EUROPEAN
COMMISSION

Brussels, 15.6.2016
SWD(2016) 211 final

PART 11/16

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Defining criteria for identifying endocrine disruptors in the context of the implementation of the plant protection products regulation and biocidal products regulation

Annex 10 out of 16

Accompanying the document

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

on endocrine disruptors and the draft Commission acts setting out scientific criteria for their determination in the context of the EU legislation on plant protection products and biocidal products

{COM(2016) 350 final}
{SWD(2016) 212 final}

ANNEX 10

HUMAN HEALTH - TRANSMISSIBLE DISEASES AND FOOD SAFETY

Contents

This Annex focuses on the assessment of potential impacts, which build on the results of the screening study explained in Annexes 3 to 5. The results of the screening do not constitute evaluations of individual substances to be carried out under the respective chemical legislations [Regulation (EC) No 1107/2009 on plant protection products and Regulation (EU) No 528/2012 on biocidal products] and in no way prejudge future decisions on active substances to be taken pursuant to these two Regulations. It would thus be erroneous to consider that the substances listed in Annex 5 are considered as endocrine disruptors within the meaning of the EU legislation. The methods and results presented in this Annex are to be interpreted as an estimation of the potential impacts.

Annexes 8 to 15 describe the impacts expected when implementing the criteria to identify EDs (Options 1 to 4) under the current regulatory framework (Option A). In addition, it was assessed whether these expected impacts would remain the same or not under consideration of different regulatory implementations (Options B and C, only applicable to the PPP Regulation). The analyses of the impacts described in these Annexes translate into the "performance" of the options, which is one of the input parameters to the MCAs (Annex 6 and 7).

The MCAs results are not concluding on any preferred option for setting scientific criteria to identify endocrine disruptors, but aim at providing additional information to decision makers with regards to the potential impacts expected when implementing the criteria, after those would have been selected on the basis of science (two MCAs were performed: Options 1 to 4 under the current regulatory context, and Options A compared to Options B and C).

At a preliminary stage of the impact assessment it was anticipated that Option C should be discarded, nevertheless it was maintained for the analysis of the impacts for methodological reasons (see Section 4.2.3 of the main report and Annexes 6 and 7). Option C only applies to the PPP Regulation.

1. INTRODUCTION

Diseases can be passed from person to person or transmitted from a host to a person. This can occur by direct contact or through a vector (for example mosquitos). The diseases are caused by pathogenic microorganisms, such as bacteria, viruses, parasites or fungi. Biocidal products (for example disinfectants and insecticides) are being used to prevent or control these transmissible diseases.

In the next section the incidence is indicated of infectious disease in health care settings and vector-borne diseases in the EU. In the third section will be discussed, the role of disinfectants and insecticides to control these diseases and the potential impacts of the different options for setting endocrine disrupting (ED) criteria.

There is no single universal disinfectant which will kill all pathogenic organisms. Therefore the availability of a range of effective biocidal products with different modes of action, and the selection of the most appropriate disinfectant for the required result, is extremely important

Disinfectants are extensively used in hospitals or other health care settings, and in the food industry to ensure the microbial safety of products, to destroy or inhibit the growth of harmful microorganisms. Some disinfectants may be used in cleaning processes (physical removal of material). Disinfectants have different modes of actions and biocidal activities. Insecticides are used, among others, to control insects which transmit human disease(s) (vectors).

The European Centre for Disease Prevention and Control (ECDC) was asked by DG SANTE[1] to provide an expert advice on this subject. The ECDC advice forms the basis for this section.

2. TRANSMISSIBLE DISEASES CAUSED BY LACK OF APPROPRIATE DISINFECTANTS OR INSECTICIDES

2.1. The incidence of transmissible diseases

2.1.1. Infectious diseases in health care facilities

Available data on the incidence or prevalence of infections in healthcare facilities (in particular hospitals) are limited to healthcare-associated infections (HAIs), i.e. infections with onset during stay of the patient in the healthcare facility and related to healthcare or associated with a previous exposure to healthcare.

From the ECDC Point Prevalence Survey of HAIs 2011-2012, the total annual number of patients with at least one HAI in the EU/EEA was estimated at 3.2 million patients with at least one HAI each year in acute care hospitals.[2] The hospital population-weighted EU/EEA HAI incidence was estimated at 3.5%. The hospital population-weighted estimated incidence

[1] Letter of 29 January 2016 to ECDC (Ares(2016)496069); ECDC provided its advice on 12th February 2016.

[2] European Centre for Disease Prevention and Control. Point prevalence survey of healthcare associated infections and antimicrobial use in European acute care hospitals. Stockholm: ECDC; 2013. Retrieved from: http://ecdc.europa.eu/en/publications/Publications/healthcare-associated-infections-antimicrobial-use-PPS.pdf

and total number of patients with HAIs, by infection type and per year for the EU/EEA, is shown in Table 1. The most common type of HAI type (in terms of number of HAIs per year) was urinary tract infections (888 106 each year), closely followed by pneumonia and other lower respiratory tract infections (860 938 each year).

The microorganisms most frequently isolated from HAIs were, in decreasing order, *Escherichia coli* (15.9%), *Staphylococcus aureus* (12.3%), *Enterococcus* spp. (9.6%), *Pseudomonas aeruginosa* (8.9%) *Klebsiella* spp. (8.7%), coagulase-negative staphylococci (7.5%), *Candida spp. (*6.1%), *Clostridium difficile* (5.4%), *Enterobacter spp*. (4.2%), *Proteus spp.* (3.8%) and *Acinetobacter spp*. (3.6%).

Table 1. Estimation of the annual number of HAIs in acute care hospitals, by type of HAI, EU/EEA.

Type of HAI	Estimated HAI incidence % (95% CI)	Number of HAIs (95% CI)	% of total HAIs (95% CI)
Pneumonia /Lower respiratory tract infection	0.95 (0.58-1.66)	860 938 (522 771-1 500 038)	24.4 (14.8-42.5)
Urinary tract infection	0.98 (0.58-1.72)	888 106 (527 129-1 554 275)	25.2 (14.9-44.0)
Surgical site infection	0.60 (0.33-1.17)	543 149 (298 167-1 062 673)	15.4 (8.4-30.1)
Bloodstream infection	0.35 (0.19-0.93)	312 822 (171 262-844 423)	8.9 (4.9-23.9)
Gastro-intestinal infection	0.29 (0.14-0.66)	258 327 (127 121-593 452)	7.3 (3.6-16.8)
Systemic infection	0.26 (0.11-1.82)	236 387 (100 646-1 647 657)	6.7 (2.9-46.7)
Skin/soft tissue infection	0.11 (0.05-0.31)	103 146 (43 564-277 627)	2.9 (1.2-7.9)
Other types of HAI	0.36 (0.17-0.85)	326 903 (151 302-770 238)	9.3 (4.3-21.8)
Total HAIs		**3 529 778 (1 941 962-8 250 382)**	

2.1.2. Infectious diseases in community settings

Norovirus infection, often called as a "winter-vomiting disease", is a highly contagious infection and once symptoms develop, it spreads easily and rapidly from person-to-person, particularly in crowded settings and mass gatherings. Due to the antigenic shift of noroviruses, similar to influenza viruses, immunity plays a minor role in preventing the infection leading to a high proportion of susceptible people for the various circulating genotypes[3]. Norovirus infections and norovirus outbreaks are not under mandatory

[3] Donaldson EF, Lindesmith LC, Lobue AD, Baric RS. 2010. Viral shape-shifting: norovirus evasion of the human immune system. Nat Rev Microbiol. 8(3):231-41. DOI: 10.1038/nrmicro2296.

surveillance in the EU. Therefore, the data on incidence is not available from the European Surveillance System.

With respect to risks of infection, the initial infection may be food- or waterborne, which has a potential to cause large gastrointestinal outbreaks particularly in school settings due to centralised school catering followed by person-to-person spread[4]. Norovirus outbreaks due to contaminated berries have been repeatedly recorded in the EU countries, and it is one of the most commonly reported causative agents for foodborne outbreaks in the EU[5,6]. Norovirus is also a well-described problem in semi-closed communities like cruise ships, causing gastrointestinal outbreaks with high attack rates among passengers and crew members.

