

**Study: 3 Presentation title “Commercial Fumigations of Wood in Czech Forests – First Experiences”
MBAO Conference, Orlando, November 2018**

Log characteristics

The logs used for this study was Norway spruce (*Picea abies*) with 200 cm in length.

Determination of stack sizes

The dimensions of the tarp size was 68 m x 4.4 m x 5 m

Treatment volume = 1496 m³

Loading rates

64%

Fumigation dose

50 g/ m³ for 10 hours

Total EDN applied = 75 kg

Methodology

The logs were placed on a tarp with sufficient overlap on the sides. The whole pile was covered with another tarp. The edge of the two tarps was rolled together and sealed with spring clamps. Five EDN application tubes were inserted into the prepared holes in the tarp. Two monitoring lines were also inserted into the log pile to measure the EDN concentration during the treatment period. Before EDN application, an exclusion zone of 20 m was marked using a tape. EDN application was completed at 8:20 and the ventilation was started around 18:30.

Wind speed and wind direction were monitored at a distance of 10 m from the tarp and at 2 m height.

A total of 75 kg of the product was applied based on the change of cylinder weight placed on a scale. It took about 20 minutes for application.

EDN and HCN monitoring inside the tarp during fumigation

A GC (Shimadzu GC-17A) equipped with manual split injector, switch to 2 columns with TC and FI detectors and RT-QBond column, 30 m, ID 0.53 mm, 0.2 um film was used. Ethanedinitrile and HCN concentrations were measured by means of sample collection into gas-tight bags and subsequent GC analysis

EDN and HCN monitoring from the fumigated space 1.5 hours after ventilation

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EDN concentration detection in the environment during fumigation:

- MSA Ultima XA 6 detectors were used to detect EDN, 10 m from the tarp
- GasAlert 4 detectors were used to detect HCN in four cardinal direction 10 m from the tarp.

EDN concentration measurement during ventilation:

- Gasmet DX4040 – 20 m in the wind direction (ethanedinitrile and HCN monitoring)
- LumaSense INNOVA 1412i – 10 m from the centre of the 68-meter-long pile in the wind direction (ethanedinitrile monitoring)
- MSA Ultima XA 6 detectors were used to detect EDN, 20 m from the tarp in all the directions
- GasAlert 4 detectors were used for HCN in four cardinal directions 20 m from the tarp in 4 cardinal directions

Results:

EDN and HCN monitoring inside the tarp during fumigation

Two samples were collected from the top for each sampling time and one sample from the bottom of the tarp. One hour after EDN application, the EDN concentration was between 27 and 28 g/ m³. EDN concentration gradually declined over 10 hours of treatment inside the tarp. One hour before ventilation, the concentration was between 3.8 and 4.1 g/ m³ (Table 1). HCN concentration remained constant during the fumigation period. The level measured inside the tarp was lower than the amount of HCN found in EDN cylinder as an impurity.

Table: 1 EDN and HCN concentration inside the tarp during fumigation

Time of sampling	Top of the stack (g/ m ³)		Bottom of the stack (g/ m ³)	
	EDN	HCN	EDN	HCN
9:30	27.807	0.103		
9:30	27.334	0.102	28.079	0.192
12:00	14.518	0.204		
12:00	14.6	0.206	14.724	0.198
15:00	6.752	0.208		
15:00	6.563	0.205	7.353	0.247
17:30	3.757	0.192		
17:30	3.77	0.205	4.107	0.18

EDN and HCN monitoring from the fumigated space 1.5 hours after ventilation

No EDN or HCN found on the fumigated area on the samples collected 1.5 hours after ventilation.

EDN concentration detection in the environment during fumigation:

No EDN or HCN was detected 10 m from the stack during fumigation. Random measurements were also performed in the close vicinity of the tarp also recorded 0 ppm of EDN or HCN.

EDN concentration measurement during ventilation:

EDN concentration measured using LumaSense immediately after ventilation at 10 m downwind direction from the stack is shown on table 2

Table: 2 EDN concentration at 10 m down wind direction from the tarp during ventilation measured using LumaSense

Sampling period	Average EDN concentration	Maximum EDN concentration
0 to 20 min	12 ppm	88 ppm
20 to 40 min	2 ppm	16 ppm
40 to 60 min	1 ppm	3 ppm

EDN concentration measured using Gasmeter immediately after ventilation at 20 m downwind direction from the stack is shown on table 3

Table: 3 EDN concentration at 20 m downwind direction from the tarp during ventilation measured using Gasmeter

Sampling period	Average EDN concentration	Maximum EDN concentration
0 to 20 min	0 ppm	0 ppm
20 to 40 min	0 ppm	0 ppm
40 to 60 min	0 ppm	0 ppm

