



Public

Notes

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## Navigating in the SKB FEP database

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# 1 Introduction

This document contains a description of the contents of the SKB FEP database after the inclusion of the outcome of the FEP-work carried out in SR-PSU, as described in the SR-PSU FEP report (SKB 2014a). It gives guidance as to how different information in the database is accessed and is in essence an extension of the previous version that provided instructions on how to navigate in the SR-Site version of the SKB FEP database (SKB 2010). The current version of the database is created with the database program FileMaker Pro, version 12.0. This program allows for relational data files, which is utilised in the SKB FEP database. The FEP database is delivered as a runtime version, which means that the database can be used without having access to the program Filemaker Pro, version 12.0.

# 2 Contents of the SKB FEP database

The current version of the SKB FEP database contains the results of the FEP processing work carried out as a part of the assessments of post-closure safety of an extended SFR repository for short-lived low- and intermediate level waste, SR-PSU (SKB 2014b), and of a final repository for spent fuel, SR-Site (SKB 2011) and SR-Can (SKB 2006a). In all assessments, the FEP database has been used as a tool for documentation of the outcome of the different steps in the FEP processing procedure as the work proceeded. These procedures are described in the SR-PSU FEP report (SKB 2014a) and in the SR-Site FEP report (SKB 2010).

The FEP database contains all source information used as well as the resulting SR-PSU (SKB 2014a), SR-Can (SKB 2006b) and SR-Site FEP catalogues (SKB 2010). For the SR-Can and SR-Site assessments, the sources were the Project FEPs included in the NEA FEP database version 1.2 (NEA 1999) and in version 2.1 (NEA 2006), the contents of the SR 97 Process report (SKB 1999) in database format and the Interaction Matrices developed for a geological repository of the KBS-3 type (Pers et al. 1999). The sources in the SR-PSU FEP processing work were the Project FEPs included in the NEA FEP database version 2.1 (NEA 2006) and the Interaction Matrices developed for SFR 1 (SKB 2001, 2008). In addition, the SKB FEP database contains files created for documentation of the outcome of the FEP audit in SR-Can, in SR-Site and in SR-PSU, one for the result of the audit against the NEA Project FEPs (NEA Mapping) and one for the result of the audit against the Interaction Matrices (Matrix Mapping). The overall structure of the SKB FEP database is schematically shown in Figure 2-1.

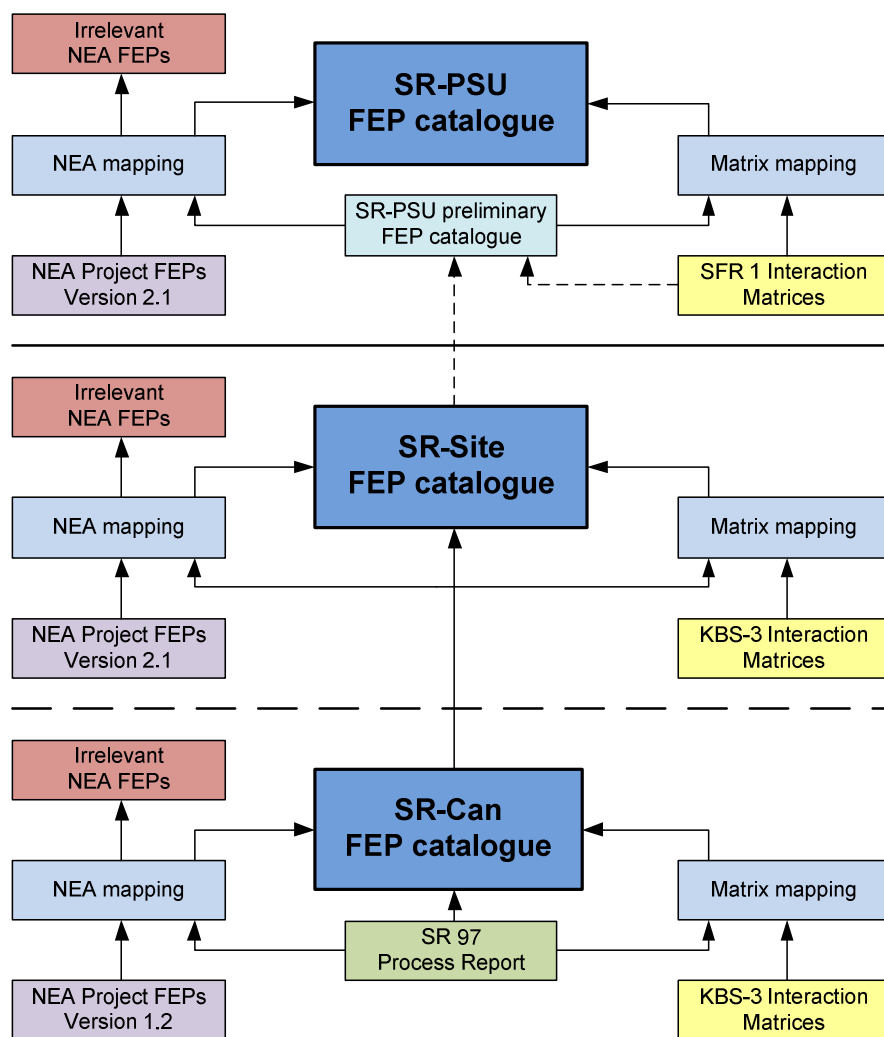


Figure 2-1. Overall structure of the SKB FEP database.

### 3 Starting and closing the FEP database and selection of database version

The FEP database is entered by opening the program file “SKB FEP database”, which will display the Start menu in the FEP database (uppermost layout in Figure 3-1) after selecting the “Guest Account” option in the login request that appears on the screen. The database is also closed from the Start menu in the FEP database via the button “Exit database”.

The required version of the FEP database is selected by pressing the button “SR-PSU”, “SR-Site” or “SR-Can”, which will display the Main menu in the SR-PSU version (upper layout in Figure 3-1), the SR-Site version (middle layout in Figure 3-1) or in the SR-Can version (lowermost layout in Figure 3-1). From these Main menus it is possible to return to the FEP database Start menu by pressing the button “Return to Start menu” or to exit the database by pressing the button “Exit database”.

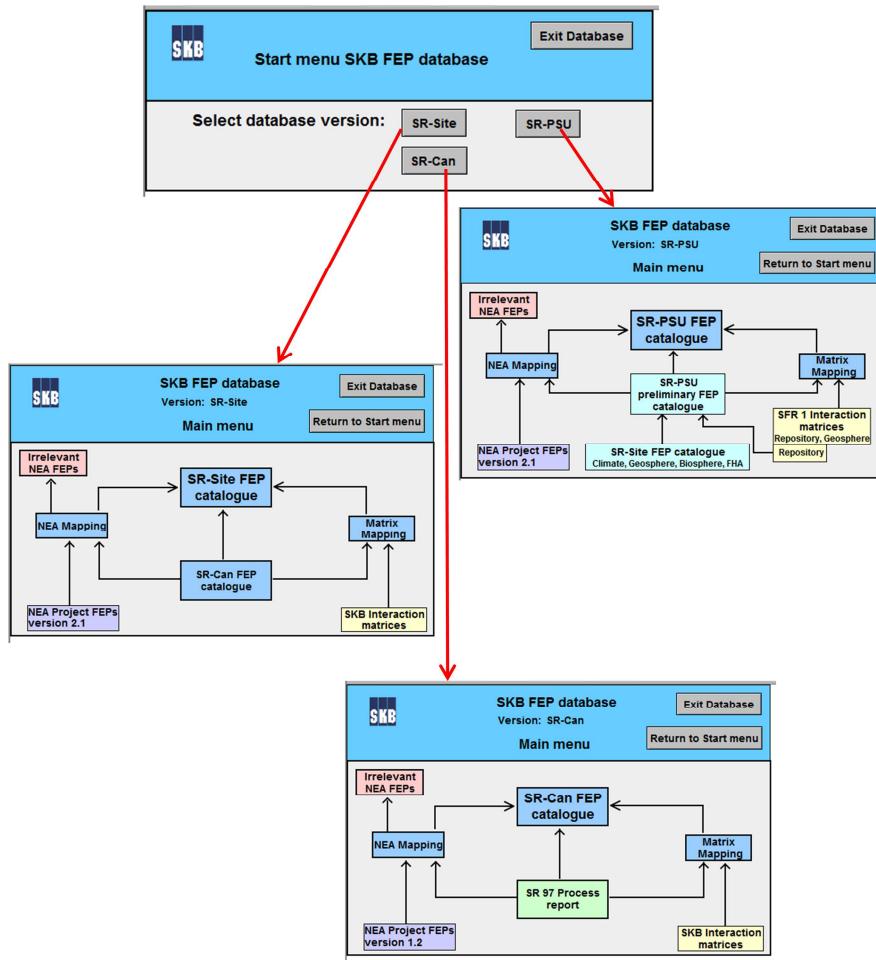


Figure 3-1. Start menu for the SKB FEP database and for the versions SR-PSU, SR-Site and SR-Can, respectively.

## 4 The SR-PSU version

### 4.1 Starting the SR-PSU FEP catalogue

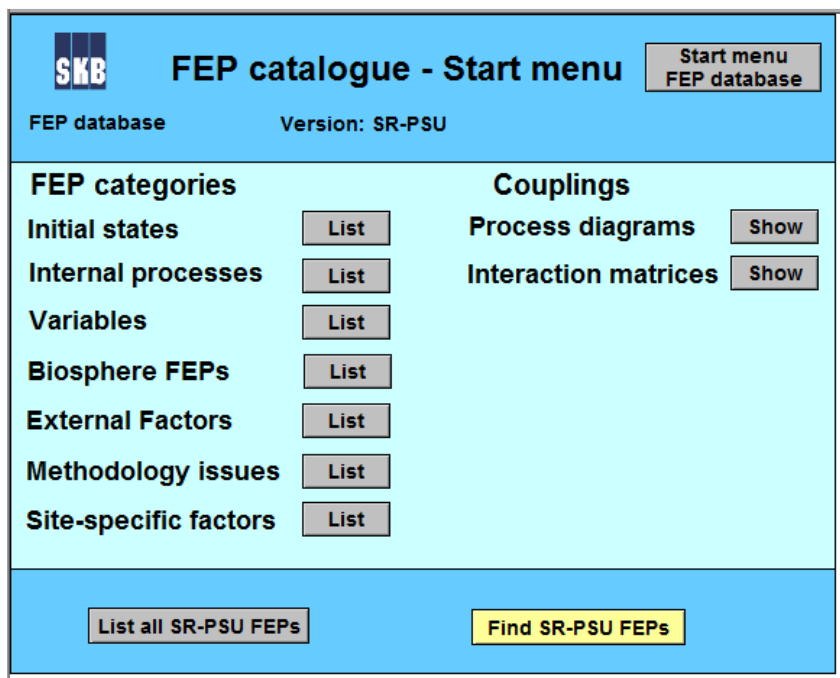
The SR-PSU FEP catalogue is accessed via the box “SR-PSU FEP catalogue” (works as a button) in the SR-PSU Main menu (upper layout in Figure 3-1). This will display a layout showing the contents of the SR-PSU FEP catalogue (Figure 4-1). Exit from the FEP catalogue is via the button “Start menu FEP database”, which again displays the FEP database start menu (uppermost layout in Figure 3-1), irrespective of in which layout in the FEP catalogue the button appears.

From the layout “Start menu” in the SR-PSU FEP catalogue (Figure 4-1), lists of FEPs in the different FEP categories are accessed via the “List” buttons. The button “List all SR-PSU FEPs” displays a list of all SR-PSU FEPs in every layout it appears. How to access FEP records in the different FEP categories and the associated information is further described below in Section 4.2.

From the Start menu in the FEP catalogue (Figure 4-1), Couplings of information contained in the FEP database can also be displayed via the grey-coloured buttons. This is further described in Section 4.3 below.

The yellow button “Find SR-PSU FEPs” and other yellow buttons in other layouts are only functioning appropriate, and should only be used, for finding records. This is further described in Section 4.4 below.





**Figure 4-1.** Layout “Start menu” giving access to the different FEP categories and Couplings contained in the SR-PSU FEP catalogue.

## 4.2 Displaying FEP records in the SR-PSU FEP catalogue and associated information

From the layout “Start menu” (Figure 4-1), lists of SR-PSU FEPs in the different FEP categories are accessed via the “List” button. The further access to FEP records and linked information is here exemplified for the category “Internal processes”, but the same procedures are also applicable for the other FEPs categories, if not otherwise stated.

The FEP list accessed (Figure 4-2) display the FEP ID and FEP name of all FEPs in the selected FEP category. The button “Start menu SR-PSU FEP catalogue” will, in every layout where it appears, display the layout “Start menu” shown in Figure 4-1. By using the scroll bar to the right on the screen (not shown in Figure 4-2), all FEPs in the list can be examined.

For a selected FEP in the FEP list, the SR-PSU FEP description is displayed in the layout “SR-PSU FEP record” (Figure 4-3) via the button “show”. This layout also shows the handling of this SR-PSU FEP and references to relevant SR-PSU reports for additional information.

FEP catalogue		
Version: SR-PSU		
FEP database		Start menu FEP database
FEP listing - Internal processes		Start menu SR-PSU FEP catalogue
WM01	Radioactive decay	<a href="#">show</a>
WM02	Radiation attenuation/heat generation	<a href="#">show</a>
WM03	Radiolytic decomposition of organic material	<a href="#">show</a>
WM04	Water radiolysis	<a href="#">show</a>
WM05	Heat transport	<a href="#">show</a>
WM06	Phase changes/freezing	<a href="#">show</a>
WM07	Water uptake and transport during unsaturated conditions	<a href="#">show</a>
WM08	Water transport under saturated conditions	<a href="#">show</a>
WM09	Fracturing	<a href="#">show</a>
WM10	Advective transport of dissolved species	<a href="#">show</a>
WM11	Diffusive transport of dissolved species	<a href="#">show</a>
WM12	Sorption/uptake	<a href="#">show</a>
WM13	Colloid formation and transport	<a href="#">show</a>
WM14	Dissolution, precipitation and recrystallisation	<a href="#">show</a>
WM15	Degradation of organic materials	<a href="#">show</a>
WM16	Water uptake/swelling	<a href="#">show</a>
WM17	Microbial processes	<a href="#">show</a>
WM18	Metal corrosion	<a href="#">show</a>
WM19	Gas formation and transport	<a href="#">show</a>
WM20	Speciation of radionuclides	<a href="#">show</a>
WM21	Transport of radionuclides in the water phase	<a href="#">show</a>
WM22	Transport of radionuclides in the gas phase	<a href="#">show</a>
Pa01	Heat transport	<a href="#">show</a>
Pa02	Phase changes/freezing	<a href="#">show</a>
Pa03	Water uptake and transport during unsaturated conditions	<a href="#">show</a>
Pa04	Water transport under saturated conditions	<a href="#">show</a>
Pa05	Fracturing/deformation	<a href="#">show</a>
Pa06	Advective transport of dissolved species	<a href="#">show</a>
Pa07	Diffusive transport of dissolved species	<a href="#">show</a>
Pa08	Sorption/uptake	<a href="#">show</a>
Pa09	Colloid transport and filtering	<a href="#">show</a>
Pa10	Dissolution, precipitation and recrystallisation	<a href="#">show</a>
Pa11	Microbial processes	<a href="#">show</a>
Pa12	Metal corrosion	<a href="#">show</a>
Pa13	Gas formation and transport	<a href="#">show</a>
Pa14	Speciation of radionuclides	<a href="#">show</a>
Pa15	Transport of radionuclides in the water phase	<a href="#">show</a>
<a href="#">List all SR-PSU FEPs</a>		

Figure 4-2. Layout FEP listing – Internal processes in the SR-PSU FEP catalogue.

