THE ANNALS OF “DUNAREA DE JOS” UNIVERSITY OF GALATI
FASCICLE IX. METALLURGY AND MATERIALS SCIENCE
N^{0}. 3– 2014, ISSN 1453 – 083X

RESEARCH ON THE WORK PLACE SECURITY AND ENVIRONMENTAL FACTORS AFFECTED BY LATHE WORK

Georgeta DRAGOMIR, Marian BORDEI,
Ștefan DRAGOMIR
“Dunarea de Jos” University of Galati, Romania
e-mail: sdragomir@ugal.ro

ABSTRACT

Most work place risks are spatially and temporally determined, so a critical early need is to establish the risk of what (is happening) to whom (which part of the environment is affected), where (location) and when (in time).

Environmental factors that can be damaged are: soil, water, air, noise, biodiversity, landscape and human settlement.

Formulating the problem in clear and unambiguous terms will assist in selecting the level and types of assessment methodology used and will improve, in the context of sustainable development, the risk management decision.

KEYWORDS: lathe work, place security, environment factors, sustainable development

1. Consideration on the work process

Work to the lathe provides machining of ferrous and nonferrous metal elements on normal lathes and special lathes, machinery and equipment of lathe technology. The elements for evaluate the work system are: lathe parts; knife, tools, profiles and devices; electrical outlet; protective equipment: overalls, shoes or boots, helmet, gloves.

The lathe work task mainly has the following components: arrival at work; checking the technical condition of the tools; transport to work of the means of production; process specifications execution.

Work environment usually means to perform activity in cutting processing workshops and reconditioning and repair workshops.

2. Identified risk factors

2.1. The main risk factors

The main risk factors that characterize the lathe work place (fig. 1) are:

► *Mechanic risk factors:*

F1 - Moving machine parts;

F2 - Catching hand;

F3 - Hanging articles of clothing;

F4 - Rolling parts, materials overthrow tools that are not insured when working at height or below "0";

F5 - Design objects or particles in the air to work with lathe;

F6 - Cutting, stinging contact with hazardous areas.

► *Thermal risks:*

F7 - High temperatures in summer when working outdoors;

F8 - Cold winter when working outdoors.

► *Chemical risk factors:*

F9 -Fine chemical powder.

► *Electric risk factors:*

F10 - Electrocution by indirect contact;

F11 - Electrocution by direct contact;

F12 - Accidental damage to electrical insulation;

F13 - Electrical panels uninsured through their fitting work platform;

F14 - Achieving under voltage the metal surfaces which are accidentally under tension;

F15 - Damage to the circuits binding of the earthing.

2.2. Risk factors in the work environment

► *Physical factors:*

F16 - Low temperature in winter and high temperature in summer for the outdoor work;

F17 - Drafts when working outdoors on the ground or at height;

F18 - Low level of lighting to working in closed (confined) spaces;

F19 - Natural disasters: lightning, flood, earthquake.

► *Chemical risk factors:*

F20 - Metal particles;

F21 - Working with the potential explosion hazard (when performing works in areas with high risk of explosion; fuel station).

► *Noise level below the maximum limit but repeated;*

► *Biological factors:*

F22 - Dangerous animals (dogs, rats) and insects (wasps) in different workstations.

► *Physical overload:*

F23 - Physical effort in lifting heavy assemblies;

F24 - Vicious working position;

F25 - Permanent demand of attention.

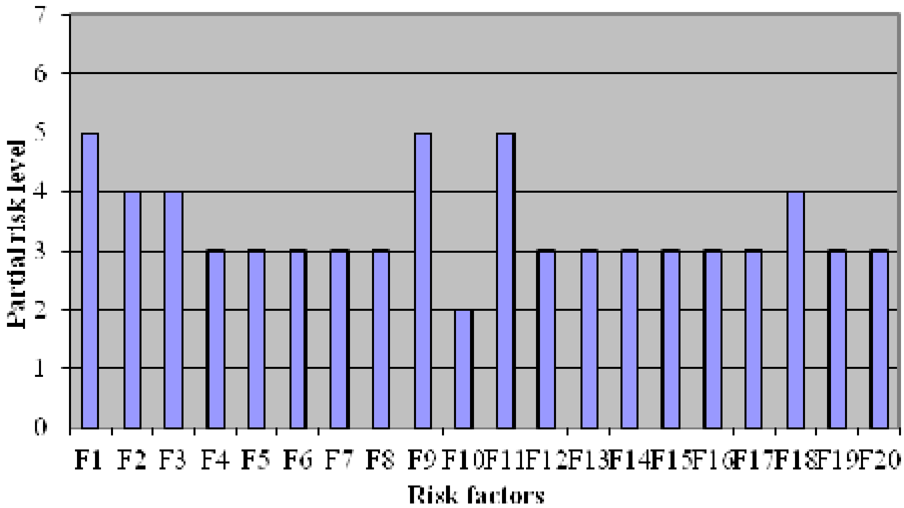

***Fig. 1.** Partial risk levels of risk factors for the workplace named lathe worker*

2.3. Risk factors of the performer

These factors are existing because the worker may do wrong actions during the work process.

