

## **REVIEW OF THE UNCONTROLLED USE OF CERTAIN CHEMICALS AND THEIR ADVERSE EFFECT ON HUMAN HEALTH AND SAFE ENVIRONMENT**

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### **ABSTRACT**

Uncontrolled and widespread use of chemicals at a global level resulted in loss of adequate control, which led to concern about potential impact on human health and environment, among other issues. In this stage of civilisation development, we have come up to a paradoxical situation. Human, the only rational being, is doing everything to destroy one own self and the environment by his ‘conscious or unconscious’ actions. This self-destruction is completely irrational. Specifically, certain chemicals created by human can be found everywhere in our surrounding, in both humans and animals. In addition to destroying environment by known chemicals, especially herbicides and fungicides, we are also destroying our health. Therefore, it is expedient to work on rising of collective awareness in this area, providing sufficient information on certain chemicals, and execute risk control and preventive actions both in terms of innovation legislation and more severe control of all stages where hazardous chemicals are being used.

*Keywords:* dangerous chemicals, safe environment, human health.

### **AIMS AND BACKGROUND**

Modern urban and economic development and general technology have advanced to undreamed levels; altogether with the application of new technologies, they have enabled better life quality and better work conditions for human<sup>1</sup>. However, on the other hand, these activities have dramatically affected the harmony between human and nature, with which humans, as all other living beings from the beginning of time, have close and unbreakable bonds<sup>2</sup>. Global economic growth has significantly initiated

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progress and innovation in the chemical industry. So far, science has established the existence of more than ten million chemical compounds, both natural and artificial. 100 000 of these are commercially manufactured, and 200 to 300 new chemicals reach the market every year. Assessments show that the current production volume of chemicals in the world is about 400 million t. In this area, Europe is one of the largest manufacturers with 38% of the total global turnover of chemical products<sup>3</sup>. Chemicals play an important role in global economy and they are being used in many products. At the same time, global expansion of these products, including waste from the chemical industry causes growing concern about the negative impact on environment and human health, since it leads to contamination of air, water, soil, and unwanted through effects on wildlife<sup>4</sup>. Therefore, production, use and disposal to chemicals must be brought under larger control, in order to avoid evident danger to human health and environment, and that way also economic costs which contribute to an increase of benefits for human well-being<sup>5</sup>. In this context, it is necessary to emphasise the fundamental weakness in the production of chemicals policy, requiring necessary reforms of such policy and articulate interdisciplinary research issues that should be addressed. All the more so, since the global chemical production has been projected to be doubled next year. This projection leads the humanity facing the bigger health, environmental and economic problems related to chemical exposure and pollution. Up to date, this policy has not been in function of adequate protection of human health and environment, nor motivation for pure scientific research of chemical technologies, collectively known as green chemistry<sup>6</sup>. That is why the governments of the countries must find legal instruments to adequately identify priorities and undertake extensive measures to mitigate the adverse effects of hazardous chemicals on human health and environment. In this regard, it is necessary to oblige manufacturers to explore and reveal enough information on hazardous properties of chemicals. List of regulations for chemicals (altogether with the regulations in the field of industrial risk and biotechnology) contains a total of 113 acts of different characters. It should be born in mind that some of the provisions in the field of chemicals, according to the official EU classification, can be found in other groups of regulations (Industrial policy and internal market, agriculture)<sup>7</sup>. Most striking regulations in this area are: Rotterdam Convention on Consent Procedure for import on the basis of prior notice for Certain Hazardous Chemicals and Pesticides in International Trade (1998) (Ref. 8); the Stockholm Convention on Persistent Organic Pollutants (2001) (Ref. 9); Protocol on Persistent Organic Pollutants (1998) with the Convention on Trans-boundary Air Pollution distances (1979) (Ref. 10); Regulation (EC) No 304/2003 of the European Parliament and of the Council concerning the export and import of dangerous chemicals, as amended by Commission Regulations No 1213/2003, (EC) No 775/2004 (Ref. 11); Directive on the classification, packaging and labelling of dangerous substances (67/548/EEC) (Ref. 12); Regulation 1272/2008 on classification, labeling and packaging of chemicals and preparations<sup>13</sup>; Regulation 1907/2006 on limiting, evaluation, authorisation and restriction of chemicals (REACH) (Ref. 14); Directive 2004/9 / EC of the European Parliament and of the Council on

