Public Health Scotland

Municipal Solid Waste Incineration and Reported Health Effects

Rapid Evidence Review

30 March 2022

Version 1.0

Contents

1. Introduction

In 2009, the Scottish Environment Protection Agency (SEPA) commissioned a review by Health Protection Scotland (HPS) on the evidence of health effects associated with incineration of clinical, hazardous, industrial, and municipal waste[1]. This was to facilitate compliance with the regulatory requirements outlined in the Waste Incinerators Directive 2000/76/EC and further detailed in the Waste Incineration (Scotland) Regulations 2003.

The HPS review presented the state of knowledge at that time based on the advice of experts on the subject, evaluations of peer-reviewed primary and review literature, and reports published in the grey literature. The review found that studies on Municipal Solid Waste Incineration (MSWI) dominated the literature and reported that associations described in the literature included cancers, birth outcomes and respiratory health effects, among others. However, the review concluded that findings were inconsistent among studies and that making conclusive statements about the health effects associated with incinerator emissions was hampered by poor methodological quality of some studies and wide variations in study methods. A consistent theme within the literature that the lack of conclusive or consistent evidence did not preclude there being some adverse effect which has defied confirmation to date. The review also concluded that any risk to human health associated with newer incinerators, operated within current regulations, was likely to be minimal and very difficult to detect.

To inform their review of the role of incineration in the waste hierarchy in Scotland, Scottish Government Zero Waste Unit requested that Public Health Scotland conduct a review of more recent evidence on the health effects of incineration and provide a submission to the Independent Chair of the review.

Due to the tight timescales involved, it was agreed that a rapid review would be conducted, the limitations of which are detailed in **Section 2** of this report.

2. Methods

2.1. Aims and scope

The aim of this rapid review was to evaluate the evidence relating to (non-occupational) physical health effects of municipal solid waste incineration (MSWI) on individuals and populations living in the vicinity of incinerators. Whilst the 2009 HPS report also reviewed evidence of health effects associated with clinical, hazardous, and industrial waste, it was agreed that this update would address only MSWI.

2.1.1. Exposures and health outcomes

The aim of the rapid review was defined by considering the populations, exposures, comparators, outcomes, timings, and settings of interest (PECOTS) (Rooney et al., 2014)[2]. This was considered together with the relevant source, pathway, receptor model in identifying the eligibility criteria of studies and for devising the search strategy.

Relevant exposures and health outcomes (based on findings from the HPS 2009 report) included the following:

Exposures:

- Air pollution
    - Persistent Organic Pollutants (POPs)
        - Dioxins and Dioxin-like compounds (PCDD)
        - Furans (PCDF)
        - Polychlorinated Biphenyls (PCBs)
    - Bio-aerosols
    - Polycyclic Aromatic Hydrocarbons (PAHs)

    - Particulate matter
    - Heavy metals
- Water pollution, soil contamination, food
    - Heavy metals
    - POPs
    - PAHs

Health Effects:

- Cancer
- Birth outcomes
- Mortality
- Cardiovascular disease
- Respiratory disease

2.2. Search strategy for identification of peer-reviewed studies

The search strategy for the rapid review comprised combinations of the source, exposure, and health-related terms, and is detailed in **Appendix 1**. Keyword search terms were mapped to their subject headings and a combination of keyword and MeSH terms were used to systematically search Ovid MEDLINE and Web of Science electronic databases.

2.2.1. Eligibility criteria

Due to time restrictions, the following eligibility criteria were set for the rapid review:

- Peer-reviewed systematic reviews or meta-analyses only (not primary research papers).
- Studies reported in English.
- Studies published from 2008 up to current date.
- Studies relating to MSWI only.

2.2.2. Selection of articles for full-text review

Due to time restrictions, the rapid review was conducted by a single reviewer only. Abstracts and titles of all articles returned by the search strategy were screened in Covidence to identify articles that may be relevant for full-text review. Following full-text review, ineligible articles were excluded, and the reasons recorded.

2.2.3. Data extraction and management

Information was abstracted to data extraction forms that were customised for systematic reviews (**Appendix 2**). The flow of information through the different phases of the review was summarised on a four-phase diagram and is presented in **Section 3**. Conclusions from the 2009 HPS report were updated based on new evidence identified.

