Submission on a Notified Resource Consent Application

Form 13

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4),
Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I ~~am~~/am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I ~~am~~/am not directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:

_____

_____

_____

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ■ **are neutral** parts or all of ☐
include—

- *the reasons for your views.*

1. I am concerned that the operation is directly across the river from the college rugby field, Te Wharekura Nga Purapura Te Aroha (School), Early Learning Centres (Barnyard, **Puawai Kohanga Reo, Early learning Centre (Apakura)),** and Te Wananga O Aotearoa. As well as surrounding houses and netball court

   I am concerned of the emissions from these operations on our Tamariki (Pre-school) and tauira (students), and the community.

   I believe more study is required on the impact on the environment, on the community and township.

I seek the following decision from the consent authority:
give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

_____

_____

_____

I do not wish to be heard in support of my submission.

I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

I ~~request~~/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: __Kerry Emery_____
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 13/10/23 ___ Contact person: _____
(name and designation, if applicant)

Postal address: _____
(or alternative method of service under section 352 of the Act):

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.
The closing date for serving submissions on the consent authority is the 20th working day after the date on which public or limited notification is given. If the application is subject to limited notification, the consent authority may adopt an earlier closing date for submissions once the consent authority receives responses from all affected persons.
If you are a trade competitor, your right to make a submission may be limited by the trade competition provisions in Part 11A of the Resource Management Act 1991.
You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.
If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840
If you make your submission by electronic means, a signature is not required. Electronic submissions on resource consent applications must be directed to submissions@waipadc.govt.nz.
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Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

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LOCATION: 401 Racecourse Road, Te Awamutu

I am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:
__*My submission relates to the whole application.*

_____

_____

_____

My submission is:

Support parts or all of ☐ ✔ **Oppose** all of **are neutral** parts or all of ☐
include—

- *the reasons for your views.*

Kia ora koutou, I writing on behalf of Environment Hubs Aotearoa, a nationwide network of organisations connecting communities to protect, nurture and improve environmental outcomes. The network brings together 22 member hubs throughout Aotearoa - from the Far North to Southland - working with their local communities to regenerate te taiao. They work towards a nationwide collaborative action to increase social cohesion, community resilience and environmental stewardship, all of which are linked with increased wellbeing and a healthy environment. As an organisation deeply involved with the wellbeing of our taiao and communities, we strongly oppose this application. We think an incinerator makes no sense with all the knowledge available about the climate crisis. We have a myriad of reasons to be against it as we list below:

_**Untested technology**

- At present Aotearoa New Zealand has no municipal solid waste (MSW) incinerators. The incinerators that were in operation around 2000 have all closed. Many of them were a significant source of dioxin contamination
- A similar, larger, proposal for a waste-to-energy incinerator in Waimate, South Canterbury has been "called in" by the Minister for the Environment in part because this is new technology with national implications.
- Te Awamutu does not want to be a testing ground for this technology
- Global Contracting Solutions does not have any experience of operation in waste incineration. It is a scrap metal business. The company does, however, have a track record of violating resource consent

conditions in their Hamilton operations.

A. **Cultural Impact**

- The application contains no formal Cultural Impact Assessment
- Fully informed consent from Iwi and Hapū must be part of this proposal including clear disclosure of human health and environmental impacts
- Taiea te Taiao was created to promote an ecological corridor to link Maungatautari and Pirongia te aroaro o Kahu. This corridor will reconnect these maunga/mountains with biodiversity plantings which will enhance native species present, transform iwi connections to the Mangapiko stream, and ultimately improve water quality. An incinerator will undermine these efforts.

B. **Air, Water and Land Pollution & Emissions**

- The incinerator will produce dioxins that are cancer-causing even in extremely low levels. These will be emitted into the air, and will settle on the land and in the water. There is no safe level of dioxins, and these "bio-accumulate" - meaning that over time they build up in human fat tissue and in animals.
- There is no assessment of land contamination included in the application. International research shows that the land surrounding incinerators can be extensively contaminated with heavy metals, microplastics and other toxic emissions including dioxin.
- Stormwater from the site will be discharged into the Mangapiko Stream. This water is likely to be contaminated with heavy metals and dioxin. Filtration systems and settlement ponds do not eliminate all of the toxic products meaning these will make their way into the waterways
- One of the emissions from burning tyres/tyre derived fuel is zinc oxide which has not been modelled and which is highly toxic to aquatic life.
- The huge earthworks over several years will impact the health and wellbeing of the Mangapiko River

C. **Inappropriate land use**

- The site is totally unsuitable for a large scale waste incinerator. The current "Specialised Dairy Industrial Area" designation means that the land use is intended to ensure that any activity there was aligned with Fonterra's activities.
- It is not appropriate to have an incinerator burning millions of tyres next to a milk production facility

- This area is not identified as an area for industrial development in the District Plan. Two areas are identified for industrial growth: at Bond Road and Paterangi Road.
- The location of a heavy industrial operation immediately next to existing and planned residential housing, schools and food businesses, and operating 24-hrs/day, 7day/week is not appropriate and conflicts with the intentions of the *Waipā District Plan* and *Growth Strategy* for the community.
- The very large size of the building and stacks does not fit in with the area. It will dominate, have a significant impact on the landscape and turn the entire area into the feel of an industrial zone.

D. Flooding

- Entire site is a floodplain - most of the site is designated a High Risk Flood Zone
- The river has been straightened and narrowed over time to enable development, this is now considered one of the major causes of flooding. Allowing rivers the ability to spread to accommodate severe rainfall events in future protects infrastructure, business and housing from inundation.
- The new incinerator buildings would increase flooding spread to the Fonterra factory and houses on Factory Road, numbers 331-467
- The company wants to build its building lower than existing requirements (because it will cost them a lot more money to build to the required levels). This will mean even greater risk to the community.
- Insurance companies are warning New Zealanders not to build on floodplains due to climate change. The incinerator may become uninsurable, and the community left with the clean up bill.

E. Climate change

- The incinerator will use non-renewable feedstock (plastic waste, tyres, mixed solid waste & flock) to create energy: this is equivalent to a fossil fuel production plant, but much dirtier and riskier because of the different composition of the materials.
- The addition of non-renewable energy from waste works against efforts to decarbonise the energy sector.
- The incinerator will be a massive contributor to climate change. It will directly add about 150 kilo tons per year of CO2.
- The facility would have a carbon footprint many times greater than the same amount of waste being sent to landfill

F. Hazards, Risks, Toxic Ash and other toxic byproducts

- The incinerator would produce 23 tonnes/day of toxic ash which **has to be landfilled**. Incinerator ash contains heavy metals, microplastics and dioxins.
- The storage of highly contaminated wastewater and other hazardous substances on site risks spills and wider contamination.
- There is no risk assessment of the possibility of fire or explosion despite the storage of hazardous materials and highly flammable feedstock. The community only has a volunteer fire brigade.

G. Feedstock, Waipā waste minimisation, zero waste alternatives:

- Te Awamutu will need to import almost all of the material for this facility from outside of the district. This is not a proposal for the benefit of the community.
- The company has no contracts for the delivery of the feedstock except from its own operations (as Global Metal Solutions). This means it is impossible to know what hazards, risks and emissions exist because only a small percentage of the feedstock is known. It also means that the company is more likely to burn recyclable materials and other things because it must always continue to operate. It will directly work against efforts to minimise waste.
- The inclusion of 35,058 tonnes of plastic (as well as a considerable portion of MSW that includes plastic) does not align with the recently released National Plastics Action Plan for Aotearoa New Zealand by the Ministry for the Environment
- Incineration does not replace the need for landfills - instead it takes ordinary materials and concentrates them into more toxic ash.
- The Waipā District Council has a great waste minimisation plan and opportunities for more comprehensive zero waste strategies that would fit with the goals of minimise wastes, while meeting community aspirations for a healthy environment, job creation and mitigation of climate emissions.
- Investing hundreds of millions of dollars into an incinerator locks in the need for continued production of waste, meaning the community misses out on other waste uses further up the waste hierarchy (like reuse, repair and repurposing).

H. Human Health

- There is no human health assessment of this proposal
- The incineration plant is a hazardous facility with serious risks of harm to human health. The plant will emit cancer-causing dioxins and furans, sulphur dioxide, nitrogen oxide, mercury and particulate matter will be released into the air.

- Dioxins damage the human immune system and cause cancer. Studies have shown direct links to non-Hodgkins lymphoma, increases in risks of miscarriages and pre-term delivery of babies. There are links to reduced male fertility. Exposure to particulate matter impacts those with respiratory problems such as asthma, cardiovascular issues, the elderly and children.
- In the Netherlands, research conducted indicated that the high dioxin output from waste incinerators could be responsible for contamination of cow's milk and meat. As a result, the production and sales of dairy products from was prohibited for several years.
- In 2016, human-made (anthropogenic) air pollution in New Zealand resulted in an estimated 3,317 premature deaths (in people aged 30+ years). The largest causes were NO2 and PM2.5. There were 32 premature deaths due to air pollution (PM2.5 and NO2) in Waipā District (among people aged 30+ years) in 2016. The incinerator will significantly add to these pollutants, and therefore, contribute to the premature death of Waipā residents.
- Under NZ's air quality standards, it is illegal to burn even one tyre because the health and environmental effects are so toxic - yet, this project is proposing to burn 35,000 tonnes a year. Burning tyres emits cyanide, carbon monoxide, sulfur dioxide, and products of butadiene and styrene. And the smell of those tyres burning will fill the community with an unbelievable stench.
- The odour and dust have not been adequately assessed. There is no indication of how often the start up/maintenance will be done and levels exceeded.
- There will be significant additional traffic in a residential area, adding to air pollution and impacting those who are old, very young and immunocompromised. It will change the nature of the community from a quiet residential street to an unsafe and busy thoroughfare of trucks at all hours of the day and night.

I seek the following decision from the consent authority:

give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

On behalf of all Environment Hubs Aotearoa members, we *want the* **Waipā District Council** *to* ***decline this application***.

I wish (or do not wish) to be heard in support of my submission.

✔ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

✔ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

✔ If others make a similar submission I will consider presenting a joint case with them at the hearing.

I request/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: _____

(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Environment Hubs Aotearoa

Date: _____ Contact person: vicky rajda McNab

(name and designation, if applicant)

Postal address: _____

(or alternative method of service under section 352 of the Act):

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.

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You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.

If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840

If you make your submission by electronic means, a signature is not required. Electronic submissions on resource consent applications must be directed to submissions@waipadc.govt.nz.

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Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

Privacy information

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Waipa DISTRICT COUNCIL

Submission on a Notified Resource Consent Application

Form 13

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4), Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I ~~am~~/am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/~~am~~ not directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:
All of the Application

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ☑ **are neutral** parts or all of ☐

include—

- *the reasons for your views.*

THE MAIN REASONS to Oppose the applications Are:
- Climate Impacts
- Cultural Impacts.

I seek the following decision from the consent authority:

give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

The Impacts to the climate contradict efforts made by local & Central government to reduce Emmisions levels. New Zealand have signed the ICPP Agreement & Committed to reduce emmisions levels by 30% by 2030. this Application would be a direct Intrest to this. Also there is an absence of Cultural Consideration & Relief for Maori as kaitiakitanga of the land.

I wish (or do not wish) to be heard in support of my submission.

☑ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

☑ If others make a similar submission I will consider presenting a joint case with them at the hearing.

You must tick one of the boxes above, otherwise it will be deemed that you do not wish to be heard and we will <u>not</u> advise you of the date of the hearing.

☑ I have served a copy of my submission on the applicant.
(this is required by section 96(6) (b) of the Resource Management Act 1991)

I ~~request~~/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: _____
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 13/10/23 Contact person: LAURA ETZ
(name and designation, if applicant)

Postal address: 25a Grey Street Kihi Kihi
(or alternative method of service under section 352 of the Act):

Notes to submitter

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Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
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Waipa DISTRICT COUNCIL

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LOCATION: 401 Racecourse Road, Te Awamutu

I ~~am~~/am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/~~am not~~ directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:

All parts of the application

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ☑ **are neutral** parts or all of ☐

include—

- *the reasons for your views.*

~~Decline application~~ I am born & bred in Te Awamutu. My sister was born physically & mentally disabled from chemicals in the air & had a lifetime impact on our family. My son teaches here & I am concerned about the effects on his children, my grandchildren.

I seek the following decision from the consent authority:

give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

Decline application

I wish (or do not wish) to be heard in support of my submission.

☑ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
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Signature of submitter: _____
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 12/10/2023 Contact person: Lesley Anne Eggleston
(name and designation, if applicant)

Postal address: _____
(or alternative method of service under section 352 of the Act):

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Waipa DISTRICT COUNCIL

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4),
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APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:

Dioxins and Furans: Dioxins and furans, released during waste combustion, are particularly insidious for children. These highly toxic compounds can impact children's developing bodies, leading to developmental issues, immune system problems, and an increased risk of childhood cancers.

My submission is:

~~**Support** parts or all of~~ ☐ **Oppose all of** ☒ ~~**are neutral** parts or all of~~ ☐
include—

- *see attached letter*

I seek the following decision from the consent authority:

- see attached letter

I wish (or do not wish) to be heard in support of my submission.

X **I do wish to be heard in support of my submission**
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
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Signature of submitter: 
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 12/10/23 Contact person: _Owen Embling_
(name and designation, if applicant)

Postal address: _____*249 Pencarrow road Tamahere*__
(or alternative method of service under section 352 of the Act):

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You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.

If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840

If you make your submission by electronic means, a signature is not required. Electronic submissions on resource consent applications must be directed to submissions@waipadc.govt.nz.

If you make a request under section 100A of the Resource Management Act 1991, you must do so in writing no later than 5 working days after the close of submissions and you may be liable to meet or contribute to the costs of the hearings commissioner or commissioners. You may not make a request under section 100A of the Resource Management Act 1991 in relation to an application for a coastal permit to carry out an activity that a regional coastal plan describes as a restricted coastal activity.

Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

Privacy information

The information you have provided on this form is required so that your submission can be processed under the RMA. The information will be stored on a public register and held by the Council, and may also be made available to the public on the Council's website. In addition, any on-going communications between you and Council will be held at Council's offices and may also be accessed upon request by a third party. Access to this information is administered in accordance with the Local Government Official Information and Meetings Act 1987 and the Privacy Act 1993. If you have any concerns about this, please discuss with a Council Planner prior to lodging your submission.

From: "Owen Embling" [redacted]
Sent: Thu, 12 Oct 2023 21:23:00 +1300
To: "Submissions" <submissions@waipadc.govt.nz>
Cc: "Irene Marcia Embling" [redacted]
Subject: External Sender: Objections to the waste-to-energy plant at 401 Racecourse Road Te Awamutu.
Attachments: dioxins-technical-guide-4sept2020.pdf, objection to -Waste to Energy plant LU-0323-21 finalise submission on 12 October 2023.pdf

Re: Opposition to Waste-to-Energy Plant Proposal in Te Awamutu

Dear Members of the Waipa District Council,

I am writing to express my deep concerns and strong opposition to the proposed waste-to-energy plant in Te Awamutu. As a resident of this vibrant community, I value the health and well-being of our town, especially for our children and future generations. This submission is based on compelling evidence, including the plant's own documentation, which raises serious doubts about the safety and appropriateness of this project.

1. Emissions and Health Concerns:

The proposal for the waste-to-energy plant indicates that it will not have zero emissions. This is a critical issue that should not be taken lightly, particularly due to the profound health risks, especially for our children:

Dioxins and Furans: Dioxins and furans, released during waste combustion, are particularly insidious for children. These highly toxic compounds can impact children's developing bodies, leading to developmental issues, immune system problems, and an increased risk of childhood cancers.

Heavy Metals: Children are more vulnerable to the toxic effects of heavy metals like lead, mercury, and cadmium, which may be released from waste incineration. Exposure to these substances can result in neurological damage, developmental delays, and long-term cognitive impairments.

Volatile Organic Compounds (VOCs): Children's developing respiratory systems make them more susceptible to the harmful effects of VOCs. Exposure to VOCs can exacerbate asthma and other respiratory conditions, leading to increased hospitalization rates among children.

Tyres and General Waste: The inclusion of tyres and general waste in the combustion process introduces unpredictable and harmful emissions. These emissions can contain a mix of carcinogenic and toxic substances, posing a higher risk to the health of our children, who are more sensitive to environmental pollutants.

2. Proximity to Sensitive Areas:

The proposed plant's proximity to schools, preschools, and highly populated areas exacerbates these health risks for our children. Children spend a significant portion of their time at school, and their exposure to harmful emissions is prolonged in such close proximity.

3. Truck Movements and Community Impact:

The expected 100 truck movements per day through residential areas of our small town not only pose risks in terms of accidents but also exacerbate health concerns. Children and their developing respiratory systems are especially vulnerable to the air pollution and noise associated with increased truck movements.

4. Alternative Solutions:

I urge the council to prioritize the safety and health of our children and the entire community by exploring alternative waste management and energy solutions. The "Zero Waste to Landfill" campaign, successfully implemented by councils in New Zealand, such as Raglan, provides a proven path toward minimizing health risks associated with waste disposal while fostering a more sustainable and responsible approach.

5. Call to Action:

Given the health risks, particularly for our children, associated with emissions from the proposed waste-to-energy plant, I strongly oppose its construction in Te Awamutu. I implore the council to prioritize the well-being and safety of our community, especially our children, by reconsidering this proposal. I also encourage fellow residents to voice their concerns and participate in the decision-making process.

6. Conclusion:

Te Awamutu is a place my Parents call home and their great grandchildren visit regularly and call their second home, along with their grandchildren and children like myself and we must protect it for current and future generations.

I urge the Waipa District Council to act responsibly and in the best interests of our community, especially our children, by rejecting the waste-to-energy plant proposal.

Thank you for considering my submission. I trust that the council will make a well-informed and responsible decision regarding this matter.

Appendix for review, covering air pollution issues which are openly discussed in the submission. This is not a 00 emission waste-to-energy plant and for that reason alone it should be rejected.

https://environment.govt.nz/publications/proposed-national-environmental-standards-for-air-quality-report-on-submissions/3-1-general-submissions/3-5-air-toxics-especially-dioxins-prohibited-activities/

https://environment.govt.nz/facts-and-science/air/air-pollutants/dioxins-furans-pcbs-effects-health/

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4892903/

https://environment.govt.nz/facts-and-science/air/air-pollutants/

The above links supports the air pollutant issues.

Sincerely
Owen Embling.

MINISTRY OF HEALTH
MANATŪ HAUORA

New Zealand Government

Dioxins: A Technical Guide

This guide for health professionals was first published as Dioxins Fact Sheet in September 2004 and has been regularly updated. This is the tenth edition.

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General information about dioxins

What are dioxins?

The term 'dioxins' refers to a group of highly toxic chemical compounds largely produced as by-products of combustion and some industrial processes – the polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Dioxins are persistent environmental pollutants. They share similar chemical structures and mechanism of toxicity.

Dioxins exist in the environment as complex mixtures. There are a few natural sources of dioxins, such as forest fires and volcanic activity, but generally these natural sources emit comparatively small amounts of dioxins into the environment compared with man-made sources, such as some industrial processes. Cigarette smoke also contains small amounts of dioxins.

Seventeen PCDD/Fs are thought to pose a health and environmental risk. Toxicity of the 17 varies; 2,3,7,8-tetrachlorodibenzo-*p*-dioxin, abbreviated as 2,3,7,8-TCDD or TCDD and commonly referred to as dioxin, is the most toxic.

Polychlorinated biphenyls (PCBs) are structurally similar to dioxins and environmentally persistent. Twelve PCBs are referred to as being 'dioxin-like' because they have the same mechanism of toxicity as dioxins.

Exposure to dioxins

Some exposure to dioxins is inevitable because of their persistence in the environment. For most New Zealanders, about 90 percent of exposure is through diet, mainly from foods that contain animal fats, such as meat, dairy products, eggs and fish. Dioxins enter the food chain after being deposited onto soil and plant surfaces and then being ingested by grazing animals. With the exception of *Cucurbitaceas* (eg, zucchini, pumpkin), plants take up only very small amounts of dioxins through their roots. Humans are also exposed from inhalation, skin absorption, and ingesting contaminated soil or dust.

Historic sources of dioxins include leaded petrol, pentachlorophenol (PCP) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). Advances in chemical and environmental management practices since the late 1980s have reduced dioxins emissions in New Zealand. To identify priorities to achieve further reductions, the Ministry for the Environment (MfE) prepared a dioxin inventory based on 1998 data (Buckland et al 2000).

An update, using 2008 data, shows total dioxins emissions to air reduced by almost 50 percent over the preceding decade (MfE 2011).

Dioxins in the body

Once in the body, dioxins accumulate in fat and persist for many years. The highest amounts are found in the liver and adipose tissue. In the blood, dioxins bind to lipids and lipoproteins and serum TCDD levels are highly correlated with adipose tissue TCDD levels when both are expressed on a lipid weight basis. Dioxins are eliminated mainly in faeces, with only small amounts eliminated in urine. Some is eliminated in breast milk.

