

# Discariche ed impatto sulla salute: quali sono le evidenze

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30 novembre 2018

SECONDA SESSIONE

**IL SIN-BRESCIA CAFFARO**

**E ALTRE PROBLEMATICHE AMBIENTALI NELL'ATS DI BRESCIA**

**LABORATORIO BRESCIA**

**LINFOMA NON HODGKIN E PCB**

Stato di avanzamento degli studi  
sulla esposizione a PCB



# Perchè “rifiuti”

La gestione di rifiuti non idonea oppure non controllata/illegale è un fenomeno diffuso in alcune aree di Paesi industrializzati e a medio-basso reddito:

**USA:** 1.684 EPA NPL siti per la presenza di rifiuti pericolosi (2007) (*Pohl et al, 2008*)

**Europa** (33 Paesi): le attività che contribuiscono maggiormente alla contaminazione di suoli e falde (38%) (2011) (EEA: *van Liedekerke M et al, 2014*)

**Asia** (7 Paesi): 679 aree contaminate da rifiuti pericolosi (*Chatman-Stephen et al, 2013*)

**Africa:** I rifiuti pericolosi tra i 3 maggiori fattori di rischio ambientale (*McCormack 2012*)

# In ITALIA: 45 SITI CONTAMINATI 319 COMUNI



PETROLCHIMICI E RAFFINERIE (20%)



IMPIANTI CHIMICI (50%)



ACCIAIERIE (18%)



AMIANTO/ALTRE FIBRE ASBESTIFORMI



DISCARICHE (60%)



PORTI



CENTRALI ELETTRICHE



MINIERE/CAVE

**5.900.000 abitanti al censimento 2011**

**circa 1.160.000 bambini in età pediatrica  
e adolescenziale (0-19 anni) e**

**660 mila giovani (20-29 anni)**

*Zona A et al, sottoposto per pubblicazione*

# BRESCIA-CAFFARO



Il Sito Brescia-Caffaro è costituito da tre Comuni (Brescia, Castegnato, Passirano) con una popolazione complessiva, al Censimento 2011, di 205.047 abitanti.

Il Decreto di perimetrazione del Sito segnala la presenza di impianto chimico e di discarica, *esposizioni ambientali* indicate in SENTIERI come C e D.

\*D: rifiuti speciali



Sixth Ministerial Conference  
on Environment and Health

EURO/Ostrava2017/6

Ostrava, Czech Republic  
13–15 June 2017

15 June 2017  
ORIGINAL: ENGLISH

DECLARATION OF THE SIXTH MINISTERIAL CONFERENCE  
ON ENVIRONMENT AND HEALTH

The aim: to shape future common actions **to decrease the burden of diseases caused by environmental factors** and to promote synergies to achieving health and well-being objectives of the United Nation 2030 Agenda for Sustainable Development.

Among the priority areas:

12 d: **preventing and eliminating the adverse environmental and health effects, costs and inequalities related to waste management and contaminated sites**, by advancing towards the elimination of uncontrolled and illegal waste disposal and trafficking, and sound management of waste and contaminated sites **in the context of transition to a circular economy**

ANNEX 1. COMPENDIUM OF POSSIBLE ACTIONS TO ADVANCE  
THE IMPLEMENTATION OF THE OSTRAVA DECLARATION

- d. Preventing and eliminating the adverse environmental and health effects, costs and inequalities related to waste management and contaminated sites

# Waste and human health: Evidence and needs

WHO Meeting Report

5–6 November 2015  
Bonn, Germany



**The available scientific evidence on the waste-related health effects is not conclusive, but suggests the possible occurrence of serious adverse effects, including mortality, cancer, reproductive health, and milder effects affecting well-being.**

**..Modern technology** for waste management can dramatically reduce noxious emissions and human exposure to hazardous agents;...

Many cases persist where old generation facilities are in use, or worse where informal uncontrolled disposal such as casual dumping or open-air burning of waste occurs, typically affecting marginalized groups.

