



Public Health
England

Protecting and improving the nation's health

Chemical Recovery Guidance and Tools

User Guide

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Chemical Recovery Guidance and Tools

User Guide

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Abstract

This user guide provides an overview of the chemical recovery navigation tool (RNT) and chemical recovery record form (RRF). These tools, developed to complement the existing UK Recovery Handbook for Chemical Incidents, cover the three environments of food production systems, inhabited areas and water environments (including drinking water supplies). The tools guide users through the decision frameworks described in the handbook and record the decisions made, to offer a clear, auditable record of the decision process. This guide gives comprehensive instructions on using the tools, together with examples.

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1 Introduction

The [UK Recovery Handbook for Chemical Incidents](#)* was developed to assist in the decision-making process for the management of contaminated food production systems, inhabited areas and water environments (including drinking water supplies) following a chemical incident (ie accidental spills or release). The handbook was developed by Public Health England (PHE), in collaboration with the Department for Environment, Food and Rural Affairs (Defra) – including the Government Decontamination Service (GDS) – the Food Standards Agency (FSA) and the Department for Transport (Dft), in conjunction with a wide range of expert stakeholders.

The handbook focuses on public health and environmental decontamination and provides guidance and checklists on how to manage the many facets of a chemical incident during the recovery phase. The handbook is aimed at national and local authorities, central government departments and agencies, environmental and health protection experts, emergency services, industry and others who may be involved in the recovery from a chemical incident.

The handbook includes decision-aiding frameworks for each environment (food production systems, inhabited areas and water environments) with decision trees and look-up tables that can be used as part of the decision-making process to develop a recovery strategy following a chemical incident.

The handbook was published in May 2012 and, to further this, a number of interactive tools have been developed to help guide users through the decision frameworks and record decisions made on why a recovery strategy was implemented, to provide a clear, auditable record of the decision process. These tools, the [chemical recovery navigation tool \(RNT\)](#) and [chemical recovery record form \(RRF\)](#), are intended to be used in conjunction with and not replace the handbook, which will still be required at stages where further information, that is not available in the RNT, is required.

This guide describes the chemical recovery record form and the chemical recovery navigation tool for each of the three environments: food production systems, inhabited areas and water environments.

* Wyke-Sanders S, Brooke N, Dobney A, Baker D and Murray V (2012). UK Recovery Handbook for Chemical Incidents. Chilton, Health Protection Agency. Available at <https://www.gov.uk/government/publications/uk-recovery-handbook-for-chemical-incidents-and-associated-publications>.

2 Chemical Recovery Record Form (RRF)

2.1 Overview

The chemical recovery record form (RRF) is a Microsoft Excel spreadsheet designed to allow the user to record decisions made at each stage of the decision process. This allows a clear record to be kept of how processes were followed; where and why recovery options were eliminated; what issues were noted that may influence the final choice of recovery options; and, where appropriate, for supporting information to be included in the record. This should provide a transparent, auditable trail if decisions need to be justified in the future.

The RRF contains six spreadsheet pages:

- a** A form for recording details of the incident
- b** A form for recording decisions about food production systems
- c** A form for recording decisions about inhabited areas
- d** A form for recording drinking water supplies
- e** A summary of all retained management options
- f** A summary of all eliminated management options

The food production systems, inhabited areas and water environments pages are set up to function in similar ways through guiding the user through the six-step decision process; however, the recovery options for the three environments are different. The six-step process is described in the handbook and is mirrored in the chemical recovery navigation tool (RNT).

Use of macros

The RRF uses macros to process the choices made by the user. Macros in Excel are often disabled for security reasons, however, unless permission is given by the user. Therefore for the RRF to function correctly, it is important that the user chooses to allow the use of macros when opening the spreadsheet by selecting “enable content” in the yellow bar that may appear at the top. Enabling the macros allows for full functionality of the RRF, which is essential to activate the various elements across the workbooks.

Incident information form

This form is designed to record the necessary details surrounding an incident and its background, see [Figure 2.1](#). Although it would be beneficial to have as much information in the record as possible, it is recognised that in some circumstances there may be limited information available. Therefore, all fields are optional and the user can continue without providing any information if necessary.

The user is asked to provide:

- a** Contact details
- b** Information about the incident
- c** A brief description of the incident

- d The circumstances/source of the incident – a list of incident types is provided and the user should indicate “yes” or “no” to each type. If applicable, the user may answer “yes” to more than one type

The right-hand side of the page provides a navigation menu containing links to the spreadsheets, each for a different environment (food production systems, inhabited areas or water environments), with a further link to access the handbook.

Figure 2.1: Incident information form

Incident Information Form	
Please provide contact details	
Name	
Date of completing form (dd/mm/yy)	
Role and responsibility in incident (eg RCG Chair)	
Organisation	
Email address	
Other agencies or departments involved in the incident	
Please provide information regarding the incident	
<i>If fields are not applicable, or if answers are not known, please leave blank or enter an approximate date or location</i>	
Incident name	
City/Location	
County	
Postcode	
Date contamination occurred	
Date contamination reported	
Incident status	
Ref No (if applicable)	

Forms for recording information.

Food production systems

Inhabited areas

Water Environment

Chemical Recovery Handbook

Layout of the recording form

The spreadsheets for the three environments can be opened by clicking on the bottom tabs of the workbook, named according to each environment. Alternatively, the spreadsheets can be opened by clicking on the links provided on the right-hand side of the first page of the workbook. The food production systems worksheet is displayed in Figure 2.2.

Figure 2.2: Recovery record form for food production systems

The screenshot shows a Microsoft Excel spreadsheet titled 'Chemical_RRF_blank.xlsx'. It features a decision tree on the left with three steps: 'Choose Food production system', 'Answer decision tree questions about the food production system', and 'Select a Chemical, Physicochemical Properties'. The main table is divided into three columns: 'Recommended', 'Elimination', and 'Justification'. The 'Recommended' column lists various options for food production systems, such as 'Eliminate air intake system at food processing plant' and 'Prevent harvest of crop from contamination'. The 'Elimination' column lists 'Potassium cyanide' and 'Physicochemical Property Form'. The 'Justification' column lists 'Eliminate Options based on the effectiveness'. The table also includes a 'Potential for increased weather exposure' column and an 'Effect' column.

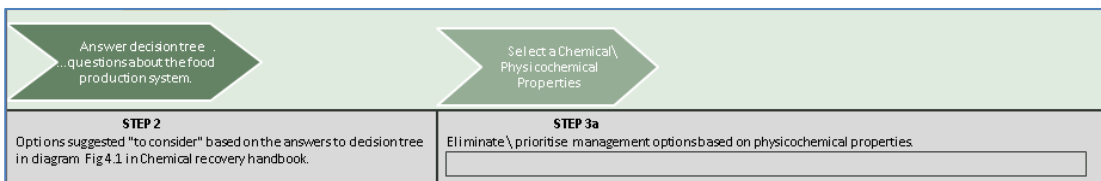
Recommended	Elimination	Justification	Potential for increased weather exposure	Effect
14 [1] Eliminate air intake system at food processing plant			Unlikely	Up to 100%
15 [2] Prevent harvest of crop from contamination			High risk	Up to 100%
16 [3] Restriction on entry of food into the food chain/withdrawal from market			Unlikely	Up to 100%
17 [6] Product recall			Unlikely	Potentially
18 [2] Control of entry into food chain			Unlikely	Up to 100%
19 [3] Use of a FFP order			Unlikely	Up to 100%
20 [3] Precautionary/distance advice			Unlikely	Up to 100%
21 [10] Processing or treatment of food products			Unlikely	Up to 100%
22				
23 Recovery Options				
24 [14] Selection of alternative land use			Unlikely	Up to 100%
25 [16] Washing methods			Moderate risk	Potentially
26 [18] Removal/encapsulation of soil			Moderate risk	Up to 100%
27 [20] Soil washing / irrigation of agricultural land			Moderate risk	Limited eff.
28 [23] Adjust pH of soil			Moderate risk	Potentially
29 [21] Application of potassium fertiliser to enable soil understorey			Moderate risk	Potentially
30 [22] Natural attenuation (with monitoring)			Unlikely	Potentially
31				
32 Foreign affected produce				
33 [11] Temporary storage			Unlikely	Potentially
34 [15] Selection of alternative product use			Unlikely	Up to 100%
35 [17] Washing in of a standing crop			Moderate risk	Potentially
36 [24] Biological degradation/decomposition			Unlikely	Potentially
37 [25] Bioremediation			Unlikely	Up to 100%
38 [26] Burial in situ			High risk	Limited eff.
39 [27] Incineration			Unlikely	Up to 100%
40 [28] Landfill			Unlikely	Up to 100%