An infant absorbs at least 95 percent of the dioxins in breast milk. Models indicate that the level of dioxins in a breastfed New Zealand infant balances its mother's level after about six months of breastfeeding and then exceeds it (Smith and Lopipero 2001). Modelling shows that, by about 10 years of age, the level of dioxins in breastfed children is similar to that found in formula-fed children (US EPA 2000). The estimated New Zealand infant daily intake of dioxin-like compounds by breast milk is low compared to other countries ('t Mannetje et al 2014). If potential adverse effects are balanced against positive health aspects for (breastfed) infants, the advantages of breastfeeding far outweigh the possible disadvantages (Van den Berg et al 2017).

The half-life of TCDD in humans is uncertain but an average of 7–11 years is generally accepted. Generally, TCDD has a shorter half-life in children, men and those with less body fat. Half-life also depends on concentration. High concentrations have an initial phase of rapid elimination with shorter than average half-lives (Aylward et al 2005a; Kerger et al 2006). The mechanism underlying the rapid elimination phase is unknown. Follow-up 20 years later of women exposed in Seveso in 1976 found half-life was 7.1 years for those aged over 10, 4.3 years for those under 5 and 5.2 years for those 6–10 years (Warner et al 2014).

The levels of dioxins in humans are declining. From 1988 to 1998, dioxins in breast milk of New Zealand women decreased by about 70 percent (Bates et al 2001) and from 1998 to 2008, by 40 percent ('t Mannetje et al 2010). From 1996 to 2012, the mean age-weighted concentration of serum PCDD/F TEQ[1] and PCB TEQ reduced by 49 and 68 percent respectively. The mean weighted concentration of PCDD/Fs in New Zealanders aged 19–64 years is 5.81 pg TEQ/g lipid. Mean concentrations increase with age, with concentrations in the 50–64 years age group being 2.6 times higher than concentrations in the 19–24 years age group ('t Mannetje et al 2013).

New Zealand PCDD/Fs concentrations are generally comparable to or lower than those reported for other countries (Australia, United States) with recent population serum studies ('t Mannetje et al 2013).

[1] Toxic Equivalent: the amount of TCDD it would take to equal the combined toxic effects of all the dioxins in the mixture.

2,4,5-T manufacture in New Zealand

The former Ivon Watkins-Dow (IWD), now Dow AgroSciences, chemical plant located in Paritutu, New Plymouth, manufactured the herbicide 2,4,5-T from 1962 to 1987. 2,4,5-T was used extensively in New Zealand to control the pest plant gorse.

Trichlorophenol (TCP), which is an intermediate in 2,4,5-T manufacture, was manufactured on site from 1969. During TCP manufacture, TCDD is formed and remains as a contaminant in 2,4,5-T. Processing and regulatory changes since 1973 significantly reduced the amount of TCDD produced. TCDD was not a contaminant in other chemicals known to have been manufactured at the plant.

Liquid waste was incinerated on site from 1975 until 1979, and in 1985 and 1986. In 1981, a solid waste incinerator was established. Since 1986, this incinerator has operated on a non-continuous basis. Under the Clean Air Act 1972 (replaced by the Resource Management Act 1991), air monitoring was undertaken by the Department of Health.

The Department of Scientific and Industrial Research, on behalf of the Department of Health, measured incinerator emissions for dioxins every six months from 1974 to 1979, and again periodically from 1983 to 1986. Available ambient air monitoring data for the peak years of liquid waste incineration (1975–79) are incomplete. What data are available on historical emissions from the waste incinerator do not account for the total mass of TCDD present in the soil environment.

The solid waste incinerator was upgraded in 1995.[2] Whilst historically the solid waste incinerator would have contributed to some of the residential exposure demonstrated in the Paritutu serum dioxins study, the study's report suggests it was very unlikely to have been the primary source (Fowles et al 2005).

Two chemical release incidents are known to have occurred at the site. In November 1972, there was an explosion in the plant that manufactured the herbicide 4-(4-chloro-2-methylphenoxy) butanoic acid (MCPB). No TCDD was reported to have been released. In April 1986, a bursting disc failure in the TCP plant released an estimated 70–735 mg TCDD (Air and Environmental Sciences Ltd 2002).

In 1980, independent scientists, in association with a union representative, examined current work practices at the plant and found procedures to be satisfactory. However, it was recommended that existing procedures be extended to include the pilot plant

[2] The incinerator is used for the treatment and disposal of solid and liquid waste materials associated with Dow AgroSciences' operations. Dow AgroSciences' resource consent for discharge of contaminants to air was renewed in 2014 and is monitored by the Taranaki Regional Council. Consent conditions include an upper limit of 0.1 ng/m^3 dioxins in any discharge from the incinerator stack.

facility, the functions of which included cleaning up plant wastes and recovering usable materials (Department of Health 1980a).

During the 1970s, there were a number of 'clusters' of birth defects in New Zealand which were alleged to have been caused by 2,4,5-T. These were investigated by the Department of Health and no evidence was found to implicate 2,4,5-T as a causal factor (Department of Health 1977).

Concerns relating to uncertainty over exposure to dioxin from the plant and health effects were the subject of a Ministerial inquiry in 1986. The inquiry found no substantiated evidence that the manufacture of 2,4,5-T had any adverse effect on residents' health (Brinkman et al 1986).

In 2001, the Ministry of Health contracted the Institute of Environmental Science and Research (ESR) to investigate non-occupational exposure to dioxins among current and former Paritutu residents. The community were consulted and most agreed to instigation of a serum dioxins study (Baker et al 2003). This study found elevated mean TCDD levels (6.5 pg/g lipid; 1.7 pg/g lipid expected), particularly in those who had lived in the area for at least 15 years (14.7 pg/g lipid; 2.4 pg/g lipid expected) and in older people. The TCDD levels found have been largely attributed to historical fugitive emissions from the IWD plant throughout the production years (Fowles et al 2005).

Mortality, morbidity and serum dioxins studies of IWD workers have been undertaken by Massey University ('t Mannetje et al 2005, 2016, 2019) and the University of Otago and Dow AgroSciences (Collins et al 2008b, McBride et al 2009).

Dioxins and health

General information

Many studies have looked at how dioxins, in particular TCDD, can affect health, and much is still not completely understood. Dioxins can affect the growth and development of cells in ways that have the potential to result in a broad range of adverse effects.

Dioxins bind to a cellular protein, the aryl hydrocarbon receptor (AhR), which regulates gene expression. Whether adverse effects result from this binding depends on what biological responses follow. These responses differ among and within species, and among tissues in individual species. Currently it is not possible to state how, or at what levels, exposed individuals will respond because of the potential diversity of biological responses to dioxins in the body. How much dioxins a person is exposed to and for how long are both important factors as well as individual susceptibility.

Dioxins differ in toxic potential. Each congener has a Toxic Equivalency Factor (TEF) assigned to it, which denotes its toxicity relative to TCDD. The product of the congener's concentration and its TEF is added to those of the other congeners to give the Toxic Equivalent (TEQ), which is the amount of TCDD it would take to equal the combined toxic effect of all the dioxins in the mixture.

Low doses of dioxins produce biochemical changes, such as enzyme induction (eg, CYP1A1) in animals and humans, the clinical significance of which is uncertain (DeVito et al 1995). At high doses, TCDD can cause a severe acne-like skin condition, known as chloracne, as well as cancer. The range of TCDD levels in the body that result in chloracne in humans is 436 to 13,600 pg/g lipid (DeVito et al 1995). DeVito et al (1995) estimated TCDD levels at the time of highest exposure associated with increased cancer incidence to be from 495 to 31,800 pg/g lipid, based on a study of workers (Fingerhut et al 1991) and a 10-year follow-up study of the Seveso general population cohort (Bertazzi et al 1993). The estimated range for increased cancer incidence needs updating to take account of more recent epidemiological and toxicokinetic evidence.

No case of chloracne was ever diagnosed among IWD workers, including those involved in the 1986 release (Aylward et al 2010).

Animal studies show immune, reproductive and developmental effects from dioxin exposure. Reproductive and developmental toxicity has been seen in all of the animal species tested and mostly at similar doses. These animal studies have been used internationally to establish health-based guidelines for exposure to dioxins in soil, air and food.

Differences have been observed among the epidemiological studies, particularly for non-cancer effects. Some of these could be explained by differences in exposure levels and length of observation periods since exposure, and, in the case of occupational

cohorts, accompanying exposure to other chemicals. It is also reasonable to assume that Paritutu residents may have been exposed to other chemicals at the same time as TCDD.

The United States Environmental Protection Agency (US EPA) began reassessing the health risk of dioxin and related compounds in 1992. This eventually separated into assessments of the non-cancer and cancer risks. The reference dose[3] for non-cancer risk is 0.7 pg/kg/day based on epidemiological studies by Mocarelli et al (2008) and Baccarelli et al (2008) (US EPA 2012). The World Health Organization (WHO) set a tolerable daily intake range of 1–4 pg/kg in 1997 and a provisional tolerable monthly intake of 70 pg/kg in 2002 (WHO 1998; FAO/WHO 2002). In 2002 the New Zealand Ministry of Health adopted 30 pg/kg/month, as the lower end of this range, expressed as a monthly intake given the long half-lives in humans. The US EPA's final cancer risk assessment has not been released.

TCDD is not considered to be genotoxic. However, there is some evidence that it may have an indirect genotoxic effect through oxidative stress (National Research Council 2006). In animals, TCDD is a promoter and weak initiator of carcinogenesis. Therefore, it is plausible that a carcinogenic response to TCDD exposure in humans depends upon exposure to other initiators such as cigarette smoking.

National Academy of Sciences evaluation of studies on dioxin and health

As a result of the (US) Agent Orange Act of 1991 and subsequent legislation, the Institute of Medicine (IOM) of the National Academy of Sciences in the United States has reviewed scientific evidence about health effects of exposure to herbicides used in Vietnam and any of their components or contaminants, such as dioxin.[4] This information is provided to the United States Department of Veterans Affairs and influences what diseases among Vietnam veterans are recognised for compensation. The reviews include toxicological studies (cellular and animal) and epidemiological studies of Vietnam veterans as well as occupationally exposed and environmentally exposed populations. Distinctions among categories are based on statistical association not causation. The most recent (and final) review was in 2018 (National Academies of Sciences, Engineering, and Medicine 2018).

The list of specific diseases and conditions has been developed from the literature, concerns raised by Vietnam veterans and requests from the United States Department of Veterans Affairs. The review committee takes a neutral stance in regard to any

[3] The US EPA defines a reference dose as an estimate, with uncertainty spanning perhaps an order of magnitude, of a daily oral exposure to the human population (including sensitive groups) that is likely to be without an appreciable risk of adverse effects during a lifetime.

[4] 2,4-D, 2,4,5-T, TCDD, cacodylic acid and picloram.

condition that has not yet been addressed in the literature as having an association or not with the chemicals of interest.

The most recent review resulted in two changes of category:

- addition of hypertension from the limited or suggestive evidence category into the sufficient evidence category
- addition of monoclonal gammopathy of undetermined significance into the sufficient evidence category

The committee did not achieve consensus on whether Type 2 diabetes which has previously been in the limited or suggestive category should remain there or move into the sufficient evidence category (National Academies of Sciences, Engineering, and Medicine 2018).

The conditions that have been accepted in the sufficient evidence of health effects category are:

- Hodgkin's disease[5]
- non-Hodgkin's lymphoma[6]
- soft tissue sarcoma (STS)
- chronic lymphocytic leukaemia (CLL)
- chloracne
- hypertension
- monoclonal gammopathy of undetermined significance[7].

There is limited or suggestive evidence that exposure to dioxin may cause respiratory cancers (lung, bronchus, larynx and trachea), prostate cancer, multiple myeloma, early-onset peripheral neuropathy, porphyria cutanea tarda, AL amyloidosis, Parkinson's disease, ischaemic heart disease (IHD), stroke, bladder cancer and hypothyroidism. IHD and Parkinson's disease were added to the limited or suggestive evidence category as a result of the 2008 review and stroke as a result of the 2012 review. The 2008 review also clarified that CLL includes all chronic B-cell leukaemias, for example, hairy cell leukaemia. The 2014 review clarified the breadth of the 2008 findings for Parkinson's disease so that it includes Parkinsonism and Parkinson-like syndromes.

The 2010 review changed the terminology of early-onset transient peripheral neuropathy to early-onset peripheral neuropathy to reflect that the condition is not necessarily transient (Institute of Medicine 2012). The 2014 review resulted in addition of bladder cancer and hypothyroidism to the limited or suggestive evidence category and removal of spina bifida in offspring from the limited or suggestive evidence category into the inadequate or insufficient evidence category (National Academies of Sciences, Engineering, and Medicine 2016).

5 Also known as Hodgkin disease and Hodgkin lymphoma.

6 Also known as non-Hodgkin lymphoma.

7 Asymptomatic condition characterised by the presence of an abnormal protein in blood and/or urine. It increases the risk of multiple myeloma and other plasma cell disorders.

A number of other conditions have been suggested, but there is insufficient or inadequate evidence to confirm that these are associated with exposure to dioxin or herbicides used in Vietnam (Table 1) (National Academies of Sciences, Engineering, and Medicine 2018).

Table 1: Evidence of association between exposure to herbicides and adverse health outcomes

Strength of association	Health outcome
Sufficient evidence	Chloracne
	STS
	Non-Hodgkin's lymphoma
	Hodgkin's disease
	CLL
	Hypertension
	Monoclonal gammopathy of undetermined significance
	Type 2 diabetes?
Limited/suggestive evidence	Respiratory cancers (larynx, trachea, lung, bronchus)
	Prostate cancer
	Bladder cancer
	Multiple myeloma
	Early-onset peripheral neuropathy
	Porphyria cutanea tarda
	AL amyloidosis
	IHD
	Parkinson's disease (including Parkinsonism & Parkinson-like syndromes)
	Stroke
	Hypothyroidism
	Type 2 diabetes?
Inadequate/insufficient evidence	Cancers of oral cavity, pharynx or nasal cavity
	Cancers of pleura, mediastinum, and other unspecified sites within the respiratory system and intrathoracic organs
	Oesophageal cancer
	Stomach cancer
	Colorectal cancer
	Hepatobiliary cancers
	Pancreatic cancer
	Bone and joint cancer
	Cancers of the reproductive organs (cervix, uterus, ovary, testis, penis)
	Renal cancer
	Leukaemia (other than CLL)
	Other myeloid diseases, including myeloproliferative neoplasms
	Melanoma

Strength of association	Health outcome
	Non-melanoma skin cancers
	Breast cancer
	Cancers of the brain and nervous system, including eye
	Endocrine cancers
	Cancers at other and unspecified sites
	Infertility
	Spontaneous abortion (other than for paternal TCDD exposure)
	Birth defects (including spina bifida)
	Neonatal/infant death and stillbirth
	Low birth weight
	Childhood cancer in offspring, including acute myeloid leukaemia (AML)
	Neurobehavioural disorders
	Neurogenerative disorders, excluding Parkinson's disease
	Chronic peripheral nervous system disorders
	Gastrointestinal, metabolic and digestive disorders
	Immune system disorders
	Circulatory disorders (other than hypertension, IHD and stroke)
	Respiratory disorders
	Kidney disease
	Endometriosis
	Endocrine disruption (other than hypothyroidism)
	Hearing loss
	Eye problems
	Bone conditions
	Chronic skin disorders
Limited/suggestive evidence of no association	Spontaneous abortion and paternal TCDD exposure

Source: National Academies of Sciences, Engineering, and Medicine 2018

The 2000 IOM review committee concluded that there was limited or suggestive evidence of an association between acute myeloid leukaemia (AML) in offspring and dioxin exposure. In 2002, this conclusion was rescinded, and AML was moved to the inadequate or insufficient evidence category. The earlier conclusion had largely been based on an Australian study, the data from which were later found to be faulty. After the data had been corrected, the study showed that children of Australian Vietnam veterans did not have an increased risk of AML. Evidence from German and Norwegian studies of AML in the children of parents who had occupational exposure to pesticides was also considered in the re-evaluation.

There is no evidence dioxins can mutate DNA sequences (ie, are genotoxic). However, toxicological studies indicate that TCDD could lead to multigenerational and transgenerational effects as a result of epigenetic changes.[8] Epigenetic changes in

[8] Influences on gene expression without a change in DNA sequence.

animals have been shown following paternal or maternal TCDD exposure of the embryo or fetus *in utero*. Effects include lowered male/female sex ratio, reduced fertility, adverse effects on reproduction and skeletal abnormalities. In humans, lowered male/female sex ratio has been found following paternal only, or paternal and maternal, but not maternal only, TCDD exposure (Viluksela and Pohjanvirta 2019).

The 2018 review committee concluded that there is inadequate or insufficient evidence to determine whether there is an association between exposure of men and women to TCDD before conception or during pregnancy and disease in their children or grandchildren. Findings from the Seveso second and third generation health studies initiated in 2014-2016 will contribute to addressing this knowledge gap.

Cancer

The first evidence that dioxin caused cancer came from an animal study published in 1978. Dioxin was not classified as a human carcinogen until 1997 by the International Agency for Research on Cancer (IARC) and the United States National Toxicology Program in 1999.

The first epidemiological studies suggesting a cancer risk were a case report of three STSs in phenoxy herbicide workers (Hardell 1977) followed by a case control study on STS that showed a six-fold excess risk among workers exposed to phenoxy herbicides or chlorophenols (Hardell and Sandstrom 1979). In the 1980s, three large cohort studies were set up – two (United States National Institute for Occupational Safety and Health (NIOSH) and IARC) involve chemical workers and workers producing or spraying phenoxy herbicides and chlorophenols from many sites, and one involves people who were exposed to TCDD in Seveso, Italy, following an explosion at a TCP plant in 1976 (the Seveso studies).

At the time of IARC's 1997 evaluation, there was debate about whether classification as a human carcinogen based on limited human, sufficient animal and AhR-mediated mechanistic evidence was appropriate. In 2009, IARC reaffirmed carcinogenicity of TCDD based on sufficient human evidence for all cancers combined and limited human evidence for lung cancer, STS and non-Hodgkin's lymphoma. In 2009, 2,3,4,7,8-pentachlorodibenzofuran (PeCDF) and PCB 126 were also classified as human carcinogens based on sufficient animal and AhR-mediated mechanistic evidence (Baan et al 2009).

Birth defects

Cleft palate has been observed in several animal species, in particular the mouse, following perinatal TCDD exposure. In mice, TCDD exposure that is not toxic to the mother, results in hydronephrosis and cleft palate (Smith and Lopipero 2001). Studies in several rodent species also show malformations of female offspring external genitalia as a result of a single dose of TCDD being administered to the mother. Animal

studies of potential male-mediated birth defects following TCDD exposure are too limited for conclusions to be reached.

There are problems with extrapolating results from animals to humans because the factors that determine susceptibility to effects vary among species. There is also a lack of strong evidence of organ-specific effects among species and differences in route, dose, duration and timing of TCDD exposure.

From 1996 until 2014, the IOM concluded that there was suggestive evidence that paternal exposure to TCDD and herbicides used in Vietnam was associated with spina bifida in veterans' children but that there was insufficient or inadequate evidence of any other birth defect association. As a result of the 2014 review, spina bifida was moved into the inadequate or insufficient evidence of association category consistent with all other birth defects. This occurred because the further evidence that in 1996 was anticipated would support the association between spina bifida and paternal exposure did not eventuate.

Most epidemiological studies have investigated paternal rather than maternal TCDD exposure and its effects on offspring. These studies are frequently limited by small numbers of birth defects and poorly characterised exposure.

During the 1970s, there were a number of 'clusters' of birth defects that were alleged to have been caused by 2,4,5-T. In 1972, a letter to the editor of the *New Zealand Medical Journal* raised concerns about aerial 2,4,5-T spraying after two babies from adjacent Waikato farms were born with neural tube defects within a month of one another (Sare and Forbes 1972). The Department of Health reviewed the toxicology and epidemiology of 2,4,5-T and investigated three alleged clusters of neural tube defects in Waikato, Northland and Taranaki. No evidence was found to implicate 2,4,5-T as a causal factor in any of the cases investigated (Department of Health 1977). The department also carried out an investigation in response to a medical practitioner linking the birth of two babies with fatal congenital abnormalities to 2,4,5-T exposure. One baby had biliary atresia, and the other had cardiac defects. It was not established that either mother was significantly exposed to 2,4,5-T at any time during her pregnancy (Department of Health 1980b).

All birth defects in Northland maternity hospital catchment areas from 1960 to 1977 were compared with densities of aerial 2,4,5-T spraying in the same areas and over the same time period. No association was found between spraying and spina bifida, anencephaly, cleft lip with or without cleft palate, isolated cleft palate, cardiac defects or hypospadias/epispadias. Aerial spraying was significantly associated with talipes, independent of ethnicity (Hanify et al 1981a, 1981b).

A study of New Zealand male pesticide applicators using 2,4,5-T found the rate of birth defects among their children did not differ from the rate among male agricultural contractors. The rate for each group was similar to that reported in other New Zealand studies (Smith et al 1981, 1982).

