



# HAZRUNOFF

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## **Hazard and Risk Prioritisation and Assessment**



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# Aims

- Define the concepts of Hazard and Risk
- Describe risk assessment process
  - Source-Pathway-Receptor
- Identify how hazards and risks may be prioritised
- Present Hazrunoff hazard prioritisation approach
- Present Hazrunoff Risk assessment tool



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# Key Definitions

## *Hazard*

*“Any source of potential damage, harm or adverse effects”*

hazard is an inherent property it cannot be modified.

## *Risk*

*“The chance or probability that an adverse effect will occur”*

A situation involving exposure to danger

Source Oxford English Dictionary



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# Risk Assessment

Process by which **Risk(s)** are characterized.

- can be proactive (planning) and reactive (response).
- vital to incident management.
- can relate to both acute (immediate) and chronic (longer term) effects.

Mathematically it can be expressed as:

$$\text{RISK}^* = \text{Severity of Hazard (consequence)} \times \text{Probability of Exposure (Likelihood)}$$

\*Risk also incorporates the extent of the effect and numbers affected.  
Also influenced by perception



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# Source-pathway-receptor approach

- a source (Hazard) e.g. chemicals,
- a receptor (e.g. people, ecological) that may be affected by the chemicals
- a pathway for the chemical hazard to reach the receptor.

**All 3 must be present to represent a risk.**



Once viable S-P-R Linkages have been identified risks can then be assessed either by quantitative or qualitative judgement of severity and likelihood of exposure



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# Risk Management

Mitigate or control risk to a level deemed acceptable. Achieved by:

- Breaking S-P-R linkages:
- Reducing likelihood of an event:
- Reducing severity of an event:

Where multiple hazards are identified it is not always possible to manage them all at once.

In such cases it is often useful to undertake **prioritisation** process enabling those hazards that pose the highest relative risk to be addressed first.



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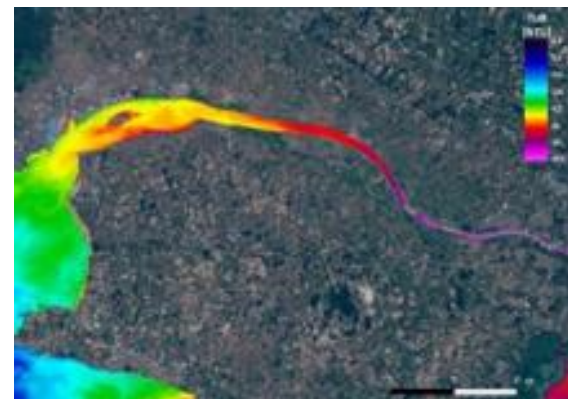
# Hazrunoff Prioritisation Framework

Many coastal areas pose risks from former infrastructure such as landfills and industrial plant

Natural processes such as coastal erosion and flooding, can increase the potential for contaminants to impact health and the environment.

Not possible to provide contingencies for every eventuality.

Framework to prioritise chemical hazards, helping to focus resources on key pollutants



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# An Illustration



© BBC

## Huge sand dune designed to prevent major gas terminal falling into sea

In a UK first, 10,000 cubic metres of sand is being pumped every hour to create a 6km (3.7 mile) sand barrier to prevent Bacton gas terminal, which supplies a third of the UK's gas, from tumbling over the edge of a cliff into the sea.

It's hoped it will also save the coastline, as well as the villages nearby.