In the handbook the analysis of recovery management options is divided into six key steps:

- Step 1** Obtain relevant information regarding the incident
- Step 2** Consult decision trees for food production systems
- Step 3** Determine the effectiveness of recovery options:
 - a physicochemical properties
 - b effectiveness
- Step 4** Review key considerations (social, economic, etc)
- Step 5** Consult recovery option sheets
- Step 6** Compare remaining recovery options

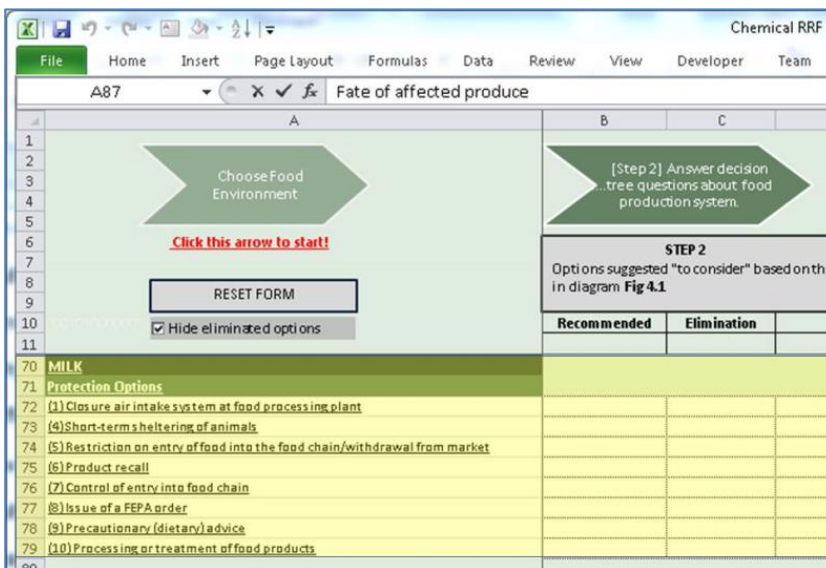
Across the top of the spreadsheet, there are arrows and information boxes that correspond to the steps in the decision process. The direction of the arrows, left to right, indicates the flow of information as the user works through the stages from step 2 to step 6, as shown in Figure 2.3. The arrows and grey boxes on the RRF correspond to the steps in the handbook.

Figure 2.3: Steps and arrows in the RRF



Various recovery options are displayed in the column on the left of the spreadsheet; these are divided into protection options, remediation options and dealing with waste (fate of affected produce). Applicable or relevant recovery options for the selected environment for which the recovery strategy is being developed are listed on the left. In Figure 2.4, the relevant protection options are listed for milk.

Figure 2.4: Recovery options are listed on the left side of the RRF



Navigating through the spreadsheet

The RRF uses pop-up forms to help the user navigate through the decision process. All the stages are clearly numbered and labelled.

The navigation forms can be accessed by clicking on the arrows. To return to a previous step, the user can close the pop-up form on display (if open) and click on an arrow to bring up a previous stage. The arrows which are displayed across the top of the spreadsheets are buttons which bring up pop-up forms.

Resetting the content

While developing the recovery strategy, if for any reason the user wants to remove their progress and return to the beginning, the “reset user input” button allows this, see [Figure 2.5](#). This button removes any information which was added to cells and provides a clean spreadsheet to begin the process.

Figure 2.5: Reset form button



Links to the recovery handbook

While using the form, if any further information is required about any recovery option, this can be easily accessed through direct links to the handbook. There are built-in hyperlinks to specific pages in the handbook or recovery options that can be accessed through selecting the cell with the name of the recovery option in the left panel of the spreadsheet, which in turn opens the relevant recovery option in the handbook.

Progression through the steps

The form is designed to be used in conjunction with the handbook and the chemical RNT. If for any reason the user wants to back track or return to a previous step, this is possible by selecting the arrow for that step along the top panel of the RRF.

To return/jump to a different stage than the one on display, this can be done by clicking on the relevant arrow in the top panel.

2.2 Developing a recovery strategy

The RRF guides the user through the six-step decision process of the handbook by a series of prompts (pop-up windows asking questions) and has been designed as a tool to record and evaluate decisions on the recovery strategy.

Begin using the form

To begin developing a recovery strategy, the user is guided to click the “choose food production system” arrow button, [Figure 2.6](#), denoted in the red font, which is at the top left-hand side of the spreadsheet.

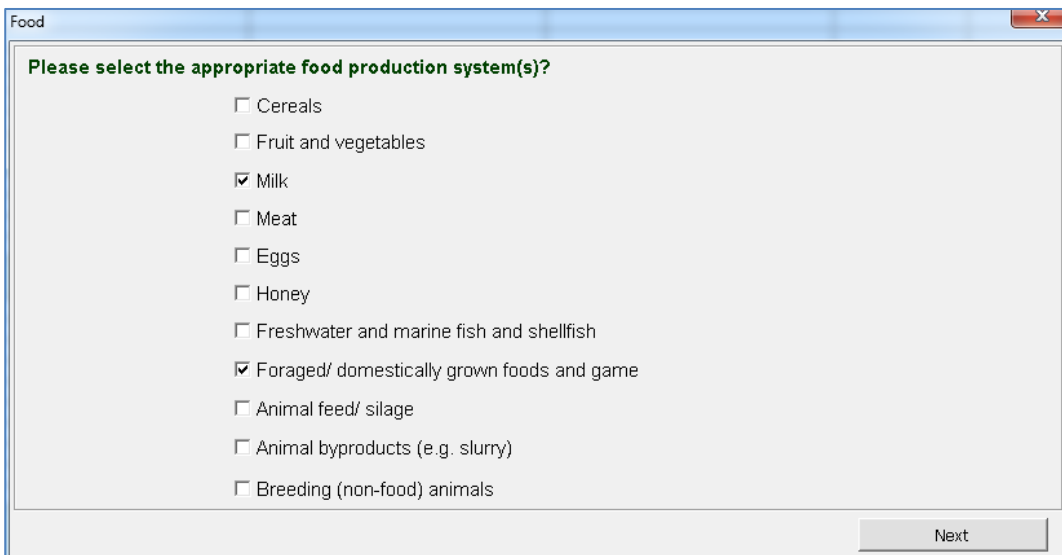
Figure 2.6: Start arrow



Having selected to begin developing a strategy, a pop-up window appears ([Figure 2.7](#)) which guides the user to select the relevant food production system(s). The user can select as many food production systems as needed from the list.

When a food production system is selected, the management options relevant to the system(s) appear on the left column in rows on the spreadsheet. To continue, “next” should be selected, which brings the user on to the next window for step 2.

Figure 2.7: First “pop-up” form in the RRF for food production systems



If required, the user can return to this pop-up window to select or deselect different food types. No data would be lost if the user makes a new selection or removes an existing selection, as the relevant rows are hidden rather than being cleared.

Step 2 Answering decision tree questions

The RRF mirrors the decision trees developed in the handbook and included in the RNT. The RRF lists questions which may be relevant for developing the recovery strategy, which the

user is prompted to answer. Answering the questions that appear in the pop-up window (Figure 2.8) triggers relevant recovery options to be marked as “recommended” in the left column on the spreadsheet.

Figure 2.8: Step 2 pop-up window

Food

Step 2: Answering the questions below from the Decision Tree (see fig 4.1 in the handbook) will help highlight options worth considering (Only the questions which have an easy and clear effect in this way have been listed, others have been omitted).

If the incident involves a chemical plume, has the plume grounded? YES NO Unknown (Only answer this if there is a chemical plume.)

Is monitoring data available? YES NO Unknown

Next

The user is guided to select either “yes”, “no” or “unknown” to answer the questions. The user can continue with the form by answering both as “unknown” if required. Once the questions have been answered, the “next” button should be clicked, which applies changes to the recovery options on the left panel, and begins the next step. Any changes made to the pop-up window are only applied to the worksheet once the user has pressed the “next” button.