In the layout “SR-PSU FEP record” (Figure 4-3), return to the list of internal processes is possible via the button “List internal processes”. Different information linked to the FEP can be viewed from the layout “SR-PSU FEP record”. The button “Linked NEA FEPs” displays all NEA FEPs linked to the SR-PSU FEP (Figure 4-4), a list of Matrix interactions linked to the FEP is shown via the button “Linked Matrix interactions”, and the button “Process diagram” shows a process diagram automatically generated based on tabulated influences between the process and the variables defined for the system component in question, i.e. for the system component “Waste form” in the example illustrated in Figure 4-3. These buttons have the same function in whatever layout they appear in the SR-PSU FEP catalogue. However, process diagrams are only relevant for the FEP categories “Internal processes” and “Biosphere FEPs”. Process diagrams are also accessed via the Start menu in the SR-PSU FEP catalogue (Figure 4-1) as described in Section 4.3 below.

**SKB** **FEP catalogue** **Start menu FEP database**  
 Version: SR-PSU **Start menu SR-PSU FEP catalogue**  
**FEP database** **SR-PSU FEP record**

**Internal process** **Waste form**  
**Diffusive transport of dissolved species** **WM11**

**Description/Definition**  
 A wide range of unconditioned and conditioned waste forms are present in SFR, and these possess very different diffusive properties. There is also large heterogeneity within individual packaging when they contain a variety of waste materials and conditioning. Transport in conditioned wastes in e.g. the BMA and the Silo is likely diffusion controlled under the initial state conditions. However, the conditioned waste forms may undergo chemical degradation and

**Handling in SR-PSU**  
 Diffusion plays a central role for the transport of dissolved species in all parts of SFR, including the waste. The diffusion process is included in the modelling of e.g. concrete degradation and radionuclide transport.

**References:** **Section number**  
 SR-PSU Waste form and packaging process report, TR-14-03 3.5.2, 5.1  
 SR-PSU Main report, TR-14-01 Appendix F

**Linked NEA FEPs** **Process diagram** **List Internal processes**  
**Linked SAR-08 Matrix interactions** **Return to List Found records**

Figure 4-3. Layout SR-PSU FEP record in the SR-PSU FEP catalogue.

The list of NEA FEPs displayed via the button “Linked NEA FEPs” allows for access to definition of the NEA Project FEPs and to documentation of handling of the NEA Project FEPs in SR-PSU (Figure 4-4). The full list of NEA Project FEPs linked to the SR-PSU FEP can be examined by using the scroll bar on the right hand side of the FEP list field.

**SKB** **FEP catalogue** **Start menu FEP database**  
 Version: SR-PSU **Start menu SR-PSU FEP catalogue**  
**FEP database** **Linked NEA Project FEPs**

**Internal process** **Waste form**  
**Diffusive transport of dissolved species** **WM11**

**NEA FEPs mapped to this SR-PSU FEP** **NEA FEP description**

A 1.27	Diffusion	show
A 1.36	Galvanic coupling	show
E GEN-09	Diffusion	show
E SFR-09	Diffusion in the near-field	show
I 300	Temperature effects (on transport)	show
J 3.2.06	Diffusion - surface diffusion	show
S 002	Anion-exclusion	show
S 024	Diffusion in and through failed canister	show
W 2.095	Galvanic coupling	show
W 2.096	Electrophoresis	show

**SR-PSU FEP description** **Handling NEA FEPs**

Scroll bar for Examining list of NEA FEPs

Figure 4-4. Layout "Linked NEA Project FEPs" in the SR-PSU FEP catalogue.

The documentation of the handling of NEA Project FEPs associated with the SR-PSU FEP is accessed via the button “Handling NEA FEPs” (Figure 4-4), which displays the information in table format (Figure 4-5). For each NEA FEP (leftmost column), aspects of the NEA FEP addressed, and if not addressed, the reason why, are displayed as documented by the expert named in the field below the table. The full table can be examined by using the rightmost scrollbar in the layout (indicated in Figure 4-5) and the full text in each text field can be examined by using the scrollbar on the right side of the text field (indicated in Figure 4-5). The button “SR-PSU FEP description” is used to switch to the layout “SR-PSU FEP record” (Figure 4-3) and the function of this button is the same in every layout in the SR-PSU FEP catalogue.

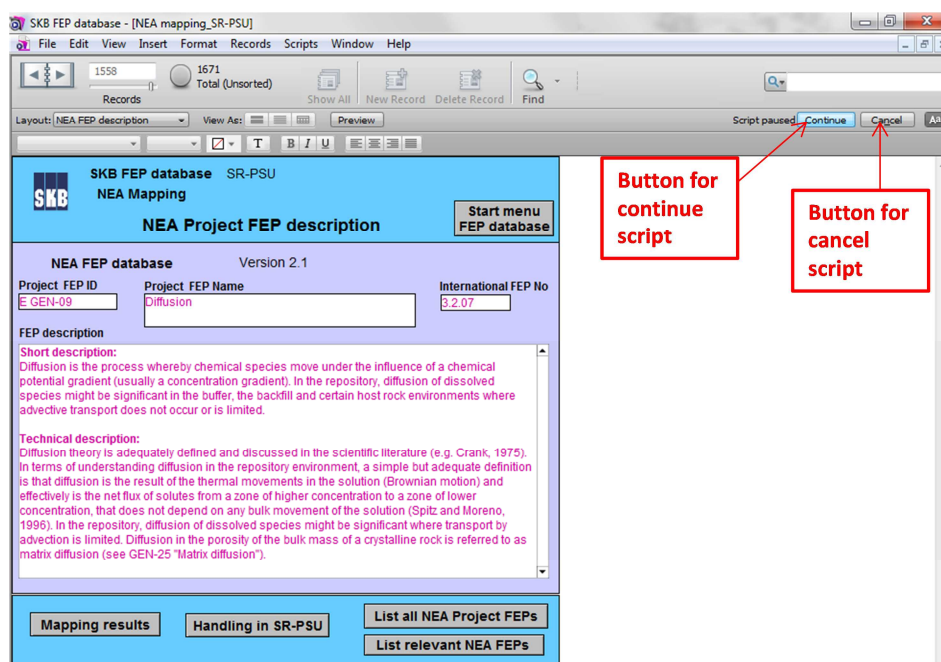
NEA FEP	Aspects addressed	Aspects not addressed because	Comments
A 1.27 Diffusion	Contaminant movement due to diffusion through the water and sealing materials is addressed.		
A 1.39 Galvanic coupling		Enhanced movement of contaminants due to galvanic coupling with a far ore body is not considered due to the presence of	
E GEN-09 Diffusion	The issue of quantifying repository-relevant diffusion coefficients for the chemical species of		
E SFR-09 Diffusion in the near-field	Diffusion in the near-field may occur through water-filled cracks and voids in the mass of the		

Recorded by: Magnus Sidborn Date: April 2012  
 Checked and revised by: Kristina Skagius Date: February 2014  
 Revision approved by: Magnus Sidborn Date: March 2014  
 Need further revision: ☐ Yes ☒ No

SR-PSU FEP description

**Figure 4-5.** Layout “Handling linked NEA Project FEPs” in the SR-PSU FEP catalogue showing the handling of each NEA Project FEP as documented by the experts.

The description of each NEA Project FEP linked to the SR-PSU FEP is displayed via the button “show” in the list of NEA Project FEPs in the layout “Linked NEA Project FEPs” (Figure 4-4). This button activates a script that opens the corresponding NEA Project FEP record in the register “NEA mapping” in SR-PSU (see upper layout in Figure 3-1). The layout entered is shown in Figure 4-6. The full description of the NEA Project FEP is examined by using the scrollbar on the right side of the text field. Return to the SR-PSU FEP catalogue occurs via the button “Continue” in the upper right corner of the screen outside the actual layout (marked by an arrow in Figure 4-6). This button continues the script, but it is possible to examine other information in the NEA Mapping register via the buttons in the footer part of the layouts before continuing this script, since this script button will appear in the upper right corner until the script is continued or cancelled via the button just to the right (“Cancel”). As long as the script is active, it is not possible to enter the FEP database start menu via the button in the header part of the layouts. However, if the script is cancelled, the only return to the SR-PSU FEP catalogue is via this button and the FEP database start menu.



**Figure 4-6.** Layout "NEA Project FEP description in the NEA Mapping register as accessed from the SR-PSU FEP catalogue. The left arrow marks the button for return to the SR-PSU FEP catalogue, layout "Linked NEA Project FEPs" (Figure 4-4).

In the layout "SR-PSU FEP record" (Figure 4-3), automatically generated process diagrams are accessible through the button "Process diagram". This is further described in Section 4.3.1 below.

The same procedures are applicable for access to lists of SAR-08 Matrix interactions and the tables with documentation on handling as those for NEA Project FEPs, but via the buttons:

- "Linked SAR-08 Matrix interactions" in the layout "SR-PSU FEP record" (Figure 4-3), and
- "Handling SAR-08 Matrix interactions" in the layout "Linked SAR-08 Matrix interactions".

Furthermore, the definitions of the Matrix interactions are displayed by activating a script via the button "show" in the layout "Linked SAR-08 Matrix interactions". This script opens the corresponding Matrix interaction record in the register "Matrix mapping" (see upper layout in Figure 3-1) and, as for NEA Project FEPs, return to the SR-PSU FEP catalogue occurs via the button "Continue" in the upper right corner of the screen outside the actual layout.

However, it should be pointed out that although all SAR-08 Matrix interactions are linked to the appropriate SR-PSU FEP in the FEP catalogue, no formal documentation of the handling of each interaction has been made. The reasons for, and implications of this is further discussed in the SR-PSU FEP report (SKB 2014b).

### 4.3 Couplings in the SR-PSU version of the FEP database

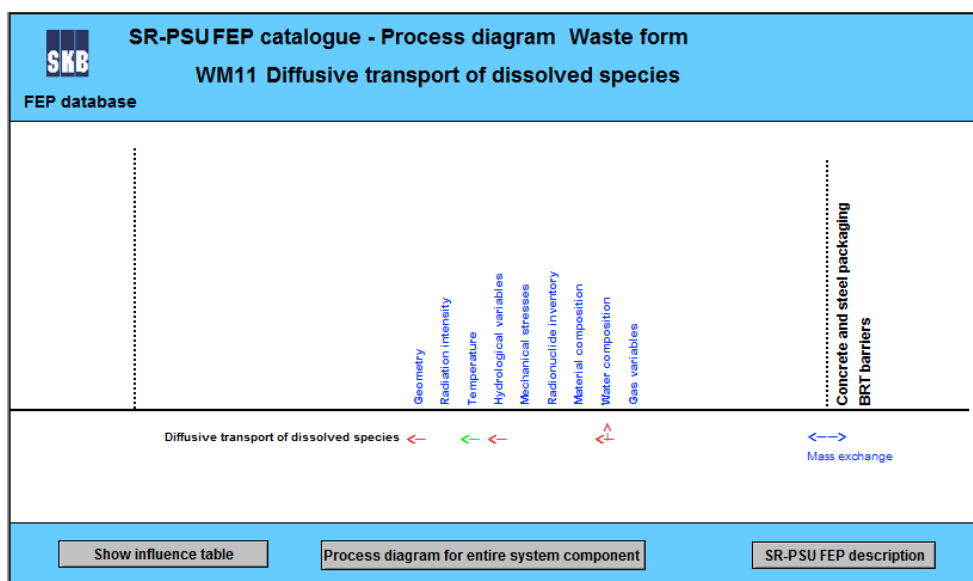
In the SR-PSU version of the FEP database, couplings can be displayed from the "Start menu" in the SR-PSU FEP catalogue (Figure 4-1). These couplings are:

- Process diagrams (Section 4.3.1)
- Interaction matrices (Section 4.3.2)

#### 4.3.1 Process diagrams

Process diagrams for each internal process and Biosphere FEP as well as for the system components in SR-PSU are available in the FEP database. These process diagrams are based on information in the influence tables published in the SR-PSU Process reports. Process diagrams for each process and biosphere FEP are accessible through the button "Process diagram" in the layout "SR-PSU FEP

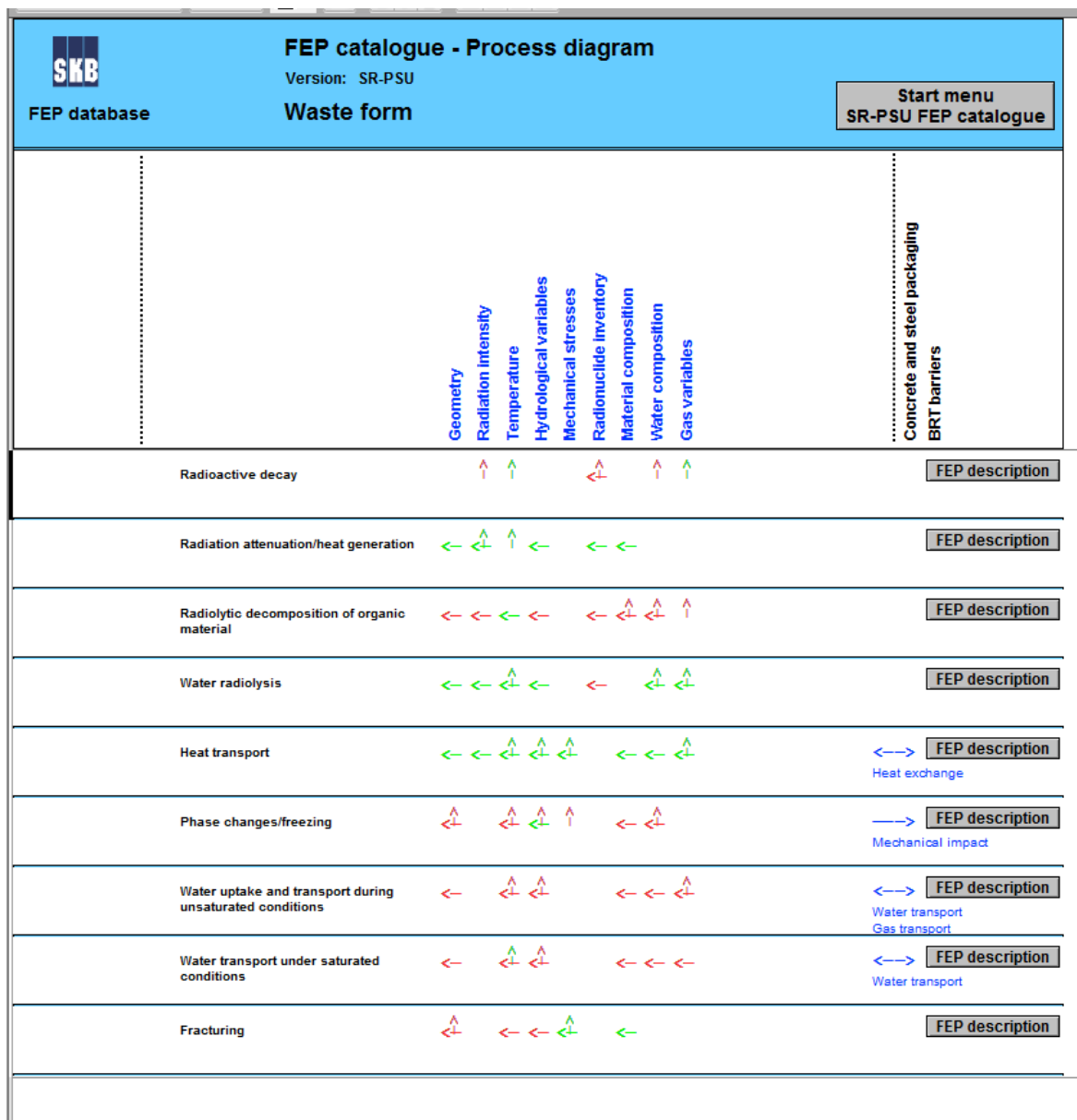
record” (Figure 4-3). Corresponding influence tables have been created in the FEP database with the requirement that the table in the FEP database must distinguish the presence of an influence or not by Yes or No and the handling of the influence by Neglected or Handled. This is because the presence of an arrow or not and its colouring in the process diagrams in the FEP database are automatically generated based on this information. In general, the original influence tables in the Process reports are clear concerning whether there is an influence or not, which determines the presence or absence of an arrow in the process diagram. A green arrow means that the influence is neglected and a red arrow represents an influence that is handled in SR-PSU. It is not totally clear in all cases from the text in the influence tables if the influence is handled or neglected. This means that there are some uncertainties connected to the colour-coding of the arrows in the process diagrams. The influence tables in the FEP catalogue are accessed via the button “Show influence table” in the layout “Process diagram” (Figure 4-7).