the inspection and verification of good laboratory practice (GLP) (Ref. 15); Directive 2004/10/EC of the European Parliament and of the Council on the harmonisation of regulations on the application of the principles of good laboratory practice and the verification of their applications for tests on chemical substances<sup>16</sup>; Directive 98/8/EC of the European Parliament and of the Council concerning the placing on the market of biocide products exchanged by Regulation (EC) 1882/2003 and Directive 2006/50/EC, 2006/140/EC and Commission Directive 2007/20/EC, 2007/47/EC, 2007/69/EC and 2007/70/EC (Ref. 17).

In addition, the regulations in the field of chemicals, including the regulations governing the protection of asbestos and the protection of the ozone layer, among which the most important are: Council Directive 87/217/EEC on the prevention and reduction of environmental pollution by asbestos, which is exchanged by Regulation (EC) 87/2003 (Ref. 18); Decision of the Council Directive 88/540/EEC on the conclusion of the Vienna Convention on the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer<sup>19</sup>; Regulation (EC) No 2037/2000 of the European Parliament and of the Council on Substances that Deplete the Ozone Layer, as amended several times<sup>20</sup>. The Commission Decision 2002/612/EC in accordance with Regulation 2037/2000/EC of determining the quantities of controlled substances allowed for use in the Community<sup>21</sup>. Other aspects of the management of chemicals including regulations relating to the protection of laboratory animals such as Council Directive 86/609/EEC on the approximation of provisions on the protection of animals used for experimental and other scientific purposes, as amended by Directive 2003/6/EC (Ref. 22) and Commission Decision 1999/575/EC on the conclusion by the Community of the European Convention for the protection of vertebrates used for experimental and other scientific purposes<sup>23</sup>.

## RESULTS AND DISCUSSION

Known chemicals, especially herbicides, pesticides and fungicides, not only damage the environment, but also destroy our health. Due to use and performance of different tests on the chemicals which are widely treated in fields and gardens, showed many negative effects, not only on the environment but also on human and animal health.

The bar graphic compares current (2005) and projected (2015 and 2030) chemicals production for 3 world regions in USD. The map precises the regions considered: OECD countries, BRIICS countries, and rest of the world.

