



## The evidence of toxic wastes dumping in Campania, Italy



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### Contents

1. Introduction.....	84
2. The relationship between the illegal dumping waste and the increased cancer mortality.....	85
3. Discussion.....	89
Conflict of interests.....	90
Acknowledgement.....	90
References.....	90
Biographies.....	91

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### ABSTRACT

The region of Campania (particularly Naples and Caserta) were subjected to extensive illegal dumping operations of toxic and radioactive wastes since the 1980s. The highly toxic wastes (HTW) dumping operations that have taken place both along the coast and the hinterland, have extremely adverse effects on health, livelihoods and the future prospect of sustainable development of the local population. The toxic wastes dumping in Campania is real and it has compromised (irreversibly) the human health, natural environment, food security and the long-term development prospects of the affected population. To reverse this tragic trend, it is necessary the identification, isolation and reclamation of the polluted sites and full assessment of the nature and the scale of the polluting chemicals and other hazardous wastes. The purpose of this review is to contribute significantly to the available evidence of the long-running toxic waste dumping in Campania and its negative impact on the health of population.

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### 1. Introduction

Hazardous waste sites have emerged as a major environmental health concern in many countries. There are a number of different options available for the management and treatment of waste including minimisation, recycling, composting, energy recovery and disposal. At present, an increasing amount of the resources contained in waste is recycled, but a large portion is incinerated or permanently lost in landfills. The various methods of waste management release a number of substances, most in small quantities and at extremely low levels. However, concerns remain about potential health effects associated with the main waste management technologies and there are many uncertainties involved in the assessment of health effects. Several studies reported the pos-

sible health effects on populations living in proximity of landfills and incinerators (Saunders, 2007; Franchini et al., 2004; Rushton, 2003), that have been associated with some reproductive and cancer outcomes. Much of the health literature on the toxicity of the individual substances highlighted above relates to occupational or accidental exposure and thus generally to higher levels of exposure than those expected from waste disposal methods. Many of the substances, such as cadmium, arsenic, chromium, nickel, dioxins and Polycyclic Aromatic Hydrocarbons (PAHs) are considered to be carcinogenic, based on animal studies or studies of people exposed to high levels. In addition to carcinogenicity, many of these substances can produce other toxic effects (depending on exposure level and duration) on the central nervous system, liver, kidneys, heart, lungs, skin, reproduction, etc. However, additional contaminants pose risks to humans and biota (Nolan et al., 2009; Richardson, 2009; Birnbaum and Staskal, 2004). Recent monitoring of municipal wastewater effluent, urban surface waters, and biota has documented the occurrence of groups of unrecognized contaminants called contaminants of emerging concern

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(CECs) (Schultz et al., 2006; Mitch et al., 2003; Kolpin et al., 2002). For other pollutants such as SO<sub>2</sub> and PM<sub>10</sub>, air pollution studies have indicated that there may be effects on morbidity and mortality at background levels of exposure, particularly in susceptible groups such as the elderly. Chemicals such as dioxins and organochlorines may be lipophilic and accumulate in fat-rich tissues and have been associated with reproductive or endocrine-disrupting endpoints. Environmental factors contribute to the global burden of disease and, in particular, they contribute to the growing incidence of non-transmissible diseases, like cancer, in the different countries. Recent data demonstrate that more than half of cancer cases and 60% of deaths occur in developing countries (IARC World Cancer Report, 2014). Adverse health effects due to waste management practices, in particular of hazardous waste, potentially represent a public health issue in many less developed regions and developing countries, because of growing waste production, inadequate waste management practices, lack of appropriate legislation and control systems, as well as of growing illegal hazardous waste transboundary movements driven by the most industrialized countries. Campania (a region of south Italy) has been used extensively by Italian and foreign companies as a dumping ground to dispose large quantities of highly toxic waste from the industrialized countries. Recent studies have reported a significant increase of cancer mortality as well as an increased rate of congenital malformation in the Campania but particularly in Provinces of Naples and Caserta. In such areas illegal dumping of toxic wastes has been largely documented (ARPAC *Annuario dei Dati Ambientali in Campania*, 2006). Despite the gravity of its negative impact, the problem of the illegal toxic wastes dumping in Campania has been ignored until now even if it has been largely documented (D'Alisa et al., 2014; Editorial, 2014; Senior and Mazza, 2004). The purpose of this review is to present the findings of the different studies concerning the distribution of cancer mortality and birth defects in the Provinces of Naples and Caserta, the part of Campania most severely affected by illegal waste dumping sites.