EDN concentration measured using MSA and HCN using GasAlert at 20 m from the stack in 4 direction around the stack is shown on table 4

Table: 4 EDN and HCN concentration measured in 4 directions (N, E, S, W) 20 m from the stack

Sampling period	EDN concentration (N, E, S, W)	HCN concentration (N, E, S, W)
0 to 20 min	0 ppm	0 ppm
20 to 40 min	0 ppm	0 ppm
40 to 60 min	0 ppm	0 ppm

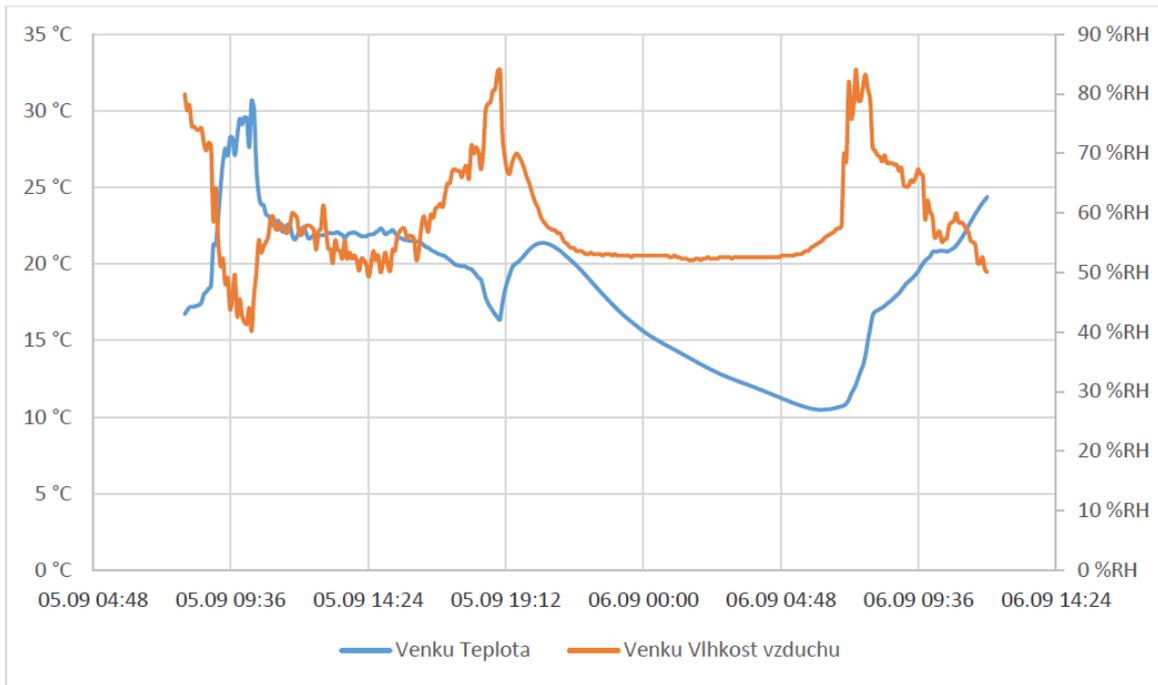


Figure: 1 Temperature and Humidity outside the tarp

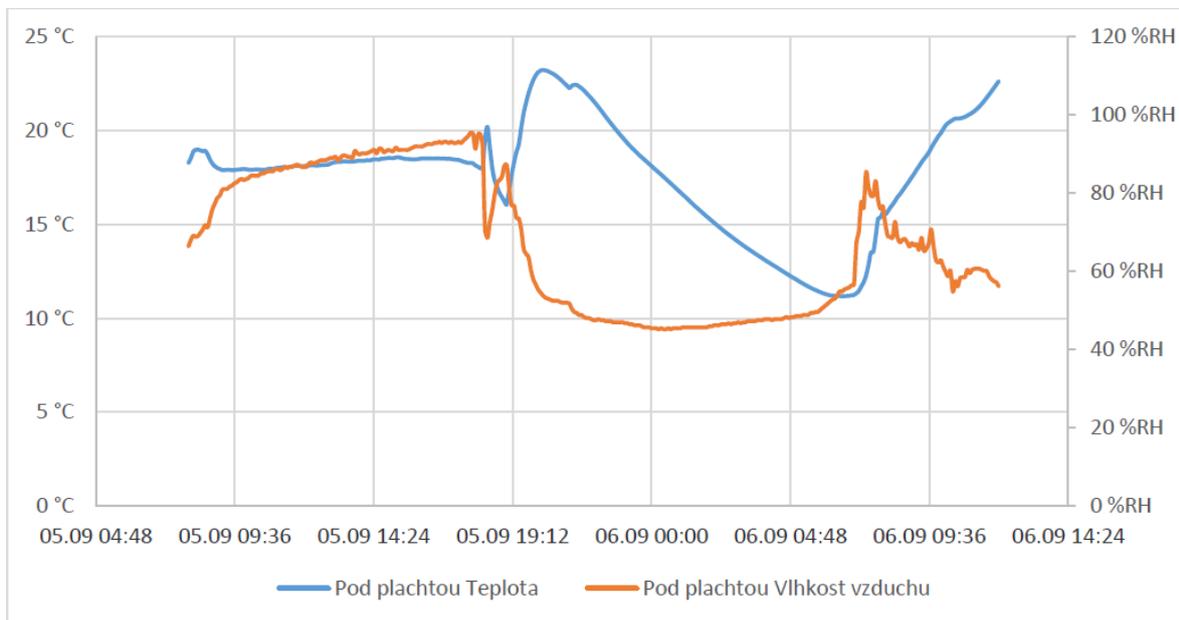