Depending on the answers provided in step 2, certain recovery options may be marked as “recommended”, as shown in Figure 2.9. Recommended recovery options will depend on the answers in step 2 and circumstances of the incident. It is important to remember that not all recovery options in the handbook are relevant to each food production system.

Figure 2.9: First column displays which options are recommended (if any)

<p>Click this arrow to start!</p> <p>RESET FORM USER INPUT</p> <p>Hide eliminated options</p>		<p>STEP 2</p> <p>Options suggested "to consider" based on the answers to decision tree in diagram Fig 4.1 in Chemical recovery handbook.</p>		
		Recommended	Elimination	Justification
MILK				
Protection Options				
(1) Closure air intake system at food processing plant		Recommended		
(4) Short-term sheltering of animals		Recommended		
(5) Restriction on entry of food into the food chain/withdrawal from market				
(6) Product recall				
(7) Control of entry into food chain				
(8) Issue of a FEPA order				
(9) Precautionary (dietary) advice				
(10) Processing or treatment of food products				

Eliminating or retaining options

The purpose of the RRF is to record the decisions and justifications for eliminating or retaining certain recovery options. The user is guided to manually eliminate or retain options through pop-up boxes, as shown in Figure 2.10. When a recovery option is included in the left panel of the spreadsheet, the option is given to eliminate or retain that option. To do so, in the elimination column the drop down box (one for each cell) should be used and a choice made

to eliminate or retain that option, as shown in [Figure 2.11](#). The justification reasons should then be saved as text within the “justification” cell on the spreadsheet that corresponds to the particular recovery option. The user can select and mark options as eliminated or retained. Options which are eliminated will then appear as greyed out.

Figure 2.10: Prompt to manually eliminate/retain options

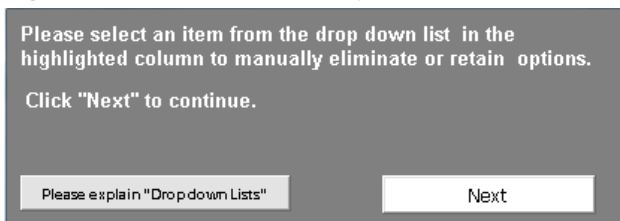


Figure 2.11: Eliminating or retaining options in the form

STEP 2		
Options suggested "to consider" based on the answers to decision tree in diagram Fig 4.1 in Chemical recovery handbook.		
Recommended	Elimination	Justification
Recommended	Eliminate	
Recommended		
	Retain	
	<div style="border: 1px solid black; padding: 2px;"> Eliminate Retain </div>	

Having altered the combinations in the “elimination” column, the user is reminded to complete and fill in any remaining empty justification boxes (highlighted in pink in [Figure 2.12](#)). This is optional and does not have to be completed in full in order to continue to the next stage.

Figure 2.12: Reminder to complete justification boxes

STEP 2		
Options suggested "to consider" based on the answers to decision tree in diagram Fig 4.1 in Chemical recovery handbook.		
Recommended	Elimination	Justification
Recommended		
	Eliminate	Please add reason.

If the user wishes to focus only on the retained recovery options, it is possible to hide the eliminated recovery options. To do so, the user should click on the “hide eliminated options” checkbox (spreadsheet cell A:10, see [Figure 2.13](#)). This does not delete any user input but merely hides the row for the option. There is a risk if it is later decided to cancel the elimination

and “retain” the option, if the user cannot find or see the option, so the status of the checkbox in cell A:10 should be checked to see whether eliminated options are hidden.

Figure 2.13: Checkbox to hide eliminated options

The screenshot shows a spreadsheet interface with a green arrow pointing right containing the text "Choose Food production system". Below the arrow is the instruction "Click this arrow to start!". A button labeled "RESET USER INPUT" is visible. In cell A10, a checkbox labeled "Hide eliminated options" is checked and highlighted in yellow. Below the spreadsheet, a list of options is shown: "CEREALS", "Protection Options", "(1) Closure air intake system at food processing plant", and "(3) Protect harvested crops from contamination".

Step 3 Understanding chemical or physicochemical properties

Understanding and interpreting data on how a chemical behaves in the environment is an important aspect of developing a recovery strategy following a chemical incident. The RRF has information on the physicochemical properties of 16 chemicals (see [Figure 2.14](#) and [Table 1](#)). If a chemical involved in an incident is included in this set, the user is prompted to select that chemical in the drop down box entitled “chemical name”. Once the “apply” button is clicked the selected chemical is saved to the spreadsheet (so that upon re-opening the spreadsheet, the chemical’s name will be displayed in the “step 3a” box). The chemical properties box can be reopened by selecting the “select chemical properties” box above step 3a and the selected chemical will be shown. The user is asked to provide information on the physical form of the contaminant (ie solid, liquid or gas) and is prompted to check the relevant box.

Figure 2.14: Physicochemical properties table

The screenshot shows a dialog box titled "Food" with the following content:

Step 3: Selecting a Chemical or defining physicochemical properties using the form below will help eliminate unnecessary recovery options.

Chemical Name: Kerosene

Physical form: Solid Liquid Gas

Vapour pressure (Pa): 49,995	<input type="checkbox"/> No exact figure	High (Volatile)	<input type="checkbox"/> Rule disabled
Water Solubility (mg/l): 0	<input checked="" type="checkbox"/> No exact figure	Negligible	<input type="checkbox"/> Rule disabled
Persistence (days): 0	<input checked="" type="checkbox"/> No exact figure	Moderately Short Lived	<input type="checkbox"/> Rule disabled
Partition coefficient: 0	<input checked="" type="checkbox"/> No exact figure	Likely to bioaccumulate	<input type="checkbox"/> Rule disabled
Density of liquid: 0.8	<input type="checkbox"/> No exact figure	Form a surface film	<input type="checkbox"/> Rule disabled
Viscosity (mPa x s): 0	<input checked="" type="checkbox"/> No exact figure	Low	<input type="checkbox"/> Rule disabled
Soil sorption: 0	<input checked="" type="checkbox"/> No exact figure	High (likely to be mobile in the soil)	<input type="checkbox"/> Rule disabled
Absorb to porous: Absorbs	<input checked="" type="checkbox"/> No exact figure	Absorbs	<input type="checkbox"/> Rule disabled
Vapour density: 5	<input type="checkbox"/> No exact figure	Stay close to the ground	<input type="checkbox"/> Rule disabled

Buttons: Restore Chemical Defaults, Detailed elimination descriptions, Show prioritisations, Apply, Next

The user is also able to edit and update information in the physicochemical properties table. For example, the “density of liquid” value could be changed to 1.2. This is >1 so it would sink,

which updates the interpretation box accordingly to denote “sinks in water”. Subsequently, on clicking the “apply” button the rule corresponding to “density of liquid” will be applied to the spreadsheet highlighting or greying out recovery options.

To reset a chemical’s values to those provided in the original physicochemical table, the user can click on the “restore chemical defaults” button in the lower left corner of the physicochemical table window.

The user can edit the physicochemical properties given in the RRF and add information if the chemical involved in the incident is not listed. During an incident this information can be provided by relevant public health (eg PHE) or environmental science experts (eg Environment Agency). Depending on the environment affected there is a small difference in the physicochemical properties that are listed in the RRF.

