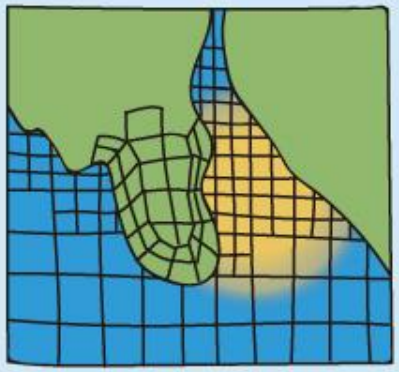

HAZRUNOFF

PROJECT

Public Health England
Novel Tools for Planning Preparedness and Response

Vigo
February 2019

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European Union
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and Humanitarian Aid

Public Health England - Who we are

Public Health England

Protecting and improving the nation's health

Part of the UK Department of Health leading on the protection and promotion of public health.

The Centre for Radiation, Chemical and Environmental Hazards (CRCE) provides advice on human health effects from chemicals and radiation in the environment.

CRCE Wales is based in Cardiff and provides specialist advice to Wales and Ireland.

Category 1 Responder to chemical incidents meaning that we have a core responsibility to plan, prepare and respond to emergencies.

Also a WHO Coordination Centre for chemical incidents worldwide and have been involved in European maritime research for several years.

World Health Organization

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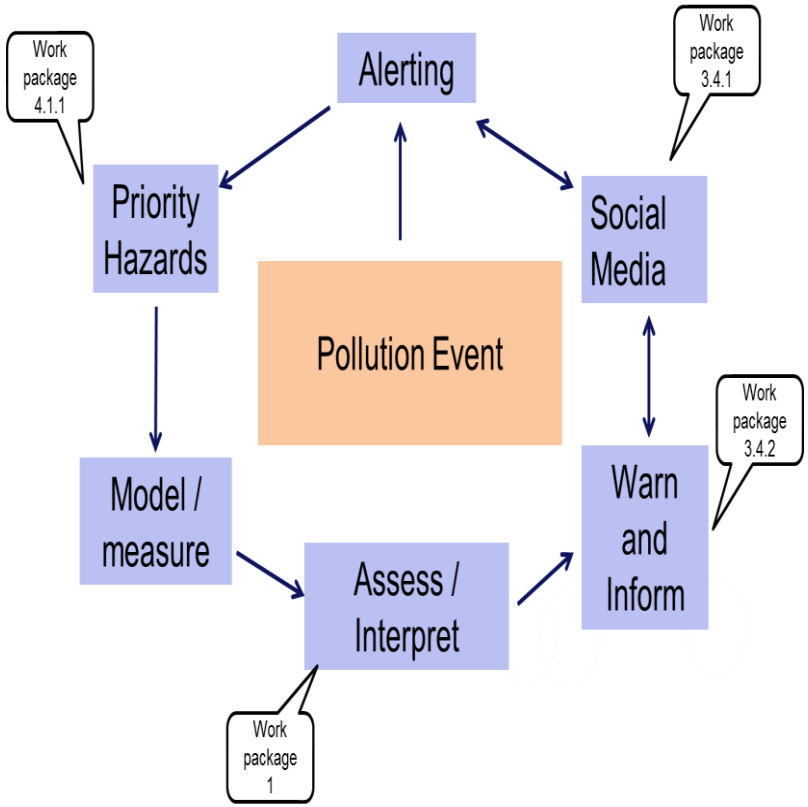
Planning, Alerting and Risk management

Development of tools and guides to aid risk management. Specifically –

Review of Monitoring and Detection technologies and development of an automated data assessment tool (WP1)

Review of the use of social media as an early alerting mechanism and assessment of warning and informing messages (WP3)

Development of a hazard prioritisation framework for planning and preparedness to identify key pollutants (WP4)



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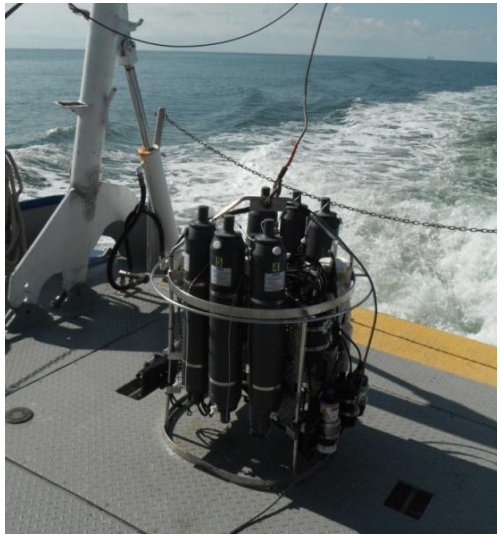
Review of Monitoring Capabilities, Assessment of Pollution Indicators

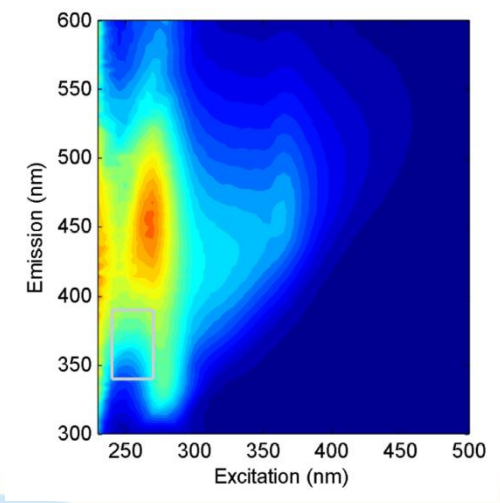


During response it is important to have knowledge of the chemicals that have been released and to be able to assess their potential impact in order to inform the risk assessment.

PHE proposed

- to review monitoring and detection technologies and identify key pollutants (and / or proxy indicators) for incident alerting

- to produce an automated tool to help assess and interpret monitoring data for identified indicators.