► *Wrong actions:*

F26 - Work in an advanced state of fatigue or after administration of drugs;

F27 - Execution of works without being insured (to have a helmet);

F28 - Lowering of the work (in height) in prohibited areas;

F29 - Execution of works in hazardous areas without taking protective measures work;

F30 - Falls from height by stepping into the empty slip, loss of balance;

F31 - Sync mismatch to work in team;

F32 – Fall, flush sliding, stumbling, loss of balance;

F33 - Stopping power tools without providing them in advance (stop task);

F34 - Failure to use personal protective equipment and other protective equipment supplied.

3. Calculus of global risk level

In the next part, we well calculate the global risk level in the lathe work place. For that we use the risk factors „ri" and the worthiness note function of periculosity of each risk factor, „Ri", „n" represents the number of risk factors that are taken into account [2]. With next formulas we can calculate the global risk level at the workplace:

$$N_{rg} = \frac{\sum_{i=1}^{n} r_i \times R_i}{\sum_{i=1}^{n} r_i} = \frac{2(6\times6)+3(5\times5)+5(4\times4)+18(3\times3)+4(2\times2)+1(1\times1)}{2\times6+3\times5+5\times4+18\times3+4\times2+1\times1} = 3.69 \quad (1)$$

Overall risk level calculated for work lathe worker equals 3.69, it is a value that falls into the category of jobs with unacceptable risk level, the result is supported by the evaluation form according which it appears that from the total of 33 risk factors identified in Table 1, and only 10 are ranged as partial risk level 3:

- 2 factors represent very serious risk consequences 6 - representing 6.1%;
- 3 risk factors represent serious consequence 5 - representing 9.1%;
- 5 risk factors represent major consequences 4 - representing 15.15%, the rest falling into the medium risk category.

In Table 1 are shown the worthiness notes for each work place and the safety measures proposed to diminish the work accidents.

***Table 1.** The worthiness notes for each work place and the safety measures proposed to diminish the work accidents*

No.	Risk factors	Risk level	Measures proposed	Who is responsible	Time required to fix the problem
			Nominating measure		
0	1	2	3	4	5
1	F1 - Moving machine parts	6	TECHNICAL MEASURES: - Indication of access roads; ORGANIZATIONAL MEASURES: - Training	Workplace leader	Immediately and permanently
2	F2 – Impact by means auto, and high, shifting between headquarters and the workplace	4	TECHNICAL MEASURES - Indication of access roads ORGANIZATIONAL MEASURES - Training - Proper signage	Workplace leader	Immediately and permanently
3	F5 - Free fall tools, parts, materials uninsured or improperly handled at higher levels of the job	4	TECHNICAL MEASURES - Provision and use of PPE ORGANIZATIONAL MEASURES - Training	Workplace leader	Immediately and permanently
4	F5 - Design objects or particles in the air to work with lathe	4	TECHNICAL MEASURES - Using equipment supplied ORGANIZATIONAL MEASURES - Training	Workplace leader	Immediately and permanently
5	F21 - Working with the potential explosion hazard (when performing of works in areas with high risk of explosion; fuel station) - Noise level below the maximum limit but repeated	5	TECHNICAL MEASURES - Use exhausting installation. ORGANIZATIONAL MEASURES - Training	Workplace leader	Immediately and permanently
6	F22 - Dangerous animals (dogs, rats) and insects (wasps) in different workstations	6	TECHNICAL MEASURES - Checking ground equipment ORGANIZATIONAL MEASURES - Training	Workplace leader	Immediately and permanently
7	F23 - Physical effort in lifting heavy assemblies	5	TECHNICAL MEASURES - Provision and use of PPE (EIP) ORGANIZATIONAL MEASURES - Training	Workplace leader	Immediately and permanently
8	F26 - Working in an advanced state of fatigue or after administration of drugs	4	TECHNICAL MEASURES - Ensure the electrical panels ORGANIZATIONAL MEASURES - Training	Workplace leader	Immediately and permanently
9	F28 - Lowering of the work (in height) in prohibited areas	5	TECHNICAL MEASURES - Prohibition of the use of improvised means for access and working at lower heights ORGANIZATIONAL MEASURES - Training	Workplace leader	Immediately and permanently
10	F32 – Fall, flush sliding, stumbling, loss of balance	4	- Provision and use of PPE (EIP) ORGANIZATIONAL MEASURES - Training	Workplace leader	Immediately and permanently

