximum depth of isotherms at repository location

Short description of data

The dataset contains maximum depths of the 0°C, –1°C, –2°C, –3°C, –4°C and –5°C isotherms at the repository location as a function of the annual average Forsmark air temperature at 2-metres height.

Source of data

Brandefelt et al. (2013) combined climate modelling and permafrost modelling to investigate the potential for permafrost at Forsmark in the next 60,000 years. The study focused on the expected periods of minimum in the summer insulation at high northern latitudes at c. 19,000 years AD and c. 56,000 years AD. A range of Earth System Model of Intermediate Complexity (EMIC) and Earth System model (ESM) simulations with a wide range of atmospheric CO_2 concentrations and insulation distributions for the next 60,000 years was performed. The study is described in Brandefelt et al. (2013) and in the **Climate report** (Sections 2.1.4 and 4.2.4)

Used in model or assessment activity

The results of the permafrost modelling simulations and climate model simulations, in combination with estimates of future atmospheric CO_2 concentrations in the periods around 19,000 AD and 54,000 AD given in the **Climate report** (Section 3.3.1 and 4.1.4), were used in the definition of permafrost conditions in the climate cases representing prolonged interglacial conditions, see the **Climate report** (Section 4.2.4).

Data used

The maximum depths of the 0°C, –1°C, –2°C, –3°C, –4°C and –5°C isotherms at the repository location is given in the **Climate report** (Figure 2-11) as a function of the annual average Forsmark air temperature at 2-metres height. The numerical data used can be found in SKBdoc 1433270.

5.15 AMF Number 189

Output from AMF activity	Input to AMF activity
Surface denudation	Climate cases representing prolonged interglacial conditions
Dataset	
Maximum surface denudation rate	

5.15.1 Maximum surface denudation rate

Short description of data

The dataset contains an estimate of the maximum denudation rate for a future climate evolution in Forsmark without presence of ice sheets.

Source of data

The data originate from a Geographical Information System (GIS) modelling study of denudation described in Olvmo (2010) and in the **Climate report** (Section 2.4.4).

Used in model or assessment activity

The data are used in the definition of maximum denudation during the next 100,000 years in the climate cases representing prolonged interglacial conditions, see the **Climate report** (Sections 4.1.5, 4.2.5 and 4.3.5).

Data used

The data used are given in the **Climate report** (Section 2.4.6 and Table 2-8)

5.16 AMF Number 190

Output from AMF activity	Input to AMF activity
Shore-level evolution	Climate cases representing prolonged interglacial conditions
Dataset	
Shore-level evolution for a future warm climate	

5.16.1 Shore-level evolution for a future warm climate

Short description of data

The dataset contains relative shore-level evolution at Forsmark for the next 100,000 years in Forsmark. Relative shore-level is defined as the vertical distance between the shore-level at a specific time and the average shore level at present.

Source of data

Relative shore-level for a future warm climate was defined based on Glacial Isostatic Adjustment (GIA) model simulations, extrapolations of up-to-present Holocene isostatic uplift rates at the Forsmark site, and peer-review-published data on future sea-level rise, see details in the **Climate report**, (Sections 2.2.4, 4.1.3 and 4.3.3).

Used in model or assessment activity

The data were used in the definition of the relative shore-level evolution in the climate cases representing prolonged interglacial conditions.

Data used

Data on the evolution of relative shore-level in a future warm climate is illustrated in the **Climate report** (Figure 2-37). The numerical data used are found in SKBdoc 1359616.

5.17 AMF Number 191

Output from AMF activity	Input to AMF activity
Weichselian glacial cycle climate case representing natural variability	Climate cases representing prolonged interglacial conditions

Dataset
Weichselian glacial cycle climate case ice-sheet evolution Weichselian glacial cycle climate case geosphere temperature evolution Weichselian glacial cycle climate case shore-level evolution Weichselian glacial cycle climate case evolution of climate domains

5.17.1 Weichselian glacial cycle climate case ice-sheet evolution

Short description of data

The dataset contains ice-sheet thickness at Forsmark for the period 2000 AD to 52,000 AD as defined in the *Weichselian glacial cycle climate case* representing natural variability.

Source of data

The data were obtained from numerical ice sheet simulations made for the reconstruction of Weichselian conditions described in the **Climate report** (Section 2.3.4) and in SKB (2010a, Section 3.1.4).

Used in model or assessment activity

The data was used for the definition of ice-sheet thickness evolution for the period 52,000 AD to 102,000 AD in the *global warming* and *early periglacial* climate cases (**Climate report**, Sections 4.1.2 and 4.2.2).

Data used

See Source of data.

5.17.2 Weichselian glacial cycle climate case geosphere temperature evolution

Short description of data

The dataset contains geosphere temperature evolution at Forsmark, including development of permafrost and frozen depths, for the period 2,000 AD to 52,000 AD as defined in the *Weichselian glacial cycle climate case* representing natural variability. The dataset also contains information on freeze-out of salt during periods of geosphere freezing as well as the development of taliks along the investigated profile.

Source of data

The data was obtained from numerical permafrost simulations made for the reconstruction of Weichselian conditions described in the **Climate report** (Section 2.1.4), SKB (2010a, Section 3.4.4) and in Hartikainen et al. (2010).

Used in model or assessment activity

The data was used for the definition of permafrost development for the period 52,000 AD to 102,000 AD in the *global warming* and *early periglacial* climate cases (**Climate report**, Sections 4.1.4 and 4.2.4).

Data used

Examples of the used data are given in SKB (2010a, Figure 3-56).

5.17.3 Weichselian glacial cycle climate case shore-level evolution

Short description of data

The dataset contains a time series of shore-level variations for the *Weichselian glacial cycle climate case* representing natural variability.

Source of data

The data were mainly obtained from numerical GIA (Glacial Isostatic Adjustment) simulations made for the reconstruction of Weichselian conditions described in the **Climate report** (Section 2.2.4), (SKB 2010a, Section 3.3.4) and in Whitehouse (2009). For the initial few thousands of years, extra-polated data from Holocene data were used (Påsse 2001), see the **Climate report** (Section 2.2.4).

Used in models, assessments, scenarios, and calculation cases

The data were used for the definition and description of the shore-level development in the Weichselian glacial cycle climate case (**Climate report**, Section 4.4.3).

Data used

The data on shore-level development are shown in the **Climate report** (Figure 4-11).

5.17.4 Weichselian glacial cycle climate case evolution of climate domains

Short description of data

The dataset contains the evolution of climate domains defined for years 2000 AD to 52,000 AD of the *Weichselian glacial cycle climate case* representing natural variability.

Source of data

The data originate from the combination of permafrost, glacial isostatic adjustment (GIA) and ice-sheet modelling for the last glacial cycle, described in the **Climate report** (Sections 2.1.4, 2.2.4 and 2.2.3) and in Olvmo (2010).

Used in model or assessment activity

The data were used to define the succession of climate domains for the period 52,000 AD to 102,000 AD in the *global warming* and *early periglacial* climate cases (**Climate report**, Sections 4.1.5 and 4.2.5).

Data used

The data on evolution of climate domains are shown in the **Climate report** (Figure 4-18). Numerical data used can be found in the following documents:

- Weichselian glacial cycle climate case ice-sheet thickness and temperature evolution (SKBdoc 1437317)
- Weichselian glacial cycle climate case geosphere temperature evolution (SKBdoc 1437319)
- Weichselian glacial cycle climate case shore-level evolution (SKBdoc 1437321)
- Weichselian glacial cycle climate case development of climate domains (SKBdoc 1338361)

5.18 AMF Number 192

Output from AMF activity	Input to AMF activity
Weichselian permafrost development	Weichselian glacial cycle climate case representing natural variability
Dataset	
Reconstructed Weichselian geosphere temperature development	

5.18.1 Reconstructed Weichselian geosphere temperature development

Short description of data

The dataset contains a time series of reconstructed geosphere temperatures for the last glacial cycle for Forsmark, including development of permafrost and frozen depths. The dataset also contains information on freeze-out of salt during periods of geosphere freezing as well as the development of taliks along the investigated profile.

Source of data

The data were obtained from numerical permafrost simulations made for the reconstruction of Weichselian conditions (**Climate report**, Section 2.1.4, SKB 2010a, Section 3.4.4, Hartikainen et al. 2010).

