

SOFIA UNIVERSITY ST. KLIMENT OHRIDSKI













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## GREEN DEAL INITIATIVES, SUSTAINABLE MANAGEMENT, MARKET DEMANDS, AND NEW PRODUCTION PERSPECTIVES IN THE FORESTRY-BASED SECTOR

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Title of the paper: Selected economic and health risks in the process of production and storage of biomass for energy purposes.

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## INTRODUCTION

- The European Union has prioritized renewable energy sources in the past decade, with a target for these sources to cover 32% of final energy consumption by 2030. Among these sources, biomass, including the biodegradable part of waste, stands out as a crucial component, constituting 63.3% of total energy production from renewables in the EU.
- The entire logistics chain, which includes the production, storage, and consumption of forest biomass as an energy source, brings a whole spectrum of different risks and dangers that can cause damage to health, endanger the lives of workers, as well as the risk of deterioration or damage to property and equipment.





## INTRODUCTION

- Since 2008, the number of employees of forestry enterprises in the Slovak Republic has decreased by more than 15,000 (mainly in blue-collar professions). Most of these workers have moved to the private sector (the requirements for compliance with the rules of safety and health protection at work are relativized)
- The aim of the work is the analysis and economic quantification of the risks that arise especially during the long-term storage of forest chips, which in the long-term context can become a serious problem for human health, especially from the point of view of the production of phytopathogens and wood dust.



#### Source: M. Kovalčík



## METHODOLOGY

- The long-term monitoring initiative focuses on three urban heating plants situated in the Banská Bystrica Self-Governing Region.
- Sample collection for the monitoring program occurred between 2019 and 2023, involving the extraction of five samples from each heating plant—three from the surface of the piles and two from a depth of 0.5 meters.
- All collected samples underwent microbial analysis at the accredited laboratory of the Regional Office of Public Health in Poprad to detect the presence of phytopathogens.





# METHODOLOGY

- In parallel, a dust measurement was conducted in one of the heating plants during the winter period in 2023. The CEM DT-9880 device was employed for dustiness measurement.
- The assessment of dustiness in the environment aligns with Government Regulation no. 356/2006 Coll. and is evaluated as harmful to human health based on the technical guideline value for the respirable component of wood dust, set at 3 mg.m<sup>-3</sup>. However, there is currently no guideline value in legislation for exposure to phytopathogens.
- According to the World Health Organization (WHO) standard from 2021, healthy air is defined as having an average daily concentration of PM2.5 dust particles not exceeding 15 μg.m<sup>-3</sup> (Pai et al., 2022).





# METHODOLOGY

- From an economic perspective, the impact of the potential occurrence of occupational diseases during the production and storage of biomass was assessed.
- Lung and respiratory tract cancer, Allergic diseases of the respiratory tract, Hearing loss, Occupational deafness, Vibration disease, Diseases of bones, joints, tendons, and nerves of the limbs due to longterm, excessive, and unilateral loads.
- For the economic classification of these diseases, valid legislation was utilized (Act No. 437/2004 Coll., the database of the National Center for Health Information – NCHI, regulations of the Social Insurance Company). Laws 461/2003 and 311/2001 were used to implement legislative regulations that define procedures and financial compensation for recognized occupational diseases.
- With the use of the markup, a calculation method was proposed a framework for allocating overhead costs, which also considered the risk of financial compensation for occupational diseases. The relationship for difference determination of overhead cost surcharge  $\Delta OCS$  (1) and general calculation formula was used in this study:  $\Delta OCS = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in overhead costs by calculation risks}{\Delta OCS} = \frac{Difference in costs by calculation risks}{\Delta OCS} = \frac{Difference in costs by calculation risks}{\Delta OCS} = \frac{Difference in costs}{\Delta OCS} = \frac{Difference in costs}{\Delta OCS} = \frac{Difference in costs}{\Delta OCS} = \frac{Difference}{\Delta OCS} = \frac{D$

## IDENTIFICATION OF PHYTOPATHOGENS IN URBAN-TYPE HEATING PLANTS

Year		Storage Nr.1 (number of ident. species)	Storage Nr.2 (number of identified species)	Storage Nr.3 (number of ident. species)		
20	19	7	6	8		
2020		10	7	6		
20	21	5	6	5		
2022		7	7	6		
2023		6	5	5		
The most common identified species		Penicillium sp.	Aspergillus flavus	Aspergillus niger		
	Aspergillus Aspergillus Fumigatus	Lungs	etated irway Damaged Cilia			

Species of the genus Aspergillus sp. are known to cause serious respiratory diseases, including respiratory and skin allergic diseases. (e.g. Aspergillosis, which carries a 20% mortality rate). Additionally, these species can induce carcinogenic diseases, particularly in individuals with compromised immune systems.