**Figure 4-7.** Layout "Process diagram" for internal processes and biosphere FEPs.

Process diagrams for an entire system component are displayed via the button “Process diagram for entire system component” in the layout “Process diagram” (Figure 4-7). These diagrams are also accessed directly from the “Start menu” for the SR-PSU FEP catalogue (Figure 4-1) via the button “Show” Process diagrams and the button for the system component selected. An example is shown in Figure 4-8. The full diagram is examined by using the scrollbar on the right-hand side of the screen. Process diagrams are available for all system components and are generated based on influence tables in the SR-PSU process reports. For processes where influence tables are missing in the process reports, the text “not available” is displayed in the process diagram. For processes where influence tables are missing in the process reports because the processes are judged as not relevant for the system, the text “not relevant” is displayed in the process diagram. Finally, a couple of biosphere processes described in the general FEP report for the biosphere were judged to be of no importance for the low- and intermediate level waste repository at Forsmark and were, therefore, excluded. Hence, no process diagram is provided for these processes, instead the text “Excluded – not important for a repository at Forsmark” is displayed.

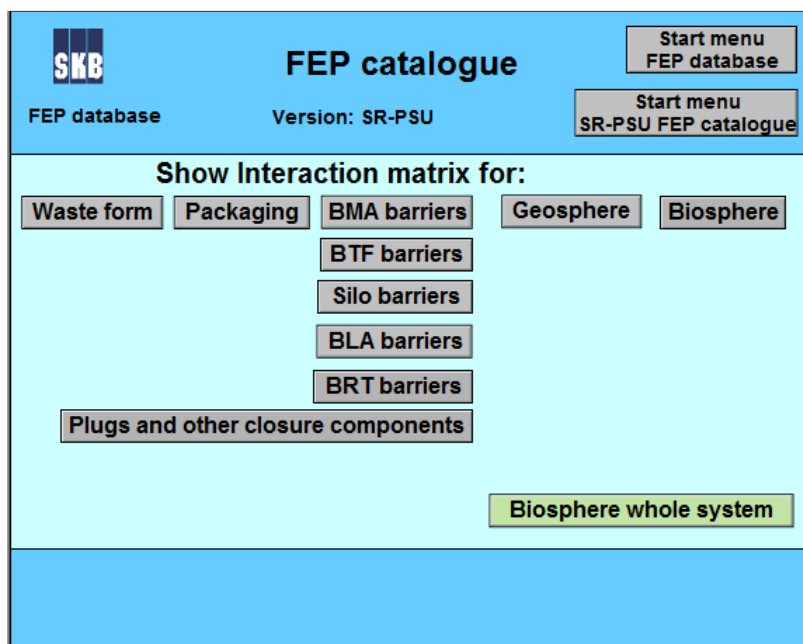




**Figure 4-8.** Process diagram for the system component *Waste form* as displayed in the SR-PSU FEP catalogue. The total diagram is examined by using the scrollbar on the right-hand side of the screen (not shown in the figure).

#### 4.3.2 Interaction matrices

Interaction matrices for the different system components are displayed via the button “Show” Interaction matrices (Figure 4-1) and then by clicking the button for the system component selected (see Figure 4-9). An Interaction matrix is an alternative to a process diagram to illustrate couplings between variables and processes and similar to a process diagram, it is automatically generated based on the influence tables. An example of such an Interaction matrix is shown in Figure 4-10.



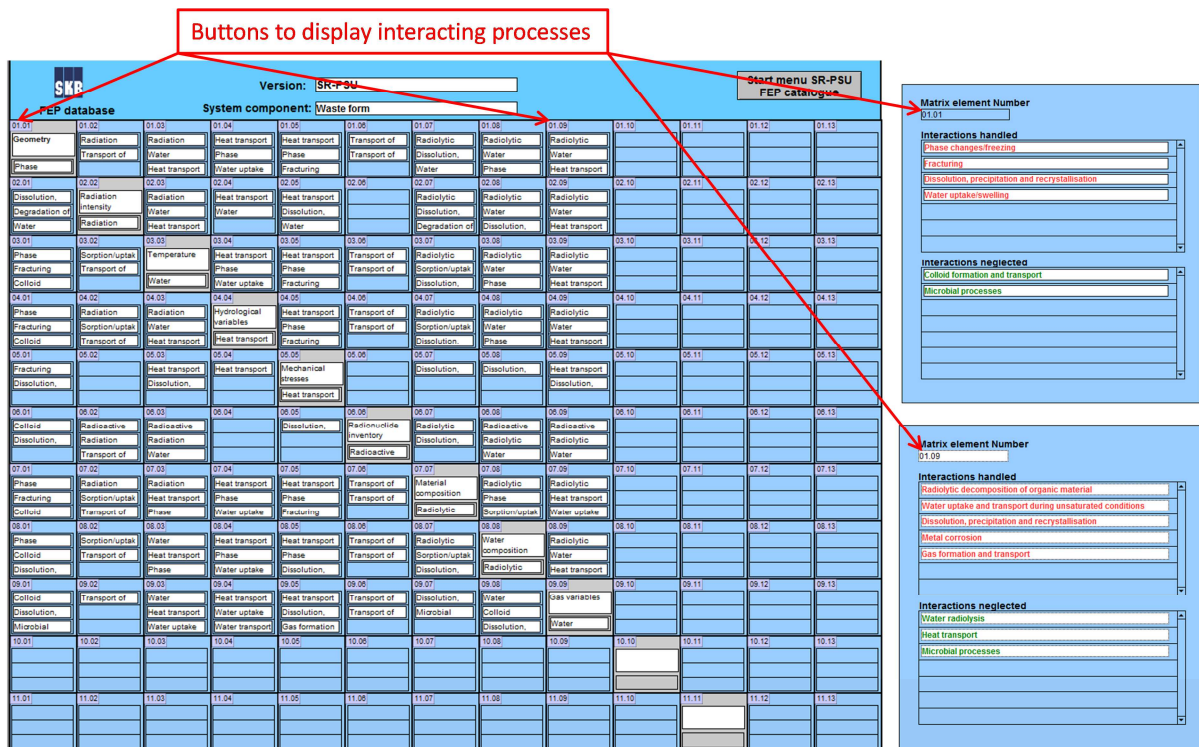
**Figure 4-9.** Layout for selecting Interaction matrix. Grey buttons display matrices with variables in the principal diagonal elements. Green button displays the Interaction matrix for the whole biosphere system with subsystems of the biosphere as elements in the principal diagonal.

The elements of the principal diagonal in the matrix show the variables defined for the system component in question, whereas off-diagonal elements show the internal processes that act directly between two variables in a clock-wise manner. It is not possible to display the whole interaction matrix with all interacting processes at the same time. However, every element number in the matrix acts as a button to display all processes interacting between the variables defined by the element in question (see Figure 4-10). This more detailed information also shows which processes are handled in the assessment (red text) and which are neglected (green text).

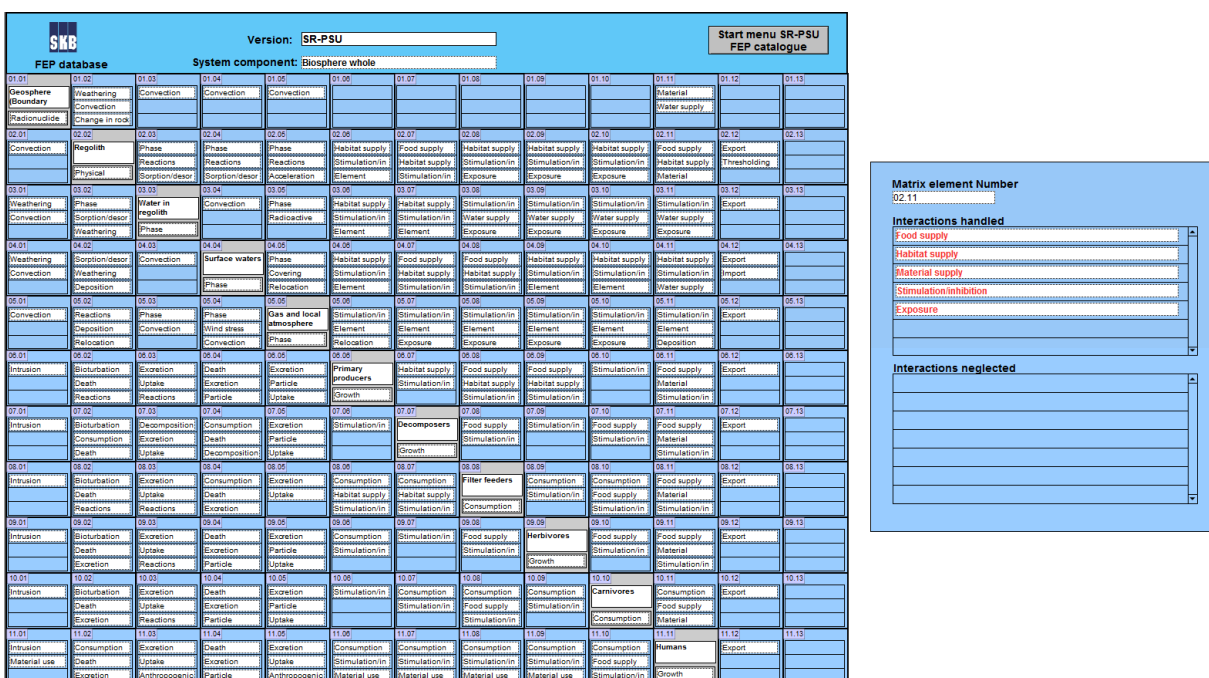
The biosphere consists of many subcomponents, both abiotic and biotic (e.g. regolith, water, primary producers). Therefore, the biosphere process report (SKB 2014c) contains an Interaction matrix with subcomponents as elements of the principal diagonal, in order to highlight where processes of importance for transport and accumulation of radionuclides take place in the biosphere. This biosphere Interaction matrix is included in the FEP database and is accessed from the same layout as the other Interaction matrices (Figure 4-9, green button).

The biosphere Interaction matrix with subcomponents along the principal diagonal is shown in Figure 4-11. As for the other Interaction matrices, every element number in the matrix acts as a button to display all processes interacting between the subcomponents defined by the element in question and processes that are handled in the assessment are given in red text, whereas processes that are neglected are given in green text.





**Figure 4-10.** Interaction matrix for the system component Waste form with system variables as principal diagonal elements in the matrix. The matrix element numbers act as buttons to display all interacting processes (right part of the figure).

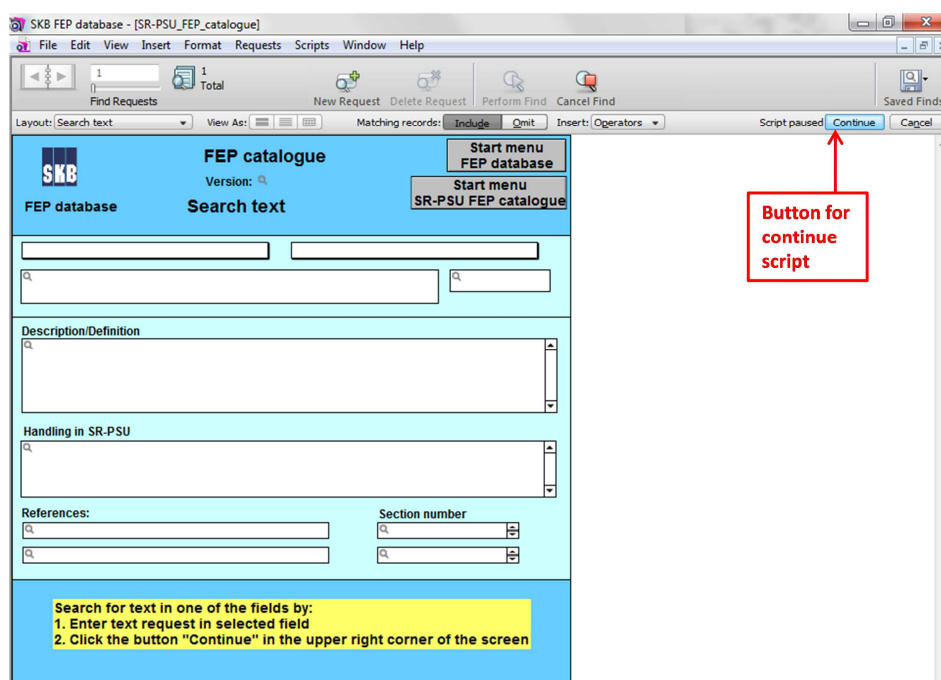


**Figure 4-11.** Interaction matrix for the biosphere with subcomponents of the biosphere as principal diagonal elements in the matrix. The matrix element numbers act as buttons to display all interacting processes (right part of the figure).

## 4.4 Find records in the SR-PSU FEP catalogue

It is possible to do a text search for finding records in the SR-PSU catalogue. For this purpose, only the yellow buttons are to be used. The search is activated by the button “Find SR-PSU FEPs” in the

“Start menu” in the SR-PSU FEP catalogue (Figure 4-1). This will activate a script that displays a layout for entering a text request in one of the fields defining the SR-PSU FEPs (Figure 4-12). The text request is entered in one of the fields and the script is continued by clicking the button “Continue” in the right upper corner of the screen (marked with an arrow in Figure 4-12).



**Figure 4-12.** Layout for entering a text request for finding SR-PSU FEP records that matches the request. See Figure 4-3 for fields without names.