ECDC influenza surveillance system is based primarily on two separate surveillance systems. Sentinel influenza surveillance is based on nationally organised networks of primary care physicians, mostly general practitioners, covering at least 1–5% of the population in their countries. Depending on the country, physicians report the weekly number of patients seen with influenza-like illness (ILI) or acute respiratory infection (ARI), or both, to the national focal point for influenza surveillance. In addition to the sentinel surveillance, national influenza centres receive respiratory specimens from a range of sources in their countries (so-called non-sentinel sources, such as hospital laboratories, schools, nursing homes and similar settings where influenza outbreaks may have occurred). However, ECDC does not receive surveillance data reported by setting (e.g. schools, nursing homes or day-care centres)[7].

Outbreaks of influenza and other respiratory viruses occur in the settings defined as being of interest, where close proximity in indoor settings favours direct airborne spread of infection. Transmission via contaminated surfaces may also occur.

2.1.3. Mosquito-borne diseases (West Nile Fever, Dengue, Chikunguya and Malaria)

Between 2010 and 2014, ten EU Member States (MS) (Austria, Bulgaria, Croatia, Czech Republic, Greece, Hungary, Italy, Romania, Slovenia and Spain) have reported more than 1 000 locally acquired human West Nile fever cases. Greece is the country that reported the majority of those cases. During this period, the yearly number of cases reported has been fluctuating. Over time, the geographic spread of cases has been expanding.

In the EU, dengue, chikungunya and malaria are primarily travel-related diseases. Table 2 shows an overview of the number of cases imported in the EU. Zika-virus, an emerging

[4] Bernard H, Faber M, Wilking H, Haller S, Hohle M, Schielke A, et al. 2014. Large multistate outbreak of norovirus gastroenteritis associated with frozen strawberries, Germany, 2012. Euro surveillance : bulletin Europeen sur les maladies transmissibles = European communicable disease bulletin. 19(8):20719.

[5] Tavoschi L, Severi E, Niskanen T, Boelaert F, Rizzi V, Liebana E, et al. 2015. Food-borne diseases associated with frozen berries consumption: a historical perspective, European Union, 1983 to 2013. Euro surveillance : bulletin Europeen sur les maladies transmissibles = European communicable disease bulletin. 20(29): 21193.

[6] European Food Safety Authority, European Centre for Disease Prevention and Control. The European Union, summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2014. EFSA Journal [Internet]. 2015; 13(12):[191 p.]. Retrieved from: http://ecdc.europa.eu/en/publications/Publications/zoonoses-trends-sources-EU-summary-report-2014.pdf

[7] The weekly influenza surveillance data is reported in: http://www.flunewseurope.org

health concern, is also transferred by mosquitos and it is considered an emerging infectious disease with the potential to spread to new areas where the *Aedes* mosquito vector is present[8].

In southern Europe, local transmission of the dengue virus was reported in Croatia in 2010 and in France in 2010, 2013, 2014 and 2015. Rapid detection and investigation of imported or suspected local cases, during the period of vector activity (mostly from May to October in southern Europe), allow taking preventive measures to control the spread of the virus in infested areas.

In 2007, an outbreak of chikungunya was reported for the first time in Europe in Italy. A total of 217 cases were reported in July–September 2007 in the Emilia-Romagna. Two autochthonous cases were reported in September 2010 in southern France and in September 2014 in total eleven autochthonous cases occurred in Montpellier, a town recently colonised by the vector mosquito species *Aedes albopictus* in France.

Autochthonous transmission of malaria has occasionally been reported over the last 10 years. In Greece local transmission was for the first time recorded in 2009 – 2013. In 2014 no local transmission was recorded in Greece, most likely due to the implemented control measures including active surveillance, early treatment and vector control. However, in 2015 six locally acquired cases were reported again in Greece.

Table 2. Overview of the imported dengue, chikungunya and malaria cases in the EU/EEA 2010-2014.[9]

Year	Dengue	Chikungunya	Malaria
2010	1622	179	6759
2011	610	55	5482
2012	1209	51	5184
2013	2515	72	5873
2014	1796	1461	6017

2.2. The role of biocides in the control of transmissible diseases

2.2.1. Biocidal products used for hand hygiene

The importance of hand hygiene as a cornerstone of standard precautions for infection prevention and control has been demonstrated for more than one century and biocides play a crucial role in it. This because an important proportion of HAIs are caused by microorganisms transmitted through the hand of healthcare workers, from patient to patient

[8] Zika virus infection information is available on the ECDC website: http://ecdc.europa.eu/en/healthtopics/zika_virus_infection/pages/index.aspx

[9] Data retrieved from The European Surveillance System (TESSy) at ECDC website. Data accessible at http://ecdc.europa.eu/en/activities/surveillance/Pages/data-access.aspx

or indirectly after contact with the hospital environment.[10;11;12] Hand hygiene is, therefore, the leading measure for preventing the spread of antimicrobial-resistant bacteria and for reducing the incidence of HAIs.[13;14;15] WHO recommends the use of alcohol-based hand rubs for hand hygiene.[16]

Consumption of alcohol-based hand rubs (in litres per 1 000 patient-days) is considered a good proxy indicator of hand hygiene compliance of healthcare workers. In a review of literature, Boyce found that in 77% of studies looking at both indicators, alcohol hand rub consumption and hand hygiene compliance were correlated[17]. Alcohol hand rub consumption was also found to be associated with reduction of meticillin-resistant *Staphylococcus aureus* (MRSA) and HAI rates in several studies.[18;19]

Since the beginning of the WHO hand hygiene campaign "SAVE LIVES: Clean Your Hands", alcohol-based hand rub solutions are increasingly used in hospitals and other healthcare facilities worldwide as first choice for hand hygiene. Data on the consumption of alcohol hand rub solutions in acute care hospitals in EU/EEA Member States were collected during the ECDC point prevalence survey of HAIs and antimicrobial use in 2011-2012 (data on alcohol hand rub consumption were from 2010 or 2011) and will be collected by ECDC during a similar point prevalence survey in 2016-2017.

The median hand rub consumption in acute care hospitals that participated in the ECDC point prevalence survey was 18.7 litres per 1000 patient-days and was significantly lower in primary hospitals than in tertiary hospitals ($p<0.001$).

The median hospital alcohol hand rub consumption varied greatly between EU/EEA Member States, from less than 10 litres per 1000 patient-days in Bulgaria, Hungary, Lithuania, Italy, Romania and Slovakia to more than 50 litres per 1000 patient-days in Denmark, Greece, Norway, Malta and Sweden (Figure 1). The WHO guidelines on hand hygiene in healthcare

[10] Dancer S.J. 2014. Controlling hospital-acquired infection: focus on the role of the environment and new technologies for decontamination. Clin Microbiol Rev. Oct;27(4):665-90.
[11] Grundmann H, Barwolff S, Tami A, Behnke M, Schwab F, Geffers C, et al. 2005. How many infections are caused by patient-to-patient transmission in intensive care units? Crit Care Med.May;33(5):946-51.
[12] Weber DJ, Anderson D, Rutala WA. 2013. The role of the surface environment in healthcare-associated infections. Curr Opin Infect Dis. 26(4):338-44.
[13] Allegranzi B, Pittet D. 2009. Role of hand hygiene in healthcare-associated infection prevention. J Hosp Infect. 73(4):305-15.
[14] Chen YC, Sheng WH, Wang JT, Chang SC, Lin HC, Tien KL, et al. 2011. Effectiveness and limitations of hand hygiene promotion on decreasing healthcare-associated infections. PloS One. 6(11):e27163.
[15] Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, et al. 2000. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. Infection Control Programme. Lancet. 356 (9238): 1307-12.
[16] World Health Organization (WHO). 2009. WHO guidelines on hand hygiene in health care. Retrieved from: http://www.who.int/gpsc/5may/tools/9789241597906/en/
[17] Boyce JM. 2011. Measuring healthcare worker hand hygiene activity: current practices and emerging technologies. Infect Control Hosp Epidemiol. 32(10):1016-28.
[18] Marimuthu K, Pittet D, Harbarth S. 2014. The effect of improved hand hygiene on nosocomial MRSA control. Antimicrob Resist Infect Control. 3:34.
[19] Sroka S, Gastmeier P, Meyer E. 2010. Impact of alcohol hand-rub use on meticillin-resistant *Staphylococcus aureus*: an analysis of the literature. J Hosp Infect. 74(3):204-11.

provide a review of products other than alcohols that are used for hand hygiene and surgical disinfection[20] (summary in Table 4).