Table 1: Physicochemical properties included in the RRF

Physicochemical property	Environment	Rational for inclusion
Physical form	Food production systems Inhabited areas Water environments	Is the chemical a solid, liquid or gas? This will affect distribution
Vapour pressure (Pa)	Food production systems Inhabited areas Water environments	Measure of how easily a liquid evaporates or gives off vapours (potentially an inhalational risk). Higher volatility would result in a higher vapour pressure
Water solubility (mg/l)	Food production systems Inhabited areas Water environments	Ability of a chemical (gas, liquid or solid) to dissolve in water. Water-soluble materials (eg acids) may be more easily dispersed in water and have a greater potential to pollute water environments (eg groundwater). Equally, many water-insoluble chemicals may be spread by flowing water (eg petrol/crude oil)
Persistence	Food production systems Inhabited areas Water environments	Time for which the released chemical is physically present following release. Persistence is affected by environmental conditions (ie humidity, temperature and natural weathering). This is an important factor to consider when judging when recovery options should be implemented following an incident
Partition coefficient (K_{ow})	Food production systems Inhabited areas Water environments	Indicates the solubility of a chemical and can be used to indicate if a chemical is likely to sorb to soil and sediments
Soil sorption (K_{oc})	Food production systems Inhabited areas	Measures how readily a chemical is adsorbed to organic surfaces in the soil matrix and gives a likely indication of the persistence in soil of a chemical
Vapour density (D vapour)	Food production systems Inhabited areas	Indicates how likely a gas will either stay close to the ground or rise and mix with air
Biological half-life	Food production systems	How long a chemical will persist in animals (eg milk/meat). This information will give an indication of how long recovery options may be effective (eg culling of livestock)
Adsorb to porous surfaces	Inhabited areas	Ability of a chemical to adsorb to porous surfaces (eg concrete) as this may influence the effectiveness of recovery options
Viscosity	Inhabited areas	Viscosity of a chemical determines how easily it flows within an environment, and may influence how easy it is to remove from the environment
Density of liquid	Water environments	Density (specific gravity) of a liquid will affect whether or not the chemical will sink in water or form a surface film on water

For the various physicochemical properties that are listed in the RRF, the measurements are entered in the relevant units for that property, eg water solubility is measured in mg/l. To incorporate the unit into the form, a rule is applied which sorts the figure into a classification category (based on a number of rules). Depending on the value and how this coincides with the rule, the RRF will potentially recommend eliminating or prioritising a recovery option. The button “apply” must be clicked to mark the affected recovery options on the main spreadsheet.

For example, kerosene has a vapour density value of 5, as shown in [Figure 2.15](#). Vapour density indicates how likely a gas will either stay close to the ground ($D > 1.29$) or rise and mix with air ($D < 1.29$). For kerosene the interpretation box displays “stay close to the ground” as kerosene has a vapour density of 5 (*greater than 1.29*), which indicates kerosene fumes will remain close to the ground. This value/classification can then be used to eliminate or retain recovery options.

Figure 2.15: Physicochemical properties table for kerosene

Step 3: Selecting a Chemical or defining physicochemical properties using the form below will help eliminate unnecessary recovery options.

Chemical Name:	Kerosene		
Physical Form:	<input type="checkbox"/> Solid	<input checked="" type="checkbox"/> Liquid	<input type="checkbox"/> Gas
Vapour pressure (Pa):	49,995	<input type="checkbox"/> No exact figure	High (Volatile) <input type="checkbox"/> Rule disabled
Water Solubility (mg/l):	0	<input checked="" type="checkbox"/> No exact figure	Negligible <input type="checkbox"/> Rule disabled
Persistence (days):	0	<input checked="" type="checkbox"/> No exact figure	Moderately Short Lived <input type="checkbox"/> Rule disabled
Partition coefficient:	0	<input checked="" type="checkbox"/> No exact figure	Likely to bioaccumulate <input type="checkbox"/> Rule disabled
Soil sorption:	0	<input checked="" type="checkbox"/> No exact figure	High (likely to be mobile in the soil) <input type="checkbox"/> Rule disabled
Vapour density:	5	<input type="checkbox"/> No exact figure	Stay close to the ground <input type="checkbox"/> Rule disabled
Biological half-life (days):	0	<input checked="" type="checkbox"/> Not applicable	Long <input checked="" type="checkbox"/> Rule disabled

Restore Chemical Defaults Detailed elimination descriptions Show prioritisations Apply

Next

Irregular data

Information and advice on the physicochemical properties in the RRF can be sought from PHE’s Environmental Hazards and Emergencies Department which has access to a range of chemical databases and validated information sources. Care should be taken when searching the internet for this information as often there is no exact figure for a physicochemical property, or no data, or the property is not applicable. If in doubt, please contact your local PHE health protection team or regional centre (www.gov.uk/government/collections/contacts-public-health-england-regions-local-centres-and-emergency).

There are checkboxes within the window to try and help deal with such complexities, as shown, for example, in [Figure 2.16](#) for dioxins. No exact values are provided for the physicochemical properties data (as the data can widely vary). As no data is entered in the numerical cells, all check boxes for “no exact figure”, “no data” and “not applicable” are selected.

For viscosity, the checkbox is marked as “no data” and the interpretation box for viscosity is disabled by the checkbox to the right of the cell labelled “rule disabled”. For vapour density, the checkbox is marked as “not applicable”, no value is shown and the interpretation and rule are disabled.

Figure 2.16: Physicochemical properties for dioxins

Food

Step 3: Selecting a Chemical or defining physicochemical properties using the form below will help eliminate unnecessary recovery options.

Chemical Name: Dioxins

Physical Form: Solid Liquid Gas

Vapour pressure (Pa):	0	<input checked="" type="checkbox"/> No exact figure	Low (non volatile)	<input type="checkbox"/> Rule disabled
Water Solubility (mg/l):	0	<input checked="" type="checkbox"/> No exact figure	Negligible	<input type="checkbox"/> Rule disabled
Persistence (days):	0	<input checked="" type="checkbox"/> No exact figure	Highly Persistent	<input type="checkbox"/> Rule disabled
Partition coefficient:	0	<input checked="" type="checkbox"/> No exact figure	Likely to bioaccumulate	<input type="checkbox"/> Rule disabled
Density of liquid:	0	<input checked="" type="checkbox"/> Not applicable	Sink in water	<input checked="" type="checkbox"/> Rule disabled
Viscosity (mPa x s):	0	<input checked="" type="checkbox"/> No data	High	<input checked="" type="checkbox"/> Rule disabled
Soil sorption:	0	<input checked="" type="checkbox"/> No data	High (likely to be mobile in the soil)	<input checked="" type="checkbox"/> Rule disabled
Absorb to porous:	Absorbs	<input checked="" type="checkbox"/> No data	Absorbs	<input checked="" type="checkbox"/> Rule disabled
Vapour density:	0	<input checked="" type="checkbox"/> Not applicable	Stay close to the ground	<input checked="" type="checkbox"/> Rule disabled

Restore Chemical Defaults Detailed elimination descriptions Show prioritisations

For dioxins, no exact figure is provided for any of the physicochemical properties. However, dioxins fall into certain categories for many properties. The vapour pressure of dioxins is low (non-volatile), water solubility is negligible, and they are highly persistent. The rule category has been selected for the relevant physicochemical properties, but no value has been entered, i.e. the checkbox “rule disabled” is not set. Therefore, the rule has an effect on recovery management options despite no exact value being included in the box.

Manually changing and entering data

If the user discovers a value for a physicochemical property and would like to enter it manually, the “no data” or “no exact figure” checkbox can be unchecked, and the figure then entered manually in the textbox. Unchecking or checking this checkbox will update and change the interpretation box as necessary. The corresponding rule can be enabled/disabled, by checking/unchecking the “rule disabled” checkbox and selecting the “apply” button to affect the recovery management options.

If required, a rule can be manually disabled by selecting the “disable rule” checkbox.

If required, the rule classification and category for a physicochemical property can be changed manually. To do this, an option should be selected from the interpretation boxes and the “apply” boxes then clicked. For example, water solubility has the following interpretations: negligible, potentially and water soluble. Any of these interpretations can be manually selected and applied.

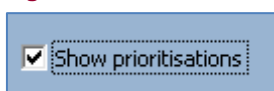
Detailed elimination descriptions

Within the physicochemical properties window, there is an option to select “detailed elimination descriptions” by using a checkbox. Enabling this shows the rule which justifies the elimination of a recovery option. Given the range of rules and properties, there may be more than one rule which justifies the elimination of an option. The number of different rules underpinning the elimination of an option is shown in square brackets after the description of the reason.

Prioritisations checkbox

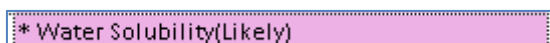
If the user wishes to see any possible prioritised recovery option based on the physicochemical properties, this can be achieved by selecting the “show prioritisations” checkbox (Figure 2.17) within the physicochemical properties box and clicking the “apply” button. Prioritised or recommended options can be overturned by a rule which eliminates recovery options. However, for recovery options that are not eliminated, a priority may be shown on the spreadsheet.