A meta-analysis of 22 studies of Agent Orange (50 percent 2,4-D and 50 percent 2,4,5-T) exposure in Vietnam shows an increased risk of birth defects (RR[9] 1.95; 95% CI[10] 1.59–2.39) (Ngo et al 2006). However, the conclusions that can be drawn from this study are limited as more than 50 percent of the studies (13 of 22) included have not been published in a peer-reviewed journal and 11 of the 13 Vietnamese studies included are unpublished. Schecter and Constable (2006) who have also studied dioxin exposure in Vietnam, have considered the Ngo et al study and state:

> "... we are not convinced that Vietnamese investigations linking congenital malformations to dioxin are, as yet, more than suggestive. We know of no non-Vietnamese studies linking herbicide or dioxin exposure to congenital malformations other than spina bifida and anencephaly ....This article and its novel approach confirm the need for continued rigorously controlled research to definitively answer the question [has exposure to Agent Orange or its dioxin contaminant resulted in an increased incidence of birth defects in Vietnam?] To date the answer is, at best, scientifically equivocal and, at worst, without valid positive scientific evidence." (p1231)

Cardiovascular disease

Twelve cohort studies (10 occupational, two environmentally exposed) have examined the relationship between dioxins and cardiovascular mortality.

Of the six occupational cohort studies that included internal comparisons and detailed exposure assessments,[11] dose-related increases in IHD mortality were found in four studies that reported this outcome and weaker associations with all cardiovascular disease (CVD) mortality. Only two of these studies adjusted for potential confounding by major CVD risk factors (Humblet et al 2008).

In contrast, the Seveso cohort reported no dose-related increase in IHD or all CVD mortality. This may relate to the younger population age and acute (not chronic) exposure. Excess circulatory disease mortality was seen in men in zone A of the Seveso area, the most heavily exposed zone, within 10 years of exposure which Bertazzi et al (2001) hypothesised resulted from psychosocial stress.

In its 2008 review the IOM concluded that there is suggestive evidence of an association between exposure to TCDD and herbicides used in Vietnam and IHD (Institute of Medicine 2009).

9 RR = relative risk.

10 95% CI = lower and upper 95% confidence interval around the mean.

11 These studies are of higher quality than the others because they minimise exposure misclassification and confounding due to workers being healthier than the general population ie, the healthy worker effect.

Occupational studies

Mortality

Four highly exposed occupational cohort studies show small increases in mortality from all cancers combined (SMR[12] for the combined cohorts is 1.4; 95% CI 1.2–1.6) and lung cancer (SMR 1.4; 95% CI 1.1–1.7). All-cancer mortality has been shown to increase with higher TCDD exposure and latency period of at least 20 years since exposure (Smith and Lopipero 2001).

All-cancer mortality for 2,187 United States Dow Chemical Company workers exposed to dioxins from 1940 to 1983 and followed up to 1994 was the same as the background level (SMR 1.0; 95% CI 0.8–1.1). This Dow cohort was the largest in the IARC cohort and has the longest follow-up. Eleven percent of this cohort had developed chloracne, but this sub-group had lower than expected all-cancer mortality (SMR 0.5; 95% CI 0.3–1.0) (Bodner et al 2003).

Further follow-up to the date of death or 2012 found no trends of increased mortality with increased TCDD levels except for STS (SMR = 3.08, 95% CI 0.84–7.87). However, the number of deaths was small. There were nine deaths in TCP workers from acute non-lymphatic leukaemia (SMR = 2.88, 95% CI 1.32– 5.47), four mesothelioma deaths (SMR = 5.12, 95% CI 1.39–13.10) and four STS deaths (SMR = 3.08, 95% CI 0.84–7.87) (Collins et al 2016).

In New Zealand, production workers along with sprayers[13] were included in the IARC cohort study of about 22,000 workers in 12 countries exposed to phenoxy herbicides, chlorophenols and dioxins. This study found an association between exposure to phenoxy herbicides contaminated with TCDD or higher chlorinated dioxins with increased mortality from circulatory disease, particularly IHD, and possibly diabetes (Vena et al 1998) and from STS and slight elevations from all cancers (SMR 1.2; 95% CI 1.1–1.3), non-Hodgkin's lymphoma and lung cancer. A 29 percent non-significant excess all-cancer mortality was found when workers exposed to TCDD or higher chlorinated dioxins were compared with workers in the IARC cohort with no such exposure (rate ratio 1.29; 95% CI 0.94–1.76) (Kogevinas et al 1997). New Zealand findings were not published separately because the short follow-up time to 1990 meant relatively few deaths had occurred.

The two New Zealand cohorts that were part of the IARC cohort have been subsequently followed up. Follow-up covered 1969–2000 for 813 IWD production workers[14] and 1973–2000 for 699 sprayers classified as exposed to TCDD, higher chlorinated dioxins and phenoxy herbicides. Non-significant excess all-cancer mortality was found among the production workers (SMR 1.24; 95% CI 0.90–1.67). All-cancer mortality was highest for synthesis workers (SMR 1.69; 95% CI 0.85–3.03) for whom it

[12] SMR = standardised mortality ratio.

[13] The sprayers cohort comprised 703 sprayers on the chemical applicators register from 1973–1984 which was previously studied by Smith et al (1982) in a study of birth defects.

[14] Employed for at least one month from January 1969 to December 1984.

was significantly associated with duration of exposure. Lymphohaematopoietic cancer mortality was non-significantly increased (SMR 1.65; 95% CI 0.53–3.85) particularly for multiple myeloma (SMR 5.51; 95% CI 1.14–16.1). All-cancer mortality was reduced for workers who handled the final products (SMR 0.83; 95% CI 0.40–1.53) and sprayers (SMR 0.82; 95% CI 0.57–1.14) ('t Mannetje et al 2005).

In another study with different inclusion criteria, follow-up to the end of 2004 of all IWD workers (n=1599)[15] found 196 deaths among the 1,134 workers potentially exposed to TCDD. Non-significant excess mortality was found for all cancers (SMR 1.1; 95% CI 0.9–1.4), STS (SMR 3.4; 95% CI 0.1–19.5) and non-Hodgkin's lymphoma (SMR 1.6; 95% CI 0.3–4.7) and lower than expected mortality from lung cancer. Diabetes mortality was less than expected, and there was a small increase in IHD mortality (SMR 1.1; 95% CI 0.9–1.5). No trend of increasing mortality with increasing cumulative TCCD exposure was seen for selected causes of death, including all cancers (McBride et al 2009).

Follow-up to 2004 found an increase in all cancers (RR 1.4; 95% CI 1.1–1.7) in veterans of Operation Ranch Hand, the United States Air Force unit that aerially sprayed herbicides in Vietnam from 1962 to 1971, after stratification by calendar period of service (during or before 1968), days of spraying (at least 30) and time spent in South-East Asia (up to two years).[16] Without stratification, there was no significant increase in cancer in the Ranch Hand cohort or any of the three TCDD exposure categories (Michalek and Pavuk 2008).

Almost 30 years after Vietnam service, United States Army veterans who had sprayed herbicides showed significantly higher risks of diabetes (OR[17] 1.5; 95% CI 1.15–1.95), heart disease (OR 1.52; 95% CI 1.18–1.94), hypertension (OR 1.32; 95% CI 1.08–1.61) and chronic respiratory diseases (OR 1.62; 95% CI 1.28–2.05) compared with non-sprayers. Odds ratios for these outcomes were also elevated for Vietnam veterans compared with veterans who did not serve in Vietnam but, apart for chronic respiratory diseases, were not statistically significant. All cancers (excluding non-melanoma skin cancers) were significantly elevated among Vietnam compared with non-Vietnam veterans (OR 1.46; 95% CI 1.02–2.10), but not among Vietnam sprayers compared with Vietnam non-sprayers of herbicides. Odds ratios were adjusted for factors that included age and current smoking status (Kang et al 2006). An association between diabetes and spraying herbicides has also been found among Ranch Hand veterans (Henriksen at al 1997, Michalek and Pavuk 2008).

A study of New Zealand Vietnam veterans who served between 1964 and 1975, with follow-up to the end of 2008, found significantly lower all-cause mortality; significantly increased mortality for head and neck cancers, and cancers of the oral cavity, pharynx and larynx; a non-significant excess cancer incidence; significantly increased CLL; and non-significant excess incidence and mortality for HD and multiple myeloma (McBride et al 2013).

[15] Employed for at least one day from January 1969 to November 1988. 1 November 1988 was the last day of 2,4,5-T use.

[16] All-cancers risk increased with years of service in South-East Asia among the veterans who were compared, hence the stratum of interest was no more than two years of service.

[17] OR = odds ratio.

Morbidity

A small morbidity survey during 2007-8 of 245 former IWD employees found that TCDD exposure was associated with self-reported diabetes and non-fasting glucose levels> 6.6 mmol/l and a range of subclinical effects, including decreased immunoglobulin G (IgG), increased triglycerides, decreased high density lipoprotein (HDL) cholesterol, decreased free thyroxine (T4), and a higher frequency of abnormal reflexes among those with serum TCDD ≥10 pg/g. Blood results, other than for TCDD, were available for only 53% of participants ('t Mannetje et al 2018).

A record linkage study of New Zealand Vietnam veterans' first hospital admissions for major causes between 1988 and 2009 found a small but significant increase in hospital admissions (standardised hospitalisation ratio for all causes was 1.18; 99% CI 1.15–o 1.21). Small increases were seen for cardiovascular and cerebrovascular disease. There was an increasing trend with age for chronic obstructive respiratory disease and chronic renal failure (Cox et al 2015).

Seveso studies

An explosion at a TCP plant in Seveso, Italy, in 1976 released up to 30 kilograms of TCDD into the environment. This is the highest TCDD exposure known in a human residential population. However, the exposure (as measured by blood TCDD levels) was in the order of 10 to 25 times less than that reported in occupational cohort studies. It is also unique in that the exposure was to TCDD alone, and both genders and all ages are included in the exposed population. The Seveso Women's Health Study, initiated in 1996 with follow-up in 2008 and 2014, is the only comprehensive study to date of the health of a female population exposed to TCDD.

Following the incident, three exposure zones were classified based on decreasing soil TCDD levels, which were subsequently validated by blood TCDD results. Populations of the zones at the time of the incident were about 730 (zone A: highest exposure), about 5,900 (zone B: mid-range zone of exposure) and about 38,000 (zone R: low exposure). About 232,000 people from the surrounding non-exposed area have also been followed up to serve as the reference population.

For a summary of the health studies of Seveso residents, see Eskenazi et al (2018).

The findings for various health outcomes are described in more detail below.

Chloracne

Chloracne (193 cases) was the only health effect established with certainty at the time of the incident. Most cases occurred in children, and the highest prevalence was seen in the highest exposed zone, in particular close to the plant.

Cancer incidence

There was a non-significant excess (RR 1.2; 95% CI 0.7–2.1) in cancer incidence in the first 10 years (1977–1986) after the explosion among all young people (aged 0–19 years) who had been living in any of the three exposure zones at the time of the incident. The three zones were grouped because of the small size of the population aged 0–19 years in the two most exposed zones and the rarity of the outcomes being studied in this age group (Pesatori et al 1993).

Twenty years after the explosion, cancer incidence among all residents who had been aged 0–74 years in 1976 did not differ from expected in any of the three zones. Excess lymphohaematopoietic cancer was found in the two most contaminated zones (zone A, RR 1.39; 95% CI 0.52–3.71 and zone B, RR 1.56; 95% CI 1.07–2.27). After 15 years, excess breast cancer was found among women in zone A (RR 2.57; 95% CI 1.07–6.20). A non-significant excess for lung cancer was also noted after 15 years in zone A (RR 2.04; 95% CI 0.76–5.47). No cases of STS were found in the two most exposed zones (Pesatori et al 2009).

When follow-up was extended to 30 years, a slight increase in lymphohaematopoietic cancer incidence in zone A (RR 1.2; 95% CI 0.5–2.7) and a significant excess in zone B (RR 1.5; 95% CI 1.1–2.0) were found. A two-fold increase in all leukaemias (lymphatic and myeloid) was found in both zone A (RR 2.3; 95% CI 0.7–7.2) and B (RR 2.0; 95% CI 1.2–3.4) (Pesatori et al 2011).

Follow-up of the Seveso Women's Health Study (SWHS) cohort in 2008 found a significant positive association of individual serum TCDD with cancer incidence. The study cohort comprises women who were 1 month to 40 years of age in 1976, lived in one of the most highly exposed zones and had blood taken and stored soon after the incident. Sixty-six (6.7 percent) of the women had been diagnosed with cancer. Mean age at diagnosis was 48.8 years and geometric mean serum TCDD level was 95.3 pg/g. The adjusted hazard ratio for cancer associated with a 10-fold increase in serum TCDD level was 1.80 (95% CI 1.29–2.52) (Warner et al 2011).

Mortality

After 20 years of follow-up, the Seveso cohort study found increased all-cancer (SMR 1.1; 95% CI 1.0–1.3), lung and rectal cancer mortality for men. Diabetes mortality was increased for women after 10 years since exposure. For men and women there was a moderate increase in lymphohaematopoietic (includes Hodgkin's disease, non-Hodgkin's lymphoma and leukaemia) cancer mortality. These results are for the two most exposed zones combined. Increased chronic cardiovascular and respiratory disease mortality occurred in the 5 to 10 years immediately after the incident among the most exposed zone residents which might be related in part to psychosocial stress (Bertazzi et al 2001).

After 25 years of follow-up, the researchers noted the finding of excess lymphohaematopoietic cancer mortality in both of the most highly exposed zones and for both men and women. All-cancer mortality was not increased but was in the 20 or more-years latency category in the most exposed zone (RR 1.65; 95% CI 1.04–2.62)

because of increased male mortality (RR 1.93; 95% CI 1.12–3.33). There was suggestive evidence of excess mortality for rectal cancer, lung cancer, circulatory diseases, chronic obstructive respiratory disease and diabetes (Consonni et al 2008).

Most of the elevated mortality excesses found previously have been confirmed in the most recent update including deaths to 2013. The observed increased mortality from lympho-haematopoietic cancers in zones A and B persisted, in particular among women. Diabetes-related deaths increased, mainly among women, with an exposure zone related gradient (zone A (n=5, RR 2.1; 95% CI 0.9–5.0); zone B (n=24, RR 1.7; 95% CI 1.1– 2.5); zone R (n=161, RR 1.4; 95% CI 1.2–1.6)) (Consonni et al 2016).

Women in the two most exposed zones had elevated mortality from lymphohaematopoietic cancers (zone A (n=4, RR 1.8; 95% CI 0.7-4.9); zone B (n=20, RR 1.5; 95% CI 1.0-2.4)), diabetes (zone A (n=5, RR 2.1; 95% CI 0.9-5.1); zone B (n=24, RR 1.7; 95% CI 1.1-2.5)), chronic obstructive respiratory disease (zone B (n=17, RR 1.8; 95% CI 1.1-3.0)), and hypertension (zone A (n=9, RR 3.2; 95% CI 1.7-6.2)). Mortality was elevated 30+ years after the explosion for stomach cancer (zone A (n=3, RR 6.7; 95% CI 2.1-21.2)); melanoma (zone B (n=3, RR 5.3; 95% CI 1.6-17.8)), and hypertension (zone A (n=4, RR 5.4; 95% CI 2.0-14.4)). Men in zone A showed increased mortality from chronic ischaemic heart disease (n=9, RR 1.9; 95% CI 1.0-3.7) and other heart diseases (n=9, RR 2.0; 95% CI 1.0-3.8). In zone B, all-cancer mortality was elevated in males 20-29 years after the explosion (n=21, RR 1.7; 95% CI 1.1-2.6) (Consonni et al 2016).

Reproductive health

A cytogenetic study in 1977 found no consistent evidence of chromosomal effects associated with TCDD exposure (Pesatori et al 2003).

There was no evidence of birth defects attributable to TCDD in 34 cases of abortion that occurred in 1976 after the incident (Pesatori et al 2003).

There was no increase in birth defects among live births and stillbirths to women who were living in the area at the time of the incident in any of the three exposure zones during the five-year period 1977–1982. The small number of exposed pregnancies in the two most exposed zones might have meant non-detection of a low risk and/or rare defects (Pesatori et al 2003).

Children born to potentially exposed parents in the 20 years (1977–1996) after the incident showed a significantly lower sex ratio (ie, increased females) with increasing paternal serum TCDD levels. This effect occurred from about 100 pg/g. Males who had been younger than 19 years old when they were exposed, fathered significantly more girls than boys (sex ratio 0.38; 95% CI 0.30–0.47) (Mocarelli et al 2000).

The Seveso Women's Health Study (n=981) was initiated in 1996 to mainly study the effects of TCDD on reproductive health. Results have been published about menstrual cycle characteristics, age at menarche and menopause, cancer incidence, endometriosis, ovarian function, uterine leiomyoma (fibroids), time to pregnancy, and birth outcomes. Differing exclusion criteria, such as age and oral contraceptive use, were applied to various components of the SWHS.

About 300 women participated in the survey on menstrual function (some women were excluded for reasons such as, older than 44 and use of hormonal contraceptives). A 10-fold increase in TCDD was associated with reduced odds of having an irregular menstrual cycle. The same increase in TCDD in women who were pre-menarcheal at the time of the explosion was associated with slightly longer (less than a day) reported menstrual cycle and reduced odds of scanty menstrual flow. There was no change in other menstrual cycle characteristics (Eskenazi et al 2002b) or age at menarche (Warner at al 2004). There was no change in age at menopause with a 10-fold increase in TCDD but a dose-related increasing risk of earlier menopause up to about 100 pg/g (Eskenazi et al 2005).

By 1998, 15 women in the SWHS cohort had been diagnosed with breast cancer. Serum TCDD close to the time of the explosion ranged from 13.1–1,960 pg/g (median 71.8 pg/g). Modelling of these results predicted a statistically significant two-fold increase (HR 2.1; 95% CI 1.0–4.6) in the hazard ratio for breast cancer associated with a 10-fold increase (eg, from 10 to 100 pg/g) in serum TCDD (Warner et al 2002). By the 2008 follow-up, the increase was not statistically significant. There were 33 cases, the majority of which were premenopausal. The adjusted hazard ratio associated with a 10-fold TCDD increase was 1.44 (95% CI 0.89–2.33)(Warner et al 2011). Serum TCDD and breast cancer incidence will be re-examined using the 2014–2016 follow-up data as the majority of the SWHS cohort will then have reached menopause and breast cancer incidence will likely have peaked (Eskenazi et al 2018).

A two-fold non-significant excess (RR 2.1; 90% CI 0.5–8.0) for endometriosis was found among women with serum TCDD levels greater than 100 pg/g close to the time of the incident, but there was no clear dose-response relationship. Nineteen women in the SWHS cohort were diagnosed with endometriosis (surgically confirmed or ovarian endometriosis diagnosed by ultrasound). Serum TCDD ranged from 9.6–686 pg/g (median 77.3 pg/g). Study limitations include a small number of cases and the possibility of misclassification of disease status as it was not possible to confirm this surgically or by ultrasound for all the participants. Disease status was uncertain for 305 women (Eskenazi et al 2002a).

No adverse effects on ovarian function were found (Warner et al 2007). There was a reduced age-adjusted risk of fibroids associated with serum TCDD above 20 pg/g collected soon after the incident (Eskenazi et al 2007).

Dose-related increases in time to pregnancy and infertility have been found. A 10-fold increase in TCDD measured at the time of the incident or extrapolated to the time of the first post-incident pregnancy was associated with about a 25 percent reduction in the monthly probability of conception (adjusted OR 0.75; 95% CI 0.60–0.95) and about a doubling of odds that pregnancy took at least 12 months to conceive (adjusted OR 1.9; 95% CI 1.1–3.2). Results were similar for different subgroups in sensitivity analyses. Median time to pregnancy was two months. Seventeen percent reported taking at least 12 months to conceive (Eskenazi et al 2010). Follow-up 40 years after the explosion, when most women will have completed their families, also found a 10-fold increase in serum TCDD was associated with longer time to pregnancy (adjusted OR0.80; 95% CI 0.66–0.98). Preliminary analyses suggest gene-environment interaction (between AhR pathway gene variants and TCDD levels) may play a role (Eskenazi et al 2019).

A retrospective study of pregnancy outcomes in women from the two most exposed zones found no significant findings in terms of birth outcomes such as birth weight, birth defects, spontaneous abortion and gestational age. Median serum TCDD level was 46.6 pg/g at the time of the incident.[18] Associations for TCDD and lowered birth weight and gestational age were stronger though non-significant for pregnancies that occurred within the first half-life (ie, eight years) after the explosion. Within the first year after the explosion, about one-third of all pregnancies ended in voluntary abortion, but the rate did not vary by exposure. Some of these pregnancies could have resulted in an adverse outcome. The authors noted the possibility that the effects are yet to be observed since the most heavily exposed women were the youngest and the least likely to have had a pregnancy at the time of the study (Eskenazi et al 2003). The 2008 SWHS follow-up found no association between estimated TCDD at pregnancy (ie, *in utero* TCDD) and spontaneous abortion, fetal growth or gestational age and a non-significant inverse association between 1976 TCDD and birth weight (Wesselink et al 2014).

In the most recent SWHS follow-up (2014–2016), no associations were found between maternal initial serum TCDD or maternal TCDD estimated at pregnancy and spontaneous abortion. Results were also similar when the analysis was limited to first post-explosion pregnancies only.

