Environmental Risk Assessment & Cost Benefit Analysis

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ENGINEERING
ENVIRONMENTAL
SURVEYING
CONSULTING

ikm

COMAH – control of major accidents and hazards

- COMAH regulations 1994 and 2005
- All Measures Necessary to Prevent Major Accident occurring and Minimise Harm to Environment and People
- Safety Report and Environmental Risk Assessment

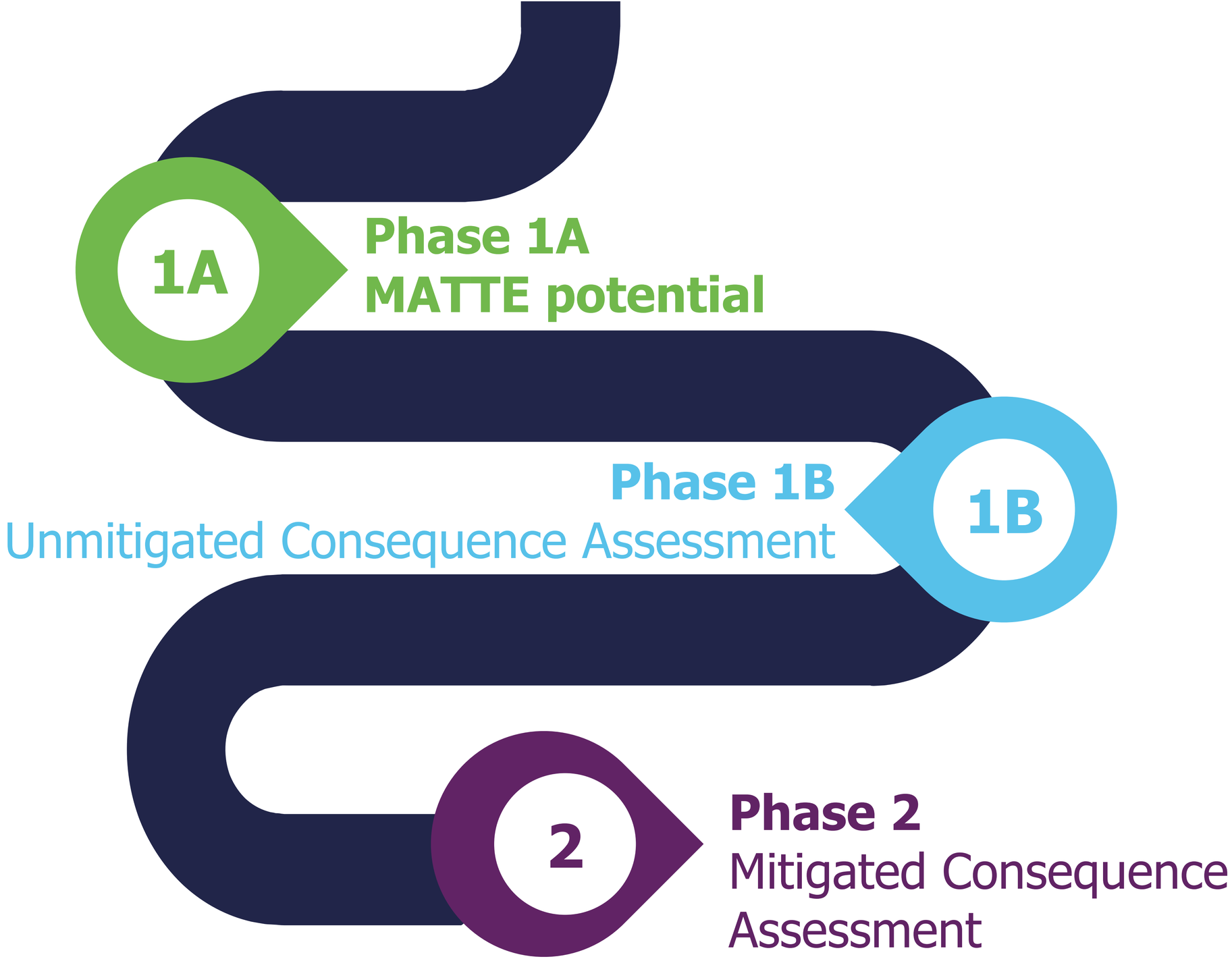
ALARP methodology & Tolerability

Broadly Acceptable

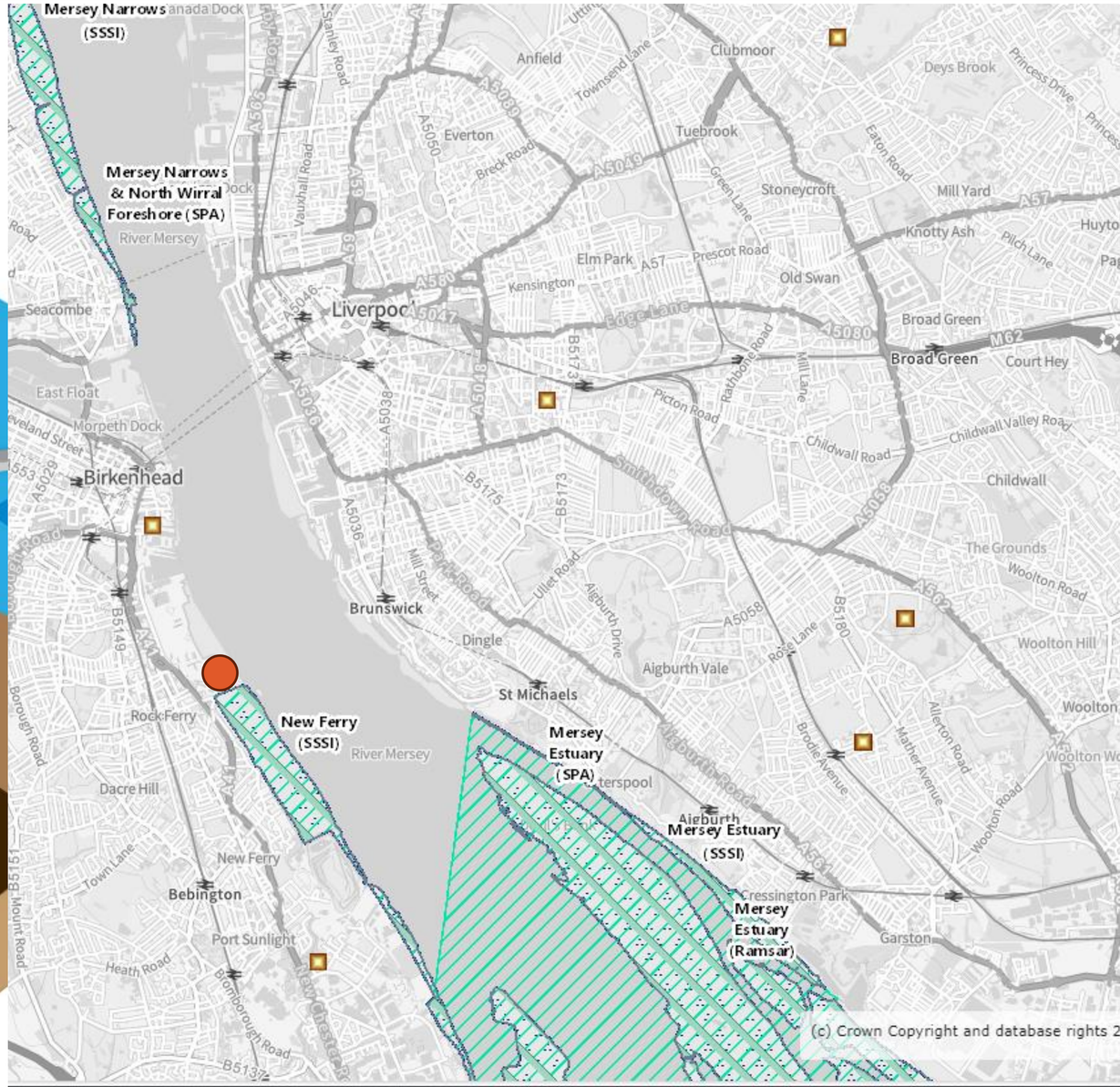