Figure 2.17: Prioritisations checkbox



Some chemicals are well suited to certain recovery options depending on the site and physical form. For example, if a chemical is water soluble then water-based cleaning methods would be deemed appropriate. This is demonstrated in Figure 2.18 from the inhabited areas section: if sodium bromate is selected (which is water soluble), the “show prioritisations” checkbox has been checked and recovery option 9 (*other water-based cleaning methods*) becomes highlighted in pink. The interpretation states “water solubility (likely)” on the spreadsheet.

Figure 2.18: Water solubility interpretation



Further information regarding all of the recovery options can be found in the handbook, as all recovery options listed in the left column of the RRF are hyperlinked to the relevant page in the handbook.

Clear eliminations

A checkbox has been included on the spreadsheet (cell E:11) which enables the user to disable the application of eliminated rules to the management options displayed on the spreadsheet, see Figure 2.19.

Figure 2.19: Eliminations removal



By clicking “apply” on the physicochemical properties box, the “clear elimination” checkbox will be set to unticked so that the rules can be seen. As before, the columns entitled “elimination” and “justification” ask the user to eliminate/retain recovery options, and then to provide justification for doing so.

In the final step an option exists to create a summary of all eliminated options including their justification reason (by step).

The final step of the development of the strategy provides an option to create a summary of all eliminated options including the reason for the exclusion (by step).

The user is then guided to select the type of contamination affecting the system. A drop down arrow appears which guides the user to select “free”, “absorbed”, “inaccessible” or “unknown”, as shown in [Figure 2.23](#).

Figure 2.23: Drop down box to choose description of contamination type

Contamination Type	Effectiveness
Free Absorbed Inaccessible Unknown	

After selecting the contamination type and selecting “next”, the effectiveness rating for these options appears ([Figure 2.24](#)).

Figure 2.24: Effectiveness of chosen contamination type

Contamination Type	Effectiveness
Free	Up to 100% effective
Absorbed	Potentially effective
Inaccessible	
Unknown	

Following that, the user should select “next” which directs them to the elimination column, where they are guided to “eliminate” or “retain” the available options, and to then provide justification for the decision if the option has been excluded.

Step 4 Identify possible constraints

The user is given the opportunity to eliminate options based on [Tables 4.7](#) and [4.8](#) of the handbook. Consideration should be given to factors such as waste, technical factors, social factors, cost, time and overall impact on public health.

As shown in [Figure 2.25](#), the user must choose between “no major constraints”, “eliminate option due to constraints” and “major constraint but consider” through the drop down menu which appears beside each cell. Eliminated options become greyed out to rule them out, with a justification required for the elimination to be entered in free-text field.

Further comments may include an assessment of the risks and an overview of the linked/associated recovery options.

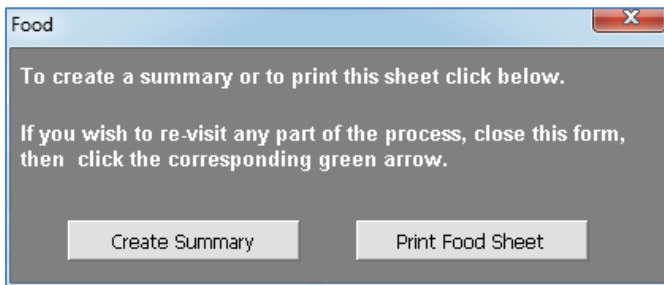
Figure 2.28: Step 6 drop down menu

STEP 6 Compare the remaining recovery options. What options are suitable?	
Suitable?	Comments

Finish: create summary and print sheet

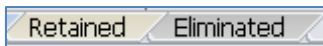
The user is given the option to either “create summary” or “print food/inhabited/water sheet” depending on the environment being examined, as shown in [Figure 2.29](#).

Figure 2.29: Window to summarise or print form contents



The “create summary” button will transfer all the retained options to a new worksheet called “retained” and will copy all eliminated options to a worksheet called “eliminated” ([Figure 2.30](#)) which can be accessed through the tabs on the bottom of the spreadsheet.

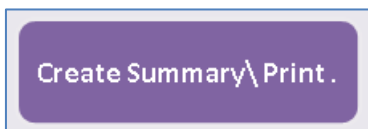
Figure 2.30: Tabs on the worksheet to view retained or eliminated options



The comments from steps 5 and 6 for retained options will be copied, as will the eliminated justifications from steps 2, 3A, 3B and 4.

On each worksheet there is a print button in the top right-hand corner, to allow printing of each sheet as necessary ([Figure 2.31](#)). This button opens the print preview window which enables the printing of the record form.

Figure 2.31: Button to summarise/print contents of the form

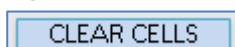


Once the form has been completed, the user can edit more or less any cell within the entire worksheet. If the final form is closed, it is possible to go back to any stage by clicking on the arrows along the top of the spreadsheet.

Cell content

If for any reason the user wishes to clear the recovery options that are listed on the left section of the spreadsheet, there is a button to clear cells (see [Figure 2.32](#)). On selecting this button, the user is asked if they are sure they want to do so, through a pop-up window asking if they want to proceed. By selecting yes, the content along steps 2 to 6 is cleared within the cells.

Figure 2.32: Button to clear cells content

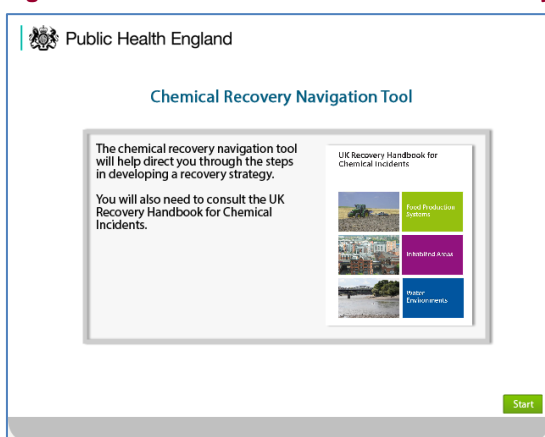


3 Chemical Recovery Navigation Tool (RNT)

3.1 Information about the chemical recovery navigation tool

The chemical recovery navigation tool (RNT) has been designed to guide users through the six-step process used in the handbook for food production systems, inhabited areas or water environments (including drinking water supplies). When the RNT is opened, the title screen (see [Figure 3.1](#)) advises that the user will also need to consult the handbook. **The RNT is designed to support the use of the handbook, not to replace it.** The RNT is intended to be accompanied by users also completing the chemical recovery record form (RRF).

Figure 3.1: Title screen of the chemical recovery navigation tool



The RNT is displayed within a web browser. The user may need to adjust the scale (zoom) to make the display fit their screen. The RNT is interactive, allowing the user to go backwards or forwards through the process by using green navigation buttons at the bottom of the screen. These buttons should be used, rather than the back button within the web browser. Most screens within the RNT include “next” and “back” buttons as well as a button to return to the start. Some screens also present choices to the user. [Sections 3.2](#), [3.3](#) and [3.4](#) give more information about the information presented for the three environments of food production systems, inhabited areas and water environments. The instructions for developing a recovery strategy follow the same principles, with six key steps across all three environments.

3.2 Food production systems

To use the chemical RNT to help develop a recovery strategy for food production systems, the user should click on the food option, as shown in [Figure 3.2](#). Some introductory information is given and the user is guided either to start developing a recovery strategy or to access further background information for chemical recovery of food production systems, as shown in [Figure 3.3](#).

To begin developing a recovery strategy, the user should click on that icon, which leads to explanatory information about the six key steps. The user is then guided to save, print and email the chemical RRF to record and share information on the incident, as shown in [Figure 3.4](#), which is step 1 of the six-step process.

Step 1

It is important to identify and record information regarding the incident (chemical, extent of contamination and physicochemical properties) in the RRF. Expert advice should be sought to assist with determining and interpreting the physicochemical properties of the chemicals.

