



# **STATE OF THE ENVIRONMENT REPORT 2018**

## **Chapter 7: Environmental Health**

**Reporting status from 2009 to 2015**



## KEY MESSAGES

- The quality of drinking water has consistently satisfied all mandatory and indicator microbiological legal parameters. The percentage of failure in the mandatory parameters in 2015 was due to samples analysed for boron. Despite the fact that the levels are well below those that might generate health risks, WSC has concluded that the best way to reduce the boron levels to less than 1.0mg/l, without causing unnecessary financial burden on the consumers, would be to periodically replace reverse osmosis membranes through specific funding.
- The local bathing water has also indicated excellent quality. Furthermore audit-based inspections throughout the year verifying that swimming pools are kept safe for recreational use have concluded no swimming pool closure due to legal non-compliance.
- Two regulations were published under the Public Health Act to regulate and control the risk from exposure to *Legionella* bacteria, namely the Control of *Legionella* Regulations, 2006 (S.L. 465.03) and the Registration of Cooling Towers and Evaporative Condensers Regulations, 2006 (S.L. 465.04). During the period from 2013 to 2015 the number of reported cases of *Legionella* per year was low, rarely exceeding eight cases per year.
- Sanitation is not locally considered an environmental health issue since the country is well served with a sewage disposal infrastructure. Domestically the drainage system network also seems to be coping with the population's demands considering that practically all households in Malta are connected to the sewage network system. According to 2011 statistics only 1,286 households (0.9 %) reported not to have a bath or shower in a dwelling for sole use of the household.
- A safe environment that encourages personal mobility and physical exercise is important for health and prevents obesity and overweight. The Health Behaviour in School-aged Children survey for 2005/2006 shows that children aged between 11 and 15 years in Malta are well below the average of countries when it comes to performing physical activity at the recommended level (11 years: girls 18 %, boys 27 %; 13 years: girls 14 %, boys 20 %; 15 years: girls 13 %, boys 19 %). This leads to Malta's population gaining the highest prevalence of overweight and obesity in the European region. The creation of safer roads will encourage more parents walking their children to school; creating safer playgrounds which ideally should be away from traffic-congested areas and creating greener areas in our localities is recommended.
- Transport in Malta is a critical issue. Over 1,500 traffic-related accidents occur annually. Respondents in Malta are more likely to use the car than the EU-28 average; and less likely to use public transport, cycle or walk, inducing air and noise pollution. Malta respondents are more likely to feel that they encounter problems that limit their access to activities, goods or services; and that road congestion and the need to provide improved public transport are important. Transport strategies should include measures to reduce exposure to air and noise pollution, reduce the risk of accidents, and increase levels of daily physical activity. Such strategies should aim to discourage the use of cars and heavy goods vehicles in urban areas; create dedicated urban space for walking, cycling, and public transport; and limit urban sprawl.

- Noise is being considered an equity issue in relation to socioeconomic status (income and education), age and place of residence, indicating that the poor, the old and those living in dense places exposed to heavy traffic are most affected.
- A study performed locally as part of the European Union SINPHONIE (Schools Indoor Pollution and Health: Observatory Network in Europe) concludes that schools geographically sited towards the South of the island had the highest prevalence of recurrent wheezers and other medical conditions that would exhibit signs of respiratory conditions amongst children. The study also notes a correlation between small open window areas and increased rhinitic (inflammation of the mucous lining of the nose) symptoms. In addition, classrooms facing roads had increased incidents of recurrent wheezers and exhaled carbon monoxide levels, which was also significantly associated with the number of light and heavy vehicles passing near the school; the proximity to power plants, and fuel storage facilities; and the accumulation of dust in classrooms. Further studies are recommended to enhance our understanding of these correlations.
- The procedures outlining the requirements for environmental monitoring of radionuclides in Malta are set out in Operating Procedures of the Radiation Protection Board (RPB), which is the inter-ministerial body in charge of protecting the general public and the environment from exposure to radiation. The RPB have set up a regulatory framework for radioactive waste management; the control of discharges to the environment; the transportation of radioactive materials; and the regulatory control of medical establishments. The RPB has also administered announced and unannounced inspections of sites using ionizing radiation.
- The Malta Communications Authority (MCA) is responsible to ensure that the Electromagnetic Field (EMF) emitted does not exceed the guidelines for public maximum exposure set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and to perform regular audits accordingly. Results available on the MCA's website. Considering the very low exposure levels and research results collected to date, there is no scientific evidence that the weak RF signals from base stations and wireless networks cause adverse health effects.
- The introduction of Smoking Control in Private Vehicles Regulations, 2016 (S.L.315.11) makes it an offence for a person to consume or allow to be consumed a tobacco product in a private vehicle in the presence of a minor, contributing towards a cleaner air quality for younger children.
- A local study of lead levels in blood was performed amongst children and adults in 2011. It resulted that in children the average blood lead level was lower than 50 µg/l. Blood lead levels in the adult population have steadily decreased since the 1990s from as high as 274 µg/l in 1981 down to 72 µg/l and 59 µg/l in 2002 and 2005 respectively.
- The illegal use of pesticides is another possible hazard within the local environment; the use of pesticides is highly regulated, and requires the compulsory training of users. Notwithstanding, annual statistics produced by the Malta Competition and Consumer Affairs Authority (MCCAA) shows an increase in MRL (Maximum Residue Level) exceedance in the total number of samples analysed from 2014 to 2016. It should be emphasised that samples tested ranged from local, EU and third country imports.
- Locally the most frequent cause of biological hazards originates from consumption of contaminated food products. It is noted that during recent years there has been an increase

in food-borne illnesses due to consumption of contaminated food. Public health hazards do not only occur through the macro environment but also within the micro environment such as restaurants and similar premises' kitchens. A higher degree of surveillance in order to avert such cases is thus warranted.

- Environmental health inequalities are a reality in Malta and this may be considered as the primary future challenge towards enhancing public health, thereby, one may consider augmenting research in Malta to provide evidence on the extent of link that exists between exposure to these environmental impacts and public health.

## 7.1 INTRODUCTION

The World Health Organization (WHO) is the authority responsible for public health within the United Nations system. The WHO Regional Office for Europe is one of WHO's six regional offices around the world. It serves the WHO European Region, which comprises 53 countries.<sup>1</sup>

Public health is defined as 'the art and science of preventing disease, prolonging life and promoting health through the organized efforts of society' (Acheson, 1988; WHO).<sup>2</sup>

The overall vision is to promote greater health and well-being in a sustainable way, while strengthening integrated public health services and reducing inequalities. In order to achieve this vision, the public health approach involves working with other sectors to address the wider determining factors of health.<sup>3</sup>

Across the WHO European Region, the main current challenges faced by public health include environmental damage and climate change. As a result of these challenges, the WHO Regional Office for Europe has adopted the European Action Plan (EAP) for Strengthening Public Health Capacities and Services and this is based on a Ministerial resolution.<sup>4</sup>

Health 2020 is the European health policy framework. It aims to support action across government and society to 'significantly improve the health and well-being of populations, reduce health inequalities, strengthen public health and ensure that people-centred health systems are universal, equitable, sustainable and of high quality'.<sup>5</sup>

This policy framework is evidence-based and peer-reviewed. It makes the case for investment in health and creating societies where health is valued. It details the ways that good health benefits all in society. Good health is vital for economic and social development and supports economic recovery.<sup>6</sup>

---

<sup>1</sup> WHO/Europe 2017a.

<sup>2</sup> WHO/Europe 2017b.

<sup>3</sup> WHO 1978.

<sup>4</sup> WHO/Europe 2017b.

<sup>5</sup> WHO/Europe 2017c.

<sup>6</sup> Ibid.

The overarching goals are to attain high-quality, longer lives free of preventable disease, disability, injury, and premature death; to achieve health equity, eliminate disparities, and improve the health of all groups; and to create social and physical environments that promote good health for all.<sup>7</sup>

Realizing the importance of the environment on the health of the population, in the late 1980s, European countries initiated the first ever process to eliminate the most significant environmental threats to human health. Progress towards this goal is driven by a series of ministerial conferences held every five years and coordinated by WHO/Europe.

The conferences are unique, bringing together different sectors to shape European policies and actions on environment and health. The first conference was held in Frankfurt in 1989. The Fourth Conference took place in Budapest in 2004.

The Fifth Conference was held in 2010 in Parma, Italy. The Parma Declaration bound governments of the 53 European Member States to set clear-cut targets to reduce the adverse health impact of environmental threats on health within the next decade.

The Parma Declaration encompasses 4 Regional Priority Goals (RPG) within the WHO European region. These are listed as follows:

- Regional Priority Goal 1 - Ensuring public health by improving access to safe water and sanitation
- Regional Priority Goal 2 - Addressing obesity and injuries through safe environments, physical activity and healthy diet
- Regional Priority Goal 3 - Preventing disease through improved outdoor and indoor air quality
- Regional Priority Goal 4 - Preventing disease arising from chemical, biological and physical environments.<sup>8</sup>

The Ostrava Declaration following the Sixth Ministerial Conference on Environment and Health summarizes the priorities in the area of environmental health in the WHO European Region; provides tools to Member States to develop national portfolios for action, which they are committed to develop by the end of 2018; and introduces new institutional arrangements for the European Environment and Health Process that should come into force in 2018.<sup>9</sup> This conference highlights the challenges faced by European states, including Malta.

Considering the importance attributed by the above, environmental health has become a priority towards enhancing public health. Environmental health is considered as the science and practice of preventing human injury and illness and promoting well-being by identifying and evaluating environmental sources and hazardous agents and limiting exposures to hazardous physical, chemical,

---

<sup>7</sup> Office of Disease Prevention and Health Promotion 2017

<sup>8</sup> WHO 2010a.

<sup>9</sup> WHO/Europe 2017d.

and biological agents in air, water, soil, food, and other environmental media or settings that may adversely affect human health.<sup>10</sup>

This chapter is intended to identify the state of public health through the exposure of our population to environmental issues mainly in comparison to the policies related to the regional priority goals declared in Parma.

### **7.1.1 Environmental health in Malta**

The Environmental Health Directorate (EHD) in Malta is a branch of the Superintendence of Public Health. The EHD promotes and safeguards the well-being and health of the public from adverse environmental effects. The Directorate is the official control body in the fields of environmental health and food control.<sup>11</sup>

The Health Inspectorate forms part of the EHD. Environmental Health Officers within the Health Inspectorate Services are responsible to safeguard and protect human health by ensuring that food produced, distributed, marketed and consumed by humans meets the highest possible standards of food safety and hygiene as laid down by the Food Safety Act, 2002 (Act XIV of 2002; Chapter 449); by carrying out environmental health policies emanating from the Public Health Act, 2003 (Act XIII of 2003; Chapter 465); and by participating in 'health protection issues' as may be required.<sup>12</sup>

The Public Health Laboratory generally supports and provides essential technical backup services for other units and sections within the EHD. The laboratory is equipped to test water and food for chemical and bacteriological analysis.<sup>13</sup>

### **7.1.2 Parma Declaration on Environment and Health**

In 2010, governments from the WHO European region adopted a declaration pledging to reduce the adverse health impact of environmental threats in the next decade. The text was endorsed by 53 Member States including Malta.

Through the Declaration and commitment to act, participating governments agreed to implement national programmes on ensuring access to safe water and sanitation, opportunities for physical activity and a healthy diet, improved air quality and an environment free of toxic chemicals. Governments vowed to tackle the adverse health impact of climate change and to reduce social and gender inequalities in exposure to risk. They also pledged to place health at the centre of socioeconomic development through increased investment in new technologies and green jobs.<sup>14</sup>

---

<sup>10</sup> NEHA 2017.