**.. Promoting circular economy**, in line with the European Union waste hierarchy, which gives priority to reduced production and re-use or recycling of waste over incineration and landfilling.

## **MUNICIPAL SOLID WASTE – LANDFILLS (1)**

The possible health effects related to residential proximity to **landfills** have been studied in several papers and summarized in systematic reviews. They mainly concern cancer and births outcomes; more recently respiratory diseases and annoyance were also investigated.

- **Excess for cancer** has been found for different sites (e.g., pancreas, larynx, liver, kidney) and non-Hodgkin lymphoma, but the overall evidence **is not sufficient for drawing firm conclusions.**  
(Jarup et al, 2002; Porta et al, 2009; Mattiello et al, 2013)
- Although several alternative explanations, including ascertainment bias, and residual confounding cannot be excluded, estimates effects and their level of confidence **suggest an increase in risk of congenital anomalies due to the landfills.**  
(Dolk, 1998, Elliott et al, 2009; Porta et al, 2009; Mattiello et al, 2013)

## MUNICIPAL SOLID WASTE – LANDFILLS (2)

- **Excesses for respiratory diseases** in populations living near to landfills, have been reported in several studies “**suggestive of a relationship between residential exposure to landfill pollution and respiratory diseases**” (Mataloni et al, 2016; Heaney et al, 2011; Correa et al. 2011; Mattiello et al, 2013).
- In the most recent literature, **health outcomes have been analysed that are less severe**, but of a greater overall impact as more frequent in the exposed population. Several papers reported associations **between exposure to odorous disposal facilities such as landfills, and respiratory symptoms and other non-specific symptoms in the population, such as noise and other problems due to annoyance**. (Aatamila et al, 2011; Heaney et al, 2011; De Feo et al, 2013).



# MUNICIPAL SOLID WASTE – LANDFILLS (3)

## Towards a European assessment of the health impact of landfilling

**Notwithstanding numerous uncertainties, the available knowledge makes it possible to develop a framework for assessing the health impact of waste management facilities in residential areas.** Based on the evidence outlined above, a two-step process can be applied to select health outcomes to be considered in a health impact assessment (HIA) exercise of waste management.

- 1. First, consider diseases with at least “limited evidence”,** as indicated by recent reviews, as cancer for incinerators, **congenital anomalies and low-birth weight for landfills.** Regarding cancer for **incinerators**, following considerations mentioned above on the reduction of emissions of these plants since the 1980s, a temporal correction coefficient has to be applied (following Forastiere et al., 2011).
- 2. Next, based on more recent findings,** consider preterm births for **incinerators, respiratory diseases and annoyance for landfills,** based on multisite cohort studies with at least one similar positive result in the literature.

*Da: WHO, 2015*

# MUNICIPAL SOLID WASTE – LANDFILLS (4)

## Towards a European assessment of the health impact of landfilling

The outcomes that can be considered in the assessment for landfills:

Exposure buffer	Exposure index	Health outcome	Health risk	Metrics*	Ref.
2 km	Distance	- congenital anomalies	Relative risk (RR) = 1.02 (99%CI = 1.01-1.03)	I.C.	Elliott et al. 2001
		- annoyance from odour	5.4%**	P.	Herr et al. 2003
		- low birth weight	RR = 1.06 (99%CI=1.052-1.062)	I.C.	Elliott et al. 2001
5 km	H <sub>2</sub> S (disp.model)	- respiratory diseases	RR = 1.09 (95%CI 1.00-1.19)	P.	Golini et al. 2016

\* I.C. = cumulative incidence on the simulation period (2004-2020); P. = annual prevalence

\*\* Confidence intervals are not available, because this value refers to data from questionnaires

**Table 1. Exposure and health outcome metrics used for health impact assessments for landfills**

***Da: WHO, 2015***

**LIMITATA:** un'associazione positiva è stata osservata tra esposizione e malattia per la quale un'interpretazione causale è considerata essere credibile, ma il ruolo del caso, bias o confondenti non può essere escluso con ragionevole confidenza.