Figure 3.2: Selecting food production systems in the RNT

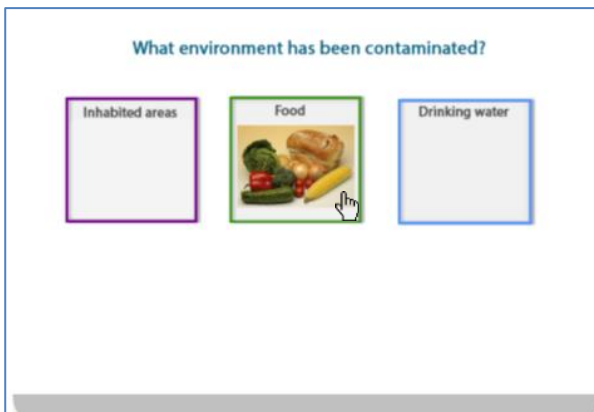


Figure 3.3: Beginning a recovery strategy for food production systems in the RNT

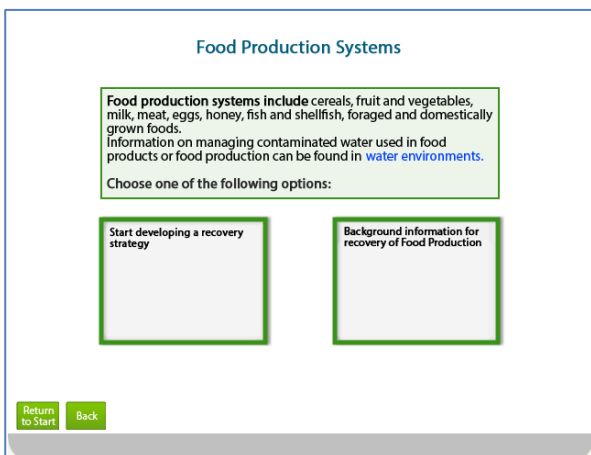
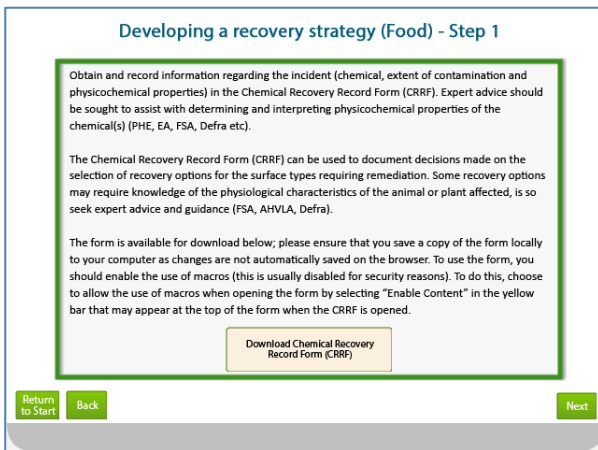


Figure 3.4: Choice of forms for download in the RNT



Step 2

Food production systems considered within the handbook are presented in step 2 (Figure 3.5). The user should select the contaminated food production system by clicking on its name. If more than one system is affected, then each system should be considered in turn. Once the process has been completed for a food production system, the user will be given the option to return and select another system. This is step 2 of the six-step process and should be accompanied by updating the RRF to show which food production system is contaminated.

The user is also guided to consider infrastructure used in food production systems, by being advised to consult the inhabited areas and water environments sections of the handbook if applicable, as shown in Figure 3.6.

Figure 3.5: Choice of food production systems in the RNT

Developing a recovery strategy (Food) - Step 2

Each food production system has a range of recovery options that are potentially applicable. Please consider all recovery options.

Select affected Food Production System:

Cereals	Fruit and vegetables	Milk
Meat	Eggs	Honey
Fish and shellfish	Foraged / domestically grown food and grain	Animal feed / silage
Animal by-products	Breeding (non-food) animals	

Update, save and record contaminated food production system in the Chemical Recovery Record Form.

Return to Start
Back

Figure 3.6: Consideration of alternative environments for food production systems in the RNT

Developing a recovery strategy (Food) - Step 2
(Infrastructure used in Food Production Systems)

Infrastructure and different surface types (eg machinery, warehouses, production lines and farm buildings) are considered in the [Inhabited Areas](#) section of the [recovery handbook](#).

Contaminated drinking water used for food production is considered in [Water Environments](#).



Return to Start
Back
Next

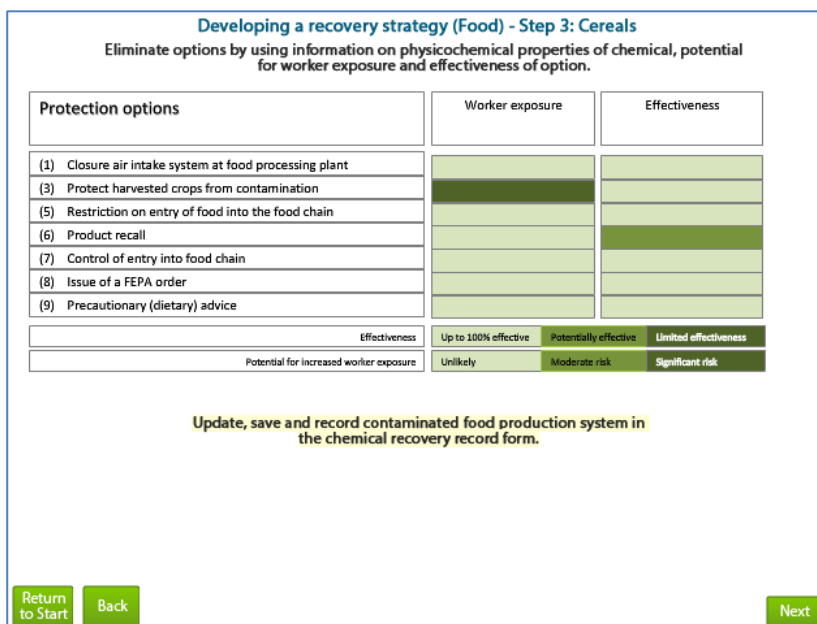
Step 3

Once a food production system has been selected, the user is presented with lists of the recovery management options applicable for that system. This is step 3 of the process. The management options are divided into three sections:

- a** Protection options, those that protect people from exposure to chemical contamination, usually through skin contact, inhalation or ingestion
- b** Restoration options, which reduces the amount of contamination present on a specific surface, target medium or contaminated water source
- c** Fate of affected produce (waste disposal), those that are used for managing contaminated waste

There are three screens presented within step 3, one for each of the categories described above. On each screen the management options for the selected food production system within the given category are listed, with an indication about whether the option is recommended for implementation within each of the given timescales. Figure 3.7 shows the management options available for cereals. The key at the foot of the table indicates the meanings attached to the colour coding used.

Figure 3.7: Example of step 3 in the RNT for food production systems



The same management options should be listed in the RRF. The user is advised to check this, and to answer the step 3 question given in the RRF and then save the RRF before continuing to step 4.

Step 4

As in step 3, there are three screens presented within step 4, one for each of the categories mentioned in step 3 (protection, restoration and fate of affected produce). Figure 3.8 shows the management options available for cereals. The key at the foot of the table indicates the meanings attached to the colour coding used.

Figure 3.8: Example of step 4 in the RNT for food production systems

Developing a recovery strategy (Food) - Step 4: Cereals
Review key considerations and constraints of recovery options.

Restoration options	Public Health	Waste	Social	Technical	Cost	Time
(10) Processing or treatment of food products						
(14) Selection of alternative land use						
(16) Ploughing methods						
(19) Removal / relocation of topsoil						
(20) Soil washing / irrigation of agricultural land						
(21) Treatment of soil / adjust pH of soil						
(22) Application of potassium fertilisers to arable soils and grassland						
(23) Natural attenuation (with monitoring)						

Considerations / constraints	None or minor	Moderate	Significant (key)
Time - when to implement recovery option	No restrictions on time	Weeks to months/years	Hours - Days

Update, save and record contaminated food production system in the chemical recovery record form.

Return to Start Back Next

The user is asked to consider if all the affected food production systems have been considered in the strategy, and if necessary they are advised to return to step 2 if appropriate, as shown in Figure 3.9.