<sup>11</sup> Ministry of Health, Malta 2017a.

<sup>12</sup> Ibid.

<sup>13</sup> Ministry of Health, Malta 2017b.

<sup>14</sup> WHO/Europe 2010a.

Ms Zsuzsanna Jakab, WHO Regional Director for Europe said: ‘We need a radically new vision for European health policy to address the biggest health challenges of our Region. This Conference has opened an exciting new chapter in the way European governments work on environment and health - helping to push these closely inter-related issues higher up the political agenda’.<sup>15</sup>

European governments pledged to integrate health issues into climate change mitigation and adaptation measures, policies and strategies in all sectors, since evidence is growing that climate change is contributing to an increase in the frequency of natural disasters, such as heatwaves, floods and droughts.

Close coordination between the Environmental Health Directorate and other entities, foremost of all ERA, should be bolstered in order to achieve these goals.

## **7.2 WATER AND SANITATION**

The first priority goal arising from the Parma Declaration is related to ensuring public health by improving access to safe water and sanitation. Water is vital for life since it sustains human, animal and plant life. It is also an indispensable resource for the economy.

Though 75 % of the Earth is covered in water, access to clean, fresh drinking water is still a major world concern.<sup>16</sup> Water, including sea water and fresh water pools, is also a source of recreation. In view of our tourism-orientated economy, recreational water increases further in importance.

The Water Framework Directive (2000/60/EC) transposed into Maltese legislation as Subsidiary Legislation 549.100 (Water Policy Framework Regulations, 2004) provides for the long-term sustainable management of water resources on the basis of a high level of protection of the aquatic environment.<sup>17</sup> Further detail on this topic is found in the Fresh and Marine Waters Chapter.

### **7.2.1 Drinking water**

In Malta the Water Services Corporation (WSC) is the public entity responsible for the complete drinking and waste water cycle in the Maltese Islands. The WSC produces and distributes potable water for the public water supply and collects and treats the wastewater of over 250,000 households, businesses, industries, hotels, etc. serving over 420,000 people. The WSC operates reverse osmosis, sewage treatment and polishing plants, pumping stations, reservoirs and boreholes all over the country.<sup>18</sup>

Subsidiary Legislation 449.57 under the Public Health Act transposes Council Directive 98/83/EC on the quality of water intended for human consumption. These regulations mostly concern the quality

---

<sup>15</sup> WHO/Europe 2010b.

<sup>16</sup>Shahan 2017.

<sup>17</sup>MRA 2017.

<sup>18</sup>WSC 2017.

of water intended for human consumption, with the objective to protect human health from the adverse effects of any eventual contamination of water intended for human consumption by ensuring that it is wholesome and clean, and to set in place a regime that provides protection to persons consuming the water. They shall apply to any water supplied by a water supplier.<sup>19</sup> They regulate the microbiological and chemical parameters for the distribution of wholesome water. Private water suppliers, usually via tankers/bowsers, are also required to be registered with the EHD and are required to conform with the legislative microbiological and chemical parameters. There are currently eight private water suppliers so registered under Subsidiary Legislation 449.45.<sup>20</sup>

On the other hand, all the water distributed through the national network is supplied by the WSC. Such drinking water has consistently satisfied all mandatory and indicator microbiological legal parameters. The percentage of failure in the mandatory parameters in 2015 was due to samples analysed for boron. Boron is a non-metallic element found ubiquitously in the environment and in 0.001 % of the earth's crust. It is commonly found in rocks, soil and water especially seawater. Latest WHO guidelines of 2011 on water intended for human consumption stipulate a Boron guideline level of 2.4mg/L in potable water. Moreover, the WHO also states that in some countries where part of the supply originates from desalination, and in areas with high boron levels, local regulatory and health authorities should consider a value in excess of 2.4 mg/L by assessing exposure from other sources (WHO guidelines (November 2011)). Boron in potable water could occur due to various sources. In countries like Malta where desalination is used to meet the rising demand for drinking water, the presence of boron has become a challenge. This is because standard reverse osmosis desalination only partially removes boron and the intake seawater is generally high in this element especially in the Mediterranean basin. Thus this may result in values greater than 1.0mg/L but lower than world health standard values. Nevertheless, WSC has concluded that the best way to reduce the boron levels to less than 1.0mg/l and come in compliance with national and European Union (EU) legislation on the quality of water intended for human consumption, without causing unnecessary financial burden on the consumers, would be to periodically replace reverse osmosis membranes. This would not only reduce boron, but has the added advantages of improving the flow of the system and reducing specific power.<sup>21</sup> Membranes were purchased through the EU structural funds 2007 – 2013 under CF355 *Water Quality System Improvement Project*, and by end of 2016 most of the membranes in the three RO plants in Malta - Pembroke, Lapsi and Ċirkewwa - were replaced. The total cost of this project was around EUR 2.8 million. Furthermore, WSC is working on a water quality and supply improvement project, which consists of the reconfiguration of the groundwater network and the blending system in Malta to better manage the supply of improved water quality to all localities and ensure an adequate supply of good quality drinking water when demand is high.

---

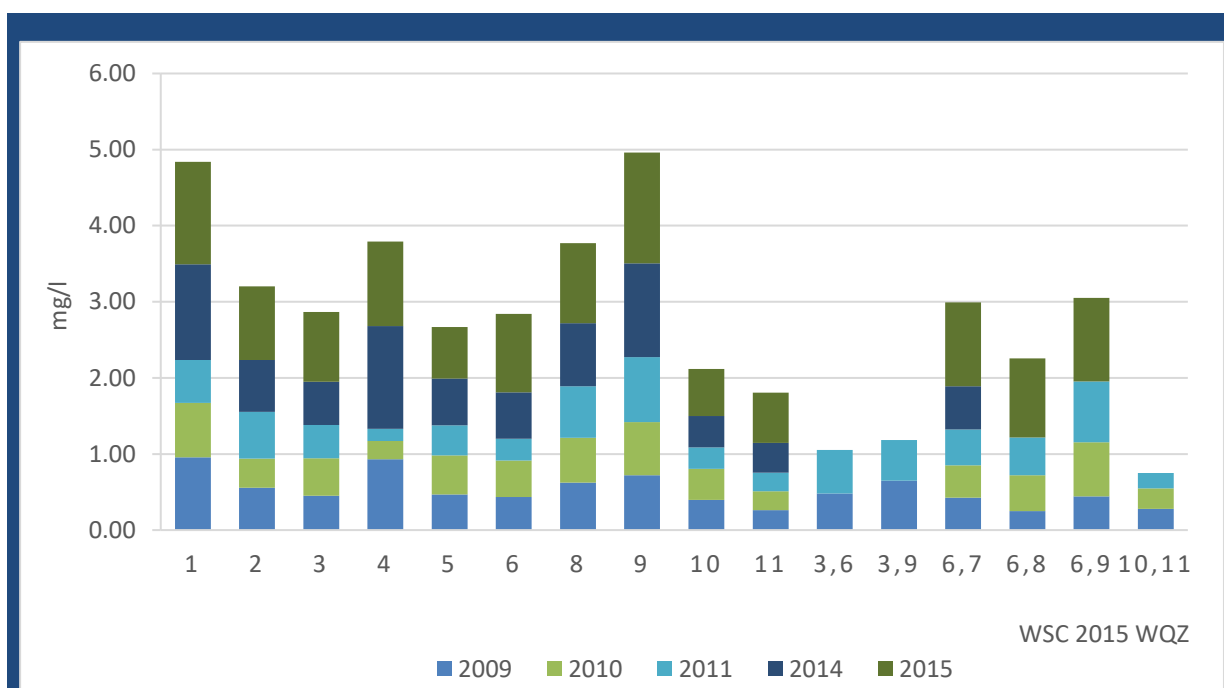
<sup>19</sup>S.L. 449.57.

<sup>20</sup>Environmental Health Directorate 2017a.

<sup>21</sup>WSC 2015.



**Figure 7.1: Yearly average water Boron levels (mg/l) in the Water Services Corporation (WSC) 2015 water quality zones (WQZ)**



WSC 2015 Water Quality Zones  
(available at: [http://www.wsc.com.mt/Portals/0/WQZ\\_2015.pdf?ver=2016-10-19-151255-940](http://www.wsc.com.mt/Portals/0/WQZ_2015.pdf?ver=2016-10-19-151255-940))

WQZ	Localities
WQZ 1	Ghadira, Marfa, Ċirkewwa, Comino
WQZ 2	Mellieħa, Xemxija, Selmun, Tunny Net, Mistra
WQZ 3	Magħtab, Burmarrad, Salina, Buġibba, St. Paul's Bay, Manikata, Ghajn Tuffieħa, Wied il-Għasel, Qawra, Naxxar, Mosta, Parts of Lija, Parts of Balzan, Iklin, Għargħur, Madliena, Tal-Ibraġ, Techno Park, St. Margerita & Fortizza Areas at Mosta, San Ġwann Ta' Żwejt
WQZ 4	Mġarr, Żebbiegħ, Wardija, Pitkali Area
WQZ 5	Rabat, Dingli, Mdina, Baħrija, Mtarfa, Bidnija, Kuncizzjoni + Mtaħleb + Santi
WQZ 6	Ta' Qali + Crafts Village, Żokrija, Żebbug Village, Siġġiewi, Farzina, Ħandaq, Attard, Santa Venera, Parts of Lija, Parts of Balzan, Ħamrun (excl. Rabbat area), Valletta, Floriana, Albert Town (Excl. Wasteserv, Civil Abattoir, and Marsa Open Centre), Gwardamangia, Pietà, Lower Parts of Msida, Parts of Ta' Xbiex, Parts of B'Kara, Marsa (Excl. Upper + Race Course)
WQZ 7	Parts of Żebbug (Laurenti Area included), Għar Lapsi, Siġġiewi (Providenza Area)
WQZ 8	Qrendi, Mqabba, Kirkop, Żurrieq, Safi, Gudja, Għaxaq, B'Bugia, Żejtun, Żabbar, Isla, Bormla, Birgu, Kalkara, Xgħajra, Marsaxlokk, Marsaskala, Fgura, Paola, Tarxien, Ħal Far, Free Port, Luqa, Ħal Farrug, Kordin Ind. Est., Qormi (excluding Ħandaq + Farzina), Drydocks, St. Vincent de Paule, Marsa Ind. Est, Ħamrun Rabbat area, Parts of Marsa (Upper + Racecourse, Wasteserv, Civil Abattoir, and Marsa Open Centre), Tar-Rabbat Area.
WQZ 9	Baħar iċ-Ċaġħaq, St. Andrews, Pembroke, Swieqi, Paceville, St. Julians, Sliema, Gżira, Mater Dei, University Heights, San Ġwann (Excl. Ta' Żwejt), Parts of Birkirkara (Ta' Paris), Swatar & Upper Parts of Msida (including Msida Circus & Lautier Aluminium area), Parts of Ta' Xbiex
WQZ 10	Għajnsielem, Mġarr, Qala, Xagħra, Nadur, Xewkija (lower), Victoria (upper), Fontana.
WQZ 11	Sannat, Munxar, Xlendi, Għarb, Għasri, Kerċem, M'Forn, Victoria (Lower), San Lawrenz, Xewkija (upper), Żebbuġ.

