Impact of Within Kiln Temperature Variations on Final MC Uniformity in SPF

NEKDA 2008 Fall Meeting

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Overview of presentation

- General objective
- Key Performance Indicator approach
- Measurement methodology
- Analysis of 3 industrial cases
- Impact on MC uniformity

KPI approach

- **2005 Establishment of KPI related to drying**
  - Works with FPInnovations expert and auditor team
  - KPI Implementation in each mill
    - **Equipments**
    - **Handling operations related to drying**

Kiln equipments and drying conditions		
Tightness	25%	91%
Mechanical components	25%	76%
Airflow	25%	79%
Temperature	25%	69%
		79%

Handling operations		
Piling and stacking	30%	87%
Green lumber yard	20%	74%
Kiln loading	35%	91%
Dry lumber yard	15%	73%
		84%

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KPI approach

- **Evaluation of handling operations**

Piling and Stacking

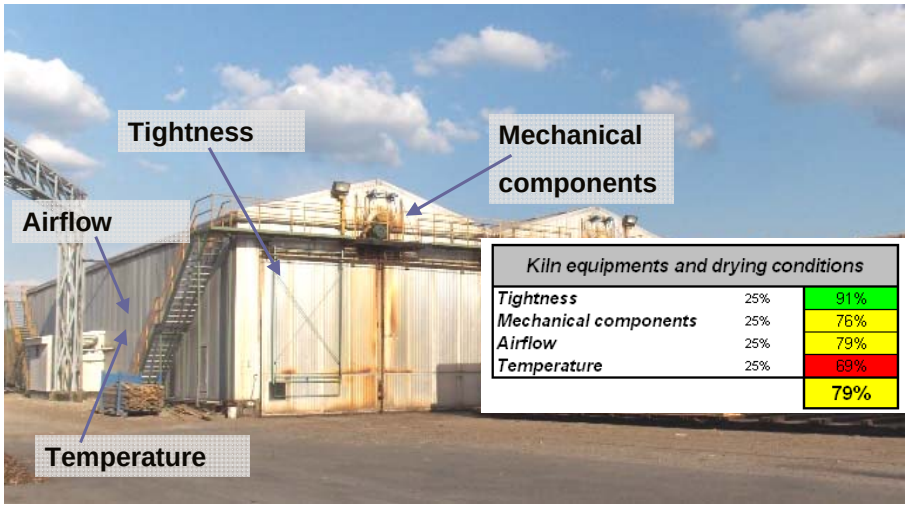
Green and dry yard

Kiln loading

Handling operations		
Piling and stacking	30%	87%
Green lumber yard	20%	74%
Kiln loading	35%	91%
Dry lumber yard	15%	73%
		84%

KPI approach

- Evaluation of mechanical components
- Measurement of conditions



KPI approach

- Measurement at 14 mills - 34 kilns
- Evaluation of different types of kiln
  - Bachrich, Cathild, Mec
  - Moore, Salton, Secovac

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Measurement methodology
Verification of temperature variations

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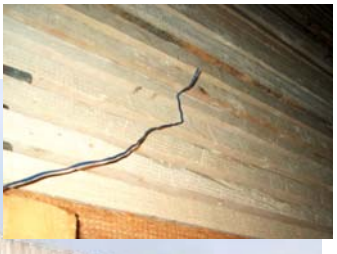
Measurement methodology

Readings across the length of the kiln



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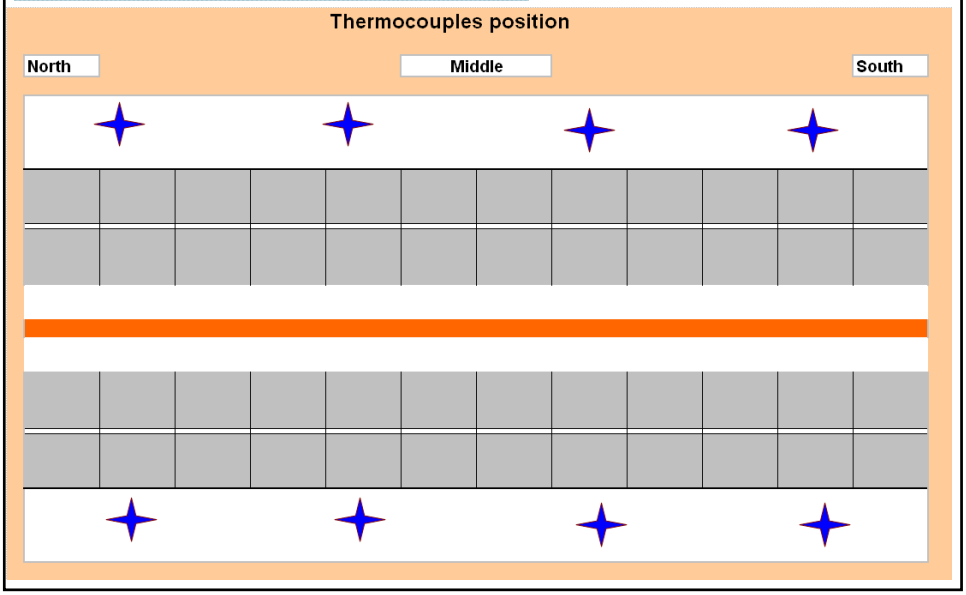
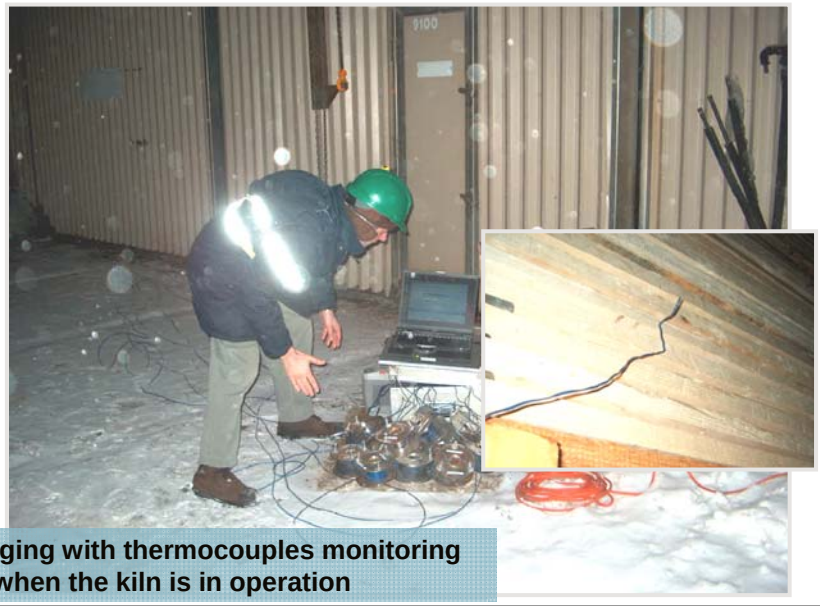
Measurement methodology