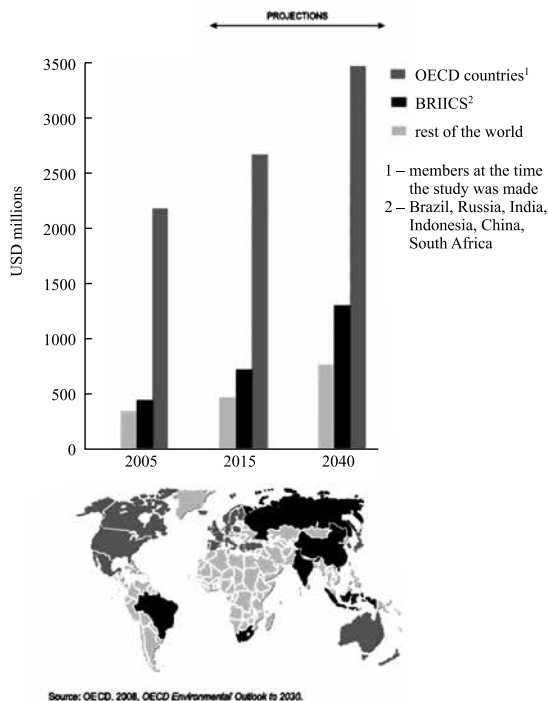


Fig. 1. Production of chemicals<sup>24</sup>

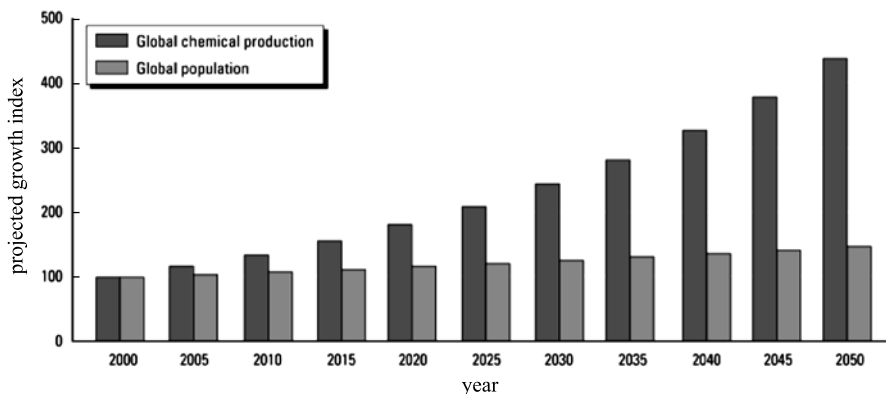
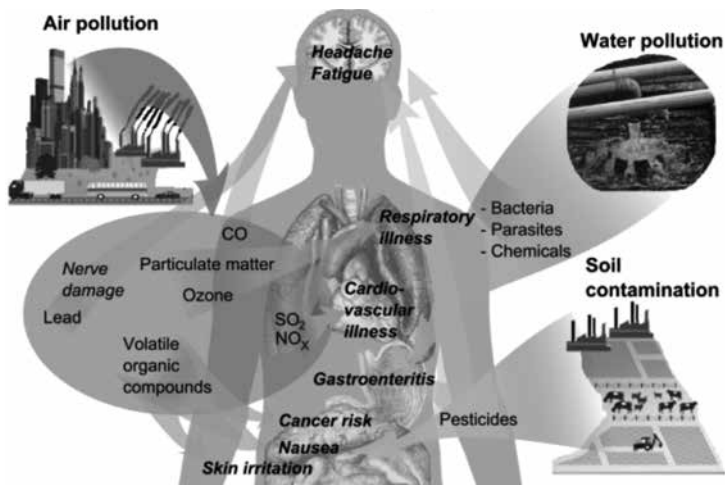


Fig. 2. Global chemical production and global population<sup>25</sup>

Global chemical production is projected to grow at a rate of 3% per year, rapidly outpacing the rate of global population growth, estimated at 0.77% per year. On this trajectory, chemical production will be doubled by 2024, indexed to 2000 (American Chemistry Council 2003; OECD 2001; United Nations 2004). Health effects of pesticides may be acute or delayed in those who are exposed<sup>26</sup>. Systematic review (2007) found that ‘most studies on non-Hodgkin lymphoma and leukemia showed

positive associations with pesticide exposure<sup>7</sup> and thus concluded that cosmetic use of pesticides should be decreased<sup>27</sup>. Strong evidence also exists for other negative outcomes from pesticide exposure including neurological problems, birth defects, fetal death, and neuro-developmental disorder<sup>28</sup>. Acute health problems may occur in workers that handle pesticides, such as abdominal pain, dizziness, headaches, nausea, vomiting, as well as skin and eye problems<sup>29</sup>. In China, an estimated half million people are poisoned by pesticides each year, of whom 500 die<sup>30</sup>. Pyrethrins, insecticides commonly used in common bug killers, can cause a potentially deadly condition if breathed in<sup>31</sup>. Many studies have examined the effects of pesticide exposure to the risk of cancer: leukemia, lymphoma, brain, kidney, breast, prostate, pancreas, liver, lung, and skin cancer<sup>32</sup>.



**Fig. 3.** Health effects of pollution<sup>33</sup>

The increased risk is particularly common in professional exposure. The increased rates of cancer were found among farmers, workers who handle these chemicals. For example, professional exposure to pesticides of mother during pregnancy is associated with an increased risk that her child is diagnosed with leukemia, tumors and cancers of the brain, which we see in Fig. 3. There are also many other negative long-term health effects, such as neurological health problems. For example, risk of developing Parkinson disease is 70% higher in those exposed to even low levels of pesticides<sup>34</sup>. Regarding reproductive effects, there is compelling evidence that exposure of pregnant women to pesticides, leads to birth defects, fetal death, dwarfism. Studies have shown that exposure to pesticides occurs due to decreased fertility in men, to respiratory diseases, increased risk of diabetes, memory disorders and depression. People can be exposed to pesticides in many different ways, at home, at school, through food intake and so on. Pesticides used to control pests on crops are extremely dangerous to humans who consume these foods. This concern, among others, is one