Used in model or assessment activity

The data were used for the definition and description of the permafrost development in the Weichselian glacial cycle climate case (**Climate report**, Section 4.4.3).

Data used

Examples of the used data are seen in SKB (2010a, Figures 3-56 and 3-68). The numerical data used for the Weichselian ice-sheet thickness and temperature development can be found in SKBdoc 1265613.

5.19 AMF Number 193

Output from AMF activity	Input to AMF activity
Weichselian ice-sheet development	Weichselian glacial cycle climate case representing natural climate variability
Dataset	
Weichselian ice-sheet thickness and temperature development	

5.19.1 Weichselian ice-sheet thickness and temperature development

Short description of data

The dataset contains a time series of reconstructed ice sheet thickness for the last glacial cycle for Forsmark, including ice temperatures and timings of ice sheet coverage over Forsmark.

Source of data

The data was obtained from numerical ice sheet simulations made for the reconstruction of Weichselian conditions (**Climate report**, Section 2.3.4, SKB 2010a, Section 3.1.4).

Used in model or assessment activity

The data was used for the definition and description of the ice sheet development in the Weichselian glacial cycle climate case (**Climate report**, Section 4.4.2).

Data used

An example of data used on ice sheet thickness is given in the **Climate report** (Figure 3-21). The numerical data used can be found in SKBdoc 1436190.

5.20 AMF Number 194

Output from AMF activity	Input to AMF activity
Weichselian shore-level evolution	Weichselian glacial cycle climate case representing natural climate variability
Dataset	
Reconstructed Weichselian shore-level evolution	

5.20.1 Reconstructed Weichselian shore-level evolution

Short description of data

The dataset contains a time series of reconstructed shore-level variations for the last glacial cycle for Forsmark.

Source of data

The data were mainly obtained from numerical GIA (Glacial Isostatic Adjustment) simulations made for the reconstruction of Weichselian conditions described in the **Climate report** (Section 2.2.4), (SKB 2010a, Section 3.3.4) and in Whitehouse (2009). For the initial few thousands of years, extrapolated data from Holocene data were used (Påsse 2001), see the **Climate report** (Section 2.2.4).

Used in model or assessment activity

The data were used for the definition and description of the shore-level development in the Weichselian glacial cycle climate case (**Climate report**, Section 4.4.3).

Data used

The data used on shore-level development are shown in the **Climate report** (Figure 3-20). The numerical data used can be found in SKBdoc 1436249.

5.21 AMF Number 195

Output from AMF activity	Input to AMF activity
Weichselian surface denudation	Weichselian glacial cycle climate case representing natural climate variability
Dataset	
Weichselian surface denudation	

5.21.1 Weichselian surface denudation

Short description of data

The dataset contains estimates of surface denudation rates for the Forsmark site in a 100,000 year time perspective.

Source of data

The data originate from a Geographical Information System (GIS) modelling study of denudation in a large region surrounding the Forsmark site described in the **Climate report** (Sections 2.4.4–2.4.6) and in Olvmo (2010).

Used in model or assessment activity

The estimates of future surface denudation are used to describe the potential surface denudation for the *Weichselian glacial cycle* climate case.

Data used

The estimated denudation rates for the repository location at Forsmark are given in the **Climate report** (Table 2-8).

5.22 AMF Number 196

Output from AMF activity	Input to AMF activity
Weichselian glacial cycle climate case representing natural climate variability	RN transport and dose
Dataset	
Weichselian glacial cycle climate case ice-sheet development Weichselian glacial cycle climate case shore-level evolution	

5.22.1 Weichselian glacial cycle climate case ice-sheet development

Short description of data

The dataset contains ice-sheet thickness at Forsmark as reconstructed for the last glacial cycle.

Source of data

The *Weichselian glacial cycle climate case* was defined based on a reconstructed evolution of climate and climate-related issues for the last glacial cycle, see the **Climate report** (Sections 2.3.4 and 4.4). The evolution of ice-sheet thickness at Forsmark was determined based on simulations with the UMISM ice-sheet model, see the **Climate report** (Section 2.3.4).

Used in model or assessment activity

The timing of the first future deglaciation of Forsmark (around 68,000 years AD) is used in the calculation case glacial conditions in which submerged conditions are assumed at 68,000 AD (the calculation is further described in the **Radionuclide transport report**).

Data used

The data used on ice-sheet thickness over Forsmark in the *Weichselian glacial cycle climate case* is displayed in the **Climate report** (Figure 4-10).

5.22.2 Weichselian glacial cycle climate case shore-level evolution

Short description of data

The dataset contains shore-level evolution at Forsmark as reconstructed for the last glacial cycle.

Source of data

The *Weichselian glacial cycle climate case* was defined based on the reconstructed evolution of climate and climate-related issues for the last glacial cycle, see the **Climate report** (Sections 2.3.4 and 4.4). The first few thousands of years of the future period are based on extrapolated observed relative sea-level data (Påsse 2001) whereas from about 10,000 years AD and onwards the time series is constructed from Glacial Isostatic Adjustment (GIA) modelling, see the **Climate report** (Section 2.2.4).

Used in model or assessment activity

See Section 5.22.1.

Data used

The data used on shore-level evolution at Forsmark in the *Weichselian glacial cycle climate case* is displayed in the **Climate report** (Figure 4-11). Detailed references to where numerical data can be found are given in the following documents:

- Weichselian glacial cycle climate case ice-sheet development (SKBdoc 1471889).
- Weichselian glacial cycle climate case shore-level evolution (SKBdoc 1471890).

The used data are stored in the file:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/Climate/Shore level data Forsmark reference evolution and Global warming climate case.xlsx

5.23 AMF Number 198

Output from AMF activity	Input to AMF activity
Geothermal heat flux	Weichselian ice-sheet development
Dataset	
Geothermal heat flux	

5.23.1 Geothermal heat flux

Short description of data

The dataset contains a distributed dataset on geothermal heat flux over northern Europe, including high-resolution data for Sweden and Finland.

Source of data

The high resolution data for Sweden and Finland was calculated from detailed datasets of γ-emission measurements from bedrock and till (see the **Climate report**, Section 2.3.2 and Näslund et al. 2005). The surrounding low resolution data were interpolated from drill-hole data (**Climate report,** Section 2.3.2 and Pollack et al. 1991).

Used in model or assessment activity

The dataset was used as input to the thermo dynamical ice sheet modelling made for reconstructing the Weichselian ice sheet (**Climate report**, Section 2.3.4)

Data used

The data used on geothermal heat flux are shown in the **Climate report** (Figure 2-45). Numerical data used can be found in SKBdoc 1433662.

5.24 AMF Number 200

Output from AMF activity	Input to AMF activity
Digital elevation data ETOP02	Weichselian ice-sheet development
Dataset	
Digital elevation	

5.24.1 Digital elevation

Short description of data

The dataset contains global digital elevation data, including bathymetry, with a 2×2 minute resolution. For the present assessment data were extracted for northern Europe.

Source of data

The data were obtained from the National Geophysical Data Center (NGDC) ETOPO2 Global 2' Elevations dataset (ETOPO2 2001).

Used in model or assessment activity

The dataset was used as input to the thermo dynamical ice sheet modelling made for reconstructing the Weichselian ice sheet (**Climate report,** Section 2.3.4)

Data used

Digital elevation data (2x2 minute resolution) for Northern Europe from the ETOPO 2 data base (ETOPO2 2001). The dataset was originates from http://www.ngdc.noaa.gov/mgg/global/etopo2.html and can be found in SKBdoc 1469820 with a description of the dataset in SKBdoc 1469822.

5.25 AMF Number 203

Output from AMF activity	Input to AMF activity
Weichselian landscape modelling	Weichselian permafrost development
Dataset	
Future vegetation and surface cover types Future lakes	

5.25.1 Future vegetation and surface cover types

Short description of data

The dataset contains the evolution of future vegetation and surface cover types.

Source of data

The data are given in Hartikainen et al. (2010, Appendix J).

Used in model or assessment activity

Weichselian permafrost development at Forsmark during the period from 115,000 years ago to 70,000 years ago was modelled with a numerical permafrost model in a 2D vertical cross-section (Hartikainen et al. 2010), as described in the **Climate report** (Section 2.1.4)

The results of these 2D permafrost model simulations were utilised, together with the 1D permafrost simulations that were made for the full glacial cycle, in the definition and description of the *Weichselian glacial cycle climate case* representing natural variability, see the **Climate report** (Section 4.5).