**Source:** Water Services Corporation website  
(accessed on 15 February 2018)

### 7.2.2 Recreational water

Recreational water comprises both sea water when used for bathing and recreational pools. A sea water bathing monitoring programme is carried out by the Health Inspectorate Services within the EHD. Analytical tests for microbiological parameters of weekly samples, such as intestinal enterococci and *Escherichia coli*, are carried out in terms of the Management of Bathing Water Quality Regulations, 2008 (S.L 465.09), and the Bathing Water Quality Directive 2006/7/EC. Further analysis and data on the quality of bathing water are found in the Fresh and Marine Waters Chapter.

In addition to compliance with EU legislation, the local EHD also analysis sea water quality in terms of the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean adopted in 1995. The Barcelona Convention requires monitoring for intestinal enterococci with the same statistical analysis as that under the EU Bathing Water Directive. The Convention's main objectives are: to assess and control marine pollution; to ensure sustainable management of natural marine and coastal resources; to integrate the environment in social and economic development; to protect the marine environment and coastal zones through prevention and reduction of pollution, and as far as possible, eliminate pollution, whether land or sea-based; to protect the natural and cultural heritage; and to strengthen solidarity among Mediterranean coastal States to contribute to improvement of the quality of life.<sup>22</sup> This Convention stipulates a more frequent sampling protocol.

In terms of the Barcelona Convention the local bathing water has also indicated excellent quality results as shown in the Tables below.

---

<sup>22</sup> EC 2017a.

**Table 7.1: Barcelona Convention Classification based on intestinal enterococci counts in line with the EU Directive 2006/7/EC (%)**

		Total number of bathing waters	Excellent Quality		Good Quality		Sufficient Quality		Poor Quality		Closed		Insufficiently sampled		New		Changes	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Coastal bathing waters	2009	87	81	93.1%	4	4.6%	2	2.3%	0	0.0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	2010	87	83	95.4%	3	3.4%	1	1.1%	0	0.0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	2011	87	85	97.7%	1	1.1%	1	1.1%	0	0.0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	2012	87	84	96.6%	3	3.4%	0	0.0%	0	0.0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	2013	87	86	98.9%	1	1.1%	0	0.0%	0	0.0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	2014	87	87	100.0%	0	0.0%	0	0.0%	0	0.0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	2015	87	85	97.7%	2	2.3%	0.0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source: EHD

**Table 7.2: Barcelona Convention Classification based on intestinal enterococci counts in line with the EU Directive 2006/7/EC (%) as per reporting standards of the EU**

		Total number of bathing waters	Excellent Quality		Good Quality		Sufficient Quality		Poor Quality	
			No.	%	No.	%	No.	%	No.	%
Coastal bathing waters	2009	87	73	83.9%	13	14.9%	1	1.1%	0	0.0
	2010	87	87	100.0%	0	0.0%	0	0.0%	0	0.0
	2011	87	87	100.0%	0	0.0%	0	0.0%	0	0.0
	2012	87	86	98.9%	1	1.1%	0	0.0%	0	0.0
	2013	87	87	100.0%	0	0.0%	0	0.0%	0	0.0
	2014	87	87	100.0%	0	0.0%	0	0.0%	0	0.0
	2015	87	87	100.0%	0	0.0%	0	0.0%	0	0.0

Source: EHD

The Swimming Pools Regulations, 2005 (S.L. 465.02) published under the Public Health Act, 2003 (Act No. XIII of 2003) require the responsible person to register any swimming pool on his premises whether being a conventional pool used for recreational bathing, wading pool, spas, diving pool or special purpose pool, which is not used or intended to be used as a pool at a single family residence but found at hotels, apart-hotels, farmhouses, health centres, beauty clinics, gyms, etc. Environmental health officers perform audit-based inspections throughout the year to verify that swimming pools are kept safe for recreational use.<sup>23</sup> During the three years ending 2015, an average of 183 swimming pools were audited in terms of the law and no swimming pool closure due to legal incompliance was reported.<sup>24</sup> This legislation ensures that public swimming pools are kept under check with respect to public health threats occurrences.

### 7.2.3 Legionella

Legionnaires' disease is an uncommon form of pneumonia that may have serious consequences for some people, particularly the elderly. People may become infected if they breathe air that contains the *Legionella* bacteria that may become dispersed in the air in very fine droplets of water known as aerosols. Infection may occur if the bacteria are inhaled. The bacteria live naturally in environmental water sources but can cause a risk to human health if they are present in the water systems of buildings through showers etc. Control and prevention of the microorganism is through treatment of water systems.

Two regulations were published under the Public Health Act to regulate and control the risk from exposure to *Legionella* bacteria, namely the Control of *Legionella* Regulations, 2006 (S.L. 465.03) and the Registration of Cooling Towers and Evaporative Condensers Regulations, 2006 (S.L. 465.04).

S.L. 465.03 primarily requires the responsible person of a trade or business (whether for profit or not) and including any healthcare facility and schools, to perform a risk assessment to identify and assess the risk of exposure to *Legionella* bacteria from work activities and the water systems within the premises under his control. This risk assessment is as identified in the legal guidelines based on the European Working Group for *Legionella*:<sup>25</sup> *Infections (EWGLI) Guidelines for the Investigation, Control and Prevention of Travel Associated Legionnaires' Disease*.<sup>26</sup>

S.L. 465.04 mainly deals with the requirements for the registration of all cooling towers and evaporative condensers by the responsible person.

During the period from 2013 to 2015 an average of 112 audits per year of risk assessment reports and procedural manuals were performed by the Environmental Health Directorate. The number of reported cases of *Legionella* is low, rarely exceeding eight cases per year, and these have consistently been due to imported cases rather than local sources.<sup>27</sup>

---

<sup>23</sup> Environmental Health Directorate 2017b.

<sup>24</sup> Ministry of Health, Malta 2013, 2014 & 2015.

<sup>25</sup> Environmental Health Directorate 2017c.

<sup>26</sup> EC and ECDC 2011.

<sup>27</sup> Mellilo 2016.

#### 7.2.4 Sanitation

Sanitation is not locally considered an environmental health issue in Malta since the country is well served with a sewage disposal infrastructure. The Maltese Islands have an underground sewage collection network that covers close to 100 % of the national territory, though certain areas are still served by cesspits which unless correctly maintained might give rise to underground pollution. Adequate planning of sewage infrastructure should be ascertained pre- rather than post-urban construction.

Considering that based on 2011 statistics only 1,286 households (0.9 %) reported not to have a bath or shower in a dwelling for sole use of the household<sup>28</sup> domestic drainage facilities seem to be adequate.

### 7.3 SAFE ENVIRONMENTS AND PHYSICAL ACTIVITY

As aforementioned, the second WHO regional priority goal addresses obesity and injuries through safe environments, physical activity and healthy diet.

Safer environments contribute towards healthier living. It is considered one of the WHO European Region priorities since it addresses obesity and the reduction of injuries through safer environments just as much as through physical activity and healthier diets.

Lack of the latter two have contributed to obesity becoming a global epidemic and Malta is statistically evident not to be an exception. The WHO has identified Malta as one of the European countries with the highest obesity prevalence. A study identified 69.75 % of the Maltese population to be either overweight or obese.<sup>29</sup>

Various experts maintain that changes to the environment over the years may also have played a role in the ways that kids move compared with previous times. Examples of environmental factors that may affect children's physical activity levels include the rising cost of participating in structured activities, such as sports; lack of time on the parents' part to facilitate interest in exercise among their children; and safety concerns, such as dangerous streets and playground availability.<sup>30</sup> Doyeon et. al advocate the creation of safe environments where children can play to reduce obesity through physical activity.<sup>31</sup>

A safe environment that encourages personal mobility and physical exercise is important for health and prevents obesity and overweight. The Health Behaviour in School-aged Children survey for 2013/2014 shows that the majority of children aged between 11 and 15 years in Malta do not perform physical activity at the recommended level of 60 minutes daily (Percentage of children performing at least 60 minutes per day of physical activity – 11-year-olds: girls 21 %, boys 28 %; 13-year-olds: girls 11 %, boys 20 %; 15-year-olds: girls 9 %, boys 16 %), and these rates have consistently decreased since the start of the HBSC survey in 2002.<sup>32</sup>

---

<sup>28</sup> NSO 2013.

<sup>29</sup> Cuschieri et al. 2016.

<sup>30</sup> Doyeon and Kravitz 2007.

<sup>31</sup> Ibid.

<sup>32</sup> Inchley et al. 2016.

This is particularly leading to Malta's population gaining the highest prevalence of overweight and obesity in the European region.<sup>33</sup>

It is recognised that many entities play an important role in ensuring safe environments and sustainable and safe infrastructure to encourage physical activity amongst children. For example creating safer roads will encourage more parents walking their children to school; creating safer playgrounds which ideally should be away from traffic-congested areas and creating greener areas in our localities would assist in achieving the WHO plans on protecting children against injuries and reducing the incidence of obesity.

The 2009 WHO Environment and Health Performance Review for Malta states that 'concerted efforts are needed for preventing obesity comprising both diet and nutrition and increased physical activity'.<sup>34</sup> Whilst notable progress has been made in achieving this, further efforts are required to increase physical activity at school, during leisure activities and in transport modes, whilst encouraging walking and cycling.

## 7.4 AIR QUALITY

The WHO third regional priority goal considers the prevention of disease through improved outdoor and indoor air quality: 'Air pollution causes degradation of air quality. It is a widely acknowledged fact that air pollution has adverse effects on human health. Today, air pollution is recognised as being the single largest environmental health risk in the European Union and has been classified by the International Agency for Research on Cancer of the WHO, as a leading environmental cause of cancer deaths'.<sup>35</sup>

According to the WHO, cardiovascular disease is the most common reason for premature death as a result of poor air quality; followed by lung diseases (including lung cancer). Air pollution is not only the cause of premature mortality, but is also known to increase the incidence of various diseases.<sup>36</sup> Concerns about the health implications of air quality are reflected in the enactment of the Clean Air Act, Cap. 200 as early as 1968,<sup>37</sup> and the Tobacco (Smoking Control) Act, Cap. 315 in 1987,<sup>38</sup> falling under the auspices of the Health Ministry. The EU Air Quality Directive<sup>39</sup> was later adopted under the Environment Protection Act, Cap. 549<sup>40</sup> by means of S.L. 549.59 Ambient Air Quality Regulations.<sup>41</sup> The following section briefly discusses traffic-induced pollution, and further examines indoor air, radon, non-ionising radiation, and tobacco. The Air Quality Chapter of this report further reviews ambient air quality in greater detail.

---

<sup>33</sup> Grech et al. 2015.

<sup>34</sup> Ibid.

<sup>35</sup> International Agency for Research on Cancer WHO 2013.

<sup>36</sup> EC 2016.

<sup>37</sup> Cap. 200.

<sup>38</sup> Cap. 315.

<sup>39</sup> EC 2017b.

<sup>40</sup> Cap. 549.

<sup>41</sup> S.L. 549.59.