As of the most recent follow-up (2014–2016), 52 children were born with any birth defect and 13 children were born with a major birth defect (hypospadias/epispadias (n=2), anencephaly (n=1), anomalies of the heart (n=5), anomalies of the vascular system (n=3), cleft palate/lip (n=2)). In unadjusted analyses, a 10-fold increase in maternal initial serum TCDD was not associated with having a child with a birth defect (RR 1.18; 95% CI 0.72–1.91). Results were similar for maternal TCDD estimated at pregnancy (RR 1.30; 95% CI 0.84– 2.02). The small number of cases limits statistical power and there was no medical record confirmation of cases (Eskenazi et al 2018).

Decreases in sperm quality (count and motility) were reported in 1998 in men who were under 10 years of age at the time of the explosion. The opposite effect was seen in men exposed during puberty. No effect was seen for those exposed as young adults (18–26 years). In both the
1–9 and 10–17 years age groups, there was a significant reduction 22 years later in the reproductive hormone estradiol and a corresponding increase in follicle stimulating hormone (FSH). These effects were seen at TCDD concentrations less than 68 pg/g. TCDD concentrations in 1976 were comparable among the three age groups (Mocarelli et al 2008).

About 50 percent lowered sperm concentration and total sperm count and 20 percent lowered sperm motility has been found in young adult men born to women who were living in zone A in 1976, who were exposed both *in utero* and through breastfeeding. In addition, the concentration of FSH was increased and inhibin B decreased. These findings were seen starting from 19 to 40 pg/g above the background level. They were not seen in males who had been exposed *in utero* but had not been breastfed (Mocarelli et al 2011).

[18] TCDD results are for blood taken shortly after the explosion and before conception.

Other

Childhood TCDD level was associated with developmental enamel defects, particularly in those aged less than five years at the time of the explosion, and hypodontia (Alaluusua et al 2004).

Other SWHS findings

The 2008 SWHS follow-up found no adverse effect on bone mineral density in those exposed aged 20 or less years. Median serum TCDD soon after the explosion was 73 pg/g (Eskenazi et al 2014). TCDD and dioxin-like PCBs have been shown to impair bone metabolism in some animal studies.

A 10-fold increase in TCDD was associated with metabolic syndrome in 2008 but only among women aged 12 years or younger at the time of the explosion (adjusted OR 2.03; 95% CI
1.25–3.30). There was no association between a 10-fold increase in TCDD and obesity, irrespective of age at exposure, or diabetes (Warner et al 2013).

Serum TCDD concentration in 1976 was inversely associated with total thyroxine concentration in 1996, but not in 2008, in women who were pre-menarche at the time of the explosion. No association was seen between TCDD concentration in 1996 and total thyroxine in 1996 or 2008. There was no association between TCDD and any other thyroid hormone (Chevrier et al 2014).

No associations were found between serum TCDD in 1976 and cognitive function (verbal or spatial working memory) measured 30 years later. No associations were also found between serum TCDD and physical function (walking speed, lower body flexibility, or manual dexterity) measured 20 years after, with the exception of a U-shaped relationship with grip strength with poorer strength at lowest and highest levels of TCDD exposure. The authors commented that further follow-up is warranted given the women were relatively young (average age 52 for memory and 57 for physical function) at the time of assessment and limited neuropsychological tests were undertaken (Ames et al 2018a).

Effects on the second generation

Evidence suggests that maternal TCDD exposure affects neonatal thyroid function. A study of singleton live births from 1994 to the end of 2009 found that the level of neonatal thyroid-stimulating hormone (TSH) was significantly associated with maternal TCDD levels in 1996 and at pregnancy but not in 1976 among SWHS women who were aged less than five years at the time of the 1976 explosion. There was no relationship between neonatal TSH and maternal TCDD levels among women aged five years or older at the time of the explosion (Mocarelli et al 2013). Baccarelli et al (2008) found significantly higher mean neonatal TSH levels in children born between 1994 and 2005 to women from Seveso zones A and B (resident at the time of the explosion or who had moved into the area some time up to the end of 1979) compared with the level in children born to women from the surrounding non-contaminated area. Neonatal TSH

levels were also highest in the children whose mothers had the highest TCDD levels at delivery. The association between maternal serum TCDD and neonatal TSH is being re-evaluated in a larger sample through data collected in the Seveso Second Generation Health Study (Eskanazi et al 2018).

In 2014–2016, 611 children of SWHS participants who were born after the explosion were enroled in the Seveso Second Generation Health Study (66.4% of 920 alive and eligible children born to 402 mothers). This study's goal is to describe the health impacts of *in utero* TCDD exposure in the children of SWHS participants (Eskenazi et al 2018).

Sixty-five percent (n=161) of children who were 7–17 years old at enrolment had a neuropsychological assessment. A 10-fold increase in 1976 maternal serum TCDD and maternal serum TCDD estimated to pregnancy were not significantly associated with their children's neuropsychological performance. There were suggestive findings of differences by sex and breastfeeding history to learning (more errors in boys than girls) and attention (0-1 month breastfeeding) measures (Ames et al 2019). The authors commented that further research that includes the adult children in the second generation, many of whom received the highest prenatal exposures, may better reveal the long-term neuropsychological effects of prenatal TCDD exposure.

Aryl hydrocarbon receptor genetics may explain variation in human susceptibility to dioxin. Wesselink et al (2014) found a 10-fold increase in 1976 maternal serum TCDD was associated with a non-significant reduction in birthweight. A stronger adverse association between maternal TCDD and child birthweight was found for some variations in maternal AhR genotypes suggesting gene-environment interaction (Ames et al 2018b).

In experimental studies, prenatal and perinatal exposure to TCDD suppresses immune function.
Maternal TCDD in 1976 or estimated at pregnancy was not significantly associated with asthma or hay fever. Maternal TCDD in 1976 was significantly inversely associated with eczema (adjusted RR 0.63; 95% CI 0.40–0.99). Maternal TCDD estimated at pregnancy was not significantly associated with eczema. There was no strong evidence of effect modification by child sex (Ye et al 2018).

The ratio of the length of the second finger to the fourth finger (2D:4D) is a biomarker of androgen levels and the androgen/estrogen balance *in utero*. Although TCDD is an endocrine disruptor, *in utero* TCDD exposure, either maternal TCDD in 1976 or TCDD estimated at pregnancy, was not significantly associated with 2D:4D ratio in the Seveso children (Slama et al 2019).

Warner et al (2019) found prenatal TCDD exposure alters cardiometabolic endpoints in a sex-specific manner. Maternal TCDD soon after the explosion was inversely associated with body mass index (BMI) for daughters only and associated with increased risk for metabolic syndrome (hyperglycemia, hypertension, and dyslipidemia) for sons only (adjusted RR 2.09, 95% CI 1.09– 4.02). Results for TCDD estimated at pregnancy were comparable.

Study of the Seveso third generation (ie, the SWHS grandchildren) has also begun. Of the 431 SWHS children who were 18 years or older, 76 daughters have reported 134 pregnancies and 45 sons have reported 76 pregnancies at interview (Eskenazi et al 2018).

Dioxins in breast milk

The mean TCDD level in the 1988 New Zealand breast milk study which sampled 38 women who were breastfeeding their first child was 5.1 pg/g (range 0.9–13) (Bates et al 1990). Ten years later, a repeat study of 53 breastfeeding women found the mean TCDD level was 1.22 pg/g (range 0.35–2.9) (Bates et al 2001). In 2008, this had further declined to 0.75 pg/g (range 0.29–1.72) ('t Mannetje et al 2010).

The third national breast milk study of 39 women used the same methodology. Total TEQ was 4.8 pg/g compared with 8.7 pg/g in 1998, and higher in rural than in urban areas. About 75 percent of the total TEQ was attributable to dioxins; the rest to dioxin-like PCBs. There was a 40 percent decrease in total TEQ for dioxins and a 54 percent decrease for dioxin-like PCBs. There was also a decline in levels of selected organochlorines, for example, dieldrin, over the 10 years, ranging between 34 and 90 percent ('t Mannetje et al 2010).

New Zealand submitted the first two samples collected for its 1988 national breast milk study to the 1988 WHO breast milk survey of dioxins. Participating countries followed the same study protocol as far as possible. The purpose was to compare the total toxic burden in breast milk in different countries and in some instances, different areas within a country. Outside the European region, the lowest TEQ levels were reported from New Zealand, Thailand, India and north Vietnam (Hanoi). The highest TEQ values were reported in some areas of south Vietnam, although large differences were reported between areas in Vietnam. Large differences for TCDD levels were also reported between areas in Vietnam, including within south Vietnam. Table 2 compares the TCDD results for New Zealand with those of some other countries, including specific areas in Vietnam (Yrjanheikki 1989).

Comparison of breast milk dioxins results from different studies is not valid unless the study protocols for collecting and analysing the samples are consistent. For example, breast milk dioxins decrease over the period of lactation and generally are lower as the parity (or number of children) of the woman increases.

Table 2: TCDD levels (pg/g lipid) in breast milk in certain countries (1988 WHO breast milk survey)

	TCDD (pg/g)
Vietnam (Song Be)	17
Belgium	9.7
Vietnam (Ho Chi Minh)	7.1
Netherlands	5.3
United Kingdom	5.5
Poland	3.6
USA	3.3
Vietnam (Hanoi)	2.2
New Zealand	**1.4**
India	<1
Thailand	<1

The most recent national breast milk study ('t Mannetje et al 2010) submitted a pooled sample taken from 37 first-time mothers aged 20–30 years to the fourth WHO breast milk survey. The TCDD concentration was 0.55 pg/g lipid. The PCDD/F TEQ was 3.51 pg/g and the PCB TEQ 1.95 pg/g ('t Mannetje 2012).

Blood TCDD levels

Occupational studies

New Zealand

A study of nine New Zealand 2,4,5-T applicators, with an average of 193 months spraying, found that the mean TCDD serum level (53.3 pg/g) in 1988 was almost 10 times that of the matched control subjects (mean 5.6 pg/g). In general, the serum TCDD level increased with duration of 2,4,5-T exposure. These applicators had sprayed 2,4,5-T from 83 to 372 months. Given the half-life of TCDD, the findings suggest that the increase in TCDD would be about 3 pg/g among workers who only sprayed for one year (Smith et al 1992).

Over the period 2005–2007, serum samples were collected from 241 of 1134 IWD workers who had been employed between 1962 and 1988 for at least one day and were estimated to have potential TCDD exposure based on one or more of their jobs and/or were involved in the 1986 Paritutu accidental release. These workers had spent an average of 32.5 months in a job with potential TCDD exposure. Current mean serum TCDD was 9.9 pg/g.

Table 3: Mean TCDD levels of IWD workers by department and exposure level (pg/g lipid)

Department	Estimated exposure level	Serum TCDD level
Continuous exposure		
Trichlorophenol	Low	23.4
	High	21.9
Phenoxy	Low	12.4
	Medium	13.9
	High	17.9
Formulations	Very low	8.6
	Low	5.9
Herbicides	Low	6.6
Pilot plant	High	7.5
Intermittent exposure		
Construction and maintenance	Very infrequent	8.4
	Infrequent	13.1
	Monthly	13.9

Department	Estimated exposure level	Serum TCDD level
Mechanics and transport	Very infrequent	6.6
	Infrequent	19.1
	Monthly	22.1
Phenoxy laboratory	Daily	3.6
TCDD laboratory	Daily	5.9
Other laboratories, R&D	Very infrequent	3.7
	Infrequent	3.5
	Monthly	3.9
Professional personnel (including engineering and manufacturing)	Very infrequent	15.8
	Infrequent	6.2
	Monthly	10.0
	Daily	17.5
Accident		
1986 release	NA	37.9
Unexposed workers		
Never exposed	NA	4.9

NA = not applicable

Source: Collins et al 2008b

Mean serum TCDD was 4.9 pg/g for 105 of 465 workers whose work histories indicated they were never exposed to TCDD. These workers spent an average of 53.9 months in these jobs.

There were no significant differences between the exposed and non-exposed groups for dioxins other than TCDD, furans or PCBs.

The highest current mean serum TCDD of 37.9 pg/g was found among those involved in the 1986 release. Among workers with routine continuous exposures, levels of 21.9 or 23.4 pg/g, depending on job type, were found in the TCP department. Phenoxy plant workers ranged from 12.4 to 17.9 pg/g, and workers with jobs in formulations, herbicides and the pilot plant ranged from 5.9 to 8.6 pg/g. Those with intermittent exposure, such as construction and maintenance workers, mechanics and transport and professional personnel, had levels generally consistent with many continuous exposure jobs (see Table 3 above). The lowest TCDD levels were found in laboratory workers, with the exception of the TCDD laboratory (5.9 pg/g) (Collins et al 2008b).

Measured current serum TCDD levels of former IWD workers are relatively low compared with other occupational cohorts with a similar time period between blood collection and last occupational exposure. Estimated serum TCDD levels[19] for all workers in the cohort (n=1599) were less than 300 pg/g over the study period (Aylward et al 2010).

[19] Measured TCDD levels for 346 workers, work histories and a pharmacokinetic model were used to estimate the levels for all workers.

Another serum study of former IWD workers[20] who provided blood around the same time as the company funded study found men who had worked in the phenoxy/ TCP production area had a mean TCDD serum concentration of 19.1 pg/g lipid, three times the mean concentration of workers in other parts of the plant. Duration of employment in certain occupations, in particular phenoxy herbicide synthesis, was associated with increased serum TCDD.

Most other workers, and 39 firefighters stationed near the plant and/or who attended call-outs to the plant during the period of 2,4,5-T manufacture had serum concentrations of dioxin-like compounds comparable to those of the general population. Mean TCDD serum concentration for the firefighters was 1.6 pg/g ('t Mannetje et al 2016).

The historical TCDD exposure of the former IWD workers is comparable to that reported for the US Ranch Hand cohort by Pavuk et al (2014), and comparable to or lower than that reported for several 2,4,5-T production cohorts from other countries ('t Mannetje et al 2016).

The serum dioxin congener profile from former sawmill workers randomly selected from a morbidity study cohort 20 years after PCP use had ceased showed a predominance of 1,2,3,6,7,8-HxCDD, 1,2,3,4,6,7,8-HpCDD and OCDD (see Table 4 below). Age-adjusted levels increased with duration of exposure, particularly those with more than 10 years exposure. Levels of specific higher chlorinated dioxin congeners were significantly higher in those whose work involved high exposure (mixing PCP, cleaning sludge from dip tanks and handling treated timber on a sorting table) (McLean et al 2009b).

Exposed sawmill workers' jobs were PCP concentrate mixer, dip bath operator, timber grader, green table hand or green chain puller, yard hand, order man or boron diffusion plant operator.

Table 4: Mean levels of selected dioxin congeners in former sawmill workers (pg/g lipid)

	Exposed (n=71)	Non-exposed (n=23)
2,3,7,8-TCDD	1.88	1.48
1,2,3,7,8-PeCDD	5.64	4.62
1,2,3,4,7,8-HxCDD	2.98	2.46
1,2,3,6,7,8-HxCDD	29.39	13.54
1,2,3,7,8,9-HxCDD	3.78	2.53
1,2,3,4,6,7,8-HpCDD	28.51	13.58
OCDD	309.25	157.83
WHO-TEQ	13.67	9.56

Source: McLean et al 2009b

[20] This study of 244 production cohort workers included the serum PCDD/Fs results of 133 workers who had already provided blood as part of the company funded study.

Serum results from 23 members of Sawmill Workers Against Poisons (SWAP) tested by the Accident Compensation Corporation (ACC) in 2006 (at the same laboratory, using the same analytical method) showed considerably higher levels than the exposed sawmill workers but also elevated non-PCP specific congeners (see Table 5 below). The SWAP members worked at the Whakatane sawmill.

Table 5: Levels of selected dioxin congeners in SWAP members (pg/g lipid)

	Mean	Range
2,3,7,8-TCDD	3.58	0.62–9.25
1,2,3,7,8-PeCDD	14.84	5.97–28.4
1,2,3,4,7,8-HxCDD	9.82	2.37–18.3
1,2,3,6,7,8-HxCDD	95.26	21.5–285
1,2,3,7,8,9-HxCDD	9.95	2.71–27.4
1,2,3,4,6,7,8-HpCDD	83.96	9.27–200
OCDD	917.60	184–2200
WHO-TEQ	37.74	13.7–77.7

Source: McLean et al 2009b

International

The blood TCDD levels estimated at the last time of exposure from three occupational cohorts that have shown increased all-cancer mortality are 2,000 pg/g (mean) up to 32,000 pg/g, 1000 to 2400 pg/g, and 345 to 3890 pg/g (Smith and Lopipero 2001).

The mean serum TCDD level of 30 United States Dow Chemical Company workers exposed to chlorophenols was estimated to be 582 pg/g, assuming a seven-year half-life, and 1928 pg/g, using a toxicokinetic model at the time workplace exposure ended (Collins et al 2006).

Non-occupational studies

New Zealand population

In the 2012 national population (aged 19–64 years) serum persistent organic pollutants study the mean weighted TCDD concentration was 0.88 pg/g lipid. TCDD was only detected in 37 percent of the sample ('t Mannetje et al 2013).

Arithmetic mean TCDD was 62 percent lower than in the 1997 survey. The weighted geometric mean of PCDDs/Fs was 5.3 pg/g which increased by age (3.2, 4.4, 4.8 and 8.1 pg/g for the 19-24, 25-34, 35-49 and 50-64 years age groups). The toxic equivalency

for the overall weighted arithmetic mean PCDD/F (using WHO 1998 toxic equivalence factors) was 50 percent lower than in the 1997 survey (Coakley et al 2018).

Paritutu, New Plymouth

Modelling was used in the Paritutu serum dioxins study to identify a potentially highly exposed group of current and former residents from a self-selected sample of the population who had lived within a 2-kilometre radius east and 1-kilometre radius south of the former IWD plant for at least one year during the period of 2,4,5-T manufacture.

The mean serum TCDD concentration was 6.5 pg/g, while the expected national mean for a similar group in 2004 was 1.7 pg/g (ie, there was a 3.8-fold increase). Expected background TCDD levels in 2004 were extrapolated from the MfE's national serum organochlorines study carried out from 1996 to 1997 (Buckland et al 2001). Individual TCDD levels ranged from 0.85 to 33.3 pg/g. Mean elevations in the age-gender subgroups were up to seven times higher than those expected, with greater elevations for older than younger people. The serum TCDD levels for each subgroup are given in Tables 6 and 7 below.

There was a non-significant mean elevation in serum TEQ of 1.2-fold, which was predominantly due to the elevation in TCDD.

Duration of residence throughout the period 1962–1987 was important in terms of whether participants had an elevated TCDD level or not. The mean TCDD level for those who had lived in Paritutu for at least 15 years was 14.7 pg/g (n=14) compared with an expected mean of 2.4 pg/g, whereas for those who had lived in Paritutu for less than 15 years, it was 3.6 pg/g (n=38) compared with an expected mean of 1.5 pg/g.

There was a statistically significant two-fold elevation in mean TEQ for those who had lived in Paritutu for at least 15 years, but there was no difference from the background TEQ level when TCDD was subtracted from the total TEQ.

Table 6: Mean serum TCDD levels for Paritutu and New Zealand

Age group	N	Paritutu TCDD (pg/g lipid) Mean (95% CI)	Projected TCDD (pg/g lipid) from MfE study Mean (95% CI)
Female			
19–24 years	4	1.4 (0.8–2.1)	0.6 (0.5–0.7)[21]
25–34 years	4	1.3 (1.0–1.6)	0.9 (0.8–1.1)
35–49 years	7	5.3 (2.3–8.3)	1.4 (1.3–1.6)
50–64 years	11	6.0 (3.1–8.9)	2.4 (1.9–2.8)
65+ years	4	17.8 (9.9–25.7)	4.1 (3.5–4.6)
Total	**30**	**6.2 (3.8–8.6)**	
Male			
25–34 years	2	1.7 (0.7–2.7)	0.6 (0.5–0.7)
35–49 years	3	1.9 (1.3–2.5)	1.1 (1.0–1.2)
50–64 years	12	6.1 (2.3–10.0)	1.5 (1.4–1.7)
65+ years	5	14.0 (4.1–24.0)	1.9 (1.7–2.1)
Total	**22**	**6.9 (3.5–10.3)**	
All ages	**52**	**6.5 (4.6–8.6)**	**1.7 (1.5–1.9)**

Source: Fowles et al 2005

For study participants who had lived in Paritutu at least 15 years, the peak increase in serum TCDD above the background level at the time 2,4,5-T production ceased in 1987 (or earlier if they left the area) is crudely estimated to have been between 39 and 77 pg/g, assuming average half-lives of 7.1 and 11 years. For the total study group, the mean past peak TCDD level is estimated to have been between 17 and 35 pg/g above the background level.

[21] The MfE stratum was for 15–24 year olds.