We see that there are ten risk factors that are situated at the unacceptable risk level:

F1 - Moving machine parts;

F2 – Impact by means auto, and high, shifting between headquarters and the workplace;

F5 - Free fall tools, parts, materials uninsured or improperly handled at higher levels of job;

F21 - Working with e potential explosion hazard;

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F22 - Dangerous animals (dogs, rats) and insects (wasps) in different workstations;

F23 - Physical effort in lifting heavy assemblies;

F26 - Work in an advanced state of fatigue or after administration of drugs;

F28 - Lowering of the work (in height) in prohibited areas;

F32 – Fall, flush sliding, stumbling, loss of balance.

To reduce or eliminate the 10 risk factors (which are situated in the unacceptable level), should be applied the measures presented in the measures file proposed for Turning work.

Regarding the distribution of risk factors on the generating sources, the situation is as follows:

- 45.46% - the means of production factors;
- 18.18% - the working environment factors;
- 18.18% - work task factors;
- 18.18% - factors specific to the performer.

From the analysis of the evaluation form it is found that 66.67% of the identified risk factors may have irreversible consequences for the performer (death or disability).

4. Evaluation of environment impact

Assessment of environmental impact shall be carried out using the matrix method (for index of quality) and V. Rojanschi method (calculation of global pollution index) [3].

An assessment of the impact on the environment shall be based on:

- indices of quality on environmental factors (water, air, soil-sub soil, noise, human settlement, biodiversity, landscape) (I_C);

- index of global pollution (I_{PG});

Quality of environment factors is falling within the allowed limits of STAS or European Normative Reglementations.

It is estimated effects „project" on the environment based on „factor size" which is to be analyzed taking into account the level of quality indicators that characterize its effects.

The formula of environmental quality index is (I_c):

$$I_c = \frac{L_{proiect}}{L_{reglementat}} = E \quad (2)$$

where: $L_{proiect}$ – project actions;

$L_{reglementat}$ – reglementations of Normative actions;

E – environmental effects.

Interplay between actions project ($L_{project}$) and environmental effects (E) can be highlight by marking the appropriate box of its size estimated by a common system to the whole assembly (with +, - or zero), as follows:

- + positive influence
- 0 zero influence
- – Negative influence

I_c = **0** to **+1**	- positive influences; Environment is influenced within admissible limits.
I_c = **- 1** to **0**	- negative influences; Environment is influenced above admissible limits.
I_c = **0**	- Environment is not influenced.

4.1. An assessment of the impact on environmental factors by the quality indexes (Ic)

Table 2. *Matrix for impact assessment*

Environmental actions	**Effects on environmental factors**			
	Air	Water	Soil	Noises
Air	-	+	+	0
Water	0	-	+	0
Soil	+	+	-	0
Landscape	0	0	0	0
Noises	0	0	+	-
Human settlement	0	0	0	0
Effects E	**0**	**+1**	**+2**	**-1**

The values of Effects (E) are: For air, E =0; For water, E =+1; For soil, E=+2; For noises, E=-1

4.2. Assessment of quality index values

This assessment is based on:

- Quality index values (I_c) for each environmental factors;

- Worthiness note that corresponds to I_C values like in Table 3.

Table 3.

Worthiness note	**I_C value**	**Environmental effects**
10	**$I_c = 0$**	Environment is not affected by the developed activity.
9	**$I_c = 0.0 \div 0.25$**	Environment is affected within admissible limits. Level 1. Positive effects.
8	**$I_c = 0.25 \div 0.50$**	Environment is affected within admissible limits. Level 2. Positive effects.