Table 3. Alcohol hand rub consumption in acute care hospitals that participated in the ECDC point prevalence survey of HAIs and antimicrobial use, by hospital type, EU/EEA (data for 2010 or 2011)[21]

Type of hospital	Number of hospitals	Alcohol hand rub consumptions (litres per 1000 patient-days)					
		Mean	10th percentile	25th percentile	Median	75th percentile	90th percentile
Primary	237	20.3	3.2	8.6	15.6	25.7	39.2
Secondary	247	23.5	4.0	8.2	16.8	28.8	52.0
Tertiary	177	27.2	6.8	13.1	21.0	35.3	55.1
Specialised	85	25.2	4.6	11.5	20.6	34.2	44.6
Unknown	59	28.0	11.9	18.4	25.2	32.6	48.7
All types of hospital	**805**	**23.9**	**4.7**	**10.3**	**18.7**	**30.6**	**49.9**

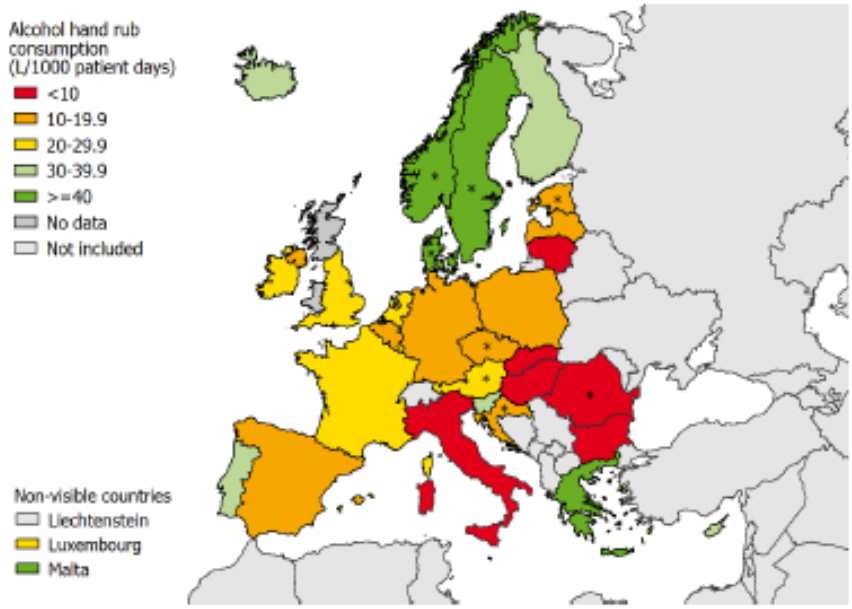

Figure 1. Median alcohol hand rub consumption (litres per 1000 patient-days) in acute care hospitals that participated in the ECDC point prevalence survey of HAIs and antimicrobial use, EU/EEA (data for 2010 or 2011).[22]

[20] World Health Organization (WHO). 2009. WHO guidelines on hand hygiene in health care. Retrieved from: http://www.who.int/gpsc/5may/tools/9789241597906/en/

[21] European Centre for Disease Prevention and Control. Point prevalence survey of healthcare associated infections and antimicrobial use in European acute care hospitals. Stockholm: ECDC; 2013. Retrieved from: http://ecdc.europa.eu/en/publications/Publications/healthcare-associated-infections-antimicrobial-use-PPS.pdf

Table 4. Antimicrobial activity and summary of properties of biocides used in hand hygiene.

Antiseptics	Gram-positive bacteria	Gram-negative bacteria	Viruses enveloped	Viruses non-enveloped	Myco-bacteria	Fungi	Spores
Alcohols	+++	+++	+++	++	+++	+++	-
Chloroxylenol	+++	+	+	±	+	+	-
Chlorhexidine	+++	++	++	+	+	+	-
Hexachlorophene[a]	+++	+	?	?	+	+	-
Iodophors	+++	+++	++	++	++	++	±[b]
Triclosan[d]	+++	++	?	?	±	±[e]	-
Quaternary ammonium compounds[c]	++	+	+	?	±	±	-

Antiseptics	Typical conc. in %	Speed of action	Residual activity	Use
Alcohols	60-70 %	Fast	No	HR
Chloroxylenol	0.5-4 %	Slow	Contradictory	HW
Chlorhexidine	0.5-4%	Intermediate	Yes	HR,HW
Hexachlorophene[a]	3%	Slow	Yes	HW, but not recommended
Iodophors	0.5-10 %)	Intermediate	Contradictory	HW
Triclosan[d]	(0.1-2%)	Intermediate	Yes	HW; seldom
Quaternary ammonium compounds[c]		Slow	No	HR,HW; Seldom; +alcohols

Good = +++, moderate = ++, poor = +, variable = ±, none = –
HR: handrubbing; HW: handwashing
*Activity varies with concentration.
[a] Bacteriostatic.
[b] In concentrations used in antiseptics, iodophors are not sporicidal.
[c] Bacteriostatic, fungistatic, microbicidal at high concentrations.
[d] Mostly bacteriostatic.
[e] Activity against *Candida* spp., but little activity against filementous fungi.
Source: adapted with permission from Pittet, Allegranzi & Sax, 2007.[479]

2.2.2. Biocidal products used for other hospital hygiene purposes

In addition to hand hygiene, biocides are widely used in hospitals and other healthcare settings for perioperative skin antisepsis, sterilisation and disinfection of medical and surgical equipment, and for environmental cleaning. Disinfectants kill or destroy microorganisms which may be present on the object or surface required to be "clean", i.e. disinfected with the aim of eliminating pathogenic microorganisms. The purpose of biocidal products is to prevent HAI associated with surgical and non-surgical operations through transfer of microorganisms in sterile compartments, or to prevent and control transmission of microorganisms between patients (e.g. hepatitis C, multidrug-resistant bacteria) and also indirectly via the environment.

[22] World Health Organization (WHO). 2009. WHO guidelines on hand hygiene in health care. Retrieved from: http://www.who.int/gpsc/5may/tools/9789241597906/en/

There is no single universal disinfectant which will kill all pathogenic organisms. Therefore the availability of a range of products with different modes of action and the selection of the most appropriate disinfectant for the required result is extremely important.[23]

Disinfection of medical and surgical equipment, including endoscopes

A variety of biocides are used for sterilisation and disinfection of equipment and of the environment in hospital and other healthcare facilities, and for perioperative skin antisepsis.[24]

Sterilisation is the process of elimination of all living microorganisms, including spores, and is accomplished by physical or chemical measures. It is used for equipment that is considered critical because of the high risk of infection if it is contaminated, such as but not limited to surgical instruments, vascular catheters and implants. Sterilisation is essential for the prevention of subsequent HAI when such equipment is used. Usually, sterilisation is accomplished by heat, however biocides are used for heat-sensitive items. Such biocides with sterilising action include ethylene oxide, hydrogen peroxide gas plasma and liquid sterilisers like preparations that include glutaraldehyde, peracetic acid, isopropanol, hypochlorous acid, hydrogen peroxide. For sterilisation, these chemicals are often used in combinations.

Disinfection refers to the elimination of most or all living microorganisms, but not of spores, and it usually involves the use of biocides. Disinfection is usually sufficient for semi-critical devices, i.e. equipment that comes in contact with mucous membranes. Such equipment includes endoscopes, anaesthesia equipment and mechanical ventilation equipment. The biocides used for this purpose include glutaraldehyde, peracetic acid, ortho-pthalaldehyde and peracetic acid.

There are no accurate data on the number of HAIs that are prevented by the use of disinfectants, as studies on the effect of using non-disinfected or non-sterile equipment would be considered unethical. However, given an estimated number of more than 50 million surgical operations in Europe every year,[25;26] and considering a conservative doubling of the average risk of HAI from 1 to 2% for various types of surgical intervention if no disinfection were applied, an estimated minimum of 500 000 of HAIs are prevented each year by disinfection only for patients undergoing surgical interventions.

For endoscopy, the rate of HAIs is reportedly very low (1 in 1.8 million procedures)[27]. However, reports of rates up to 6%[28] have been published and were often associated with

[23] Analysis of measures geared to the sustainable use of biocidal products, Final Report, 2015. Retrieved from: /CircaBC/SANTE/BPR - Public/Library/Study reports/Sustainable use/Sustainable use of Biocides - Final report.pdf

[24] Lippincott Williams & Wilkins. 2012. Hospital epidemiology and infection control. 4th ed.