🕒 18 Jul 2019

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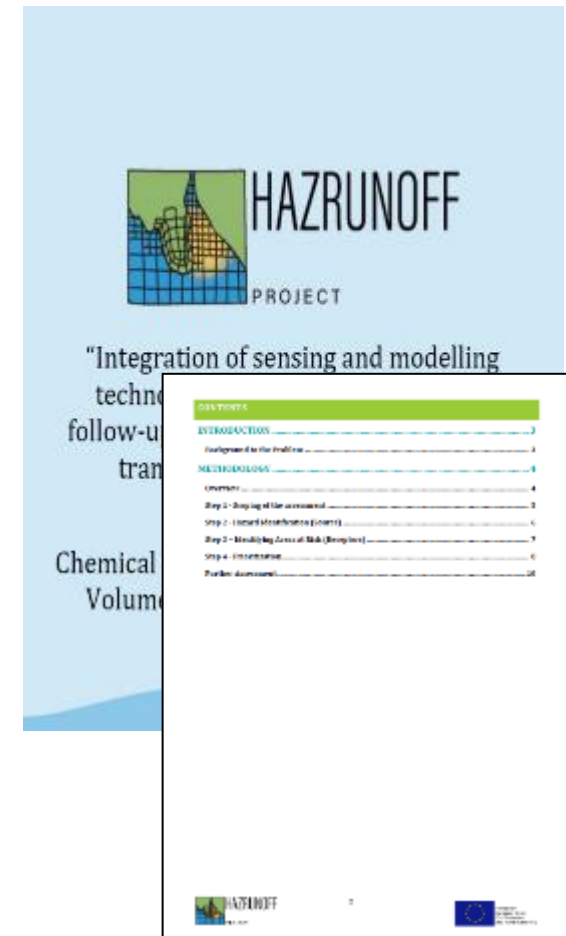


# An approach comprising two main elements

## 1. Desk based methodology to define:

- **Scope** – Temporal and geographical boundaries
- **Source** - key current and historical coastal activities / infrastructure:
- **Pathway** - Incorporating behaviour of pollutants with geological and hydrogeological \ hydrological factors
- **Receptor** – incorporating health, socio/economic and ecological factors

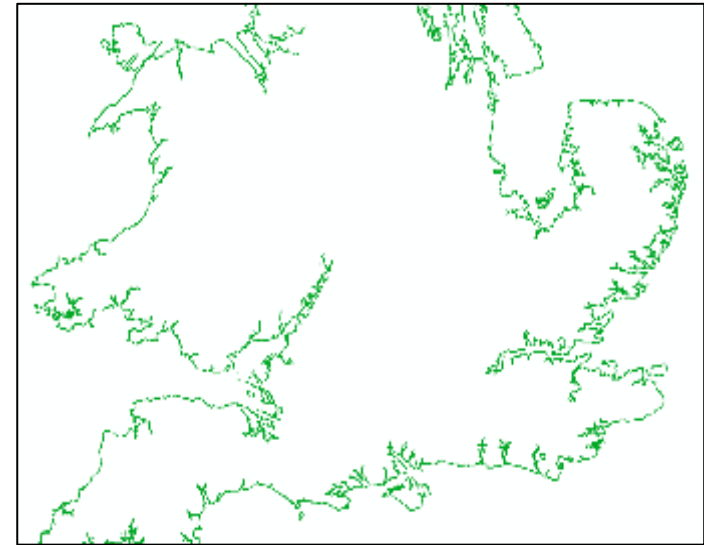
## 2. Database of key pollutants associated with industrial processes.



<http://www.hazrunoff.eu/planning-training-and-exercising-for-response/>

# Scoping – Where are we looking and why?

- Establishment of boundaries for proposed study area and time-frame for data searches.
- Determined by the assessor based upon the underlying objectives. No defined limits.
- Coastal erosion maps, flood zones, 5m contours are helpful indicators.
- Recommended to scope the area to a manageable size and if necessary use multiple assessments for large areas.



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# Source – Pathway - Receptor

Past and current industrial infrastructure.

**Human Health** - populations, amenities

**Socio-economic** – transport, industry,  
agriculture / aquaculture

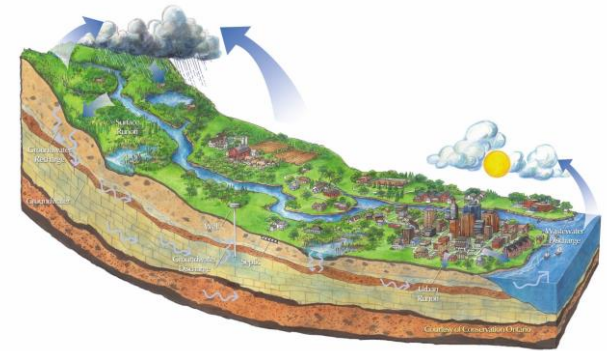
**Environmental** – rivers, aquifers

**Ecological** - habitats / species,

Determined from current and historical  
maps as well as records from regulatory  
bodies.