2.2.4. Review limitations

Only peer-reviewed systematic review articles relating to municipal solid waste incineration, published in English language between 2008 and present, have been considered due to the rapid nature of this review. Only Ovid MEDLINE and Web of Science databases were searched. For this reason, it is possible that some evidence may not have been identified or reviewed.

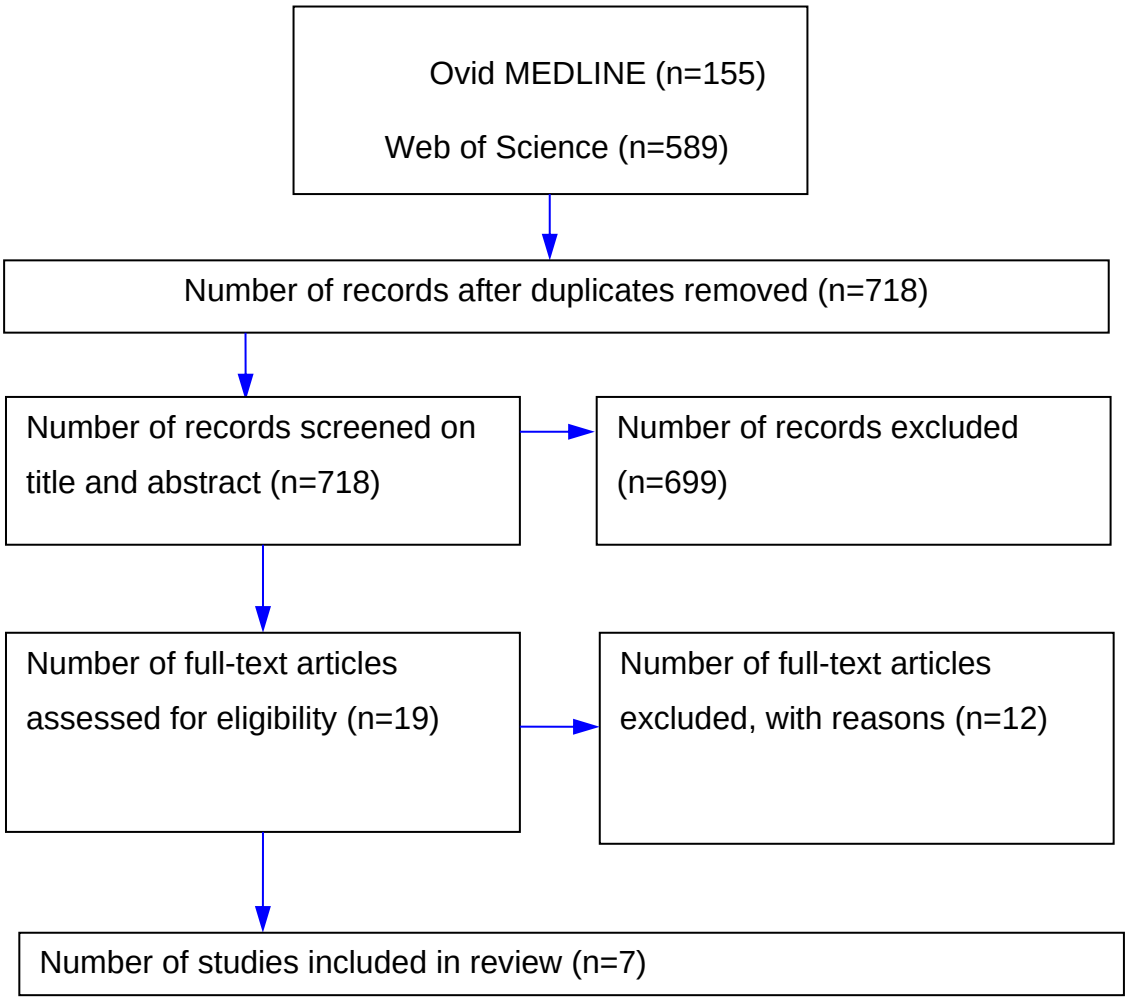
The rapid review was conducted by only one reviewer.

3. Results

Searches identified a total of 718 unique citations in peer-reviewed literature. Following screening at abstract and title level, 19 articles were retained for full-text assessment. Following full-text assessment, 7 articles were retained for inclusion in the final review. Summary tables for these articles is presented in **Appendix 2**.