Table 7: 2004 Paritutu serum TCDD concentrations (pg/g lipid)

Age group (in 1997)	N	Range	Mean	Median
Female				
19–24 years	4	0.9–2.1	1.4	1.3
25–34 years	4	0.9–1.7	1.3	1.2
35–49 years	7	1.2–13.5	5.3	5.1
50–64 years	11	1.8–17.9	6.0	4.5
65+ years	4	8.3–25.4	17.8	18.8
Total	**30**	**0.9–25.4**	**6.2**	**3.4**
Male				
25–34 years	2	1.1–2.2	1.7	1.7
35–49 years	3	1.3–2.4	1.8	1.9
50–64 years	12	1.6–24.3	6.0	3.7
65+ years	5	4.3–33.3	14.0	11.8
Total	**22**	**1.1–33.3**	**6.9**	**3.7**
All ages	**52**	**0.9–33.3**	**6.5**	**3.7**

Source: Fowles et al 2009

After the Fowles et al study had been published, the study's principal investigator re-examined the data, using toxicokinetic information about half-lives that had not been published when they originally completed their study. This unpublished re-analysis suggests that exposure was most significant in the years 1965–1968. The volume of 2,4,5-T produced and the concentration of dioxin in 2,4,5-T was also greatest for the period 1962–1973, in particular 1964 and 1967–1973 (Fowles et al 2004).

Mapua

A morbidity study of nearby Mapua residents concerned about onsite mechano-chemical dehalogenation remediation of a site extensively contaminated by previous pesticides manufacture, included some serum dioxins testing. Dioxin levels and measures of health did not differ significantly between the exposed community and a control community of similar socioeconomic status. TCDD was below the limit of detection in most serum samples, with some congeners being higher in controls (McBride et al 2016).

International

With the exception of Australia, the TCDD levels in Table 8 below may not be representative of the general population of these geographical areas.

The United States mean TCDD level of 1.9 pg/g is based on four studies, totalling 588 blood samples collected from 1996 to 2001 from non-exposed people and, with the exception of one study, is not based on a population sample.

In some geographical areas other dioxins are a much greater contributor to total toxicity than TCDD, for example, despite having lower TCDD levels, the TEQ for all dioxins for Germany is similar to that for United States and two areas (Binh Hoa, Dong Nai) in south Vietnam (Schecter et al 1994).

Table 8: Blood TCDD levels in selected countries

	TCDD (pg/g lipid)	Reference
Germany	3.6 (n=102; whole blood)	Schecter et al 1994
Vietnam:		Schecter et al 1994
• Binh Hoa (south)	28 (pooled n=50; whole blood)	
• Dong Nai (south)	12 (pooled n=33; whole blood)	
• Ho Chi Minh City (south)	3.4 (pooled n=50; whole blood)	
• Hanoi (north)	<2.4 (pooled n=32; whole blood)	
Australia	0.9	Harden et al 2004
United States	1.9	Patterson et al 2004

Aerial spraying of Agent Orange occurred in parts of south Vietnam between 1962 and 1971, with the heaviest spraying occurring between 1967 and 1969. Blood samples were taken in 1999 from people living in three communes in central Vietnam where aerial spraying had occurred from 1965 to 1970. The amount of aerial spraying was least in Hong Van. Results of pooled whole blood samples from men and women at least 25 years old are given in Table 9 below.

Table 9: Blood TCDD levels in Central Vietnam, 1999

	Male	Female
Huong Lam	17 (n=31)	5.3 (n=29)
Hong Thuong	21 (n=43)	12 (n=37)
Hong Van	ND[22] (n=37)	ND (n=27)

Source: Dwernychuk et al 2002

At the time of the Seveso explosion in 1976, no methods were available to measure low TCDD concentrations in small blood samples. Therefore, blood taken soon after the incident was stored and analysed from the late 1980s.

TCDD concentrations for zone A ranged from 828–56,000 pg/g for 10 children with chloracne and from 1770–10,400 pg/g for nine adults with no chloracne (Bertazzi et al 1998).

Median serum TCDD levels from blood collected from the supposedly most exposed residents in 1976 were 447.0 and 94.0 pg/g for zones A and B respectively (Pesatori et al 2009).

[22] ND = not detected.

Between 1992 and 1993 blood was also taken from randomly selected people over 20 years of age, and TCDD levels were back-calculated to 1976, assuming a half-life of 7.1 years (see Table 10 below).

Table 10: Back-calculated Seveso TCDD results by zone

Exposure zone	Mean	Median	N
A	333.8	388.7	6
B	111.4	76.6	52
Reference	5.3	5.5	52

Source: Bertazzi et al 1998

TCDD results close to the time of the Seveso explosion for the SWHS cohort give a range of
3.2–56,000 pg/g (median 272.0 pg/g) for zone A and 2.5–3,140 pg/g (median 47.1 pg/g) for zone B. The youngest children at the time of the incident had the highest levels, and levels decreased with age until about 13 years when they became constant. Zone of residence and age were the strongest predictors of serum TCDD. Other factors related to serum TCDD were:

- chloracne
- nearby animal mortality
- being outdoors at the time of the incident
- consumption of home-grown produce (Eskenazi et al 2004).

In 1996 (ie, 20 years later) the mean TCDD results among randomly sampled exposed residents were 53.2 pg/g for those in zone A and 11 pg/g for those in zone B. This compares with 4.9 pg/g for those in the non-exposed zone. This study excluded people with severe medical illness and previous chloracne (Landi et al 1998). Levels ranged from 1.0 to 62.6 pg/g in zone B (Landi et al 1997).

A blood serum dioxin study in 1999 of 28 adult residents from a community in Louisiana, United States, who were concerned about exposure from nearby chemical industries found a mean TCDD level of 7.6 pg/g. Study participants had an mean age of 53 years and had lived in the area at least five years. Most reported eating locally caught fish and shellfish, although a public health advisory had been issued that limited consumption because of chemical contamination (Orloff et al 2001).

The United States Dow Chemical Company funded the University of Michigan to undertake a dioxin exposure study (University of Michigan Dioxin Exposure Study) in response to public concern that soil dioxins contamination from its plant in Midland, Michigan may have resulted in elevated serum dioxins levels. In 2005, serum testing of randomly selected adults who had lived for at least five years in one of five areas including a flood plain area and a control area found significantly elevated median TEQ in the flood plain area compared with the control area. Three of the five congeners contributing most to the serum TEQ were the main contributors to elevated soil TEQ in the flood plain (2,3,4,7,8-PeCDF) and plume area downwind of the Dow plant (2,3,7,8-TCDD and 1,2,3,7,8-PeCDD) (Hedgeman et al 2009). Modelling of the serum results showed that demographic factors, including age, gender and body fat, were the most important contributors to population variation in both serum TEQ and TCDD. Living on contaminated soil and contaminated household dust were very small contributors (Garabrant et al 2009).

Paritutu TCDD levels in comparison to other non-occupational studies

The mean Paritutu serum TCDD result of 6.5 pg/g in 2004 (ie, 17 years after 2,4,5-T manufacture ceased in the area) is lower than that in the mid-range exposed zone of Seveso 20 years after the explosion there, and is lower than most reported results found in areas of central and south Vietnam where aerial spraying of Agent Orange is known to have occurred about 20 to 28 years previously. It is similar to that found in 1999 in a United States community that is situated close to chemical plants but is higher than that found near the United States Dow plant.

The mean serum TCDD result of 14.7 pg/g in 2004 for those who had lived in Paritutu for at least 15 years from 1962 to 1987 is slightly higher than that of the mid-range exposed zone of Seveso 20 years after the explosion there and similar to some, but not as high as the highest, reported results found in areas of central and south Vietnam where aerial spraying of Agent Orange is known to have occurred about 20 to 28 years previously.

Paritutu soil study

A residential Paritutu soil study undertaken in 2002 for the MfE found TCDD at all Paritutu sites investigated, but all but one result was below the most conservative international residential guidelines set to protect people's health (Pattle Delamore Partners Ltd 2002). The results are also below the New Zealand soil contaminant standard for TCDD to protect human health in regard to residential land that includes 10 percent home-grown produce consumption (Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011).[23]

These soil findings are consistent with historical emissions from the IWD plant as the source of TCDD in the area, with the level of TCDD normally low in relation to other dioxins when the primary source of dioxin is combustion. A previous MfE study did not find TCDD in urban soils in any parts of New Zealand other than New Plymouth (Buckland et al 1998).

Concentrations tend to be highest close to the former IWD plant and drop off rapidly within 800 to 1000 metres of the plant. Concentrations to the east of the plant, towards Mount Moturoa Domain, are higher than to the south of the plant. This is consistent with the prevailing winds in the area.

Dioxin is very stable under most environmental conditions, undergoing only very slow change in undisturbed soil over many decades.

[23] Available from **www.legislation.govt.nz**

Other New Plymouth studies

In 1980, an independent clinical assessment of 45 current IWD workers (90 percent response rate) involved with 2,4,5-T manufacture found no evidence that their health had been adversely affected by their work. The assessment included a comprehensive medical examination and routine laboratory tests. Three pregnancies among the partners of workers during their time employed by IWD had resulted in miscarriages; in two cases, there was a history of miscarriage, stillbirth or birth defects before the worker had been employed at IWD (Department of Health 1980a).

A cancer mortality atlas, using 1974–1978 mortality data, found a higher rate of non-Hodgkin's lymphoma and Hodgkin's disease in New Plymouth compared with the national mean (Borman 1982). At that time, there was no scientific evidence of an association between lymphatic cancer and dioxin.

From 1965 to 1971, 3.1 percent of babies born at Westown Maternity Hospital, in New Plymouth were reported by a former midwife to have had birth defects. Her study recorded 48 of 167 birth defects as neural tube defects, defined as including anencephaly, hydrocephaly, microcephaly and spina bifida (Carnachan 2002). Neural tube defects are usually defined as including anencephaly and spina bifida but not hydrocephaly, which may be caused by spina bifida or microcephaly.

A former medical officer of health carried out two studies in response to public concerns about health effects associated with living near the former IWD plant (O'Connor 2001, 2002). The first study compared health effects for the local Paritutu community with those for the New Zealand population and found no difference in cancer registrations (1990–1997), a lower rate of birth defects notifications (1988–1999) and 6 percent (within the range of variation expected by chance) higher cancer mortality (1988–1997). The results do not exclude a small increased cancer risk. Data for multiple sclerosis[24] were insufficient to draw conclusions about comparative incidence rates of the disease (O'Connor 2001).

The same former medical officer of health also investigated the incidence of neural tube defects, since the historically available labour ward records mention only major defects and at that time there was suggestive evidence of an association between spina bifida and exposure to TCDD.[25] The New Plymouth rate of neural tube defects (1965–1972) was slightly higher than the estimated national rate but the difference was not statistically significant. Three cases were identified from an area near IWD, which

[24] Multiple sclerosis had been raised as a concern by the community.

[25] As a result of the 2014 IOM review, spina bifida in offspring was moved from the limited or suggestive evidence category into the inadequate or insufficient evidence category (National Academies of Sciences, Engineering, and Medicine 2016).

was two cases more than what was expected based on the New Plymouth rate. Although not a statistically significant difference, this result is uncertain given uncertainties with the data and the definition of the study area (O'Connor 2002).

The prevalence of birth defects, and specifically talipes and congenital dislocation of the hips, in New Plymouth from Westown Maternity Hospital unpublished data for 1965–1971 was found to be significantly higher than that reported in published New Zealand hospital and population-based national and local studies from that period. There was no difference between the rates of spina bifida (which has been associated with TCDD in some studies), Down syndrome, congenital heart defects and facial clefts (Borman and Read 2010).

The New Zealand Birth Defects Monitoring Programme (NZBDMP) was established in 1977. Analysis of the earliest available data (1980–1989) from the NZBDMP showed that the rate of birth defects was consistently higher in New Plymouth than the national average and many other areas. The difference was likely due to an ascertainment bias with very high rates of congenital dislocation of the hips and talipes in New Plymouth (Borman and Read 2010).

In late 2005, the Ministry of Health released the findings of a study of all-cancer and Hodgkin's disease, non-Hodgkin's lymphoma, STS and CLL incidence and mortality in New Plymouth from 1970–2001. This study found excess all-cancer (SIR[26] 111; 95% CI 104–119), non-Hodgkin's lymphoma (SIR 175; 95% CI 121–246) and CLL (SIR 251; 95% CI 144–408) incidence for 1970–1974 compared with the rest of New Zealand. This is the only time period that shows an elevated cancer risk for all cancers and at least one of the four specific cancers associated with dioxin exposure. Assuming a 10-year minimum latency period and that the cause was TCDD, the period of exposure would have been 1960–1964, which is partially outside the 2,4,5-T manufacturing period and before TCP was manufactured on site. Moreover, annual 2,4,5-T production was lower over the period 1962–1964 compared with other years when the level of TCDD in 2,4,5-T was the same. Whilst TCDD exposure in the first few years of 2,4,5-T manufacture may have had a role, unknown exposure(s) before the start of 2,4,5-T manufacture and chance are also possible explanations. The study's limitations mean the possibility of an undetectable small elevation in cancer risk cannot be excluded (Read et al 2007).

[26] SIR = standardised incidence ratio.

The health of the Paritutu population

To date, there has been no scientific evidence of increased disease rates in the New Plymouth population attributable to dioxin. However, current data limitations mean the possibility of a small increased risk cannot be excluded.

It is possible that the TCDD levels found may have health consequences for individuals or may cause increased rates of disease, in particular cancer, on a population basis. The extent of the cancer risk is highly uncertain, but based on the evidence from the more highly exposed IARC occupational cohort and the Seveso cohort, in 2005 the Ministry of Health estimated that it may be up to 10 percent above the national cancer mortality rate as a worst-case scenario for the population who lived for at least 15 years in the most exposed areas (ie, 1 kilometre to the east and about 400 metres to the south) during the 2,4,5-T manufacturing period or possibly in the period 1965–1968.

This risk estimation was based on the scientific evidence at the time the findings of the Paritutu serum dioxins study were released. Since then, further published studies from Seveso (Consonni et al 2008, Pesatori et al 2009) and on toxicokinetics (Aylward et al 2005a, 2005b) support the conclusion that any increase in total cancer mortality in Paritutu is likely to be very small, most likely in the order of a few percent at most.

Serum dioxins testing

Individual blood dioxins testing is not recommended. The results only indicate if a person has been exposed to dioxins and cannot be used to predict either whether that person will develop health effects or not because of the exposure or the outcome of health effects that the person currently has. Back-calculation from a current serum TCDD level to estimate peak historic exposure is also limited due to varying half-life with age, body mass index and exposure dose.

Toxicokinetic models that take account of evidence that TCDD elimination is dose-dependent, using a first-order elimination model based on an average half-life (eg, 7–11 years) to back-calculate peak exposure could significantly underestimate peak exposure (Aylward et al 2005a; Aylward et al 2005b; Emond et al 2005).

Tests for measuring dioxins levels in people are not routinely available. A blood dioxins test costs about $2,200 per person tested and, depending on the detection limit, a large volume of blood is required, for example, 90 millilitres.

If the detection limit is too high and various dioxins are not detected, the scientific convention when calculating the TEQ is to assume that those dioxins are actually present at a level of half the detection limit value. Depending on the number of non-detectable dioxins, this may result in an over-estimated and uninformative result.

Pentachlorophenol

Pentachlorophenol is another chemical that was used widely in New Zealand and was contaminated with dioxins. Use in New Zealand differed from overseas where it was used mainly as a PCP in oil timber preservative. Its predominant use in New Zealand was as an antisapstain fungicide in the treatment of *Pinus radiata* either by spraying or more commonly dipping the timber in baths containing PCP solution. At four sawmills (Waipa, Hanmer Springs, Christchurch, Waikoau) a PCP-in-oil mixture, which is associated with much greater PCP absorption through the skin, was used as a timber preservative though Waikoau was a comparatively small user.

No PCP was manufactured in New Zealand. Use in the timber industry voluntarily ceased in 1988 and it was deregistered by the Pesticides Board in 1991. PCP is not approved for import or manufacture under the Hazardous Substances and New Organisms (HSNO) Act 1996.

Dioxins in PCP are mostly hexa-, hepta- and octa-chlorodibenzo-*p*-dioxins and some higher chlorinated furans. Most of the evidence on the health effects of dioxins relates to TCDD rather than these congeners. The PCP manufacturing process in the United States did not result in TCDD contamination, but elsewhere this could occur (Ruder and Yiin 2011). Results of a serum dioxins study of former New Zealand sawmill workers are given in Table 5 above. Although the dioxins in PCP are considered much less toxic than TCDD they were present in PCP at much higher concentrations than that of TCDD in 2,4,5-T. TEFs for the congeners typically found in PCP solutions are 0.1 for 1,2,3,6,7,8-HxCDD, 0.01 for 1,2,3,4,6,7,8-HpCDD and 0.0003 for OCDD.

Pentachlorophenol is readily absorbed through the lungs, skin and gastrointestinal tract. The most significant exposure route is typically skin. Elimination is predominantly in urine. Half-life is about 30 hours from plasma and 33 hours from urine following oral exposure and 19–20 days following inhalation exposure among workers. There are no human data following dermal exposure (Agency for Toxic Substances and Disease Registry 2001). Given these half-lives and the time since use ceased in New Zealand, there is no measure of PCP exposure possible now other than its dioxins contaminants.

Although PCP has acute health effects, these are not discussed here as PCP is no longer used in New Zealand.

Information on chronic health effects is limited. Epidemiological studies of chronic effects have reported impaired immune function, inflammation of the upper respiratory tract and bronchitis, reduced glomerular filtration rate and tubular function, and hepatic effects (increased biliary acid concentrations, urinary porphyrin, and serum alanine and aspartate transaminases) (Agency for Toxic Substances and Disease Registry 2001).

A study of male British Columbia sawmill workers employed for at least one year found that high exposure to chlorophenols was associated with excess risk of several birth defects. Estimated cumulative exposure during preconception and pregnancy was

associated with congenital cataracts and, during pregnancy, with congenital abnormalities of genital organs. The maximal index of exposure (hours per year) for any sawmill job during preconception was associated with neural tube defects. No associations were found for low birth weight, small for gestational age, prematurity, stillbirths or neonatal deaths (Dimich-Ward et al 1996).

Pentachlorophenol is classified by the IARC as a Group 2B or possible human carcinogen based on sufficient evidence of carcinogenicity in animals but inadequate evidence of carcinogenicity in humans. No consistent association between PCP exposure and cancer has been found.

Up to 64 years of follow-up of 773 PCP[27] manufacturing workers from the Dow Chemical Company's Midland, Michigan plant found no excess all-cancer mortality (SMR 1.0; 95% CI 0.8–1.2) and a higher than expected non-Hodgkin's lymphoma mortality rate. Mortality results were similar when 196 workers who also had TCP exposure were excluded – for non-Hodgkin's lymphoma (SMR 2.8; 95% CI 1.1–5.7 Collins et al 2008a). Further follow-up to the date of death or 2012, found there were eight deaths from non-Hodgkin's lymphoma (SMR 1.92, 95% CI 0.83–3.79), 150 from ischaemic heart disease (SMR 1.20, 95% CI 1.01–7.89) and five from stomach ulcers (SMR 3.38, 95% CI 1.10–7.89)(Collins et al 2016).

A larger study with follow-up through to 2005 of 1,402 workers from the NIOSH cohort, including the Dow workers, who manufactured PCP but not TCP found excess all-cancer mortality (SMR 1.25; 95% CI 1.09–1.42). Excess lung cancer (SMR 1.56; 95% CI 1.27–1.90) and chronic obstructive respiratory disease (SMR 1.71; 95% CI 1.28–2.24) mortality were also found, but information on smoking was not available. These workers did not have significantly elevated non-Hodgkin's lymphoma mortality in contrast to workers who had produced both PCP and TCP (SMR 2.50; 95% CI 1.08–4.93) (Ruder and Yiin 2011).

New Zealand studies of health effects

Walls et al (1998) carried out a questionnaire-based study of 127 self-selected PCP workers who attributed their health problems to PCP exposure. Exposure was estimated from the participants' work and task history. A dose-response relationship was observed between PCP exposure and reported fever/sweating, weight loss, fatigue, nausea, and a screening test for neuropsychological dysfunction (previously used in studies of solvent-exposed workers).

A cohort mortality study of 3,895 workers who had worked at least six months in the timber industry from 1970 to 1990 and were followed up to the end of December 2003 found slightly lower than national average mortality. This is likely to be due to the healthy worker effect. Non-transport accident mortality, which mainly comprises non-transport workplace accidents, was significantly elevated.

[27] PCP manufactured in the United States was contaminated with dioxins but not TCDD.

Among exposed workers there was excess non-malignant respiratory disease mortality (SMR 1.91; 95% CI 0.98–3.33). Excess all-cause mortality (RR 1.21; 95% CI 0.94–1.55), all-cancer mortality (RR 1.41; 95% CI 0.80–2.47) and non-malignant respiratory disease mortality (RR 2.98; 95% CI 1.18–7.55) was found among exposed workers compared with non-exposed workers (McLean et al 2007).

A morbidity study by McLean et al (2009a) of 293 (116 exposed, 177 not exposed) sawmill workers who had worked at least one year in the timber industry from 1970 to 1990 found that 10 percent had high exposure (mixing PCP). Only 5 percent had worked in the industry for at least 10 years.