Data used

See Source of data.

5.25.2 Future lakes

Short description of data

The dataset contains the evolution of future lakes.

Source of data

The evolution of future lakes in the Forsmark area was determined for the next 45,000 years from simulations with a landscape model (Brydsten 2006). These data were used to represent the period from 115,000 years ago until 70,000 years ago.

Used in model or assessment activity

Permafrost development at Forsmark was modelled with a numerical permafrost model in a 2D vertical cross-section (Brandefelt et al. 2013), as described in the **Climate report**.

The results of these 2D permafrost model simulations were utilised in the definition of the two of the Climate cases representing prolonged interglacial conditions, the *global warming* and *early periglacial* climate cases, see the **Climate report** (Sections 4.2 and 4.3).

Data used

The used data are described in Hartikainen et al. (2010, Appendix I).

5.26 AMF Number 204

Output from AMF activity	Input to AMF activity
Weichselian surface denudation	Surface denudation
Dataset	
Weichselian denudation rate	

5.26.1 Weichselian denudation rate

Short description of data

The dataset contains estimates of surface denudation rates for the Forsmark site in a 100,000 year time perspective.

Source of data

The data originate from a Geographical Information System (GIS) modelling study of denudation in a large region surrounding the Forsmark site described in the **Climate report** (Sections 2.4.4–2.4.6) and in Olvmo (2010).

Used in model or assessment activity

The estimates of future surface denudation were used, in combination with the succession of climate domains, to describe the potential surface denudation for the Climate cases representing prolonged interglacial conditions.

Data used

The estimated denudation rates for the repository location at Forsmark are given in the **Climate report** (Table 2-8).

5.27 AMF Number 210

Output from AMF activity	Input to AMF activity
Minimum air temperature in next 60,000 years	Climate cases representing prolonged interglacial conditions
Dataset	
Minimum Forsmark air temperature at 2-metres height	

5.27.1 Minimum Forsmark air temperature at 2-metres height

Short description of data

The dataset contains the minimum annual average air temperatures at 2 m height in Forsmark for the periods of minimum in the summer insulation at high northern latitudes at c. 19,000 years AD and c. 56,000 years AD as a function of the atmospheric CO_2 concentration.

Source of data

Brandefelt et al. (2013) combined climate modelling and permafrost modelling to investigate the potential for permafrost at Forsmark in the next 60,000 years. The study focuses on the expected periods of minimum in the summer insulation at high northern latitudes at around 19,000 years AD and 56,000 years AD. A range of Earth System Model of Intermediate Complexity (EMIC) and Earth System model (ESM) simulations with a wide range of atmospheric CO_2 concentrations and insulation distributions for the next 60 ka was performed. The results of the climate model simulations were combined with estimates of the uncertainty in the results due to future glacier and ice-sheet growth, inter-model differences, internal variability and future atmospheric greenhouse gas concentrations, in order to estimate the coldest feasible near-surface air temperature in Forsmark in the periods around 19,000 AD and 56,000 AD. The study is described in Brandefelt et al. (2013) and in the **Climate report** (Sections 2.1.4 and 4.2.4).

Used in model or assessment activity

The results of the permafrost modelling simulations and climate model simulations, in combination with estimates of future atmospheric CO_2 concentrations in the periods around 19,000 AD and 54,000 AD, given in the **Climate report** (Sections 3.3.1 and 4.1.4) were used in the description of permafrost conditions in the climate cases representing prolonged interglacial conditions, see the **Climate report** (Section 4.2.4).

Data used

The minimum annual average bias-corrected Forsmark T_{2m} when all uncertainties are taken into account is given in the **Climate report** (Table 2-2).

6 Biosphere

6.1 AMF Number 1

Output from AMF activity	Input to AMF activity
Landscape modelling	Hydrogeology
Dataset	
Bedrock and regolith-layer geometrical data Development of lakes and streams Location of future talliks	

6.1.1 Bedrock and regolith-layer geometrical data

Short description of data

The data define the evolution of the areal distribution, elevation, and thickness of the regolith layers.

Source of data

The data are delivered from the regolith development model (RDM) described in Brydsten and Strömgren (2013). The data define areal distribution, elevation, and thickness of regolith layers at given time slices. Data are given for 7 selected time slices (2000, 2500, 3000, 3500, 5000, 7000, and 9000 AD).

Used in model or assessment activity

The data are used in all hydrogeological simulations (Td08, Td11, Td12, and Td13), to reflect the prevailing hydrogeological conditions at studied time slices. The 7000 AD data are not used in hydrogeological modelling. The data are used in the SR-PSU safety assessment for:

1. Geometrically define: a) ground surface and b) bedrock surface in the discretised grid.
2. Prescribe local head: a) lakes, b) rivers and c) mixed-boundary condition approach.
3. Numerically implement sediment-layer parameterisation.
4. Visualisation of output in context with topography.

Data used

The datasets specified in Table 6-1 are stored in SKB GIS database. The Static regolith model is stored in: GIS#12_08 and the Dynamic regolith model: GIS#12_09.

6.1.2 Development of lakes and streams

Short description of data

The dataset contains the evolution of the areal extension of lakes and streams.

Source of data

The data are delivered from the lake development model (RLDM) described in Brydsten and Strömgren (2013). The data define areal extension of lakes and rivers at given time slices. Data are delivered for 7 selected time slices (2000, 2500, 3000, 3500, 5000, 7000, and 9000 AD).

1. RLDM lake geometry in ArcGIS shape vector format (lakes_<time slice>) for time slices 2000, 2500, 3000, 3500, 5000, 7000, and 9000 AD. Each ArcGIS shape object consists of a quadruplet of files with extension *.shp, *,dbf, *.sbx, and *.sbn.
2. RLDM geometry of streams and basins is originally stored in ArcGIS shape vector format, however exported in data-point ASCII format (element-ordered nodes), by Ulf Brising, to facilitate handling outside ArcGIS.

Table 6-1. Regolith data files delivered from RLDM.

Filenames[1]	Description	Usage
pdem<time slice>.asc pdem<time slice>.xyz	Upper peat surface elevation (m).	HSD parameterisation Point data used for basin filling, defining lake/river objects, grid generation.
lpgd<time slice>.asc	The upper surface of lacustrine accumulation of postglacial deposits, elevation (m).	HSD parameterisation
mpgd<time slice>.asc	The upper surface of marine accumulation of post glacial deposits, elevation (m).	HSD parameterisation
gkl<time slice>.asc	The upper surface of glacial clay, elevation (m).	HSD parameterisation
fill<time slice>.asc	The upper surface of filling, elevation (m).	HSD parameterisation
glfl<time slice>.asc	The upper glaciofluvial-material surface elevation (m).	HSD parameterisation
till<time slice>.asc	The upper till surface elevation (m).	HSD parameterisation
bedr<time slice>.asc bedr<time slice>.xyz	The upper bedrock surface, level in the height system RH 70 (m). The level has been corrected for all layers from –8000 AD to 55,000 AD using the Sea shoreline curve for the reference scenario.	HSD parameterisation Point data not used[2]

[1] Delivered for <time slice>: 2000 AD, 2500 AD, 3000 AD, 3500 AD, 5000 AD, 7000 AD, and 9000 AD. Extensions *.asc are in GIS ESRI ASCII raster format, while *.xyz is in point-data ASCII format.

[2] Owing to a "fixed-bedrock" convention used, the bedrock surface is modelled as static. The bedrock surface is therefore defined by the original definition in the static regolith model (bedrock_up_v2_2000AD.xyz), GIS #12_08.

Used in model or assessment activity

The data are used in all hydrogeological simulations (Td08, Td11, Td12, and Td13), to reflect the prevailing hydrogeological conditions at studied time slices. The 7000 AD data are not used in hydrogeological modelling.

The data are used in the SR-PSU safety assessment for:

1. Prescribed head at model top boundary.
2. Visualisation in context of particle exit locations.

Data used

The RLDM lake geometry in ArcGIS shape vector format described in section source of data above is stored at: svn:\SR-PSU\Synthesis\Leveranser\Leverans_tidssteg_geosigma

RLDM geometry of streams and basins is stored in SKB GIS database according to Table 6-2.