**INADEGUATA:** gli studi disponibili sono di qualità, consistenza o potenza statistica di qualità insufficiente per decidere la presenza o assenza di associazione causale

*(da Porta et al, 2009)*

## Review **Open Access**

# Systematic review of epidemiological studies on health effects associated with management of solid waste

Porta D, Milani S, Lazzarino AI, Perucci CA, Forastiere F.

*Environmental Health* 2009, **8**:60 doi:10.1186/1476-069X-8-60

**Table 1: Summary of the overall epidemiologic evidence on municipal solid waste disposal: landfills and incinerators.**

HEALTH EFFECT	LEVEL OF EVIDENCE	
	LANDFILLS	INCINERATORS
All cancer	Inadequate	Limited
Stomach cancer	Inadequate	Limited
Colorectal cancer	Inadequate	Limited
Liver cancer	Inadequate	Limited
Larynx cancer	Inadequate	Inadequate
Lung cancer	Inadequate	Limited
Soft tissue sarcoma	Inadequate	Limited
Kidney cancer	Inadequate	Inadequate
Bladder cancer	Inadequate	Inadequate
Non Hodgkin's lymphoma	Inadequate	Limited
Childhood cancer	Inadequate	Inadequate
Total birth defects	Limited	Inadequate
Neural tube defects	Limited	Inadequate
Orofacial birth defects	Inadequate	Limited
Genitourinary birth defects	Limited*	Limited**
Abdominal wall defects	Inadequate	Inadequate
Gastrointestinal birth defects§	Inadequate	Inadequate
Low birth weight	Limited	Inadequate
Respiratory diseases or symptoms	Inadequate	Inadequate

"Inadequate": available studies are of insufficient quality, consistency, or statistical power to decide the presence or absence of a causal association.

"Limited": a positive association has been observed between exposure and disease for which a causal interpretation is considered to be credible, but chance, bias, or confounding could not be ruled out with reasonable confidence.

\* Hypospadias and epispadias

\*\* Renal dysplasia

§ The original estimates were given for "surgical corrections of gastroschisis and exomphalos"

## Review **Open Access**

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Porta D, Milani S, Lazzarino AI, Perucci CA, Forastiere F

*Environmental Health* 2009, **8**:60 doi:10.1186/1476-069X-8-60

**Table 2: Relative risk estimates for community exposure to landfills and incinerators**

<b>Health effect</b>	<b>Distance from the source</b>	<b>Relative Risk (Confidence Interval)</b>	<b>Level of confidence**</b>
<b>Landfills</b>			
<b><i>Congenital malformations</i> [24]</b>			
All congenital malformations	Within 2 km	1.02 (99% CI = 1.01-1.03)	Moderate
Neural tube defects	Within 2 km	1.06 (99% CI = 1.01-1.12)	Moderate
Hypospadias and epispadias	Within 2 km	1.07 (99% CI = 1.04-1.11)	Moderate
Abdominal wall defects	Within 2 km	1.05 (99% CI = 0.94-1.16)	Moderate
Gastroschisis and exomphalos*	Within 2 km	1.18 (99% CI = 1.03-1.34)	Moderate
<b><i>Low birth weight</i> [24]</b>	Within 2 km	1.06 (99% CI = 1.052-1.062)	High
Very low birth weight	Within 2 km	1.04 (99% CI = 1.03-1.06)	High