TifALARP

Intolerable

CDOIF Methodology



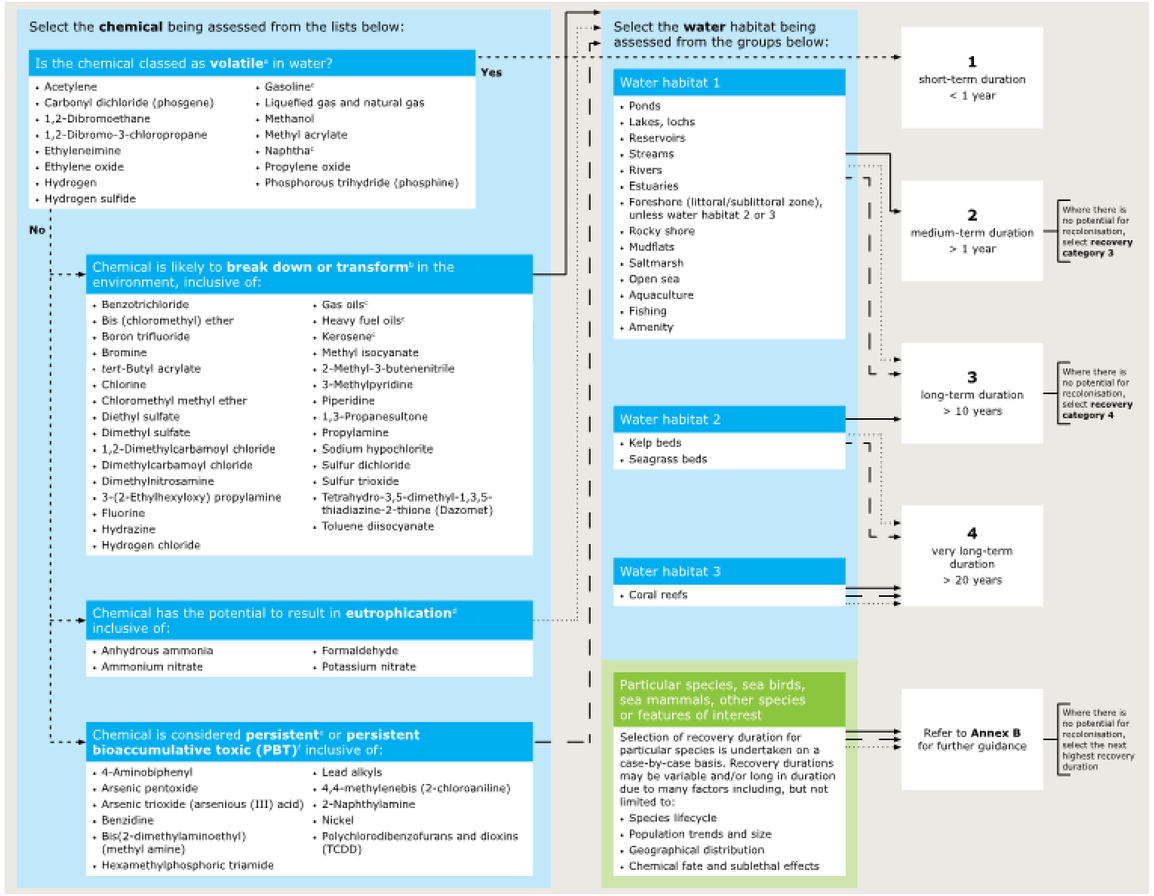
Phase 1A - MAS, CSM, MATTE



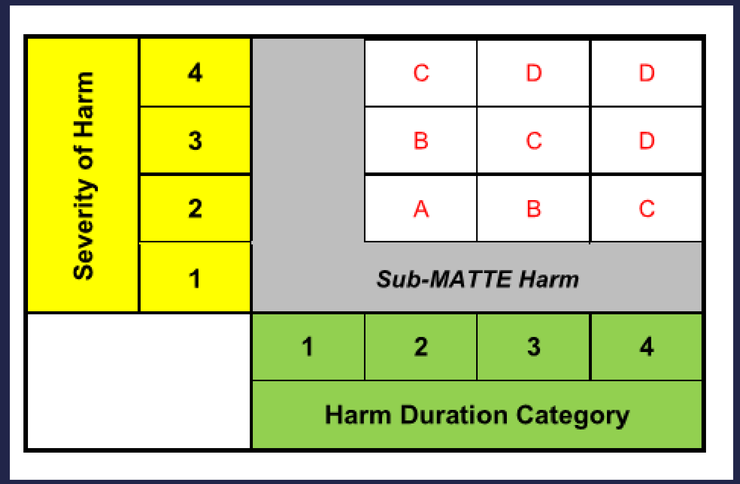
Phase 1B Severity & Duration

Receptor Type	Severity of Harm			
	Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria - the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**
Severity Level →	**1**	**2**	**3**	**4**
Designated Land/Water Sites (Nationally important)	<0.5ha or <10%	>0.5ha or 10-50% of site area, associated linear feature or population	>50% of site area, associated linear feature or population	*N/A*
Designated Land/Water Sites (Internationally important)	<0.5ha or <5% (<5% LF/Pop)	>0.5ha or 5-25% of site area or 5-25% of associated linear feature or population	25-50% of site area, associated linear feature or population	>50% of site area, associated linear feature or population
Other designated Land	<10ha or <10%	10-100ha or 10-50% of land	>100ha or >50% of land	*N/A*
Scarce Habitat	<2 ha or <10%	2-20ha or 10-50% of habitat	>20ha or >50% of habitat	*N/A*