Used files are described in (vattendrag_SDEADM.UMEU_FM_GEO_10171.txt) and (bassanger_ SDEADM.UMEU_FM_GEO_10168.txt)

6.1.3 Location of future taliks

Short description of data

Data concerning location of future taliks are taken firstly from the results of the landscape evolution model for year 20,000 AD. The results of this model comprise predicted locations of streams and lakes large enough to fulfil talik formation criteria, i.e. approximate having the same or larger dimensions as a permafrost layer is thick. The second set of information is taken from the results of a groundwater flow model focusing on the surface water balance for a temperate landscape of the year 11,000 AD. These results comprise all surface water bodies deeper than 0.5 metres that is consistent over a hydrological year.

Source of data

Landscape development in the Forsmark area from the past into the future (8,500 BC – 40,000 AD) relevant for 20,000 AD is found in Brydsten and Strömgren (2013).

Surface hydrology data relevant for 11,000 AD results are found in Werner et al. (2013).

Table 6-2. Datasets in SKB GIS database used in the modelling.

Name	Title (in Swedish)	Data type
SDEADM.UMEU_FM_GEO_9124	Modellerad överyta för fyllning (Z3c). För Variant 1.	R
SDEADM.UMEU_FM_GEO_9148	Modellerad överyta för glaciallera (Z4b). För Variant 2.	R
SDEADM.UMEU_FM_GEO_9145	Modellerad överyta för isälvsmaterial (Z3b). För Variant 2.	R
SDEADM.UMEU_FM_GEO_9122	Modellerad överyta för sand/grus (Z3a). För Variant 1.	R
SDEADM.UMEU_FM_GEO_9150	Modellerad överyta för ytnära berg (Z6). För Variant 2.	R
SDEADM.UMEU_FM_GEO_9103	Modellerad överyta för berg. För Varian 1 och Variant 2.	R
SDEADM.UMEU_FM_GEO_9147	Modellerad överyta för lergyttja (Z4a). För Variant 2.	R
SDEADM.UMEU_FM_GEO_9121	Modellerad överyta för torv. (Z2) För Variant 1.	R
SDEADM.UMEU_FM_GEO_9142	Modellerad överyta för ytlager (Z1). För Variant 2.	R
SDEADM.UMEU_FM_GEO_9127	Modellerad överyta för morän (Z5). För Variant 1.	R
SDEADM.UMEU_FM_GEO_9146	Modellerad överyta för fyllning (Z3c). För Variant 2.	R
SDEADM.UMEU_FM_GEO_9123	Modellerad överyta för isälvsmaterial (Z3b). För Variant 1.	R
SDEADM.UMEU_FM_GEO_9149	Modellerad överyta för morän (Z5). För Variant 2.	R
SDEADM.UMEU_FM_GEO_9144	Modellerad överyta för sand/grus (Z3a). För Variant 2.	R
SDEADM.UMEU_FM_GEO_9126	Modellerad överyta för glaciallera (Z4b). För Variant 1.	R
SDEADM.UMEU_FM_GEO_9125	Modellerad överyta för lergyttja (Z4a). För Variant 1.	R
SDEADM.UMEU_FM_GEO_9143	Modellerad överyta för torv (Z2). För Variant 2	R

Used in model or assessment activity

The data are assessed in all simulations concerning permafrost and hydrogeology reported in Odén et al. (2014) and are detailed described therein (Table 6-4).

Data used

The used datasets are stored at: svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Synthesis/Leveranser/_25_Talik_input/Talik_input

6.2 AMF Number 20

Output from AMF activity	Input to AMF activity
Site specific data	Landscape modelling
Dataset	
Present day topography and bathometry	

6.2.1 Present day topography and bathometry

Short description of data

The digital elevation model (DEM) for the Forsmark area describes the topography in the terrestrial area and the bathometry in lakes and the sea. The DEM is important as input for further modelling within the safety assessment. Such models include, e.g. hydrology, Quaternary deposits and land use.

Source of data

A thorough description of the construction of the DEM is found in Brydsten and Strömgren (2013).

Used in model or assessment activity

The DEM is used in the regolith depth model (RDM) and the regolith lake development model (RLDM).

Data used

The data used are stored in the SKB's GIS database (SDE) at: SDEADM.UMEU_FM_HOJ_8741.

6.3 AMF Number 22

Output from AMF activity	Input to AMF activity
Site specific data	Surface hydrology

Dataset

Present-day climate, precipitation
Present-day climate, potential evapotranspiration
Present-day climate, near-surface air temperature
Present-day sea level

6.3.1 Present-day climate, precipitation

Short description of data

Daily sums of measured precipitation (mm) from the meteorological station Högmasten during the period 2003-05-15–2010-12-31.

Source of data

The precipitation dataset from the meteorological station Högmasten station is presented in Werner et al. (2014, Chapter 2).

Used in model or assessment activity

The precipitation dataset is used in MIKE SHE models run for present-day climate conditions is given in Werner et al. (2013, Chapter 4), and the datasets used in MIKE SHE models run for 3000, 5000, and 11,000 AD are given in Werner et al. (2013, Chapter 5).

Data used

The data used are stored in files located at:
svn.skb.se/projekt/SFR/SR-PSU/Indata/Hydrology/MIKESHE/AMF22

6.3.2 Present-day climate, potential evapotranspiration

Short description of data

Daily sums of calculated potential evapotranspiration (mm) from the meteorological station Högmasten during the period 2003-05-15–2010-12-31.

Source of data

The potential evapotranspiration dataset from the meteorological station Högmasten is presented in Werner et al. (2014, Chapter 2).

Used in model or assessment activity

The potential evapotranspiration dataset is used in MIKE SHE models run for present-day climate conditions is given in Werner et al. (2013, Chapter 4), and the datasets used in MIKE SHE models run for 3000, 5000, and 11,000 AD are given in Werner et al. (2013, Chapter 5).

Data used

The data used are stored in files located at:
svn.skb.se/projekt/SFR/SR-PSU/Indata/Hydrology/MIKESHE/AMF22

6.3.3 Present-day climate, near-surface air temperature

Short description of data

Daily averages of measured near-surface air temperature (°C) from the meteorological station Högmasten during the period 2003-05-15–2010-12-31.

Source of data

The near-surface air temperature dataset from the meteorological station Högmasten is presented in Werner et al. (2014, Chapter 2).

Used in model or assessment activity

The near-surface air temperature dataset is used in MIKE SHE models run for present-day climate conditions (Werner et al. 2013, Chapter 4), and in MIKE SHE models run for 3000, 5000, and 11,000 AD (Werner et al. 2013, Chapter 5).

Data used

The data used are stored in files located at:
svn.skb.se/projekt/SFR/SR-PSU/Indata/Hydrology/MIKESHE/AMF22

6.3.4 Present-day sea level

Short description of data

Daily averages of sea level (m elevation, RHB70) from the SKB sea-level gauging station PFM10038 during the period 2003-05-15–2010-12-31. Sea level is an input parameter to both the MIKE SHE model and the surface stream model MIKE11.

Source of data

The sea-level dataset from the PFM10038 station is presented in Werner et al. (2014, Chapter 2).

Used in model or assessment activity

The sea-level dataset is used as boundary condition in all MIKE SHE models with sea present within the model domain. The dataset is also used as downstream boundary conditions for MIKE 11 surface-flow models, which are coupled to the MIKE SHE models. For further details, see Werner et al. (2013).

Data used

The data used are stored in files located at:
svn.skb.se/projekt/SFR/SR-PSU/Indata/Hydrology/MIKESHE/AMF22

6.4 AMF Number 52

Output from AMF activity	**Input to AMF activity**
Landscape modelling	Surface hydrology

Dataset

Regolith depth and stratigraphy models
Site-specific hydrogeological properties of regolith types

6.4.1 Regolith depth and stratigraphy models

Short description of data

Regolith depth and stratigraphy models are implemented in MIKE SHE to describe the regolith layers for the time slices for which MIKE SHE models were set up.

Source of data

The delivered data (GIS format) are from the landscape development model described in the **Biosphere synthesis report** and Brydsten and Strömgren (2013). The delivered data includes thickness of regolith layers in Forsmark for different climate cases and land-use variant described in the **Biosphere synthesis report** (Chapter 5).

