

Radiological Dose Assessment Tool for human and non-human species from multiple discharges to the Scottish Sewer Network

Initial Guidance Document

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Introduction & Scope

This tool has been created by the University of Stirling under contract to SEPA. It is based on the approach of the Environment Agency's Initial Radiological Assessment Tool (Ref 1) and also includes dose assessment to non-human species. It allows the user to select the discharge profile and will calculate doses to a range of groups based on the profiles selected.

As a screening assessment tool it is inherently conservative and will overestimate the doses to the groups involved. The User can modify the input parameters of discharge rate, discharge pathway (burn, river, coastal), flow rate (burn, river), raw sewage flow rate and coastal exchange rate. A selection of default parameters is included for a number of waste-water treatment works and selected estuaries across Scotland. These will be kept under review and updated periodically.

The tool allows a multiple discharge assessment to be undertaken for a single sewage treatment plant. This allows a single-site application to be undertaken with assessments made based on assessment of multiple discharge points from separate laboratories or treatment points. The only caveat with this is that all discharges must go to the same sewage treatment plant.

SEPA will accept comments and queries on the tool and user guide document, however these will only be reviewed periodically and updates will be posted on the SEPA website if required. SEPA will not provide direct support for an application or undertake dose assessments on your behalf. Feedback on the tool can be submitted to the email address on the front cover, however this is purely to assist periodic improvements.

This tool is provided openly for use by the non-nuclear user community to provide a common assessment framework to assist with the dose assessment requirements of application. Whilst it is provided freely, there are a series of conditions on its use and an exclusion of liability.

Conditions on Use & Exclusion of Liability

1. SEPA provides this tool freely and in good faith, it is created and checked for computer viruses prior to upload into the SEPA website or transmission through email. However, it is the responsibility of the User to check the download for viruses and to ensure the safe use on the spreadsheet.
2. SEPA makes no guarantee for the calculated doses or acceptance of the assessment with your application.
3. Whilst all reasonable effort has been made to ensure that the data is up to date, complete and accurate for the intended purpose, no warranty is given by SEPA in this regard. SEPA will not be responsible of the information supplied is misinterpreted or misused by the User
4. The Tool & Guidance note remain the intellectual property of the appropriate party.
5. The User accepts all risks from using this tool. SEPA will not accept any claim of damage relating to use of the tool in respect to damage to property/individuals or impact on an application. Specific guidance on

your application is available from your local SEPA inspector. SEPA inspectors will not provide any support to any assessments made using the tool.

Spreadsheet tabs

The numeric list below refers to the individual worksheet tabs within the workbook. It is recommended that the user is familiar with the layout prior to undertaking an assessment.

1. *Read Me: Guidance notes on what cell colouring means – i.e. data entry, results etc.*
2. *Assessment Details: Input sheet for application details and selection of assessment pathways.*
3. *Release to Sewer Details: Input radionuclide discharge in Bq per year*
4. *Summary Cumulative doses: Output sheet containing breakdown of dose per nuclide per group*
5. *Summary Cumulative doses Wildlife: Output sheet containing breakdown of dose rate per nuclide to river wildlife and estuary wildlife. Worst affected organisms are detailed.*
6. *Total Doses*
7. *Worker: Output sheet containing dose per nuclide to sewage treatment plant worker for external, inadvertent and inhalation dose, then total dose.*
8. *Farming Family: Output sheet containing dose per nuclide to farming family for food consumption, external, inadvertent and inhalation dose, then total dose.*
9. *Child playing in burn: Output sheet containing dose per nuclide to a child playing in a burn for external, inadvertent and inhalation dose, then total dose.*
10. *Angler: Output sheet containing dose per nuclide to River Angler for fish consumption, external, water ingestion dose, then total dose.*
11. *Irrigated Food Consumer: Output sheet containing dose per nuclide to Irrigated Food Consumer for food consumption*
12. *Fisherman: Output sheet containing dose per nuclide to Fisherman (Coastal) for external, fish consumption and total dose.*
13. *River Wildlife: Output sheet containing dose rate per nuclide to the worst affected organism in micrograys per hour.*
14. *Estuary Wildlife: Output sheet containing dose rate per nuclide to the worst affected organism in micrograys per hour.*