RESEARCH

Open Access

# Health impact assessment of waste management facilities in three European countries

Francesco Forastiere<sup>1\*</sup>, Chiara Badaloni<sup>1</sup>, Kees de Hoogh<sup>2</sup>, Martin K von Kraus<sup>3</sup>, Marco Martuzzi<sup>4</sup>, Francesco Mitis<sup>4</sup>, Lubica Palkovicova<sup>5</sup>, Daniela Porta<sup>1</sup>, Philipp Preiss<sup>6</sup>, Andrea Ranzi<sup>7</sup>, Carlo A Perucci<sup>1</sup> and David Briggs<sup>2</sup>

Waste landfills: 619 Italy+165 Slovakia+242England and Walles

**Table 7 Estimated health effects of exposures to landfills in the three countries as annual cases of congenital malformations and newborns of low birth weight**

	Italy			Slovakia			England		
	Expected cases	Additional cases	99% CI	Expected cases	Additional cases	99% CI	Expected cases	Additional cases	99% CI
All congenital anomalies	73	1.47	0.73 - 2.20	77	1.54	0.77 - 2.31	83	2.7	1.35 - 4.05
Neural tube defects	6	0.37	0.06 - 0.74	2	0.11	0.02 - 0.23	5	0.31	0.05 - 0.62
Hypospadias and epispadias	10	0.67	0.38 - 1.06	7	0.48	0.27 - 0.75	16	1.13	0.65 - 1.78
Abdominal wall defects	2	0.08	-0.09 - 0.24	12	0.60	-0.72 - 1.92	5	0.27	-0.32 - 0.86
Gastroschisis and exomphalos	2	0.27	0.05 - 0.51	12	2.16	0.36 - 4.09	5	0.85	0.14 - 1.61
Low birth weight	706	42.4	35.3-42.4	212	12.7	10.62 - 12.74	975	58.5	48.7 - 58.5

## Impatto sulla salute delle politiche di gestione dei rifiuti solidi urbani: i risultati del Progetto SESPIR

### Health impact assessment of policies for municipal solid waste management: findings of the SESPIR Project

Andrea Ranzi,<sup>1</sup> Carla Ancona,<sup>2</sup> Paola Angelini,<sup>3</sup> Chiara Badaloni,<sup>2</sup> Achille Cernigliaro,<sup>4</sup> Monca Chiusolo,<sup>5</sup> Federica Parmagnani,<sup>1</sup> Roberto Pizzuti,<sup>6</sup> Salvatore Scondotto,<sup>4</sup> Ennio Cadum,<sup>5</sup> Francesco Forastiere,<sup>2</sup> Paolo Lauriola,<sup>1</sup>

*Epidemiol Prev* 2014; 38 (5): 313-322

IMPIANTO	BUFFER DI ESPOSIZIONE	MISURA DI ESPOSIZIONE	OUTCOME SANITARIO	MISURA	INDICATORE*	REFERENZA
Inceneritori	3 km	PM <sub>10</sub> stimato da modelli	<ul style="list-style-type: none"> <li>incidenza di tumori</li> <li>nascite pre-termine</li> </ul>	RR 1,035 (IC95% 1,03-1,04) RR 1,30 (IC95% 1,08-1,57)	I.C. P	Elliott et al. 1996 <sup>18</sup> Candela et al. 2013 <sup>5</sup>
Discariche	2 km	Distanza	<ul style="list-style-type: none"> <li>anomalie congenite</li> <li>ricoveri respiratori</li> <li>annoyance odorigeno</li> <li>basso peso alla nascita</li> </ul>	RR 1,02 (IC99% 1,01-1,03) RR 1,05 (IC95% 1,01-1,08) 5,4%** RR 1,06 (IC99% 1,052-1,062)	I.C. P P I.C.	Elliott et al. 2001 <sup>19</sup> Studio ERAS <sup>20</sup> Herr et al. 2003 <sup>15</sup> Elliott et al. 2001 <sup>19</sup>
TMB	500 m	Distanza	<ul style="list-style-type: none"> <li>annoyance odorigeno</li> <li>sintomi respiratori</li> </ul>	5,4%** OR 3,18 (IC95% 1,24-8,36)	P P	Herr et al. 2003 <sup>15</sup> Herr et al. 2003 <sup>15</sup>

\* I.C. = Incidenza cumulativa sul periodo di simulazione (2008-2040); P = prevalenza annua  
I.C. = cumulative incidence on the simulation period (2004-2040); P = annual prevalence

\*\* Il valore si riferisce a dati di questionario, per cui non sono disponibili intervalli di confidenza  
Confidence intervals are not available, because this value refers to data from questionnaires.