If no records match the request, a message will appear on the screen stating that no records match the request. Via the button “Modify find” in this message, a new text request can be entered into one of the fields. Choosing the button “Cancel” in the message will cancel the search and once again display the “Start menu” in the SR-PSU FEP catalogue (Figure 4-1).

If there are records in the FEP-catalogue that matches the request, these are displayed as a list showing the SR-PSU FEP ID and FEP name. The button “show” to the right of the selected FEP will display the full description of the FEP as it appears in the layout “SR-PSU FEP record” (Figure 4-3). In order to examine descriptions of other FEPs found in the search, the list of found FEPs must once again be entered via the button “Return to found records” in the layout “SR-PSU FEP record” (Figure 4-3).

**Note!** A search will limit the accessible FEP records to those matching the search request. In order to make all FEP records accessible for a new search or for examination of other information in the FEP catalogue as described above, these activities must start from the “Start menu” in the SR-PSU FEP catalogue (Figure 4-1) or the “Start menu” in the FEP database (uppermost layout in Figure 3-1), which are accessed via the buttons “Start menu SR-PSU FEP catalogue” and “Start menu FEP database”, respectively. These buttons are available in most of the layouts in the SR-PSU FEP catalogue.

## 4.5 Navigating in the SR-PSU NEA mapping register

The SR-PSU NEA mapping register is entered via the box “NEA mapping” (works as a button) in the “Start menu” for the SR-PSU version of the FEP database (upper layout in Figure 3-1), or directly from the SR-PSU FEP catalogue in the layout “Linked NEA Project FEPs”, as described in section 4.2 above. Entering from the FEP database Start menu will display a list of all NEA project FEPs in the register (Figure 4-13). Exit from the NEA mapping register is via the button “Start menu FEP database”, which displays the FEP database start menu (uppermost layout in Figure 3-1), irrespective of in which layout in the NEA mapping register the button appears.

In the layout “NEA Project FEP listing”, the NEA project FEPs can be sorted via the buttons “Sort Alphabetical” and “Sort Numerical”. To examine the full list of FEPs, the scrollbar on the right-hand side of the screen (not shown in Figure 4-13) is used. The buttons “Description” will display the NEA Project FEP description, further addressed below. The button “List of NEA FEPs relevant to the SFR system” will produce a similar NEA Project FEP listing, but this list contains only those FEPs that are judged as relevant to the SFR repository system.

NEA FEP database	Version 2.1	NEA Project FEP listing
A 1.01	Backfill characteristics	Description
A 1.02	Backfill evolution	Description
A 1.03	Biological activity	Description
A 1.04	Boundary conditions	Description
A 1.05	Buffer additives	Description
A 1.06	Buffer characteristics	Description
A 1.07	Buffer evolution	Description
A 1.08	Cave ins	Description
A 1.09	Chemical gradients	Description
A 1.10	Chemical interactions	Description
A 1.11	Chemical kinetics	Description
A 1.12	Climate change	Description
A 1.13	Colloids	Description
A 1.14	Complexation by organics	Description
A 1.15	Concrete	Description
A 1.16	Container corrosion products	Description
A 1.17	Container failure (early)	Description
A 1.18	Container failure (long-term)	Description
A 1.19	Container failure (mechanical processes)	Description
A 1.20	Container healing	Description
A 1.21	Containers - partial corrosion	Description
A 1.22	Convection	Description
A 1.23	Correlation	Description
A 1.24	Corrosion	Description
A 1.25	Coupled processes	Description
A 1.26	Criticality	Description
A 1.27	Diffusion	Description
A 1.28	Dispersion	Description

Sort Alphabetical    List of NEA FEPs relevant to the SFR system    List of NEA FEPs not relevant to the SFR system  
 Sort Numerical

**Figure 4-13.** Start layout in the SR-PSU NEA mapping register listing all NEA Project FEPs in the register. The full list is examined by use of the scrollbar on the right-hand side of the screen (not shown in the figure).

The button “List of NEA FEPs not relevant to the SFR system” will display a list of those FEPs judged as irrelevant to the SFR system together with the motivation for this judgement and the persons responsible for this judgement (Figure 4-14). This layout is also entered directly from the “Start menu” in the SR-PSU version of the FEP database (upper layout in Figure 3-1) via the box “Irrelevant NEA FEPs”.

To examine the full list of FEPs, the scrollbar on the right-hand side of the screen is used. To view the full motivation for disregarding the FEP, if not displayed, the scrollbar to the right in the text field is used. The button “Description” will display the NEA Project FEP description.

SKB FEP database SR-PSU NEA Mapping			
Start menu FEP database			
NEA FEP database Version 2.1			
Listing of NEA FEPs not relevant for the SFR system			
	Reason for not being relevant:	Comment:	Screened out by:
A 1.02 Backfill evolution Description	Not appropriate for the actual waste (heat)		Maria Lindgren, Kristina Skagius
A 1.04 Boundary conditions Description	Too general, covered by other NEA project FEPs		Maria Lindgren, Kristina Skagius
A 1.07 Buffer evolution Description	Not appropriate for the actual waste (heat)		Maria Lindgren, Kristina Skagius
A 1.09 Chemical gradients Description	Too general, covered by other NEA project FEPs		Maria Lindgren, Kristina Skagius
A 1.10 Chemical interactions Description	Not appropriate for the actual waste (heat)		Maria Lindgren, Kristina Skagius
A 1.15 Concrete Description	Too general, covered by other NEA project FEPs		Maria Lindgren, Kristina Skagius
A 1.20 Container healing Description	Not appropriate for the actual repository design		Maria Lindgren, Kristina Skagius
A 1.25 Coupled processes Description	Too general, covered by other NEA project FEPs		Maria Lindgren, Kristina Skagius
A 1.26 Criticality Description	Not appropriate for the actual waste		Maria Lindgren, Kristina Skagius
A 1.31 Excessive hydrostatic pressures Description	Not appropriate for the actual waste (heat)		Maria Lindgren, Kristina Skagius
A 1.33 Faulty buffer emplacement Description	Not appropriate for the actual repository design		Maria Lindgren, Kristina Skagius
A 1.34 Formation of cracks Description	Too general, covered by other NEA project FEPs		Maria Lindgren, Kristina Skagius
A 1.39 Global effects Description	Too general, covered by other NEA project FEPs		Maria Lindgren, Kristina Skagius
A 1.42 Hydride cracking Description	Not appropriate for actual waste packaging design	The containers in SFR have a specified life time	Maria Lindgren, Kristina Skagius
<div> <div>List of all NEA Project FEPs</div> <div>List of NEA FEPs relevant to the SFR system</div> </div>			

**Figure 4-14.** Layout displaying a list of all NEA Project FEPs judged as not relevant to the SFR repository system. The full list is examined by use of the scrollbar on the right-hand side of the screen (not shown in the figure).

The layout entered via the button “Description” is shown in Figure 4-15. This is the same layout as is accessed from the SR-PSU FEP catalogue via a script activated by the button “show” in the layout “Linked NEA Project FEPs” (see Figure 4-4), but without the script activated. From this layout, a list of all SR-PSU FEPs to which the NEA Project FEP is associated is displayed via the button “Mapping results” (Figure 4-16). The button “Handling in SR-PSU” displays how the NEA Project FEP is addressed by the different SR-PSU FEPs to which it is associated (Figure 4-17). What is shown here, builds on the same information as that shown in the SR-PSU FEP catalogue in the layout “Handling linked NEA Project FEPs” (Figure 4-5), but here the information related to each NEA Project FEP is shown, whereas the layout in the SR-PSU FEP catalogue provides the information related to each SR-PSU FEP.

**SKB FEP database** SR-PSU  
**NEA Mapping**

**NEA Project FEP description** [Start menu](#) [FEP database](#)

**NEA FEP database** Version 2.1

Project FEP ID:  Project FEP Name:  International FEP No:

**FEP description**

The expected vault environment, or changes to the vault environment caused by biological activity, chemical processes and physical agitation could promote the generation of colloids or pseudo-colloids, affecting contaminant transport.

[Colloids are particles of contaminants, whereas psuedo-colloids are naturally-occurring particulates (such as clay) which contain sorbed contaminants. It is possible that true colloids may be generated within the container once groundwater enters the failed container. However, studies demonstrate that such colloids cannot migrate through the high-density buffer which would be very effective in filtering out colloidal particles. We have therefore assumed that there is no need for the further evaluation of the effect of colloids in the vault, but note that further experimental support is desirable. Further discussion on colloids is provided in the lists of geosphere and biosphere factors (Tables B.2 and B.3).]

[Mapping results](#) [Handling in SR-PSU](#) [List all NEA Project FEPs](#)  
[List relevant NEA FEPs](#)

Figure 4-15. Layout in the SR-PSU NEA Mapping register that shows NEA Project FEP descriptions.

**SKB FEP database** SR-PSU  
**NEA Mapping**

**Mapping results - Relevant NEA FEPs** [Start menu](#) [FEP database](#)

**NEA FEP database** Version 2.1

Project FEP ID:  Project FEP Name:  [Description](#)

**Mapped to SKB SR-PSU FEP:**

WM14	Dissolution, precipitation and recrystallisation
WM15	Degradation of organic materials
Pa10	Dissolution, precipitation and recrystallisation
BMABa12	Concrete degradation
BTFBa11	Concrete degradation
SiBa13	Concrete degradation
SiBa14	Dissolution/precipitation
SiBa19	Montmorillonite colloid release
BRTBa11	Concrete degradation
VarWM08	Water composition

[Handling in SR-PSU](#) [List all NEA Project FEPs](#)  
[List relevant NEA FEPs](#)

Figure 4-16. Layout in the NEA Mapping register that shows all SR-PSU FEPs to which the NEA FEP is associated.

**SKB FEP database SR-PSU**  
**NEA Mapping**  
**Handling of NEA FEP in SR-PSU** Start menu FEP database

**NEA FEP database** Version 2.1

Project FEP ID:  Project FEP Name:  Description

SR-PSU FEP	Aspects of NEA FEP addressed	Aspects not addressed because	Comments:
WM14 Dissolution, precipitation and recrystallisation	Relevant aspects are mentioned with reference to the processes Colloid formation and transport (WM13) and Colloid transport and filtering		
WM15 Degradation of organic materials		Organic colloids are not addressed here, but in colloid process description, WM 13.	
Pa10 Dissolution, precipitation and recrystallisation	Relevant aspects are mentioned with reference to the processes Colloid formation and transport (WM13) and Colloid transport and filtering		
BMABa12 Concrete degradation		Colloid generation is addressed in BMABa11.	

Mapping results List all NEA Project FEPs List relevant NEA FEPs

**Figure 4-17.** Layout "Handling of NEA FEP in SR-PSU" in the NEA Mapping register showing how the NEA FEP is addressed by the different SR-PSU FEPs to which it is associated.

## 4.6 Navigating in the SR-PSU SAR-08 Matrix mapping register

The Matrix mapping register is accessed via the box "Matrix mapping" (works as a button) in the Start menu of the SR-PSU version of the FEP database (upper layout in Figure 3-1), or directly from the SR-PSU FEP catalogue in the layout "Linked SAR-08 Matrix interactions" via activating a script. As for the NEA mapping register, entering from the SR-PSU FEP database start menu will display a list of all Matrix interactions. The procedures for navigating in the Matrix mapping register from this list of matrix interactions are analogues to those set up for the NEA mapping register, and are, therefore, not further described here.

However, again it should be pointed out that although all SAR-08 Matrix interactions are linked to the appropriate SR-PSU FEP in the FEP catalogue, no formal documentation of the handling of each interaction has been made. This is further discussed in the SR-PSU FEP report (SKB 2014).



## 5 The SR-Site version

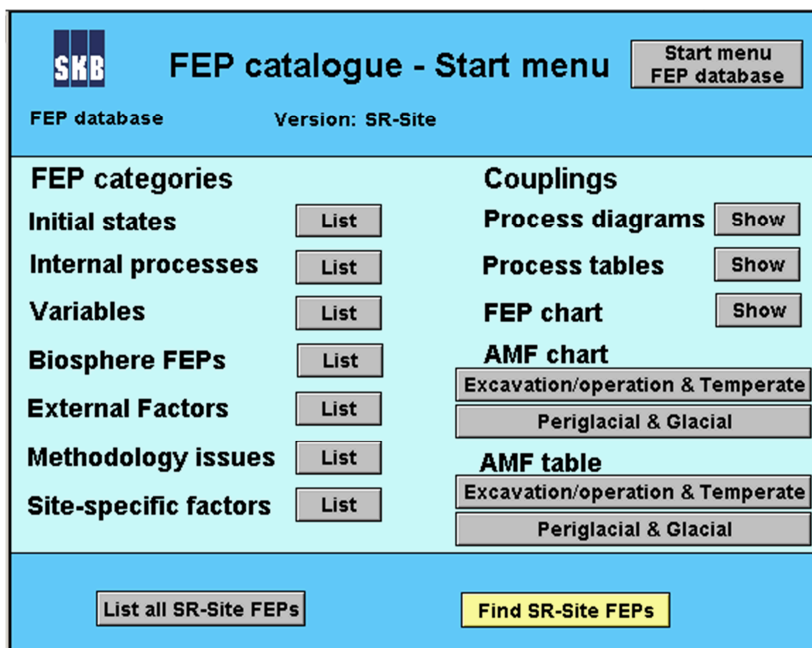
### 5.1 Starting the SR-Site FEP catalogue

The SR-Site FEP catalogue is accessed via the box “SR-Site FEP catalogue” (works as a button) in the SR-Site Main menu (middle layout in Figure 3-1). This will display a layout showing the contents of the SR-Site FEP catalogue (Figure 5-1). Exit from the FEP catalogue is via the button “Start menu FEP database”, which again displays the FEP database start menu (uppermost layout in Figure 3-1), irrespective of in which layout in the FEP catalogue the button appears.

From the layout “Start menu” in the SR-Site FEP catalogue (Figure 5-1), lists of FEPs in the different FEP categories are accessed via the “List” buttons. The button “List all SR-Site FEPs” displays a list of all SR-Site FEPs in every layout it appears. How to access FEP records in the different FEP categories and the associated information is further described below in Section 5.2.

From the Start menu in the FEP catalogue (Figure 5-1), Couplings of information contained in the FEP database can also be displayed via the grey-coloured buttons. This is further described in Section 5.3 below.

The yellow button “Find SR-Site FEPs” and other yellow buttons in other layouts are only functioning appropriate, and should only be used, for finding records. This is further described in Section 5.4 below.



**Figure 5-1.** Layout Start menu giving access to the different FEP categories and Couplings contained in the SR-Site FEP catalogue.

### 5.2 Displaying FEP records in the SR-Site FEP catalogue and associated information

From the layout “Start menu” (Figure 5-1), lists of SR-Site FEPs in the different FEP categories are accessed via the “List” button. The further access to FEP records and linked information is here exemplified for the category “Internal processes”, but the same procedures are also applicable for the other FEPs categories, if not otherwise stated.

The FEP list accessed (Figure 5-2) display the FEP ID and FEP name of all FEPs in the selected FEP category. The button “Start menu SR-Site FEP catalogue” will, in every layout where it appears,

display the layout “Start menu” shown in Figure 5-1. By using the scroll bar to the right on the screen (not shown in Figure 5-2), all FEPs in the list can be examined.