Fungi belonging to the genus *Mucor sp.* can lead to various fungal diseases, such as mucormycosis, affecting the skin, respiratory system, and organs of vision.

Species of the genus *Penicillium sp.* are capable of producing mycotoxins that have the potential to cause serious allergic and carcinogenic diseases.

## IDENTIFICATION OF EXPOSURE TO DUST IN URBAN-TYPE HEATING PLANTS



On both measurement days, they were very similar (average air temperature during the measurement was 4°C, relative air humidity 73.4%, wind flow westerly, 20 km/h). The measurement methodology corresponded to the provisions of the standards STN EN 689+AC Occupational exposure. Measurement of inhalation exposure to chemical agents. Strategy for testing compliance with occupational exposure limit values; STN EN 482 Occupational exposure. Procedures for determining the concentration of chemical factors.

# THE ECONOMIC RISKS ARISING FROM HEALTH DAMAGE IN BIOMASS PRODUCTION AND STORAGE

 Lung and respiratory tract cancer; 2. Allergic respiratory diseases; 3. Disease from long-term excessive unilateral limb loading; 4. Unilateral hearing impairment; 5. Bilateral hearing impairment; 6. Unilateral deafness; 7. Bilateral deafness; 8. Vibration-induced disease; 9. Occupational dermatosis.

			Vaar/Dic	2022	2021	2020	2010	2010	2017	2016	Togothar	Costs in s
Disease	Point value	Quantified value (€)	real/Dis.	2022	2021	2020	2019	2010	2017	2010	rogethei	COSIS III E
1	1000	26,080	2				2	2	1	2	7	146,048
2	800	20,864										
3	150	3,912	3	5	12	14	15	11	15	7	79	309,048
4	120	3,129.6	-	-	4	F	- 1	2	2	2	11	192 560
5	500	13,040	5	Т	Т	5	Т	2	2	2	14	102,500
6	400	10,432	8	1	5	4	16	15	15	9	65	1,695,200
7	1000	26,080										
8	1000	26,080	9			1	1				2	88,672
9	1700	44,336	Together	7	18	24	35	30	33	20	167	2,421,528
			5	,			55	5	55		/	11 15

## THE ECONOMIC RISKS ARISING FROM HEALTH DAMAGE IN BIOMASS PRODUCTION AND STORAGE - **CALCULATION QUANTIFICATION OF CALCULATION RISKS IN CASE OF SEVERANCE PAY (CR<sub>SP</sub>)**

Social Insurance Act 461/2003 - If an occupational disease is recognized in an employee, the employer has an obligation:
<u>To transfer</u> the employee to another job position taking into account his health condition,

• If the employee is forced to leave work, severance pay must be paid to him (min. 10 times of the average monthly salary)

The number of recognized occupational diseases in the year 2022	525 cases				
The number of employees in the national economy in the year 2022	2,580,000 empl.				
The number of employees in the industrial sector in the year 2022	516,616 empl.				
The average wage in the industrial sector in the year 2022	1,430 €/empl.				
Arguments for quantification of the cost item "calculation risks":					
<ul> <li>the share of occupational diseases in the national economy</li> </ul>	0.02%				
<ul> <li>the share of occupational diseases in the industry sector:</li> </ul>	0.10%				
Proposal for the quantification of the cost item "calculation risks (CRSP)":					
CR <sub>sP</sub> = (the number of employees in operation /1000) x 1,430 € x 10 months' x 1.362**					
for the number of 100 employees in operation, the calculation risk of severance pay/year is (1,950 €)					
**36,2 % employer's contributions to the social a	and health insurance company				

# THE ECONOMIC RISKS ARISING FROM HEALTH DAMAGE IN BIOMASS PRODUCTION AND STORAGE... - CALCULATION

QUANTIFICATION OF CALCUL. RISKS IN CASE OF PAYMENT OF DAMAGES (CR<sub>PD</sub>)

Social Insurance Act 461/2003 - If an occupational disease is recognized in an employee, the employer has an obligation:
 .....