Tool can help identify pathways

No linkage = no risk



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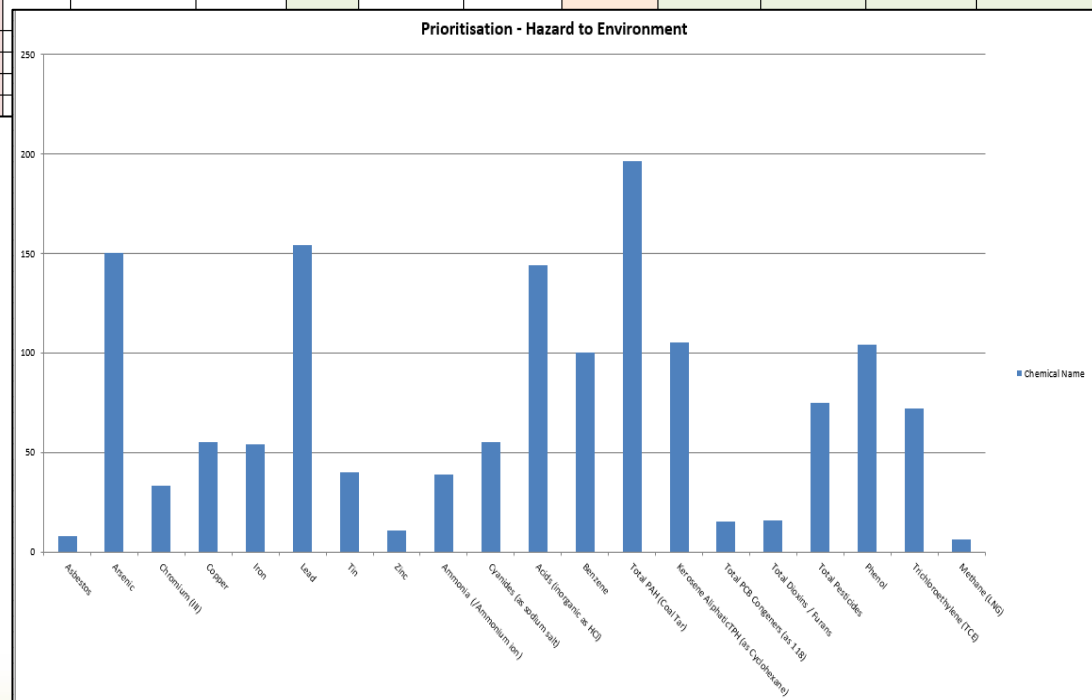
# Prioritisation Tool

Entry	Chemical Name	CAS No	Physical State	Behaviour	Acute 0-4	Chronic 0 or 4	Health Score	Aquatic Toxicity 0-4	Bioconcentration 0-4	Persistence 0-4	Eco Score	Flammability 0-3	Reactivity 0-3	Flammable / Reactive Hazard	Total Score (Eco)	Behaviour Score (1-4)	Reactivity Score (1 or 0)	Weighting (Optional)
1	Asbestos	1332-21-4	S	S	0	4	4	0	0	4	4	0	0	0	8	4	0	1
2	Arsenic	7440-38-2	S	S	2	4	6	2	0	4	6	0	0	0	150	4	0	15
3	Chromium (III)	7440-47-3	S	S	2	0	2	3	0	4	7	0	0	0	33	4	0	3
4	Copper	7440-50-8	S	S	1	0	1	3	0	4	7	0	0	0	55	4	0	5
5	Iron	7439-89-6	S	S	1	0	1	1	0	4	5	0	1	0	54	4	0	6
6	Lead	7439-92-1	S	S	2	4	6	3	0	4	7	0	0	0	154	4	0	14
7	Tin	7440-31-5	S	S	2	0	2	0	0	4	4	0	0	0	40	4	0	5
8	Zinc	7440-66-6	S	S	2	0	2	3	0	3	6	0	2	R	11	4	1	1
9	Ammonia (/Ammonium ion)	7664-41-7	L	E	4	0	4	2	0	1	3	1	0	0	39	0	0	13
10	Cyanides (as sodium salt)	143-33-9	S	E	4	0	4	4	0	1	5	0	0	0	55	0	0	11
11	Acids (Inorganic as HCl)	7647-01-0	L	D	4	0	4	4	0	0	4	0	3	R	144	3	1	18
12	Benzene	71-43-2	L	E	4	4	8	2	1	1	4	3	0	F	100	0	1	20
13	Total PAH (Coal Tar)	NA	L	S	2	4	6	4	3	2	9	2	0	F	196	4	1	14
14	Kerosene AliphaticTPH (as Cyclohexane)	110-82-7	L	E	1	0	1	3	3	0	6	3	0	F	105	0	1	15
15	Total PCB Congeners (as 118)	1336-36-3	L	S	0	4	4											
16	Total Dioxins / Furans	NA	S	S	0	4	4											
17	Total Pesticides	NA	S/L	S	4	4	8											
18	Phenol	108-95-2	S	D	4	0	4											
19	Trichloroethylene (TCE)	79-01-6	L	S	2	4	6											