[25] World Health Organisation Regional Office for Europe. European health for all database (HFA-DB) 2015. Retrieved from: http://data.euro.who.int/hfadb/

[26] Weiser TG, Regenbogen SE, Thompson KD, Haynes AB, Lipsitz SR, Berry WR, et al. 2008. An estimation of the global volume of surgery: a modelling strategy based on available data. Lancet.372(9633): 139-44.

[27] Schembre DB. 2000. Infectious complications associated with gastrointestinal endoscopy. Gastrointestinal Endoscopy Clinics of North America. 10(2):215-32.

inappropriately cleaned and decontaminated endoscopes[29]. According to Eurostat data[30], 873 000 bronchoscopies are performed each year in the EU. With an assumed rate of HAI of 6% associated with improperly disinfected endoscopes, and with >90% of such HAIs considered preventable, the number of HAIs prevented by disinfection of bronchoscopes can be estimated at 45 000 per year among patients undergoing bronchoscopy. At least similar numbers could be expected for gastrointestinal endoscopy.

Disinfection of hospital environment

Biocides are also used for environmental cleaning in hospitals and other healthcare facilities. Patient room surfaces (e.g., floor, bedrails, patient furniture) and non-critical equipment (e.g. blood pressure cuffs and stethoscopes) are disinfected with various biocides, including quaternary ammonium compounds, sodium hypochlorite and phenolic compounds. Environmental disinfection of patient rooms during hospitalisation and after discharge of the patient is a recommended measure for the prevention of infections by *Clostridium difficile*, *Staphylococcus aureus* and other pathogens is supported by a number of studies.[31] In the EU, the estimated annual number of cases of *Clostridium difficile* infection (CDI) is 124 000 and that of healthcare-associated meticillin-resistant *Staphylococcus aureus* (MRSA) infections is 179 000. Bundles of measures that include environmental disinfection have been shown to decrease incidence of CDI by up to 50%[32]. However, it is difficult to distinguish which if any part of this decrease is associated with specifically the use of disinfectants and there are also studies that failed to show a significant effect of surface disinfection.[33]

Skin disinfection

In addition, biocides (e.g. chlorhexidine, iodine compounds, alcohol-based solutions) are used for skin disinfection prior to surgical procedures as recommended by several organisations, including the Royal College of Surgeons of England[34] and the US Centers for Disease Control and Prevention (CDC).[35;36] Table 5 summarises the main disinfectant groups

[28] Gorse GJ, Messner RL. 1991. Infection control practices in gastrointestinal endoscopy in the United States: a national survey. Infect Control Hosp Epidemiol. 12(5):289-96.

[29] Kovaleva J, Peters FT, van der Mei HC, Degener JE.2013. Transmission of infection by flexible gastrointestinal endoscopy and bronchoscopy. Clin Microbiol Rev 26 (2):231-54.

[30] Eurostat. 2015. Surgical operations and procedures statistics. Retrieved from: http://ec.europa.eu/eurostat/statistics-explained/index.php/Surgical_operations_and_procedures_statistics

[31] Khanafer N, Voirin N, Barbut F, Kuijper E, Vanhems P. 2015. Hospital management of *Clostridium difficile* infection: a review of the literature. J Hosp Infect. 90(2):91-101.

[32] Gerding DN, Muto CA, Owens RC, Jr. 2008. Measures to control and prevent *Clostridium difficile* infection. Clin Infect Dis. 46 Suppl 1:S43-9.

[33] Dettenkofer M, Wenzler S, Amthor S, Antes G, Motschall E, Daschner FD. 2004. Does disinfection of environmental surfaces influence nosocomial infection rates? A systematic review. Am J Infect Control. 32(2):84-9.

[34] Leaper DJ, Orr C, Maung Z, White A. 2001. Inflammation and Infection: STEP 2000 Module II. Royal College of Surgeons of England: Blackwell Science

[35] Centers for Disease Control and Prevention. 2008. Guideline for disinfection and sterilization in healthcare facilities 2008. Retrieved from: http://www.cdc.gov/hicpac/pdf/guidelines/Disinfection_Nov_2008.pdf

[36] Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. 1999. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. Infect Control Hosp Epidemiol. 20(4):250-78; quiz 79-80.

used in healthcare facilities for sterilisation or disinfection of medical equipment and for environmental disinfection

Table 5. Characteristics and uses of the main disinfectant groups used in hospitals and other healthcare facilities (adapted from WHO[37]).

Agent	Spectrum	Uses
Alcohol (including ethanol or isopropanol)	Active against bacteria, mycobacteria, fungi and viruses. Inactive against spores	Hand hygiene, disinfection of some non-critical items (e.g. oral thermometers and stethoscopes), disinfection of small surfaces
Chlorine compounds (mostly aqueous solution of sodium hypochorite – household bleach)	Active against bacteria, mycobacteria, fungi, viruses and spores	Disinfection of environmental surfaces (e.g. floors), spills and water systems
Glutaraldehyde	Very active against bacteria, mycobacteria, fungi, viruses and spores	High-level disinfection / sterilisation of heat-sensitive semicritical items (e.g. endoscopes)
Peracetic acid	Active against bacteria, mycobacteria, fungi, viruses and spores	Disinfection of endoscopes (in automated reprocessors or for manual processing)
Orthophthalaldehyde	Very active against bacteria, mycobacteria, fungi, viruses and spores	Disinfection of endoscopes
Hydrogen peroxide	Active against bacteria, mycobacteria, fungi, viruses and spores (less active than other compounds for Gram-positive bacteria and spores)	Cold sterilisation of heat-sensitive critical items. Combined with peracetic acid, for disinfection of hemodialyzers
Phenolics	Active against bacteria, mycobacteria, fungi, viruses and spores. Less active against viruses and inactive against spores	Disinfection of inanimate objects and surfaces
Quaternary ammonium compounds	Less active against Gram-negative bacteria, fungi and viruses and inactive against mycobacteria and spores	In combination with other compounds for disinfection of non-critical items and surfaces

2.2.3. Disinfection in community settings

There is no reliable information available on actual use of biocidal products in schools and day care settings but ECDC has commissioned a systematic literature review on the prevention of norovirus infection in schools and childcare facilities in 2013.[38] The report entails detailed information on recommendations for environmental cleaning and disinfection, mostly focusing on sodium hypochlorite but mentioning also the efficacy of other disinfectants against norovirus.

[37] WHO 2014. Safe management of wastes from health-care activities 2014. Retrieved from: http://apps.who.int/iris/bitstream/10665/85349/1/9789241548564_eng.pdf?ua=1

[38] European Centre for Disease Prevention and Control. 2013. Prevention of norovirus infection in schools and childcare facilities. Stockholm: ECDC. Retrieved from: http://ecdc.europa.eu/en/publications/Publications/norovirus-prevention-infection-schools-childcare-facilities.pdf

2.2.4. Vector control of mosquito-borne diseases (West Nile Fever, Dengue, Chikunguya and Malaria)

No vaccines are available to prevent West Nile fever and chikungunya in the EU. The first dengue vaccine has been recently approved in Mexico, Brazil and The Philippines. Prevention and control of these diseases is primarily based on the implementation of vector management measures and the interruption of human–vector contact. It often constitutes the first line of activity in case of epidemics of vector-borne diseases. To be effective, vector control programs require a strong organisational backbone relying on a previously defined plan, skilled technicians and operators, appropriate equipment, and sufficient financial resources. Chemical control is still the most important element in the integrated approach to vector control[39]. Vector management options include source reduction (reducing larval breeding sites by e.g. environmental management), application of larvicides and the use of adulticides (insecticides) in case of an outbreak.[40;41]

Most West Nile virus vector control experiences have been recently developed in the US, where ecological conditions are different from the EU and vector control is organised under a different regulatory frame. The extrapolation of information produced in North America to Europe might be limited because of the seemingly different epidemiology in the European region.

In the EU malaria control is based on early diagnosis and correct treatment of cases, and vector control using indoor residual spraying and treated bed nets. Several systematic reviews provide evidence that the implementation of these vector control measures prevents and controls the disease transmission and lowers the incidence in the population at risk.[42;43;44]

2.3. Expected impacts on transmissible diseases expected by the options to set criteria to identify ED substances

In the screening of biocidal active substances of the 44 disinfectants one, Iodine, was identified as a potential ED under Option 2, Option 3 Category I, and Option 4. Of the 49 pest control substances only one insecticide, Cypermethrin, was identified as a potential ED. Under Option 3 two substances used in disinfectants (DCCP and Gluteraldehyde) were classified in Category II of suspected ED. For insecticides the substances Abamectin, Clothianidin, Deltamethrin, Fipronil, Lambda-cyhalothrin, Pyriproxifen, Hydrogencyanide

[39] WHO. 2016. WHO Pesticide Evaluation Scheme (WHOPES) Geneva [cited 2016 02 February]. Retrieved from: http://www.who.int/whopes/en/

[40] Baldacchino F, Caputo B, Chandre F, Drago A, della Torre A, Montarsi F, et al. 2015. Control methods against invasive Aedes mosquitoes in Europe: a review. Pest Manag Sci. 71(11):1471-85.