Used in model or assessment activity

The data (thicknesses and lower levels of regolith layers) are used in MIKE SHE models run for present-day conditions, and in MIKE SHE models run for 3000, 5000 and 11,000 AD. For further details, see Werner et al. (2013).

Data used

Four datasets were produced and stored in SKB's GIS-database as the following deliveries.

1. The new regolith depth model variant 1 and 2 in the global warming case. The land-use variants are described in the **Biosphere synthesis report** (Chapter 5) and the delivered files are listed in Table 6-3.
2. GIS delivery ID C296, Global warming case with updated layers for peat for time points 3000 AD, 5000 AD and 11,000 AD.
3. GIS delivery ID C245, Weichsel case where thickness of regolith layers have been transformed to levels in xyz format for time points 2500, 3000, 3500, 5000, 7000 and 9000 AD).
4. GIS delivery ID C245, Regolith thickness in the Weichsel case for time points 2500 AD, 3000 AD, 3500 AD, 5000 AD, 7000 AD and 9000 AD.

Table 6-3. GIS-datasets delivered for global warming case variant 1 and 2.

GIS-dataset		
SDEADM.UMEU_FM_GEO_9165	SDEADM.UMEU_FM_GEO_9151	SDEADM.UMEU_FM_GEO_9166
SDEADM.UMEU_FM_GEO_9126	SDEADM.UMEU_FM_GEO_9162	SDEADM.UMEU_FM_GEO_9152
SDEADM.UMEU_FM_GEO_9103	SDEADM.UMEU_FM_GEO_9141	SDEADM.UMEU_FM_GEO_9157
SDEADM.UMEU_FM_GEO_9161	SDEADM.UMEU_FM_GEO_9150	SDEADM.UMEU_FM_GEO_9124
SDEADM.UMEU_FM_GEO_9163	SDEADM.UMEU_FM_GEO_9121	SDEADM.UMEU_FM_GEO_9144
SDEADM.UMEU_FM_GEO_9153	SDEADM.UMEU_FM_GEO_9145	SDEADM.UMEU_FM_GEO_9122
SDEADM.UMEU_FM_GEO_9149	SDEADM.UMEU_FM_GEO_9148	SDEADM.UMEU_FM_GEO_9147
SDEADM.UMEU_FM_GEO_9123	SDEADM.UMEU_FM_GEO_9169	SDEADM.UMEU_FM_GEO_9167
SDEADM.UMEU_FM_GEO_9160	SDEADM.UMEU_FM_GEO_9158	SDEADM.UMEU_FM_GEO_9142
SDEADM.UMEU_FM_GEO_9168	SDEADM.UMEU_FM_GEO_9155	SDEADM.UMEU_FM_GEO_9125
SDEADM.UMEU_FM_GEO_9159	SDEADM.UMEU_FM_GEO_9143	SDEADM.UMEU_FM_GEO_9164
SDEADM.UMEU_FM_GEO_9146	SDEADM.UMEU_FM_GEO_9127	SDEADM.UMEU_FM_GEO_9156
SDEADM.UMEU_FM_GEO_9104		

6.4.2 Site-specific hydrogeological properties of regolith types

Short description of data

Hydrogeological properties (hydraulic conductivities (m/s) in the horizontal and vertical directions, specific yield (–) and specific storage coefficient (1/m)) of regolith types used in the MIKE SHE modelling.

Source of data

The dataset is presented in Bosson et al. (2010, Table 2-3).

Used in model or assessment activity

The dataset is used in MIKE SHE models run for present-day conditions, and in MIKE SHE models run for 3000, 5000 and 11,000 AD. For further details, see Werner et al. (2013).

Data used

Data used for hydrogeological properties of layers of the RDM are given in Werner et al. (2013, Table 2-2). The data are identical to the data given in Bosson et al. (2010).

6.5 AMF Number 54

Output from AMF activity	**Input to AMF activity**
Landscape modelling	RN transport and dose
Dataset	
Thresholds of the landscape Geometric parameters and infilling parameters for the biosphere objects	

6.5.1 Thresholds of the landscape

Short description of data

Thresholds or points in time when the landscape object reaches a certain level above sea level are used to model the transition of marine basins into lakes and mires.

Source of data

These thresholds are derived in the landscape development model (**Biosphere synthesis report**, Brydsten and Strömgren 2013).

Used in model or assessment activity

These thresholds are used in the radionuclide transport model for the biosphere to determine transitions between marine, limnic and terrestrial parameter values (Saetre et al. 2013).

Data used

The data used are stored in the file:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/ObjectSpecific.xlsm

6.5.2 Geometric parameters and infilling of the biosphere objects

Short description of data

These data describe the geometric parameters of the biosphere objects over time as well as successional development where the lake is turned into a mire. The geometric parameters include both terrestrial and aquatic part of the biosphere objects and include area, depth of regolith layers and water column over time. The infilling of sediments in the aquatic ecosystems are described by the sedimentation and resuspension rate. The expansion of the mire into the lake is described by peat ingrowth.

Source of data

These data are derived in the Landscape development model (**Biosphere synthesis report**, Brydsten and Strömgren 2013). The peat ingrowth is described in Grolander (2013).

Used in model or assessment activity

Data are used in the radionuclide transport model for the biosphere (Saetre et al. 2013).

Data used

The data used are stored in the files:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/ObjectSpecific.xlsm

svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/TimeSeries.xlsm

svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/Ter_growth.xlsx

6.6 AMF Number 88

Output from AMF activity	**Input to AMF activity**
Ecosystem parameters and dose coefficents	RN transport and dose
Dataset	
Site generic data Dose coefficients	

6.6.1 Site generic data

Short description of data

A large set of data describes different ecosystem properties of the biosphere objects. These data are used in the radionuclide transport modelling for the biosphere to calculate dose to humans and non-human biota. Most of the data are general in the sense that they are general for the region of Forsmark e.g. net primary production of macrophytes, leaf area index for different crops, density of peat and diet fractions for humans. Data are mostly based on site investigations from different ecosystems (Andersson 2010, Aquilonius 2010, Löfgren 2010), but some are also taken from literature.

Source of data

The site generic data contain a large number of parameters. The data and underlying calculations are described in detail in Grolander (2013).

Used in model or assessment activity

The data are used in the radionuclide transport modelling for the biosphere (Saetre et al. 2013). Data files 1, 2, 3 and 4, are used for all biosphere calculation cases. In addition some alternative parameterisations are used for alternative climate cases. Data file 5 is used for the extended global warming case and data files 6 and 7 are used for calculation case talik (periglacial conditions).

Data used

The data used are stored in the files:

1) svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/SiteGeneric.xlsm
2) svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/SiteGeneric_aquatic.xlsm
3) svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/TimeSeries_converted.xlsm
4) svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/OrganismSpecific_NHB.xlsx
5) svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/WarmerClimate/SiteGeneric.xlsm
6) svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/ColderClimate/SiteGeneric.xlsm
7) svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/ColderClimate/SiteGeneric_aquatic.xlsm

6.6.2 Dose coefficients

Short description of data

Three dose coefficients for humans are used in the PSU assessment, dose coefficients for external exposure from radionuclides in or on the ground (Sv h^{-1} per Bq m^{-3}), dose coefficients for ingestion (Sv Bq^{-1}), and dose coefficients for inhalation (Sv Bq^{-1}). In addition to this an additional calculation case were peat and wood are combusted for heat generation is applied in SR-PSU. The exposure to radionuclides in the contaminated air are considered and therefore dose conversion factors (doseCoef _comb_peat, doseCoef_comb_wood, Sv/year per Bq/kg dw) for the exposure by inhalation of contaminated air following the combustion of peat or wood.

Dose estimates to non-human biota are calculated using organism, radionuclide and radiation type specific dose conversion coefficients. Eight different kinds of coefficients in total or for non-human biota are used (see Grolander 2013).

Source of data

The dose coefficients for internal exposure (inhalation and ingestion) are taken from ICRP publication 72 (ICRP 1996) and dose coefficients for external exposure are taken from EPA (1993). Dose coefficients for peat and wood combustion were taken from Stenberg and Rensfeldt (2014).

Dose coefficients used for non-human biota are derived according to the methods in Ulanovsky and Pröhl (2006) and Ulanovsky et al. (2008).

Used in model or assessment activity

The data are used in the radionuclide transport modelling for the biosphere (Saetre et al. 2013). The data are used for all calculation cases, see the **Biosphere synthesis report**.