Readings across the length of the kiln



Measurement methodology



Data logging with thermocouples monitoring system when the kiln is in operation

Results

Results

- **Temperature variations on the length for every kiln evaluated**

	A		B		C		D		E	F		G
	# 1	# 2	# A	# B	# 1	# 2	# 1	# 3	# 3	# 2	#4	#2
Type of kiln	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Dbl pass	Dbl pass	Sgl pass
Temperature variations (°F)	4	12	5	12	3	15	15	11	4	5	20	14
Steam trap	Coll	Coll	Coll	Coll	Ind	Ind	Coll	Coll	Ind	Coll-coll	Coll-coll	Coll-coll

	H		I		J	K		L	M	N	O	
	# 1	# 2	# 2	# 3	# 3	#2	#4	# 1	# 1	# 3	#1	#2
Type of kiln	Dbl pass	Dbl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Dbl pass	Dbl pass
Temperature variations (°F)	10	9	23	16	4	25	5	18	14	6	32	36
Steam trap	Ind-Ind	Ind-Ind	Coll	Coll	Coll	Coll-Ind	Coll-Ind	Ind	Ind	Coll	Coll	Coll

	P		Q		R		S	T	U		V
	# 1	# 2	# 2	# 3	# 1	# 2	#4	# 1	#1	#2	# 3
Type of kiln	Dbl pass	Dbl pass	Dbl pass	Dbl pass	Dbl pass	Dbl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass
Temperature variations (°F)	6	9	20	15	11	11	0	12	17	15	18
Steam trap	Coll-coll	Ind-coll	Coll-coll	Coll-coll	Ind-Ind	Coll-Ind	Ind	Ind	Ind	Ind	Ind

Results

- **Important temperature variations for many kiln**
  - Maximum 36°F
  - Average 13°F More than 20 kilns are over 10°F of variation
  - Minimum 0°F

	#2	#1	#2	# 2	# 2	#4	# 3	# 1	#1	# 3	#2	# 3
Type of kiln	Dbl pass	Dbl pass	Sgl pass	Sgl pass	Dbl pass	Dbl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Dbl pass
Temperature variations (°F)	36	32	25	23	20	20	18	18	17	16	15	15
Steam trap	Coll	Coll	Coll-Ind	Coll	Coll-coll	Coll-coll	Ind	Ind	Ind	Coll	Ind	Coll-coll

	# 2	# 1	#2	# 1	# 2	# 1	# B	# 3	# 1	# 2	# 1	# 2
Type of kiln	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Dbl pass	Dbl pass	Dbl pass	Dbl pass
Temperature variations (°F)	15	15	14	14	12	12	12	11	11	11	10	9
Steam trap	Ind	Coll	Coll-coll	Ind	Coll	Ind	Coll	Coll	Ind-Ind	Coll-Ind	Ind-Ind	Ind-Ind

	# 2	# 3	# 1	#4	# 2	# A	# 3	# 1	# 3	# 1	#4
Type of kiln	Dbl pass	Sgl pass	Dbl pass	Sgl pass	Dbl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass	Sgl pass
Temperature variations (°F)	9	6	6	5	5	5	4	4	4	3	0
Steam trap	Ind-coll	Coll	Coll-coll	Coll-Ind	Coll-coll	Coll	Ind	Coll	Coll	Ind	Ind