Automated worksheets produce health and ecological prioritisations.

Can apply user defined weightings e.g. frequency of pollutant sources.

Displays results graphically for easy review



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# Using the Results

## Detailed risk assessments

- Inform fate and transport models
- Inform monitoring programmes
- Inform chemical data sheets



## Develop contingency plans

- Develop Exercises and training



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# Rapid risk assessment of Data

During an incident responders often have to evaluate large amounts of data.



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- Quickly process and display monitoring data.
- Provide an initial assessment of results against health and / or ecological standards.
- Estimate the significance of pollution – statistical analysis.
- How?

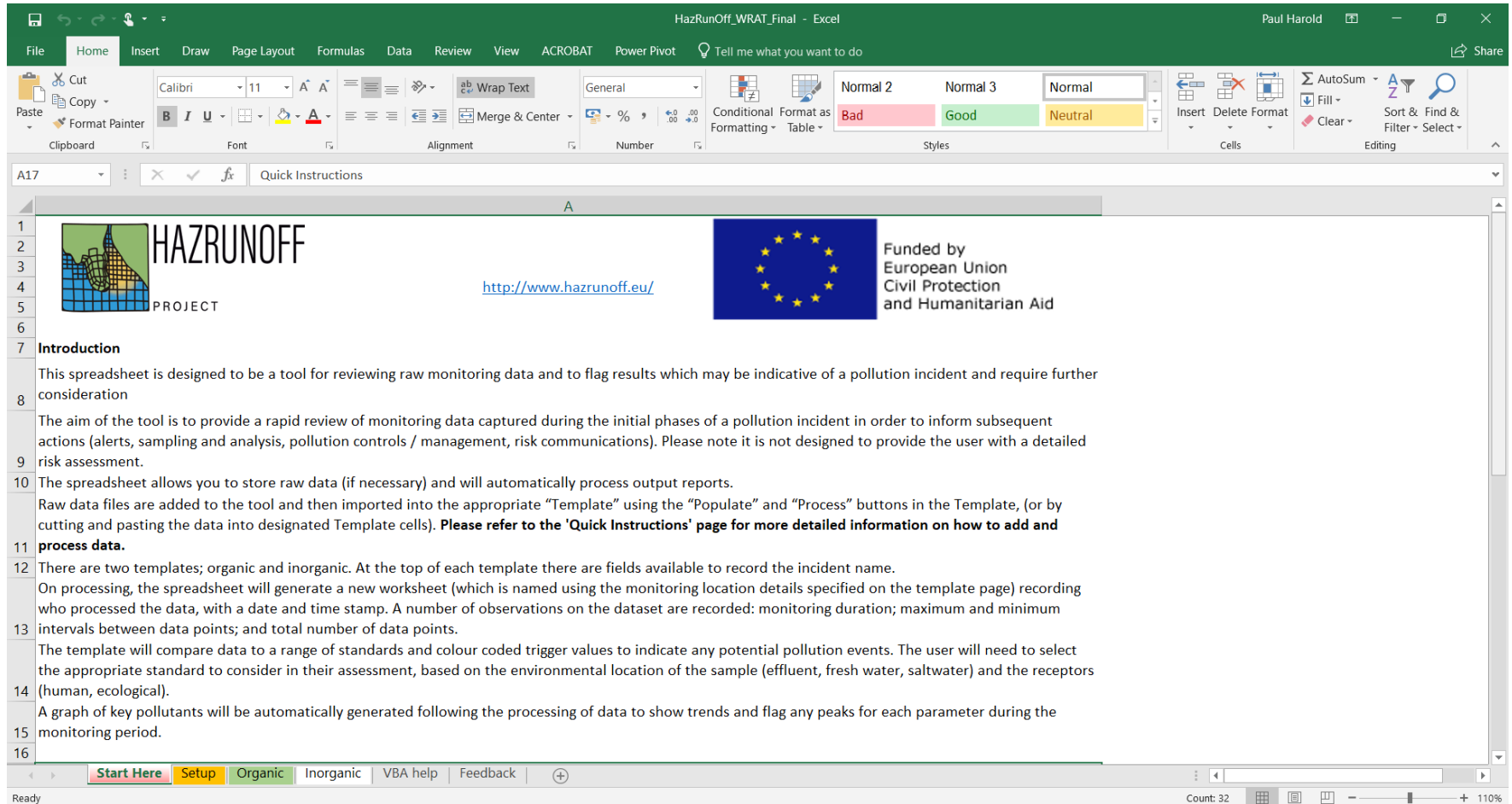


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# The Water Risk Assessment Tool (WRAT)



The screenshot shows the Microsoft Excel interface for the HazRunOff WRAT. The title bar reads "HazRunOff\_W RAT\_Final - Excel" and the user is "Paul Harold". The ribbon includes File, Home, Insert, Draw, Page Layout, Formulas, Data, Review, View, ACROBAT, and Power Pivot. The Home ribbon is active, showing options for Clipboard, Font, Alignment, Number, Styles, Cells, and Editing. The spreadsheet content includes the HazRunOff logo, a URL (<http://www.hazrunoff.eu/>), the European Union flag, and text stating it is "Funded by European Union Civil Protection and Humanitarian Aid". The "Introduction" section explains the tool's purpose: to review raw monitoring data and flag results indicative of a pollution incident. It details the process of adding raw data files, using templates, and generating reports. The bottom of the spreadsheet has a navigation bar with buttons: Start Here, Setup, Organic, Inorganic, VBA help, and Feedback. The status bar at the bottom indicates "Ready", "Count: 32", and "110%" zoom.

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<http://www.hazrunoff.eu/>

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**Introduction**

This spreadsheet is designed to be a tool for reviewing raw monitoring data and to flag results which may be indicative of a pollution incident and require further consideration.