Short term	Medium term	Long term	Very long term
Harm with such short recovery is not considered a MATTE.			
1	2	3	4



Phase 1B
Consequence Assessment

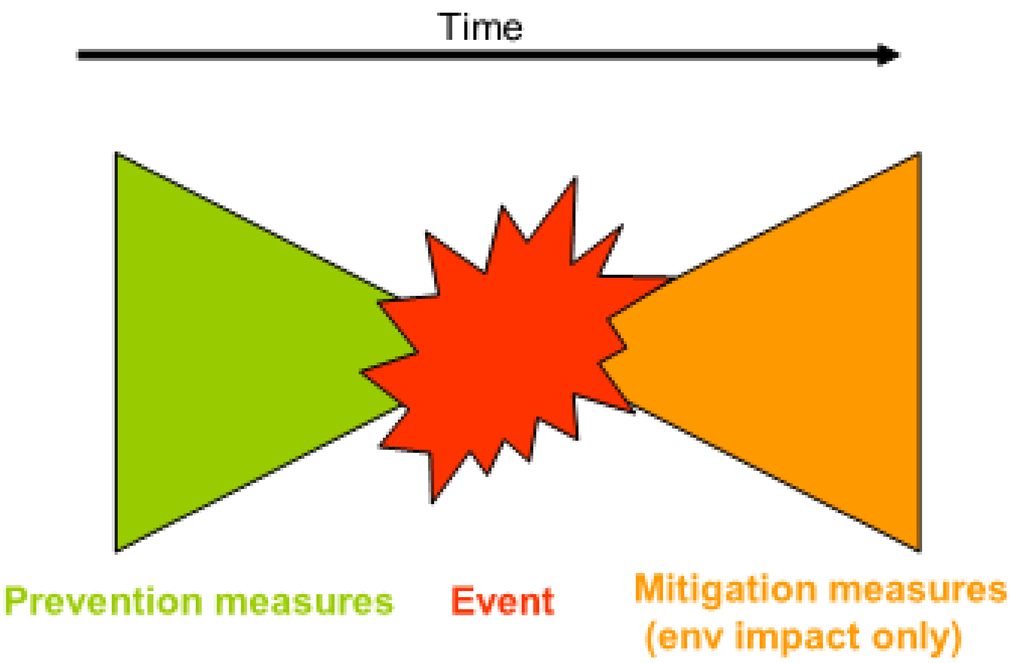


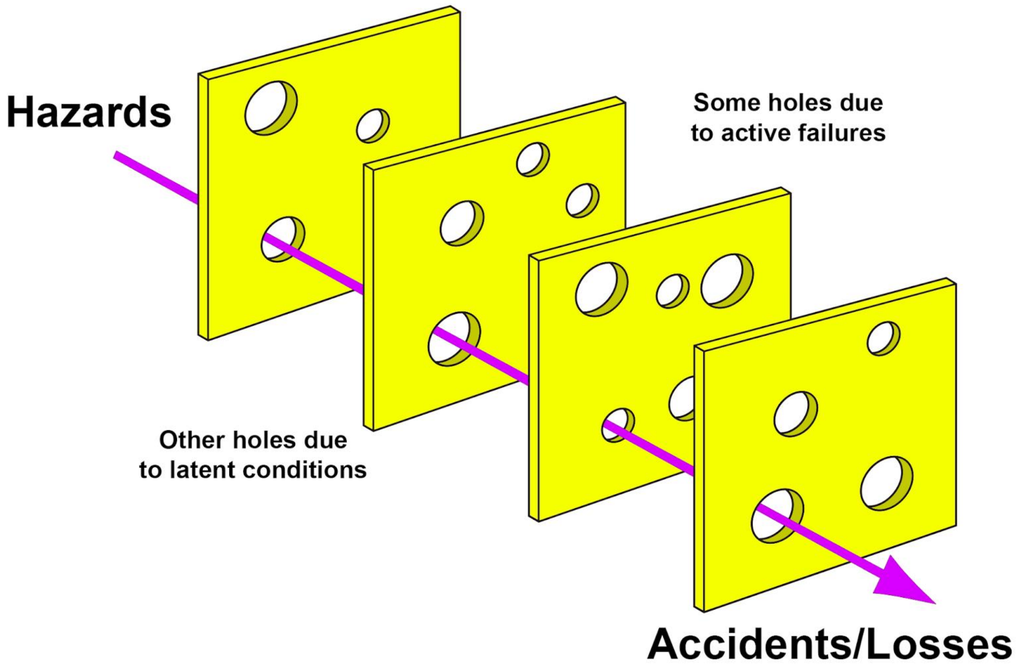
Frequency at which the CDOIF consequence level is reached or exceeded	Frequency per receptor per establishment per year	
	Intolerable (greater than)	Broadly Acceptable (less than)
A	1.0 E-02	1.0 E-04
B	1.0 E-03	1.0 E-05
C	1.0 E-04	1.0 E-06
D	1.0 E-05	1.0 E-07