Default Data

STW	Postcode	average burn/river flow rate (m ³ /s)	average raw sewage flow rate (m ³ /day)	average coastal/estuary exchange rate (m ³ /s)
Default value	NA		60	
User defined	NA		0	
Dalmuir	G81 4SA	49.16	326250	
Dalmarnock	G40 4HW	49.16	225000	
Daldowie	G71 7RX	49.16	159600	
Falkirk	FK2 7XP	5	42600	
Allanfearn	IV2 7HX	-		3600
East Calder	EH53 0BB	4.71	39000	
Galashiels	TD1 3HJ	43.5	12919.5	
Hatton	DD11 2PJ	-	107100	4300
Inverclyde	PA19 1BB	-	62149.5	450
Lanark	ML11 9EH	28.33	11550	
Meadowhead	KA11 5AP	6.168	128673	
Nigg	AB12 3LT	-	91500	4100
Ormiston	EH35 5HW	0.32	2527.5	
Paisley	PA3 4HP	6.7	119997	
Persely	AB22 8AQ	21.47	17400	
Perth	PH2 8QJ	178	20470	
Philipshill	G76 9HS	0.5	29160	
Seafield (Blackburn)	EH47 7AH	1	10050	
Shieldhall	G51 4BZ	49.16	409500	
Shotts	ML7 5BS	0.25	4954.5	
St Andrews	KY16 8PN	-	11793	3500
Stirling	FK7 7SS	57	39150	
Troqueer	DG2 7HW	28.108	14256	

Guidance on data entry

Guidance is provided in the 'Read me' worksheet, however it is reproduced with additional detail in this section.

1. The spreadsheet is colour coded as follows:

	Row and column headings
	Data entry by user
	Data provided in spreadsheet
	Results and interim calculations
	Totals
	Worst doses / Remove site button

2. Assessment Details - Enter the relevant data on this sheet. You should answer the questions relating to the route of the treated effluent as this will ensure that doses are only calculated for the appropriate population groups. You may enter the average brook flow rate, river flow rate, raw sewage flow rate and estuary/coastal water exchange rate. Default values are provided if the information is not available.

Save Path	Insert Full Filepath and end save path with a \			
Name of sewage works	v17			
SEPA Reference Number	x			
Please select preferred units for dose results	mSv/y			
Where does effluent discharge from STW go?:				
To a burn?	Yes			
To a river direct from STW or via a burn?	Yes			
To estuary/coast direct from STW or via a burn or river?	Yes			

Save Path: Cut and paste file pathname into this cell to enable the automatic save function. This must end with a backward slash. For example: "U:\My Documents \"

Name of Sewage Works: Free text field

SEPA Reference Number: Free text to enter application or licence number

Preferred units for dose results: Select from mSv/y or microSv/y

Where does effluent discharge from STW go?: Select discharge pathways to enable dose calculation to each group. Most discharges in Scotland go directly to river or to the coast.

Data entry:					
Average burn flow rate		0.1	m ³ /s		
Please state your reasons:					
Average river flow rate		49.16	m ³ /s		
Please state your reasons:					
Sewage works		St Andrews			
Average raw sewage flow rate		11793	m ³ /day		
User defined Average raw sewage flow rate		0	m ³ /day		
Please state your reasons:					
Average coastal/estuary exchange rate		3500	m ³ /s		
User defined Average coastal/estuary exchange rate		30	m ³ /s		
Please state your reasons:					

Sewage Works: From drop down list to enable autopopulation of STW flow data. If STW is not available, this information will need to be sourced and then entered manually. Free text fields are present to enable justification of data entered if required.

4. Release to Sewer Details - MRT.17 has changed it's layout to present a clearer presentation. In this tab you will be able to add new permits, remove permits, input discharge at limits for each permit and to calculate doses. Enter the limits for each radionuclide for each sewer permit. With the use of the "ADD NEW SITE" and "REMOVE SITE" buttons you can include as many permit sites as needed. You may need to select surrogate radionuclides or use the other alpha and other beta gamma categories.

Release to Sewer					
	Valid				
Add new permit					
Remove permit					
Calculate Doses	PERMIT No.				
Radionuclide	Discharge at Limits	Cumulative Discharge at Limits			
	Bq/y	Bq/y			
Tritium		0.00E+00			
Tritium (Organically Bound)		0.00E+00			
Carbon-11		0.00E+00			

5. Release to Sewer Details- After introducing the relevant data you will need to use of the "CALCULATE DOSES" button to process the doses calculations. The Assessment can take around 60 seconds depending on the number of calculation steps involved. Please be patient!

6. Worker dose, farming family dose, child in brook dose, angler dose, irrig food dose and fisherman dose - The dose contribution from each exposure pathway for these population groups are shown.

7. Final report - In the final report MRT.17 will present the Assessment details, the release to sewer details, summary cumulative doses. Summary cumulative doses for wildlife and total doses in a printing layout. In this report only radionuclides with data in the Release to Sewer Details section will be presented.

8. Printing - A new feature in MRT.17 allow the user to print the final assessment. In the Assessment Details tab you will find a Print button in cell C2. This will call for the document to be printed in an A4 layout. In Cel F2 you can type the number of copies you wish to print.

References/Further Reading

1. Initial radiological assessment methodology – part 2 methods and input data, Environment Agency, Science Report: SC030162/SR2
2. Parameter values used in coastal dispersion modelling for radiological assessments, Environment Agency Report: SC060080/R3
3. D-ERICA: An INTEGRATED APPROACH to the assessment and management of environmental risks from ionising radiation - Description of purpose, methodology and application