Search findings are summarised in Figure 1.

Figure 1: Flow diagram of search results



A range of different health outcomes were considered by each of the authors.

3.1. Overview of included reviews

In the earliest of the included reviews, Porta et al. (2009) reviewed the evidence on associations between incinerators and birth outcomes, respiratory disease, and cancers[3].

In 2013, Mattielo et al. (2013) evaluated primary studies on communities living near incinerators, most of which focussed on cancer or birth defects[4]. Other health outcomes considered were respiratory diseases, cardiovascular diseases, total mortality, and skin diseases.

Both Ashworth et al. (2014)[5] and Kihal-Talantikite et al. (2017)[6] reviewed the literature on incineration and adverse birth and neonatal outcomes only.

Cole-Hunter et al. (2020) summarised evidence on the potential health effects of waste-to-energy and refuse-derived fuel combustion emissions, including developmental outcomes, as well as cancer and non-cancer risks[7].

Domingo et al. (2020) focussed on evidence relating to health effects (including incidence of cancer and cancer mortality) in individuals living in the vicinity of hazardous waste incinerators[8]. However, to gain a better understanding of the problem, the authors also included some studies on cancer and other adverse health effects near municipal solid waste incinerators in their review. The authors did not, however, derive any overall conclusions on the balance of evidence, other than to conclude that the results were not homogenous, and even contradictory in some cases. Therefore, findings of the review have not been included in narrative for individual health outcomes.

In the most recent of the reviews identified, Vinti et al. (2021) sought to update and expand the epidemiological evidence on the association between municipal solid waste management practices (including incineration) and resident populations' health risks[9]. Outcomes included mortality, birth and neonatal outcomes, cancer, and cardiovascular and respiratory issues.

The exposure period for many of the studies included in these reviews referred to those prior to the implementation of the Waste Incineration Directive, therefore evidence will not be completely transferable to modern incinerators.

Furthermore, all reviews referred to methodological issues with primary studies such as insufficient correction for confounding and limitations in the exposure assessment, which lower the confidence in the findings.

3.2. Reproductive effects and birth outcomes

All the reviews identified by the literature search addressed reproductive effects and/or birth outcomes to varying degrees.

Mattielo et al. reported that there was no significant association between exposure to emissions from incinerators and reproductive effects[4]. Of the birth outcomes studied, they reported no significant associations with low birth weight, inconsistent evidence for an association with orofacial defects, and increased risks for congenital urinary tract defects, spina bifida, cardiac defects and renal dysplasia.

Ashworth et al. reported no evidence of association with sex ratio, low birth weight (LBW) or stillbirth and limited evidence for an association with multiple births[5]. With respect to congenital defects, the authors also noted that most studies pointed to no association with congenital anomalies (combined) although some studies pointed to weak associations with neural tube and heart defects with stronger associations for facial clefts and urinary tract defects.

Porta et al. (2009) reported that the evidence for LBW was inadequate[3]. This was likewise for associations with several congenital defects, notably total birth defects, neural tube defects, abdominal wall defects and gastrointestinal birth defects. However, the authors rated the evidence for associations with orofacial or genitourinary defects, in particular renal dysplasia, as limited.

Kihal-Talantikite et al. considered only two primary articles relating to exposure to incinerators and reproductive outcomes, one of which was previously considered in

the 2009 HPS report[6]. The authors reported some contradiction in findings for reproductive outcomes in these studies.

Cole-Hunter et al. included only two epidemiological papers in their review of health impacts of waste-to-energy plants, and only one looking at developmental outcomes[7]. The authors concluded that the results from the studies provided little evidence of an adverse impact of waste-to-energy emissions on health outcomes.

Vinti et al. considered the findings of 13 primary papers relating to the health impacts of incinerators[9]. Whilst they reported that a few studies provided evidence of adverse birth and neonatal outcomes including preterm births, congenital heart defects, genital system defects, hypospadias, and urinary tract birth defects, they also noted that several studies reported no evidence of many adverse birth outcomes.

3.3. Cancer

Several of the reviews identified in this rapid review sought to explore the evidence of association between incinerators and cancers.