UNMITIGATED ESTABLISHMENT RISK

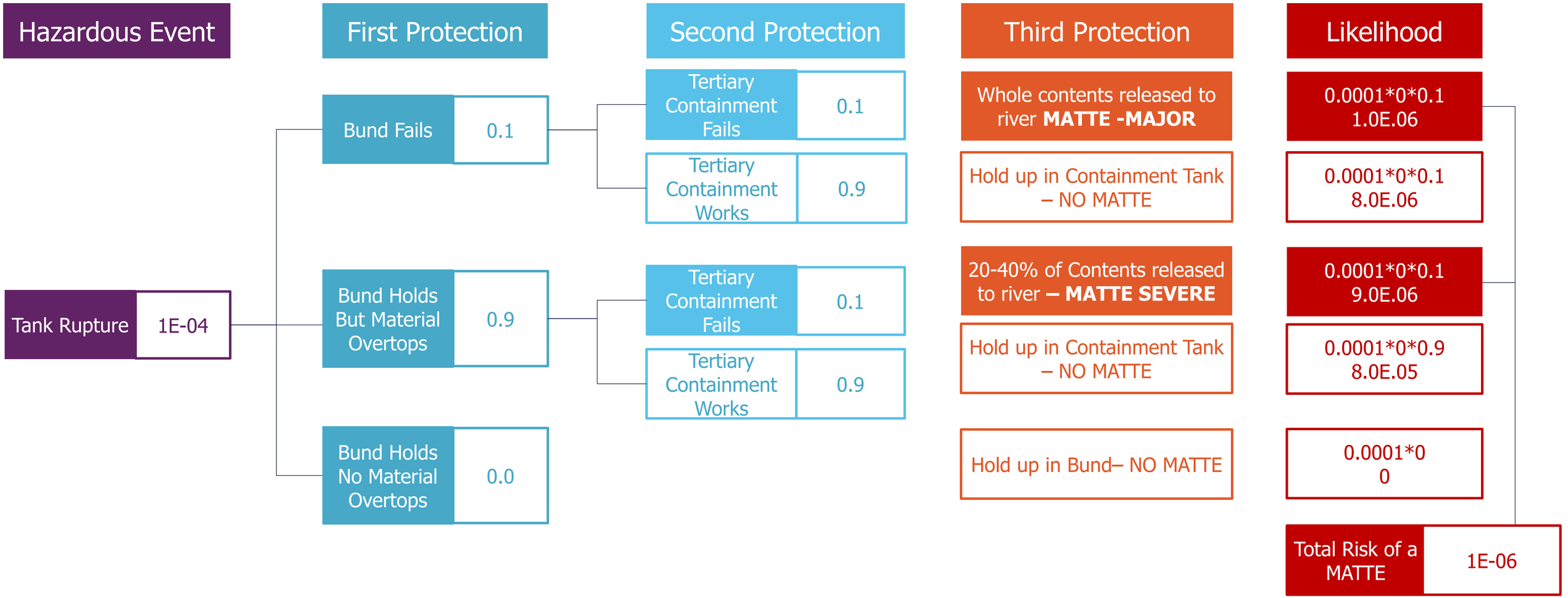
	Frequency per Establishment per Receptor per Year (unmitigated)						
Frequency at which CDOIF Consequence Level is Equalled or Exceeded	$10^{-8} – 10^{-7}$	$10^{-7} – 10^{-6}$	$10^{-6} – 10^{-5}$	$10^{-5} – 10^{-4}$	$10^{-4} – 10^{-3}$	$10^{-3} – 10^{-2}$	$>10^{-2}$
D – MATTE					RAM, M		MPA, PS
C – MATTE							RAM, M, MPA, PS
B – MATTE							RAM, M, MPA, PS
A – MATTE							RAM, M, MPA, PS
Sub MATTE	Tolerability not considered by CDOIF						