Data used

The data used are stored in the files:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/RadionuclideSpecific.xlsm

svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/RadionuclideSpecific_NHB.xlsx

6.7 AMF Number 99

Output from AMF activity	Input to AMF activity
Landscape modelling	Potential for permafrost
Dataset	
Future vegetation and surface cover types Future lakes	

6.7.1 Future vegetation and surface cover types

Short description of data

Vegetation type and surface cover type affect the potential for permafrost. These data were used in the 2D permafrost model simulations.

Source of data

The data are given in Hartikainen et al. (2010, Appendix J).

Used in model or assessment activity

Permafrost development at Forsmark was modelled with a numerical permafrost model in a 2D vertical cross-section (Brandefelt et al. 2013), as described in the **Climate report** and the **Model summary report**.

The results of these 2D permafrost model simulations were utilised in the definition of the two of the Climate cases representing prolonged interglacial conditions, the *global warming* and *early periglacial climate* cases, see the **Climate report** (Sections 4.2 and 4.3)

Data used

See Source of data.

6.7.2 Future lakes

Short description of data

Due to land-rise areas that are presently marine bays can in the future turn into lakes. This data describes future lakes in the landscape in the future.

Source of data

The permafrost model simulations were performed for a future period around 54,000 years after closure. According to the landscape development modelled for SR-Site (Brydsten 2006) and for SR-PSU (**Biosphere synthesis report**), no lakes are present along the 2D profile for this period.

Used in model or assessment activity

Permafrost development at Forsmark was modelled with a numerical permafrost model in a 2D vertical cross-section (Brandefelt et al. 2013), as described in the **Climate report** and the **Model summary report**.

The results of these 2D permafrost model simulations were utilised in the definition of the two of the Climate cases representing prolonged interglacial conditions, the *global warming* and *early periglacial climate cases*, see the **Climate report** (Sections 4.2 and 4.3).

Data used

See Source of data.

6.8 AMF Number 102

Output from AMF activity	Input to AMF activity
Site specific data	Ecosystem parameters and dose coefficients
Dataset	
Ecosystem data	

6.8.1 Ecosystem data

Short description of data

Data from site investigations in Forsmark are used to calculate ecosystem parameters. The data include data from both terrestrial and aquatic ecosystems.

Source of data

Data used to calculated terrestrial, marine and limnic ecosystem parameters are mainly based on site specific measurements and models for the Forsmark area (Löfgren 2010, Aquilonius 2010, Andersson 2010) but also some additional literature data from other sites are used. In addition, some recent reports with measurements of regolith characteristics are used.

Used in model or assessment activity

The input data from site and literature are used to assign parameter values to all ecosystem parameters described in the radionuclide transport model (AMF 88). The parameters describe properties such as primary production, production of edible food in the ecosystems, exchange between water and atmosphere, degassing from mires etc. All ecosystem parameters are thoroughly described in Grolander (2013).

Data used

Description of the data and the derivation of parameter values are found in the description of ecosystem parameters in Grolander (2013).

6.9 AMF Number 103

Output from AMF activity	Input to AMF activity
Biosphere object identification	Landscape modelling
Dataset	
Biosphere object delineation	

6.9.1 Biosphere object delineation

Short description of data

The delineation of biosphere objects is the geographical extent of the biosphere objects. The objects change with time as the areas where they are located change from sea to land areas; this means that the coordinates defining the objects are time dependent.

Source of data

The process of delineation of biosphere objects is described in the **Biosphere synthesis report** (Chapter 6).

Used in model or assessment activity

The delineation is used for further landscape modelling where the areas of different ecosystem types (marine, limnic, terrestrial), and depth of regolith layers over time in the biosphere objects are modelled. The landscape modelling data for the biosphere objects is then used for the radionuclide transport and dose modelling (AMF 54).

Data used

The data on biosphere object delineation are stored at:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Landscape/Objects_130306

6.10 AMF Number 138

Output from AMF activity	Input to AMF activity
Surface hydrology	RN transport and dose
Dataset	
Inter-basin water exchange in marine area Inter-compartment water fluxes in marine, limnic and terrestrial ecosystems	

6.10.1 Inter-basin water exchange in marine area

Short description of data

A parameter quantifying inter-basin water exchanges (WF_lobjxx_xx), i.e. annual average water flows between neighbouring marine basins.

Source of data

The dataset is calculated using the flexible-mesh modelling tool MIKE 3 FM using site data from Forsmark. For further details, see Karlsson et al. (2010) and Werner et al. (2013, Sections 4.4 and 5.6).

Used in model or assessment activity

The dataset is used as input to the modelling of radionuclide transport in the biosphere (Saetre et al. 2013 and **Biosphere synthesis report**).

Data used

The data used are stored in the files:

svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/WF_landscape.xlsx

svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/WarmerClimate/WF_landscape.xlsx

These two datafiles are derived with Matlab scripts from files with hydrological modelling results:

The Matlab script 'svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/matlab/WF_landscape.m' is used to convert the file 'svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/Marine/DHI_delivery_20121213/2012-12-13/BasinFluxes.xlsx'

The Matlab script 'svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/WarmerClimate/matlab/WF_landscape.m' is used to convert the file 'svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/Marine/DHI_delivery_20121213/2012-12-13/BasinFluxes_WET.xlsx'

6.10.2 Inter-compartment water fluxes in marine, limnic and terrestrial ecosystems

Short description of data

Parameters quantifying advective water fluxes between compartments of the radionuclide model for the biosphere (Saetre et al. 2013, **Biosphere synthesis report**) for the time steps 3000 AD, 5000 AD and 11,000 AD.

Source of data

The dataset (totally 27 parameters) is calculated using the MIKE SHE water-flow modelling tool. For further details, see Werner et al. (2013, Chapter 7 and Appendix 1).

Used in model or assessment activity

The dataset is used as input to the modelling of radionuclide transport in the biosphere (Saetre et al. 2013, **Biosphere synthesis report**).

Data used

The advective water fluxes used are stored in the file svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/q_flux.xlsx and water balances for each object and time steps are stored in excel files at svn.skb.se/projekt/SFR/SR-PSU/Indata/Hydrology.

6.11 AMF Number 164

Output from AMF activity	**Input to AMF activity**
Landscape modelling	Ecosystem parameter data and dose coefficients
Dataset	
Geometry parameters for the biosphere objects	

6.11.1 Geometry parameters for biosphere objects

Short description of data

Site specific data on depth and volume of aquatic basins determine the occurrence of aquatic primary producers which are dependent on photic depth (depth to which enough light penetrates to allow for photosynthesis). The delivered dataset includes mean depth, volume, area of photic depths in the marine and lake stages for the 7 biosphere objects in the safety assessment.

Source of data

The geometry of the biosphere objects over time and derivation of this dataset is fully described in Brydsten and Strömgren (2013).

Used in model or assessment activity

In the radionuclide transport and dose calculations the geometry of the future landscape is of interest, depths of different regolith layers, sedimentation, resuspension etc influence the transport and accumulation of radionuclides. Moreover, some parameters such as biomass and production of primary producers are used to calculate incorporation of radionuclides into biota (parameters: biom_pp_micro, biom_pp_macro, biom_pp_plank, NPP_micro, NPP_macro, and NPP_plank) are dependent on the geometry of the aquatic basins. The photic area, mean depth, and volumes of the aquatic marine basins and lakes were used to calculate biomass and production of primary producers in these ecosystems. The use of the geometry data in the calculations are fully described in Grolander (2013).

Data used

The data used are stored in the file:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Landscape/Ecolego_SFR_7_basins.xlsx

6.12 AMF Number 165

Output from AMF activity	Input to AMF activity
K_d/CR in Biosphere	RN transport and dose
Dataset	
Element-specific K_d and CR data	

6.12.1 Element-specific K_d and CR data

Short description of data

K_d and CR values selected from the underlying site-specific and literature dataset. Geometric means, geometric standard deviations, minimum and maximum values are delivered together with best estimate values used in deterministic calculations.

Source of data

The parameterisation methods and selected K_d and CR data are described in Tröjbom et al. (2013).

Used in model or assessment activity

Element-specific K_d and CR values are used in the radionuclide transport and dose modelling to assess retention in soils and on particular matter and to assess uptake in biota, for details see Saetre et al. (2013).