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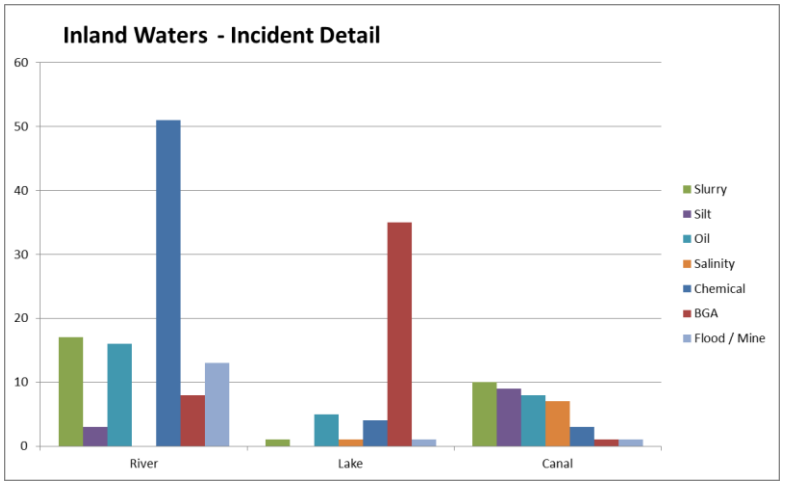
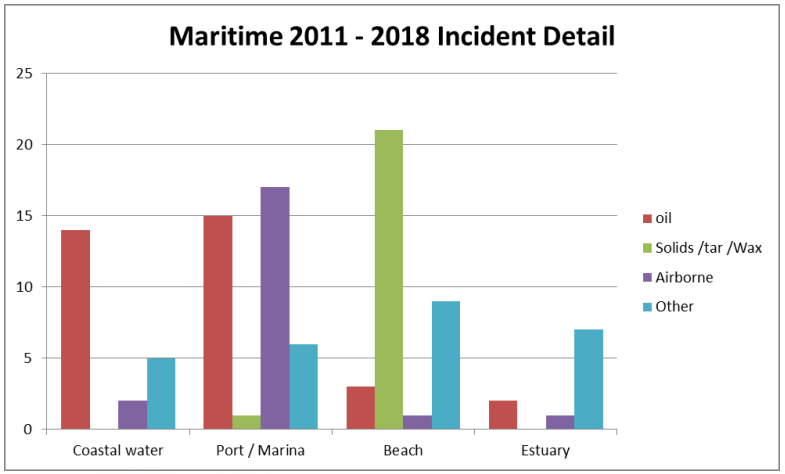
Gap Analysis

Reviewed gaps and identified field based techniques for potential sentinels / indicators based upon UK data

Incident	Pollutant	Rapid screening
Oil	PAH	Uncertain
Chemical	Pesticides	Uncertain
Shoreline	Fats / Vegetable Oils / Waxes	Uncertain
Fire	Dioxins	Uncertain
Flood	Microbial	Uncertain
Lakes	BGA	Uncertain





Produced report and simple guide for application of sentinels, interpretation of data and limitations of techniques.

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Report on Detection Methods

Summary

Inland water events associated with slurry, algae and pesticides.

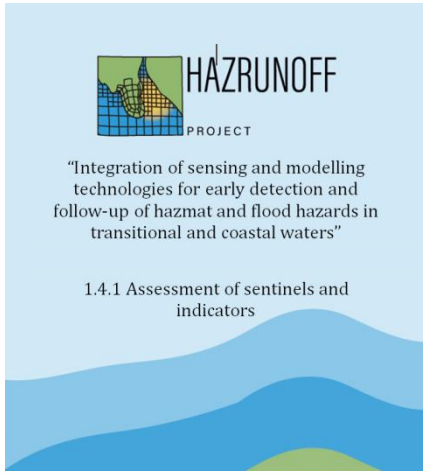
Oils, tars and waxes associated with coastal incidents.

Key pollutants identified as ammonia, hydrocarbons and general parameters.

All could be measured in-situ using commercial sensors.

Diffuse organic pollutants at very low concentrations posed potential limitation but monitors identified for this.

Solid / weathered Palm Oil type pollutants on beaches unlikely to be amenable for rapid sensing, requiring visual identification, sampling and laboratory analysis.



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Report on Detection Methods

Pollutant incident type	Pollutant*	Indicators/proxies*	Monitors
Slurry / Sewage	Ammonia (Ammonium), TOC	BOD/COD, turbidity, cells	Electrochemical
Oil Spill	TPH / PAH	VOC, BOD/COD, sulphide	Fluorescence / PID
Chemical	Various including Pesticides	pH, TOC, BOD/COD, conductivity	Fluorescence / PID
BGA	Toxin	Cells, N, P, BOD/COD	Fluorescence / Electrochemical
Airborne / Fire / Vapour	Particulates, gases, Dioxins and furans	PM_{10}, NO_2, SO_2, CO_2, CO, VOC and H_2S	None / Light scatter / PID / Electrochemical
Palm Oil / Wax	VFA, TPH	BOD, COD, Sulphide, TPH, pH	Electrochemical / Visual / PID
Flooding	TOC, salinity, metals	pH, TOC, BOD, cells, chloride, conductivity	Electrochemical

*(TOC – Total Organic Carbon, BOD – Biological Oxygen Demand, COD – Chemical Oxygen Demand, TPH – Total Petroleum Hydrocarbons, VOC – Volatile Organic Compounds, N – Nitrogenous compounds, P – phosphates, VFA – Volatile Fatty Acids).

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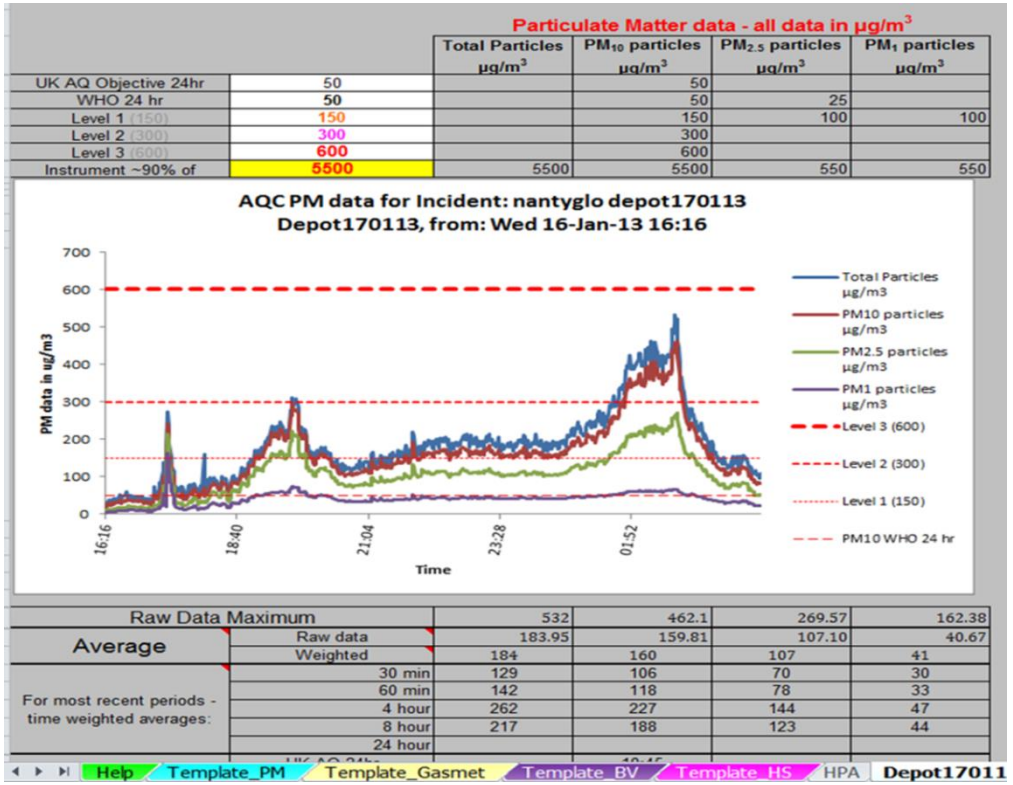
Rapid Risk Assessment Tool