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1st case
Cold zone

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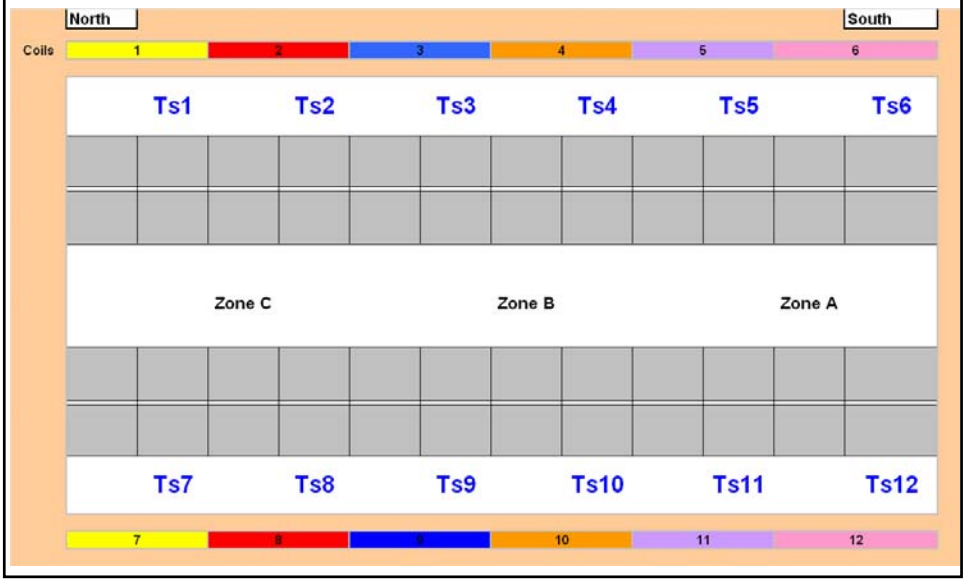
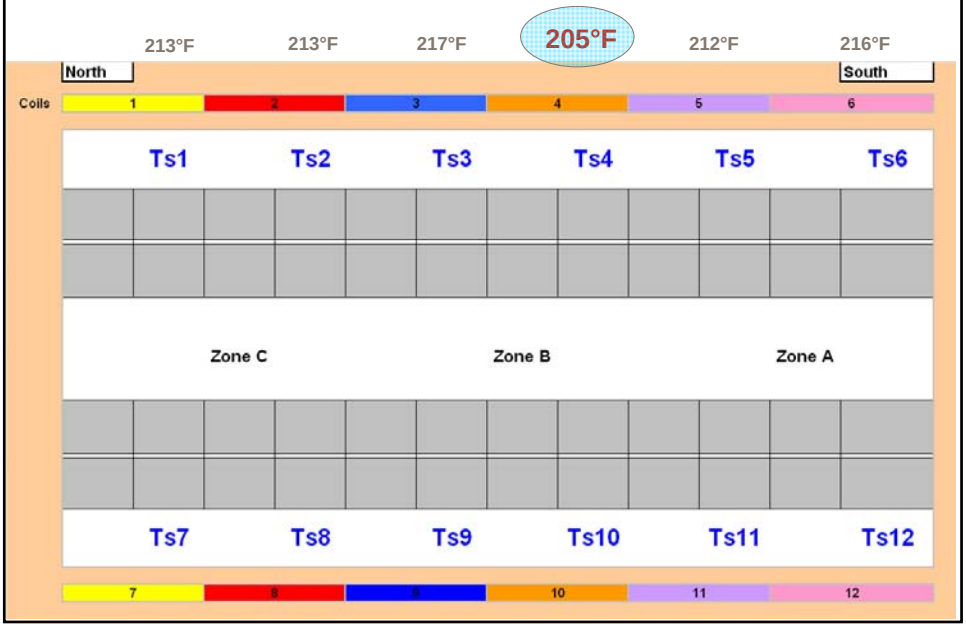
1st case – cold zone
Thermocouples position
Single pass – high temperature