**Tabella 1.** Misure di esposizione e di esito sanitario utilizzate per le valutazioni di impatto per ciascuna tipologia di impianto.

**Table 1.** Exposure and health outcome metrics used for health impact assessments for each type of facility.



ABOUT PEOPLE WORKING GROUPS ACTIVITIES MEDIA CONTACT US



## PUBBLICAZIONE

Epidemiol Prev 2018; 42 (5-6), settembre-dicembre

# Environmental health challenges from industrial contamination

### Articoli Supplemento

1. **ICSHNet. Environmental health challenges from industrial contamination**
2. **Environmental and health data needed to develop national surveillance systems in industrially contaminated sites**
3. **A review of exposure assessment methods for epidemiological studies of health effects related to industrially contaminated sites**
4. **Addressing complexity of health impact assessment in industrially contaminated sites via the exposome paradigm**
5. **Methods of health risk and impact assessment at industrially contaminated sites: a systematic review**
6. **A scoping review of the epidemiological methods used to investigate the health effects of industrially contaminated sites**
7. **Towards an assessment of the health impact of industrially contaminated sites: waste landfills in Europe**
8. **Cancer incidence in children and young adults living in industrially contaminated sites: from the Italian experience to the development of an international surveillance system**
9. **When is epidemiological research a helpful response to industrial contamination?**

<http://www.epiprev.it/pubblicazione/epidemiol-prev-2018-42-5-6-suppl-1>

# Towards an assessment of the health impact of industrially contaminated sites: waste landfills in Europe

Gavin Shaddick,<sup>1</sup> Andrea Ranzi,<sup>2</sup> Matthew L. Thomas,<sup>3</sup> Roman Aguirre-Perez,<sup>1</sup> Maria Bekker-Nielsen Dunbar,<sup>4</sup> Federica Parmagnani,<sup>2</sup> Marco Martuzzi<sup>5</sup>

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1,484 waste landfill sites reported by E-PRTR

HEALTH OUTCOME	RISK MEASURE	DISABILITY WEIGHT	DURATION (YEARS)
Low birth weight	RR: 1.06 (99% CI: 1.052-1.062)*	0.106	79.6
Congenital anomalies	RR: 1.02 (99% CI: 1.01-1.03)*	0.170	79.6
Respiratory diseases	RR: 1.05 (95% CI: 1.01-1.08)**	0.080	1.00
Annoyance from odour	Prop: 5.4%^	0.030	1.00

**RR:** relative risk; **Prop:** proportion of affected \* Exposure represented by 0-2 km \*\* Exposure represented by 0-5 km ^ Proportion based on data from questionnaires, confidence interval not available

**Table 1.** Risks, disability weights, and duration of disease for four health outcomes used in calculations of the health impacts associated with landfill sites (see Ranzi et al. for details).<sup>6</sup>

HEALTH OUTCOME	ACs (95%CI)	DALYs (95%CI)
Low birth weight	1,239 (1,110-1,307)	10,192 (9,371-11,030)
Congenital anomalies	70 (36-106)	958 (496-1,437)
Respiratory diseases	33,039 (0-63,829)	2,688 (0-5,106)
Annoyance from odour	1,582,624 (1,455,545-1,720,710)	47,505 (43,666-51,621)
Total	1,616,972 (1,487,370-1,759,540)	61,325 (56,618-66,265)

**ACs:** attributable cases; **DALYs:** disability adjusted life years

**Table 2.** Estimated health impacts (excess cases and DALYs) for the four health outcomes: medians and 95% confidence intervals from Monte Carlo simulations.