Porta et al. identified 11 primary papers investigating cancer risk in relation to incinerators[3]. The authors concluded that, whilst there were uncertainties that limited the overall interpretation of findings, there was limited evidence of increased risk of all cancers, cancers of the stomach, colon, liver, and lung, non-Hodgkins lymphoma, and soft-tissue sarcoma in populations living near incinerators. The authors concluded that evidence of association with cancer of the larynx, kidney and bladder, and childhood cancers was inadequate.

Mattiello et al. noted that evidence published in the period 1969 - 1996 consistently reported a detectable risk of some cancers in populations near incinerators[4]. However, they also noted that in comparing findings between older and newer evidence, the findings for cancer incidence and mortality were largely inconsistent. Overall, the authors reported limited evidence for an association between incinerators and both soft-tissue sarcoma and all cancers, and inadequate evidence of a link between incinerators and all other individual cancers.

Vinti et al. reported that overall health outcome results were mixed or limited, but they found no evidence suggesting an increased risk of cancer associated with incinerators[9].

3.4. Respiratory issues

Several of the new reviews considered the evidence on respiratory issues associated with incineration.

Porta et al. considered several studies that investigated respiratory outcomes in populations living near a range of incinerator types[3]. Overall, the authors concluded that there were some indications of an increased risk of respiratory diseases, especially in children. However, they also noted that the potential for residual confounding and limitations in outcome assessment meant that the overall evidence would be considered limited.

Mattiello et al. considered the findings of two studies exploring the association between incinerators and respiratory diseases[4]. Overall, the authors considered the evidence of association to be inadequate.

Vinti et al. found no evidence of increased risk of respiratory disease in the vicinity of incinerators[9].

3.5. Other outcomes

Mattiello et al. concluded that the evidence for association between incinerators and cardiovascular and skin diseases was inadequate[4].

Vinti et al. found no evidence of increased risk of cardiovascular disease in the vicinity of incinerators[9].

4. Conclusions on individual health outcomes

The conclusions drawn in the 2009 HPS evidence review are reproduced below, and updated conclusions, based on the findings of this rapid review, are also presented.

4.1. Reproductive effects and birth outcomes

In 2009, the HPS evidence review concluded:

> Reproductive and birth outcomes have been studied extensively, ranging from sex (M/F) ratios, twinning rates, birth outcomes (infant deaths) and congenital defects such as facial cleft. Past reviews have generally not identified conclusive evidence for consistent adverse effects. Of the more recent primary studies considered some additional evidence of adverse effects was noted, though again there were inconsistencies and the magnitude of reported effects varied.

Evidence on reproductive effects and birth outcomes has been considered to varying degrees by all the reviews identified in this rapid review. The evidence base is still described by authors as heterogenous and even contradictory. Whilst some of the more recent evidence reports positive associations with some outcomes, study limitations have been noted by review authors. Therefore, whilst some new evidence has identified individual positive associations, these are still, in some cases, contradicted by other negative studies and are not, therefore, conclusive. Therefore, our conclusion from the HPS 2009 report on developmental outcomes associated with incineration remains unchanged by the new evidence identified.

4.2. Cancer

In 2009, the HPS evidence review concluded:

> In total, while still not absolutely conclusive, there is now more evidence suggesting a plausible association between the risk of some forms of

(non-occupational) cancer and emissions from incinerators operated in the past, when emission levels were generally higher than would be acceptable today.

Several newly identified reviews considered the evidence on cancer risk associated with exposure to incinerators. In general, whilst authors noted inadequate, limited or no evidence of an association, it was again acknowledged that a detectable risk of some cancers was present in populations near incinerators operated in the past. However, it was also noted that findings between older and newer evidence were largely inconsistent. Therefore, our conclusion from the HPS 2009 report on cancers associated with incineration remains unchanged by the new evidence identified.

4.3. Respiratory issues

In 2009, the HPS evidence review concluded:

> Overall there is a lack of consistent evidence for an association between incineration and adverse respiratory health effects.

Recent reviews have considered the evidence for association between incinerators and respiratory diseases to be inadequate or absent. Therefore, our conclusion from the HPS 2009 report on respiratory diseases associated with incineration remains unchanged by the new evidence identified.

4.4. Other outcomes

No new evidence has been identified to demonstrate an association between incinerators or either cardiovascular or skin diseases.