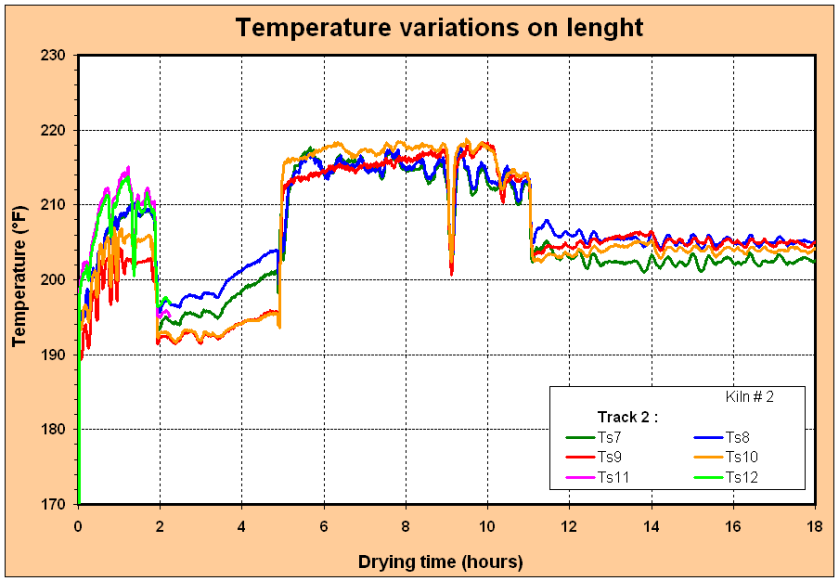


1st case – cold zone



1st case – cold zone

Uniform temperature on track #2



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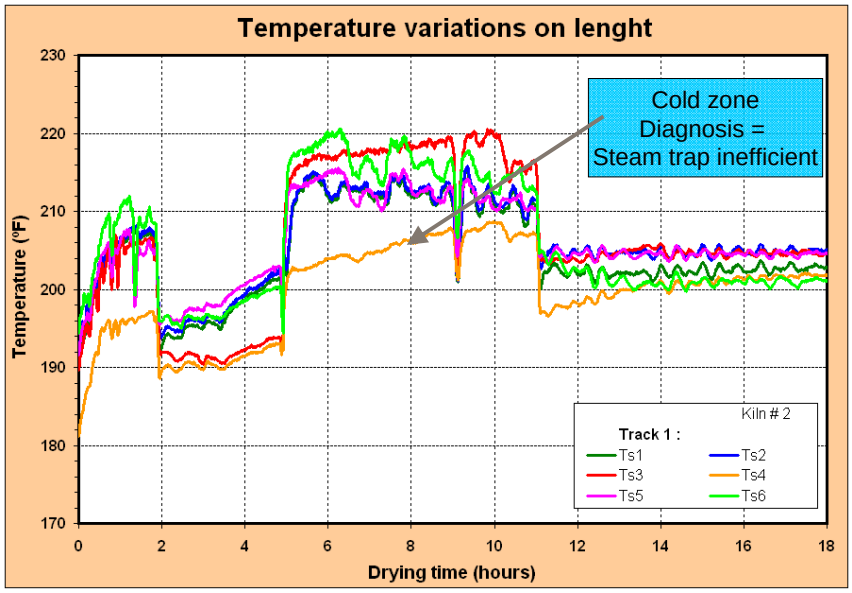
1st case – cold zone

Cold spot on track #1



2nd case
Variations in length

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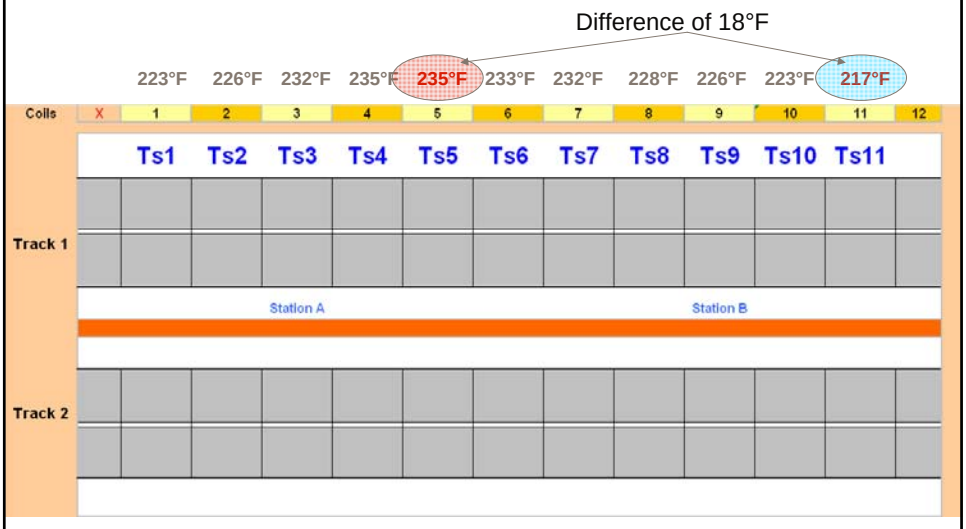
2nd case - Variations in length
Double pass – High temperature



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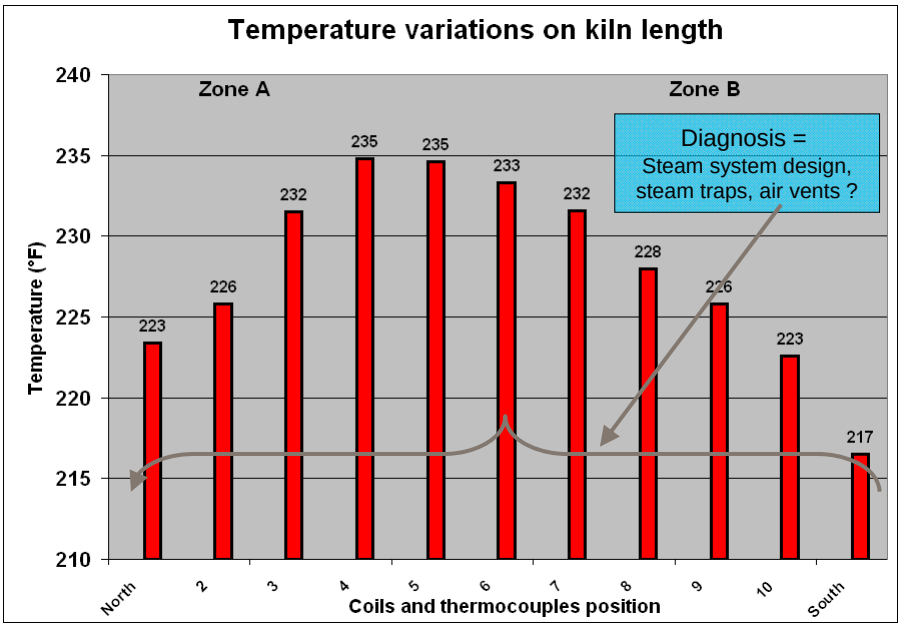
2nd case - Variations in lenght