Develop automated tool for rapid risk assessment of pollutants

- Automated Excel Tool
- Applicable to Water and Air data sets
- Accepts raw data from monitors
- Presents in graphical and numerical output
- Displays against relevant risk based thresholds / standards – DWS, EQS, SNARLs, - AEGL / PACs, AQOs



		Particulate Matter data - all data in µg/m³			
		Total Particles µg/m³	PM_{10} particles µg/m³	$PM_{2.5}$ particles µg/m³	PM_1 particles µg/m³
UK AQ Objective 24hr	50		50		
WHO 24 hr	50		50	25	
Level 1 (150)	150		150	100	100
Level 2 (300)	300		300		
Level 3 (600)	600		600		
Instrument ~90% of	5500	5500	5500	550	550

Raw Data Maximum		532	462.1	269.57	162.38
Average	Raw data	183.95	159.81	107.10	40.67
	Weighted	184	160	107	41
For most recent periods - time weighted averages:	30 min	129	106	70	30
	60 min	142	118	78	33
	4 hour	262	227	144	47
	8 hour	217	188	123	44
	24 hour				

Help | Template_PM | Template_Gasmet | Template_BV | Template_HS | HPA | Depot17011

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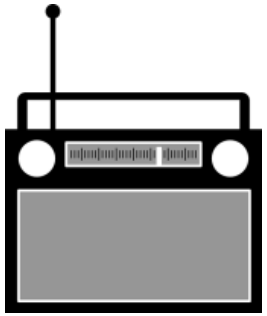
Social media for early alerting and crisis communication

- Evaluation of social media for early alerting of incidents
  - An algorithm will be developed with potential application in social media platforms
  - Development and assessment of search terms relevant to Hazmat and Flooding incidents
  - Piloting of Twitter search and analysis for alerting

- Response communication protocols
  - Use of Twitter to assess impact following receipt of warning and informing messages during incident or exercise (sentiment analysis).
  - Review of Twitter feeds around messages issued for historical incidents.



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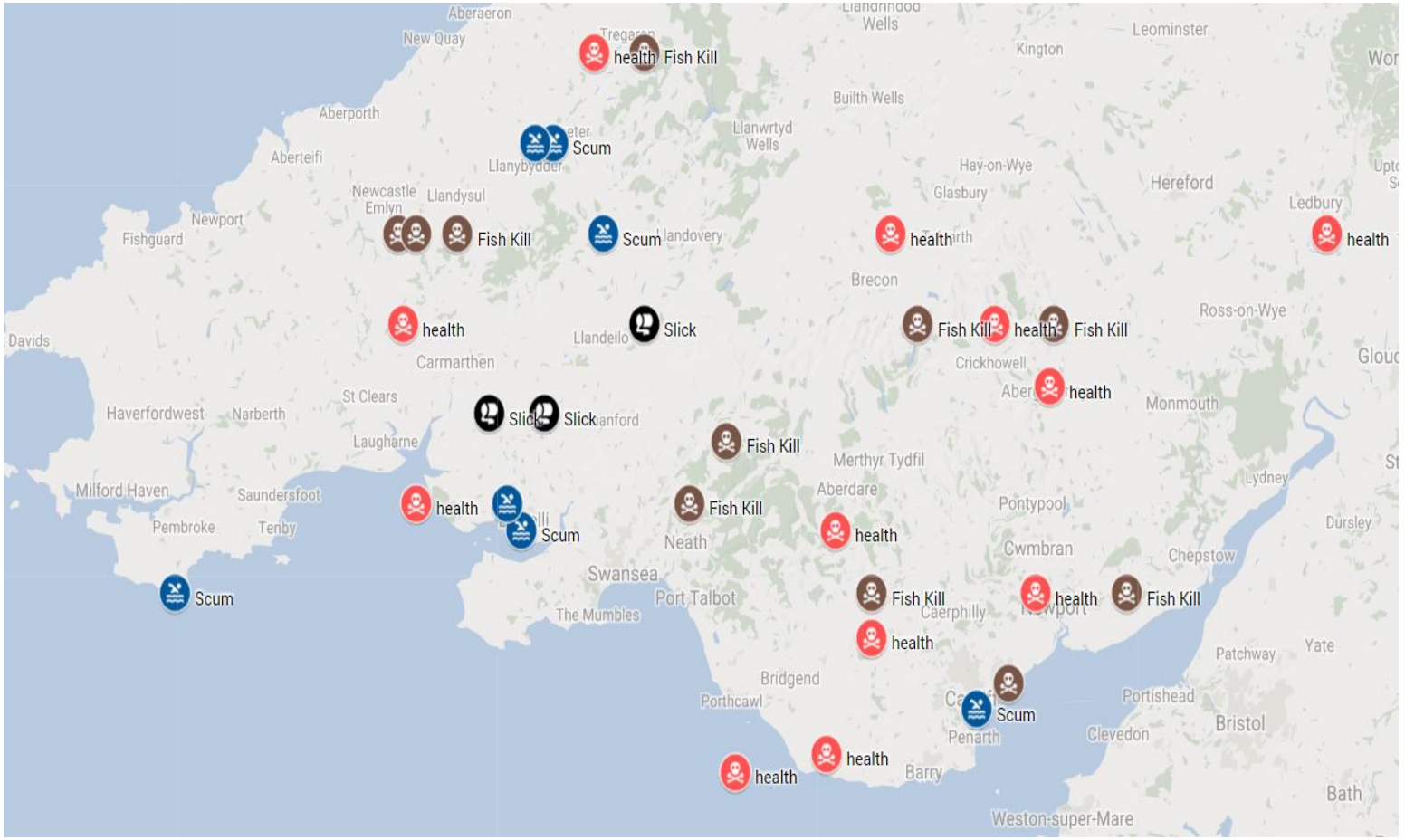
Reviewed incidents for inland, estuarine and coastal waters (2014 - 2018)