5. Overall conclusions

The overall conclusions drawn from the 2009 HPS review were as follows:

> Based on the limitations of available research literature, attempting to provide an overall conclusion on the health effects of incineration in total is particularly difficult.
>
> For waste incineration as a whole topic, the body of evidence for an association with (non-occupational) adverse health effects is both inconsistent and inconclusive. However, more recent work suggests, more strongly, that there may have been an association between emissions (particularly dioxins) in the past from industrial, clinical and municipal waste incinerators, and some forms of cancer, before more stringent regulatory requirements were implemented.
>
> For individual incineration waste streams (clinical, hazardous, industrial and municipal), the evidence for an association with (non-occupational) adverse health effects is inconclusive.
>
> The magnitude of any past health effects on residential populations living near incinerators that did occur is likely to have been small.
>
> The majority of research work in this field is of historical relevance but tells us little about the current risk of (non-occupational) adverse effects potentially associated with incineration plants in operation now.
>
> Levels of airborne emissions from individual incinerators should be lower now than in the past, due to stricter legislative controls and improved technology. Hence, any risk to the health of a local population living near an incinerator, associated with its emissions, should also now be lower.

The findings of this latest rapid review have served to reinforce the conclusions drawn in the 2009 HPS report, with any new evidence continuing to be either absent,

inadequate, or limited. Furthermore, much of the new evidence on specific outcomes has also continued to be inconsistent or even contradictory in nature.

It is, however, still reasonable to conclude that any risk to human health associated with emissions from newer incinerators, operated within the current regulations, is very likely to be less than was the case previously (and the case for much of the evidence considered in the literature identified by this rapid review).

Whilst the conclusion on (non-occupational) human health effects associated with incineration (under modern operating conditions) is relatively reassuring, where new incinerators are planned and where there are sensitive receptors, there will still be a need to take account of background ambient air quality especially in areas with other sources of similar emissions (including road traffic and other industrial sources).

Commitment to limiting the total amount of waste destined for energy recovery via thermal treatment, as well as the use of existing planning controls, should also continue to minimise public exposure to potential adverse health impacts of incineration.

6. References

1. Incineration of Waste and Reported Human Health Effects [Internet]. [cited 2022 Mar 23]. Available from: **https://hpspubsrepo.blob.core.windows.net/hps-website/nss/2407/documents/1_incineration-of-waste-and-reported-human-health-effects.pdf**

2. Rooney AA, Boyles AL, Wolfe MS, Bucher JR, Thayer KA. Systematic review and evidence integration for literature-based environmental health science assessments. Environmental health perspectives. 2014 Jul;122(7):711-8.

3. Porta D, Milani S, Lazzarino AI, Perucci CA, Forastiere F. Systematic review of epidemiological studies on health effects associated with management of solid waste. Environmental health. 2009 Dec;8(1):1-4.

4. Mattiello A, Chiodini P, Bianco E, Forgione N, Flammia I, Gallo C, Pizzuti R, Panico S. Health effects associated with the disposal of solid waste in landfills and incinerators in populations living in surrounding areas: a systematic review. International journal of public health. 2013 Oct;58(5):725-35.

5. Ashworth DC, Elliott P, Toledano MB. Waste incineration and adverse birth and neonatal outcomes: a systematic review. Environment international. 2014 Aug 1;69:120-32.

6. Kihal-Talantikite W, Zmirou-Navier D, Padilla C, Deguen S. Systematic literature review of reproductive outcome associated with residential proximity to polluted sites. International journal of health geographics. 2017 Dec;16(1):1-39.

7. Cole-Hunter T, Johnston FH, Marks GB, Morawska L, Morgan GG, Overs M, Porta-Cubas A, Cowie CT. The health impacts of waste-to-energy emissions: a systematic review of the literature. Environmental Research Letters. 2020 Dec 1;15(12):123006.

8. Domingo JL, Marquès M, Mari M, Schuhmacher M. Adverse health effects for populations living near waste incinerators with special attention to hazardous waste incinerators. A review of the scientific literature. Environmental Research. 2020 Aug 1;187:109631.

9. Vinti G, Bauza V, Clasen T, Medlicott K, Tudor T, Zurbrügg C, Vaccari M. Municipal solid waste management and adverse health outcomes: A systematic review. International journal of environmental research and public health. 2021 Jan;18(8):4331.