2nd case - Variations in lenght

Now
Group coils on steam trap
No air vents

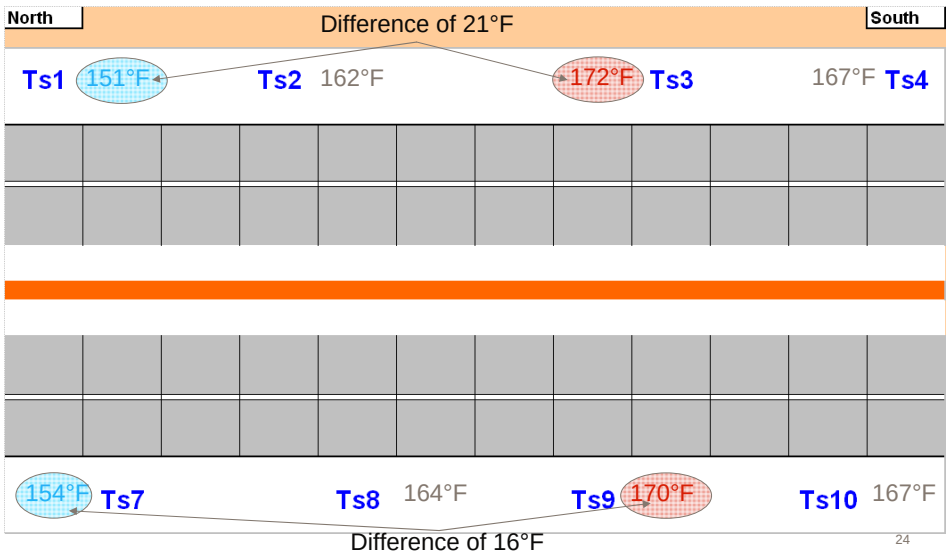
Plan
Individual steam trap on each coil
Air vent on each coil

3rd Case

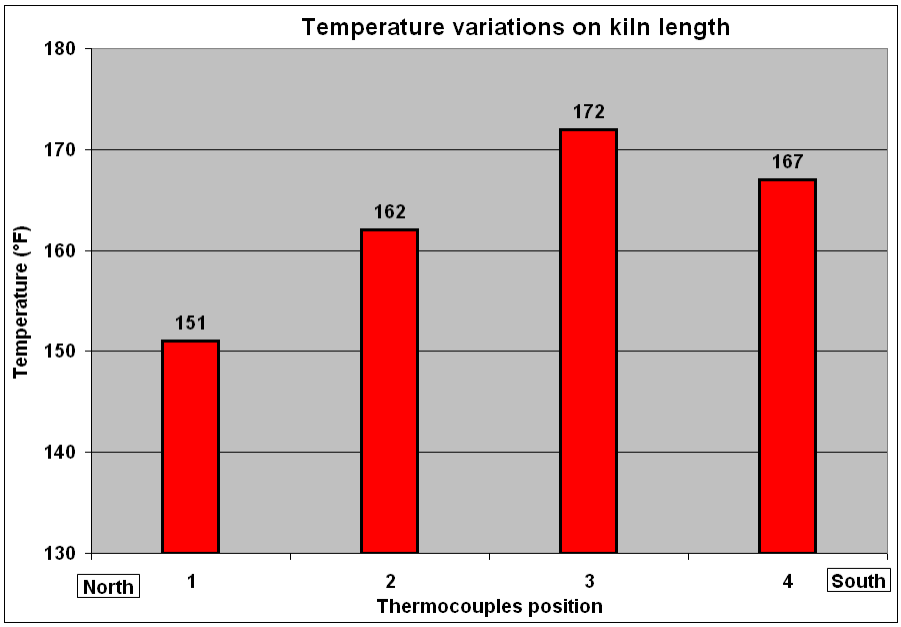
Variations in length

3rd case - Variations in length

Double pass – Conventional temperature

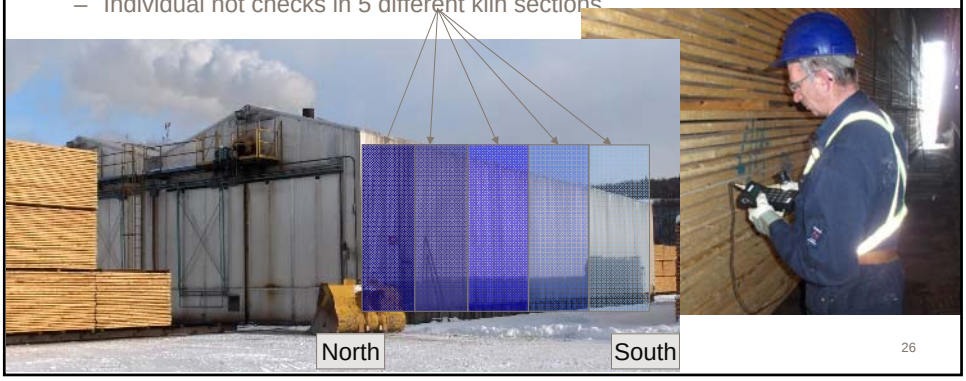


3rd case - Variations in length



3rd case - Variations in length

- **Actions**
  - To monitor the impact of temperature variations on wood MC
- **Measurement**
  - Detailed monitoring of MC in fall, winter and spring period
  - Sample of 70 kiln charges - black spruce
  - Analysis of charges over than 16% MC
  - Analysis of charges lower than 15% MC
  - Individual hot checks in 5 different kiln sections