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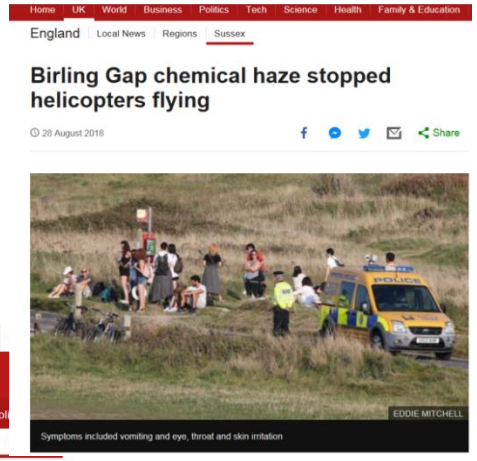
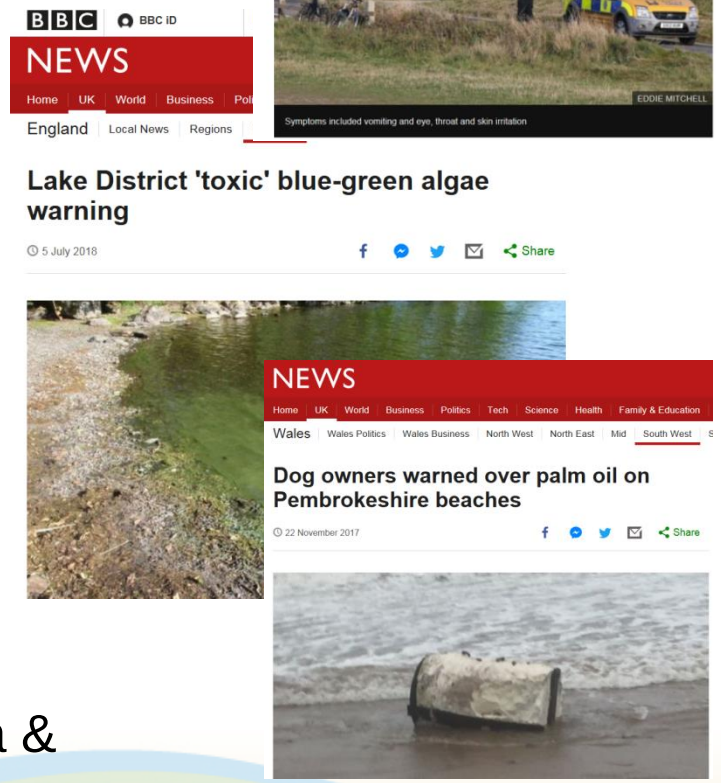
Initial assessment using The Europe Media Monitor (EMM)

(EC Joint Research Centre)

- Web based media monitoring system
- Search terms tested for sensitivity and specificity
- **Slurry** - Fish Kill / Foam / Odour - River / Lake / beach
- **Oil** - Sheen / Odour / Slick / river / lake / canal / beach
- **Chemical** - Discoloration / Gas cloud / Toxic / Haze / Odour / River / Lake / Health
- **BGA** - Algal Bloom / Scum / Lake / Dock / canal / Health / Pets
- **Veg Oils** - Fats / wax / Tar / Beaches / Dogs
- Results used to inform design of social media & piloting





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EMM Pilot Results

Boolean search string using key words from incident review piloted for 1 month.

Manual daily review of results

Assessment of results for key statistics using recognised diagnostic methodology

	Alert trigger met	Alert trigger not met	
Alert issued	18 True Positive	272 False Positive	290
No alert issued	11 False Negative	139,728 True Negative	139739
	29	140000	140019

Sensitivity – proportion of incidents identified = 62% (95% CI=42% to 79%)

Specificity– articles screened out = 99.8% (95% CI=99.78% to 99.83%)

Positive Predictive Value - proportion of incidents identified **correctly** = 6.2% (95% CI = 4.64% to 8.26%) .

Conclusions

- Limited use at identifying and predicting incidents.
- Many incidents too small for national / international coverage
- News sources generic and exclude many industry publications,
- language / translation a problem
- More bespoke system could improve performance – social media

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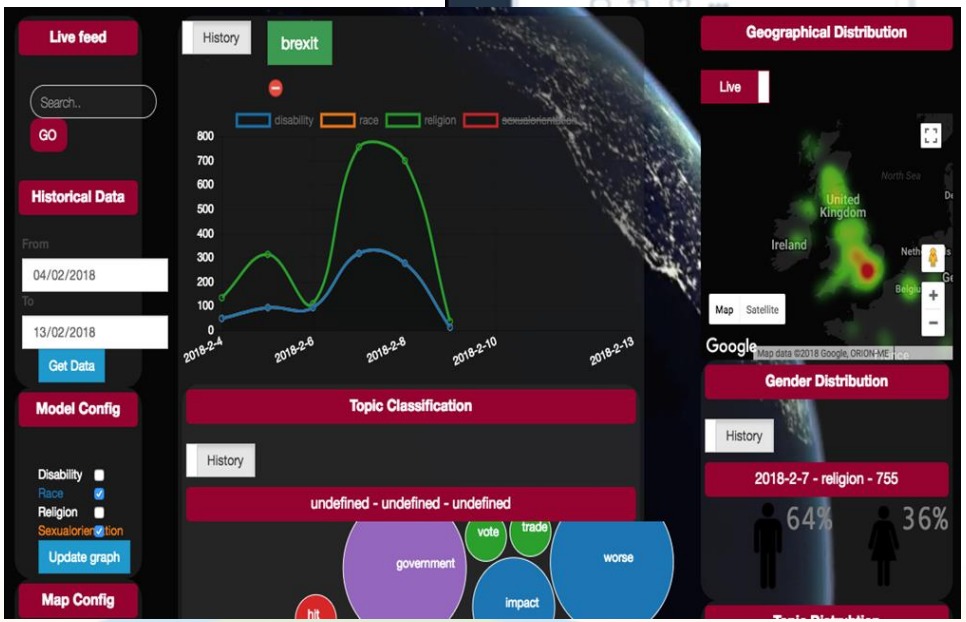
Social Media for Alerting (A3.4.2)

- Specification developed for social media algorithm and pilot study
  - Frequency chart, Geographical analysis, Key word analysis
  - Data storage / recovery
  - Trial terms over 3-4 months across selected region (Bristol Channel)
- Use of results from EMM pilot to further define search terms and exclusion criteria
- Procurement process still to be completed (February / March)
- Pilot (second quarter 2019)