FEP catalogue		
Version: SR-Site		
FEP database		
FEP listing - Internal processes		
Start menu FEP database		
Start menu SR-Site FEP catalogue		
F01	Radioactive decay	show
F02	Radiation attenuation/heat generation	show
F03	Induced fission (criticality)	show
F04	Heat transport	show
F05	Water and gas transport in canister cavity, boiling/condensation	show
F06	Mechanical cladding failure	show
F07	Structural evolution of fuel matrix	show
F08	Advection and diffusion	show
F09	Residual gas radiolysis/ acid formation	show
F10	Water radiolysis	show
F11	Metal corrosion	show
F12	Fuel dissolution	show
F13	Dissolution of gap inventory	show
F14	Speciation of radionuclides, colloid formation	show
F15	Helium production	show
F16	Chemical alteration of the fuel matrix	show
F17	Radionuclide transport	show
C01	Radiation attenuation/ heat generation	show
C02	Heat transport	show
C03	Deformation of cast iron insert	show
C04	Deformation of copper canister from external pressure	show
C05	Thermal expansion (both cast iron insert and copper canister)	show
C06	Copper deformation from internal corrosion products	show
C07	Radiation effects	show
C08	Corrosion of cast iron insert	show
C09	Galvanic corrosion	show
C10	Stress corrosion cracking of cast iron insert	show
C11	Corrosion of copper canister	show
C12	Stress corrosion cracking of the copper canister	show
C13	Earth currents - stray current corrosion	show
C14	Deposition of salts on canister surface	show
C15	Radionuclide transport	show
Bu01	Radiation attenuation/ heat generation	show
Bu02	Heat transport	show
Bu03	Freezing	show
Bu04	Water uptake and transport for unsaturated conditions	show
Bu05	Water transport for saturated conditions	show
Bu06	Gas transport/dissolution	show
Bu07	Piping/erosion	show
Bu08	Swelling/mass redistribution	show
Bu09	Liquefaction	show
Bu10	Advective transport of species	show
Bu11	Diffusive transport of species	show
Bu12	Sorption (including exchange of major ions)	show
Bu13	Alterations of impurities	show
Bu14	Aqueous speciation and reactions	show
List all SR-Site FEPs		

Figure 5-2. Layout FEP listing – Internal processes in the SR-Site FEP catalogue.

The SR-Site FEP description is displayed in the layout “SR-Site FEP record” (Figure 5-3), which is accessed via the button “show” for a selected FEP in the FEP list. This layout also shows the handling of this SR-Site FEP and references to relevant SR-Site reports for additional information.



**Figure 5-3.** Layout SR-Site FEP record in the SR-Site FEP catalogue.

In the layout “SR-Site FEP record” (Figure 5-3), return to the list of internal processes is possible via the button “List internal processes”. Different information linked to the FEP can be viewed from the layout “SR-Site FEP record”. The button “Linked NEA FEPs” displays all NEA FEPs linked to the SR-Site FEP (Figure 5-4), a list of Matrix interactions linked to the FEP is shown via the button “Linked Matrix interactions”, and the button “Process diagram” shows a process diagram automatically generated based on tabulated influences between the process and the variables defined for the system component in question, i.e. for the system component “Fuel/cavity in canister” in the example illustrated in Figure 5-3. These buttons have the same function in whatever layout they appear in the SR-Site FEP catalogue. However, process diagrams are only relevant for the FEP category “Internal processes”. Process diagrams are also accessed via the Start menu in the SR-Site FEP catalogue (Figure 5-1) as described in Section 5.3 below.

The list of NEA FEPs displayed via the button “Linked NEA FEPs” allows for access to definition of the NEA Project FEPs and to documentation of handling of the NEA Project FEPs in SR-Site (Figure 5-4). The full list of NEA Project FEPs linked to the SR-Site FEP can be examined by using the scrollbar on the right hand side of the FEP list field.

The documentation of the handling of NEA Project FEPs associated with the SR-Site FEP is accessed via the button “Handling NEA FEPs” (Figure 5-4), which displays the information in table format (Figure 5-5). For each NEA FEP (leftmost column), aspects of the NEA FEP addressed, and if not addressed, the reason why, are displayed as documented by the expert named in the field below the table. The full table can be examined by using the rightmost scrollbar in the layout (indicated in Figure 5-5) and the full text in each text field can be examined by using the scrollbar on the right side of the text field (indicated in Figure 5-5). The button “SR-Site FEP description” is used to switch to the layout “SR-Site FEP record” (Figure 5-3) and the function of this button is the same in every layout in the SR-Site FEP catalogue.

**SKB FEP catalogue**  
Version: SR-Site

FEP database **Linked NEA Project FEPs** Start menu FEP database Start menu SR-Site FEP catalogue

Internal process: Fuel/cavity in canister  
Fuel dissolution: F12

NEA FEPs mapped to this SR-Site FEP		NEA FEP description
A 1.09	Chemical gradients	show
A 1.11	Chemical kinetics	show
A 1.30	Electrochemical gradients	show
A 1.62	Precipitation and dissolution	show
A 1.66	Radiolysis	show
A 1.75	Source terms (expected)	show
A 1.76	Source terms (other)	show
A 1.79	Stability of UO <sub>2</sub>	show
E GEN-27	Radionuclide precipitation and dissolution	show
E SFL-13	Degradation of the spent fuel elements	show

SR-Site FEP description Handling NEA FEPs

Scroll bar for examining list of NEA FEPs

Figure 5-4. Layout "Linked NEA Project FEPs" in the SR-Site FEP catalogue.

**SKB FEP catalogue**  
Version: SR-Site

FEP database **Handling linked NEA Project FEPs** Start menu FEP database Start menu SR-Site FEP catalogue

Internal process: Fuel/cavity in canister  
Fuel dissolution: F12

NEA FEP	Aspects addressed	Aspects not addressed because	Comments
A 1.09 Chemical gradients		Not covered due to negligible relevance inside canister	FEP concerns mainly buffer
A 1.11 Chemical kinetics	Addressed/covered	Poorly poised EN not relevant. Concentrations below solubility limits pessimistically neglected in F14.	Other aspects of chemical kinetics covered
A 1.30 Electrochemical gradients		Not covered because the effect on fuel dissolution inside the massive Fe/Cu canister is expected to be negligible.	
A 1.62 Precipitation and dissolution	Dissolution of UO <sub>2</sub> addressed/covered	Solubility constraints, dissolution of zircaloy not covered; discussed elsewhere.	Also discussed in F11, F13, F14.

Recorded by: Kastriot Spahiu Recording date: December 2010  
Checked and Revised by: Kristina Skagius Date: December 2010  
Need further revision: ☐ Yes ☒ No

SR-Site FEP description

Scroll bar for examining full text in the text field  
Scroll bar for examining the full table

Figure 5-5. Layout "Handling linked NEA Project FEPs" in the SR-Site FEP catalogue showing the handling of each NEA Project FEP as documented by the experts.

The description of each NEA Project FEP linked to the SR-Site FEP is displayed via the button “show” in the list of NEA Project FEPs in the layout “Linked NEA Project FEPs” (Figure 5-4). This button activates a script that opens the corresponding NEA Project FEP record in the register “NEA mapping” in SR-Site (see middle layout in Figure 3-1). The layout entered is shown in Figure 5-6. The full description of the NEA Project FEP is examined by using the scrollbar on the right side of the text field. Return to the SR-Site FEP catalogue occurs via the button “Continue” in the upper right corner of the screen outside the actual layout (not shown in Figure 5-6, but marked by an arrow in Figure 4-6). This button continues the script, but it is possible to examine other information via the buttons in the footer part of the layouts before continuing this script, since this script button will appear in the upper right corner until the script is continued or cancelled via the button just to the right (“Cancel”). As long as the script is active, it is not possible to enter the FEP database start menu via the button in the header part of the layouts. However, if the script is cancelled, the only return to the SR-Site FEP catalogue is via the FEP database start menu.

The screenshot displays the 'SKB FEP database SR-Site NEA Mapping' interface. At the top, there is a header bar with the SKB logo and the text 'SKB FEP database SR-Site NEA Mapping'. Below this, a sub-header reads 'NEA Project FEP description'. On the right side of the header, there is a button labeled 'Start menu FEP database'. The main content area is titled 'NEA FEP database Version 2.1'. It contains three input fields: 'Project FEP ID' with the value 'A 1.62', 'Project FEP Name' with the value 'Precipitation and dissolution', and 'International FEP No' with the value '2.1.09'. Below these fields is a section titled 'FEP description' containing a text area with a scrollbar. The text in the description area reads: 'Solubility constraints may be important in controlling transport in the buffer, backfill the container. For example, the dissolution rate of the waste matrices could be affected by local dissolution and precipitation, and precipitation could change porosity of the buffer and backfill. Solubility constraints are affected by temperature. All important components of this factor should be included in the postclosure assessment. Important components include the dissolution of the UO2 and Zircaloy waste matrices and the dissolution and precipitation of key chemical elements. On the other hand, it will be acceptable to neglect some other components. For example, precipitation of chemical compounds in the buffer is expected to result in a decrease in the buffer porosity. It is difficult to predict in detail the extent of the porosity decrease, but it is known that the effect would be a reduction in contaminant transport. Thus if changes to buffer porosity are neglected in the postclosure assessment, the result would be to overestimate impacts. Related discussion is provided under Groundwater - evolution and Precipitation and dissolution in the list of geosphere factors (Table B.2).]'. At the bottom of the interface, there are four buttons: 'Mapping results', 'Handling in SR-Site', 'List all NEA Project FEPs', and 'List relevant NEA FEPs'.

**Figure 5-6.** Layout “NEA Project FEP description in the NEA Mapping register as accessed from the SR-Site FEP catalogue. See Figure 4-6 for the location of the button for return to the SR-Site FEP catalogue, layout “Linked NEA Project FEPs” (Figure 5-4).

In the layout “SR-Site FEP record” (Figure 5-3), automatically generated process diagrams are accessible through the button “Process diagram”. This is further addressed in Section 5.3 below.

The same procedures are applicable for access to lists of Matrix interactions and the tables with documentation on handling as those for NEA Project FEPs, but via the buttons:

- “Linked SR 97 Matrix interactions” in the layout “SR-Site FEP record (Figure 5-3), and
- “Handling SR 97 Matrix interactions” in the layout “Linked SR 97 Matrix interactions”.

Furthermore, the definitions of the Matrix interactions are displayed by activating a script via the button “show” in the layout “Linked SR 97 Matrix interactions”. This script opens the corresponding Matrix interaction record in the register “Matrix mapping” (see middle layout in Figure 3-1) and, as for NEA Project FEPs, return to the SR-Site FEP catalogue occurs via the button “Continue” in the upper right corner of the screen outside the actual layout.

However, it should be pointed out that no effort has been made to update the handling of matrix interactions in SR-Site. This means that the handling documented in the SR-Site version of the FEP database is the same as that documented for SR-Can. This is further discussed in the SR-Site FEP report (SKB 2010).

### 5.3 Couplings in the SR-Site version of the FEP database

In the SR-Site version of the FEP database, a number of couplings can be displayed from the “Start menu” in the SR-Site FEP catalogue (Figure 5-1). These couplings are:

- Process diagrams (section 5.3.1)
- Process tables (section 5.3.2)
- FEP charts (section 5.3.3)
- Assessment model flow charts, AMFs (section 5.3.4)
- AMF tables (section 5.3.5)

#### 5.3.1 Process diagrams

Process diagrams for each internal process as well as for the entire system components in SR-Site are available in the FEP database. These process diagrams are based on information in the influence tables published in the SR-Site Process reports. Process diagrams for each internal process are accessible through the button “Process diagram” in the layout “SR-Site FEP record” (Figure 5-3). Corresponding influence tables have been created in the FEP database with the requirement that the table in the FEP database must distinguish the presence of an influence or not by Yes or No and the handling of the influence by Neglected or Handled. This is because the presence of an arrow or not and its colouring in the process diagrams in the FEP database are automatically generated based on this information. In general, the original influence tables in the Process reports are clear concerning whether there is an influence or not, which determines the presence or absence of an arrow in the process diagram. A green arrow means that the influence is neglected and a red arrow represents an influence that is handled in SR-PSU. It is not totally clear in all cases from the text in the influence tables if the influence is handled or neglected. This means that there are some uncertainties connected to the colour-coding of the arrows in the process diagrams. The influence tables in the FEP catalogue are accessed via the button “Show influence table” in the layout “Process diagram” (Figure 5-7).