# RIFIUTI PERICOLOSI (1)

- **Vrijeheid et al, 2000 (review): the evidence for a causal relationship with hazardous waste sites and cancers “is still weak”**, highlighting specific cancers, as reported in more than one study: leukaemia, bladder, lung and stomach cancers.

The review **suggested a relationship with adverse pregnancy outcomes:** low birth weights, total birth defects and cardiac, musculoskeletal and central nervous system defects.

However, the authors stated that the studies were **still few to draw conclusions regarding causality**

- **WHO, 2015: Several diseases were reported in excess in single-site studies, but the study design and, in particular, the exposure evaluation, does not allow causal inference.**

...

Much better and more complete data are needed on informal waste management activities and illegal operations, **given the likely substantial magnitude of the health burden suffered by the people involved.**

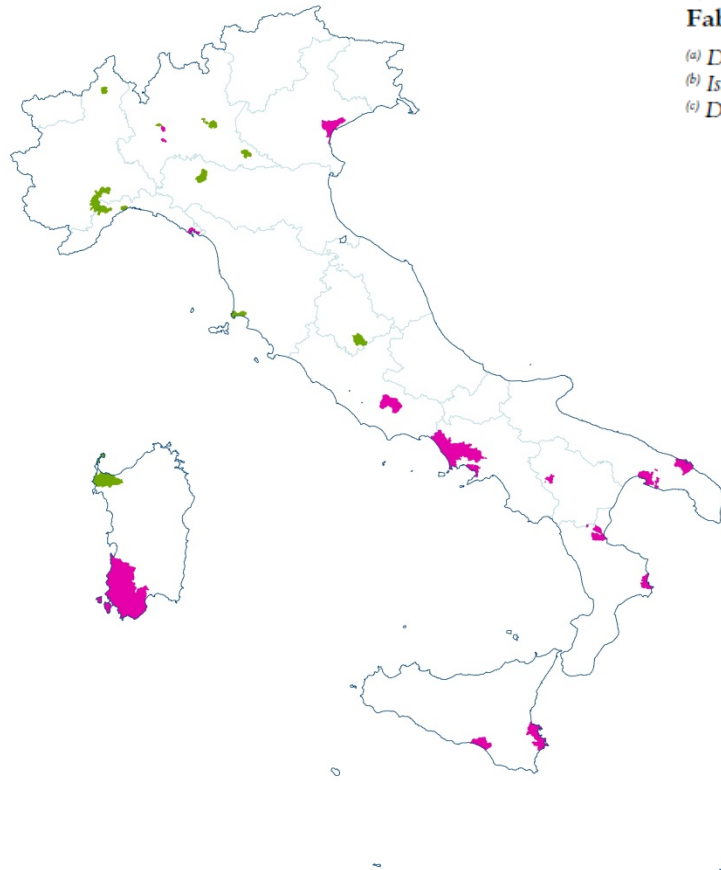
# A meta-analysis of mortality data in Italian contaminated sites with industrial waste landfills or illegal dumps

Lucia Fazzo<sup>(a)</sup>, Fabrizio Minichilli<sup>(b)</sup>, Roberta Pirastu<sup>(c)</sup>, Mirella Bellino<sup>(a)</sup>,  
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24 IPS with waste sites

1  
2



## Classe 1

**10 SIN con discariche di rifiuti pericolosi**  
(50 comuni; 771,898 residenti)

## Classe 2

**14 SIN con smaltimento illegale**  
(155 comuni; 3,192,527 residenti)



## **I 24 SIN sono stati così classificati**

### **Classe 1: Discariche controllate di rifiuti pericolosi: 10 SIN**

Porto Torres; Cengio e Saliceto; Cogoleto-Stoppani; Mantova; Piombino; Sesto San Giovanni; Terni; **Brescia-Caffaro**; Fidenza, Pieve Vergonte