Phase 2 – Mitigated Assessment





Phase 2 – Event Trees, PFD and DDR



Unmitigated vs Mitigated

Frequency at which CDOIF Consequence Level is Equalled or Exceeded	Frequency per Establishment per Receptor per Year (mitigated)						
	$10^{-8} – 10^{-7}$	$10^{-7} – 10^{-6}$	$10^{-6} – 10^{-5}$	$10^{-5} – 10^{-4}$	$10^{-4} – 10^{-3}$	$10^{-3} – 10^{-2}$	$>10^{-2}$
D – MATTE					RAM, M		MPA, PS
C – MATTE							RAM, M, MPA, PS
B – MATTE							RAM, M, MPA, PS
A – MATTE							RAM, M, MPA, PS
Sub MATTE	Tolerability not considered by CDOIF						

Unmitigated

Frequency at which CDOIF Consequence Level is Equalled or Exceeded	Frequency per Establishment per Receptor per Year (Reassessed)						
	$10^{-8} – 10^{-7}$	$10^{-7} – 10^{-6}$	$10^{-6} – 10^{-5}$	$10^{-5} – 10^{-4}$	$10^{-4} – 10^{-3}$	$10^{-3} – 10^{-2}$	$>10^{-2}$
D – MATTE		MPA,	PS				
C – MATTE		RAM	MPA, PS	M			
B – MATTE		RAM	MPA, PS	M			
A – MATTE		RAM	MPA, PS		M		
Sub MATTE	Tolerability not considered by CDOIF						