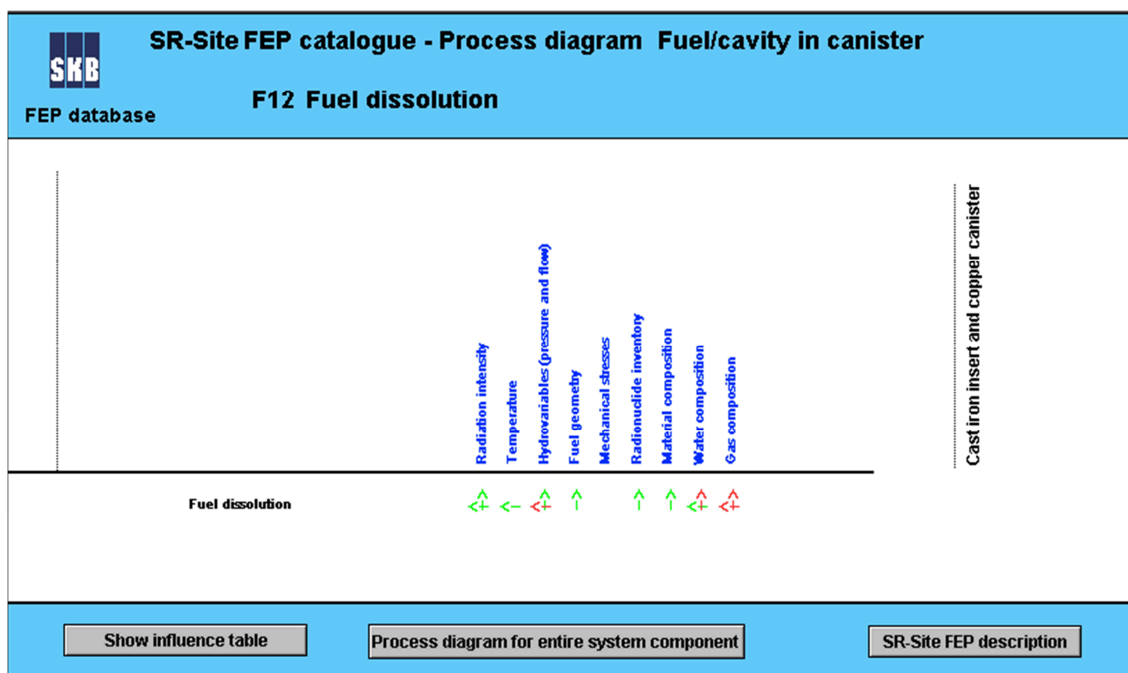
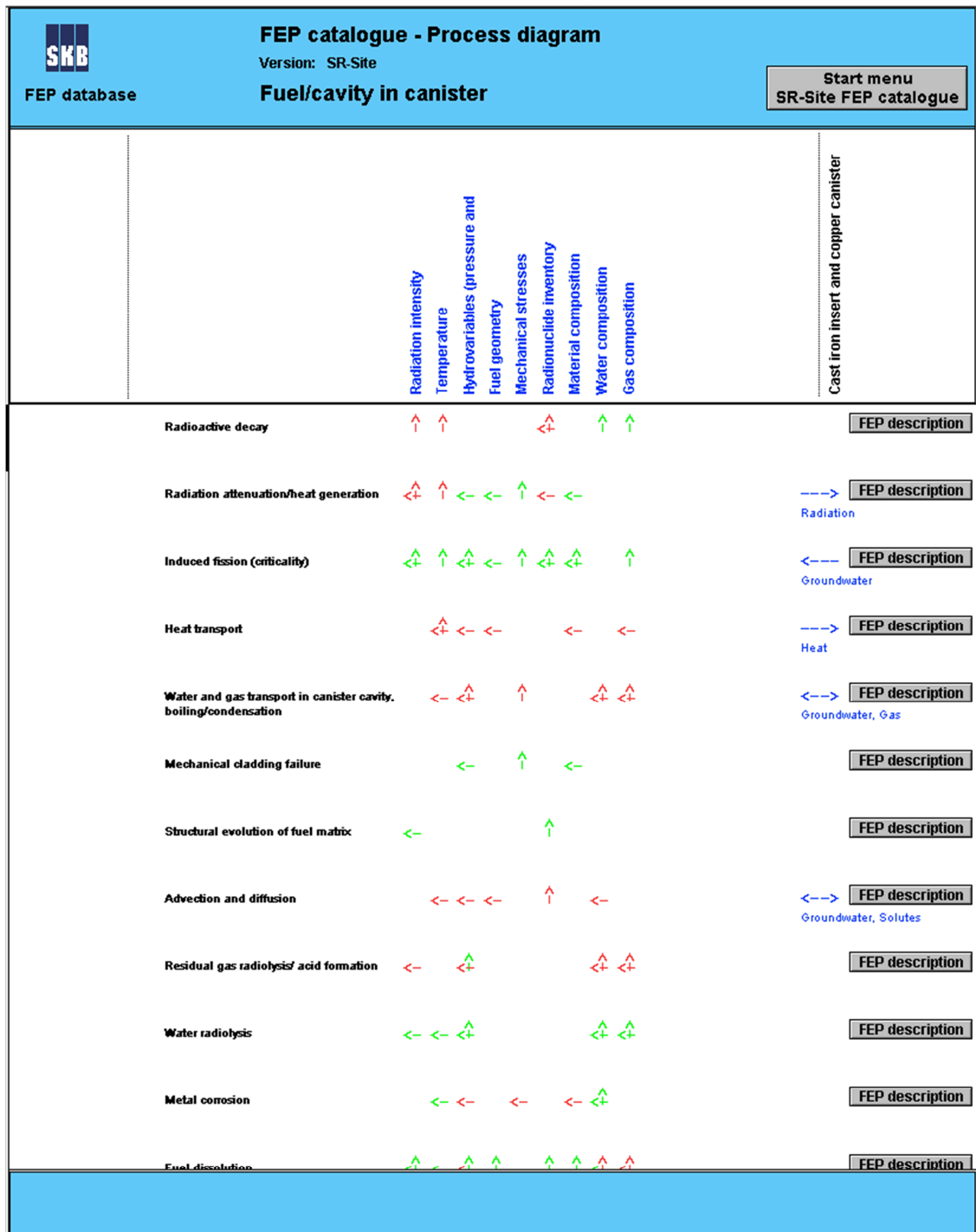


Figure 5-7. Layout “Process diagram” for internal processes.


Process diagrams for an entire system component are displayed via the button “Process diagram for entire system component” in the layout “Process diagram” (Figure 5-7). These diagrams are also accessed directly from the “Start menu” in the SR-Site FEP catalogue (Figure 5-1) via the button “Show” process diagrams and the button for the system component selected. An example is shown in Figure 5-8. The full diagram is examined by using the scrollbar on the right-hand side of the screen. Process diagrams are available for all system components, but for those of less importance for safety, the diagrams are not complete. This is because the diagrams are generated based on influence tables in the SR-Site process reports and for many processes defined for the system components of less importance for safety, influence diagrams are missing. For processes where influence diagrams are missing, the text “not available” is displayed in the process diagram.



**Figure 5-8.** Process diagram for the system component Fuel/cavity in canister as displayed in the SR-Site FEP catalogue. The total diagram is examined by using the scrollbar on the right-hand side of the screen (not shown in the figure).

### 5.3.2 Process tables

Process tables for the different system components are displayed via the button “Show” Process tables (Figure 5-1) and then by clicking the button for the system component selected. An example is shown in Figure 5-9. As in the SR-Site main report (SKB 2011, Section 7.4), the process tables display the handling of each process in SR-Site, the corresponding FEP chart item and notes/references to relevant sections in the main report, but also to the modelling activity in the assessment model flow charts, AMFs, (see SKB (2011), Section 7.5) where the process in question is included. From the Process table layout it is possible to display the FEP chart for SR-Site via the button “Show FEP chart”, see further Section 5.3.3 below.

<div>  <b>FEP catalogue</b>  Version: SR-Site <div> Start menu FEP database </div> <div> Start menu SR-Site FEP catalogue </div> </div>						
FEP database						
Process table for Fuel/cavity in canister						
	Intact canister	FEP chart item	Failed canister	Notes	AMF item	Time period
F01 Radioactive decay	Thermal model.	Decay, heat generation	CCMP23	In thermal calculation, see section 10.3.4, in nuclide transport calculations section 13.4.1 in SR-Site Main report, SKB TR-11-01.	Buffer and rock temperatures  Radionuclide transport, near field  Permafrost modelling	Excavation/operation and temperate  Excavation/operation and temperate Periglacial and glacial  Periglacial and glacial
F02 Radiation attenuation/heat generation	Thermal model	Decay, heat generation	Neglected when releases occur after period of elevated temperatures.	In thermal calculation, see section 10.3.4 in SR-Site Main report, SKB TR-11-01.	Buffer and rock temperatures  Permafrost modelling	Excavation/operation and temperate  Periglacial and glacial
F03 Induced fission (criticality)	Neglected since there will be insufficient amounts of moderator inside the canister prior to failure.		Neglected since the probability is negligibly small if credit is taken for the burn-up of the fuel.	See further section 13.3 in SR-Site Main report, SKB TR-11-01.		
F04 Heat transport	Thermal model.	Heat conduction	Neglected when releases occur after period of elevated temperatures.	In thermal calculation, see section 10.3.4 in SR-Site Main report, SKB TR-11-01.		
<div>Show FEP chart</div>						

**Figure 5-9.** Process table for the system component Fuel/cavity in canister as displayed in the SR-Site FEP catalogue. The whole table is examined by using the scrollbar on the right-hand side of the screen (not shown in the figure).

### 5.3.3 FEP charts

The FEP chart developed for SR-Site (Section 8.5 in SKB (2011)) is displayed from the “Start menu” in the SR-Site FEP catalogue (Figure 5-1) via the button “Show” FEP chart and also, as described in Section 5.3.2 above, from the process table layout. Some of the fields in the FEP chart act as buttons (marked with a black dot) for displaying the processes corresponding to this FEP chart item as defined in the Process table (see Section 5.3.2 above). For example, by clicking the FEP chart item “Decay, heat generation”, all processes linked to this FEP chart item in the process table are displayed together



with their handling in SR-Site (Figure 5-10). Return to the FEP chart is via the button “FEP chart” (Figure 5-10).

FEP chart item and linked processes			
FEP database		FEP chart item	
Cast iron insert and copper canister Fuel/cavity in canister		Decay, heat generation	
Processes	Intact canister/ Resaturation - Long-term	Failed canister/ Earthquakes	Notes
F01 Radioactive decay	Thermal model.	COMP23	In thermal calculation, see section 10.3.4, in nuclide transport calculations section 13.4.1 in SR-Site Main report, SKB TR-11-01.
F02 Radiation attenuation/heat generation	Thermal model.	Neglected when releases occur after period of elevated temperatures.	In thermal calculation, see section 10.3.4 in SR-Site Main report, SKB TR-11-01.
CD1 Radiation attenuation/ heat generation	Radiation attenuation: Initial radiation levels given in Canister production report, SKB TR-10-14, referring to calculations in the Spent Fuel report, SKB TR-10-13. Heat generation: Included in integrated modelling of thermal evolution; thermal model.	Neglected when releases occur after period of elevated temperatures.	See sections 5.3.4 (initial radiation levels) and 10.3.4 (thermal evolution) in SR-Site Main report, SKB TR-11-01.

**Figure 5-10.** FEP chart item and processes linked to this FEP chart item according to the Process table. Layout displayed by clicking the FEP chart item field in the FEP chart.

### 5.3.4 Assessment model flow charts, AMFs

The assessment model flow charts, AMFs, developed for SR-Site (Section 7.5 in SKB (2011)) are displayed from the “Start menu” in the SR-Site FEP catalogue (Figure 5-1) via the buttons AMF chart “Excavation/operation & Temperate” and “Periglacial & Glacial”. In both AMFs, calculation/modelling activities are represented by yellow fields. These yellow fields function as buttons to display information on the numerical code used, full reference to the modelling report and processes included in the modelling as specified in the AMF tables provided in Section 7.5 in the SR-Site main report (SKB 2011). For modelling activities including internal processes, the handling of these processes as specified in the process tables are displayed. For modelling activities including external and biosphere processes, the handling as defined in the SR-Site FEP catalogue is displayed. This handling is based on the SR-Site Climate report and provided by the experts documenting the handling of Biosphere FEPs, respectively. An example is provided in Figure 5-11. Return to the AMF is via the AMF buttons at the footer of the layout (Figure 5-11).

**SR-Site**  
**AMF modelling activities and linked processes**  
Excavation/operation and temperate  
Periglacial and glacial

Start menu  
SR-Site FEP catalogue

Start menu  
FEP database

FEP database

Biosphere landscape model

**Code**  
Ecologo  
MIKE\_SHE  
Pandora  
Erica

**Modelling report reference**  
Avila R, Ekström P-A, Åstrand P-G, 2010. Landscape dose conversion factors used in the safety assessment SR-Site. SKB TR-10-06, Svensk Kärnbränslehantering AB.

**Note**  
Biosphere processes

Linked Biosphere processes

Processes	Definition	Handling in SR-Site
Bio01 Bioturbation	The mixing of elements and particles in both aquatic and terrestrial regolith by organisms.	Bioturbation is considered in the Biosphere Interaction Matrix (SKB R-10-37), and in the Radionuclide Model (RM). The handling is further described in the SR-Site Biosphere synthesis report, SKB TR-10-00, and in the ecosystem reports, SKB TR-10-01, -02 and -03.
Bio02 Consumption	When organisms feed on solid material and/or on other organisms.	Consumption is considered in the Biosphere Interaction Matrix (SKB R-10-37) and in the Radionuclide Model (RM). The handling is further described in the SR-Site Biosphere synthesis report, SKB TR-10-00, and in the ecosystem reports, SKB TR-10-01, -02 and -03.
Bio03 Death	The generation of dead organic matter by organisms, including losses of parts as well as death of entire organisms.	Death is considered in the Biosphere Interaction Matrix (SKB R-10-37) and in the Radionuclide Model (RM). The handling is further described in the SR-Site Biosphere synthesis report, SKB TR-10-00, and in the ecosystem reports, SKB TR-10-01, -02 and -03.
Bio04 Decomposition	The breakdown of organic matter by organisms.	Decomposition is considered in the Biosphere Interaction Matrix (SKB R-10-37) and in the Radionuclide Model (RM). The handling is further described in the SR-Site Biosphere synthesis report, SKB TR-10-00, and in the ecosystem reports, SKB TR-10-01, -02 and -03.
Bio05 Excretion	The excretion of water or elements to the surrounding media by humans and other organisms.	Excretion is considered in the Biosphere Interaction Matrix (SKB R-10-37) and in the Radionuclide Model (RM). The handling is further described in the SR-Site Biosphere synthesis report, SKB TR-10-00, and in the ecosystem reports, SKB TR-10-01, -02 and -03.
Bio06 Food supply	The fraction of produced biomass and particulate matter that can be used as a food source for humans and other organisms.	Food supply is considered in the Biosphere Interaction Matrix (SKB R-10-37) and in the Radionuclide Model (RM). The handling is further described in the SR-Site Biosphere synthesis report, SKB TR-10-00, and in the ecosystem reports, SKB TR-10-01, -02 and -03.
Bio07 Growth	The generation of biomass by organisms	Growth is considered in the Biosphere Interaction Matrix (SKB R-10-37) and in the Radionuclide Model (RM). The handling is further described in the SR-Site Biosphere synthesis report, SKB TR-10-00, and in the ecosystem reports, SKB TR-10-01, -02 and -03.

AMF Excavation/operation Temperate
AMF Periglacial Glacial

**Figure 5-11.** Layout for displaying information regarding modelling activities in the assessment model flow charts, AMF. In this example, the full list of linked processes is examined by use of the scrollbar on the right-hand side of the layout.

### 5.3.5 AMF tables

AMF tables corresponding to those reported in Section 7.5 of the SR-Site main report (SKB 2011) are displayed from the “Start menu” in the SR-Site FEP catalogue (Figure 5-1) via the buttons AMF tables “Excavation/operation & Temperate” and “Periglacial & Glacial”. These tables show for each modelling activity the processes included, the modelling codes, notes, reference to sections in the SR-Site Main report where the modelling activity is described and a full reference to the modelling report in SR-Site (see Figure 5-12). The complete AMF table is examined by use of the scrollbar at the right-hand side of the screen. From the AMF tables, it is possible to access the AMF charts via the buttons at the footer of the layout (see Figure 5-12).



SR-Site					
FEP database					
AMF Table Excavation/operation and temperate periods					
Modelling activity in AMF	Included Processes	Code	Note	Section(s) in Main report TR-11-01	Modelling report reference
Buffer and rock temperatures	F01 Radioactive decay	SDEC	Decay and heat generation modelled as exponential expressions fitted to results of detailed calculations.	10.3.4	Hokmark H, Lönnqvist M, Falth B, 2010. THM-issues in repository rock. Thermal, mechanical, thermo-mechanical and hydromechanical evolution of the rock at the Forsmark and Laxemar sites. SKB TR-10-23, Svensk Kärnbränslehantering AB
	F02 Radiation attenuation/heat generation				
	Bu01 Radiation attenuation/heat generation				
	Bu02 Heat transport				
	Ge01 Heat transport				
THM saturation (buffer and backfill)	Bu02 Heat transport	ABAQUS	Decay and heat generation modelled as exponential expressions fitted to results of detailed calculations	10.3.8	Åkesson M, Kristensson O, Borgesson L, Dueck A, Hernelind J, 2010. THM modelling of buffer, backfill and other system components. Critical processes and scenarios. SKB TR-10-11, Svensk Kärnbränslehantering AB
	Bu04 Water uptake and transport for unsaturated conditions				
	Bu03 Water uptake and transport for unsaturated conditions				
Near-field stresses (geosphere)	Ge05 Displacements in intact rock	SDEC		10.2.2 (Excavation/operation) 10.3.5 (Initial temperate)	Hokmark H, Lönnqvist M, Falth B, 2010. THM-issues in repository rock. Thermal, mechanical, thermo-mechanical and hydromechanical evolution of the rock at the Forsmark and Laxemar sites. SKB TR-10-23, Svensk Kärnbränslehantering AB
Reactivation	Ge06 Reactivation - Displacement along existing	SDEC		10.2.2 (Excavation/operation) 10.3.5 (Initial temperate)	Hokmark H, Lönnqvist M, Falth B, 2010. THM-issues in repository rock. Thermal, mechanical, thermo-mechanical and hydromechanical evolution of the rock at the Forsmark and Laxemar sites. SKB TR-10-23, Svensk Kärnbränslehantering AB
Fracturing (spalling)	Ge07 Fracturing	SDEC		10.2.2 (Excavation/operation) 10.3.5 (Initial temperate)	Hokmark H, Lönnqvist M, Falth B, 2010. THM-issues in repository rock. Thermal, mechanical, thermo-mechanical and hydromechanical evolution of the rock at the Forsmark and Laxemar sites. SKB TR-10-23, Svensk Kärnbränslehantering AB
FPI calculations		Matlab	Calculation of the occurrence of Full Perimeter Intersecting fractures in deposition tunnels (see Section 5.2.2 in TR-11-01). Initial state issue.	10.4.5	Munier R, 2010. Full perimeter intersection criteria. Definitions and implementations in SR-Site. SKB TR-10-21, Svensk Kärnbränslehantering AB
<div>AMF Excavation/operation Temperate</div> <div>AMF Periglacial Glacial</div>					

**Figure 5-12.** AMF table as displayed in the SR-Site FEP catalogue. The whole table is examined by use of the scrollbar on the right-hand side of the screen (not shown in the figure).