### **Classe 2: Siti di smaltimento abusivo: 14 SIN**

Fiume Sacco; Cerro al Lambro; Sulcis; Taranto, Venezia- Porto Marghera; Litorale Vesuviano; Domizio flegreo, Pioltello Rodano; Pitelli; Brindisi; Crotone; Gela, Priolo; Tito

Sono stati, esclusi i seguenti SIN:

- Balangero ed Emares, nei quali le discariche sono esclusivamente a servizio del materiale proveniente dalle cave di amianto
- Manfredonia, unico SIN ad avere discariche controllate di Rifiuti Solidi Urbani
- Massa Carrara, che oltre ad avere una discarica, ha anche un inceneritore

Il Sito di Bussi sul Tirino allora non incluso in SENTIERI

**Quindi, in totale, la meta-analisi include 24 SIN  
(205 comuni; 3,964,425 residenti al censimento 2001)**

# A meta-analysis of mortality data in Italian contaminated sites with industrial waste landfills or illegal dumps

Lucia Fazzo<sup>(a)</sup>, Fabrizio Minichilli<sup>(b)</sup>, Roberta Pirastu<sup>(c)</sup>, Mirella Bellino<sup>(a)</sup>,  
Fabrizio Falleni<sup>(a)</sup>, Pietro Comba<sup>(a)</sup> and Fabrizio Bianchi<sup>(b)</sup>

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## Abstract

**Objectives.** Adverse effects of waste management represent a public health issue. Mortality meta-analysis in Italian National Priority Contaminated Sites (NPCSs) with industrial waste landfills or illegal dumps is presented.

**Methods.** 24 NPCSs include industrial waste landfills or illegal dumps. Class 1 (10 NPCSs with industrial waste landfills) and Class 2 (14 NPCSs with illegal dumps) were categorized. Random-effects model meta-analyses of Standardized Mortality Ratios non-adjusted (SMRs) and adjusted for Deprivation (DI-SMRs) computed for each CS (1995-2002) were performed for overall 24 NPCSs and the two classes. The North-Southern gradient was considered.

**Results.** 24 CSs pooled-SMRs are significantly increased in both genders for cancer of liver (men: SMR = 1.13; women: SMR = 1.18), bladder (men: SMR = 1.06; women: SMR = 1.11), and for cirrhosis (men: SMR = 1.09; women: SMR = 1.13). In Class 2 the increase is confirmed in both genders for liver and bladder cancers and for cirrhosis and in men only for lung cancer. Congenital anomalies and adverse perinatal conditions are not increased.

**Conclusion.** The results are consistent with the hypothesis of adverse health effects of non-adequately managed hazardous waste. Causal interpretation is not allowed, but the meta-analytic approach provides more confidence in the findings.

# RIFIUTI PERICOLOSI (2)

Fazzo et al. *Environmental Health* (2017) 16:107  
DOI 10.1186/s12940-017-0311-8

Environmental Health

REVIEW

Open Access

## Hazardous waste and health impact: a systematic review of the scientific literature



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**Methods.** Applying transparent and *a priori* defined methods:

1. Specify the research question, in terms of “**Population-Exposure-Comparators-Outcomes**” (PECO). Population: people living near hazardous waste sites; Exposure: exposure to hazardous waste; Comparators: all comparators; Outcomes: all diseases/health disorders.
2. **Carry out the literature search**, in Medline and EMBASE.
3. **Select studies** for inclusion: original epidemiological studies, published between 1999 and 2015, on populations residentially exposed to hazardous waste.
4. **Assess the quality of selected studies**, taking into account study design, exposure and outcome assessment, confounding control.
5. **Rate the confidence in the body of evidence** for each outcome taking into account the reliability of each study, the strength of the association and concordance of results.

