



# How the Cefic guidance on Transport Risk Assessment can be used in practice - Some examples

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# Qualitative risk analysis

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A first step in the overall risk assessment process.

- filtering out the lower risk activities => focus on higher risk scenarios.
- Does not require precise numeric values <= requires systematic and consistent approach.
- use of a risk matrix.



# Scope of the example

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- Transportation of **Butadiene** in bulk from plants and storage to outbound deep sea or local customers.
- Transportation of **MTBE** in bulk from plants and storage to outbound deep sea or local customers.

# Step 1

## Consequence analysis



<b>Hazard severity (Potential impact)</b>	<b>Criteria</b>	<b>Score (A)</b>
<b>Low potential impact</b>	<b>PG III in bulk</b>	<b>1</b>
<b>Intermediate potential impact</b>	<b>PG II in bulk</b>	<b>2</b>
<b>High potential impact</b>	<b>PG I in bulk</b>	<b>3</b>
<b>Very high potential impact</b>	<ul style="list-style-type: none"><li>-Toxic by inhalation in any quantity</li><li>- Flammable gases in bulk</li><li>- Toxic gases in bulk</li><li>- Highly flammable liquids in bulk</li><li>- Highly toxic liquids in bulk</li></ul>	<b>4</b>



# 1.1 Hazard severity analysis (exmp)

- Butadiene, class 2F (flammable gas) but also a monomer
- MTBE, class 3 (Flammable liquid) PG II (fp = -28°C)

<b>Hazard severity (Potential impact)</b>	<b>Criteria</b>	<b>Score (A)</b>
<b>Intermediate potential impact</b>	MTBE Road MTBE Barge	2
<b>High potential impact</b>	<b>Butadiene Road</b>	4



## 1.2 Hazard exposure ranking

Identification of the potential exposure to the transport hazard based on population densities along the transport route and environmental considerations,

<b>Population density along the transport route</b>	<b>Proximity of environmental sensitive areas *</b>	<b>Score (B)</b>
<b>Low</b>	<b>Very distant</b>	<b>1</b>
<b>Intermediate</b>	<b>Distant</b>	<b>2</b>
<b>High</b>	<b>Close</b>	<b>3</b>
<b>Very high</b>	<b>Very close</b>	<b>4</b>



# 1.2 Hazard exposure ranking

Barge transport – based on the nature of inland waterway is ‘close’.

Road transport for the in-scope supply chains are ‘close’ to ‘intermediate’.

No ‘Very close’ scenarios are identified,

<b>Population density/proximity of environmental sensitive areas</b>		<b>Score (B)</b>
<b>Intermediate / distant</b>	<b>MTBE Road</b>	<b>2</b>
<b>High / close</b>	<b>MTBE Road MTBE Barge Butadiene Road</b>	<b>3</b>

# 1.3 Total consequence ranking



By combining the hazard severity ranking (A) and the hazard exposure ranking (B), the total consequence ranking is obtained. The result should be used to set priorities and to decide whether further steps in transport risk analysis and risk assessment for a transport operation should be undertaken

Hazard Severity Ranking Score (A)	Hazard Exposure Ranking Score (B)			
	4	3	2	1
4	16 (IV)	12 (IV)	8 (III)	4 (III)
3	12 (IV)	9 (III)	6 (III)	3 (II)
2	8 (III)	6 (III)	4 (III)	2 (II)
1	4 (III)	3 (II)	2 (II)	1 (I)

Total Consequence Ranking	Total score
Very high consequence (IV)	16/12
High consequence (III)	9/8/6/4
Moderate consequence (II)	3/2
Low consequence (I)	1





# 1.3 Total consequence ranking

Hazard Severity Ranking Score (A)	Hazard Exposure Ranking Score (R)			
	4	3	2	1
4		Butadiene Road (IV)		
3				
2		(III) MTBE Road MTBE Barge	(III) MTBE Road	
1				

Total Consequence Ranking	Total score
Very high consequence (IV)	16/12
High consequence (III)	9/8/6/4
Moderate consequence (II)	3/2
Low consequence (I)	1

*Note: A red arrow points from the 'Butadiene Road (IV)' cell in the matrix to the 'Very high consequence (IV)' row in the ranking table. Two green arrows point from the 'High consequence (III)' row in the ranking table to the 'Total Consequence Ranking' column of the table.*



# 1 Consequence analysis

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Total Consequence Ranking	Total score
Very high consequence (IV)	Butadiene Road
High consequence (III)	MTBE Road MTBE Barge



## 2 Probability analysis

The probability analysis aims at identifying the **probability** of occurrence of a transport hazard, taking into account the **average accident frequencies** for the transport mode being assessed.