of the reasons for appearance of movements that promote organic food. The fact is that many food crops, including fruits and vegetables, contain pesticide residues, even washed, because some chemicals are simply resistant to decay, so for a long time they can remain in the soil and water, as well as in food. Pesticides can enter the body in solid, liquid or gaseous form. The most dangerous are highly concentrated and highly toxic chemicals, especially liquids and gases. When a pesticide is absorbed, it enters the bloodstream and gets distributed in organs. After absorption of pesticides, body responds in one of the following three ways: metabolising, excretion or by depositing in certain organs<sup>35</sup>. A number of pesticides including clothianidin, dinotefuran, imidacloprid are toxic to bees<sup>36</sup>. Exposure to pesticides may be one of the contributory factors to colony collapse disorder<sup>37</sup>. A study in North Carolina indicated that more than 30% of the quail tested were made sick by one aerial insecticide application. Once sick, wild birds may neglect their young, abandon their nests, and become more susceptible to predators or disease<sup>38</sup>.



**Photo 1.** A pesticide that kills bees<sup>39</sup>



**Photo 2.** Kreozan, poison for bees and dogs<sup>40</sup>

In Photos 1 and 2 we see that kreoazan, pesticide used for winter treatment of woody plants against pests and diseases, although being one of the best remedies for these purposes, is likely to cause poisoning not only of bees, but also dogs. After its chemical structure 'kreoazan' belongs to a group of dinitrophenol. It is yellow, and places where it was applied can be easily distinguished. However, in addition to its efficacy in the prevention of pests and diseases, this pesticide is characterised by very high toxic effects on humans and domestic animals, because it belongs to the first group of toxins.



**Photo 3.** Chemical poison and death of animals<sup>41</sup>

In Photo 3 we see a shocking picture of rabbit which dies immediately after inhaling the fresh chemical poisons the fields were treated with, while running across the field immediately after spraying (Srbobran yard in Vojvodina – Serbia). Unfortunately, such shocking images are not the only ones. Many animals end up in similar, tragic way; people are often indifferent and careless, manifesting inhuman tolerance for such atrocities.

The environmental impact of pesticides consists of the effects of pesticides on non-target species. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, because they are sprayed or spread across entire agricultural fields<sup>42</sup>. Runoff can carry pesticides into aquatic environments while wind can carry them to other fields, grazing areas, human settlements and undeveloped areas, potentially affecting other species. Other problems emerge from poor production, transport and storage practices. Over time, repeated application increases pest resistance, while its effects on other species can facilitate the pest resurgence<sup>43</sup>. Each pesticide or pesticide class comes with a specific set of environmental concerns. Such undesirable effects have led many pesticides to be banned, while regulations have limited and/or reduced the use of others. Over time, pesticides have generally become less persistent and more species-specific, reducing their environmental footprint. In

addition the amounts of pesticides applied per hectare have declined, in some cases by 99%. However, the global spread of pesticide use, including the use of older/obsolete pesticides that have been banned in some jurisdictions, has increased overall<sup>44</sup>.