Appendix 1. Search strategy

Ref	Search term or string
1	Incineration/ or co-incineration.mp. or incinerat*.mp.
2	thermal treatment.mp.
3	combustion process*.mp.
4	pyrolysis.mp.
5	gasification.mp.
6	plasma gasfication.mp.
7	Coal Ash/ or bottom ash.mp. or fly ash.mp.
8	Dioxins/ or "Dioxins and Dioxin-like Compounds"/ or dioxins.mp.
9	Polychlorinated Dibenzodioxins/ or PCDD.mp.
10	Dibenzofurans, Polychlorinated/ or PCDF.mp. or Furans/ or furan.mp.
11	Polychlorinated Biphenyls/ or PCB.mp.
12	(persistent organic pollutants or POPs).mp.
13	Polycyclic Aromatic Hydrocarbons/ or Mutagens/
14	bioaerosols.mp.
15	Metals, Heavy/ or heavy metals.mp.
16	Particuate matter/ or ultrafine particles.mp. or fine particles.mp.
17	((Environment$ adj3 Pollut*) or Environmental Monitoring or Air Pollut$ or Water Pollut$ or Soil Pollut$ or Food contaminat$).mp.
18	("Municipal solid waste incinerator" or MSW?).mp.
19	(waste-to-energy or energy from waste).mp.
20	Hazardous Waste/ or Recycling/ or Waste Management/ or Refuse Disposal/ or Industrial Waste/ or Medical Waste Disposal/ or "Conservation of Natural Resources"/
21	Environmental Pollution/ae or Air Pollution, Indoor/ae or Water Pollution/ae or Food Contaminaton/ae

Ref	Search term or string
22	*Environmental Health/ or Occupational Health/ or Urban Health/ or Maternal Health/or Reproductive health/ or Public Health/ or Child Health/
23	(Environment$ health or maternal health or urban health or reproductive health or public health or child health).mp.
24	*morbidity/ or morbidity.mp.
25	isch?emic heart disease.mp. or exp Myocardial ischemia/
26	cancer.mp. or exp Neoplasms/
27	respiratory effects.mp.
28	1 or 2 or 3 or 4 or 5 or 6
29	18 or 19 or 20
30	21 or 22 or 23 or 24 or 25 or 26 or 27
31	28 and 29 and 30
32	7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17
33	29 and 30 and 32
34	31 or 33
35	limit 34 to yr="2008 -Current"
36	(((systematic or state-of-the-art or scoping or literature or umbrella) adj (review* or overview* or assessment*)) or "review* of reviews" or meta-analy* or metaanaly* or ((systematic or evidence) adj1 assess*) or "research evidence" or metasynthe* or meta-synthe*).tw. or exp Review Literature as Topic/ or exp Review/ or Meta-Analysis as Topic/ or Meta-Analysis/ or "systematic review"/
37	35 and 36

Appendix 2. Summary information - reviews

Author (Year)	Aim of Review (years covered)	Outcomes (incineration)	Conclusions/Comments
Ashworth (2014)	To systematically review epidemiologic studies evaluating the relationship between waste incineration and the risk of adverse birth and neonatal outcomes. (No date range specified).	Congenital anomalies Fetal growth and preterm birth Stillbirths, neonatal deaths, infant deaths, spontaneous abortions and spontaneous fetal deaths Twinning Sex ratio at birth	"Our review found limited evidence for an association between incineration and twinning and no evidence, based on few studies, of an association with low birth weight, stillbirths or sex ratio. Most studies report no association with all major congenital anomalies combined, but this may be too crude a measure to be meaningful in this context; however, some studies point towards weak associations for neural tube and heart defects, with stronger associations for facial clefts and urinary tract defects."
Cole-Hunter (2020)	To systematically review and summarise current evidence on the potential health effects (benefits and risks) of exposure to WtE/RDF-related combustion emissions. (until 20th March 2020)	"Health" used as general search term. Papers identified looked at developmental outcomes, cancer and non-cancer risks.	"The limited evidence from the two epidemiological studies, along with HRAs, LCAs and emissions monitoring studies suggests that the risks to human health from emissions of appropriately designed, properly managed (including feedstock), state-of-the-art WtE incineration plants are relatively lower compared to prevailing alternative waste management practices, including incineration of unsorted waste (without energy recovery) and landfill." Only two epi papers identified so conclusions drawn are limited.