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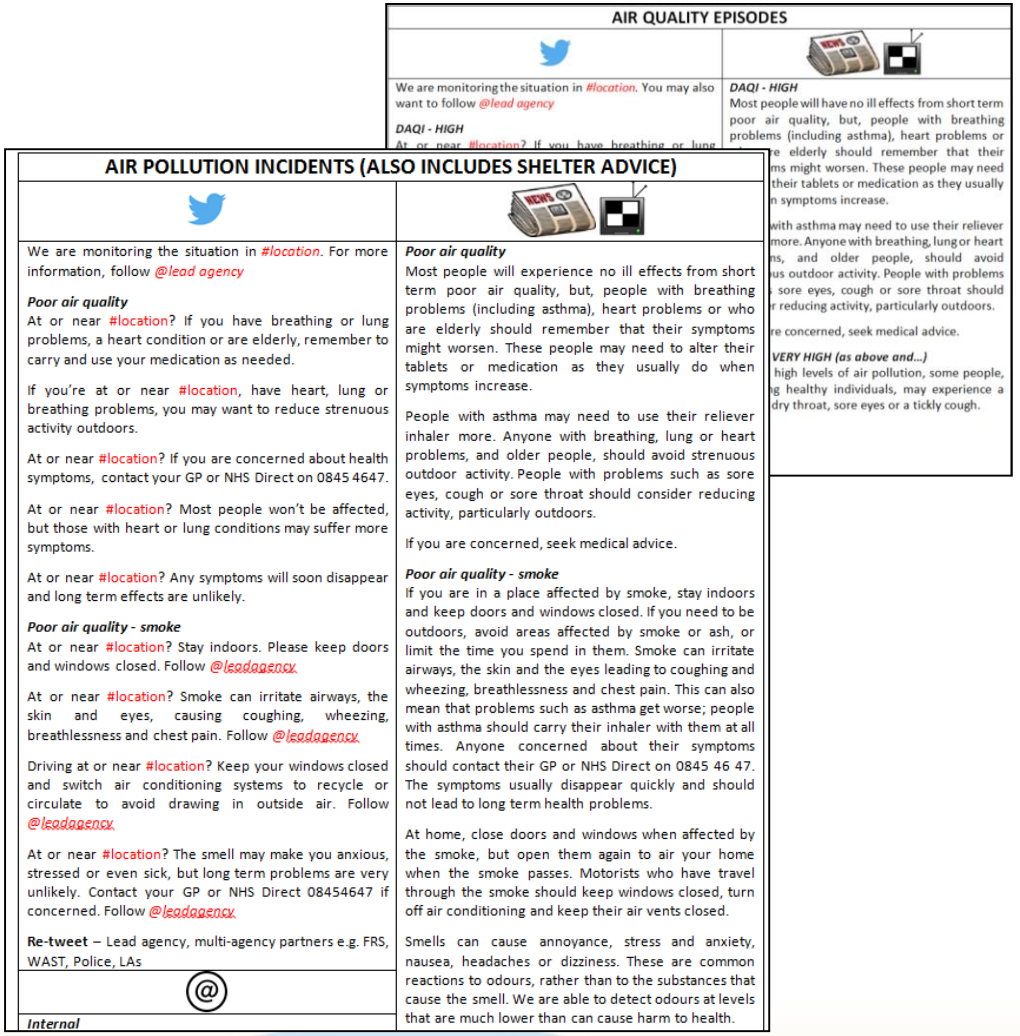
Crisis Communications – Warning and Informing

- Messages developed in line with key incidents
  - Pollutants
  - Hazards
  - Advice
  - Actions to take
- Pilot with real-time or historic incident – Fire, Flood, spill
- Sentiment analysis
- Identify positive or negative impact of messages



AIR QUALITY EPISODES

We are monitoring the situation in #location. You may also want to follow @lead agency

DAQI - HIGH

DAQI - HIGH
Most people will have no ill effects from short term poor air quality, but, people with breathing problems (including asthma), heart problems or
re elderly should remember that their
ms might worsen. These people may need
their tablets or medication as they usually
n symptoms increase.

with asthma may need to use their reliever
more. Anyone with breathing, lung or heart
ns, and older people, should avoid
us outdoor activity. People with problems
sore eyes, cough or sore throat should
r reducing activity, particularly outdoors.

re concerned, seek medical advice.

VERY HIGH (as above and…)
high levels of air pollution, some people,
g healthy individuals, may experience a
dry throat, sore eyes or a tickly cough.

AIR POLLUTION INCIDENTS (ALSO INCLUDES SHELTER ADVICE)

We are monitoring the situation in #location. For more information, follow @lead agency

Poor air quality
At or near #location? If you have breathing or lung problems, a heart condition or are elderly, remember to carry and use your medication as needed.

If you're at or near #location, have heart, lung or breathing problems, you may want to reduce strenuous activity outdoors.

At or near #location? If you are concerned about health symptoms, contact your GP or NHS Direct on 0845 4647.

At or near #location? Most people won't be affected, but those with heart or lung conditions may suffer more symptoms.

At or near #location? Any symptoms will soon disappear and long term effects are unlikely.

Poor air quality - smoke
At or near #location? Stay indoors. Please keep doors and windows closed. Follow @leadagency

At or near #location? Smoke can irritate airways, the skin and eyes, causing coughing, wheezing, breathlessness and chest pain. Follow @leadagency

Driving at or near #location? Keep your windows closed and switch air conditioning systems to recycle or circulate to avoid drawing in outside air. Follow @leadagency

At or near #location? The smell may make you anxious, stressed or even sick, but long term problems are very unlikely. Contact your GP or NHS Direct 08454647 if concerned. Follow @leadagency

Re-tweet – Lead agency, multi-agency partners e.g. FRS, WAST, Police, LAs

@

Internal

Poor air quality
Most people will experience no ill effects from short term poor air quality, but, people with breathing problems (including asthma), heart problems or who are elderly should remember that their symptoms might worsen. These people may need to alter their tablets or medication as they usually do when symptoms increase.

People with asthma may need to use their reliever inhaler more. Anyone with breathing, lung or heart problems, and older people, should avoid strenuous outdoor activity. People with problems such as sore eyes, cough or sore throat should consider reducing activity, particularly outdoors.

If you are concerned, seek medical advice.

Poor air quality - smoke
If you are in a place affected by smoke, stay indoors and keep doors and windows closed. If you need to be outdoors, avoid areas affected by smoke or ash, or limit the time you spend in them. Smoke can irritate airways, the skin and the eyes leading to coughing and wheezing, breathlessness and chest pain. This can also mean that problems such as asthma get worse; people with asthma should carry their inhaler with them at all times. Anyone concerned about their symptoms should contact their GP or NHS Direct on 0845 46 47. The symptoms usually disappear quickly and should not lead to long term health problems.

At home, close doors and windows when affected by the smoke, but open them again to air your home when the smoke passes. Motorists who have travel through the smoke should keep windows closed, turn off air conditioning and keep their air vents closed.

Smells can cause annoyance, stress and anxiety, nausea, headaches or dizziness. These are common reactions to odours, rather than to the substances that cause the smell. We are able to detect odours at levels that are much lower than can cause harm to health.