Figure: 2 Temperature and humidity inside the tarp

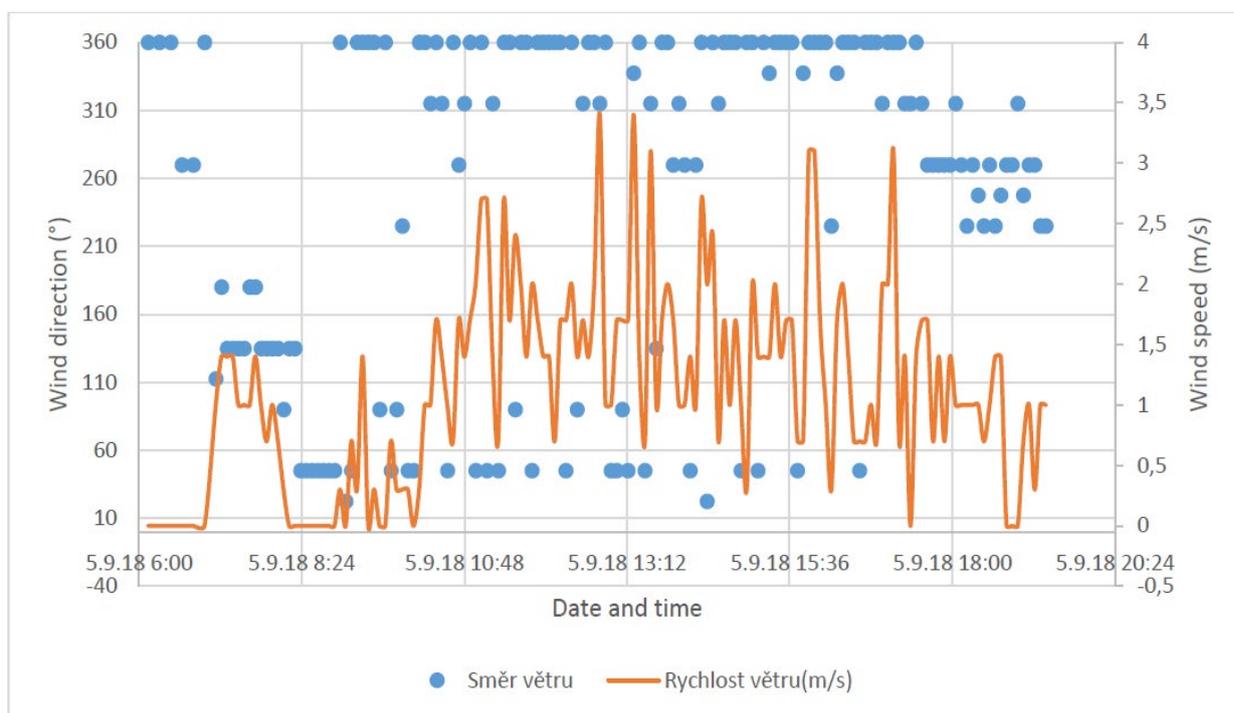


Figure: 3 Wind speed and wind direction during fumigation and ventilation. Wind direction during the ventilation was between 225 and 315 °

Table: 5 The left Y axis of Figure 3 is converted to degrees corresponding to the direction on the compass rose:

Cardinal direction	Degrees	Cardinal direction	Degrees
N	360	SE	135
NNE	22.5	SW	225
NE	45	W	270
E	90	WSW	247.5
ESE	112.5	NW	315
S	180	NNW	337.5