[41] Bellini R, Zeller H, Van Bortel W. 2014. A review of the vector management methods to prevent and control outbreaks of West Nile virus infection and the challenge for Europe. Parasit Vectors. 7:323.

[42] Gamble CL, Ekwaru JP, ter Kuile FO. 2006. Insecticide-treated nets for preventing malaria in pregnancy. Cochrane Database of Systematic Reviews. (2):CD003755.

[43] Pluess B, Tanser FC, Lengeler C, Sharp BL. 2010. Indoor residual spraying for preventing malaria. Cochrane Database of Systematic Reviews. (4):CD006657.

[44] Lengeler C. 2004. Insecticide-treated bed nets and curtains for preventing malaria. Cochrane Database of Systematic Reviews. (2):CD000363.

and Permethrin were identified under Category II and Etofenprox and Imidacloprid under Category III (see results of the screening in Annex 5). It is important to note that the results of the screening should be very cautiously interpreted for the potential impact as it is not possible to judge how representative the screening results are within and across the product groups. For example, the screening did cover only 44 of the 266 active substance-product types in the main group of disinfectants. However, it is clear that the setting of ED criteria implies that some active substances used in biocidal products could be non-approved or approved under strict conditions. The results also indicate that the different options may result in different numbers of disinfectants or insecticides identified as ED. Critical impacts may occur if key substances for transmissible diseases would not be available and no appropriate alternatives could be found or developed.

Based on the current information it cannot be excluded neither properly estimated whether non-approval of key biocidal substances in relation to transmissible diseases will occur The BP Regulation provides the possibility, notwithstanding a chemical is identified as an ED, to authorise it with restrictions for a fixed time period in cases the substance is essential to prevent or control a serious danger to human health. However, at the moment no experience exists with the application of this derogation. Nevertheless, it can be assumed that a key substance to control a serious danger to human health, for example to stop local transmission of the dengue virus or malaria, would be approved under derogation for use in the relevant Member States. Under this consideration all Options 1 to 4 would have the same impact. Contrarily, it seems less likely that disinfectants identified as EDs would be approved because the use of these substances can be less directly linked to a specific human health threat. Nonetheless several substances remain available on the market, the non-approval of a substances used in disinfectants may have a health impact. As explained above, there is a need for wide spectrum of disinfectants as there is no single universal disinfectant which will kill all pathogenic microorganisms. The choice of a disinfectant depends on the situation: the surface or item to be disinfected and the risk of specific organisms being present. Some disinfectants can kill many different types of microorganisms, while others are more specific in the organisms they kill but are often preferred because, as disinfectants, they are non-corrosive and so will not damage the equipment being disinfected In Annex 14 it is indicated that the non-approval of active substances in the EU will probably not trigger automatically innovation for replacing these by other substances, even if it is noted that disinfectants are a growing market and thus some innovation may be expected to occur in this commercially interesting market segment (see Figure 2).

Notwithstanding the above described high uncertainties it can be assumed that the impact on transmissible diseases would be associated with the number of chemicals that would be identified as EDs, which are likely to be non-approved. Although it is important to stress that no linear relationship can be considered between the number of active substances available and the efficacy of tools to manage transmissible diseases. The application of derogations in the BP Regulation could make available to professional users biocides to minimise the risk of spread of these diseases, this will be not the case for consumers. In any case, it cannot be excluded that also for professional users the number of biocides may decrease, even if derogations may be granted for some substances identified as ED. The ranking of the four

options can be done with the option having the most number of chemicals identified as EDs performing the worst as in theory less biocidal substances would be available. Thus Option 4 would be expected to have the least impact compared to options 2 3, and 1, i.e. 4 > 2/3 > 1. options A, B and C were not evaluated as these are not relevant for biocidal products.

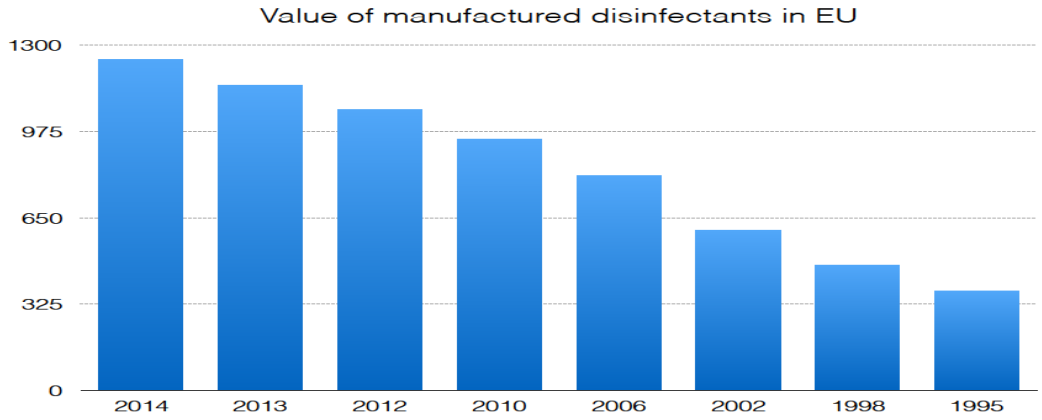

Figure 2. Value of manufacture disinfectants (millions Euro); data of Eurostat (PRODCOM database).

3. FOOD SAFETY (CONTAMINATION OF FOOD BY MYCOTOXINS)

The EU legislation aims to ensure a high level of food safety via an integrated approach which covers all relevant areas "from the farm to the fork" and improve the effective functioning of the internal market. The implementation of this approach involves having effective control systems to ensure compliance with EU safety and quality standards, which include chemical safety because of the role chemical substances, play in food production and processing. The benefits of using chemicals in food production and processing have, on the other hand, to be balanced with potential risks for the health of the food consumer due to side effects and residues of these chemicals. That is why, for instance, for the traces pesticides leave in treated food products, the EU legislation[45] asks for setting maximum residue levels (MRLs), which are applicable also for substances identified as endocrine disruptors used in plant protection products (PPP). Similarly, for active substances contained in biocidal products limits should be established where the use of these substances in the environment of food production or food processing, or in direct contact with food, may involve a risk for human health. Annexes 15 (Food supply and international trade) and 9 (Human health – Hormone related diseases) provide details on the MRL setting for PPP and its potential impacts.

[45] Regulation (EC) No 396/2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and amending Council Directive 91/414/EEC OJ L 70

However, a number of chemical substances may be present in the environment as pollutants. These contaminants may be unintentionally present in raw materials used in food production. Union food legislation aims at the reduction of contaminants in accordance with the high level of consumer protection that is required in Article 152 of the Treaty establishing the European Community. The legislation on contaminants is based on scientific advice and the principle that contaminant levels shall be kept as low as can be reasonably achieved following good working practices. Maximum levels have also been set for certain contaminants (e.g. mycotoxins) in order to protect public health. To achieve this high level of health protection for the consumer, a risk analysis procedure that is based on sound scientific evaluation and takes into account other factors – such as the feasibility of control – underpins Community legislation.

Mycotoxins are produced during storage or plant growth and have an important impact on human health. As their occurrence is affected by the use of PPP, they are considered as one criterion for the assessment of potential impacts on human health in the framework of this impact assessment.

3.1. Threats, risks and costs of mycotoxins

Mycotoxins are a group of chemicals produced by fungi species (molds) and represent one of the most important categories of biologically produced natural toxins relative to health[46]. For example, the World Health Organisation[47] estimated that there were 22,000 cases of aflatoxin-related cancer (hepatocellular carcinoma).