### 7.4.1 Traffic

According to the WHO (2015), in its document *Economic cost of the health impact of air pollution in Europe*, 228 deaths in Malta in 2010 were attributed to ambient air pollution. 3,606 Disability Adjusted Life Years (DALYs) were lost in Malta in 2010 because of air pollution.<sup>42 43</sup>

Clearly, transport in Malta is a critical issue, with Malta ranking in the top three of the indicators regarding mobility, pollution and the potential for improvement as reported in a 2013 attitude survey by Eurobarometer.<sup>44</sup> The report notes that the use of public or alternative, non-motorised forms of transport in Malta is relatively weak.<sup>45 46</sup>

Noise pollution is also a contributing factor resulting from transport. 62 % of Maltese deem noise pollution within cities to be a very important issue (EU-28: 27 %). Malta tops the list.<sup>47</sup>

In addition, transport is also considered a significant cause of mental stress not only whilst driving but also in finding suitable parking spaces.<sup>48</sup> Over 1,500 traffic-related accidents occur annually.<sup>49</sup> The Eurobarometer on urban mobility identifies respondents in Malta as more likely to use the car than the EU-28 average, and less likely to use public transport, cycle or walk. Malta respondents are more likely to feel that they encounter problems that limit their access to activities, goods or services, and that road congestion and the need to provide improved public transport are important, as referred in Table 7.2.

Transport strategies should therefore include measures to reduce exposure to air and noise pollution, reduce the risk of accidents, and increase levels of daily physical activity. Such strategies should aim to discourage the use of cars and heavy goods vehicles in cities; create dedicated urban space for walking, cycling, and public transport; and limit urban sprawl.<sup>50</sup>

---

<sup>42</sup> WHO/Europe 2015.

<sup>43</sup> Debono. (undated).

<sup>44</sup> EC 2013.

<sup>45</sup> Ibid.

<sup>46</sup> Ibid.

<sup>47</sup> Debono. (undated).

<sup>48</sup> Ibid.

<sup>49</sup> Ibid.

<sup>50</sup> Ibid.

**Table 7.3: Replies by Maltese respondents questioned on transport-related issues and the average of all European Union Member States**

CRITERIA	MALTA	EU-28
Use car several times a day	48 %	35 %
Use public transport	40 % never	29 % never
Cycling	93 % never	50 % never
Walking	10 % never	4 % never
Limited access to activities, goods & services	74 % (top of the list)	38 %
Road congestion	97 % (73 % deem 'very important')	76 % (30 % deem 'very important')
Think better public transport improves travel	76 %	56 %

Source: Eurobarometer 2013<sup>51 52</sup>

The WHO co-sponsored Transport, Health, and Environment Pan-European Programme (THE PEP), has built a model of regional, Member State and multi-sectoral cooperation for mitigation of air pollution and other health impacts in the transport sector, as well as tools for assessing the health benefits of such mitigation measures.<sup>53 54</sup> THE PEP addresses key challenges to achieve sustainable transport patterns. THE PEP Steering Committee is composed of UNECE and WHO/Europe Member State representatives from the transport, environment and health sectors.<sup>55</sup> Amongst others, THE PEP comprises activities related to sustainable urban transport and the health impacts of transport, cycling and walking as feasible non-motorised transport modes for urban areas.<sup>56</sup>

THE PEP encourages governments to pursue an integrated approach to policymaking and to put sustainable mobility at the top of the international agenda.

At the Third High-level Meeting on Transport, Health and Environment in January 2009, governments adopted the Amsterdam Declaration<sup>57</sup> agreeing on four priority goals:

- 'To contribute to sustainable economic development and stimulate job creation through investment in environment- and health-friendly transport
- To manage sustainable mobility and promote a more efficient transport system
- To reduce emissions of transport-related greenhouse gases, air pollutants and noise
- To promote policies and actions conducive to healthy and safe modes of transport'.<sup>58</sup>

<sup>51</sup> EC 2013.

<sup>52</sup> Debono. (undated).

<sup>53</sup> UNECE and WHO 2017a.

<sup>54</sup> WHO 2016.

<sup>55</sup> UNECE and WHO 2017a.

<sup>56</sup> Ibid.

<sup>57</sup> WHO/Europe and UNECE 2009.

<sup>58</sup> Ibid.



Through the adoption of recommendations outlined by THE PEP, the transport, health and environment sectors can work together to easily find innovative solutions to make our environment more healthy, liveable and prosperous in the coming years.<sup>59</sup>

#### 7.4.2 Indoor air

A number of air pollutants have been recognised to exist indoors, including Nitrogen Oxides (NO<sub>x</sub>), Sulphur Dioxide (SO<sub>2</sub>), Ground Level Ozone (O<sub>3</sub>), Carbon Monoxide (CO), Volatile and Semi-Volatile Organic Compounds (VOCs), Particulate Matter (PM), radon, and microorganisms. Some of these pollutants, for example NO<sub>x</sub>, SO<sub>2</sub>, O<sub>3</sub>, and PM, may commonly be originating from the outdoor environment.<sup>60</sup>

Minimal recent local data seems to be available with respect to indoor air quality, however a study was performed locally as part of the European Union SINPHONIE (Schools Indoor Pollution and Health: Observatory Network in Europe) Study commissioned by DG SANCO. It is related to school indoor air quality, since after all children spend most of their time within the school environment. The study aimed to investigate the school environment and its impact on the respiratory health of the children. One hundred and ninety one pupils between the ages of 9 and 11 years were selected from five primary state schools. The study involved school and health questionnaires as well as performing medical examinations covering spirometry, acoustic rhinometry, nasal lavage, urine for environmental tobacco smoke biomarkers. Traffic counts were also used.

It was reported that there is a tendency for students to suffer from cumulative wheezing (32.98 %) as well as recurrent wheezing (17.8 %). These results are compatible with the International Study of Asthma and Allergies in Childhood Malta data. Surveyed schools geographically sited towards the South of the island had the highest prevalence of recurrent wheezers and other medical conditions that would exhibit signs of respiratory conditions amongst children.

It was observed that small open window areas increased rhinitic (inflammation of the mucous lining of the nose) symptoms. In addition, classrooms facing roads had increased incidence of recurrent wheezers and exhaled carbon monoxide levels. It was also reported that recurrent wheezing was also significantly associated with the number of light and heavy vehicles passing near the school. The presence of smokers at home was significantly associated with urinary cotinine and *trans*-3'-hydroxycotinine (3HC), that is the nicotine metabolites, which are considered as biomarkers for identifying tobacco exposure. Another finding from the survey identified that the proximity to power plants increased the recurrent wheezers who had impaired spirometry that is the measuring of breath for lung function. Asthma symptoms and elevated exhaled carbon monoxide levels were also associated with fuel storage facilities near schools. Finally, the study found that the accumulation of dust on flat surfaces within classrooms was also related to wheezing.

In conclusion it was reported by the authors that the school environment had a direct impact on the respiratory health of children, with several of the factors having a direct impact on the children's health.<sup>61</sup>

---

<sup>59</sup> Ibid.

<sup>60</sup> Leung 2015.

<sup>61</sup> Fsadni et al. 2015.

Further studies are recommended to better understand the correlation between school location and children's health.

### 7.4.3 Radon

According to the WHO, after tobacco smoke, in the general population radon is the second cause of lung cancer. Epidemiological studies have provided convincing evidence of an association between indoor radon exposure and lung cancer, even at the relatively low radon levels commonly found in residential buildings.<sup>62</sup> Current estimates of the proportion of lung cancers attributable to radon range from 3-14 %, depending on the average radon concentration in the country concerned and the calculation methods.<sup>63</sup>

WHO proposes a reference level of 100 Bq/m<sup>3</sup> to minimize health hazards due to indoor radon exposure. However, if this level cannot be achieved under the prevailing country-specific conditions, the chosen reference level should not exceed 300 Bq/m<sup>3</sup> which represents approximately 10 mSv per year according to recent calculations by the International Commission on Radiation Protection.<sup>64</sup> Studies in Malta have indicated a geometric mean of radon at 40 Bq/m<sup>3</sup>.<sup>65</sup>

The Directorate for Environmental Health conducted a national geographically based survey to determine the distribution of the mean annual indoor radon gas concentration levels in dwellings in the Maltese Islands and map these levels. Radon measurements were carried out in 85 buildings distributed over the Maltese Islands between November 2010 and November 2011 using alpha-track radon detectors. The mean annual indoor radon concentration for the Maltese Islands was 32 Bq/m<sup>3</sup>, with a geometric mean of 25 Bq/m<sup>3</sup> (standard deviation (SD) 25). A radon map of the Maltese Islands was produced using the geographic mean annual indoor radon gas concentration level for each building. The study concluded that the mean annual indoor radon concentration in Malta is well below the lowest proposed WHO reference levels with no dwellings having a mean annual indoor radon gas concentration above 100 Bq/m<sup>3</sup>.<sup>66</sup>

The Commission Recommendation 2000/473/Euratom<sup>67</sup> concerning the monitoring of the levels of radioactivity in the environment for the purpose of assessing the exposure of the population as a whole recommends Member States to establish the facilities necessary to carry out continuous monitoring of the levels of radioactivity in air, water and soil and to ensure compliance with the basic safety standards and for Member States to provide the Commission with periodic reports on the data collected so that it is kept informed of the level of radioactivity to which the public is exposed. The procedures outlining the requirements for environmental monitoring of radionuclides in Malta are set out in the operating procedures of the Radiation Protection Board (RPB), which is the inter-ministerial body in charge of protecting the general public and the environment from exposure to radiation.

To date the interministerial RPB set up by S.L. 365.15 (Nuclear Safety and Radiation Protection Regulations, 2003) is responsible for occupational radiation; medical radiation exposure control; radiological emergency

---

<sup>62</sup> WHO 2009a.

<sup>63</sup> Ibid.

<sup>64</sup> Ibid.

<sup>65</sup> Baluci et al. 2013.

<sup>66</sup> Baluci et al. 2013.

<sup>67</sup> 2000/473/Euratom.

preparedness; protection and monitoring of the environment; and fulfilling Maltese obligations under the nuclear-related treaties of the International Atomic Energy Agency. Following the IAEA Integrated Regulatory Review Services (IRRS) mission of 2015, the Board has prepared an Act for Nuclear Safety and Radiation Protection, which was published for stakeholder consultation between 29 December 2016 and 10 January 2017. The RPB has also prepared subsidiary legislation to fall under this act seeking to transpose 2014/71/EURATOM Amendments to the Nuclear Safety Directive and 2013/59/EURATOM EU Basic Safety Standards. The RPB have set up a regulatory framework for radioactive waste management; control of discharges to the environment; transportation of radioactive materials; and regulatory control of medical establishments. The RPB has also administered announced and unannounced inspections of sites using ionizing radiation (approximately 210 sites). The average number of regulatory site visits averaged at approximately 85 per year between 2013 and 2016. Inspections include the review of all medical establishments (excluding dentists) which have also been issued licenses.

#### 7.4.4 Non-ionising radiation

Non-ionizing radiation exists all around us from many sources. Examples include:

- radiofrequency (RF) radiation used in many broadcast and communications applications;
- microwaves used in the home kitchen;
- infrared radiation used in heat lamps;
- ultraviolet (UV) radiation from the sun and tanning beds.<sup>68</sup>

Locally the biggest concern of exposure to the public of non-ionizing radiation arises from mobile phones antennae spread across the islands.

The WHO states that the electromagnetic fields produced by mobile phones are classified by the International Agency for Research on Cancer as possibly carcinogenic to humans and it should be noted that studies are ongoing.

It is understood that mobile or cellular phones are now an integral part of modern telecommunications. Mobile phones communicate by transmitting radio waves through a network of fixed antennas called base stations. Radiofrequency waves are electromagnetic fields, and unlike ionizing radiation such as X-rays or gamma rays, can neither break chemical bonds nor cause ionization in the human body.<sup>69</sup>

Mobile phones are low-powered radiofrequency transmitters, operating at frequencies between 450 and 2700 MHz with peak powers in the range of 0.1 to 2 watts. The handset only transmits power when it is turned on. A person using a mobile phone 30–40 cm away from their body – for example when text messaging, accessing the Internet, or using a hands-free device – will therefore have a much lower exposure to radiofrequency fields than someone holding the handset against their head.