## 5.4 Find records in the SR-Site FEP catalogue

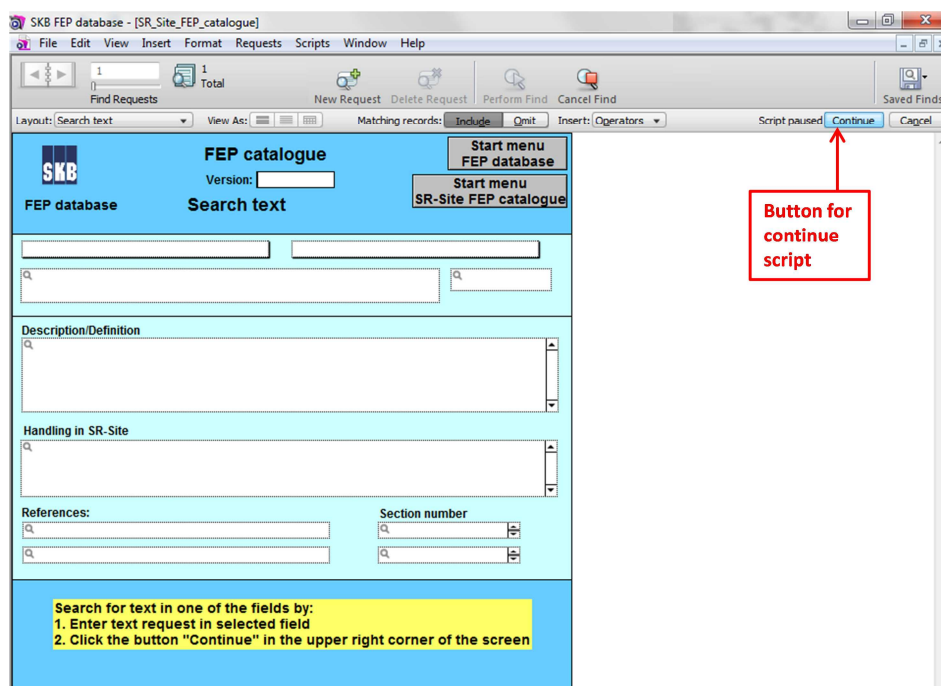
It is possible to do a text search for finding records in the SR-Site catalogue. For this purpose, only the yellow buttons are to be used. The search is activated by the button “Find SR-Site FEPs” in the “Start menu” in the SR-Site FEP catalogue (Figure 5-1). This will activate a script that displays a layout for entering a text request in one of the fields defining the SR-Site FEPs (Figure 5-13). The text request is entered in one of the fields and the script is continued by clicking the button “Continue” in the right upper corner of the screen (marked with an arrow in Figure 5-13).

If no records match the request, a message will appear on the screen stating that no records match the request. Via the button “Modify find” in this message, a new text request can be entered into one of the fields. Choosing the button “Cancel” in the message will cancel the search and once again display the “Start menu” in the SR-Site FEP catalogue (Figure 5-1).

If there are records in the FEP-catalogue that matches the request, these are displayed as a list showing the SR-Site FEP ID and FEP name. The button “show” to the right of the selected FEP will display the full description of the FEP as it appears in the layout “SR-Site FEP record” (Figure 5-3). In order to examine descriptions of other FEPs found in the search, the list of found FEPs must once again be entered via the button “Return to found records” in the layout “SR-Site FEP record” (Figure 5-3).

**Note!** A search will limit the accessible FEP records to those matching the search request. In order to make all FEP records accessible for a new search or for examination of other information in the FEP catalogue as described above, these activities must start from the “Start menu” in the SR-Site FEP catalogue (Figure 5-1) or the “Start menu” in the FEP database (uppermost layout in Figure 3-1), which are accessed via the buttons “Start menu SR-Site FEP catalogue” and “Start menu FEP

database”, respectively. These buttons are available in most of the layouts in the SR-Site FEP catalogue.



**Figure 5-13.** Layout for entering a text request for finding SR-Site FEP records that matches the request. See Figure 5-3 for fields without names.

## 5.5 Navigating in the SR-Site NEA mapping register

The SR-Site NEA mapping register is entered via the box “NEA mapping” (works as a button) in the “Start menu” for the SR-Site version of the FEP database (middle layout in Figure 3-1), or directly from the SR-Site FEP catalogue in the layout “Linked NEA Project FEPs”, as described in Section 5.2 above. Entering from the FEP database Start menu will display a list of all NEA project FEPs in the register (Figure 5-14). Exit from the NEA mapping register is via the button “Start menu FEP database”, which displays the FEP database start menu (uppermost layout in Figure 3-1), irrespective of in which layout in the NEA mapping register the button appears.

In the layout “NEA Project FEP listing”, the NEA project FEPs can be sorted via the buttons “Sort Alphabetical” and “Sort Numerical”. To examine the full list of FEPs, the scrollbar on the right-hand side of the screen (not shown in Figure 5-14) is used. The buttons “Description” will display the NEA Project FEP description, further addressed below. The button “List of NEA FEPs relevant to the KBS-3 repository” will produce a similar NEA Project FEP listing, but this list contains only those FEPs that are judged as relevant for the KBS-3 repository system.

SKB FEP database SR-Site		Start menu FEP database
NEA Mapping		
NEA FEP database Version 2.1		
NEA Project FEP listing		
A 1.01	Backfill characteristics	Description
A 1.02	Backfill evolution	Description
A 1.03	Biological activity	Description
A 1.04	Boundary conditions	Description
A 1.05	Buffer additives	Description
A 1.06	Buffer characteristics	Description
A 1.07	Buffer evolution	Description
A 1.08	Cave ins	Description
A 1.09	Chemical gradients	Description
A 1.10	Chemical interactions	Description
A 1.11	Chemical kinetics	Description
A 1.12	Climate change	Description
A 1.13	Colloids	Description
A 1.14	Complexation by organics	Description
A 1.15	Concrete	Description
A 1.16	Container corrosion products	Description
A 1.17	Container failure (early)	Description
A 1.18	Container failure (long-term)	Description
A 1.19	Container failure (mechanical processes)	Description
A 1.20	Container healing	Description
A 1.21	Containers - partial corrosion	Description
A 1.22	Convection	Description
A 1.23	Correlation	Description
A 1.24	Corrosion	Description
A 1.25	Coupled processes	Description
A 1.26	Criticality	Description
A 1.27	Diffusion	Description
A 1.28	Dispersion	Description
A 1.29	Earthquakes	Description

Sort Alphabetical  
Sort Numerical  
List of NEA FEPs relevant to the KBS-3 repository  
List of NEA FEPs not relevant to the KBS-3 repository

**Figure 5-14.** Start layout in the SR-Site NEA mapping register listing all NEA Project FEPs in the register. The full list is examined by use of the scrollbar on the right-hand side of the screen (not shown in the figure).

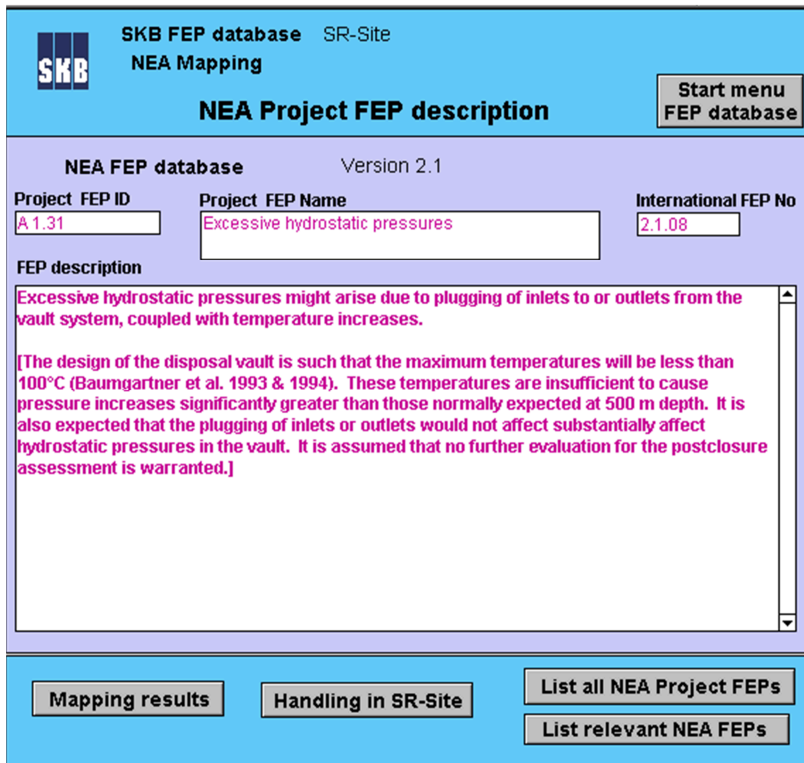
The button “List of NEA FEPs not relevant to the KBS-3 repository” will display a list of those FEPs judged as irrelevant to the KBS-3 repository system together with the motivation for this judgement and the persons responsible for this judgement (Figure 5-15). This layout is also entered directly from the “Start menu” in the SR-Site version of the FEP database (middle layout in Figure 3-1) via the box “Irrelevant NEA FEPs”.

To examine the full list of FEPs, the scrollbar on the right-hand side of the screen is used. To view the full motivation for disregarding the FEP, if not displayed, the scrollbar to the right in the text field is used. The button “Description” will display the NEA Project FEP description.

SKB FEP database SR-Site NEA Mapping			Start menu FEP database
NEA FEP database Version 2.1			
Listing of NEA FEPs not relevant to the KBS-3 repository			
	Reason for not being relevant:	Screened out by:	
A 1.04 Boundary conditions Description	Too general, covered by other NEA project FEPs	Kristina Skagius	
A 1.10 Chemical interactions Description	Too general, covered by other NEA project FEPs	Allan Hedin, Johan Andersson, Kristina Skagius	
A 1.25 Coupled processes Description	Too general, covered by other NEA project FEPs	Allan Hedin, Johan Andersson, Kristina Skagius	
A 1.34 Formation of cracks Description	Too general, covered by other NEA project FEPs	Allan Hedin, Johan Andersson, Kristina Skagius	
A 1.39 Global effects Description	Too general, covered by other NEA project FEPs	Allan Hedin, Johan Andersson, Kristina Skagius	
A 1.46 Incomplete filling of containers Description	Not appropriate for actual canister design (glass filling)	Kristina Skagius	
A 1.48 Intrusion (animal) Description	Not appropriate for the actual repository design (near surface repository)	Allan Hedin, Johan Andersson, Kristina Skagius	
A 1.58 Other waste (other than used fuel) Description	Not appropriate for the actual repository design	Allan Hedin, Johan Andersson, Kristina Skagius	
A 1.78 Stability Description	Too general, covered by other NEA project FEPs	Kristina Skagius	
A 1.81 Temperature effects Description	Too general, covered by other NEA project FEPs	Kristina Skagius	
A 1.82 Temperature rises (unexpected effects) Description	Not appropriate for the actual repository design	Allan Hedin, Johan Andersson, Kristina Skagius	
A 1.83 Time dependence Description	Too general, covered by other NEA project FEPs	Kristina Skagius	
A 2.32 Groundwater composition Description	Too general, covered by other NEA project FEPs	Allan Hedin, Johan Andersson, Kristina Skagius	
A 2.36 Intrusion (magmatic) Description	Not appropriate for actual geological setting	Kristina Skagius	
List of all NEA Project FEPs			List of NEA FEPs relevant to the KBS-3 repository

**Figure 5-15.** Layout displaying a list of all NEA Project FEPs judged as not relevant to the KBS-3 repository system. The full list is examined by use of the scrollbar on the right-hand side of the screen (not shown in the figure).

The layout entered via the button “Description” is shown in Figure 5-16. This is the same layout as is accessed from the SR-Site FEP catalogue via a script activated by the button “show” in the layout “Linked NEA Project FEPs” (see Figure 5-6), but without the script activated. From this layout, a list of all SR-Site FEPs to which the NEA Project FEP is associated is displayed via the button “Mapping results” (Figure 5-17). The button “Handling in SR-Site” displays how the NEA Project FEP is addressed by the different SR-Site FEPs to which it is associated (Figure 5-18). What is shown here, builds on the same information as that shown in the SR-Site FEP catalogue in the layout “Handling linked NEA Project FEPs” (Figure 5-5), but here the information related to each NEA Project FEP is shown, whereas the layout in the SR-Site FEP catalogue provides the information related to each SR-Site FEP.



**SKB FEP database** SR-Site  
**NEA Mapping**

**NEA Project FEP description** [Start menu](#) [FEP database](#)

**NEA FEP database** Version 2.1

Project FEP ID:  Project FEP Name:  International FEP No:

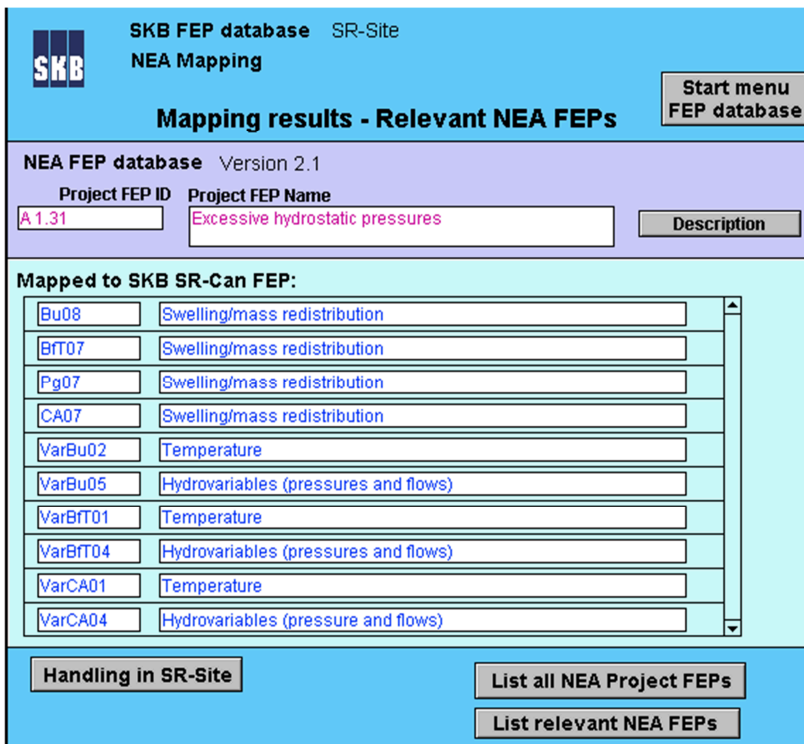
**FEP description**

Excessive hydrostatic pressures might arise due to plugging of inlets to or outlets from the vault system, coupled with temperature increases.