These colorless, tasteless and odorless toxins are produced during storage or plant growth.[48] Aflatoxins, ochratoxins, trichothecenes, zearalenone, fumonisins, tremorgenic toxins, Deoxynivalenol (DON), and ergot alkaloids are the mycotoxins of greatest health and economic importance. Mycotoxins do not decompose easily in the body of the animals, so they can also endanger the health of consumers by their presence in food of animal origin (milk, meat, butter, cheese, eggs). The economic impact of mycotoxins concern loss of human and animal life, increased health care and veterinary costs, reduced livestock production, disposal of contaminated foods and feeds, and investments to prevent mycotoxin occurrence.[48]

No detailed data are available on the economic impact in the EU. The total mycotoxin – related losses to agriculture in the US are calculated as high USD 1,4 billion annually[49]. For

[46] Mycotoxins are capable of having acute toxic, carcinogenic, mutagenic, teratogenic, immunotoxin, and oestrogenic effects in man and animals, for example aflatoxin B1 have been shown to be genotoxic i.e. can damage DNA and cause cancer.

[47] Gibb et al. 2010. WHO estimates of the global and regional disease burden of four foodborne chemical toxins. Food Research 4: 1393.

[48] Hussein S. Hussein, Jeffrey M. Brasel. 2001. Toxicity, metabolism, and impact of mycotoxins on humans and animals. Toxicology 167, p 101.

[49] Vardon, P., McLaughlin, C, Nardinelli, C. 2003. Potential economic costs of mycotoxins in the United States. In: Council for Agricultural Science and Technology (CAST). Mycotoxins: Risks in Plant, Animal,and Human Systems, Task Force Report No. 139: Ames, IA, 2003.

the Philippines, Thailand and India the total social costs of aflatoxin were estimated at USD 900 million (market losses USD 200 million, livestock losses USD 200 million and health losses USD 500 million)[50]. Lack of information on animal health (e.g. animal illnesses and productivity losses due to low-level exposures) makes the evaluation of economic impacts of mycotoxins in animal feed charged with uncertainty[51]. In a recent review, it was estimated that 25% of the world's crops may be contaminated with mycotoxins.[48] Therefore, taking into account the worldwide contamination of many foods and feeds with mycotoxins, probably the occurrence of mycotoxins leads to significant economic impacts.

In the public consultation in 2015 it was indicated that the loss of PPP would undoubtedly lead to significant yield reductions, and to an increase in the occurrence of mycotoxins, especially in grain. The potential impacts on food safety were emphasised.

3.2. The occurrence of mycotoxins in the EU

In 2003 EU-experts concluded that *Fusarium* mycotoxins are widely distributed in the food chain in the EU[52] (see Table 6 and Table 7). The major sources are products made from cereals, in particular wheat and corn.

In the EU the presence of mycotoxins in food and feed is monitored. The Rapid Alert System for Food and Feed (RASFF) was put in place to provide food and feed control authorities with a tool to exchange information. RASFF notifications report on risks identified in food or feed that is placed on the market. Each year several hundred notifications occur for mycotoxins (see Table 8), mostly for aflatoxins in imported products (peanuts, pistachios and dried figs). Several RASFF notifications relate to aflatoxins in maize produced in EU regions. Mycotoxins can be considered a concern in the EU as it is one of the main hazard categories notified. Interestingly, the mycotoxin zearalenone is a potent endocrine disruptors commonly found on several foods and feeds in temperate regions worldwide.[53]

Each year academic, governmental and commercial organisations provide to the European Food Safety Authority (EFSA) analytical results on chemical contaminants in food and feed. Mycotoxins is one of the groups reported.

The provided data in Table 9 shows that mycotoxins are detected in many samples of food and feed in the EU and can be considered currently a concern in the EU.

[50] Lubulwa, A.S.G., Davis, J.S., 1994. Estimating the social costs of the impacts of fungi and aflatoxins in maize and peanuts. In: Stored Product Protection: Proceedings of the 6th International Working Conference on Stored-product Protection, Highley, E., Wright, E.J., Banks, H.J., Champ, B.R., Eds. CAB International, Zallingford, UK: pp 1017-1042.

[51] Wu, F. 2007. Measuring the economic impacts of Fusarium toxins in animal feeds. Animal Feed Science and Technology 137: 363-374.

[52] Report of experts participating in Task 3.2.10, Collection of occurrence data of Fusarium toxins in food and assessment of dietary intake by the population of EU Member States (2003). Retrieved from: http://ec.europa.eu/food/fs/scoop/task3210.pdf

[53] Zinedine, A. et al. 2007. Review on the toxicity, occurrence, metabolism, detoxification, regulations and intake of zearalenone: an oestrogenic mycotoxin. Food Chem Toxicolo 45(1): 1-18.

Table 6. Overview on Fusarium toxin occurrence data (2003)[52]

Fusarium toxin	Countries	Number of samples	Positive samples
Type B trichothecenes			
Deoxynivalenol	11	11 022	57 %
Nivalenol	7	4 166	16 %
3-Acetyldeoxynivalenol	6	3 721	8 %
15-Acetyldeoxynivalenol	3	1 954	20 %
Fusarenon X	3	1 872	10 %
Type A trichothecenes			
T-2 Toxin	8	3 490	20 %
HT-2 Toxin	6	3 032	14 %
T-2 Triol	2	1 389	6 %
Neosolaniol	2	1 323	1 %
Diacetoxyscirpenol	3	1 886	4 %
Monoacetoxyscirpenol	1	853	1 %
Verrucarol	1	121	0%
Zearalenone	9	5 018	32 %
Fumonisins			
Fumonisin B_1	9	3 863	46 %
Fumonisin B_2	6	1 010	42 %
Fumonisin B_3	1	239	36 %
	Sum:	**44 959**	

Table 7. Summary of food groups most frequently contaminated with Fusarium mycotoxins (2003)[52]

Fusarium toxin	Main food items/food groups contaminated (percentage of positive samples)
Type B trichothecenes	
Deoxynivalenol	corn (89 %), wheat* (61 %)
Nivalenol	corn (35 %), oats (21 %), wheat*(14 %)
3-Acetyldeoxynivalenol	corn (27 %), wheat*(8%)
Type A trichothecenes	
T-2 Toxin	corn (28 %), wheat (21 %), oats (21 %)
HT-2 Toxin	oats (41 %), corn (24 %), rye** (17 %)
Zearalenone	corn (79 %), corn milling fractions (51 %), corn based products (53%); wheat (30 %), wheat milling fraction (24 %), wheat based products (11 %); baby food (23 %)
Fumonisins	
Fumonisin B_1	corn (66 %), corn flour (79 %), corn based products (31 %), corn flakes (46 %); wheat (79 %)
Fumonisin B_2	corn (51 %)

* Wheat and wheat flour ** Rye and rye flour

Table 8. The Rapid Alert System for Food and Feed (RASFF) - Notifications on mycotoxins in food and feed[54].

Substance	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Aflatoxins	839	946	801	705	902	368	649	585	484	341
Deoxynivalenol (DON)				10	4	3	2	11	4	8
Fumonins	14	2	15	9	2	1	3	4	4	7
Ochratoxin A	27	42	54	30	20	27	34	35	32	54
Patulin		6	7		3					
Zearalenon			1	6	2					
Total mycotoxins	880	996	878	760	933	669	688	635	528	410
Total notifications RASFF	5562	7170	6840	7354	3099	3322	3358	3812	3516	3205

[54] European Commission. 2016. DG SANTE Website Directorate-General for Health and Food Safety: http://ec.europa.eu/food/safety/rasff/reports_publications/index_en.htm

Table 9. Occurrence of mycotoxins in agricultural products of EU-origin in the years 2004-2014 (EFSA – Extract of the EFSA database on Collection on Contaminant Occurrence Data[55])