---

<sup>68</sup> CDC 2015.

<sup>69</sup> WHO 2006e.

A large number of studies have been performed over the last two decades to assess whether mobile phones pose a potential health risk. To date, no adverse health effects have been established as being caused by mobile phone use.

Tissue heating is the principal mechanism of interaction between radiofrequency energy and the human body. At the frequencies used by mobile phones, most of the energy is absorbed by the skin and other superficial tissues, resulting in negligible temperature rise in the brain or any other organs of the body.

A number of studies have investigated the effects of radiofrequency fields on brain electrical activity, cognitive function, sleep, heart rate and blood pressure in volunteers. To date, research does not suggest any consistent evidence of adverse health effects from exposure to radiofrequency fields at levels below those causing tissue heating. Further, research has not been able to provide support for a causal relationship between exposure to electromagnetic fields and self-reported symptoms, or 'electromagnetic hypersensitivity'.

Results of animal studies also consistently show no increased cancer risk for long-term exposure to radiofrequency fields.<sup>70</sup>

This wireless technology relies upon an extensive network of fixed antennas, or base stations, relaying information with radiofrequency (RF) signals. Recent surveys have shown that the RF exposures from base stations range from 0.002 % to 2 % of the levels of international exposure guidelines, depending on a variety of factors such as the proximity to the antenna and the surrounding environment. This is lower or comparable to RF exposures from radio or television broadcast transmitters.

A common concern about base station and local wireless network antennas relates to the possible long-term health effects that whole body exposure to the RF signals may have. To date, the only health effect from RF fields identified in scientific reviews has been related to an increase in body temperature (>1°C) from exposure at very high field intensity found only in certain industrial facilities, such as RF heaters. The levels of RF exposure from base stations and wireless networks are so low that the temperature increases are insignificant and do not affect human health.

The strength of RF fields is greatest at its source, and diminishes quickly with distance. Detailed reviews conducted so far have not revealed any hazard specific to different RF modulations.

Considering the very low exposure levels and research results collected to date, there is no scientific evidence that the weak RF signals from base stations and wireless networks cause adverse health effects.<sup>71</sup>

In 2016, the SCENIHR updated its 2009 Opinion on the potential health effects of exposure to electromagnetic fields (EMF) in light of newly available information, giving special consideration to areas where important knowledge gaps were identified in the previous Opinions.<sup>72</sup> The results of current scientific research show

---

<sup>70</sup> Ibid.

<sup>71</sup> WHO 2006.

<sup>72</sup> EC 2018.

that there are no evident adverse health effects if exposure remains below the levels recommended by the EU legislation based on the guidelines for public maximum exposure set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Overall, the epidemiological studies on radiofrequency EMF exposure do not show an increased risk of brain tumours. Furthermore, they do not indicate an increased risk for other cancers of the head and neck region. Previous studies also suggested an association of EMF with an increased risk of Alzheimer's disease. New studies on that subject did not confirm this link.

The Malta Communications Authority (MCA) is responsible to ensure that Electromagnetic Field (EMF) emitted does not exceed the guidelines for public maximum exposure set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).<sup>73</sup> <sup>74</sup> The ICNIRP provides scientific advice and guidance on the health and environmental effects of Non-Ionizing Radiation (NIR) to protect people and the environment from detrimental NIR exposure.<sup>75</sup>

For this purpose, MCA performs regular audits with the results available on the MCA's website.<sup>76</sup>

#### 7.4.5 Tobacco

According to the WHO the tobacco epidemic is one of the biggest public health threats the world has ever faced, killing more than 7 million people a year. More than 6 million of those deaths are the result of direct tobacco use while around 890,000 are the result of non-smokers being exposed to second-hand smoke.

Nearly 80 % of the more than 1 billion smokers worldwide live in low- and middle-income countries, where the burden of tobacco-related illness and death is heaviest.

Tobacco users who die prematurely deprive their families of income, raise the cost of health care and hinder economic development.<sup>77</sup>

Tobacco smoke is made up of thousands of chemicals, including at least 70 known to be carcinogens (cancer-causing). Some of the chemicals found in tobacco smoke include the addictive nicotine, hydrogen cyanide, formaldehyde,<sup>78</sup> lead,<sup>79</sup> arsenic,<sup>80</sup> ammonia, radioactive elements, such as uranium, benzene,<sup>81</sup> carbon monoxide, nitrosamines, and Polycyclic Aromatic Hydrocarbons (PAHs).<sup>82</sup>

The Tobacco Products Directive (2014/40/EU) aims to improve the functioning of the internal market for tobacco and related products in the EU, while ensuring a high level of health protection for European citizens. These new rules consist of new and strengthened rules on how tobacco products can be manufactured,

---

<sup>73</sup> ICNIRP 2017.

<sup>74</sup> MCA 2017a.

<sup>75</sup> ICNIRP 2017.

<sup>76</sup> MCA 2017b.

<sup>77</sup> WHO 2017a.

<sup>78</sup> American Cancer Society 2017a.

<sup>79</sup> American Cancer Society 2017b.

<sup>80</sup> American Cancer Society 2017c.

<sup>81</sup> American Cancer Society 2017d.

<sup>82</sup> American Cancer Society 2017e.

presented, and sold, as well as new provisions for products that were not specifically regulated so far, including e-cigarettes and herbal products for smoking. These play a vital role in amplifying and consolidating the progress of the anti-tobacco momentum evidenced by falling smoking rates. Subsidiary Legislation 315.10 - Manufacture, Presentation and Sale of Tobacco and Related Products Regulations, 2016 - transposed this directive into Maltese legislation in 2016.

The restrictions of smoking in virtue of Chapter 315 Tobacco (Smoking Control) Act have been in force locally for some time, however it is worth noting that the introduction of Smoking Control in Private Vehicles Regulations, 2016 (S.L.315.11) making it an offence for a person to consume or allow to be consumed a tobacco product in a private vehicle in the presence of a minor will certainly contribute towards a cleaner air quality particularly for younger children.

The WHO Framework Convention on Tobacco Control (FCTC) works towards implementing policies and international protocols in order to minimize *inter alia* the use of tobacco.<sup>83</sup>

## 7.5 CHEMICAL AND BIOLOGICAL HAZARDS

The fourth and final regional priority goal for the WHO European region is preventing disease arising from chemical, biological and physical environments.

The use of chemicals has increased dramatically due to the economic development in various sectors including industry, agriculture and transport. As a consequence, children are exposed to a large number of chemicals of both natural and man-made origin. Exposure occurs through the air they breathe, the water they drink or bathe in, the food they eat, and the soil they touch. They are exposed virtually wherever they are: at home, in the school, at the playground, and during transport. Chemicals may have immediate, acute effects, as well as chronic effects, often resulting from long-term exposures. Chronic, low-level exposure to various chemicals may result in a number of adverse outcomes, including damage to the nervous and immune systems, impairment of reproductive function and development, cancer, and organ-specific damage.

Sound management of chemicals, particularly heavy metals, pesticides and persistent organic pollutants (POPs), is a prerequisite for the protection of health.<sup>84</sup>

It is to be noted that the establishment of a poison-control centre is still pending despite recommendations under the 2009 Environment and Health Performance Review.<sup>85</sup> This centre should also have direct access to databases used for registration of imported chemicals and particular registers pertaining to exotic animals in order to ensure that suitable antidotes are available at all times for effective treatments.

A study performed locally in 2011 considered the lead levels in blood. This study was performed amongst children selected from the Paediatric Outpatients, Day Care Ward and adults selected through the Pilot

---

<sup>83</sup> WHO 2017b.

<sup>84</sup> WHO 2017c.

<sup>85</sup> WHO 2009b.

Health Examination Survey, 2010.<sup>86</sup> The aim of the study was to determine the mean blood lead levels in Maltese children and adults.

It resulted that in children the average blood lead level was lower than 50 µg/l, which is presently considered to be the threshold for blood lead levels in children, though research indicates that there might be no threshold level below which lead causes no injury to the developing human brain. Lead is associated with neuro-behavioural damage at an extremely low Blood Lead Level (BLL).<sup>87 88</sup>

BLLs in the adult population have steadily decreased since the 1990s from as high as 274 µg/l in 1981 down to 72 µg/l and 59 µg/l in 2002 and 2005 respectively. This study confirms that the mean BLLs in the adult population have further decreased to 40 µg/l, far below the threshold of 100 µg/l as stipulated by the CDC. Measures that contributed towards this decrease include the ban on importation and manufacture of leaded paint for domestic use in 1984; the ban on inappropriate use of fuel in bakeries in 1989; the introduction of unleaded petrol in 1991; and the ban on leaded petrol in 2003.<sup>89</sup>

Further action between the Environment Health Directorate and the Environment and Resources Authority is being planned to address lead residues emanating from old bakery ovens.

It is encouraging to note that Malta became signatory of the Minamata Convention on Mercury in 2014 and ratified the agreement in 2017 prior to the Convention entering into force on 16 August 2017. This convention is a global treaty to protect human health and the environment from the adverse effects of mercury. Mercury is a naturally occurring metal with broad uses in everyday objects and is released to the atmosphere, soil and water from a variety of sources.<sup>90</sup>

Amongst other the Minamata Convention includes a phase-out of mercury use in a number of products and processes to control measures on emissions to air and on releases to land and water, and the regulation of the informal sector of artisanal and small-scale gold mining. The Convention also addresses interim storage of mercury and its disposal once it becomes waste, sites contaminated by mercury as well as health issues.<sup>91</sup>

The illegal use of pesticides may also be considered to be another possible hazard within the local environment. In recent years the possibility of such hazards would have been reduced since the use of pesticides has become highly regulated including through compulsory training of users.

Notwithstanding, annual statistics produced by the Malta Competition and Consumer Affairs Authority (MCCAA) shows an increase in MRL (Maximum Residue Level) exceedance of the total number of samples analysed from 2014 to 2016. It should be emphasised that samples tested ranged from local, EU and third country imports.

---

<sup>86</sup> DeBono et al. 2012.

<sup>87</sup> WHO 2010.

<sup>88</sup> DeBono et al. 2012.

<sup>89</sup> Ibid.

<sup>90</sup> UNEP 2013.

<sup>91</sup> Ibid.

**Table 7.4: Samples analysed (2014-2016) for MRL of pesticides in local, EU or imported produce**

Year	Number of samples tested	% of local Produce	% of total number of samples (local, EU or imported) with residues exceeding the MRL (national or EC)
2014	173	60.1	5.8
2015	124	58.1	3.2
2016	178	62.9	11.2

*Source: MCCA*

Pesticides have been linked to a wide variety of health hazards from headaches and nausea to cancer and endocrine disruption.

### 7.5.1 Biological hazards

Locally the most frequent cause of biological hazards originates from consumption of contaminated food products. It is noted that during recent years there has been an increase in food-borne illnesses due to consumption of contaminated food.



During 2016 a total of 412 sporadic (single) cases of food-borne illness were investigated by the Infectious Disease Control Unit (IDCU) within the Superintendence of Public Health. The most common bacterial agents were found to be *Campylobacter* (n=203) and *Salmonella* (n=142). The table below indicates the full list of sporadic cases.