Author (Year)	Aim of Review (years covered)	Outcomes (incineration)	Conclusions/Comments
Domingo (2020)	To review the information on health effects - including the incidence of cancer and cancer mortality - for the people residing in the vicinity of HWIs. (1996 – 2020)	Cancers Respiratory symptoms and morbidity Birth outcomes Mortality Reproductive effects	"A good number of epidemiological/ecological studies have been also conducted. In general terms, the results are not homogenous, being even contradictory in some cases." Authors included 30 studies relating to MSWI and a range of health outcomes. However, articles were only summarised and no overall conclusion was derived (other than to say results are not homogenous).
Kihal – Talantikite (2017)	To assess the evidence on the association between residential proximity to industrial sites (hazardous waste sites, industrial facilities and landfill sites) and adverse pregnancy outcome (low birth weight, preterm birth, small for gestational age, intrauterine growth retardation, infant mortality, congenital malformation). (1990 – date)	Low birth weight Preterm birth Small for gestational age Intrauterine growth retardation Infant mortality Congenital malformation	"There is suggestive evidence from the post-1990 literature that residential proximity to polluted sites (including landfills, hazardous waste sites and industrial facilities) might contribute to adverse reproductive outcomes, especially congenital malformations and low birth weight—though not mortality. This body of evidence has limitations that impede the formulation of firm conclusions, and new, well-focused studies are called for." Only two papers relating to incinerators identified so conclusions drawn are limited.

Author (Year)	Aim of Review (years covered)	Outcomes (incineration)	Conclusions/Comments
Mattiello (2013)	To carry out an independent systematic review of the scientific literature on the potential health hazards for the environment and people living nearby landfills and incinerators.	Cancers Birth defects Respiratory diseases Cardiovascular diseases Total mortality Skin disease	“Environmental epidemiology of waste disposal suffers from limitations conducive to inadequate or contrasting results." Authors described the evidence for incineration and a range of outcomes: All cancers (limited) – soft tissue sarcoma (limited), all other individual cancers (inadequate) All birth defects and reproductive disorders (limited) Low birth weight (inadequate) – orofacial and genitourinary tract defects (limited), all other individual outcomes (inadequate) Respiratory diseases or symptoms (inadequate) Cardiovascular diseases (inadequate) Skin diseases (inadequate)

Author (Year)	Aim of Review (years covered)	Outcomes (incineration)	Conclusions/Comments
Porta (2009)	To systematically review the available epidemiological literature on the health effects in the vicinity of landfills and incinerators and among workers at waste processing plants to derive usable excess risk estimates for health impact assessment. (1983-2008)	Cancer Birth defects and reproductive disorders Respiratory diseases or symptoms	"The studies we have reviewed suffer from many limitations due to poor exposure assessment, ecological level of analysis, and lack of information on relevant confounders. With a moderate level confidence, however, we have derived some effect estimates that could be used for health impact assessment of old landfill and incineration plants. The uncertainties surrounding these numbers should be considered carefully when health effects are estimated." Authors described the evidence for incineration and a range of outcomes: Limited evidence for stomach, colon, liver, lung cancer, soft tissue sarcoma, non-Hodgkin's lymphoma or all cancers. Inadequate evidence larynx, kidney, bladder or childhood cancers. Inadequate evidence for total birth defects, neural tube, abdominal wall, and GI birth defects. Limited evidence for orofacial or genitourinary birth defects. Inadequate evidence for low birth weight. Inadequate evidence for respiratory disease.

Author (Year)	Aim of Review (years covered)	Outcomes (incineration)	Conclusions/Comments
Vinti (2021)	To update and expand the epidemiological evidence on the association between MSW management practices and resident populations' health risks. (January 2005 – January 2020)	Mortality Birth and neonatal outcomes Cancer Cardiovascular issues Respiratory issues	"There was some evidence of an increased risk of adverse birth and neonatal outcomes for residents near landfills, incinerators, and dumpsites/open burning sites." "Additionally, there was some evidence of increased risk of mortality associated with living near incinerators. However, in many cases, the evidence was inadequate to establish a strong relationship between a specific exposure and outcomes. Additionally, most landfills and incinerators investigated referred to the old generation of technologies, although studies on new generations' plants are starting to be published. Therefore, future research should focus on new generation landfills and incinerators, to have a more specific analysis of these upgraded MSW practices."