## 2. The relationship between the illegal dumping waste and the increased cancer mortality

Different studies have linked low birth weight (less than 2500 kg), the occurrence of birth defects, and miscarriages in women who lived in close proximity to the landfill, in fact researchers Vianna and Polan (1984) and Goldman et al. (1985) have carried out a study in the population of the Love Canal, in the years 1940–1953 and later in the years 1965–1978 related to the birth of underweight children and the parents' home in proximity to landfill. Subsequent studies have affirmed a relationship between an increase of children born underweight and the distance of their mothers to live approximately a 1 km from the Lipari landfill in New Jersey (Berry and Bove, 1997) also in California has been correlated the relationship between low weight babies and deaths and the time of the exposure of mothers to hazardous waste found in landfills (Kharazi et al., 1997) Elliott et al. (2001), between 1982 and 1997 in the United Kingdom, evaluated the adverse events in relation to the birth of live about 2 km from an active landfill, and the results of the study claimed an increase in certain birth defects including neural tube defects, hypospadias and epispadias, abdominal wall defects and surgical correction of gastroschisis and omphalocele. Another interesting study, conducted among the population living in the vicinity of Welsh landfill Nant-y-Gwyddon, revealed high rates of birth defects (Fielder et al., 1997; Fielder et al., 2000). Subsequently, Dolk et al. (1998) assessed mothers who have lived to a radius of 3 km from the landfill had a high incidence of malformations of the septa cardiac abnormalities and of the large arteries and veins, and chromosomal abnormalities in the offspring.

This European multicenter study EUROHAZCON, a survey of case-control on the risk of congenital malformations associated with residence within 7 kilometers from landfills for hazardous wastes on the basis of EU Directive 689/91.6, examined 21 landfill sites in 15 areas, using data from 10 regional registries of birth defects operating in European countries (Belgium, Denmark, France, Italy and Great Britain), including the registry of Tuscany coordinated by the Institute of clinical Physiology of National Research Council (CNR) in Pisa. The results of this study showed a significantly increased risk of chromosomal birth defects (Odd Ratio (OR) = 1.33) and non-chromosomal (OR = 1.49), especially neural tube defects, great vessels and cardiac septum, between residents within 3 kilometers from the landfill than the outer ring (Dolk et al., 1998; Vrijheid et al., 2002). As regards the knowledge in Italy, studies so far available are few, different in design and purpose. In 2004 were published the data of the project of 'Broader inherent in the "Evaluation of the health risk and environmental disposal of municipal and hazardous waste" (Musumeci, 2004). This study was performed in some landfill sites supposedly representative of the Italian situation to identify possible risk factors; besides, on the areas surrounding these landfill sites, epidemiological analyses of mortality data, disaggregated on municipal scale (for malformations, perinatal diseases, leukaemia and encephalon cancer, at the age 0–14 years), congenital malformations, born mortality, spontaneous abortion, low birth weight, preterm birth, sex ratio were carried out. The aforementioned study took into consideration 14 landfill sites (5 in Northern Italy, 9 in the South Italy) and was also performed on populations living in areas at a distance of 5 km from the landfill (Lauria et al., 2004; Minichilli et al., 2004; Mitis et al., 2004; In: Musumeci L. (Ed.) 2004). In this report, other authors were also taken into account all the municipalities of the eight provinces where it was known to contain a landfill (Belliet al., 2004; In: Musumeci L. ed. 2004) and was made a subsequent investigation focused on epidemiology veterinary (De Nardo, 2004; In: Musumeci L. ed. 2004). The results point out the necessity of further investigations in order to identify possible and reliable cause-effect relations between exposure to waste and health risk (Musumeci, 2004). Furthermore, Comba et al. (2003) found that living within a 2 km radius of an industrial waste incinerator in Mantua (Italy) was associated with a significant increase in risk of soft-tissue sarcomas. Parodi et al. (2004) looked at lung cancer mortality in two regions of northern Italy exposed to environmental pollution emitted by a coal-fired power station and other industrial sources, including a waste incinerator. Following to these review documents, Elliott et al. (2009) investigated the risk of congenital anomalies around 8804 landfill sites, including 607 where hazardous wastes were conveyed, with reference to the years 1983–1998. Discussion of these findings was prompted by a comment of Vrijheid (2009), who stressed the need to develop more detailed monitoring of chemicals emitted by landfills, in order to pursue a specific exposure assessment and thus a valid estimate of the health impact of landfills. Several studies cited numerous cases of death and illness brought about in areas exposed to hazardous waste materials, including the so-called 'cancer villages' of China, where residents increased susceptibility to several classifications of tumours has been directly attributed to their exposure to cadmium and mercury released through the recycling of e-waste (Shi et al., 2016; He et al., 2015; Luo et al., 2015; Song and Li, 2015; Lau et al., 2014; Zheng et al., 2013). More recently, the United Nations Environment Programme has reported that the environmental restoration of Ogoniland in Nigeria, following 50 years of oil operations, could prove to be the world's most wide-ranging and long term oil clean-up exercise ever undertaken. The data for the report included over 5000 medical records and the conclusion drawn revealed that "at least 10 Ogoni communities where drinking water is contaminated with high levels of hydrocarbons, public health is seriously threat-

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