**Table 7.5: Number of sporadic cases of food-borne illness reported to IDCU in 2016**

CAUSATIVE ORGANISM	NO. OF CASES
<i>Campylobacter</i>	203
<i>Salmonella</i>	142
Unspecified food-borne illness	29
Hepatitis A	6
Toxic (Scombroid)	5
<i>E. coli</i> (VTEC)	4
<i>Giardia</i>	4
Cryptosporidiosis	3
<i>Shigella</i>	2
Amoebiasis	1
Echinococcosis	1
<i>Listeria</i>	1
Typhoid fever ( <i>Salmonella typhi</i> )	0
<i>Yersinia</i>	0

Source: IDCU

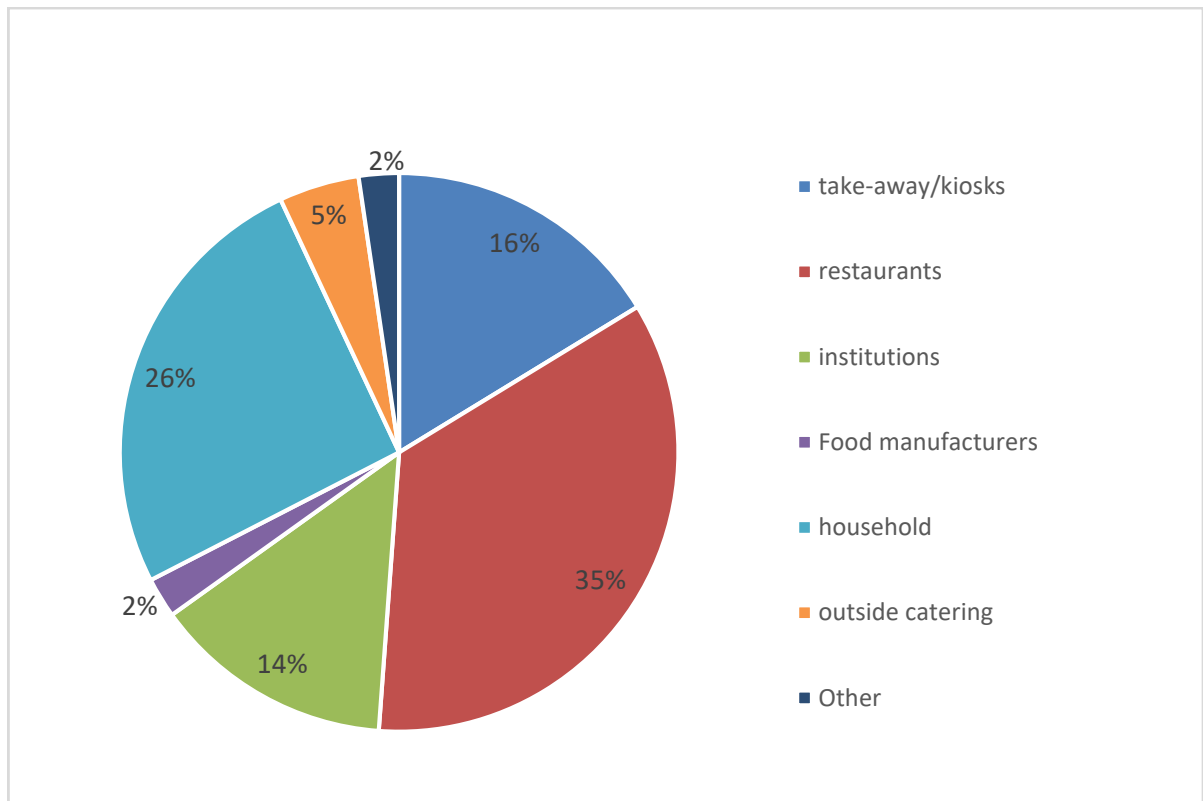
In 2016, 43 outbreaks (2 or more linked cases) of gastroenteritis were investigated in contrast to 29 outbreaks in 2015 and 55 outbreaks in 2014 respectively. These outbreaks affected 246 cases. In addition, norovirus was responsible for 8 other gastroenteritis outbreaks which affected 665 people.

*Salmonella* was the causative agent for 10 outbreaks whilst *Campylobacter* was the causative organism of 7 outbreaks. The causative agent for the remaining 26 outbreaks could not for different reasons be identified.

‘Of the 43 outbreaks of food-borne illness investigated (excluding norovirus), 11 were found to be in households (domestic), 15 were linked to restaurants, 7 to kiosks or take-away establishments, 6 occurred in institutions, 2 were linked to outside catering services whereas one outbreak was traced back to food produced by a local manufacturer.’<sup>92</sup>

<sup>92</sup> Ministry of Health 2016.

**Figure 7.2: Type of premises implicated in the outbreaks of food-borne illness reported to IDCU in 2016**



Source: IDCU

Evidently, public health hazards do not only occur through the macro environment but also within the micro environment such as restaurants and similar premises' kitchens. A higher degree of surveillance in order to avert such cases is thus warranted.

## 7.6 CLIMATE CHANGE AND HEALTH

The Parma Declaration mentioned above and endorsed by 53 European governments pledged to reduce the adverse health impact of environmental threats in the next decade.

Amongst other measures governments vowed to tackle the adverse health impact of climate change and to reduce social and gender inequalities in exposure to risk. They also pledged to place health at the centre of socioeconomic development through increased investment in new technologies and green jobs.

'We need a radically new vision for European health policy to address the biggest health challenges of our Region. This Conference has opened an exciting new chapter in the way European governments work on environment and health - helping to push these closely inter-related issues higher up the political agenda', says Ms Zsuzsanna Jakab, WHO Regional Director for Europe.<sup>93</sup>

<sup>93</sup> WHO/Europe 2010b.

Climate change is evidently contributing to an increase in the frequency of natural disasters, such as heatwaves, floods and droughts. The WHO's Roadmap, *Protecting Health in an Environment Challenged by Climate Change*, provides a comprehensive roadmap laying out steps and priorities for coordinated international and national action.

There are various methods on how public health can respond to the health risks associated with climate change. Amongst these are:

- the reduction of exposures to climate change;
- introduction of legislative policies;
- alterations in buildings to make them more environmentally friendly;
- the prevention of the onset of adverse outcomes;
- introduction of early warning systems;
- enhancing surveillance and monitoring tools;
- improved vector control programs;
- public education and outreach response;
- medical training and awareness;
- responsive treatment; and
- emergency response.<sup>94</sup>

Such mitigation measures can provide significant health benefits. For example estimates of the benefits of reducing air pollution from coal-fired power plants and transport suggest the immediate health and environmental benefits will be significant; cleaner vehicles can reduce urban air quality whilst reducing morbidity and mortality from air pollutants; transport policies can increase public transport and create more walkable cities.<sup>95</sup>

The impact of a changing climate on vector-borne diseases is difficult to predict since there are different impacts for each vector. However, one has to consider the whole life cycle and impact of climate change on the vector's habitat which might lead to increased larval development, more adult survival and more breeding sites resulting in increased pathogenic infections. Increased temperature will mean a combination of increased vector density due to warmer climate resulting in more mosquito- and other vector-borne health consequences such as tick bites. Early identification of imported illness resulting through vectors is therefore important as much as contingency plans for new vectors and outbreaks which might appear locally. Further assessment of impact of climate change on individual vectors should also be deployed.<sup>96</sup>

---

<sup>94</sup> WHO/Europe 2010c.

<sup>95</sup> Menne. (undated).

<sup>96</sup> Spiteri. (undated).

## 7.7 CONCLUSION AND FUTURE CHALLENGES

Public health is dynamic and changes according to the current environmental factors. It is for this reason that this chapter identified areas which are prioritised through the WHO Environment and Health process since it encompasses the challenges that are faced by society in this ever-changing environment.

The WHO policy document Health 2020 aims to ‘significantly improve the health and well-being of populations, reduce health inequalities, strengthen public health and ensure people-centred health systems that are universal, equitable, sustainable and of high quality’.<sup>97</sup> To accomplish this task and to follow up on the commitments endorsed at the Fifth Ministerial Conference on Environment and Health, the WHO Regional Office for Europe carried out a baseline assessment of environmental health inequalities in the European region, covering amongst other indicators, those arising from environmental risks. The National Environment and Health Action Plan (NEHAP) has provided the main national policy framework for tackling environmental health issues in the Maltese Islands through an intersectoral approach. Environmental health inequality indicators include:

- noise exposure at home;
- lack of access to green/recreational areas;
- second-hand smoke exposure at home; and
- second-hand smoke exposure at work.

While progress has been made on each sector above, data related to these health inequality indicators show that they have remained a challenge to continue working on in the future.

Noise is being considered an equity issue in relation to socioeconomic status (income and education), age and place of residence, indicating that the poor, the old and those living in dense places exposed to heavy traffic are most affected.<sup>98</sup>

The provision of green and recreational areas and clean indoor and outdoor air pollution are also priority issues which the general public have voiced their concerns on during the review period.

However, despite self-reported health status being associated with environmental conditions, for some environmental exposures, such as noise, air pollution or access to green and recreational areas, there is no clear association or gradient with health outcomes.<sup>99</sup> Environmental health inequalities are a reality in Malta and this may be considered as the primary future challenge towards enhancing public health, thereby, one may consider augmenting research in Malta to provide evidence on the extent of link that exists between exposure to these environmental impacts and public health.

In particular, environmental health inequalities are frequently linked to social determinants of health. As outlined by the WHO Commission on Social Determinants of Health in its background paper *Action On The*

---

<sup>97</sup> WHO/Europe 2017c.

<sup>98</sup> Department for Health Regulation-Ministry for Health, and Environmental Health Directorate 2013.

<sup>99</sup> Ibid.

*Social Determinants Of Health: Learning From Previous Experiences*,<sup>100</sup> social factors should be adequately addressed since they largely contribute to disparate environmental exposures and health inequalities.

---

<sup>100</sup> WHO 2005c.

## REFERENCES

2000/473/Euratom: Commission Recommendation of 8 June 2000 on the application of Article 36 of the Euratom Treaty concerning the monitoring of the levels of radioactivity in the environment for the purpose of assessing the exposure of the population as a whole (notified under document number C(2000) 1299). Official Journal of the European Union L 191, 27.7.2000, pp. 37–46.

Ambient Air Quality Regulations 2010, S.L. 549.59. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11577&l=1> (Accessed 20 September 2017).

American Cancer Society 2017a. Formaldehyde. Available at: <https://www.cancer.org/cancer/cancer-causes/formaldehyde.html> (Accessed 21 September 2017).

American Cancer Society 2017b. Lead. Available at: <https://www.cancer.org/cancer/cancer-causes/lead.html> (Accessed 21 September 2017).

American Cancer Society 2017c. Arsenic and Cancer Risk. Available at: <https://www.cancer.org/cancer/cancer-causes/arsenic.html> (Accessed 21 September 2017).

American Cancer Society 2017d. Benzene and Cancer Risk. Available at: <https://www.cancer.org/cancer/cancer-causes/benzene.html> (Accessed 21 September 2017).

American Cancer Society 2017e. Harmful Chemicals in Tobacco Products. Available at: <https://www.cancer.org/cancer/cancer-causes/tobacco-and-cancer/carcinogens-found-in-tobacco-products.html> (Accessed 21 September 2017).

Baluci C., Vincenti K., Tilluck B., Conchin S., Formosa S., & Grech D. 2013. National mapping survey of indoor radon levels in the Maltese Islands (2010-2011). Malta Medical Journal 25 (4) pp. 33-39. Available at: <http://www.um.edu.mt/umms/mmj/showpdf.php?article=409> (Accessed 4 June 2018).