Workers who had been exposed to PCP reported increased prevalence of chronic respiratory disease (including TB, pleurisy and pneumonia) and recurrent diarrhoea. Of 17 neuropsychological symptoms, palpitations and sweating for no reason were more prevalent.

Neurological examination of 13 signs found exposed workers had more difficulty with straight leg raising. Non-statistically significant increases were found in exposed workers for diabetes, impaired liver function, unexplained persistent fevers, recurrent nausea, depression, frequent mood changes without reason and cranial nerve function deficit.

A significant dose-response trend was seen for chronic respiratory disease and cranial nerve function deficit; duration of employment and thyroid disorders and some neuropsychological symptoms (often going back to check things, low libido, palpitations) and frequent mood changes without reason.

Cumulative exposure was associated with frequent mood changes without reason, low libido, palpitations, the number of neuropsychological symptoms reported and difficulty with straight leg raising (McLean et al 2009a).

Bibliography

Agency for Toxic Substances and Disease Registry. 1998. *Toxicological Profile for Chlorinated Dibenzo-p-dioxins (CDDs).* Atlanta: ATSDR. URL: **www.atsdr.cdc.gov/toxprofiles/tp.asp?id=366&tid=63** (accessed 28 February 2014).

National Academies of Sciences, Engineering, and Medicine. 2016. *Veterans and Agent Orange: Update 2014.* Washington DC: The National Academies Press. URL: **http:www.nap.edu/21845** (accessed 11 July 2016).

United States Environmental Protection Agency. 2004. *Exposure and Human Health Reassessment of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds.* NAS review draft. Washington, DC : US EPA. EPA/600/P-00/001Cb. URL: **www.epa.gov/ncea/pdfs/dioxin/nas-review** (accessed 28 February 2014).

United States Environmental Protection Agency. 2010. *EPA's Reanalysis of Key Issues Related to Dioxin Toxicity and Response to NAS Comments*. External Review Draft. Washington, DC: US EPA. EPA/600/R-10/038A. URL: **http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=222203** (accessed 28 February 2014).

WHO. *Dioxins and their Effects on Human Health.* Geneva: World Health Organization. URL: **www.who.int/mediacentre/factsheets/fs225/en** (accessed 28 February 2014).

References

Agency for Toxic Substances and Disease Registry. 2001. *Toxicological Profile for Pentachlorophenol. Update*. Atlanta: ATSDR. URL: **www.atsdr.cdc.gov/ToxProfiles/tp.asp?id=402&tid=70** (accessed 28 February 2014).

Air and Environmental Sciences Ltd. 2002. Multipathway assessment of exposures from dioxin releases in the Paritutu area. Appendix B in Fowles J, Gallagher L, Baker V, et al. 2005. *A Study of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) Exposures in Paritutu, New Zealand. Report to the New Zealand Ministry of Health*. Porirua: ESR.

Alaluusua S, Calderara P, Gerthoux PM, et al. 2004. Developmental dental aberrations after the dioxin accident in Seveso. *Environmental Health Perspectives* 112: 1313–18.

Ames J, Warner M, Brambilla P, et al. 2018a. Neurocognitive and physical functioning in the Seveso Women's Health Study. *Environmental Research* 162: 55-62. doi.org/10.1016/j.envres.2017.12.005.

Ames J, Warner M, Mocarelli P, et al. 2018b. AHR gene-dioxin interactions and birthweight in the Seveso Second Generation Health Study. *International Journal of Epidemiology* 47: 1992–2004. doi: 10.1093/ije/dyy165.

Ames J, Warner M, Siracusa C, et al. 2019. Prenatal dioxin exposure and neuropsychological functioning in the Seveso Second Generation Health Study. *International Journal of Hygiene and Environmental Health* 222: 425-433. doi.org/10.1016/j.ijheh.2018.12.009.

Aylward LL, Bodner KM, Collins JJ, et al. 2010. TCDD exposure estimation for workers at a New Zealand 2,4,5-T manufacturing facility based on serum sampling data. *Journal of Exposure Science and Environmental Epidemiology* 20: 417–26.

Aylward LL, Brunet RC, Carrier G, et al. 2005a. Concentration-dependent TCDD elimination kinetics in humans: toxicokinetic modeling for moderately to highly exposed adults from Seveso, Italy, and Vienna, Austria, and impact on dose estimates for the NIOSH cohort. *Journal of Exposure Analysis and Environmental Epidemiology* 15(1): 51–65.

Aylward LL, Brunet RC, Starr TB, et al. 2005b. Exposure reconstruction for the TCDD-exposed NIOSH cohort using a concentration- and age-dependent model of elimination. *Risk Analysis* 25(4): 945–56.

Baan R, Grosse Y, Straif K, et al. 2009. A review of human carcinogens – Part F: Chemical agents and related occupations. *Lancet Oncology* 10: 1143–44.

Baccarelli A, Giacomini SM, Corbetta C, et al. 2008. Neonatal thyroid function in Seveso 25 years after maternal exposure to dioxin. *PLoS Med* 5(7): e161.doi:10.1371/journal.pmed.0050161.

Baker V, Fowles J, Phillips D, et al. 2003. *New Plymouth, Paritutu Community Dioxin Exposure Assessment Study*. Porirua: ESR.

Bates MN, Buckland SJ, Hannah DJ, et al. 1990. *Organochlorine Residues in the Breast Milk of New Zealand Women: A report to the Department of Health*. Petone: Department of Scientific and Industrial Research.

Bates M, Thomson B, Garrett N. 2001. *Investigation of Organochlorine Contaminants in the Milk of New Zealand Women.* Porirua: ESR.

Bertazzi PA, Bernucci I, Brambilla G, et al. 1998. The Seveso studies on early and long-term effects of dioxin exposure: a review. *Environmental Health Perspectives* 106(Suppl 2): 625–33.

Bertazzi PA, Consonni D, Bachetti S, et al. 2001. Health effects of dioxin exposure: a 20-year mortality study. *American Journal of Epidemiology* 153: 1031–44.

Bertazzi PA, Pesatori AC, Consonni D, et al. 1993. Cancer incidence in a population accidentally exposed to 2,3,7,8-tetrachlorodibenzo-para-dioxin. *Epidemiology* 4: 398–406.

Bodner KM, Collins JJ, Bloemen LJ, et al. 2003. Cancer risk for chemical workers exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin. *Occupational and Environmental Medicine* 60: 672–75.

Borman B. 1982. *A Cancer Mortality Atlas of New Zealand*. Wellington: National Health Statistics Centre, Department of Health.

Borman B, Read D. 2010. *Birth Defects in the New Plymouth District*. Wellington: Centre for Public Health Research.

Brinkman GL, Matthews REF, Earl WB. 1986. *Possible Health Effects of Manufacture of 2,4,5-T in New Plymouth. Report of Ministerial Committee of Inquiry to the Minister of Health.* Wellington: Ministerial Committee of Inquiry.

Buckland SJ, Bates MN, Garrett N, et al. 2001. *Concentrations of Selected Organochlorines in the Serum of the Non-occupationally Exposed New Zealand Population*. Wellington: Ministry for the Environment.

Buckland SJ, Ellis HK, Dyke P. 2000. *New Zealand inventory of dioxin emissions to air, land and water, and reservoir sources.* Wellington: Ministry for the Environment.

Buckland SJ, Ellis HK, Salter RT. 1998. *Organochlorines in New Zealand: Ambient concentrations of selected organochlorines in soils.* Wellington: Ministry for the Environment.

Carnachan H. 2002. Toxic waste: is this the result of dioxin poisoning in New Zealand? *Investigate* April.

Chevrier J, Warner M, Gunier RB, et al. 2014. Serum dioxin concentrations and thyroid hormone levels in the Seveso Women's Health Study. *American Journal of Epidemiology* 180(5):490–498.

Coakley J, Bridgen P, Bates MN, et al. 2018. Chlorinated persistent organic pollutants in serum of New Zealand adults, 2011-2013. *Science of the Total Environment* 615: 624-631. doi: 10.1016/j.scitotenv.2017.09.331.

Collins JJ, Bodner KM, Aylward LL, et al. 2016. Mortality risk among workers with exposure to dioxins. Occupational Medicine 66: 706–712. doi:10.1093/occmed/kqw167.

Collins JJ, Bodner K, Swaen G, et al. 2008a. Death rates among pentachlorophenol workers exposed to higher chlorinated dioxins. *Organohalogen Compounds* 70: 1189–92.

Collins JJ, Budinsky RA, Burns CJ, et al. 2006. Serum dioxin levels in former chlorophenol workers. *Journal of Exposure Analysis and Environmental Epidemiology* 16(1): 76–84.

Collins JJ, Wilken M, McBride DI, et al. 2008b. Serum dioxins, furans, and PCB levels among New Zealand trichlorophenol workers. *Organohalogen Compounds* 70: 1193–6.

Consonni D, Pesatori A, D'Oro LC, et al. 2016. Cohort study of the population exposed to dioxin after the Seveso, Italy accident: Mortality results, 1976-2013. ISEE conference, Rome. URL: https://ehp.niehs.nih.gov/doi/abs/10.1289/isee.2016.4349

Consonni D, Pesatori AC, Zocchetti C, et al. 2008. Mortality in a population exposed to dioxin after the Seveso, Italy, accident in 1976: 25 years of follow-up. *American Journal of Epidemiology* Advance access published online Jan 10 2008; doi: 10.1093/aje/kwm371.

Cox B, McBride D, Broughton J, et al. 2015. Health conditions in a cohort of New Zealand Vietnam veterans: hospital admissions between 1988 and 2009. *British Medical Journal Open* 5:e008409. doi:10.1136/bmjopen-2015008409.

Department of Health. 1977. *2,4,5-T and Human Birth Defects*. Wellington: Department of Health.

Department of Health. 1980a. *A Review to Determine Whether the Health of Employees Has Been Adversely Affected by Their Association with the Manufacture of 2,4,5-T*. Wellington: Department of Health.

Department of Health. 1980b. Report to the Minister of Health of an investigation into allegations of an association between human congenital defects and 2,4,5-T spraying in and around Te Kuiti. *New Zealand Medical Journal* 91 (658): 314–15.

DeVito MJ, Birnbaum LS, Farland WH, et al. 1995. Comparisons of estimated human body burdens of dioxinlike chemicals and TCDD body burdens in experimentally exposed animals. *Environmental Health Perspectives* 103: 820–31.

Dimich-Ward H, Hertzman C, Teschke K, et al. 1996. Reproductive effects of paternal exposure to chlorophenate wood preservatives in the sawmill industry. *Scandinavian Journal of Work Environment and Health* 22: 267–73.

Dwernychuk LW, Cau HD, Hatfield CT, et al. 2002. Patterns of human exposure to Agent Orange TCDD in southern Viet Nam. Paper presented at Viet Nam – United States scientific conference on human health and environmental effects of Agent Orange/dioxin Ha Noi, Viet Nam March.

Emond C, Michalek JE, Birnbaum LS, et al. 2005. Comparison of the use of a physiologically based pharmacokinetic model and a classical pharmacokinetic model for dioxin exposure assessments. *Environmental Health Perspectives* 113: 1666–8.

Eskenazi B, Mocarelli P, Warner M, et al. 2002a. Serum dioxin concentrations and endometriosis: a cohort study in Seveso, Italy. *Environmental Health Perspectives* 110: 629–34.

Eskenazi B, Mocarelli P, Warner M, et al. 2003. Maternal serum dioxin levels and birth outcomes in women of Seveso, Italy. *Environmental Health Perspectives* 111: 947–53.

Eskenazi B, Mocarelli P, Warner M, et al. 2004. Relationship of serum TCDD concentrations and age at exposure of female residents of Seveso, Italy. *Environmental Health Perspectives* 112: 22–7.

Eskenazi B, Rauch S, Ames J, et al. 2019. Gene-dioxin interactions and time to pregnancy in the Seveso Women's Health Study. International Society for Environmental Epidemiology conference, Utrecht, 25-28 August 2019. URL: **https://isee2019.org/wp-content/uploads/2019/08/Abstractbook_Tuesday_27-August_.pdf** (accessed 6 November 2019).

Eskenazi B, Warner M, Brambilla P, et al. 2018. The Seveso accident: A look at 40 years of health research and beyond. *Environment International* 121: 71-84. doi.or.g/10.1016/j.envint.2018.08.051.

Eskenazi B, Warner M, Marks AR, et al. 2005. Serum dioxin concentrations and age at menopause. *Environmental Health Perspectives* 113: 858–62.

Eskenazi B, Warner M, Marks AR, et al. 2010. Serum dioxin concentrations and time to pregnancy. *Epidemiology* 21: 224–31.

Eskenazi B, Warner M, Mocarelli P, et al. 2002b. Serum dioxin concentrations and menstrual cycle characteristics. *American Journal of Epidemiology* 156: 383–92.

Eskenazi B, Warner M, Samuels S, et al. 2007. Serum dioxin concentrations and risk of uterine leiomyoma in the Seveso Women's Health Study. *American Journal of Epidemiology* 166: 79–87.

Eskenazi B, Warner M, Sirtori M, et al. 2014. Serum dioxin concentrations and bone density and structure in the Seveso Women's Health Study. *Environmental Health Perspectives* 122: 51–7.

Food and Agriculture Organization (FAO)/WHO. 2002. Safety evaluation of certain food additives and contaminants polychlorinated dibenzodioxins, polychlorinated dibenzofurans, and coplanar polychlorinated biphenyls. *Food Additives Series* 48. Geneva: World Health Organization.

Fingerhut MA, Halpern QE, Narlow BS, et al. 1991. Cancer mortality in workers exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin. *New England Journal of Medicine* 342: 212–18.

Fowles J, Baker V, Phillips D, et al. 2004. *A Study of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) Exposures in Paritutu, New Zealand. An Interim Report to the New Zealand Ministry of Health*. Porirua: ESR.

Fowles J, Gallagher L, Baker V, et al. 2005. *A Study of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) Exposures in Paritutu, New Zealand. Report to the New Zealand Ministry of Health*. Porirua: ESR.

Fowles J, Noonan M, Stevenson C, et al. 2009. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) plasma concentrations in residents of Paritutu, New Zealand: evidence of historical exposure. *Chemosphere* 75: 1259–65.

Garabrant DH, Franzblau A, Lepkowski J, et al. 2009. The University of Michigan Dioxin Exposure Study: Predictors of human serum dioxin concentrations in Midland and Saginaw, Michigan. *Environmental Health Perspectives* 117: 818–24.

Hanify JA, Metcalf P, Nobbs CL, et al. 1981a. Aerial spraying of 2,4,5-T and human birth malformations: an epidemiological investigation. *Science* 212: 349–51.

Hanify JA, Metcalf P, Nobbs CL, et al. 1981b. *Aerial Spraying of 2,4,5-T and Human Birth Malformations. Final Report of an Epidemiological Study carried out in the Northland Region of New Zealand.* Auckland: Northland Births Survey.

Hardell L. 1977. Malignant mesenchymal tumors and exposure to phenoxy acids – a clinical observation. *Lakartidningen* 74: 2753–4.

Hardell L, Sandstrom A. 1979. Case-control study: soft-tissue sarcomas and exposure to phenoxyacetic acids or chlorophenols. *British Journal of Cancer* 39: 711–17.

Harden F, Muller J, Toms L, et al. 2004. *Dioxins in the Australian Population: Levels in Blood.* National Dioxins Program Technical Report No. 9. Canberra: Australian Government Department of the Environment and Heritage.

Hedgeman E, Chen Q, Hong B, et al. 2009. The University of Michigan Dioxin Exposure Study: Population survey results and serum concentrations for polychlorinated dioxins, furans, and biphenyls. *Environmental Health Perspectives* 117: 811–17.

Henriksen GL, Ketchum NS, Michalek JE, et al. 1997. Serum dioxin and diabetes mellitus in veterans of Operation Ranch Hand. *Epidemiology* 8:252–58.

Humblet O, Birnbaum L, Rimm E, et al. 2008. Dioxins and cardiovascular disease mortality. *Environmental Health Perspectives* 116: 1443–8.

Institute of Medicine. 2009. *Veterans and Agent Orange: Update 2008*. Washington DC: The National Academies Press.

Institute of Medicine. 2012. *Veterans and Agent Orange: Update 2010*. Washington DC: The National Academies Press.

Institute of Medicine. 2014. *Veterans and Agent Orange: Update 2012*. Washington DC: The National Academies Press. URL: **www.nap.edu** (accessed 28 February 2014).

Kang HK, Dalager NA, Needham LL, et al. 2006. Health status of Army Chemical Corps Vietnam veterans who sprayed defoliant in Vietnam. *American Journal of Industrial Medicine* 49: 875–84.

Kerger BD, Leung H-W, Scott P, et al. 2006. Age- and concentration-dependent elimination half-life of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in Seveso children. *Environmental Health Perspectives* 114: 1596–1602.

Kogevinas M, Becher H, Benn T, et al. 1997. Cancer mortality in workers exposed to phenoxy herbicides, chlorophenols, and dioxins. An expanded and updated international cohort study. *American Journal of Epidemiology* 145: 1061–75.

Landi MT, Consonni D, Patterson DG, et al. 1998. 2,3,7,8-tetrachlorodibenzo-p-dioxin plasma levels in Seveso 20 years after the accident. *Environmental Health Perspectives* 106: 273–7.

Landi MT, Needham LL, Lucier G, et al. 1997. Concentrations of dioxin 20 years after Seveso [letter]. *Lancet* 349: 1811.

McBride DI, Collins JJ, Humphry NF, et al. 2009. Mortality in workers exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin at a trichlorophenol plant in New Zealand. *Journal of Occupational and Environmental Medicine* 51: 1049–56.

McBride D, Cox B, Broughton J, et al. 2013. The mortality and cancer experience of New Zealand Vietnam war veterans: a cohort study. *British Medical Journal Open* 3:e003379 doi:10.1136/bmjopen-2013-003379 (accessed 8 August 2016).

McBride D, Lovelock K, Shepherd D, et al. 2016. Community exposure to hazardous site remediation in rural New Zealand: an exposed referent study of serum dioxins and health effects. *Australian and New Zealand Journal of Public Health* 40: 412-7. doi: 10.1111/1753-6405.12583.

McLean D, Eng A, 't Mannetje A, et al. 2007. *Health outcomes in former New Zealand timber workers exposed to pentachlorophenol (PCP)*. Wellington: Centre for Public Health Research.

McLean D, Eng A, Dryson E, et al. 2009a. Morbidity in former sawmill workers exposed to pentachlorophenol (PCP): a cross-sectional study in New Zealand. *American Journal of Industrial Medicine* 52: 271–81.

McLean D, Eng A, Walls C, et al. 2009b. Serum dioxin levels in former New Zealand sawmill workers twenty years after exposure to pentachlorophenol (PCP) ceased. *Chemosphere* 74: 962–67.

Michalek JE, Pavuk M. 2008. Diabetes and cancer in veterans of Operation Ranch Hand after adjustment for calendar period, days of spraying, and time spent in Southeast Asia. *Journal of Occupational and Environmental Medicine* 50: 330–40.

MfE. 2006. *New Zealand's National Implementation Plan under the Stockholm Convention on Persistent Organic Pollutants.* Wellington: Ministry for the Environment. URL: **www.mfe.govt.nz/publications/hazardous/stockholm-convention-pops-dec06/index.html** (accessed 2 March 2014).

MfE. 2011. *New Zealand Inventory of Dioxin Emissions to Air, Land and Water, and Reservoir Sources.* Wellington: Ministry for the Environment.

Mocarelli P, Gerthoux PM, Ferrari E, et al. 2000. Paternal concentrations of dioxin and sex ratio of offspring. *Lancet* 355: 1858–63.

Mocarelli P, Gerthoux PM, Needham LL, et al. 2011. Perinatal exposure to low doses of dioxin can permanently impair semen quality. *Environmental Health Perspectives* 119: 713–18.

Mocarelli P, Gerthoux PM, Patterson DG, et al. 2008. Dioxin exposure, from infancy through puberty, produces endocrine disruption and affects human semen quality. *Environmental Health Perspectives* 116: 70–7.

Mocarelli P, Warner M, Wesselink A, et al. 2013. Maternal serum dioxin concentrations and neonatal thyroid function in Seveso children. Poster presented at Conference on Environment and Health, Basel, 2013. Abstract number P-2-24-31. URL: **http://ehp.niehs.nih.gov/ehbasel13/** (accessed 25 November 2013).

National Academies of Sciences, Engineering, and Medicine. 2016. *Veterans and Agent Orange: Update 2014.* Washington DC: The National Academies Press. URL: http:www.nap.edu/21845 (accessed 11 July 2016).

National Academies of Sciences, Engineering, and Medicine. 2018. *Veterans and Agent Orange: Update 11 (2018).* Washington DC: The National Academies Press. URL: **https://doi.org/10.17226/25137** (accessed 30 July 2019).

National Research Council. 2006. *Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment.* Washington DC: The National Academies Press.

Ngo AD, Taylor R, Roberts CL, et al. 2006. Association between Agent Orange and birth defects: systematic review and meta-analysis. *International Journal of Epidemiology* 35: 1220–30.

