Abstract. Running machining processes determine the discharge in environment of different amounts of pollutants. In this way the analysis presented in this paper refers to all stages of the technological process starting with the pickling and cleaning of parts. So, it was found that pickling and cleaning processes parts cause environmental pollution with hydrochloric acid HCl and sulfuric acid H2SO4, and manufacturing processes cause the appearance of volatile compounds in atmosphere that may cause irritation of mucous membranes of working staff.

Keywords: analysis, eco-technological, mechanical, acids, volatile compounds

1. Introduction

Cleaning, pickling, degreasing are very important stage in product design and realization of any product because before any pretentious technological operation, cleaning, pickling and degreasing surfaces must be executed [1]. There are many situations where cleaning is done by different methods: conventional manual (hammering, filling), mechanical (pick-hammer, wire brush, sanding-shot cleaning), special (chemical, electrochemical, vibration, plasma, laser, ultrasonic and abrasive flame, thermal, electrochemical, jet of water, flame etc.) [2]. Each of these methods has a higher or smaller impact on the environment, according to the used methods and future technological operations, because there is a difference between cleaning surfaces for welding and cleaning surfaces of coated parts after debate and cleaning surfaces of medical instruments [3]. The main pollutants that occur in cleaning, etching, degreasing process by chemical methods are VOC [4].

Mechanical processing represents the most important operations that molded, plastic or welded deformed semi products are subject to, because the final dimensions and geometric precision required by functional role are obtained [5]. They are realized to achieve a certain form and position accuracy and a certain roughness for each surface area bordering the part in space. The main cutting machining operations are: turning, planing, mortising, milling, drilling, widening, deepening, reaming, chamfering, lamar, tapping, broaching, grinding, honing, lapping, smoothing and running [6].

2. Analiza ecotehnologica a proceselor de prelucrare mecanica

To understand the complexity of the problem, Figure 1 presents the steps and sources of pollution from hydrochloric acid pickling, and Figure 2 presents the steps and sources of pollution from sulfuric acid pickling. Depending on how to do this job cleaning, pickling and degreasing the coefficient pollution C_pcd, introduced in this relationship can be calculated:

\[ C_{pcd} = Q_{ptc} \cdot M_u = (Q_{pca} + Q_{pcl} + Q_{pcs}) \cdot M_u \ [t \ emissions] \] (1)

where: \( Q_{ptc} \) is the total amount of pollutants that occur in the operation of cleaning, pickling, degreasing in kg emissions / ton of cleaned, pickled, degreased material; \( Q_{pca} \) - the amount of...
pollutants in the atmosphere that occurs in cleaning, etching, degreasing; $Q_{pcl}$ - the amount of water pollutant that occurs in the operation of cleaning, pickling, degreasing, $Q_{pcs}$ - the amount of pollutants in soil that is the job of cleaning, pickling, degreasing, $M_u$ - useful mass of the semi processed product or part. Each operation is run on specific technological equipment, with corresponding TCD and in certain sections of work (certain parameters of the process, using certain substances, emulsions or accelerated cooling of the cutting process, developing certain temperatures). These operations imply a number of substances that pollute air, water or soil to a greater or lesser measure depending upon the conditions in which the cutting process develops.

Fig.1. HCl pickling and sources of pollution (*- phases and sources of pollution)
Fig.2. $\text{H}_2\text{SO}_4$ pickling and sources of pollution (*- phases and sources of pollution)

For example, during cutting process a number of volatile organic compounds (VOCs) as shown in Table 1, which may have direct effects on health and the environment, by the inherent harmfulness and some physic-chemical properties, or indirect, by the degradation of air (photochemical pollution and greenhouse effect).

The maximum amounts that cannot be exceeded, to protect human health and take into account high-risk subjects (children, those with respiratory failure, and elderly) are presented in Table 2.
During the machining process, vapor and droplets still appear through the use of emulsions of different categories. In general, the term vapor refers to microscopic size droplets of liquid (less than 10 μm). If the diameter is higher than 10 μm is considered a powdered aerosol or simply drops. These droplets are formed near the exploding bubbles near the spray, but especially near the sprayed emulsion dispensers.