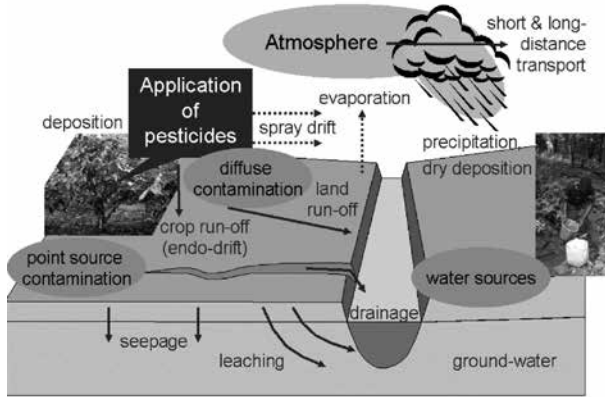


Fig. 4. Pesticide pathways<sup>45</sup>

In Fig. 4 we can see that pesticides can indisputably contribute to air pollution. Even a common mosquito spraying from the air has a negative impact on the environment, as the particles are carried by air to other areas which can be potentially contaminated. On the other hand, pesticides applied to crops can also be blown by the wind through surrounding areas, which represents a potential threat to wildlife in the area. As a matter of fact, weather conditions, temperature and relative humidity and especially wind speed can cause spreading of pesticides in the air. The unity of eco-system is based on the interactions of the living and nonliving environments: soil, water, air, temperature, humidity. Other negative effects of pesticides reflect on:

- Soil, as many chemicals used in pesticides are persistent soil pollutants whose influence can endure for decades and have a negative impact on the area conservation. It has been shown that the use of pesticides reduces the overall biodiversity in soil.
- Plants, as it has been proven that pesticides have a direct adverse effect on plants. They can cause stress in plants, which can lead to delayed growth and retardation of various metabolic processes, which ultimately affect the yield loss.
- Animals, because animals can be poisoned with pesticide residues remained in food, for example, when wild animals enter sprayed fields or nearby areas shortly after spraying.
- Birds, as there are evidences that the birds continue to be threatened by the use of pesticides.
- Fish and other aquatic animals may be endangered if pesticides contaminate water, which can cause fish kills.
- Survival of amphibians, due to the cumulative toxic effects.

– People: Pesticides are associated with a variety of impacts on human health due to pollution, and so on.

The above cases reflect only part of a broader range of health and environmental problems, which are woven into the fabric of modern society, as part of the global problems that cause special attention and concern, because of the wrong approach and risk assessment, which can lead to huge ‘humanitarian prices’, which will eventually have to be paid by all humanity.

## CONCLUSIONS

Policy of the production and use of chemicals has created a huge market, underestimating profit safety of chemicals on human health and the environment. Governments and large companies marginalised an essentially big problem, ‘pushing under the carpet’ of toxic properties of certain chemicals. At the same time, avoiding research investments, development, education and control, the manufacturers have made ‘technological and security gap’, which showed a number of weaknesses. Reforms of such irresponsible policy are necessary, because only through transparency and accountability in the market, one can reach the key results in the field of public health, environmental protection and the reduction of barriers to green chemistry. In this regard, manufacturers of chemicals should analyse and make available relevant information on health and environmental effects of chemical substances and mixtures. Governments of the countries should pursue a responsible policy, which would result in appropriate legal framework to effectively regulate and control the use of chemicals that are threat to human health or environment. In this regard, governments should not create unnecessary obstacles to technological innovation, but stimulate them financially and in every other way. In 2009, the European Parliament overwhelmingly adopted amendments to the Regulation on Plant Protection Products, which was two years prior to that proposed by the European Commission, and obtained approval of the 27 member states of EU Council. This act prohibits use of 22 substances in herbicides, insecticides and fungicides, which are considered to cause cancer, infertility, birth defects or disorders of the endocrine system in humans, and are also related to the possible cause of mass mortality of European bees in 2008. Import of plant product into the EU countries from the third countries that use prohibited substances has been banned. This approach is fully justified and right, for these and similar ordinances that protect the health and nature, are very good answer and solution of which will primarily benefit the farmers, because they will be applying these measures to protect their health. However, the vast industry of these chemicals has found a compromise with environmental experts and movements by stated transitional periods, which last up to 2018 for some chemicals, where some means may be used until less dangerous alternative is found. On the other hand, Argumentation Community Pesticide Manufacturers (ECPA) indicates that the regulation is too strict, stating that ‘it is dangerous to consume coffee in large amounts’, therefore substances should not be banned but have

prescribed their maximum usage level. These discussions indicate the complexity of this phenomenon, as it has been noted in practice, legal and procedural requirements for the affirmation of human health and a healthier environment, mostly thwarted and subordinated by profit and indisputable influence of certain multinational companies, thus narrowing the room for maneuver for emergency reaction.

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