CDC (Centers for Disease Control and Prevention) 2015. The Electromagnetic Spectrum: Non-Ionizing Radiation. Available at: [https://www.cdc.gov/nceh/radiation/nonionizing\\_radiation.html](https://www.cdc.gov/nceh/radiation/nonionizing_radiation.html) (Accessed 20 September 2017).

Clean Air Act 1968, Cap. 200. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=8709&l=1> (Accessed 20 September 2017).

Control of *Legionella* Regulations 2006, S.L. 465.03. Laws of Malta. Available at: <http://justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11860&l=1> (Accessed 20 September 2017).

Council Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. Official Journal of the European Communities. L327, 21.12.2000, pp. 1-72.

Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption. Official Journal of the European Union L 330, 5.12.1998, pp. 32–54.

Cuschieri, S. Vassallo, J. Calleja, N. Camilleri, R. Borg, A. Bonnici, G. Zhang, Y. Pace, N. and Mamo, J. 2016. Prevalence of obesity in Malta. Obesity Science and Practice 2(4) pp.466-470. Available at: <http://onlinelibrary.wiley.com/doi/10.1002/osp4.77/full> (Accessed 10 September 2017).

Debono R. Undated. Presentation The health effects of bad transport policy in Malta A missed Opportunity.

DeBono, R. Baluci, C. Gauci, D. Attard Montalto, S. Calleja, N. Sammut, M. and Vincenti, K. 2012. Blood Lead Levels in Maltese Children and Adults: Poster P2.05 VIII [Poster]. Exhibited at Malta Medical School Conference, The Westin, November 2012.

Department for Health Regulation-Ministry for Health, and Environmental Health Directorate 2013.

Environmental Health Inequalities in Malta. Available at:

[http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0016/243160/Environmental-Health-Inequalities-in-Malta.pdf?ua=1](http://www.euro.who.int/__data/assets/pdf_file/0016/243160/Environmental-Health-Inequalities-in-Malta.pdf?ua=1) (Accessed 10 September 2017).

Directive 2002/3/EC of the European Parliament and of the Council of 12 February 2002 relating to ozone in ambient air. Official Journal of the European Union L 67, 9.3.2002, pp. 14–30.

Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC Bathing Water Quality Directive 2006/7/EC. Official Journal of the European Union L 64, 4.3.2006, pp. 37–51.

Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. Official Journal of the European Union L 152, 11.6.2008, pp. 1–44.

Doyeon, K. M.S. and Kravitz, L. 2007. Childhood Obesity: Prevalence, Treatment and Prevention. IDEA Health and Fitness Association. Available at: <http://www.ideafit.com/fitness-library/childhood-obesity-prevalence-treatment-and-prevention> (Accessed 15 September 2017).

EC (European Commission) and ECDC (European Centre for Disease Prevention and Control) 2011. EWGLI (European Working Group for Legionella Infections Technical Guidelines for the Investigation, Control and Prevention of Travel Associated Legionnaires' Disease. Available at:

[https://ecdc.europa.eu/sites/portal/files/media/en/healthtopics/legionnaires\\_disease/ELDSNet/Documents/EWGLI-Technical-Guidelines.pdf](https://ecdc.europa.eu/sites/portal/files/media/en/healthtopics/legionnaires_disease/ELDSNet/Documents/EWGLI-Technical-Guidelines.pdf) (Accessed 9 September 2017).

EC (European Commission) 2013. Special Eurobarometer 406 Attitudes of Europeans Towards Urban Mobility Report. Available at:

[http://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs\\_406\\_en.pdf](http://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs_406_en.pdf) (Accessed 20 September 2017).

EC (European Commission) 2016. Air Quality and Noise legislation: Module 1: Why are air and noise pollution an issue-DG Environment. Available at:

[http://ec.europa.eu/environment/legal/law/5/e\\_learning/module\\_1\\_1.htm](http://ec.europa.eu/environment/legal/law/5/e_learning/module_1_1.htm) (Accessed 12 February 2018).

EC (European Commission) 2017a. The Barcelona Convention-DG Environment. Available at:

[http://ec.europa.eu/environment/marine/international-cooperation/regional-sea-conventions/barcelona-convention/index\\_en.htm](http://ec.europa.eu/environment/marine/international-cooperation/regional-sea-conventions/barcelona-convention/index_en.htm) (Accessed 5 September 2017).

EC (European Commission) 2017b. New Air Quality Directive-DG Environment. Available at:

<http://ec.europa.eu/environment/air/quality/directive.htm> (Accessed 20 September 2017).

EC (European Commission) 2018. Final opinion on potential health effects of exposure to electromagnetic fields (EMF). Available at:

[https://ec.europa.eu/health/scientific\\_committees/consultations/public\\_consultations/scenih\\_r\\_consultation\\_19\\_en](https://ec.europa.eu/health/scientific_committees/consultations/public_consultations/scenih_r_consultation_19_en) (Accessed 8 June 2018).

Environment Protection Act 2016, Cap. 549. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=12446&l=1> (Accessed 20 September 2017).

Environmental Health Directorate 2017a. Malta Registered Private Water Suppliers as per L.N. 357 of 2004 Registered to distribute Water Intended for Human Consumption by Water Bowser. Available at: [https://health.gov.mt/en/environmental/Documents/Health-Inspectorate/Health-Risk-Management/Register/Private\\_Water\\_Supplies\\_by\\_Bowsers\\_Register.pdf](https://health.gov.mt/en/environmental/Documents/Health-Inspectorate/Health-Risk-Management/Register/Private_Water_Supplies_by_Bowsers_Register.pdf) (Accessed 28 August 2017).

Environmental Health Directorate 2017b. Swimming Pools. Available at: <https://deputyprimeminister.gov.mt/en/environmental/Pages/Health-Inspectorate/Environmental-Health-Risk-Management/Swimming-Pools.aspx> (Accessed 5 September 2017).

Environmental Health Directorate 2017c. Legionella Control. Available at: <https://deputyprimeminister.gov.mt/en/environmental/Pages/Health-Inspectorate/Environmental-Health-Risk-Management/Legionella-Control.aspx> (Accessed 8 September 2017).

Food Safety Act 2002, Cap. 449. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=8915&l=1> (Accessed 20 September 2017).

Fsadni, P. Bezzina, F. Fsadni, C. Aquilina, N. and Montefort, S. 2015. 'The impact of school environment on children's respiratory health'. International Journal of Integrative Medicine 2 pp. 129-138.

Grech K., Podesta M., Calleja A., Calleja N. 2015. Performance of the Maltese Health System, 2015. Ministry for Energy and Health (Health), Valletta, Malta 2015. Available at: <https://deputyprimeminister.gov.mt/en/dhir/Documents/HSPA%20-%20Malta%20Report%20-%20Final%20050416.pdf> (Accessed 18 May 2018).

ICNIRP (International Commission on Non-Ionizing Radiation Protection) 2017. International Commission on Non-Ionizing Radiation Protection Website. Available at: <http://www.icnirp.org/> (Accessed 20 September 2017).

Inchley J., Currie D., Young T., Samdal O., Torsheim T., Augustson L., Mathison F., Aleman-Diaz A., Molcho M., Weber M. & Barnekow V. 2016. Growing up unequal: gender and socioeconomic differences in young people's health and well-being. World Health Organization Europe Health Policy for Children and Adolescents, No. 7. HBSC 2016 study (2013/2014 survey). Available at: [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0003/303438/HSBC-No.7-Growing-up-unequal-Full-Report.pdf?ua=1](http://www.euro.who.int/__data/assets/pdf_file/0003/303438/HSBC-No.7-Growing-up-unequal-Full-Report.pdf?ua=1) (Accessed 20 September 2017).

International Agency for Research on Cancer, World Health Organization 2013. Outdoor air pollution a leading environmental cause of cancer deaths. Available at: [https://www.iarc.fr/en/media-centre/iarcnews/pdf/pr221\\_E.pdf](https://www.iarc.fr/en/media-centre/iarcnews/pdf/pr221_E.pdf) (Accessed 20 September 2017).

Lenntech 2017. Chemical Properties of Boron – Health Effects of Boron – Environmental Effects of Boron. Available at: <https://www.lenntech.com/periodic/elements/b.htm> (Accessed 28 August 2017).

Leung, Dennis Y. C. 2015. Outdoor-indoor air pollution in urban environment: challenges and opportunity, Frontiers in Environmental Health Sciences. Available at: <http://journal.frontiersin.org/article/10.3389/fenvs.2014.00069/full> (Accessed 20 September 2017).



Management of Bathing Water Quality Regulations 2008, S.L 465.09. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11866&l=1> (Accessed 28 August 2017).

MCA (Malta Communication Authority) 2017a. Malta Communications Authority Website. Available at: <https://mca.org.mt/> (Accessed 20 September 2017).

MCA (Malta Communication Authority) 2017b. EMF Results. Available at: <https://mca.org.mt/regulatory/emf-results> (Accessed 20 September 2017).

Mellilo T. 2016. Infectious Disease Report.

Menne B. Undated. Presentation Protecting health in Europe from climate change.

Ministry of Health, Malta 2014. Annual Report 2013. Available at: <https://www.gov.mt/en/Government/Publications/Publications%20and%20Policies/Documents/Ministry%20for%20Health%20Annual%20Report%202013.pdf> (Accessed 28 August 2017).

Ministry of Health, Malta 2015. Annual Report 2014. Available at: [https://www.gov.mt/en/Government/Publications/Documents/Annual%20Reports/2014/MEH%20\(Health\)%20Annual%20Report%202014.pdf](https://www.gov.mt/en/Government/Publications/Documents/Annual%20Reports/2014/MEH%20(Health)%20Annual%20Report%202014.pdf) (Accessed 28 August 2017).

Ministry of Health, Malta 2016. Annual Report 2015. Available at: [https://www.gov.mt/en/Government/Publications/Documents/Annual%20Reports/2015/MEH\(Health\)%20-%20Consolidated%20Annual%20Report%202015.pdf](https://www.gov.mt/en/Government/Publications/Documents/Annual%20Reports/2015/MEH(Health)%20-%20Consolidated%20Annual%20Report%202015.pdf) (Accessed 28 August 2017).

Ministry of Health (Health Promotion and Disease Prevention Directorate), Malta 2016. Summary of food-borne illness cases and outbreaks investigated by the Infectious Disease Prevention and Control unit (IDPCU). Unpublished report.

Ministry of Health, Malta 2017a. Environmental Health Directorate. Available at: <https://deputyprimeminister.gov.mt/en/environmental/Pages/Home-Page.aspx> (Accessed 28 August 2017).

Ministry of Health, Malta 2017b. Public Health Laboratory. Available at: <https://deputyprimeminister.gov.mt/en/environmental/Pages/Public-Health-Laboratory/Public-Health-Laboratory.aspx> (Accessed 28 August 2017).

Ministry of Health, Malta 2017c. Health Inspectorate. Available at: <https://health.gov.mt/en/environmental/Pages/Health-Inspectorate/Health-Inspectorate.aspx> (Accessed 28 August 2017).

Ministry of Health, Malta 2017d. Policy Coordinating Unit. Available at: <https://health.gov.mt/en/environmental/Pages/Policy-Coordinating-Unit/Parma-Declaration.aspx> (Accessed 28 August 2017).

Ministry of Health, Malta 2017e. Swimming Pools. Available at: <https://deputyprimeminister.gov.mt/en/environmental/Health-Inspectorate/EHRM/Pages/Swimming-Pools.aspx> (Accessed 28 August 2017).