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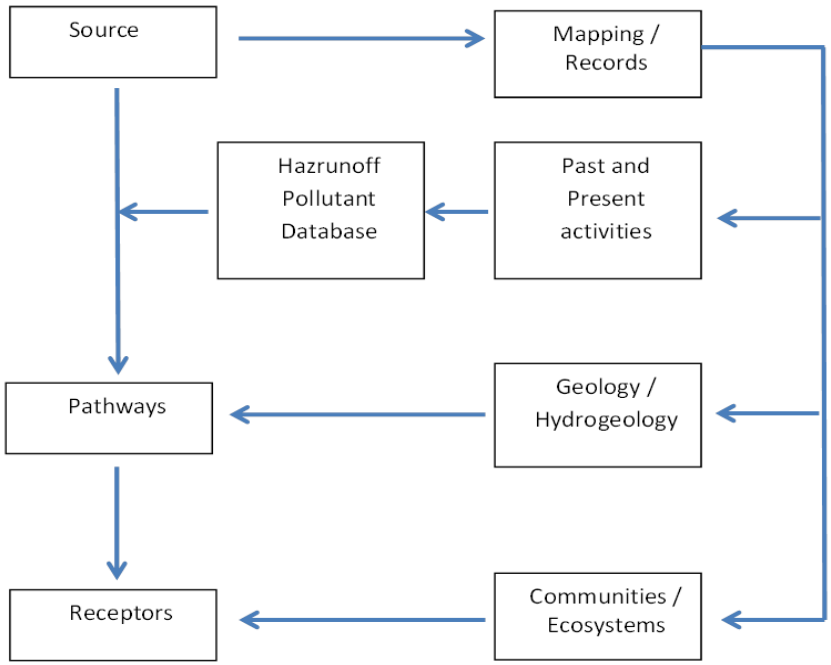
Planning and Preparedness - Hazard Prioritisation

Framework to aid planning and preparedness and to help focus resources on highest risk pollutants

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

Methodology to identify key pollutants associated with past and present coastal infrastructure

Tool to prioritise pollutants based upon potential risk to receptors in the event of their release into the environment .



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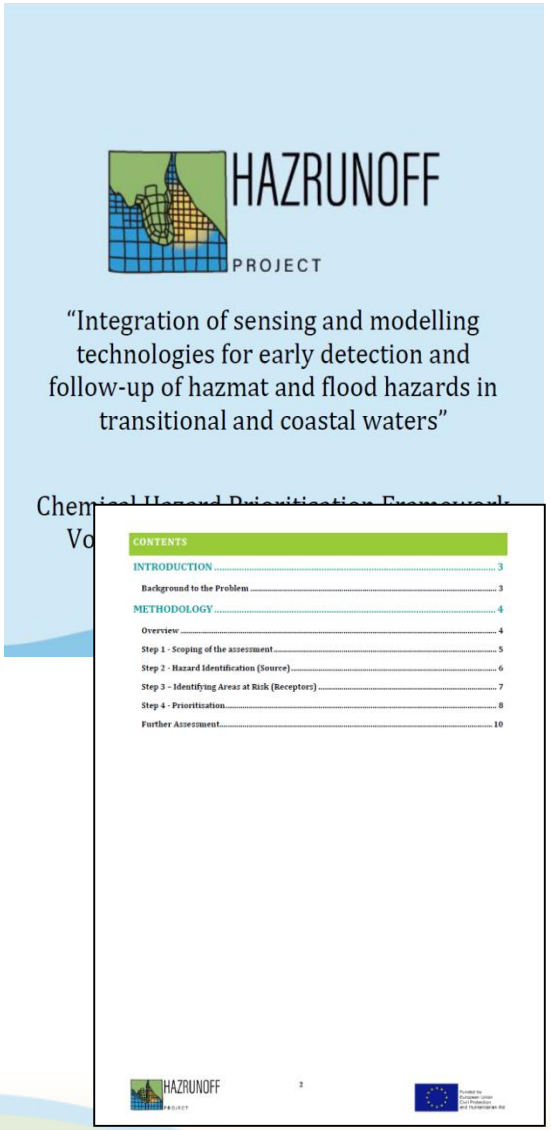
Framework - Adopts Source-Pathway-Receptor approach

Divided into two main elements

1. **Desk based methodology to identify**:
   - **Scoping** – Temporal and geographical boundaries
   - **Sources** - key current and historical coastal activities / infrastructure:
   - **Pathways -** Incorporating behaviour of pollutants with geological and hydrogeological \ hydrological factors
   - **Receptors** – 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/

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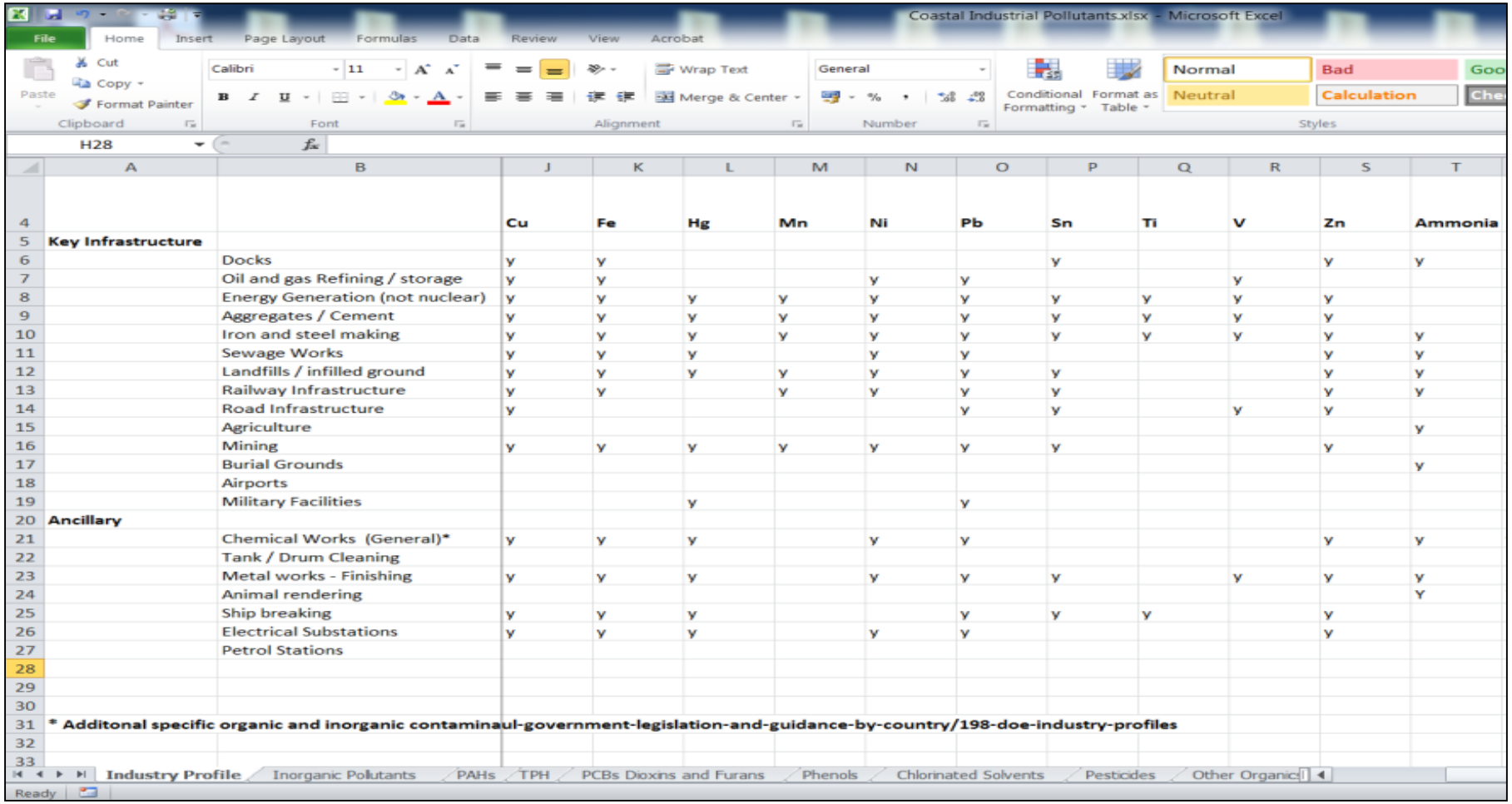
Excel Database of key coastal pollutants