The aim of the tool is to provide a rapid review of monitoring data captured during the initial phases of a pollution incident in order to inform subsequent actions (alerts, sampling and analysis, pollution controls / management, risk communications). Please note it is not designed to provide the user with a detailed risk assessment.

The spreadsheet allows you to store raw data (if necessary) and will automatically process output reports.

Raw data files are added to the tool and then imported into the appropriate "Template" using the "Populate" and "Process" buttons in the Template, (or by cutting and pasting the data into designated Template cells). **Please refer to the 'Quick Instructions' page for more detailed information on how to add and process data.**

There are two templates; organic and inorganic. At the top of each template there are fields available to record the incident name.

On processing, the spreadsheet will generate a new worksheet (which is named using the monitoring location details specified on the template page) recording who processed the data, with a date and time stamp. A number of observations on the dataset are recorded: monitoring duration; maximum and minimum intervals between data points; and total number of data points.

The template will compare data to a range of standards and colour coded trigger values to indicate any potential pollution events. The user will need to select the appropriate standard to consider in their assessment, based on the environmental location of the sample (effluent, fresh water, saltwater) and the receptors (human, ecological).

A graph of key pollutants will be automatically generated following the processing of data to show trends and flag any peaks for each parameter during the monitoring period.

**Start Here** **Setup** **Organic** Inorganic VBA help Feedback

Count: 32 110%

Download from <http://www.hazrunoff.eu/detecting-sensing-and-sampling/>



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# Design Specifications and Aims

- Simple to use downloadable automated tool
- No requirement for internet access
- Accepts raw data from monitors (.txt, .xls and .csv)
- Presents results in graphical and numerical outputs
- Displays against relevant risk based thresholds / standards
  - Drinking Water Standards
  - Environmental Quality Standards
  - Site specific limits
- Indicates potential risks