[The design of the disposal vault is such that the maximum temperatures will be less than 100°C (Baumgartner et al. 1993 & 1994). These temperatures are insufficient to cause pressure increases significantly greater than those normally expected at 500 m depth. It is also expected that the plugging of inlets or outlets would not affect substantially affect hydrostatic pressures in the vault. It is assumed that no further evaluation for the postclosure assessment is warranted.]

[Mapping results](#) [Handling in SR-Site](#) [List all NEA Project FEPs](#) [List relevant NEA FEPs](#)

Figure 5-16. Layout in the SR-Site NEA Mapping register that shows NEA Project FEP descriptions.



**SKB FEP database** SR-Site  
**NEA Mapping**

**Mapping results - Relevant NEA FEPs** [Start menu](#) [FEP database](#)

**NEA FEP database** Version 2.1

Project FEP ID:  Project FEP Name:  [Description](#)

**Mapped to SKB SR-Can FEP:**

Bu08	Swelling/mass redistribution
Brt07	Swelling/mass redistribution
Pg07	Swelling/mass redistribution
CA07	Swelling/mass redistribution
VarBu02	Temperature
VarBu05	Hydrovariables (pressures and flows)
VarBrt01	Temperature
VarBrt04	Hydrovariables (pressures and flows)
VarCA01	Temperature
VarCA04	Hydrovariables (pressure and flows)

[Handling in SR-Site](#) [List all NEA Project FEPs](#) [List relevant NEA FEPs](#)

Figure 5-17. Layout in the NEA Mapping register that shows all SR-Site FEPs to which the NEA FEP is associated.

**SKB FEP database SR-Site**  
**NEA Mapping**  
**Handling of NEA FEP in SR-Site**  
 Start menu FEP database

**NEA FEP database Version 2.1**

Project FEP ID	Project FEP Name	Description
A 1.31	Excessive hydrostatic pressures	

SR-Site FEP	Aspects of NEA FEP addressed	Aspects not addressed because	Comments:
<b>Bu08</b> Swelling/mass redistribution	Thermal expansion is considered.		
<b>Bf07</b> Swelling/mass redistribution	Thermal expansion is considered.		
<b>Pg07</b> Swelling/mass redistribution	Pressure gradient is discussed.		
<b>Ca07</b> Swelling/mass redistribution			Not relevant in this context.

Mapping results      List all NEA Project FEPs      List relevant NEA FEPs

**Figure 5-18.** Layout "Handling of NEA FEP in SR-Site" in the NEA Mapping register showing how the NEA FEP is addressed by the different SR-Site FEPs to which it is associated.

## 5.6 Navigating in the SR-Site SR 97 Matrix mapping register

The SR 97 Matrix mapping register is accessed via the box "Matrix mapping" (works as a button) in the Start menu of the SR-Site version of the FEP database (middle layout in Figure 3-1), or directly from the SR-Site FEP catalogue in the layout "Linked SR 97 Matrix interactions" via activating a script. As for the NEA mapping register, entering from the SR-Site FEP database start menu will display a list of all Matrix interactions. The procedures for navigating in the Matrix mapping register from this list of matrix interactions are analogues to those set up for the NEA mapping register, and are, therefore, not further described here.

However, again it should be pointed out that no effort has been made to update the handling of matrix interactions in SR-Site. This means that the handling documented in the SR-Site version of the FEP database is the same as that documented for SR-Can. This is further discussed in the SR-Site FEP report (SKB 2010a).

## 6 The SR-Can version

Navigating in the SR-Can version of the FEP database is for almost all parts identical to the procedures for navigating in the SR-Site version of the database. However, the SR-Can version does not contain the couplings included in the SR-Site version and, therefore, the start menu in the SR-Can FEP catalogue is somewhat different from that in the SR-Site FEP catalogue.

### 6.1 SR-Can FEP catalogue

The SR-Can FEP catalogue is entered via the box "SR-Can FEP catalogue" (works as a button) in the "Start menu" of the SR-Can version of the FEP database (lowermost layout in Figure 3-1), but also



from the “Start menu” of the SR-Site version of the FEP database (middle layout in Figure 3-1). This will display a layout showing the different FEP categories in the SR-Can FEP catalogue (Figure 6-1). To return to this layout when navigating in the SR-Can FEP catalogue, the button “Content categories” is used. This button appears in the footer of the layouts in the SR-Can FEP catalogue.

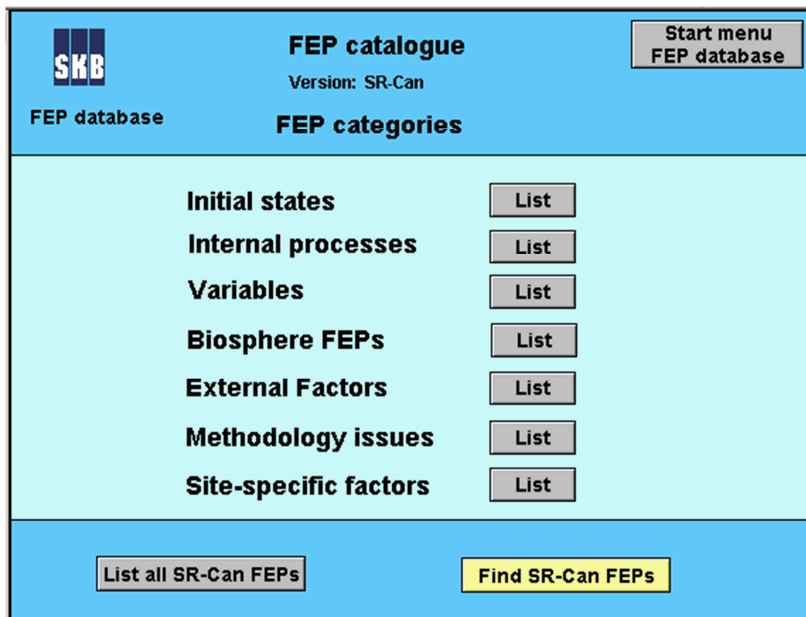


Figure 6-1. Layout FEP categories in the SR-Can FEP catalogue.

## 6.2 The SR 97 process register

The SR-Can version of the FEP database also contains process descriptions, variable definitions and descriptions of initial states as reported in the SR 97 Process report (SKB 1999). This information is accessed via the box “SR 97 process report” (works as a button) in the Start menu of the SR-Can version of the FEP database (lowermost layout in Figure 3-1). This will display the Main menu in the SR 97 process report register (Figure 6-2). From this Main menu, lists of processes and variables are displayed via the different buttons marked with the system components. From the list of processes and variables for the various system components, it is possible to return to the Main menu in the SR 97 Process report register (button SR 97 Main Menu) and to display lists of processes or variables for the other system components.

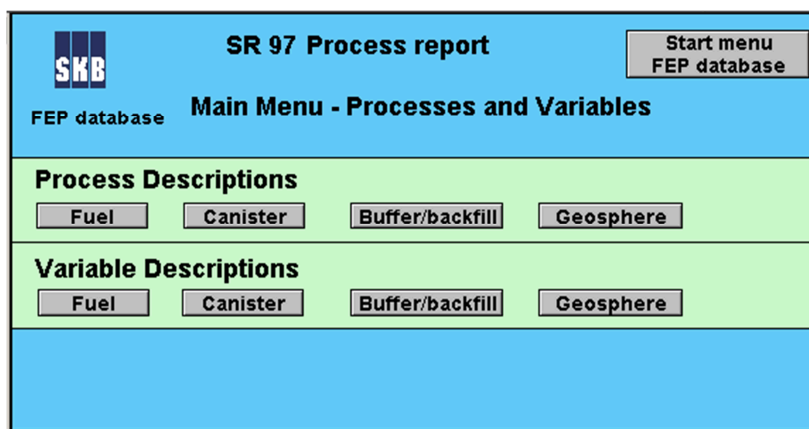
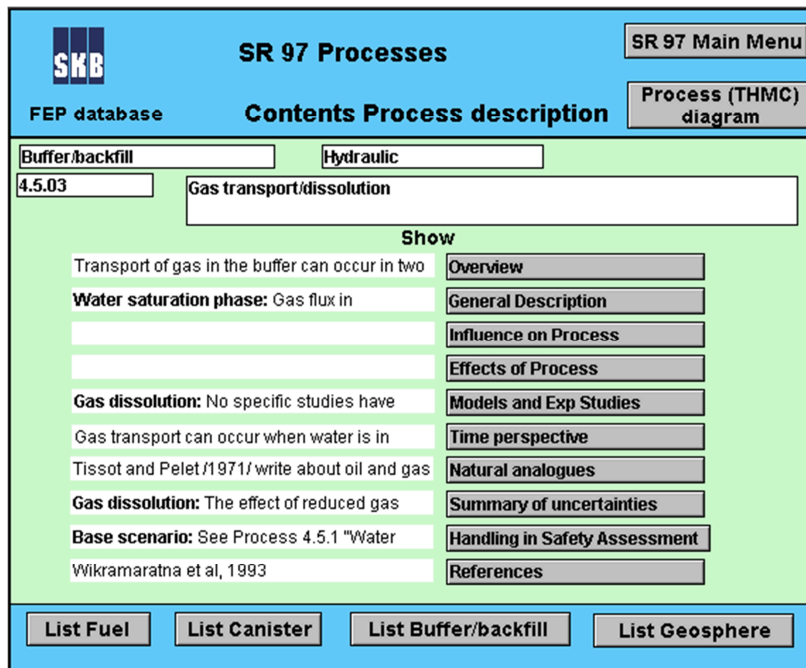


Figure 6-2. Main menu in the SR 97 Process report register.

The description of a process or a variable is accessed via the button “Description” in the lists of processes or variables. If a process description is selected, this will display a “Contents” layout with

buttons for further selection of one of the subsections in the process description (Figure 6-3). These subsections correspond to the subsections in the SR 97 Process report and the text in each subsection is displayed in full via the button named with the heading of the subsection. The text field to the left of the button shows the first lines of the description (Figure 6-3) and an empty field means that there is no text in that particular subsection for the selected process. From this “Contents” layout, it is also possible to display the lists of processes for the various system components and to return to the SR 97 Main menu (Figure 6-2). In addition, the Process (or THMC) diagram for the system component in question, corresponding to the THMC diagram in the SR 97 Process report, can be viewed via the button “Process (THMC) diagram”.



**Figure 6-3.** Layout “Contents Process description” in the SR 97 Process report register for further selection and access to the text under various subheadings in the process description.

The layouts accessed via the subsection buttons is exemplified in Figure 6-4. These layouts contain the text as it appears in the SR 97 Process report under the subheading in question, and the full text can be viewed by using the scrollbar to the right in the text field. Any figures that are associated with the text under the subheading can be viewed via the buttons to the right of the text field that are named with a figure caption. From the figure layout (not shown here), the text layout is once again displayed via a button named with the subsection in question, in this example a button named “General description”. From all text layouts, it is possible to return to the “Contents” layout for the process in question (button “Contents”) and to the SR 97 Main menu (button “SR 97 Main Menu”).

Selecting the button “References” in the “Contents” layout (Figure 6-3) will display a list of all literature references for the process in question.

Selecting a variable description via the button “Description” in the list of variables accessed from the layout “SR 97 Main menu” (Figure 6-2) will display a layout where the definition of the variable and, if present in the SR 97 Process report, a description of the initial state are shown (Figure 6-5). By using the scrollbars to the right in the text fields, the full text can be examined. The buttons to the right of the text fields that are named with a figure caption can be used to view any figures associated with the text. The button “References” below the text fields will display a list of all literature references mentioned in the text.



SKB SR 97 Processes		
FEP database		SR 97 Main Menu
General description		
System component	Process type	Process number
Buffer/backfill	Hydraulic	4.5.03
Process : Gas transport/dissolution		
<b>General description</b> <p><b>Water saturation phase:</b> Gas flux in conjunction with wetting of the buffer and backfill is described in section (Process) 4.5.1. Under these conditions, all gas is expected to be dissolved in the buffer's pore water and transported by diffusion.</p> <p><b>Gas transport from broken canister before saturation:</b> Before the buffer is saturated, water is only expected to be able to get into the canister via vapour-phase diffusion. Hydrogen production from corrosion will therefore be limited and the gas that is formed is expected to be able to leave the buffer. The gas transport resistance in an unsaturated buffer is also considerably lower than in a saturated one.</p> <p><b>Gas from broken canister after saturation:</b></p>		<b>Figures</b> <p>Figure 4-7.</p>

Figure 6-4. Layout "General description" in the SR 97 Process report register exemplifying layouts for examining the text under the various subheadings in the SR 97 process descriptions.

SKB SR 97 Variables	
Fuel/cavity in canister	
FEP database	
Definition/Description	
Variable: Fuel geometry	Variable number: 04
<b>Definition</b> <p>Geometric dimensions of all components of the fuel assembly, such as fuel pellets and Zircaloy cladding. Also includes the detailed geometry, including cracking, of the fuel pellets.</p>	
<b>Description/Initial state</b> <p><b>Structure of the fuel assemblies</b>            Nuclear fuel consists of cylindrical pellets of uranium dioxide. The pellets are 11 mm long and have a diameter of 8 mm. In fuel of the SVEA 96 type, the pellets are stacked in approximately 4-metre-long cladding tubes or "cans" of Zircaloy, a durable zirconium alloy. The cladding tubes are sealed with welds and assembled into fuel assemblies. Each assembly contains 96 cladding tubes. A fuel assembly also contains channel, handle, spacers etc. These parts are made of the nickel alloys Inconel and Incoloy as well as of stainless steel.</p> <p><b>Detailed description of fuel structure</b>            The nuclear fuel consists of centimetre-sized cylindrical pellets of sintered ceramic uranium dioxide. The pellets are stacked in cladding tubes to form fuel rods, which are in turn assembled into fuel assemblies. The fuel assemblies for a Swedish BWR reactor consist of 64 to 100 rods, arranged in a square array of 8x8 or 10x10 rods. These are in turn enclosed by a square fuel channel with a cross-sectional area of</p>	
<b>Figures</b> <p>Figure 2-1.</p>	
<b>References</b>	
<div> <div>List Fuel variables</div> <div>List Buffer/backfill variables</div> <div>List Canister variables</div> <div>List Geosphere variables</div> </div>	

Figure 6-5. Layout "Definition/Description" in the SR 97 Variables register showing the definition of the variable and, if present in the SR 97 Process report, a description of the initial state.

## 7 References

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