Type of mycotoxin	Commodity	Number of	Number of samples	Mean (µg/kg)	Median (µg/kg)	P95 (µg/kg)	Maximum allowed
Aflatoxin B1	barley	235	225	0,0	0,0	0,0	2,0
	Corn	943	681	3,2	0,0	16,2	2,0
	Oats	142	142	0,0	0,0	0,0	2,0
	wheat	562	538	0,0	0,0	0,0	2,0
	Almond	634	490	1,2	0,0	1,5	8,0
	Pistachios	522	419	5,9	0,0	16,4	8,0
	Peanuts	725	641	0,4	0,0	0,2	2,0
	dried figs	533	436	1,7	0,0	6,7	6,0
Aflatoxins	barley	87	72	0,3	0,0	1,8	4,0
	Corn	320	231	1,0	0,0	2,7	4,0
	Oats	15	15	0,0	0,0	0,0	4,0
	wheat	215	188	0,2	0,0	1,4	4,0
	Almond	101	87	0,6	0,0	2,4	10,0
	Pistachios	90	70	1,5	0,0	10,7	10,0
	Peanuts	222	207	0,1	0,0	0,5	4,0
	dried figs	206	170	2,3	0,0	6,2	10,0
Ochratoxin A	barley	498	438	0,7	0,0	1,1	3,0
	Corn	272	234	0,3	0,0	1,3	3,0
	Oats	221	189	10,6	0,0	3,0	3,0
	wheat	1463	1280	0,1	0,0	0,5	--
	Almond	92	85	0,1	0,0	0,2	--
	Pistachios	117	109	0,2	0,0	0,4	--
	Peanuts	65	49	0,8	0,0	1,4	--
	dried figs	320	219	3,9	0,0	10,2	--
Deoxynivalenol	barley	1706	1145	126,4	0,0	500,0	750,0
	Corn	1209	639	261,4	0,0	1170,5	750,0
	Oats	615	342	4669,3	0,0	756,0	750,0
	wheat	3236	1428	199,0	33,2	900,8	750,0
Zearalenone	barley	2498	1777	8,7	0,0	33,0	75,0
	Corn	3258	1545	64,3	5,0	270,0	100,0
	Oats	1029	815	8,7	0,0	41,2	75,0
	wheat	8932	5637	16,3	0,0	61,0	75,0
Fumonisin B1	Corn	1517	708	499,6	33,4	2353,6	--
Fumonisin B2	Corn	1542	1001	153,7	0,0	825,7	--
Total Fumonisins	Corn	1980	1295	289,0	0,0	1410,2	1000,0

[55] EFSA. 2016. European Food Safety Authority. Summary of the 2014 data collection on contaminant occurrence data. Published 21 January 2016. Retrieved from: http://www.efsa.europa.eu/en/supporting/pub/954e

Table 10. Occurrence of mycotoxins in imported agricultural products (non-EU-origin) in the years 2004-2014 (EFSA – Extract of the EFSA database on Collection on Contaminant Occurrence Data[56])

Type of mycotoxin	Commodity	Number	Number	Mean	Median	P95	Maximum
Aflatoxin B1	barley	11	10	0,1	0,0	0,6	2,0
	corn	159	141	1,6	0,0	1,4	2,0
	oats	0	0				2,0
	wheat	87	73	0,0	0,0	0,2	2,0
	almond	2877	2334	7,8	0,0	1,8	8,0
	pistachios	11870	9653	2,3	0,0	5,2	8,0
	peanuts	5423	4373	20,7	0,0	4,9	2,0
	dried figs	6266	4812	1,4	0,0	3,9	6,0
Aflatoxins	barley	0	0				4,0
	corn	4	3	0,1	0,0	0,2	4,0
	oats	0	0				4,0
	wheat	1	1	0,0	0,0	0,0	4,0
	almond	1505	1272	1,2	0,0	2,1	10,0
	pistachios	9047	7366	2,4	0,0	5,1	10,0
	peanuts	2080	1776	3,3	0,0	5,7	4,0
	dried figs	3753	2932	2,0	0,0	6,6	10,0
Ochratoxin A	barley	3	3	0,0	0,0	0,0	3,0
	corn	38	37	0,0	0,0	0,0	3,0
	oats	1	0	200,0	200,0	200,0	3,0
	wheat	35	18	0,8	0,0	4,4	--
	almond	147	140	0,0	0,0	0,0	--
	pistachios	171	155	0,6	0,0	0,7	--
	peanuts	1176	1142	0,1	0,0	0,0	--
	dried figs	981	676	3,8	0,0	8,2	--
Deoxynivalenol	barley	4	3	28,5	0,0	97,0	750,0
	corn	66	53	25,0	0,0	182,5	750,0
	oats	5	2	10017,8	39,0	40010,0	750,0
	wheat	87	69	35,5	0,0	76,2	750,0
Zearalenone	barley	2	2	0,0	0,0	0,0	75,0
	corn	95	72	13,7	0,0	73,6	100,0
	oats	0	0				75,0
	wheat	41	41	0,0	0,0	0,0	75,0
Fumonisin B1	corn	164	36	1170,3	312,5	5411,4	--
Fumonisin B2	corn	167	53	352,0	74,1	1405,0	--
Total Fumonisins	corn	61	29	247,3	49,0	944,0	1000,0

[56] EFSA. 2016. European Food Safety Authority. Summary of the 2014 data collection on contaminant occurrence data. Published 21 January 2016. Retrieved from: http://www.efsa.europa.eu/en/supporting/pub/954e

3.3. Protection of citizens, animals and the environment in the EU from mycotoxins

To protect humans and animals from the dangerous effects of mycotoxins, the European Commission has set, based on scientific advice, maximum levels in food and feed products for several mycotoxins.[57;58] It is important to underline that the same legislation applies whether food or feed are imported in the EU or produced in the EU.

In order to avoid or reduce the presence of mycotoxins in food and feed, the most effective way is to prevent fungal infestation of plant material, but even the best management of agricultural strategies cannot totally eradicate mycotoxin contamination.[59] A number of methods are available to reduce the occurrence of mycotoxins, which are briefly detailed below.

3.3.1. Agronomical measures

Contamination by mycotoxins depends on both climate and cropping system.[60] Crop rotation and tillage are recommended to control plant contamination with *Fusarium* spp., but these agricultural practices are not always recognised as efficient.[59] It is interesting to note that several studies indicate that, notwithstanding the absence of applying PPP in organic farming, that the levels of mycotoxins in organic and non-organic products are similar.[61;62] This may be also related to plant varieties, as plant breeding can provide varieties that are more resistant to spoilage and mycotoxin formation. This method can be considered as the best solution for disease control.[59]

3.3.2. Chemical plant protection products

Chemical PPP are applied to control diseases, and this disease reduction then may lead to a reduction in mycotoxin production. However, it is important to note that most PPP used on crops were primarily designed to control diseases and associated reductions in crop yield, and not for their impact in reducing mycotoxin formation.[63] In 1999 the Scientific Committee on Plants concluded that there was insufficient evidence that pesticides play a major role in

[57] Commission Regulation (EC) No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs. Retrieved from: http://ec.europa.eu/food/safety/chemical_safety/contaminants/legislation/index_en.htm.

[58] The presence of contaminants in feed is controlled by EC Directive 2002/32. Retrieved from: http://ec.europa.eu/food/food/animalnutrition/contaminants/index_en.htm.

[59] Jean Pierre Jouany. 2007. Methods for preventing, decontaminating and minimizing the toxicity of mycotoxins in feeds. Animal Feed Science and Technology 137: 342–362

[60] A. Champeil, J.F. Fourbet, T. Dore, L. Rossignol. 2004. Influence of cropping system on Fusarium head blight and mycotoxin levels in winter wheat. Crop Protection 23:531–537, p 531.

[61] Vanova et al. 2008. The content of Fusarium mycotoxins, grain yield and quality of winter wheat cultivars under organic and convential cropping systems. Plant Soil Environ. 54: 395-402.

[62] Edwards, S.G. 2009. Fusarium mycotoxin content of UK organic and convential barley. Food Additives and Contaminants 26: 1185-1190.

[63] Belli, N., et al. 2007. Effect of chemical treatments on ochratoxigenic fungi and common mycobiota of grapes. Journal of Food Protection 70: 157-163.

preventing or inhibiting the production of mycotoxins by toxicogenic fungi[64]. Currently azole fungicides have been reported to be the most effective active substances in the control of *Fusarium* species and in the reduction of the main mycotoxins that occur in cereal grain, such as DON[65]. *Fusarium* ear rot is a severe and worldwide disease of maize[66]. Treatments with fungicides applied in combination with an insecticide, significantly reduced the mycotoxin fumonisin occurrence in maize.[59] In an advice to the Food Standards Agency[67] the efficacy of PPP to control mycotoxins in the UK was reviewed since the publication of the report of the Scientific Committee on Plants. It was concluded that, based on fifteen studies, there is a strong body of evidence that fungicide application does reduce DON formation in wheat. It was also concluded there is good evidence that insecticides reduce the levels of fumonisins in maize. The advice further stated that the results of studies into the effects of PPP on DON in barley were less conclusive and other mycotoxin and crop combinations have received relatively little attention of scientists (for example, T2 and HT2 toxins in wheat, barley and oats, DON in maize, ochratoxin in grapes).