Mitigated

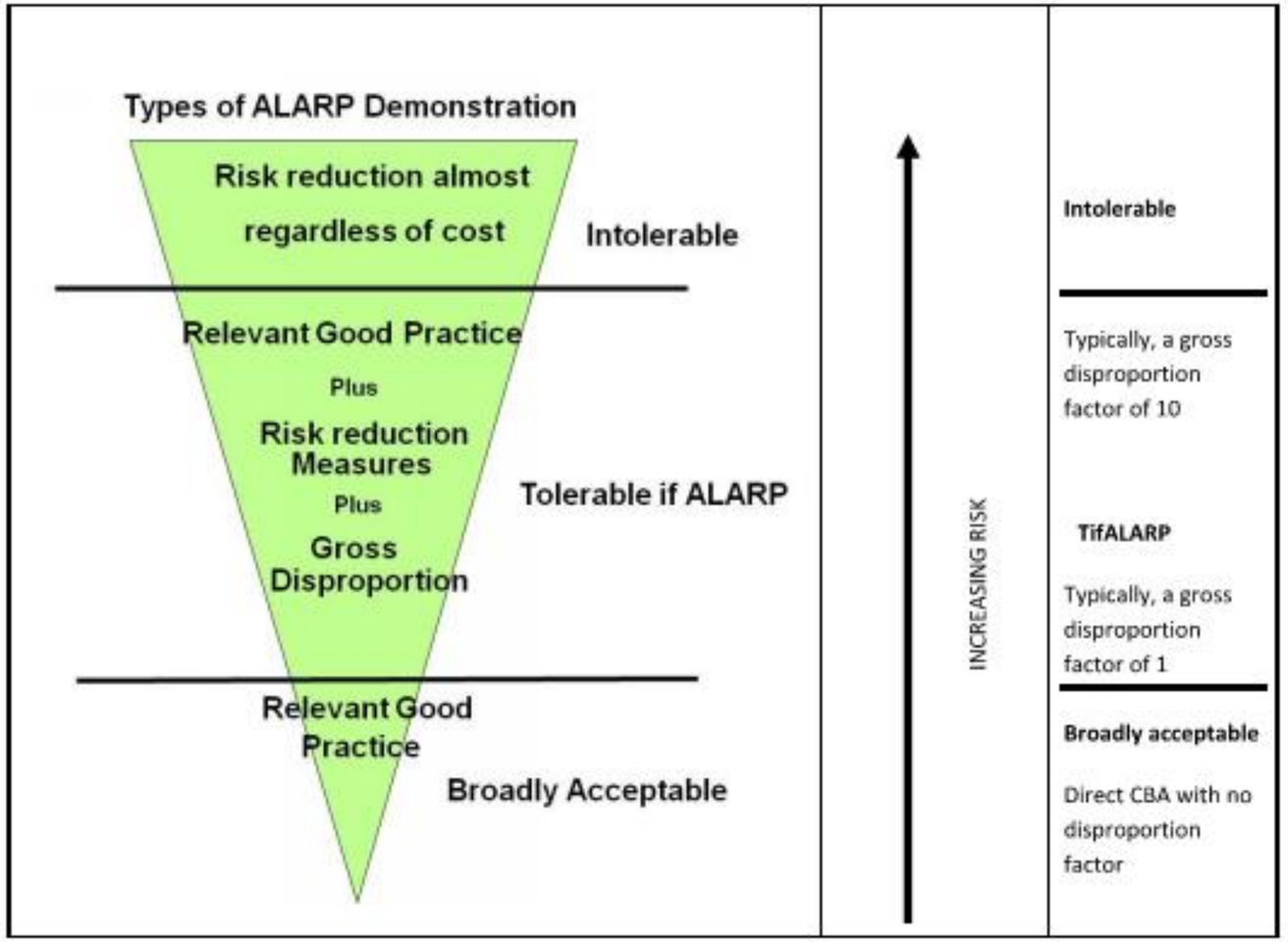
ALARP and Cost Benefit Analysis

A measure is reasonably practicable unless:

Costs/ Benefits >Disproportionate Factor

CBA looks at:

