ISOPA PRODUCT STEWARDSHIP PROGRAMMES

"One Step Ahead – 2nd Generation"

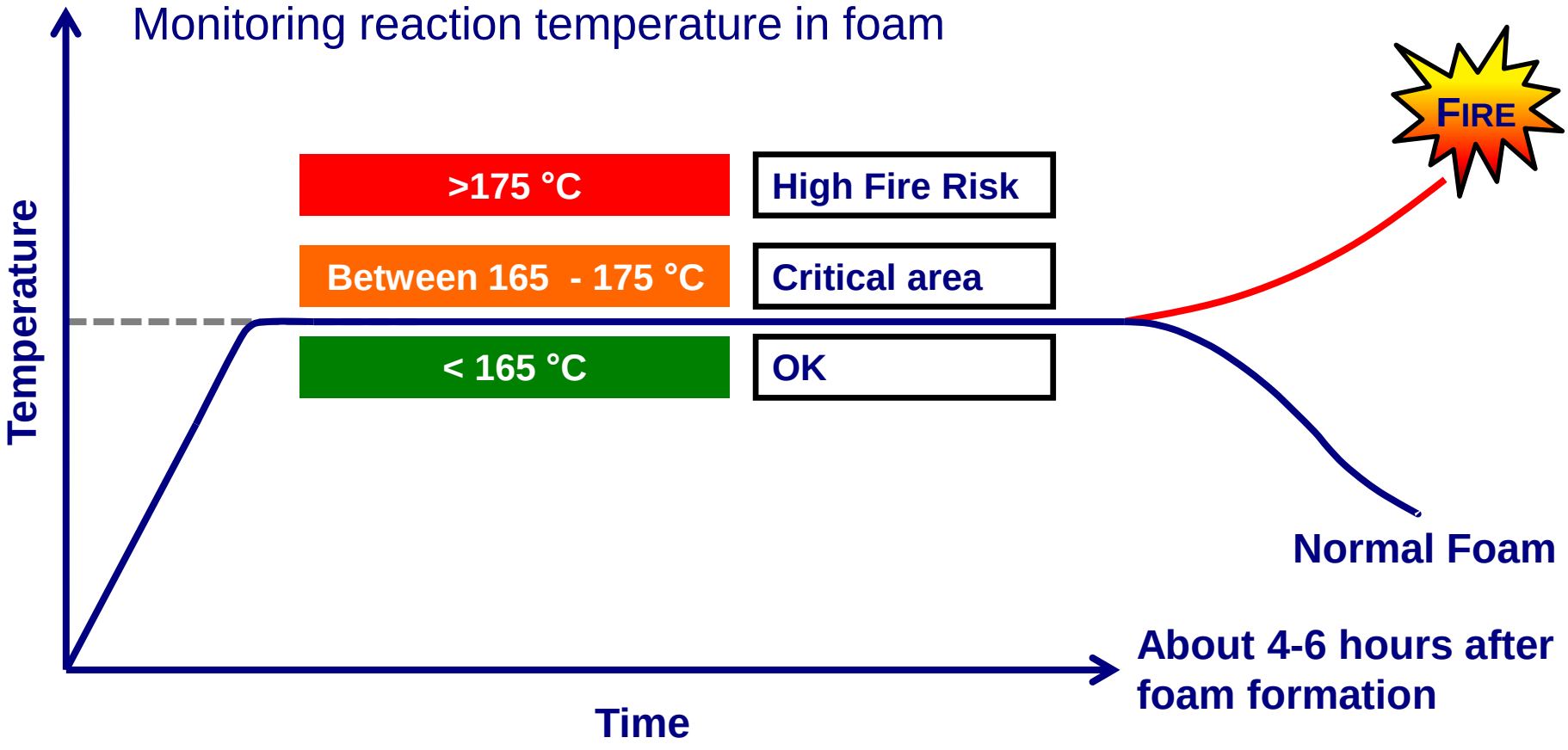
Exotherm management in flexible slabstock foam

Version 2019

Foam Exotherm

- Catching fire is the most important risk associated to foam production.
- The heat generated by the chemical reactions during foaming can induce fire.
- Foam may also catch fire due to external sources (sparks, flame, cigarettes, etc.)