(Barrett, 2014; Johnson et al, 2014; Woodruff TJ, 2014)

<https://ehjournal.biomedcentral.com/articles/10.1186/s12940-017-0311-8>

## The evidence was rated in three grades:

partly derived from the approach used by the International Agency for Research on Cancer (IARC) Monographs, **but specifically defined**, as follows.

- **Sufficient:** More than one study of high or moderate/high quality (rated 5-4) report positive findings with strong (high values of relative risk) and precise, overall consistent association. Alternative explanations, in particular the role of random variability, bias, confounding factors, can be reasonably excluded. The force of association, considerations on dose-response relationship, time coherence and biological plausibility further support causality.
- **Limited:** More than one study of high or moderate/high quality (rated 5-4) report positive findings with strong (high values of relative risk) and precise association. Among the concurring different risk estimates, the results of higher quality studies was given higher weight. A role of random variability, bias and confounding factors may not be completely excluded.
- **Inadequate:** Less than two studies of moderate or higher quality rate (rated 5-3) report findings of risk in excess; or, there are two or more studies of moderate/high quality, but the results in excess are not consistent and/or the associations are weak and inaccurate.

# Results

1,680 records retrieved from searching published in the 1999-2015 period. **57 papers of epidemiological investigations were selected for the evidence evaluation.**

The association between **95 health outcomes** (diseases and disorders) and residential exposure to hazardous waste sites was evaluated. Health effects of residential hazardous waste exposure, previously partially unrecognized, were highlighted.

- **Sufficient evidence** was found of association between **exposure to oil industry waste that releases high concentrations of hydrogen sulphide and acute symptoms;**
- **Limited for:** liver, bladder, breast and testis cancers, non-Hodgkin lymphoma, asthma, congenital anomalies overall and anomalies of the neural tube, urogenital, connective and musculoskeletal systems, low birth weight and pre-term birth;
- **Inadequate** for the other health outcomes.

# Concluding remarks

The results, **although not conclusive, provide indications that more effective public health policies on hazardous waste management are urgently needed.**

International, national and local authorities should oppose and eliminate poor, outdated and illegal practices of waste disposal, including illegal transboundary trade, and increase support regulation and its enforcement.



## RIFIUTI ELETTRONICI (E-WASTE)

Given the pollutants involved, health effects from treatment of e-waste **may include neurodevelopmental outcomes.**

A recent review recorded plausible outcomes related to alterations in **thyroid function**, associations of exposure to chromium, manganese and nickel with **lung function, adverse birth outcomes** (preterm birth, low birth weight, stillbirth, and congenital malformations), **behavioural alterations**, as well as **DNA damage and chromosomal aberrations in lymphocytes**. (*Grant K et al, 2013: [http://dx.doi.org/10.1016/S2214-109X\(13\)70101-3](http://dx.doi.org/10.1016/S2214-109X(13)70101-3)*)

This relatively recent and growing problem needs to be addressed by suitable epidemiological studies in vulnerable populations (such as pregnant women and children).

*Da: WHO, 2015*

## HAZARDOUS WASTE: A CHALLENGE FOR PUBLIC HEALTH

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## The need for:

### 1. Public policies :

- strong measures **to counteract the illegal trafficking** of hazardous waste;
- implementation of **the best practices** in the management of hazardous waste;
- **environmental remediation** of waste contaminated sites

### 2. Epidemiological studies:

- **evaluation of exposure** to a mixture of chemicals;
- **multiple diseases endpoints**: birth defects, fetal deaths, cognitive developments and physical growth (children); infections, cancers, diabetes, cardiovascular, liver and kidney diseases, and endocrine and reproductive effects (adults)

# Grazie per l'attenzione

.. Promoting circular economy, in line with the European Union waste hierarchy, which gives priority to reduced production and re-use or recycling of waste over incineration and landfilling.

Figure 1. EU waste management hierarchy



*Da: WHO, 2015*