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1st ANALYSIS

Charges higher 16 % MC

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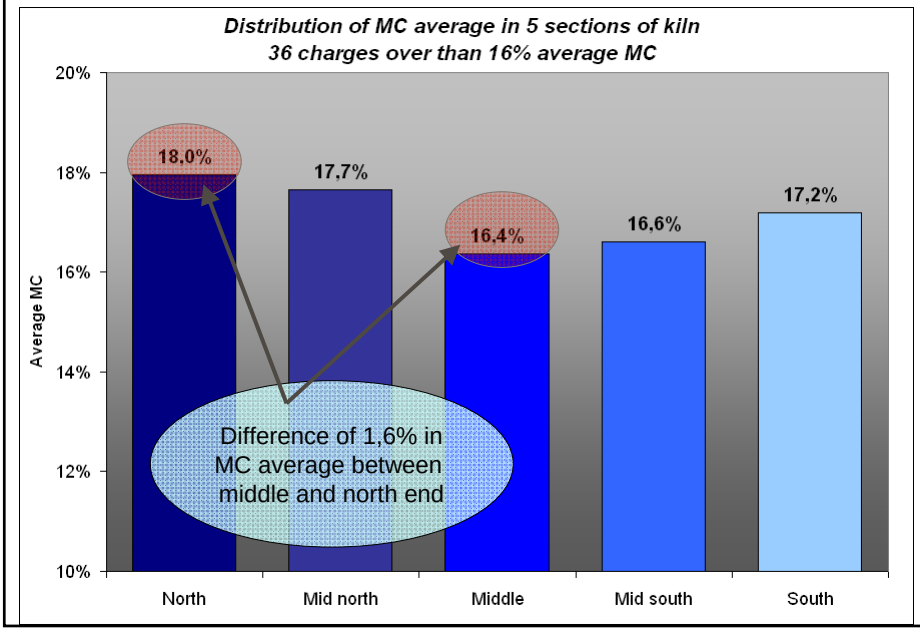
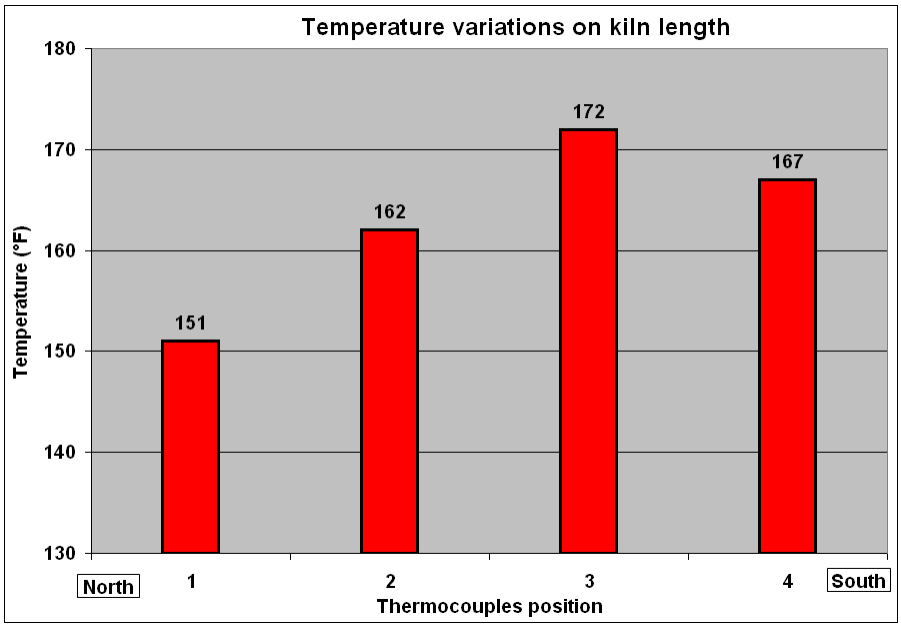
1st analysis



1st analysis



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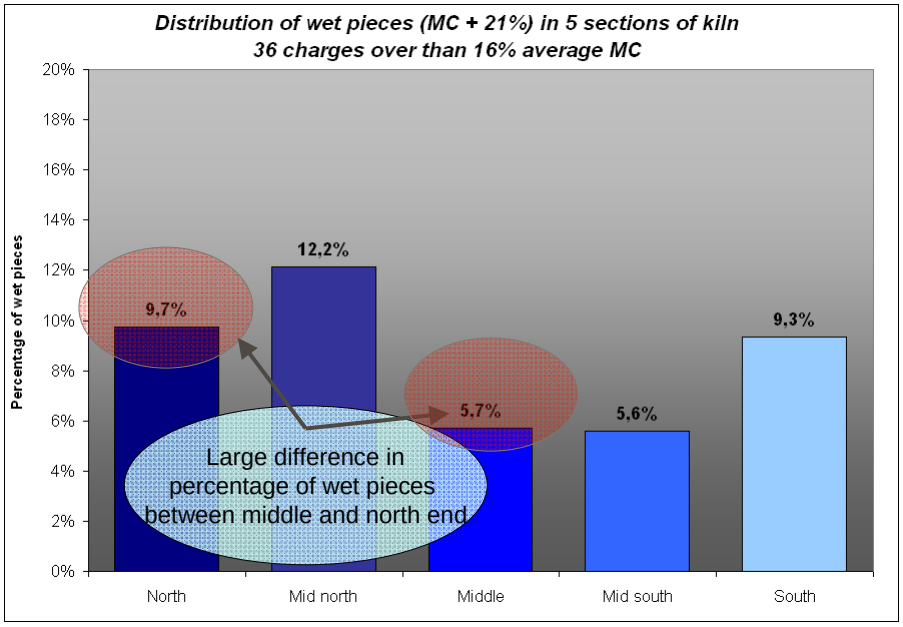