Foam Exotherm & Fire Risk



Foam Exotherm & Fire Risk

one step ahead
Safety in Action

Warnings:

- Warm raw materials lead to higher exotherm
- The maximum quantity of TDI in a foam formulation without Methylene chloride should NOT exceed 55 pphp in order to obtain a safe exotherm.
- This formula gives only a theoretical estimation of a foam exotherm, assuming that the metering of every chemical is correct during production.

Estimating the Foam Exotherm	
+	**69**
+	**Raw Material Temperature (ºC)**
+	**1.394 × pphp TDI**
–	**1.17 × pphp Methylene Chloride**
=	**Theoretical Exotherm in ºC**

Note: php = per hundred polyol: The quantities of TDI and Methylene Chloride in the formula are according to 100 parts of polyol.

- Theoretical exotherm should always be **<165ºC**
- Always keep on the safe side and contact your suppliers in case of doubt.
- The bigger the block size the longer it takes to cool down

Exotherm & Fire Risk

one step ahead
Safety in Action

Formulations Examples (raw materials at 20ºC) :

	High Exotherm	Critical Exotherm	Safe Exotherm
Polyol 15%	100	100	100
TDI Index 115	70,6	68,4	64,4
Methylene Chloride	8,4	10	12,9
Water	5,7	5,5	5,14
Exotherm ºC	**178**	**173**	164
Water + Methylene Chloride/8	6,75	6,75	6,75

- Those 3 formulations lead to the same density with different exotherms
- Ratio Water+(Methylene Chloride/8) has to be constant to maintain the same density
- Increasing Methylene Chloride and reducing water lowers the exotherm

one step ahead
Safety in Action

Antioxidants:

- Polyols designed for slabstock foam production typically have antioxidant packages sufficient to stabilize the blocks during production and curing for exotherm <165°C
- However there are polyols designed for other applications (CASE* & moulded foam) with an antioxidant content that is not appropriate for slabstock foam production
- An insufficient amount of antioxidant in the polyol can be the reason for a fire caused by self ignition of the foam during curing
- Make sure to use only polyols designed for slabstock foam production.
- Consult your suppliers in case of doubt

* coatings, adhesives, sealants and elastomers

Foam Exotherm & Fire Risk

It is crucial to monitor foam temperature after production. Each foam formulation will lead to an exotherm in a specific range. It is important to remain below <165°C and to monitor unexpected temperature deviations

Segregate foams from the start, the grade change and the end. Measure their temperatures as these are potential situations with high fire risk.

In case the foam temperature is rising too high

- move the foam out of the factory and away from any flammable material
- cut the foam in small pieces
- finally apply water on or into the foam to cool it down

Foam Exotherm & Fire Risk

Like all measuring instruments, thermocouples used for exotherm measurements have to be calibrated regularly, at least once a year.

An easy way to check the indication of a thermocouple is to put the probes into boiling water.

Caution: the temperature of boiling water may vary according to the altitude of your plant:

Altitude (m)	Temperature of boiling water ºC
0	100,0
500	98,3
1000	96,7
1500	95,0
2000	93,3

Question

Which statement is correct related to the temperature evolution of the foam?

a) The recipe has no influence on the exotherm of the foam
b) TDI can be used in any amount as long as the index is at 100
c) TDI should not exceed 55 pphp – in case of foam that is not blown with methylene chloride
d) The theoretical exotherm of a reaction can be calculated
e) The size of the block has no influence on the decay of the exotherm of a block

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Question

The temperature of the foam is monitored. You realize that the temperature is rising to a critical level. What would you suggest?

a) Remove the foam from the factory and away from any flammable parts
b) Cut the foam into small pieces and spray water on the foam
c) Wrap the foam into paper

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