Data used

K_d and CR values used in the radionuclide transport model for the biosphere are given in the file:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/ElementSpecific.xlsx

CR values used for the non-human biota assessment are given in the file:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/Element Specific_NHB.xlsx.

6.13 AMF Number 166

Output from AMF activity	Input to AMF activity
Input data	K_d/CR in Biosphere
Dataset	
Site-specific concentrations Literature K_d and CR data.	

6.13.1 Site-specific concentrations

Short description of data

Site-specific concentrations in water, regolith and biota from both Forsmark and Laxemar-Simpevarp are used to calculate site-specific K_d and CR values according to methods described in Tröjbom et al. (2013).

Source of data

The site specific measurements of concentration used for deriving K_d and CR data are from several underlying SKB reports and are described in detail in Tröjbom et al. (2013).

Used in model or assessment activity

The calculated site-specific K_d and CR values are used together with literature K_d and CR data (see Section 6.13.2) to derive K_d and CR parameter values used in the radionuclide transport model for calculation of retention in regolith layers and uptake in biota, see AMF number 165 (Section 6.12).

Data used

The underlying site-specific chemistry dataset is compiled in an excel file: svn://svn.skb.se/projekt/SFR/SR-PSU/Indata/Element specific/Leverans/Underlag/SKB_Chemistry_SR_PSU.zip.

6.13.2 Literature K_d and CR data

Short description of data

K_d and CR values compiled in several openly available studies, these compilations of data contain K_d and CR data for many elements and for many types of soils and biota.

Source of data

These compilations of literature data used are IAEA (2010), ICRP (2011) and data presented in the ERICA modelling tool (Beresford et al. 2008, Hosseini et al. 2008). The data used in the assessment are described in detail in Tröjbom et al. (2013).

Used in model or assessment activity

The literature K_d and CR data are used (together with the site-specific K_d and CR data) to derive K_d and CR values for the radionuclide transport model for calculation of retention in regolith layers and uptake in biota, see AMF number 165 (Section 6.12).

Data used

The literature K_d and CR values are stored in an access database:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/Element specific/Leverans/Underlag/SKB_Kd_CR.zip

6.14 AMF Number 172

Output from AMF activity	**Input to AMF activity**
Well investigation	Well related flow data
Dataset	
Well investigation	

6.14.1 Well investigation

Short description of data

The dataset includes well locations, depths and discharges, and it is used as input to analyses of groundwater flow from SFR 1 and SFR 3 to future water-supply wells drilled in the rock. Specifically, the analyses concern (1) wells drilled and used by future agricultural settlements (i.e. wells associated to potential arable land) and (2) wells drilled in the contamination plume downstream from SFR (decoupled from any foreseeable land use for a self-sustaining community).

Source of data

The methodology and background data used for assigning well locations, depths and discharges are described in Werner et al. (2013, Chapter 6).

Used in model or assessment activity

The dataset is used in DarcyTools groundwater-flow modelling, specifically in the *global warming climate case* (CCM_GW) and in the *wells in discharge area calculation case* (CCL_WD). The setup of the DarcyTools modelling and associated modelling results are summarised in Werner et al. (2013, Chapter 6).

Data used

Initial and relocated well locations (coordinate system RT 90 2.5 gon V/0:15) for the *global warming climate case* are given in Werner et al. (2013, Table 6-10) and initial and relocated well locations (coordinate system RT 90 2.5 gon V/0:15) for the *wells in discharge area calculation case* are given in Werner et al. (2013, Table 6-12).

In all calculation cases, a well depth of 60 mbgs (metres below ground surface) and a well discharge of 700 L/day are used.

6.15 AMF Number 173

Output from AMF activity	Input to AMF activity
Surface hydrology	Ecosystem parameters and dose coefficients
Dataset	
Percolation	

6.15.1 Percolation

Short description of data

Percolation is the net downward flow (precipitation–interception–evaporation–transpiration) to the saturated zone causing leaching in the upper aerated and biologically active layer. This parameter is used to calculate the leaching of radionuclides previously incorporated into the organic soil layer of a drained mire used for agricultural purposes. The percolation is calculated in MIKE-SHE simulations (Bosson et al. 2010) describing the landscape of Forsmark at 2000 AD, 5000 AD and 10,000 AD.

Source of data

The percolation data are described in detail in Grolander (2013) and originate from Bosson et al. (2010).

Used in model or assessment activity

The data are compiled among the ecosystem parameters to fit the overall description of the different ecosystems and is further used in the radionuclide transport modelling for the biosphere (Saetre et al. 2013).

Data used

The parameter percolation is found among site generic data in the file:
svn.skb.se/trac/projekt/browser/SFR/SR-PSU/Indata/parameter_indata/SiteGeneric.xlsm

References

SKB's (Svensk Kärnbränslehantering AB) publications can be found at www.skb.se/publications.
References to SKB's unpublished documents are listed separately at the end of the reference list.
Unpublished documents will be submitted upon request to document@skb.se.

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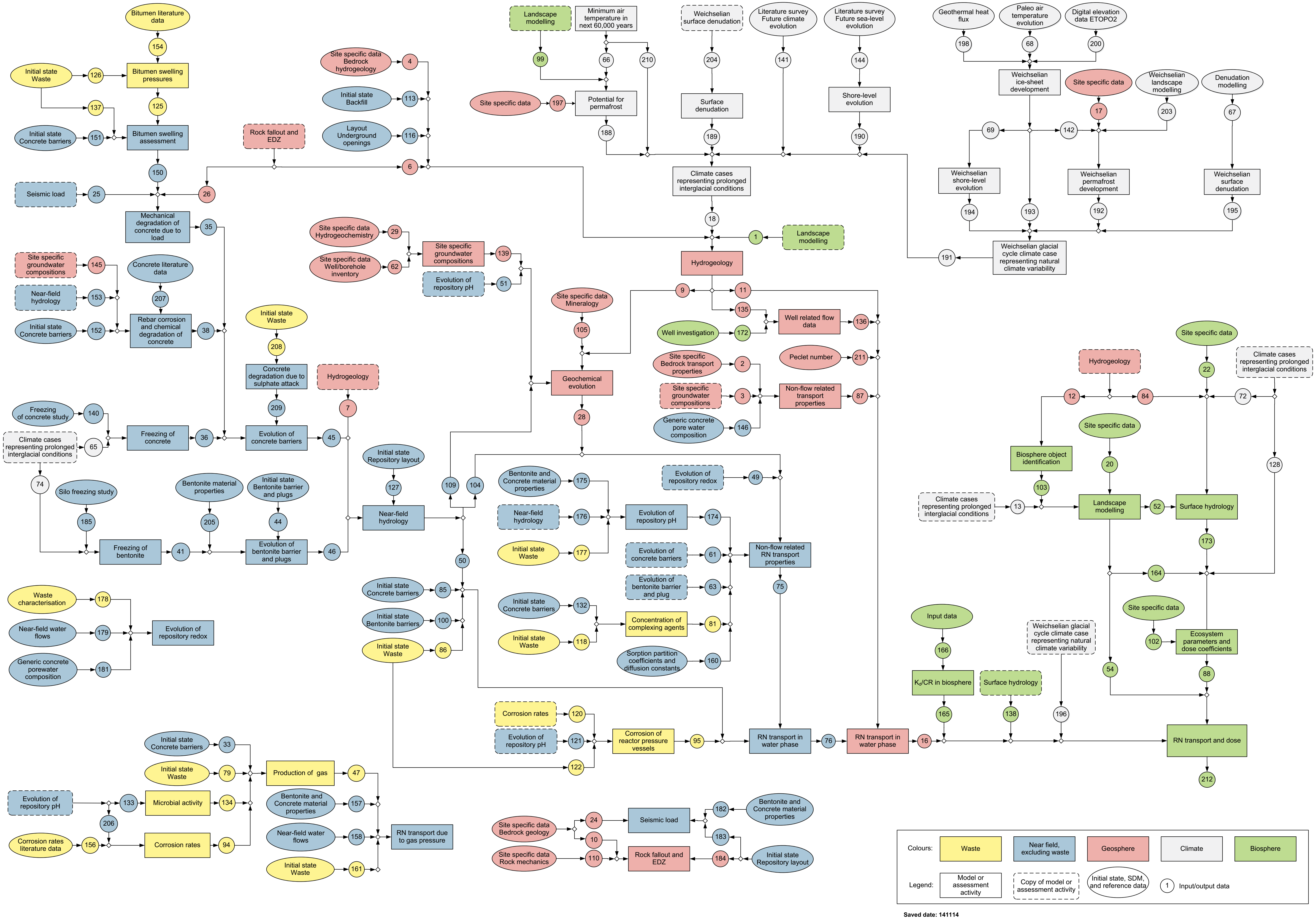
1265613 ver 1.0	Data used in the SR-Site Climate program	SKB, 2011
1338361 ver 1.0	Climate domains Weichselian glacial cycle SR-PSU	SKB, 2015
1338745 ver 1.0	Summary of future climate projections	SKB, 2015
1358612 ver 1.0	SFR Förslutningsplan. (In Swedish.)	SKB, 2014
1359610 ver 2.0	Shore level data Forsmark Early periglacial climate case SR-PSU	SKB, 2015
1359616 ver 2.0	Shore level data Forsmark Global warming SR-PSU	SKB, 2012
1395214 ver 1.0	TD08 – SFR3 effect on the performance of the existing SFR1	SKB, 2013
1417785 ver 1.0	Översiktlig bedömning av konsekvenser för omgivande barriärer i BMA (SFR) till följd av ny behandling och förpackning av indunstarkoncentrat i Forsmark. (In Swedish.)	SKB, 2013
1427105 ver 4.0	Radionuclide inventory for the application of extension of the SFR repository – Treatment of uncertainties	SKB, 2014
1433163 ver 1.0	Shore level data Forsmark Extended global warming SR-PSU	SKB, 2015
1433269 ver 1.0	monthlymean_T2m_Forsmark_LOVECLIM_54k_180	SKB, 2015
1433270 ver 1.0	Maximum isotherm depths at the SFR location for a range of annual average air temperature at 2-m height	SKB, 2015
1433654 ver 1.0	xyz-x3a	SKB, 2015
1433662 ver 1.0	GHF full dataset lat long wgs-84	SKB, 2015
1436190 ver 1.0	Reconstructed Weichselian ice thickness and temperature Forsmark SR-PSU.	SKB, 2015
1436249 ver 1.0	Reconstructed Weichselian rsl data Forsmark SR-PSU.	SKB, 2015
1436252 ver 1.0	Reconstructed Weichselian ice thickness and temperature Forsmark SR-PSU.	SKB, 2015
1437317 ver 1.0	Ice thickness and temperature Weichselian glacial cycle Forsmark SR-PSU	SKB, 2015
1437319 ver 1.0	Permafrost and perennially frozen depth 1D simulation data Weichselian glacial cycle SR-PSU.	SKB, 2015
1437321 ver 1.0	Shore level data Weichselian glacial cycle Forsmark SR-PSU.	SKB, 2015
1469758 ver 1.0	AMF 141 Future climate evolution.	SKB, 2015
1469820 ver 1.0	ETOPO2.dos.	SKB, 2015
1469822 ver 1.0	readme ETOPO2.	SKB, 2015
1471889 ver 1.0	Weichselian glacial cycle climate case ice-sheet development.	SKB, 2015
1471890 ver 1.0	Weichselian glacial cycle climate case shore-level evolution	SKB, 2015
1481419 ver 1.0	Ny beräkning av Mo-93 i normkolli till PSU 2015-05 (In Swedish.)	SKB, 2015