scenario	Total probability	Probability ranking
MTBE Barge	5.1%	likely
MTBE Road	1.4%	Not likely
Butadiene Road	2.7%	Not Likely

*Consistency*



# Example of in-house probability

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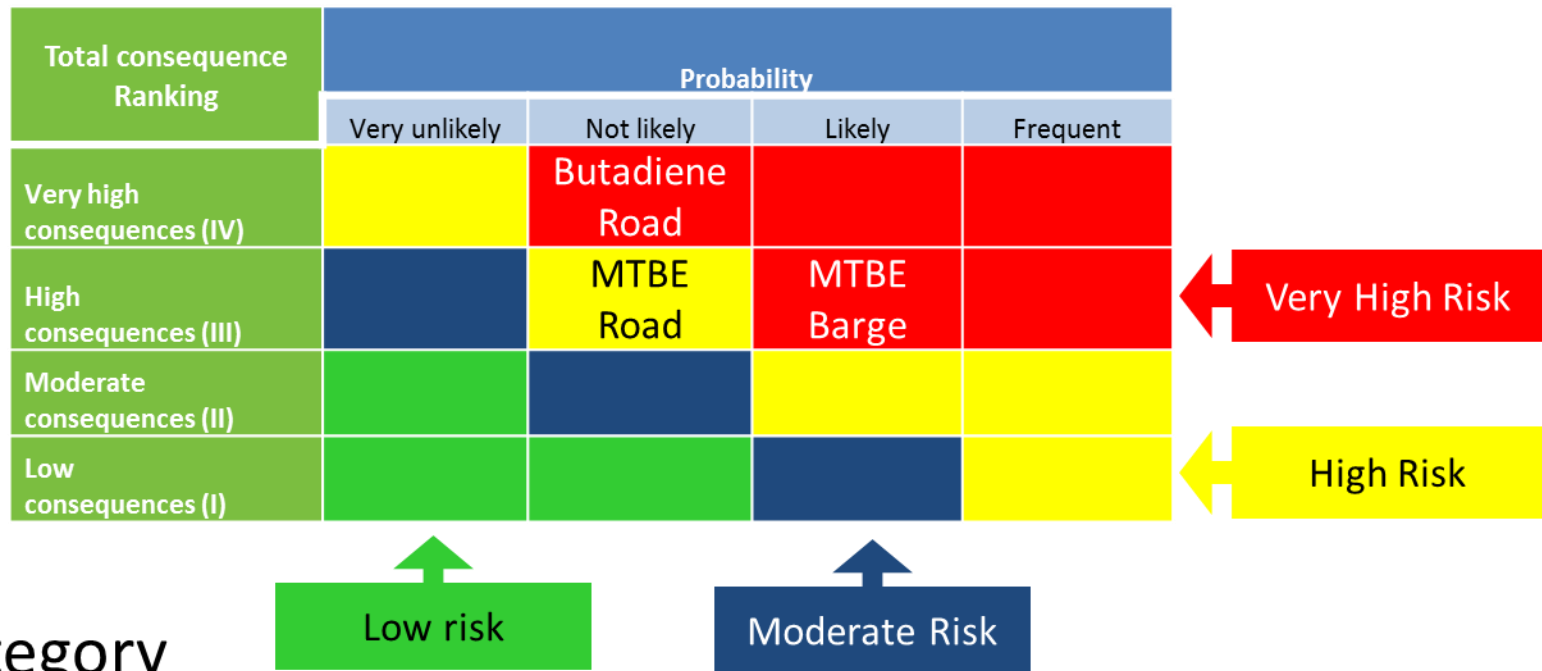
- $T$  = number of transports per year
- $D$  = duration of the transport (av) distance (km) or days
- $A$  = number of accidents per year
- $T_{prod.mode}$  = # of tr. of this product in this mode p/a
- $A_{mode}$  = # of acc. in this mode p/a

$$Probability_{prod.mode} = \frac{T_{prod.mode}}{T_{mode}} \cdot \frac{D_{prod.mode}}{D_{mode}} \cdot A_{mode}$$



# 3. Risk Matrix

- Combines Total consequence with Probability



- Risk Category
  - MTBE Barge : **Very High Risk**. (mitigate)
  - Butadiene road: **Very High Risk** (mitigate)
  - MTBE Road : High Risk



# Conclusion

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- MTBE transport Barge is a focus area for the 1<sup>st</sup> analysis cycle, more than MTBE by road transport.
- Butadiene transport by road is in a higher level than MTBE transport by road

Both very high risk scenarios will be quantified in a single risk assessment cycle.