O'Connor P. 2001. *Rates of Reported Illness in Paritutu and Moturoa*. A report to the Taranaki District Health Board.

O'Connor P. 2002. *Neural Tube Defects at Westown Maternity Hospital, 1965–72.* A report to the Taranaki District Health Board.

Orloff KG, Hewitt D, Metcalf S, et al. 2001. Dioxin exposure in a residential community. *Journal of Exposure Analysis and Environmental Epidemiology* 11: 352–8.

Patterson DG, Patterson D, Canady R, et al. 2004. Age specific dioxin TEQ reference range. *Organohalogen Compounds* 66: 2878–83.

Pattle Delamore Partners Ltd. 2002. *Dioxin Concentrations in Residential Soil, Paritutu, New Plymouth.* Prepared for the Ministry for the Environment and the Institute of Environmental Science and Research Ltd. Wellington: Pattle Delamore Partners Ltd.

Pavuk M, Patterson DG, Turner WE. 2014. Serum concentrations of TCDD and other dioxin-like compounds in US Air Force veterans of Operation Ranch Hand. *Chemosphere* 102:18–23.

Pesatori AC, Consonni D, Bachetti S, et al. 2003. Short- and long-term morbidity and mortality in the population exposed to dioxin after the "Seveso accident". *Industrial Health* 41: 127–38.

Pesatori A, Consonni D, Cacace R, et al. 2011. Lymphohemopoietic neoplasms and dioxin exposure in the Seveso cohort 30 years after the accident (1977–2006). In: Abstracts of the 23rd Annual Conference of the International Society for Environmental Epidemiology (ISEE). 13–16 September 2011, Barcelona, Spain. *Environmental Health Perspectives.* URL: **http://ehp.niehs.nih.gov/isee/PDF/isee11Abstract00790.pdf** (accessed 24 March 2014).

Pesatori AC, Consonni D, Rubagotti M, et al. 2009. Cancer incidence in the population exposed to dioxin after the "Seveso accident": twenty years of follow-up. *Environmental Health* 8: 39. URL: **www.ehjournal.net/content/8/1/39** (accessed 2 March 2014).

Pesatori AC, Consonni D, Tironi A, et al. 1993. Cancer in a young population in a dioxin-contaminated area. *International Journal of Epidemiology* 22: 1010–13.

Read D, Wright C, Weinstein P, et al. 2007. Cancer incidence and mortality in a New Zealand community potentially exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) from 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) manufacture. *Australian and New Zealand Journal of Public Health* 31: 13–18.

Ruder AM, Yiin JH. 2011. Mortality of US pentachlorophenol production workers through 2005. *Chemosphere* 83: 851–61.

Sare WM, Forbes PI. 1972. Possible dysmorphogenic effects of an agricultural chemical: 2,4,5-T. *New Zealand Medical Journal* 75: 37–8.

Schecter A, Constable JD. 2006. Commentary: Agent Orange and birth defects in Vietnam. *International Journal of Epidemiology* 35: 1230–2.

Schecter A, Furst P, Furst C, et al. 1994. Chlorinated dioxins and dibenzofurans in human tissue from general populations: a selective review. *Environmental Health Perspectives* 102(Suppl 1):
159–71.

Slama N, Warner M, Mocarelli P, et al. 2019. The 2nd to 4th digit length ratio (2D:4D) among children of Seveso women exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin. *Early Human Development* 131: 45-50. doi.org/10.1016/j.earlhumdev.2019.02.009.

Smith AH, Fisher DO, Pearce N, et al. 1982. Congenital defects and miscarriages among New Zealand 2,4,5-T sprayers. *Archives of Environmental Health* 37: 197–200.

Smith AH, Lopipero P. 2001. *Evaluation of the Toxicity of Dioxins and Dioxin-like PCBs: a Health Risk Appraisal for the New Zealand Population*. Wellington: Ministry for the Environment.

Smith AH, Matheson DP, Fisher DO, et al. 1981. Preliminary report of reproductive outcomes among pesticide applicators using 2,4,5-T. *New Zealand Medical Journal* 93: 177–9.

Smith AH, Patterson DG, Warner ML, et al. 1992. Serum 2,3,7,8-tetrachlorodibenzo-p-dioxin levels of New Zealand pesticide applicators and their implication for cancer hypotheses. *Journal of the National Cancer Institute* 84: 104–8.

't Mannetje A. 2012. Addition to the report to the Ministry of Health. *Concentrations of Persistent Organic Pollutants in the Milk of New Zealand Women.* Wellington: Centre for Public Health Research.

't Mannetje A, Coakley J, Bates M, et al. 2013. *Concentrations of Selected Persistent Organic Pollutants (POPs) in the Serum of New Zealanders*. A report for the Ministry of Health, Wellington. Wellington: Centre for Public Health Research. URL: **http://publichealth.massey.ac.nz/home/research/research-projects/serum-levels-of-persistent-organic-pollutants-pops-in-the-new-zealand-population-2/** (accessed 2 March 2014).

't Mannetje A, Coakley J, Bridgen P, et al. 2014. Estimated infant intake of persistent organic pollutants through breast milk in New Zealand. *New Zealand Medical Journal* 127(1401): 56–68.

't Mannetje A, Douwes J, Duckett H, et al. 2010. *Concentrations of Persistent Organic Pollutants in the Milk of New Zealand Women.* Wellington: Centre for Public Health Research.

't Mannetje A, Eng A, Walls C, et al. 2016. Serum concentrations of chlorinated dibenzo-p-dioxins, furans and PCBs, among former phenoxy herbicide production workers and firefighters in New Zealand. *International Archives of Occupational and Environmental Health* 89:307–318. doi: 10.1007/s00420-015-1074-6.

't Mannetje A, Eng A, Walls C, et al. 2018. Morbidity in New Zealand pesticide producers exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). *Environment International* 110: 22-31. doi.org/10.1016/j.envint.2017.09.018.

't Mannetje A, McLean D, Cheng S, et al. 2005. Mortality in New Zealand workers exposed to phenoxy herbicides and dioxins. *Occupational and Environmental Medicine* 62: 34–40.

US EPA. 2000. *Exposure and Human Health Reassessment of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds*. Part III: Integrated summary and risk characterization for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and related compounds. Science Advisory Board review draft. Washington DC: United States Environmental Protection Agency, National Center for Environmental Assessment, Office of Research and Development.

US EPA. 2012. *EPA's Reanalysis of Key Issues Related to Dioxin Toxicity and Response to NAS Comments, Volume 1*. Washington, DC: United States Environmental Protection Agency. EPA/600/R-10/038F. URL: **http://www.epa.gov/iris/supdocs/dioxinv1sup.pdf** (accessed 2 March 2014).

University of Michigan Dioxin Exposure Study. URL: **www.sph.umich.edu/dioxin** (accessed 2 March 2014).

Van den Berg M, Kypke K, Kotz A, et al. 2017. WHO/UNEP global surveys of PCDDs, PCDFs, PCBs and DDTs in human milk and benefit–risk evaluation of breastfeeding. *Archives of Toxicology* 91: 83–96. doi 10.1007/s00204-016-1802-z.

Vena J, Boffetta P, Becher H, et al. 1998. Exposure to dioxin and nonneoplastic mortality in the expanded IARC international cohort study of phenoxyherbicide and chlorophenol production workers and sprayers. *Environmental Health Perspectives* 106(Suppl 2): 645–53.

Viluksela M, Pohjanvirta R. 2019. Multigenerational and transgenerational effects of dioxins. *International Journal of Molecular Sciences* 20: 2947. doi:10.3390/ijms20122947.

Walls CB, Glass WI, Pearce NE. 1998. Health effects of occupational pentachlorophenol exposure in timber treatment sawmill employees: a preliminary study. *New Zealand Medical Journal* 111(1074): 362–64.

Warner M, Eskenazi B, Mocarelli P, et al. 2002. Serum dioxin concentrations and breast cancer risk in the Seveso Women's Health Study. *Environmental Health Perspectives* 110: 625–8.

Warner M, Eskenazi B, Olive DL, et al. 2007. Serum dioxin concentrations and quality of ovarian function in women of Seveso. *Environmental Health Perspectives* 115: 336–40.

Warner M, Mocarelli P, Brambilla P, et al. 2013. Diabetes, metabolic syndrome, and obesity in relation to serum dioxin concentrations: the Seveso Women's Health Study. *Environmental Health Perspectives* 121: 906–11.

Warner M, Mocarelli P, Brambilla P, et al. 2014. Serum TCDD and TEQ concentrations among Seveso women, twenty years after the explosion. *Journal of Exposure Science and Environmental Epidemiology* 24(6): 588–594.

Warner M, Mocarelli P, Samuels S, et al. 2011. Dioxin exposure and cancer risk in the Seveso Women's Health Study. *Environmental Health Perspectives* 119: 1700–5.

Warner M, Samuels S, Mocarelli P, et al. 2004. Serum dioxin concentrations and age at menarche. *Environmental Health Perspectives* 112: 1289–92.

Warner M, Rauch S, Ames J, et al. 2019. In utero dioxin exposure and cardiometabolic risk in the Seveso Second Generation Study. *International Journal of Obesity* doi.org/10.1038/s41366-018-0306-8.

Wesselink A, Warner M, Samuels S, et al. 2014. Maternal dioxin exposure and pregnancy outcomes over 30 years of follow-up in Seveso. *Environment International* 63: 143–148.

WHO. 1998. ECEH–IPCS (European Centre for Environmental Health and International Programme on Chemical Safety) Executive Summary. Assessment of the Health Risk of Dioxins: Re-evaluation of the tolerable daily intake. Geneva: World Health Organization. URL: **www.who.int/ipcs/publications/en/exe-sum-final.pdf** (accessed 2 March 2014).Ye M, Warner M, Mocarelli P, et al. 2018. Prenatal exposure to TCDD and atopic conditions in the Seveso second generation: a prospective cohort study. *Environmental Health* 17:22. doi.org/10.1186/s12940-018-0365-2.

Yrjanheikki EJ (ed). 1989. *Levels of PCBs, PCDDs, and PCDFs in Breast Milk*. Copenhagen: WHO Regional Office for Europe.

Re: Opposition to Waste-to-Energy Plant Proposal in Te Awamutu

Dear Members of the Waipa District Council,

I am writing to express my deep concerns and strong opposition to the proposed waste-to-energy plant in Te Awamutu. As a resident of this vibrant community, I value the health and well-being of our town, especially for our children and future generations. This submission is based on compelling evidence, including the plant's own documentation, which raises serious doubts about the safety and appropriateness of this project.

1. Emissions and Health Concerns:

The proposal for the waste-to-energy plant indicates that it will not have zero emissions. This is a critical issue that should not be taken lightly, particularly due to the profound health risks, especially for our children:

Dioxins and Furans: Dioxins and furans, released during waste combustion, are particularly insidious for children. These highly toxic compounds can impact children's developing bodies, leading to developmental issues, immune system problems, and an increased risk of childhood cancers.

Heavy Metals: Children are more vulnerable to the toxic effects of heavy metals like lead, mercury, and cadmium, which may be released from waste incineration. Exposure to these substances can result in neurological damage, developmental delays, and long-term cognitive impairments.

Volatile Organic Compounds (VOCs): Children's developing respiratory systems make them more susceptible to the harmful effects of VOCs. Exposure to VOCs can exacerbate asthma and other respiratory conditions, leading to increased hospitalization rates among children.

Tyres and General Waste: The inclusion of tyres and general waste in the combustion process introduces unpredictable and harmful emissions. These emissions can contain a mix of carcinogenic and toxic

substances, posing a higher risk to the health of our children, who are more sensitive to environmental pollutants.

2. Proximity to Sensitive Areas:

The proposed plant's proximity to schools, preschools, and highly populated areas exacerbates these health risks for our children. Children spend a significant portion of their time at school, and their exposure to harmful emissions is prolonged in such close proximity.

3. Truck Movements and Community Impact:

The expected 100 truck movements per day through residential areas of our small town not only pose risks in terms of accidents but also exacerbate health concerns. Children and their developing respiratory systems are especially vulnerable to the air pollution and noise associated with increased truck movements.

4. Alternative Solutions:

I urge the council to prioritize the safety and health of our children and the entire community by exploring alternative waste management and energy solutions. The "Zero Waste to Landfill" campaign, successfully implemented by councils in New Zealand, such as Raglan, provides a proven path toward minimizing health risks associated with waste disposal while fostering a more sustainable and responsible approach.

5. Call to Action:

Given the health risks, particularly for our children, associated with emissions from the proposed waste-to-energy plant, I strongly oppose its construction in Te Awamutu. I implore the council to prioritize the well-being and safety of our community, especially our children, by reconsidering this proposal. I also encourage fellow residents to voice their concerns and participate in the decision-making process.

6. Conclusion:

Te Awamutu is a place my Parents call home and their great grandchildren visit regularly and call their second home, along with their grandchildren and children like myself and we must protect it for current and future generations.

I urge the Waipa District Council to act responsibly and in the best interests of our community, especially our children, by rejecting the waste-to-energy plant proposal.

Thank you for considering my submission. I trust that the council will make a well-informed and responsible decision regarding this matter.

Sincerely,

Owen Embling

Appendix for review, covering air pollution issues which are openly discussed in the submission. This is not a 00 emission waste-to-energy plant and for that reason alone it should be rejected.

https://environment.govt.nz/publications/proposed-national-environmental-standards-for-air-quality-report-on-submissions/3-1-general-submissions/3-5-air-toxics-especially-dioxins-prohibited-activities/

https://environment.govt.nz/facts-and-science/air/air-pollutants/dioxins-furans-pcbs-effects-health/

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4892903/

https://environment.govt.nz/facts-and-science/air/air-pollutants/

The above links supports the air pollutant issues.

Submission on a Notified Resource Consent Application

Form 13

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4),
Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:
_My kids attend the kura and puna reo located in the area of where the purposed waste plant will be located

My submission is:

Support parts or all of ☐ **Oppose** all of √ **are neutral** parts or all of ☐
include—

To whom it may concern,

Re: Global Contracting Solutions Ltd's 'The Waste Incineration Plant' application

I am writing to oppose the application to develop a Waste Incineration Plant in Te Awamutu. This letter is specifically in regards to Global Contracting Solutions Ltd's application. I am requesting that this application for the Waste Incineration Plant be declined. This letter is directed to the Waipa District Council and the Waikato Regional Council.

I reside in Pukeatua mother of 3 Maori Tamariki who are heavily involved in their Maunga – Maungatautari as well as their marae Pohara Marae. They are involved in a lot of sports, kura in Te awamutu and working in Te awamutu as well part time. If this is to go ahead there will be serious decisions we will have to make in regards to our kids attending

To follow are the reasons I oppose this application.

- ***1 the health and safety of our kids and whanau.***

My kids niece and nephew and whanau attend both the Kura & Puna Reo I do not want my kids to be inhaling all the toxic that will be burning 24/7 days a week our kids play sports in these areas on the weekend as well there is no consideration on their health and the side effect this bring on both my son's has asthma & bronchitis. **People with asthma are at greater risk from breathing in small particles. The particles can make asthma worse. Both long-term and short-term exposure can cause health problems such as reduced lung function and more asthma attacks. This will affect generations to come as well as harm our kaumatua who some already find it hard to breath after covid.**

- **2 the impact and the effects it will have on the environment & papatuanuku**

With Mangapiko stream so close to where the plant is wanting to build and the land around there always flooding and is known as a high risk flood zone why would you think this is a good idea this is just asking for trouble our streams are already polluted by current business and council has done nothing to try and keep our stream clean and you want to add more rubbish and contaminate our stream. CO2 emissions will be at an all-time high in a time where we are trying to decrease our emission not make our carbon footprint bigger than our town. Surrounding areas will be affected and potentially our Maunga and birdlife.

- **3 the impact on our community**

We are great town and community that tends to stick together, with the persistent odour, dust , toxic air emissions I see a lot of people would have to move out of town. No one would want to come to our town no new businesses, no new families it would be a ghost town of smelly rubbish. Cheap houses as no one will want to live here. TE AWAMUTU does not want to be a testing ground for this incinerator as present there are no municipal solid waste incinerators all of there have closed due to sources of dioxin contamination. Global contracting solutions have no previous experiences in operating in waste disposal and have violated resource consent conditions previously.

- **4 Iwi hapu and cultural impact**

Has there been any formal cultural impact assessment done or consent from iwi and hapu?
Have Global Contracting Solutions Limited been in conversations with iwi and hapu?
Where does this leave the Taiea Te Taiao project how will this improve our water quality?

I seek the following decision from the consent authority:
give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

____Decline Application _____

I wish (or do not wish) to be heard in support of my submission.

√ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

√ If others make a similar submission I will consider presenting a joint case with them at the hearing.

You must tick one of the boxes above, otherwise it will be deemed that you do not wish to be heard and we will not advise you of the date of the hearing.

I request/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: __A.Edwards_____
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: ___12.10.2023___ Contact person: _Ariane Edwards _____
(name and designation, if applicant)

Postal address: _____*27 Tari Raod,pukeatua* _____
(or alternative method of service under section 352 of the Act):

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.
The closing date for serving submissions on the consent authority is the 20th working day after the date on which public or limited notification is given. If the application is subject to limited notification, the consent authority may adopt an earlier closing date for submissions once the consent authority receives responses from all affected persons.
If you are a trade competitor, your right to make a submission may be limited by the trade competition provisions in Part 11A of the Resource Management Act 1991.
You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.
If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840
If you make your submission by electronic means, a signature is not required. Electronic submissions on resource consent applications must be directed to submissions@waipadc.govt.nz.
If you make a request under section 100A of the Resource Management Act 1991, you must do so in writing no later than 5 working days after the close of submissions and you may be liable to meet or contribute to the costs of the hearings commissioner or commissioners. You may not make a request under section 100A of the Resource Management Act 1991 in relation to an application for a coastal permit to carry out an activity that a regional coastal plan describes as a restricted coastal activity.
Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

Privacy information
The information you have provided on this form is required so that your submission can be processed under the RMA. The information will be stored on a public register and held by the Council, and may also be made available to the public on the Council's website. In addition, any on-going communications between you and Council will be held at Council's offices and may also be accessed upon request by a third party. Access to this information is administered in accordance with the Local Government Official Information and Meetings Act 1987 and the Privacy Act 1993. If you have any concerns about this, please discuss with a Council Planner prior to lodging your submission.

From:	Raewyn Easton
To:	Submissions
Cc:	richard.falconer@terragroup.co.nz
Subject:	External Sender: re: Resource Consent application no: LU/0323/21
Date:	Wednesday, 11 October 2023 4:31:04 pm

Hello, my name is Raewyn Easton. I am a landowner with my husband in the town of Te Awamutu. We have lived here in Te Awamutu for well over 55 years, our parents lived and worked here. We raised our family here and we now have 5 grandchildren who we look after during the school holidays, etc. We love it here because of its central location to the rest of the country. We are good law abiding people and we always pay our property rates on time.

My contact address is 39 Oak Ridge Drive, Te Awamutu, my phone number is [redacted]

My submission relates to the whole application. I oppose this application and I want the Waikato Regional Council to decline this application from Global Metal Solutions Ltd.

This proposal cannot be granted because there are too many factors impacting too many people. I belong to the Te Awamutu Marathon Clinic. Our club rooms are on Factory Road. We meet every Sunday morning and walk around the area of the proposed site often.

It is currently illegal to burn tyres in the Waipa District.

There is no assessment of land or water contamination included in the application. There has been no human health assessment for this proposal. Air, water and land pollution are all reasons why this cannot be allowed.

We are all meant to be doing our bit to prevent climate change and this proposal goes against everything we are doing. It will be fueling the climate crisis. This is not a proposal for the benefit of my community and we need to stop this before it starts.

I would like to be heard in support of my submission.

Please stop this!

Raewyn Easton

Submission on a Notified Resource Consent Application

Form 13

Waipa DISTRICT COUNCIL

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4),
Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I am/~~am not~~* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/~~am not~~ directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:
The impacts on our community with relation to the health of our local community as regards the toxic environment which the burning in this incinerator of rubber plastics 'flock' & household rubbish, would produce. This would poison the air in our town and the roads would be congested with a huge number of HT traffic.

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ☑ **are neutral** parts or all of ☐
include—

- *the reasons for your views.*

I am extremely concerned about the pollution to our atmosphere here in Te Awamutu, especially for children (I have an 8 year old grandson) and the elderly (I am a 75 year old cancer survivor) but my concerns are for the health of our community as a whole.

I seek the following decision from the consent authority:
give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought
I seek to have the application by Global Contracting Solutions Ltd, completely overturned. Their toxic project would be a disaster for Te Awamutu's health and enviroment and the negative impact on our community would be massive.

I wish (or do not wish) to be heard in support of my submission.

☐ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☑ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

☐ If others make a similar submission I will consider presenting a joint case with them at the hearing.

You must tick one of the boxes above, otherwise it will be deemed that you do not wish to be heard and we will not advise you of the date of the hearing.

☐ I have served a copy of my submission on the applicant.
(this is required by section 96(6) (b) of the Resource Management Act 1991)

I request/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: B. Emo.
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 30 Sept. '23. Contact person: Beverley Emo.
(name and designation, if applicant)

Postal address: 2/1110 Bank Street Te Awamutu, 3800.
(or alternative method of service under section 352 of the Act):

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.