Knowing these factors the rate of pollution introduced by mechanical processing \( C_{pm} \), which can be calculated with the equation can be determined

\[
C_{pm} = Q_{pm} \cdot \mu = (Q_{pm} + Q_{pml} + Q_{pms}) \mu
\]  

where: \( Q_{pm} \) is the total amount of pollutants that occur in mechanic processes in t emissions/t of product; \( Q_{pm} \) - the quantity of air pollutant that occurs the machining in t emissions/t of product; \( Q_{pml} \) - the amount of pollutant water mechanical processing emissions t emissions/t of product; \( Q_{pms} \) - amount of pollutant of soil that occurs in mechanical processing t emissions/t of product, \( M_\mu \) - quantity of substance used to perform useful product in tons;

<table>
<thead>
<tr>
<th>Chlorinated compounds</th>
<th>Nitrogen components</th>
<th>Sulfur compounds</th>
<th>Aromatic compounds</th>
<th>Heavy metal compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine acetic acid</td>
<td>Nitrobenzene</td>
<td>Tioli, tio ethane</td>
<td>Propenal</td>
<td>Alkyl compounds Pb</td>
</tr>
<tr>
<td>Chlorine acetaldehyde</td>
<td>Nitrocresol</td>
<td></td>
<td>Pheno chlor cresol</td>
<td></td>
</tr>
<tr>
<td>1/2 Chlorine methane</td>
<td>Nitrophenol</td>
<td></td>
<td>Toluene</td>
<td></td>
</tr>
<tr>
<td>Chlorin etoluene, C8</td>
<td>Nitrotoluene</td>
<td></td>
<td>Diisocyanate</td>
<td></td>
</tr>
<tr>
<td>Chlorine ethylene, 2/3 C8</td>
<td></td>
<td>2 fur aldehyde</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 – chlorine ethane</td>
<td></td>
<td></td>
<td>Phenol pyridine</td>
<td></td>
</tr>
<tr>
<td>3/4 chlorine ethylene</td>
<td></td>
<td></td>
<td>O-toluidine</td>
<td></td>
</tr>
<tr>
<td>CCl₄</td>
<td></td>
<td></td>
<td></td>
<td>Xylenol</td>
</tr>
<tr>
<td>Other compounds</td>
<td>Acetaldehyde, acrylic acid, formic acid, metal acrylate, aniline, dyetilenamin, 1,4 - dioxin, etylenamin, metylcylrate, metylamin</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Volatile organic compounds (VOC) arising from cutting and cleaning, etching, degreasing.

<table>
<thead>
<tr>
<th>Compounds</th>
<th>Maximum values given by OMS</th>
<th>Exposure duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 dichlorine ethane</td>
<td>0,7 mg/m³</td>
<td>24 h</td>
</tr>
<tr>
<td>Dichloro ethane</td>
<td>3 mg/m³</td>
<td>24 h</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>100μg/m³</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Styrene</td>
<td>800 μg/m³</td>
<td>24 h</td>
</tr>
<tr>
<td>Tetrachlor ethylene</td>
<td>5 μg/m³</td>
<td>24 h</td>
</tr>
<tr>
<td>Toluene</td>
<td>8 μg/m³</td>
<td>24 h</td>
</tr>
<tr>
<td>Trichlor ethylene</td>
<td>1μg/m³</td>
<td>24 h</td>
</tr>
</tbody>
</table>
3. Conclusions

In conclusion we can say that the design of any eco product, any eco process to provide any services or any activity resulting from a technological eco process should consider the following elements:
- quality plan;
- technological route;
- technological process flow diagram;
- stages and times of environmental impact;
  - sources of pollution;
  - the nature of pollutants;
  - mode of action of pollutants on the environment (nature of pollution);
  - coefficient of pollution at each stage and the total pollution coefficient necessary to establish measures necessary for performance of established objectives, namely: changes in the technological process in order to transform it into an eco technologic process, replacement of operation or phases with high pollution;
  - indicator of environmental quality;
  - pollution prevention measures at each stage of development of process technology;
  - measures to reduce pollution at each stage of development of process technology;
  - options for replacement of hazardous pollution substances with others;
  - less polluting or dangerous substances;
  - recovery treatment and recycling measures of secondary waste;
  - measures for reconditioning and recycling of waste;
  - measures to reintegrate waste into the environment;
  - the cost of abatement of pollution;
  - optimal level of pollution reduction;
  - the cost of pollution prevention;
  - eco technologic balance;
  - connection of economic and legal standards and instruments;
  - costs of implementing an environmental management system;
  - the possibility of transforming the company into one eco technologic unit.

Only through such an approach, the industrial-exponential consuming natural resources society and environmental pollution can thus pass from a creating exponential intelligence information society to proceed to a knowledge society and ultimately to acknowledged society.

References

[2] Amza Gh., Dobrotă D., Contributions to the implementation of environmental management system within the eco technologic organization, Fiability & Durability, no 1/2012, pp. 120-125, ISSN 1844-640X.