MRA (Malta Resources Authority) 2017. Water Framework Directive. Available at: <http://mra.org.mt/hydrogeology/wfd/> (Accessed 28 August 2017).

NEHA (National Environmental Health Association) 2017. Definitions of Environmental Health. Available at: <https://www.neha.org/about-neha/definitions-environmental-health> (Accessed 28 August 2017).

NSO (National Statistics Office, Malta) 2013. SILC 2011: Main Dwellings and Material Deprivation 2011. Available at: [https://nso.gov.mt/en/News\\_Releases/Archived\\_News\\_Releases/Documents/2013/News2013\\_112.pdf](https://nso.gov.mt/en/News_Releases/Archived_News_Releases/Documents/2013/News2013_112.pdf) (Accessed 9 September 2017).

Office of Disease Prevention and Health Promotion 2017. Healthy People 2020. Available at: <https://www.healthypeople.gov/2020/About-Healthy-People> (Accessed 28 August 2017).

Public Health Act 2003, Cap. 465. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=8931&l=1> (Accessed 28 August 2017).

Registration of Cooling Towers and Evaporative Condensers Regulations 2006, S.L. 465.04. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11861&l=1> (Accessed 28 August 2017).

Registration of Private Water Supplies Intended for Human Consumption Regulations 2004, S.L.449.45. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11122&l=1> (Accessed 28 August 2017).

Shahan, Z. 2017. How Much Clean Water is Available for Human Use? Available at: <https://instead.com/blog/clean-water-human/> (Accessed 2 October 2017).

Smoking Control in Private Vehicles Regulations 2016, S.L.315.11. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=12608&l=1> (Accessed 28 August 2017).

Spiteri G. Undated. Presentation Climate Change and Vector-Borne Diseases: How much of a threat to Malta?

Swimming Pools Regulations 2005, S.L. 465.02. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11859&l=1> (Accessed 28 August 2017).

Tobacco (Smoking Control) Act 1987, Cap. 315. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=8791&l=1> (Accessed 20 September 2017).

UNECE and WHO 2017a. Pan European Programme on Transport Health and Environment (The PEP). Available at: <https://www.unece.org/thepep/en/welcome.html> (Accessed 20 September 2017).

UNECE and WHO 2017b. Transport, Health, Environment (THE PEP). Available at: [https://www.unece.org/trans/theme\\_pep.html](https://www.unece.org/trans/theme_pep.html) (Accessed 20 September 2017).

UNEP (United Nation Environment Programme) 2004. Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean. Available at: [https://wedocs.unep.org/bitstream/handle/20.500.11822/7096/Consolidated\\_BC95\\_Eng.pdf?sequence=1&isAllowed=y](https://wedocs.unep.org/bitstream/handle/20.500.11822/7096/Consolidated_BC95_Eng.pdf?sequence=1&isAllowed=y) (Accessed 21 September 2017).

UNEP (United Nations Environment Programme) 2013. The Minamata Convention on Mercury. Available at: <http://www.mercuryconvention.org/Convention/Text/tabid/3426/language/en-US/Default.aspx> (Accessed 12 February 2018).

Water Intended for Human Consumption Regulations 2009, S.L. 449.57. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11134&l=1> (Accessed 28 August 2017).

Water Policy Framework Regulations 2004, S.L.549.100. Laws of Malta. Available at: <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=12384&l=1> (Accessed 28 August 2017).

WHO (World Health Organization) 1978. Declaration of Alma-Ata International Conference on Primary Health Care, Alma-Ata, USSR, 6-12 September 1978. Available at: [http://www.who.int/publications/almaata\\_declaration\\_en.pdf](http://www.who.int/publications/almaata_declaration_en.pdf) (Accessed 28 August 2017).

WHO (World Health Organization) 2003. Boron in Drinking-water Background document for development of WHO Guidelines for Drinking-water Quality, 2003. Available at: [http://www.who.int/water\\_sanitation\\_health/dwq/boron.pdf](http://www.who.int/water_sanitation_health/dwq/boron.pdf) (Accessed 28 August 2017).

WHO (World Health Organization) 2005a. Air Quality Guidelines 2005. Available at: [http://www.who.int/phe/health\\_topics/outdoorair/outdoorair\\_aqg/en/](http://www.who.int/phe/health_topics/outdoorair/outdoorair_aqg/en/) (Accessed 28 August 2017).

WHO (World Health Organization) 2005b. Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide Global update, 2005. Available at: [http://apps.who.int/iris/bitstream/10665/69477/1/WHO\\_SDE\\_PHE\\_OEH\\_06.02\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/69477/1/WHO_SDE_PHE_OEH_06.02_eng.pdf) (Accessed 28 August 2017).

WHO (World Health Organization) 2005c. Commission on social determinants of health. Action on the social determinants of health: learning from previous experiences. World Health Organization. Available at: [http://www.who.int/social\\_determinants/resources/action\\_sd.pdf](http://www.who.int/social_determinants/resources/action_sd.pdf) (Accessed 28 August 2017).

WHO (World Health Organization) 2006. WHO Electromagnetic fields and public health Base stations and wireless technologies, Backgrounder. Available at: <http://www.who.int/peh-emf/publications/facts/fs304/en/> (Accessed 20 September 2017).

WHO (World Health Organization) 2009a. WHO Handbook on Indoor Radon A Public Health Perspective 2009. Available at: [http://apps.who.int/iris/bitstream/10665/44149/1/9789241547673\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/44149/1/9789241547673_eng.pdf) (Accessed 28 August 2017).

WHO (World Health Organization) 2009b. Environment and Health Performance Review, Malta, 2009. Available at: <http://www.euro.who.int/en/countries/malta/publications/environment-and-health-performance-review.-malta> (Accessed 28 August 2017).

WHO (World Health Organization) 2010. Childhood Lead Poisoning, 2010. Available at: <http://www.who.int/ceh/publications/childhoodpoisoning/en/> (Accessed 28 August 2017).

WHO (World Health Organization) 2012. Measuring health gains from sustainable development 2012. Available at: [http://www.who.int/hia/green\\_economy/sustainable\\_development\\_summary1.pdf](http://www.who.int/hia/green_economy/sustainable_development_summary1.pdf) (Accessed 28 August 2017).

WHO (World Health Organization) 2016. Ambient (Outdoor) Air Quality and Health, 2016. Available at: <http://www.who.int/mediacentre/factsheets/fs313/en/> (Accessed 28 August 2017).

WHO (World Health Organization) 2017a. Tobacco Fact Sheet, 2017. Available at: <http://www.who.int/mediacentre/factsheets/fs339/en/> (Accessed 28 August 2017).

WHO (World Health Organization) 2017b. WHO Framework Convention on Tobacco Control. Available at: <http://www.who.int/fctc/en/> (Accessed 28 August 2017).

WHO (World Health Organization) 2017c. Chemical hazards. Available at: <http://www.who.int/ceh/risks/cehchemicals/en/> (Accessed 28 August 2017).

WHO (World Health Organization) 2017d. Health in the Green Economy. Available at: [http://www.who.int/hia/green\\_economy/en/](http://www.who.int/hia/green_economy/en/) (Accessed 28 August 2017).

WHO (World Health Organization) 2017e. WHO Electromagnetic fields and public health: mobile phones Fact sheet N°193. Available at: <http://www.who.int/mediacentre/factsheets/fs193/en/> (Accessed 28 August 2017).

WHO/Europe (World Health Organization, Regional Office for Europe) 2003. Health Aspects of Air Pollution with Particulate Matter, Ozone and Nitrogen Dioxide Report on a WHO Working Group Bonn, Germany 13–15 January 2003. Available at: [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0005/112199/E79097.pdf](http://www.euro.who.int/__data/assets/pdf_file/0005/112199/E79097.pdf) (Accessed 28 August 2017).

WHO/Europe (World Health Organization, Regional Office for Europe) 2010a. Parma Declaration on Environment and Health. Available at: [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0011/78608/E93618.pdf](http://www.euro.who.int/__data/assets/pdf_file/0011/78608/E93618.pdf) (Accessed 28 August 2017).

WHO/Europe (World Health Organization, Regional Office for Europe) 2010b. Fifth Ministerial Conference on Environment and Health: Closing address by Jakab Zsuzsanna, WHO Regional Director for Europe. Available at: <http://www.euro.who.int/en/about-us/regional-director/speeches-and-presentations-by-year/2010/fifth-ministerial-conference-on-environment-and-health-closing-address> (Accessed 1 September 2017).

WHO/Europe (World Health Organization, Regional Office for Europe) 2010c. Protecting health in an environment challenged by climate change: European Regional Framework for Action Contribution of the Climate Change and Health Task Force, 2010. Available at: [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0005/95882/Parma\\_EH\\_Conf\\_edoc06rev1.pdf](http://www.euro.who.int/__data/assets/pdf_file/0005/95882/Parma_EH_Conf_edoc06rev1.pdf) (Accessed 28 August 2017).

WHO/Europe (World Health Organization, Regional Office for Europe) 2015. Economic cost of the health impact of air pollution in Europe. Available at: [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0004/276772/Economic-cost-health-impact-air-pollution-en.pdf](http://www.euro.who.int/__data/assets/pdf_file/0004/276772/Economic-cost-health-impact-air-pollution-en.pdf) (Accessed 20 September 2017).

WHO/Europe (World Health Organization, Regional Office for Europe) 2017a. Organization. Available at: <http://www.euro.who.int/en/about-us/organization> (Accessed 28 August 2017).

WHO/Europe (World Health Organization, Regional Office for Europe) 2017b. Public Health Services. Available at: <http://www.euro.who.int/en/health-topics/Health-systems/public-health-services/public-health-services> (Accessed 28 August 2017).

WHO/Europe (World Health Organization, Regional Office for Europe) 2017c. Health 2020: the European policy for health and well-being. Available at: <http://www.euro.who.int/en/health-topics/health-policy/health-2020-the-european-policy-for-health-and-well-being/about-health-2020> (Accessed 28 August 2017).

WHO/Europe (World Health Organization, Regional Office for Europe) 2017d. European Environment and Health Process (EHP). Available at: <http://www.euro.who.int/en/health-topics/environment-and-health/pages/european-environment-and-health-process-ehp> (Accessed 28 August 2017).

WHO/Europe (World Health Organization, Regional Office for Europe) and UNECE (United Nations Economic Commission for Europe) 2009. Transport Health and Environment Pan-European Programme-THE PEP Amsterdam Declaration: Making THE Link: Transport choices for our health, environment and prosperity. Available at: [https://www.unece.org/fileadmin/DAM/thepep/en/hlm/documents/2009/Amsterdam\\_Declaration\\_ENG.pdf](https://www.unece.org/fileadmin/DAM/thepep/en/hlm/documents/2009/Amsterdam_Declaration_ENG.pdf) (Accessed 12 February 2018).

WSC (Water Services Corporation) Website 2017. Water Services Corporation Website. Available at: <http://www.wsc.com.mt/> (Accessed 28 August 2017).

WSC (Water Services Corporation) 2016. Annual Report 2015. Available at: [http://www.wsc.com.mt/wp-content/uploads/2018/03/Annual\\_Report\\_-\\_2015.pdf](http://www.wsc.com.mt/wp-content/uploads/2018/03/Annual_Report_-_2015.pdf) (Accessed 28 August 2017).

Yeomans M. 2012. Ionizing Radiation Report for 2011 and 2012.