Step 1 – Review list of infrastructure and associated pollutants



	A	B	J	K	L	M	N	O	P	Q	R	S	T
4			Cu	Fe	Hg	Mn	Ni	Pb	Sn	Ti	V	Zn	Ammonia
5	**Key Infrastructure**												
6		Docks	y	y					y			y	y
7		Oil and gas Refining / storage	y	y			y	y			y		
8		Energy Generation (not nuclear)	y	y	y	y	y	y	y	y	y	y	
9		Aggregates / Cement	y	y	y	y	y	y	y	y	y	y	
10		Iron and steel making	y	y	y	y	y	y	y	y	y	y	y
11		Sewage Works	y	y	y		y	y				y	y
12		Landfills / infilled ground	y	y	y	y	y	y	y			y	y
13		Railway Infrastructure	y	y		y	y	y	y			y	y
14		Road Infrastructure	y					y	y		y	y	
15		Agriculture											y
16		Mining	y	y	y	y	y	y	y			y	
17		Burial Grounds											y
18		Airports											
19		Military Facilities			y			y					
20	**Ancillary**												
21		Chemical Works (General)*	y	y	y		y	y				y	y
22		Tank / Drum Cleaning											
23		Metal works - Finishing	y	y	y		y	y	y		y	y	y
24		Animal rendering											Y
25		Ship breaking	y	y	y			y	y	y		y	
26		Electrical Substations	y	y	y		y	y				y	
27		Petrol Stations											
28													
29													
30													
31	*** Additonal specific organic and inorganic contaminaul-government-legislation-and-guidance-by-country/198-doe-industry-profiles**												
32													
33													

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Step 2 – Review pollutant behaviour, hazards, regulatory standards

					Indicative Hazard Ratings (GESAMP)							NFP Ratings			Standards in principle media					
					Human Health			Ecological												
	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	Acute Health Guideline (Air)	Chronic Health Guideline (Air)	Ecological EU WFD (lowest value)	Air Quality Standard	Drinking Water Standard	Soil^
															AEGL ppm	RFC mg/m3	ug/l	mg/m3	mg/l	mk/kg
	Tetrachloroethane (as 1,1,2,2 PCA)	76-12-0	L	SED	2	0	0	2	0	2	4	0	0	0	15000***	0.02^	140	NR	NR	2.9^
	Trichloroethane (as 1,1,1 TCA)	71-55-6	L	SED	2	0	2	1	1	2	4	1	0	0	4200	11	51.6	NR	NR	13^
	Dichloroethane (as 1,2 DCA)	107-06-2	L	SE	2	0	2	2	1	1	4	3	0	F	300	8	5.16	0.7*	0.03*	0.008
	Trichloromethane (Chloroform)	67-66-3	L	SE	2	0	2	2	1	1	4	0	1	0	3200	0.1	NR	NR	0.1	1.3^
	Dichloromethane	75-09-2	L	SE	2	0	2	2	1	1	4	1	0	0	6900	NR	20	0.45*	0.02	NR
	Tetrachloroethylene (PCE)	127-18-4	L	SED	2	4	6	2	2	1	5	0	0	0	1200	0.28	5.16	0.00025*	0.01	2.1^
	Trichloroethylene (TCE	79-01-6	L	SED	2	4	6	2	2	1	5	1	0	0	3800	0.02^	5.16	0.00023*	0.1	0.22^
	Dichloroethylene (as 1,2-DCE)	156-59-2	L	SED	2	0	2	2	1	1	4	3	2	FR	850	0.8	NR	NR	0.05*	NR
	Vinyl chloride (VC)	75-01-4	G	G	2	4	6	1	0	0	1	3	2	FR	4800	0.001*	NR	NR	0.0005	NR
	Notes																			
	*WHO Guideline																			
	** RIVM Netherlands Intervention Value																			
	*** PAC mg/m3 equivalent to 1 hour AEGL3																			
	****Ecological receptors critical level																			
	^UK Screening Level (DEFRA)																			
	^^UK Screening Level - to be reviewed (DEFRA)																			

Review key pollutants from Step 1 to identify those most likely to pose hazards

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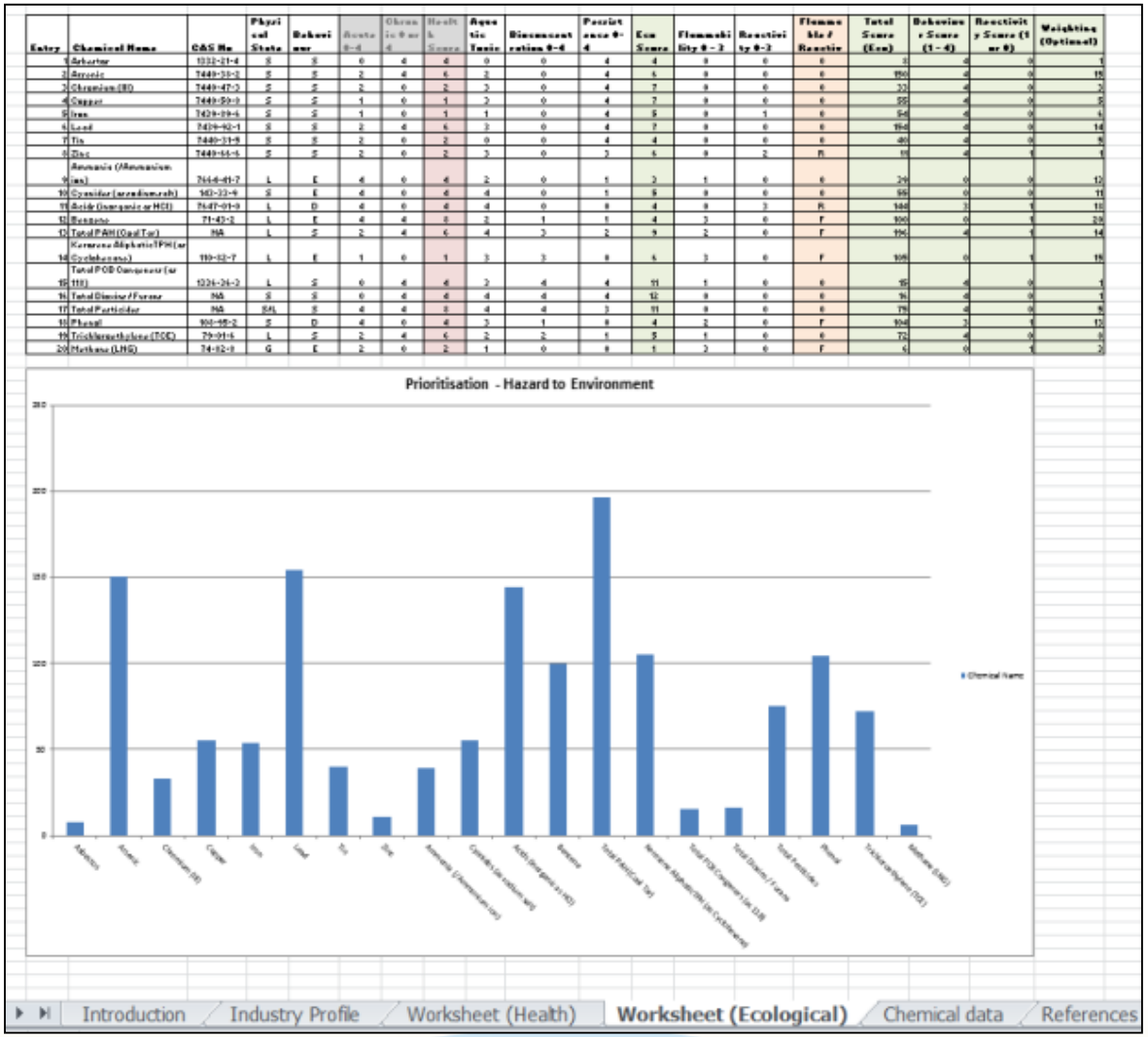
Step 3 - Prioritisation