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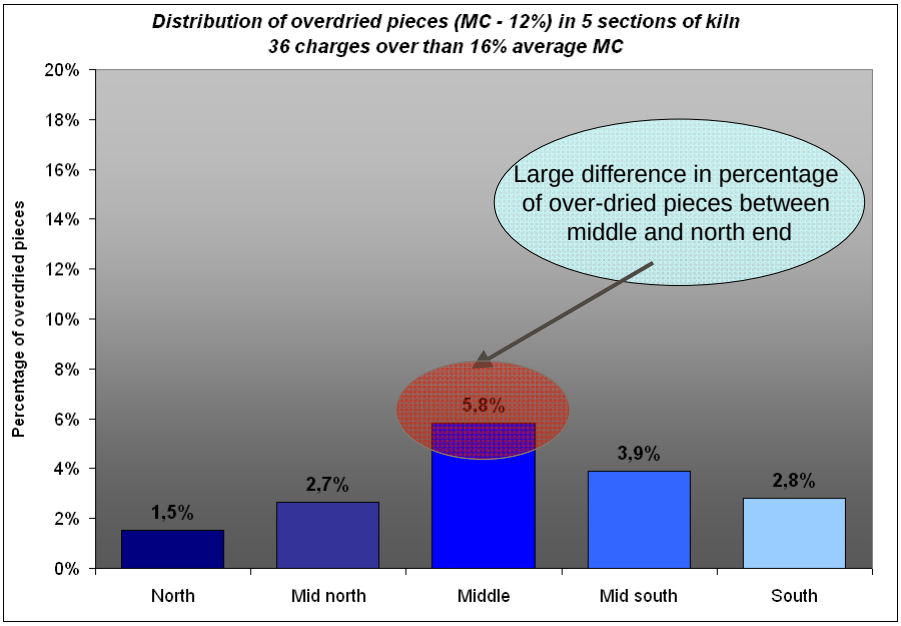

2nd ANALYSIS

Charges lower than 15 % MC

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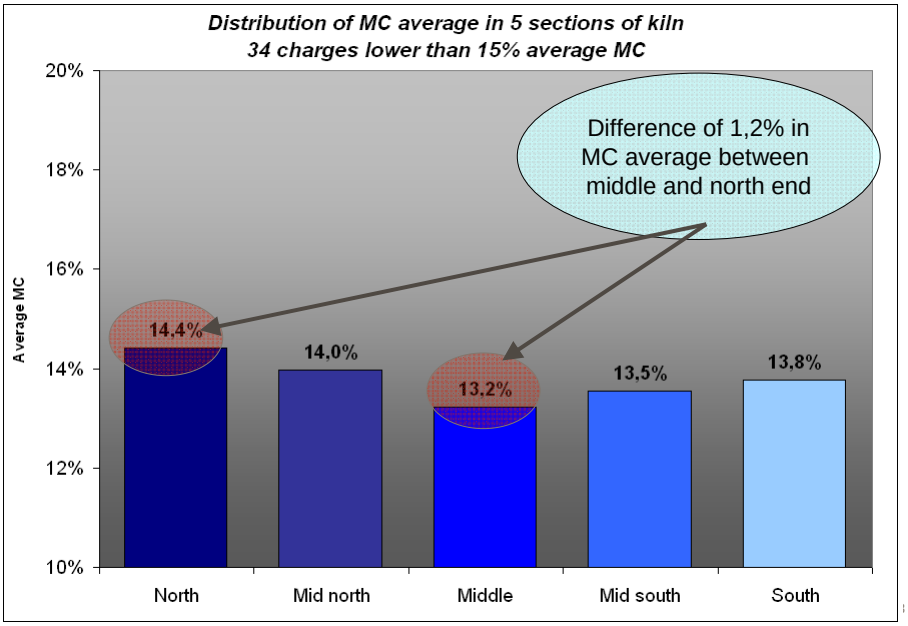
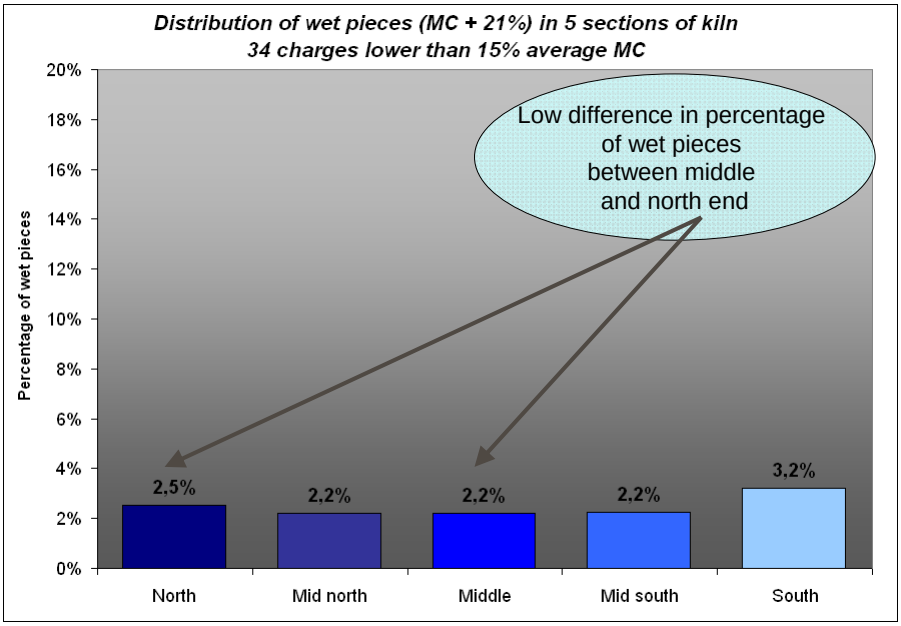
2nd analysis