An employee **recognized with an occupational disease** is entitled to **compensation for payment of damages**.

The average number of recognized occupational diseases (2016-2022*)	3,962 cases			
The total number of recognized occupational diseases (2016-2022**)	167 cases			
The economic value of recorded diseases (2016-2022*)	57,450 000 €			
The economic value of recognized diseases (2016-2022**)	2,421,528 €			
<ul> <li><u>Arguments for quantification of the cost item "calculation risks":</u></li> <li>average ratio of economic value of occupational disease/case in national economy and in the sector of agriculture, forestry and wood processing industry 14,500 €/case</li> </ul>				
Proposal for the quantification of the cost item "calculation risks (CR <sub>PD</sub> )":				
CR <sub>PD</sub> = (the number of employees in operation /1000) x 14,500 €				
*in national economy ** in the sector of agriculture, forestr	ry and wood processing			
for the number of 100 employees in operation, the calculation risk of payment of damages/year is (1,450 €				

## THE ECONOMIC RISKS ARISING FROM HEALTH DAMAGE IN BIOMASS **PRODUCTION AND STORAGE... - CALCULATION**

The frequency of occurrence and the risk of financial compensation for an occupational disease can vary for each company and may not align with proposed calculated values (CR<sub>SP</sub> and CR<sub>PD</sub>). From our perspective, it is necessary to calculate these risks of occupational disease at the level 1%) = € 34,000/year.

### This fact needs to be incorporated into the overhead cost calculation proposal

#### model cost structure:

direct cost €800,000 = allocation base, overhead cost €400,000, profit €50,000 profit margin based on Return on Cost = ROC 4.17%, overhead cost surcharge % OCS = 50%).

 $\Delta OCS = \frac{Differ.in overhead cost by calculation risks}{Allocation base} \times 100 (\%)$ mark-up method of calculation :  $\triangle OCS = 4,25\%$ Direct cost (materials, wages, others direct cost) + Overhead cost (% surcharge with using of ΔOCS)  $\Delta PM = \Delta OCS \ x \ ROC/100 = 0, 177 \ \%$ = Total own cost  $\Delta SP = \frac{\frac{\Delta OCS + \Delta PM}{100} x \text{ allocation base}}{\text{selling price}} x100 = 2,8\%$ + Profit margin (with using of % ROS and  $\triangle$  PM)

= Selling price without VAT (with determination Δ SP)

### Risk 1% = in the calculation, it is necessary to add 2,8 eurocents for every $\leq 1$ of the selling price

# CONCLUSION

- Safety regulations and technological procedures are knowingly and unknowingly violated. The risk of occupational diseases and work-related injuries has largely been shifted from organizations to subcontracting companies.
- Due to deficiencies in legislation and regulatory oversight regarding biomass heating plants, it appears that technical regulations for their construction and operation are incomplete, as stakeholders and responsible parties do not have sufficient information about many of the risks associated with their operation.





# CONCLUSION

- Update and enhance legislation: It is necessary to review and update existing legislation related to biomass heating plants to ensure that technical regulations and safety standards are sufficiently accurate and reflect the current risks of their operation.
- Improve regulatory oversight: Investment in personnel and financial resources for regulatory authorities is essential to ensure effective and regular inspections that could identify potential risks and ensure compliance with regulations.
- Education and information dissemination to stakeholders: Strengthening awareness and education among stakeholders, including operators of biomass heating plants, about risks and safety measures is crucial for the prevention and minimization of risks.
- Implementation of an information collection and exchange system: Establishing a mechanism for collecting and exchanging information among operators of heating plants, regulatory authorities, and other relevant entities could enhance the ability to respond to new risks and challenges.
- Research into new technologies and solutions: Investment in research and development of new technologies and solutions in the field of biomass heating plants could contribute to improving the efficiency and safety of this form of energy production.

## THANKS FOR PAYING ATTENTION!

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