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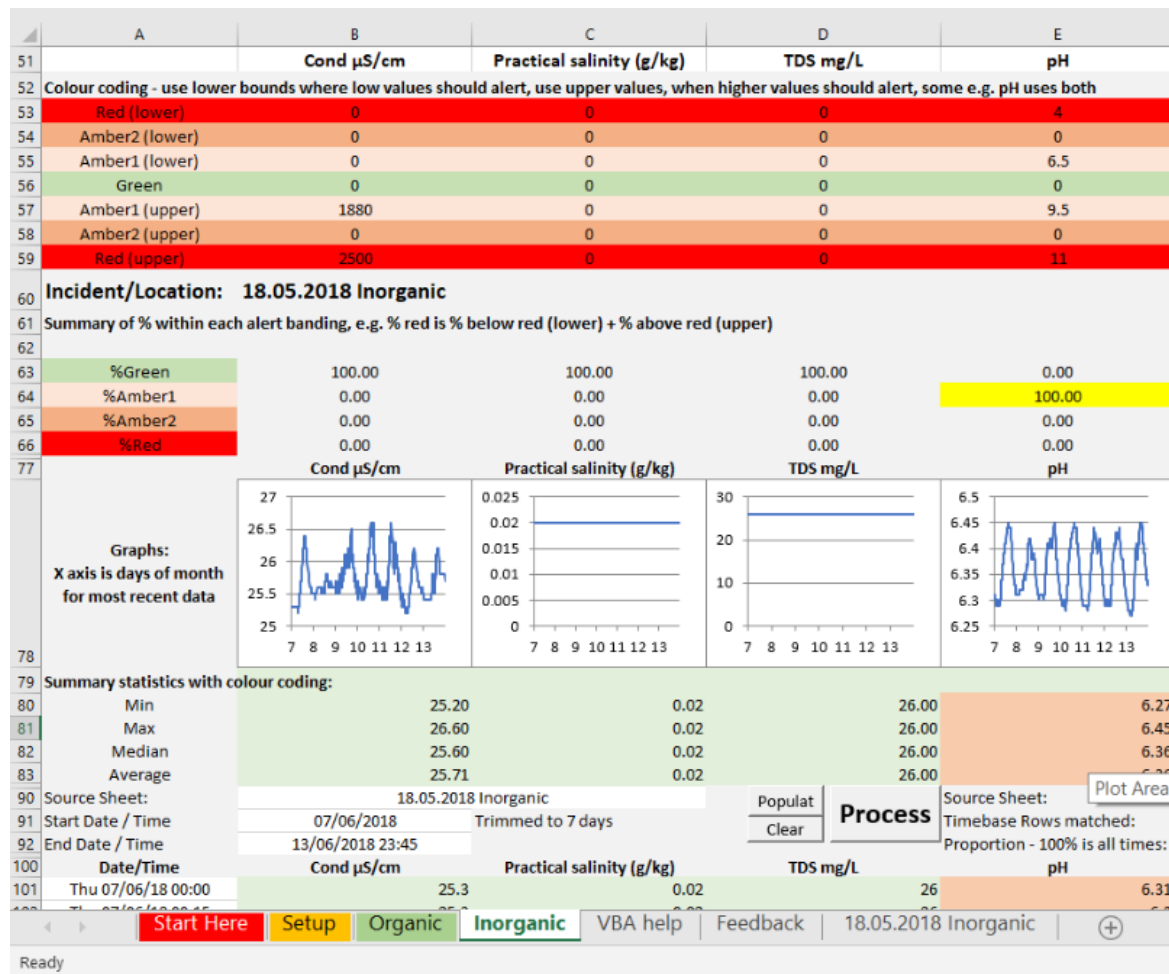


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# Results Up to 7 days Data processed in seconds



# Using the Results

## Advise tactical and strategic co-ordination groups

- Immediate risks to health and / or environment
- Trends – is it rising or falling?
- Immediate Protective actions – populations, responders, environments
- Longer term impacts – food chain, ecology



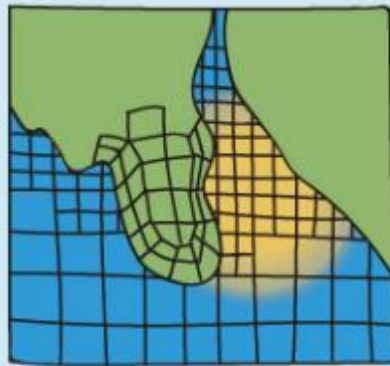
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# Questions?



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