CC-number used in the compilation of input data for the radionuclide transport calculations and the corresponding CC-name used in the reporting of the PSU safety assessment

CC-number	CC-name	Description
Main scenario		
CC1	CCM_GW	Global warming
CC6	CCM_TR	Timing of releases
CC26	CCM_CD	Collective dose
CC2	CCM_EP	Early periglacial
Less proble scenarios		
CC20	CCL_IH	High inventory
CC24	CCL_FH	High flow in the bedrock
CC16	CCL_BC	Accelerated concrete degradation
CC13	CCL_BB	Bentonite degradation
CC3	CCL_EQ	Earthquake
CC7	CCL_CA	High concentrations of complexing agents
CC9	CCL_WD	Wells downstream of the repository
CC10	CCL_WI	Intrusion wells
Residual scenarios		
CC15	CCR_B1	Loss of barrier function – no sorption in the repository
CC17	CCR_B2	Loss of barrier function – no sorption in the bedrock
CC25	CCR_B3	Loss of barrier function – high water flow in the repository
CC21	CCR_RX	Changed redox conditions in SFR 1
CC12	CCR_EX	Extended global warming
CC18	CCR_UR	Unclosed repository
CC19	CCR_GC	Glacial and post-glacial conditions
Scenario combinations		
CC28	CCC_SC1	Combinatin of high flow in the bedrock and accelerated concrete degradation
CC29	CCC_SC2	Combinatin of high flow in the bedrock and high concentrations of complexing agents


Bitumen literature data
Initial state Waste
Bitumen swelling pressures
Initial state Concrete barriers
Bitumen swelling assessment
Seismic load
Mechanical degradation of concrete due to load
Site specific data Bedrock hydrogeology
Initial state Backfill
Layout Underground openings
Rock fallout and EDZ
Site specific groundwater compositions
Near-field hydrology
Concrete literature data
Rebar corrosion and chemical degradation of concrete
Site specific data Hydrogeochemistry
Site specific data Well/borehole inventory
Site specific groundwater compositions
Evolution of repository pH
Initial state Waste
Concrete degradation due to sulphate attack
Hydrogeology
Freezing of concrete study
Climate cases representing prolonged interglacial conditions
Freezing of concrete
Evolution of concrete barriers
Initial state Repository layout
Near-field hydrology
Silo freezing study
Bentonite material properties
Initial state Bentonite barrier and plugs
Freezing of bentonite
Evolution of bentonite barrier and plugs
Waste characterisation
Near-field water flows
Generic concrete porewater composition
Evolution of repository redox
Initial state Concrete barriers
Initial state Bentonite barriers
Initial state Waste
Landscape modelling
Minimum air temperature in next 60,000 years
Site specific data
Potential for permafrost
Weichselian surface denudation
Surface denudation
Literature survey Future climate evolution
Literature survey Future sea-level evolution
Shore-level evolution
Climate cases representing prolonged interglacial conditions
Landscape modelling
Hydrogeology
Site specific data Mineralogy
Geochemical evolution
Well investigation
Well related flow data
Site specific Bedrock transport properties
Peclet number
Site specific groundwater compositions
Non-flow related transport properties
Generic concrete pore water composition
Geothermal heat flux
Paleo air temperature evolution
Digital elevation data ETOPO2
Weichselian ice-sheet development
Site specific data
Weichselian landscape modelling
Denudation modelling
Weichselian shore-level evolution
Weichselian permafrost development
Weichselian surface denudation
Weichselian glacial cycle climate case representing natural climate variability
Bentonite and Concrete material properties
Near-field hydrology
Initial state Waste
Evolution of repository pH
Evolution of repository redox
Evolution of concrete barriers
Evolution of bentonite barrier and plug
Initial state Concrete barriers
Initial state Waste
Concentration of complexing agents
Sorption partition coefficients and diffusion constants
Non-flow related RN transport properties
Hydrogeology
Site specific data
Climate cases representing prolonged interglacial conditions
Site specific data
Biosphere object identification
Climate cases representing prolonged interglacial conditions
Landscape modelling
Surface hydrology
Site specific data
Ecosystem parameters and dose coefficients
Input data
Kd/CR in biosphere
Surface hydrology
Weichselian glacial cycle climate case representing natural climate variability
Corrosion rates
Evolution of repository pH
Corrosion of reactor pressure vessels
RN transport in water phase
RN transport in water phase
RN transport and dose
Initial state Concrete barriers
Initial state Waste
Production of gas
Evolution of repository pH
Microbial activity
Corrosion rates literature data
Corrosion rates
Bentonite and Concrete material properties
Near-field water flows
Initial state Waste
RN transport due to gas pressure
Site specific data Bedrock geology
Site specific data Rock mechanics
Seismic load
Rock fallout and EDZ
Bentonite and Concrete material properties
Initial state Repository layout
Colours:
Waste
Near field, excluding waste
Geosphere
Climate
Biosphere
Legend:
Model or assessment activity
Copy of model or assessment activity
Initial state, SDM, and reference data
Input/output data
Saved date: 141114