Use automated worksheets to produce human health and ecological risk prioritisations for selected pollutants.

Prioritisation based upon predefined chemical data

Option to apply user defined weightings to reflect additional considerations e.g. frequency of pollutant sources, proximity to receptors etc.



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Case Study

Section of the Severn Estuary in UK,

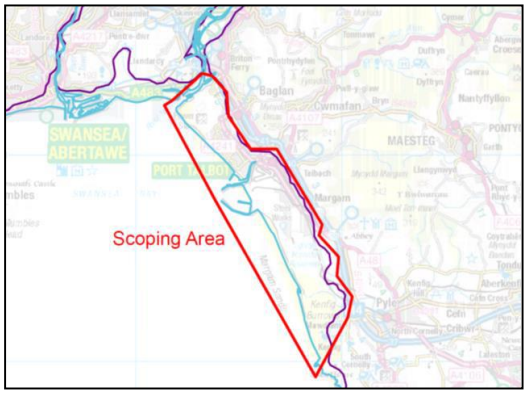
- industrialised setting,
- past industrial heritage,
- sensitive human and ecological receptors.

Scoped to reflect areas most at risk from erosion and flooding and to capture past and present activities

Identified historical and current industrial activities, principally around metal working and power.

Identified arsenic, lead, acids, benzene and PAHs as priority hazards to both human health and ecology.

Illustrated application of the framework to focus resources and inform detailed assessments



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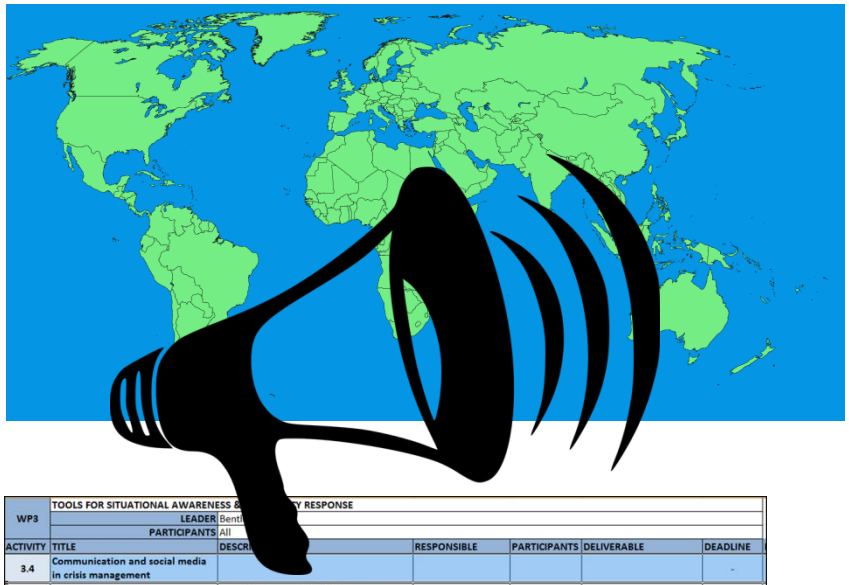
Future Objectives

Completion of Social Media Pilot pilot studies during 2019

Dissemination of all deliverables to UK stakeholders via workshop hosted in Cardiff in summer 2019

Dissemination to wider stakeholders via events organised by Hazrunoff and other international bodies during 2019

Continued collaboration and review



WP3	TOOLS FOR SITUATIONAL AWARENESS & Y RESPONSE					
	LEADER	Benti				
	PARTICIPANTS	All				
ACTIVITY	TITLE	DESCRI	RESPONSIBLE	PARTICIPANTS	DELIVERABLE	DEADLINE
3.4	Communication and social media in crisis management					-
3.4.1	Evaluation of social media and internet systems for early alerting incidents	Use of 3rd party global alerting systems to search for keywords and phrases from internet and social media sites to alert to incidents. An algorithm will be developed with potential application in social media platforms to aid alerting, surveillance and crisis management	PHE		(a) Report on Social media surveillance study; (b) Social media surveillance algorithm	(a) Apr-19; (b) Sep-19
3.4.2	Response communication protocols	Review past incidents where social media has played a role in communications in order to identify issues and also best practise. This will further be used to	PHE		Report on Use of Social Media in Crisis management: review of	Sep-19

WP1	DETECTING, SENSING AND SAMPLING						
	LEADER	EOMAP					
	PARTICIPANTS	All					
ACTIVIT	TITLE	DESCRIPTION	RESPONSIBLE	PARTICIPAN	DELIVERABLE	DEADLINE	DEPENDENCIES
1.4	Gap analysis and assessment of sentinels and indicators		PHE	CEDRE, CETMAR, IST	-	-	
1.4.1	Gap analysis	Review current state of the art around in-situ pollution monitoring and detection for key hazardous chemical groups by reference to scientific literature and guidance documentation. Survey of pollution monitoring agencies in UK	PHE	CEDRE, CETMAR, IST	Report: Gap analysis of detection capabilities	Dec-18	
1.4.2	Assessment of sentinels and indicators	Selection of sentinel/indicator chemicals to help to develop rapid risk assessment process and guide the development of suitable automatic and rapid environmental sensors and monitors	PHE		Report: Assessment of sentinels and indicators	Dec-18	exchange 1.4.2

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