The closing date for serving submissions on the consent authority is the 20th working day after the date on which public or limited notification is given. If the application is subject to limited notification, the consent authority may adopt an earlier closing date for submissions once the consent authority receives responses from all affected persons.

If you are a trade competitor, your right to make a submission may be limited by the trade competition provisions in Part 11A of the Resource Management Act 1991.

You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.

If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840

If you make your submission by electronic means, a signature is not required. Electronic submissions on resource consent applications must be directed to submissions@waipadc.govt.nz.

If you make a request under section 100A of the Resource Management Act 1991, you must do so in writing no later than 5 working days after the close of submissions and you may be liable to meet or contribute to the costs of the hearings commissioner or commissioners. You may not make a request under section 100A of the Resource Management Act 1991 in relation to an application for a coastal permit to carry out an activity that a regional coastal plan describes as a restricted coastal activity.

Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

Privacy information

The information you have provided on this form is required so that your submission can be processed under the RMA. The information will be stored on a public register and held by the Council, and may also be made available to the public on the Council's website. In addition, any on-going communications between you and Council will be held at Council's offices and may also be accessed upon request by a third party. Access to this information is administered in accordance with the Local Government Official Information and Meetings Act 1987 and the Privacy Act 1993. If you have any concerns about this, please discuss with a Council Planner prior to lodging your submission.

Waipa DISTRICT COUNCIL

Submission on a Notified Resource Consent Application

Form 13

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4), Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I am/~~am not~~* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/am not directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:

All of the application

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ☑ **are neutral** parts or all of ☐
include—

- *the reasons for your views.*

Keep it out of town

I seek the following decision from the consent authority:
give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

I oppose To this application I want the Waipa district Council to decline this application

I wish (or do not wish) to be heard in support of my submission.

☐ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☑ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

☐ If others make a similar submission I will consider presenting a joint case with them at the hearing.

You must tick one of the boxes above, otherwise it will be deemed that you do not wish to be heard and we will <u>not</u> advise you of the date of the hearing.

☐ I have served a copy of my submission on the applicant.
(this is required by section 96(6) (b) of the Resource Management Act 1991)

I ~~request~~/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: _____
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 13/10/23 Contact person: Charlie Elliott
(name and designation, if applicant)

Postal address: Do create cowl
(or alternative method of service under section 352 of the Act):

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.

The closing date for serving submissions on the consent authority is the 20th working day after the date on which public or limited notification is given. If the application is subject to limited notification, the consent authority may adopt an earlier closing date for submissions once the consent authority receives responses from all affected persons.

If you are a trade competitor, your right to make a submission may be limited by the trade competition provisions in Part 11A of the Resource Management Act 1991.

You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.

If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840

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- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
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Waipa DISTRICT COUNCIL

Submission on a Notified Resource Consent Application

Form 13

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4), Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I [redacted]/am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/[redacted] directly affected by an effect of the subject matter of the submission that—

(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:

MY SUBMISSION RELATES TO THE WHOLE APPLICATION

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ☑ **are neutral** parts or all of ☐

include—

- *the reasons for your views.*

THIS IS UNTESTED TECHNOLOGY, TEAWAMUTU DOES NOT WANT TO BE A TESTING GROUND. THE SITE IS INAPPROPRIATE AS IT IS NOT IDENTIFIED AS AN AREA FOR INDUSTRIAL DEVELOPMENT AND CONFLICTS WITH WAIPA DISTRICT PLAN AND GROWTH STRATEGY FOR THE COMMUNITY, SIGNIFICANT ADDITIONAL TRAFFIC IS UNNECESSARY.

I seek the following decision from the consent authority:

give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

DECLINE THIS APPLICATION

I wish (or do not wish) to be heard in support of my submission.

☑ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

☑ If others make a similar submission I will consider presenting a joint case with them at the hearing.

You must tick one of the boxes above, otherwise it will be deemed that you do not wish to be heard and we will not advise you of the date of the hearing.

☑ I have served a copy of my submission on the applicant.
(this is required by section 96(6) (b) of the Resource Management Act 1991)

BY EMAILING COPIES OF FORM TO
richard.falconer@terragroup.co.nz

I ~~request~~/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: V Edwards
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 10-10-2023 Contact person: VALERIE EDWARDS
(name and designation, if applicant)

Postal address: 109 EDEN AVE, TE AWAMUTU 3800
(or alternative method of service under section 352 of the Act):

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.

The closing date for serving submissions on the consent authority is the 20th working day after the date on which public or limited notification is given. If the application is subject to limited notification, the consent authority may adopt an earlier closing date for submissions once the consent authority receives responses from all affected persons.

If you are a trade competitor, your right to make a submission may be limited by the trade competition provisions in Part 11A of the Resource Management Act 1991.

You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.

If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840

If you make your submission by electronic means, a signature is not required. Electronic submissions on resource consent applications must be directed to submissions@waipadc.govt.nz.

If you make a request under section 100A of the Resource Management Act 1991, you must do so in writing no later than 5 working days after the close of submissions and you may be liable to meet or contribute to the costs of the hearings commissioner or commissioners. You may not make a request under section 100A of the Resource Management Act 1991 in relation to an application for a coastal permit to carry out an activity that a regional coastal plan describes as a restricted coastal activity.

Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

Privacy information

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Waipa DISTRICT COUNCIL

Waipa DISTRICT COUNCIL

Submission on a Notified Resource Consent Application

Form 13

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4), Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I ~~am~~/am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/~~am not~~* directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:
MY SUBMISSION RELATES TO THE WHOLE APPLICATION.

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ☑ **are neutral** parts or all of ☐

include—

- *the reasons for your views.*

THIS IS UNTESTED TECHNOLOGY, NOT VIABLE WAY TO REDUCE WASTE IN A CIRCULAR ECONOMY. INCINERATION PRODUCES DIOXINS OF UNKNOWN LEVELS. CURRENT LANDUSE IS ZONED FOR RESIDENTIAL, EDUCATION AND DAIRY INDUSTRIAL - CONFLICT OF USE, AND INTENTIONS OF THE WAIPA DISTRICT PLAN. AND GROWTH STRATEGY. SIGNIFICANT ADDITIONAL VOLUMES OF HEAVY TRAFFIC THAT WILL IMPACT THE COMMUNITY.

I seek the following decision from the consent authority:
give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

DECLINE APPLICATION

I wish (or do not wish) to be heard in support of my submission.

☑ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

☑ If others make a similar submission I will consider presenting a joint case with them at the hearing.

You must tick one of the boxes above, otherwise it will be deemed that you do not wish to be heard and we will not advise you of the date of the hearing.

☑ I have served a copy of my submission on the applicant.
(this is required by section 96(6) (b) of the Resource Management Act 1991)

By emailing copies of form to
richard.falconer@terragroup.co.nz

~~I request~~/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: NEdwards
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 10/10/2023 Contact person: NICOLA EDWARDS
(name and designation, if applicant)

Postal address: 80 McGARRY LANE, TE AWAMUTU, 3800.
(or alternative method of service under section 352 of the Act):

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.

The closing date for serving submissions on the consent authority is the 20th working day after the date on which public or limited notification is given. If the application is subject to limited notification, the consent authority may adopt an earlier closing date for submissions once the consent authority receives responses from all affected persons.

If you are a trade competitor, your right to make a submission may be limited by the trade competition provisions in Part 11A of the Resource Management Act 1991.

You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.

If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840

If you make your submission by electronic means, a signature is not required. Electronic submissions on resource consent applications must be directed to submissions@waipadc.govt.nz.

If you make a request under section 100A of the Resource Management Act 1991, you must do so in writing no later than 5 working days after the close of submissions and you may be liable to meet or contribute to the costs of the hearings commissioner or commissioners. You may not make a request under section 100A of the Resource Management Act 1991 in relation to an application for a coastal permit to carry out an activity that a regional coastal plan describes as a restricted coastal activity.

Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

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Waipa DISTRICT COUNCIL

Waipa DISTRICT COUNCIL

Submission on a Notified Resource Consent Application

Form 13

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4), Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I am/am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/am not* directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:

all of the application.

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ☑ **are neutral** parts or all of ☐

include—

- *the reasons for your views.*

My family and I oppose this as we are all asthmatic. I actually struggle to breathe here at the moment, and imagine if this incinerator is burning it will have a detrimental effect on my health.

I seek the following decision from the consent authority:

give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

Decline Application.

I wish (or do not wish) to be heard in support of my submission.

☑ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

☑ If others make a similar submission I will consider presenting a joint case with them at the hearing.

You must tick one of the boxes above, otherwise it will be deemed that you do not wish to be heard and we will not advise you of the date of the hearing.

☑ I have served a copy of my submission on the applicant.
(this is required by section 96(6) (b) of the Resource Management Act 1991)

I request/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: G M Eyre

(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 12 Oct 23. Contact person: Gaylene Eyre

(name and designation, if applicant)

Postal address: [redacted]

(or alternative method of service under section 352 of the Act):

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.

The closing date for serving submissions on the consent authority is the 20th working day after the date on which public or limited notification is given. If the application is subject to limited notification, the consent authority may adopt an earlier closing date for submissions once the consent authority receives responses from all affected persons.

If you are a trade competitor, your right to make a submission may be limited by the trade competition provisions in Part 11A of the Resource Management Act 1991.

You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.

If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840

If you make your submission by electronic means, a signature is not required. Electronic submissions on resource consent applications must be directed to submissions@waipadc.govt.nz.

If you make a request under section 100A of the Resource Management Act 1991, you must do so in writing no later than 5 working days after the close of submissions and you may be liable to meet or contribute to the costs of the hearings commissioner or commissioners. You may not make a request under section 100A of the Resource Management Act 1991 in relation to an application for a coastal permit to carry out an activity that a regional coastal plan describes as a restricted coastal activity.

Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

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Waipa DISTRICT COUNCIL

Submission on a Notified Resource Consent Application

Form 13

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4), Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I ~~am~~/am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/~~am not~~ directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:

ALL PARTS OF THE APPLICATION.

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ☑ **are neutral** parts or all of ☐

include—

- *the reasons for your views.*

DEVALUATION OF PROPERTIES IN TE AWAMUTU.
POLLUTION.
HIGH VOLUME OF TRUCKS ETC.

I seek the following decision from the consent authority:

give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

DECLINE APPLICATION.

I wish (or do not wish) to be heard in support of my submission.

☑ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

☑ If others make a similar submission I will consider presenting a joint case with them at the hearing.

You must tick one of the boxes above, otherwise it will be deemed that you do not wish to be heard and we will not advise you of the date of the hearing.

☑ I have served a copy of my submission on the applicant.
(this is required by section 96(6) (b) of the Resource Management Act 1991)

I ~~request~~/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: _____
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 13-10-2023 Contact person: WAYNE ELLIOTT.
(name and designation, if applicant)

Postal address: 145 BOND ROAD, TE AWAMUTU.
(or alternative method of service under section 352 of the Act):

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.

The closing date for serving submissions on the consent authority is the 20th working day after the date on which public or limited notification is given. If the application is subject to limited notification, the consent authority may adopt an earlier closing date for submissions once the consent authority receives responses from all affected persons.

If you are a trade competitor, your right to make a submission may be limited by the trade competition provisions in Part 11A of the Resource Management Act 1991.

You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.

If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840

If you make your submission by electronic means, a signature is not required. Electronic submissions on resource consent applications must be directed to submissions@waipadc.govt.nz.

If you make a request under section 100A of the Resource Management Act 1991, you must do so in writing no later than 5 working days after the close of submissions and you may be liable to meet or contribute to the costs of the hearings commissioner or commissioners. You may not make a request under section 100A of the Resource Management Act 1991 in relation to an application for a coastal permit to carry out an activity that a regional coastal plan describes as a restricted coastal activity.

Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

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Waipa DISTRICT COUNCIL

Submission on a Notified Resource Consent Application

Form 13

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4), Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I ~~am~~/am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/~~am not~~ directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:

_____

_____

_____

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ☑ **are neutral** parts or all of ☐

include—

- *the reasons for your views.*

Lived in Te Awamutu for 23yrs - have school aged children at both TA College & TAI. Feel this is and will be unsafe to my whanau & to others in the community.

I seek the following decision from the consent authority:

give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

All of it, I want you to decline the application.

I wish (or do not wish) to be heard in support of my submission.

☑ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

☑ If others make a similar submission I will consider presenting a joint case with them at the hearing.

You must tick one of the boxes above, otherwise it will be deemed that you do not wish to be heard and we will not advise you of the date of the hearing.

☑ I have served a copy of my submission on the applicant.
(this is required by section 96(6) (b) of the Resource Management Act 1991)

I ~~request~~/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: L Emeny
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 13-10-23 Contact person: Louise Emeny
(name and designation, if applicant)

Postal address: 1508 Cambridge Road. Te Awamutu
(or alternative method of service under section 352 of the Act)

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.

The closing date for serving submissions on the consent authority is the 20th working day after the date on which public or limited notification is given. If the application is subject to limited notification, the consent authority may adopt an earlier closing date for submissions once the consent authority receives responses from all affected persons.

If you are a trade competitor, your right to make a submission may be limited by the trade competition provisions in Part 11A of the Resource Management Act 1991.

You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.

If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840

If you make your submission by electronic means, a signature is not required. Electronic submissions on resource consent applications must be directed to submissions@waipadc.govt.nz.

If you make a request under section 100A of the Resource Management Act 1991, you must do so in writing no later than 5 working days after the close of submissions and you may be liable to meet or contribute to the costs of the hearings commissioner or commissioners. You may not make a request under section 100A of the Resource Management Act 1991 in relation to an application for a coastal permit to carry out an activity that a regional coastal plan describes as a restricted coastal activity.

Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

Privacy information

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Waipa DISTRICT COUNCIL

Submission on a Notified Resource Consent Application

Form 13

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4), Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

~~I am~~/am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/~~am not~~ directly affected by an effect of the subject matter of the submission that—

(a) adversely affects the environment; and

(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:

~~To decline~~ the entire application

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ☑ **are neutral** parts or all of ☐

include—

- *the reasons for your views.*

Toxic - not good for health + town.

I seek the following decision from the consent authority:

give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

I oppose to this application WDC to decline

I wish (or do not wish) to be heard in support of my submission.

☑ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

☑ If others make a similar submission I will consider presenting a joint case with them at the hearing.

You must tick one of the boxes above, otherwise it will be deemed that you do not wish to be heard and we will <u>not</u> advise you of the date of the hearing.

☑ I have served a copy of my submission on the applicant.
(this is required by section 96(6) (b) of the Resource Management Act 1991)

I ~~request~~/do not request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: N Emmett

(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 13/10/23 Contact person: Natasi Emmett

(name and designation, if applicant)

Postal address: 330 Wakerig rd.

(or alternative method of service under section 352 of the Act):

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.

The closing date for serving submissions on the consent authority is the 20th working day after the date on which public or limited notification is given. If the application is subject to limited notification, the consent authority may adopt an earlier closing date for submissions once the consent authority receives responses from all affected persons.

If you are a trade competitor, your right to make a submission may be limited by the trade competition provisions in Part 11A of the Resource Management Act 1991.

You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.

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- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
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Waipa DISTRICT COUNCIL

Submission on a Notified Resource Consent Application

Form 13

Sections 41D, 95A, 95B, 95C, 96, 127(3) and 234(4), Resource Management Act 1991

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I ~~am~~/am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/~~am not~~ directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:

All of the application

My submission is:

Support parts or all of ☐ **Oppose** parts or all of ☑ **are neutral** parts or all of ☐

include—

- *the reasons for your views.*

poison for environment, waterways, traffic
(my child attends the Barnyard daycare on Racecourse Rd.)

I seek the following decision from the consent authority:

give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought

I want the council to decline the application

I wish (or do not wish) to be heard in support of my submission.

☑ I do wish to be heard in support of my submission
(this means that you will speak at the hearing)

☐ I do not wish to be heard in support of my submission
(this means that you will not be advised of the date of the hearing and will not speak at the hearing)

☑ If others make a similar submission I will consider presenting a joint case with them at the hearing.

You must tick one of the boxes above, otherwise it will be deemed that you do not wish to be heard and we will <u>not</u> advise you of the date of the hearing.

☑ I have served a copy of my submission on the applicant.
(this is required by section 96(6) (b) of the Resource Management Act 1991)

~~I request~~ I do not request ~~do not request~~*, **pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.**

Signature of submitter: _____
(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 13/10/23 Contact person: Julie Elliot
(name and designation, if applicant)

Postal address: 190 Pakura Street, Te Awamutu
(or alternative method of service under section 352 of the Act):

Notes to submitter

If you are making a submission to the Environmental Protection Authority, you should use form 16B.

The closing date for serving submissions on the consent authority is the 20th working day after the date on which public or limited notification is given. If the application is subject to limited notification, the consent authority may adopt an earlier closing date for submissions once the consent authority receives responses from all affected persons.

If you are a trade competitor, your right to make a submission may be limited by the trade competition provisions in Part 11A of the Resource Management Act 1991.

You must serve a copy of your submission on the applicant as soon as reasonably practicable after you have served your submission on the consent authority.

If you make your submission in hard copy please deliver to Waipa District Council, 101 Bank Street, Te Awamutu or 23 Wilson Street, Cambridge or post to Private Bag 2402, Te Awamutu 3840

If you make your submission by electronic means, a signature is not required. Electronic submissions on resource consent applications must be directed to submissions@waipadc.govt.nz.

If you make a request under section 100A of the Resource Management Act 1991, you must do so in writing no later than 5 working days after the close of submissions and you may be liable to meet or contribute to the costs of the hearings commissioner or commissioners. You may not make a request under section 100A of the Resource Management Act 1991 in relation to an application for a coastal permit to carry out an activity that a regional coastal plan describes as a restricted coastal activity.

Please note that your submission (or part of your submission) may be struck out if the authority is satisfied that at least one of the following applies to the submission (or part of the submission):

- it is frivolous or vexatious:
- it discloses no reasonable or relevant case:
- it would be an abuse of the hearing process to allow the submission (or the part) to be taken further:
- it contains offensive language:
- it is supported only by material that purports to be independent expert evidence, but has been prepared by a person who is not independent or who does not have sufficient specialised knowledge or skill to give expert advice on the matter.

Privacy information

The information you have provided on this form is required so that your submission can be processed under the RMA. The information will be stored on a public register and held by the Council, and may also be made available to the public on the Council's website. In addition, any on-going communications between you and Council will be held at Council's offices and may also be accessed upon request by a third party. Access to this information is administered in accordance with the Local Government Official Information and Meetings Act 1987 and the Privacy Act 1993. If you have any concerns about this, please discuss with a Council Planner prior to lodging your submission.

WDC REF: LU/0323/21

THE INFORMATION ON THIS PAGE IS REQUIRED FOR ADMINISTRATION PURPOSES ONLY AND IS NOT PART OF THE SUBMISSION.

YOUR DETAILS:			
(please write clearly)			
Title: Name of submitter:	Mrs Janice Emery		
Organisation: (if applicable)			
Address for correspondence:	4 Sheehan Street		
	Kihikihi		
	Te Awamutu	Post Code:	3800
Email:	[redacted]		
Contact phone number:	[redacted]		

This is a submission on:

APPLICANT'S NAME: Global Contracting Solutions Limited
LOCATION: 401 Racecourse Road, Te Awamutu

I am not* a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am/am not directly affected by an effect of the subject matter of the submission that—
(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are:
The whole application

My submission is: Oppose all of this

Support parts or all of **Oppose** parts or all of
include—

- *the reasons for your views.*

I do not agree with any of this application. Burning our rubbish is going backwards. We should be looking at following the zero waste plans of which we already have in part started doing in our community. We do not need to be carting every other town/city's rubbish into our town 24/7. They can deal with their own rubbish solutions.The emissions from the chimneys will be deprimental to our health, our farming and_our future house values. Putting an industrial site slap bang in the middle of a residential area near schools and pre schools and food businesses doesn't make sense. This application doesn't contain a formal Cultural Impact Assessment for all residents of Te Awamutu and surrounding areas. It will also undermine the ecological corrider link from Maungatutari and Pirongia. I don't want my town to become known as the rubbish
town._____
_____
_____
_____

I seek the following decision from the consent authority:
give precise details, including the parts of the application you wish to have amended and the general nature of any conditions sought
I want Waipa District Council to decline this application totally_____
_____
_____
_____

I wish to be heard in support of my submission.

- I do wish to be heard in support of my submission
  (this means that you will speak at the hearing)
- I do not wish to be heard in support of my submission
  (this means that you will not be advised of the date of the hearing and will not speak at the hearing)
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I request*, pursuant to section 100A of the Act, that you delegate your functions, powers, and duties to hear and decide the application to one or more hearings commissioners who are not members of the local authority.

Signature of submitter: _____

(or person authorised to sign on behalf of submitter) (A signature is not required if you make your submission by electronic means.)

Date: 8/10/2023 Contact person: Janice Emery

_____

(name and designation, if applicant)

Postal address: 4 Sheehan Street Kihikihi Te Awamutu

_____

(or alternative method of service under section 352 of the Act):

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