Figure 3.9: Consideration of further food production systems in the RNT

Developing a recovery strategy (Food)

Consider all Food Production Systems that have been affected.
(go back to Step 2 if appropriate)



Yes ➤

No ➤

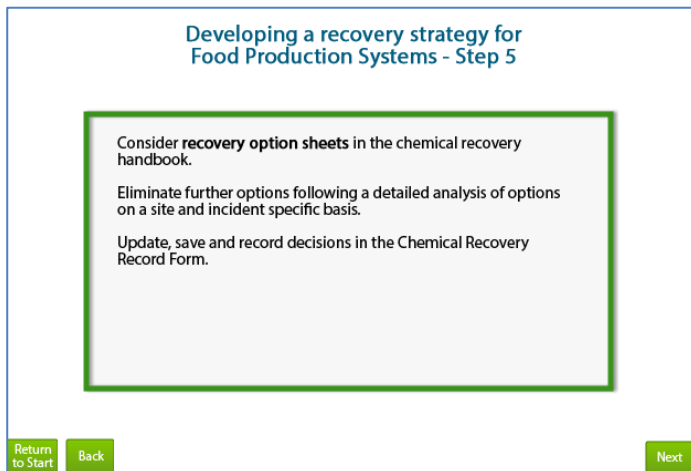
Return to Start Back Next

Step 5

The user is guided to consider the recovery option sheets in the handbook, as shown in Figure 3.10. The elimination of further options is recommended following a detailed analysis of options on a site- and incident-specific basis. The sheets go through 39 recovery options (for food production systems) in further detail, exploring considerations and constraints, including public health impact, effectiveness, feasibility costs, intervention costs, wastes, exposures and other further considerations, where appropriate.

The user is advised to update, save and record the decision in the RRF.

Figure 3.10: Step 5 in the RNT for food production systems

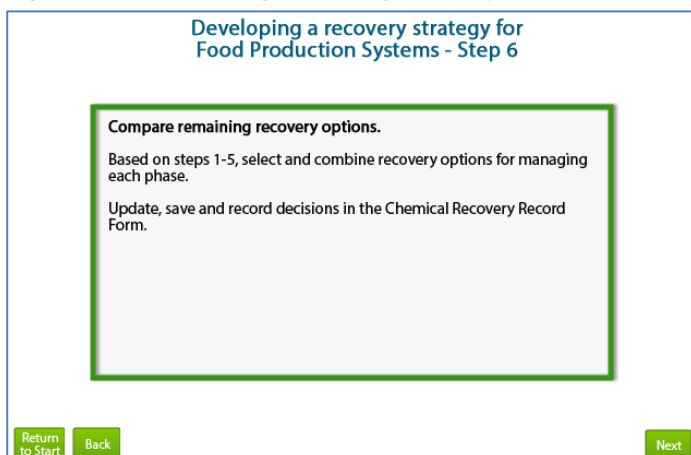


Step 6

Step 6 of the process involves combining any remaining recovery options based on steps 1 to 5. The user is instructed to select and combine recovery options for managing each phase, as shown in [Figure 3.11](#). The user is then guided to update, save and record decisions in the RRF.

The user is guided to monitor the strategy to determine its effectiveness. They are then asked to determine if the recovery strategy was effective by questioning whether the levels are acceptable or not. If yes, the user is encouraged to download, save and record the decisions in the RRF. If not, they are led back to step 2 to develop a new recovery strategy for the affected food production system.

Figure 3.11: Comparing remaining recovery options in the RNT



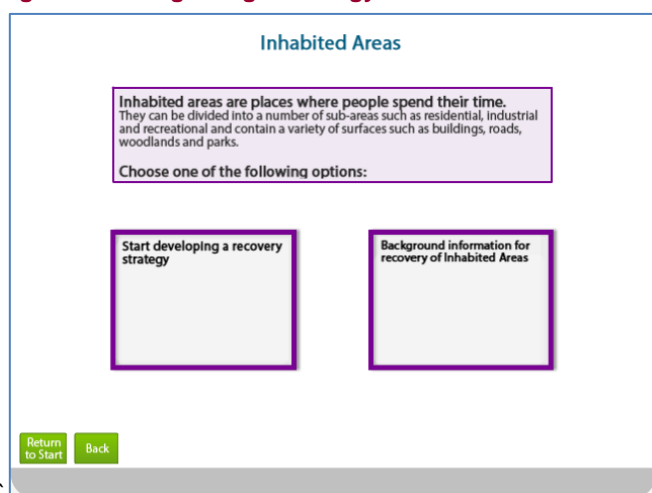
3.3 Inhabited areas

The principles of using the chemical RNT to develop a recovery strategy for inhabited areas are the same across all three environments. The user should click on the inhabited areas option, as shown in [Figure 3.2](#). Some introductory information is given and the user is guided either to start developing a recovery strategy or to access further background information on recovery following a chemical incident of inhabited areas ([Figure 3.12](#)). The user is guided to save, print and email the chemical RRF to record and share information on the incident.

Step 1

It is important to identify and record information regarding the incident (chemical, extent of contamination and physicochemical properties) in the RRF. Expert advice should be sought to assist with determining and interpreting the physicochemical properties of the chemicals.

Figure 3.12: Beginning a strategy for inhabited areas in the RNT



Step 2

A range of screens are presented in step 2 which ask different questions, and require the user to select either “yes” or “no” (see [Table 2](#)). The sequence of questions that are presented to the user are dependent on the previous answers provided and are discussed in further detail in this section. However, depending on the scenario, not all questions may be relevant, and so the user may not be presented with all 11 questions listed in [Table 2](#). The user is also guided to add to, update and save the RRF as necessary in order to complete it with the relevant information.

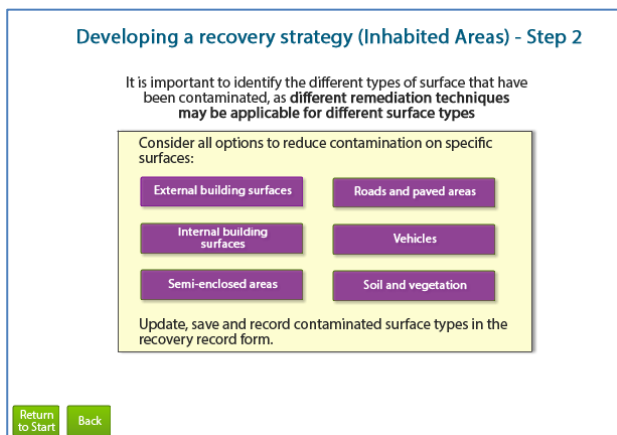
Depending on the answers provided, the user may be asked to consult with experts or to monitor the situation. Users are guided to the chemical recovery handbook for further information if required. Certain recovery options may be highlighted to the user if immediate action is required or the situation seems to be high priority for monitoring and exposure assessment.

The user may be directed to identify different types of surfaces (eg roads and paved areas) that have been contaminated, as different remediation techniques may be applicable for different surface types, as shown in [Figure 3.13](#). The user is encouraged to consider all options to reduce contamination on specific surfaces, and to update, save and record contaminated surface types in the RRF.

Table 2: Questions in step 2 of the RNT for inhabited areas

Number	Question	Possible answer	Rationale
1	Has the area surrounding the incident been contaminated?	Yes / No	Does an exclusion zone need to be implemented? Can the area be cordoned off?
2	Is there potential for contamination of water or the food chain?	Yes / No	Consult food/water aspects of the RNT and handbook
3	Is there a national critical infrastructure facility in the contaminated area that needs to be manned?	Yes / No	Some recovery options are only applicable if a critical facility needs to be manned and can be eliminated if critical infrastructure is not involved
4	Is the contaminated area used for recreation?	Yes / No	
5	Are people occupying contaminated areas (eg sheltering)?	Yes / No	Is there a need to evacuate people?
6	Is the chemical a risk to public health?	Yes / No	Is there really a need to do anything – would natural attenuation be a viable option if the chemical is not a risk to public health?
7	Is it a persistent chemical?	Yes / No	Is there a need to do anything if the chemical is not persistent and will weather or naturally degrade over time?
8	Is there evidence of chemical contamination (eg visible hot spots)?	Yes / No	Is chemical contamination visible? This makes it much easier to clean up
9	Is there a risk of adverse health effects to the population in the area?	Yes / No	
10	Is there a need to reduce contamination levels irrespective of potential exposure (eg social or political pressure)?	Yes / No	Is there a psychosocial aspect that should be considered?
11	Are levels acceptable? Can the affected area be returned to normal?	Yes / No	

Figure 3.13: Choice of surface types



Step 3

In step 3, a screen is presented showing the recovery options relevant for the contaminated surface (robust or sensitive) along with contamination type (free, absorbed or inaccessible). The screen shows the efficacy of a recovery option according to these factors for each sub-environment, eg external building surfaces as shown in Figure 3.14. The key at the foot of the table indicates the meanings attached to the colour coding used. The user is guided to update, save and record contaminated surface types in the RRF.