2nd analysis



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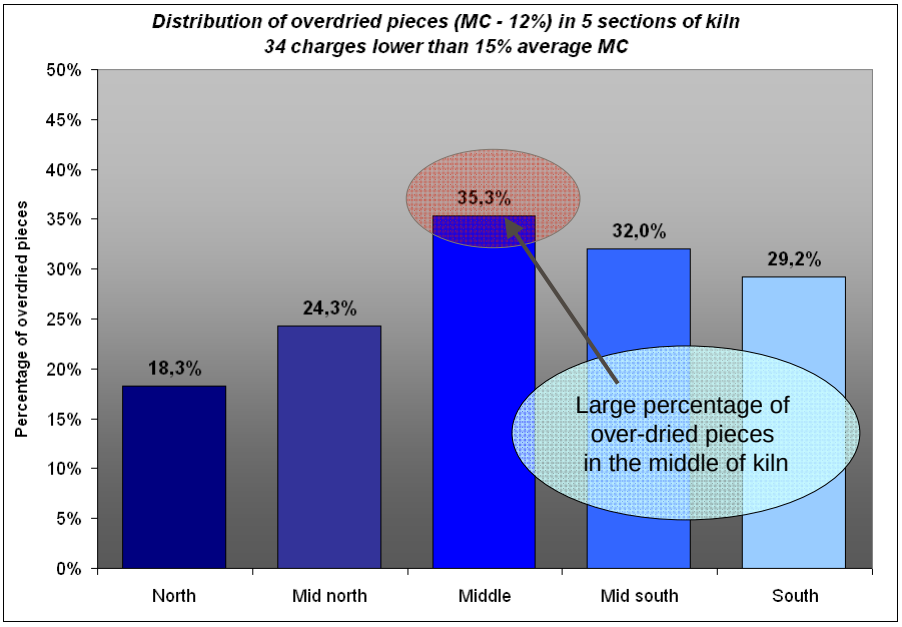

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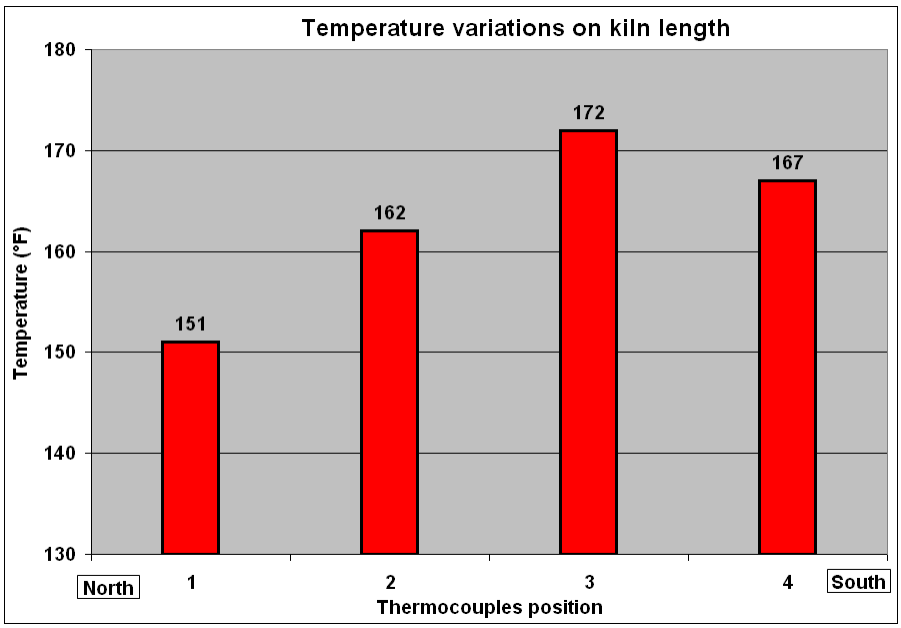

- **Objectives**
  - Share with you different case of temperature variations
  - Discuss about the impact on MC uniformity

- **Conclusions**
  - There is temperature variations in many kiln and every type of kiln.
    - **More than 20 out of 34 kilns have temperature variations over 10°F**
  - Temperature variations have an important impact on final MC of wood according to their position in kiln.
    - **For a variation of 15°F to 20°F**
      - Difference of average MC of about 1.5%
      - 2 to 4 extra hours at the end of drying
      - This is either kiln wets and/or over-dried pieces in charges

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Acknowledgements

- **New England Kiln Drying Association**
  - NEKDA board of directors

- **Participating mill personnel**
  - Roberval drying team for the MC monitoring

- **Other auditor**
  - Jean Belzile

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