3.3.3. Plant protection products based on microorganisms action

Several bacterial species have shown the ability to inhibit fungal growth and production of aflatoxins under laboratory conditions. Microbial antagonists or competitors can be sprayed on plants at the flowering stage to eradicate or limit the growth of toxin producing fungi. For example, *Bacillus subtilis* can inhibit the growth of fungi during their endophytic growth phase.[59;67] However, biological control appears not to give good control in real field conditions because it is difficult to bring the bacterial cells to the fungal infection sites on commodities under field conditions.[68]

3.4. Expected impacts on presence of mycotoxins based on the screening results

It is clear that the use of PPP in certain crop-mycotoxin combinations contributes to limit the contamination of crops with fungi and consequently the occurrence of mycotoxins in crops grown in the EU. In comparing the options outlined in this impact assessment it is key to consider from a health perspective whether a possible reduced range of available

[64] See Scientific Committees on the European Commission website: http://ec.europa.eu/food/fs/sc/scp/out56_en.html

[65] V. Scarpino, A. Reyneri, M. Sulyok, R. Krska and M. Blandino. 2015. Effect of fungicide application to control *Fusarium* head blight and 20 Fusarium and Alternaria mycotoxins in winter wheat (*Triticum aestivum* L.). World Mycotoxin Journal. 8 (4): 499-510.

[66] Filippo De Curtis, Vincenzo De Cicco, Miriam Haidukowski, Michelangelo Pascale, Stefania Somma, Antonio Moretti. 2011. Effects of agrochemical treatments on the occurrence of Fusarium ear rot and fumonisin contamination of maize in Southern Italy. Field Crops Research 123. 161–169, p 161.

[67] Food Standards Agency (FSA) report from a preliminary study carried out by the FSA. R. Massey. 2012. "The likely effects of reduced pesticide usage on mycotoxin levels in food".

[68] K.R.N. Reddy, N.I. Farhana, B. Salleh and C.A.F. Oliveira. 2010. Microbiological Control of Mycotoxins: Present Status and Future Concerns. in. A Mendez-Vilas (ed) Current Research, technology and Education Iopics in Applied Microbiology and Microbial Biotechnology. FORMATEX 2010.

fungicide/insecticide products is likely to lead to increased exposure of consumers to mycotoxins.

The screening of PPP for endocrine disrupting properties resulted in a varying number of PPP identified under the four options (see Annex 5). In all the options PPP were identified belonging to the group of azoles (for example, cyproconazole, tebuconazole, tetraconazole, see Table 3 in Annex 5). This group of fungicides is considered to be important for *Fusarium* control in the EU. Depending on the option, azoles would be impacted between 5% and 35%. Option 4 identified both the lowest number of PPP as EDs and the lowest number of substances belonging to the group of azoles (see Figure 3 and Table 3 in Annex 5).

Table 11. Factors influencing the fungal contamination of crops and the occurrence of mycotoxins in food and feed

PRE-HARVEST	**POST-HARVEST**
Environmental conditions related to storage (temperature, humidity)	Environmental conditions in the field (temperature, humidity)
Biological control	Biological control
Chemical control	Chemical control
Plant breeding	
Agronomical measures (crop rotation, soil tillage)	

It is not possible to indicate whether the loss of one or more PPP, including substances belonging to the group of azoles, will lead to higher levels of contamination of crops and consequently higher levels of mycotoxins in food and feed in the future as many factors influence the occurrence of mycotoxins (see Table 11). In addition, the uncertainties, based on the available information, exclude the possibility to determine the potential impact of the loss of one of more substances contained in PPP. The impact for mycotoxins will firstly depend on whether alternative chemicals are or will be available, assuming the identified substance will not be allowed to be made available on the EU market, to replace the identified substance. An analysis of the identified substances under each option points out that substances in the same group of PPP remain available to manage fungi (see Annex 5, Table 2 analysing the outcome of screening for groups of PPP). However, it is unclear whether these alternatives are equally effective to control the fungi producing mycotoxins and whether the efficacy will be reduced in the short term because of the development of resistance (see Annex 13). Biological control measures may become available to control the fungi producing mycotoxins, but it has to be noted that up to now the efficacy of biological control measures is limited and are not applied in practice. Therefore, it is unclear whether it would be possible, and commercially interesting, to develop effective biocontrol products on the short or long term that could replace chemical control. More promising alternatives appear using and breeding plant cultivars limiting the development of mycotoxin producing fungi and agronomical measures.

In conclusion, it cannot be excluded that farmers in the EU will be negatively impacted by the different options because they will have less effective means to control mycotoxin producing fungi and, therefore, products may not comply with legal levels of mycotoxins for food (and these products cannot be placed on the EU market). As a consequence, it cannot be excluded that public and animal health will be negatively impacted by the different options as food and feed may contain higher levels of mycotoxins.

In addition, as indicated earlier mycotoxins are a worldwide problem. This is also emphasised by RASFF-data showing that notifications concern mostly imported products (Table 8). According to RASFF the most notified products are peanuts, pistachios and dried figs. Data on trade values show (Table 12) that these products involve large markets.

Exporting countries will need to comply with lower MRLs of chemical residues for the substances identified as EDs, as a direct consequence of implementation of legal requirements (see Annex 8 on Horizontal issues, and Annex 15 on trade). At the same time, products found to contain mycotoxins above the legal level cannot be placed on the EU market. These two requirements may represent in certain cases a trade-off, since some PPP may be needed to control mycotoxin producing fungi. However, no information is available on the PPP that are used in exporting countries and the availability of alternatives for controlling mycotoxins in crops, as this depends also on the country or region.

It is thus clear that contamination of food or feed with mycotoxins or with residues above legal set MRLs for PPP can lead to trade impacts. A study estimated in 2001 that lowering the aflatoxin standard in the EU would have a negative impact on African exports of cereals, dried fruits and nuts to Europe and result in a USD 670 million loss per year to Africa.[69] It can be concluded that, depending on the availability of chemical and non-chemical alternatives for these PPP in the exporting countries, it will be more or less difficult for exporting countries to prevent mycotoxin contamination of their products and to maintain their markets in the EU. So, it cannot be excluded that an impact will occur on trade flows associated to the contamination of products with mycotoxins. It is important to note that the compliance process also can result in competitive advantage for some suppliers and contribute to more sustainable and profitable trade over the long term.[70]

The impact of the four options in relation to mycotoxins depends on many factors and includes large elements of uncertainty. It could be concluded that the likelihood of having an impact on farmers, trade and/or health will be probably higher if an option results in in a high number of substances identified as EDs and/or more substances are identified belonging to a group of PPP relevant for the control of fungi producing mycotoxins. Although it is important to stress that no linear relationship can be considered between the number of active substances available and reduced levels of contamination of crops by fungi. This implies that

[69] Otsuki, T, Wilson, J.S., Sewadeh, M. 2001. Saving two in a billion/ quantifying the trade effect of European Food Safety standards on African exports. Food Policy 26 (5): 495-514

[70] World Bank. 2005. Food safety and Agricultural Health Standards. Challenges and Opportunities for Developing Country Exports. Report No. 31207 of the World Bank, Washington DC, USA. Retrieved from: http://siteresources.worldbank.org/INTRANETTRADE/Resources/Topics/Standards/standards_challenges_synthesisreport.pdf

Option 4 appears relatively the best option in relation to control mycotoxin contamination of food and feed, followed by Option 2 and Option 3 Category I, and finally by Option 1, i.e. 4 > 2/3 > 1. Regarding regulatory decision making, Option C performs better than Options B and A, i.e. C > B > A.

Table 12. Trade value of almonds, pistachios, dried figs, cashew nuts, hazelnuts, chestnuts, macadamia nuts and Brazil nuts in the EU in 2014.

VALUE OF IMPORTED NUTS AND DRIED FIGS 2014 - THOUSAND EUR

REGION/PRODUCT	ASIA	EUROPE	NORTH AMERICA	AFRICA	LATIN AMERICA	MIDDLE EAST	OCEANIA
Almonds	€7,910	€1,778	€1,189,494	€9,367	€1,352	€2,515	€113,158
Pistachios	€1,730	€13,099	€393,939	€45	€450	€180,767	€0
Dried figs	€34	€102,864	€52	€248	€36	€530	€0
Cashew nut	€472,694	€453	€1,814	€31,055	€31,819	€21	€129
Hazelnuts	€136,697	€621,012	€4,370	€96	€22,709	€5	€121
Chestnuts	€4,489	€38,015	€0	€118	€1,152	€0	€8
Macadamia nuts	€1,503	€0	€1,585	€39,256	€3,346	€5	€13,897
Brazil Nut	€410	€95	€83	€0	€81,900	€2	€0