- **Cost of Harm**
- **Cost of Mitigation**



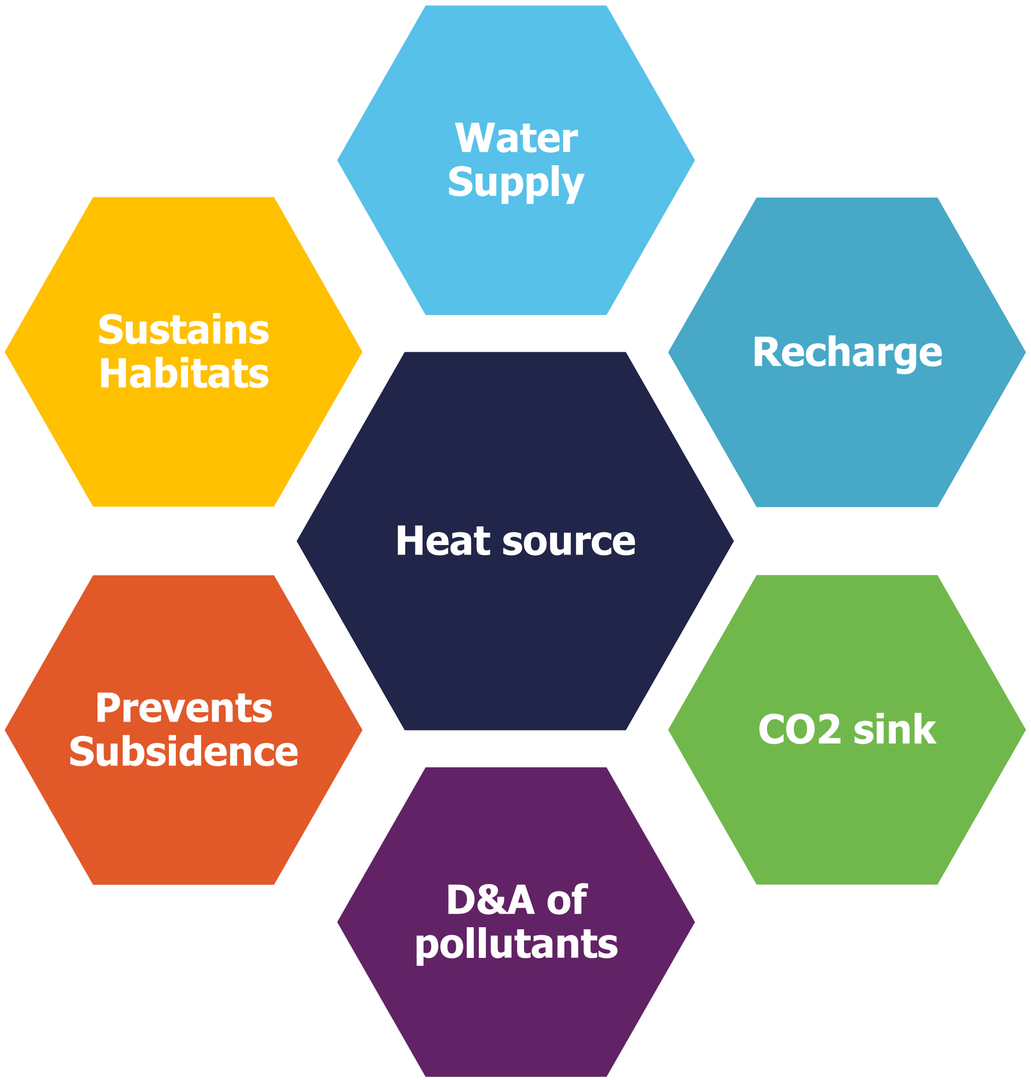
Cost of Harm - Methodology

Environmental Value of Receptor + **Cost of Incident** = **Cost of Harm**

- GW – benefit that the groundwater provides
- Estuarine – based on downgrading of the WFD status, and the cost to bring back to status
- Designated Sites – importance that the site contributes to species at International Level

- Direct Financial Costs – Competent Authority, Operator, Third Party
- Economic costs of impacts on society
- Economic costs of impact on the environment

Groundwater Benefits



DUV – direct use value
IUV – indirect use value
ALT – altruistic value
BQ – bequest value
EV – existence value

Total Economic Value

Groundwater, Surface Water & Designated Sites

Receptor	Significant area Ha	Area considered in assessment Ha	Duration	£/ha/yr	TEV Lower Bound (3 month, 1 Ha)	TEV Upper Bound (6 years, 4 Ha)
GW non drinking Water	> 1 < 100	4	3 months - 6 years	£1,981	£495.25	£47,544.00

Receptor	Significant area	Area	£/ha/yr	TEV Lower Bound 1 year	TEV Upper Bound 10 years	MATTE status
Designated Land/Water Sites (Nationally important)	SSSI	Same as RAMSAR	Same as RAMSAR	Same as RAMSAR	Same as RAMSAR	Same area/value as RAMSAR.
Designated Land/Water Sites (Internationally important)	SPA/RAMSAR (Littoral/sub-littoral and estuarine waters)	111ha	£4,313.56	£478,805.16	£4,788,051.60	MATTE Littoral/sub littoral Severity 3 (Major) RAMSAR/SPA Severity 2 (Severe)
Fresh and estuarine water habitats	Firth of XXX	85ha	£6,616.00	£562,360.00	£5,623,600.00	MATTE Severe-3 (Major)

Cost of Event

Direct Financial costs

- Regulator – Competent Authority, SEPA, LPA
- Operator - loss costs (not earnings), legal, fiscal, remediation
- Third party - direct loss of earnings

Societal Costs

- Community amenity value
- Recreation amenity

Environmental Costs

- Restocking of species
- Habitat translocation and subsequent monitoring

Cost of Harm

Groundwater, Surface Water & Designated Sites

Groundwater – Cost of harm resulting from loss of containment from tank floor

	Lower Bound	Upper Bound
TOTAL COST OF HARM (£)	£3,152,535.25	£4,859,584.00

Firth of XX Scenario 2 - Cost of harm resulting from loss of containment of 2950m³

	Lower Bound	Upper Bound
TOTAL COST OF HARM (£)	£47,752,247.66	£61,720,048.10

Cost of Mitigation & Uncertainties

- Typically requires civil, structural, and MECI input into developing an OOM.
- Revisit the ERA to update the PFDs with new mitigation added in
- Determine future improved establishment risk to determine benefit afforded
- Maybe required to +/- disproportionate factor by 1 to understand sensitivity

ENGINEERING
ENVIRONMENTAL
SURVEYING
CONSULTING

Head Office
Park House
39 Bo'ness Rd, Grangemouth
FK3 8AN
+44 1324 878 822

Regional Office
The Heath Business &
Technical Park, Runcorn
WA7 4QX
+44 1928 511 043

ikm