Worthiness note	**IC value**	Environmental effects
7	**I_c = 0.50 ÷1.00**	Environment is affected within admissible limits. Level 3. Positive effects.
6	**I_c = -1.0**	Environment is affected above admissible limits. Level 1. Negative effects
5	**I_c = -1.0 ÷ -0.5**	Environment is affected above admissible limits. Level 2. Negative effects
4	**I_c = -0.5 ÷ -0.25**	Environmental is affected above admissible limits. Level 3. Negative effects
3	**I_c = -0.25 ÷ - 0.025**	Environment is degraded, level 1. The effects are harmful in case of **long** periods of exposure.
2	**I_c = -0.025 ÷ - 0.0025**	The environment is degraded, level 2. The effects are harmful in case of **medium** periods of exposure.
1	**I_c = under – 0.0025**	The environment is degraded, level 3. The effects are harmful in case of **short** periods of exposure

$$\mathbf{I_{PG}} = S_i/S_r$$

I_{PG} = 1, no pollution existence

4.3. Quality scale by global polluted index

In the Table 4 in function of I_{PG} value:

Table 4

$I_{PG} = 1$	- Environment is not affected by human activity
$I_{PG} = 1...2$	- Environment is affected within admissible limits
$I_{PG} = 2...3$	- Environment is affected and there is a discomfort for life forms.
$I_{PG} = 3...4$	- Environment is affected and there are troubles for life forms.
$I_{PG} = 4...6$	- Environment is severely affected and there are multiple dangers for life forms.
$I_{PG} = 6$	- Environment is degraded, unsuitable for life forms.

4.4. The calculus of global pollution index (I_{PG})

It is considered a number of four environmental factors affected by pollution risk such as: air, water, soil-subsoil, noises.

Global Pollution Index $I_{PG} = S_i/S_r$;

S_i value (ideal state) – resulting geometrical figure has the surface:

$$S_i = 200\ cm^2$$

S_r value (real state).

It was built by pooling related points values Nb (note worthiness) for each environmental factor taken into account.

N_b value shall be obtained for each environmental factor scale of worthiness as a function of the value of the pollution index:

N_b for AIR:

$I_c = -1.0$ ð $N_{bair} = 7$

N_b for WATER:

$I_c = 0.25$ ð $N_{bwater} = 8$

N_b for SOIL:

$I_c = -1.0$ ð $N_{bsoil} = 9$

N_b for NOISES ($N_{bnoises}$):

$I_c = 0,5$ $N_{bnoises} = 5$

Surface Sr: $S_r = 101.46^2$

$$I_{PG} = \frac{S_i}{S_r} = \frac{200\ cm^2}{101.46\ cm^2} = 1.97$$

The index of global pollution value is:

$I_{PG} = 1.79$.

The graphical representation of the Index of global pollution is shown in Figure 2.

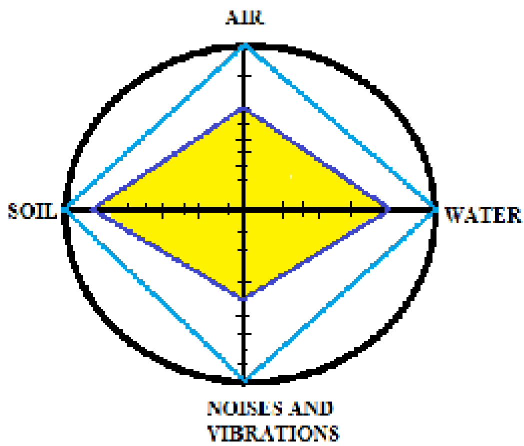

***Fig. 2.** Graphical representation of the Index of global pollution*

Index of global pollution value is:

$\mathbf{I_{PG} = 1.97}$ -> This value of global pollution index show us that environment is affected within admissible limits.

5. Conclusions

In practice, the risk factors will usually accompany development of the conceptual model. Screening can be used to determine which risks should be investigated in greater detail using techniques suitable to the nature of the risk and to the quality of the evidence.

If effective, screening should also identify those features that will not receive further analysis. Prioritization allows for the efficient allocation of resources. Justifying and recording the accompanying rationale for screening risks are valuable [4].

At this stage, risk assessors may develop an early view as to whether they have sufficient data to support a quantitative assessment of the risk if this is deemed necessary, or whether additional data and evidence to support such an assessment might be required. Quantitative risk analysis (QRA) is an expert discipline, expensive to undertake, and requires substantive data and analysis. This may include formal mathematical modeling. Not all risks will require QRA however, either because they are deemed to be insignificant on the basis of the evidence already assembled, or because the risk manager is already confident about their significance and can progress to deciding how to manage the risk.

Risk screening is useful, therefore, for highlighting those risks where uncertainty could affect the management decision and its success in the entrepreneurial system. Such risks may need to be analyzed in greater detail with more sophisticated methods.

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