Figure 3.14: Example of step 3 in the RNT for external building surfaces for inhabited areas

Developing a recovery strategy (Inhabited Areas) - Step 3: External building surfaces
Eliminate options by using information on physicochemical properties of the chemical and contaminated surface

Recovery Option	Efficacy for type of contamination and surface material				
	Surface type		Contamination type		
	Robust	Sensitive	Free	Absorbed	Inaccessible
(6) Reactive gases and vapours					
(7) Reactive liquids (bleaches, detergents, foams, gels)					
(8) Physical decontamination techniques					
(9) Other water based cleaning methods (scrubbing, shampoo)					
(10) Pressure hosing					
(11) Vacuum cleaning					
(12) Surface removal (buildings)					
(13) Fixative/strippable coatings					
(14) Dismantle and disposal of contaminated material					
(18) Natural attenuation (with monitoring)					
(23) Barriers to seal land contamination					
(24) Burial in-situ					

Effectiveness: Up to 100% effective Potentially effective Limited effectiveness

Update, save and record contaminated surface types in the chemical recovery record form.

Return to Start Back Next

Step 4

The user is presented with information showing the various considerations (eg waste, cost and time) required for the recovery options relevant to the surface area which has been selected (see Figure 3.15).

Figure 3.15: Example of step 4 in the RNT for inhabited areas

Developing a recovery strategy (Inhabited Areas) - Step 4: External building surfaces
Review key considerations and constraints of recovery options

Recovery Options Considerations	Public Health	Waste	Social	Technical	Cost	Time
Protection options						
(1) Restrict public access						
(2) Controlled workforce access						
(3) Impose restrictions on transport						
(4) Temporary relocation from residential areas						
(5) Permanent relocation from residential areas						
Considerations						
	None or minor	Moderate	Important (high)			
Time - when to implement recovery option						
	No restrictions on time	Weeks to months/years	Hours - Days			

Update, save and record contaminated surface types in the chemical recovery record form.

Return to Start Back Next

Where the tables shown in the RNT for step 4 indicate that there are constraints, further details about those constraints can be found in Tables 4.7 and 4.8 of the handbook.

Step 5

The user is guided to consider the recovery option data sheets available in the handbook. Elimination of further options is recommended following a detailed analysis of options on a site- and incident-specific basis. The datasheets explore 24 recovery options for inhabited areas in detail.

Step 6

The user is guided to select and combine any remaining recovery options based on steps 1 to 5 to manage each phase of the recovery process. The user is guided to monitor the strategy to determine its effectiveness, by questioning whether the levels are acceptable or not. If yes, the user is encouraged to download, save and record decisions in the RRF. If not, they are led back to step 2 to develop an alternative recovery strategy for the affected inhabited area. Where appropriate, the user is led to save and record decisions in the RRF.

3.4 Water environments (including drinking water)

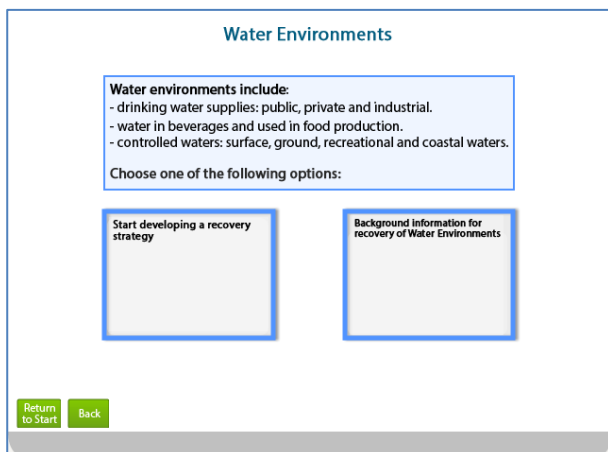
To use the chemical RNT to help develop a recovery strategy for water environments, the user should click on the water environments option, as shown in [Figure 3.2](#). Some introductory information is given and the user is guided either to start developing a recovery strategy or to access further background information on recovery following a chemical incident affecting water environments, see [Figure 3.16](#). The user is guided to save, print and email the chemical RRF to record and share information on the incident.

The user is led to select either a drinking water environment or other water environment. The instructions for developing a strategy for water environments follow the same methodology as for food production systems and inhabited areas.

Step 1

It is important to identify and record information regarding the incident (chemical, extent of contamination and physicochemical properties) in the RRF. Expert advice should be sought to assist with determining and interpreting the physicochemical properties of the chemicals.

Figure 3.16: Start developing a recovery strategy for water environments



Step 2

After selecting the affected water environment, the user is presented with a series of screens containing further information and questions. If more than one drinking water supply has been affected, the user should consider one supply at a time. Once the process has been completed for a drinking water supply, the user can return and select another supply.

The questions that appear are determined by the water environment the user has selected – either drinking water (public or private) or other water environment. The sequence of questions that are presented to the user are dependent on the previous answers provided. The questions that may be asked are listed in [Table 3](#). However, depending on the scenario, not all questions may be relevant, so the user may not see all 14 questions. The user is guided to add to, update and save the RRF as necessary in order to complete it with the relevant information.

Table 3: Drinking water questions

Number	Question
1	Is it suspected that the water environment has been or could be contaminated?
2	Is it possible to safely contain the chemical within the water environment?
3	Are levels acceptable?
4	Is it possible that contamination of the water supply has occurred after water treatment?
5	Is there the potential for existing treatment processes at water treatment works/private water supplies to reduce contamination?
6	Is monitoring data available for drinking water supplied 'at the tap'?
7	Do monitoring results in treated drinking water/water supplied 'at the tap' indicate there is a potential health risk to consumers?
8	For each supply: do early 'estimates' of concentrations in drinking water indicate that levels are likely to lead to a potential health risk to consumers?
9	Is it a public water supply?
10	Does the chemical have a short persistence in the public water supply?
11	Is there a requirement to reduce the concentration in drinking water irrespective of potential health risks?
12	Consider all water environments that have been affected, do you need to check other water environments?
13	Does the chemical have a short persistence in the private water supply?
14	Is adding/modifying or installing water treatment at a private supply an option?

Notes

Public water supplies are those delivered by statutorily appointed water companies to the majority of properties including private houses, commercial and public buildings, industrial premises and other properties.

Private water supplies are defined as any regular supply of water that is not provided by a statutorily appointed water company and where the responsibility for its maintenance and repair lies with the owner or person who uses it.

Further information regarding different aspects of water environments can be found in [Chapter 8](#) of the handbook.

After selecting “other water environment” the user is presented with questions to gather information on the incident, as shown in [Table 4](#).

Table 4: Other water environment questions

Number	Question	Possible answer
1	Is it suspected that the water environment has been or could be contaminated?	Yes / No
2	Is it possible to safely contain the chemical within the water environment?	Yes / No

Steps 3, 4, 5 and 6

The user is presented with information on suitable recovery options and their effectiveness for the type of water environment that is affected, and further information listing associated considerations (eg cost and time). As part of step 5 the user is guided to consider recovery option sheets in the handbook. If appropriate, further options are eliminated following a detailed analysis of options on a site- and incident-specific basis. There are 22 recovery options for water environments, which explore the practical aspects and considerations of implementing the option, including effectiveness, public health impact, feasibility costs, intervention costs, wastes, potential worker exposures and other considerations where appropriate. In the final step (6) the user is guided to select and combine any remaining recovery options based on steps 1–5 to manage each phase of the recovery process.

At all points the user is guided to monitor the recovery strategy to determine its effectiveness, by questioning whether the levels are acceptable or not. If yes, the user is encouraged to download, save and record decisions in the RRF. If not, they are led back to step 2 to develop an alternative recovery strategy for the affected environment.