AGENDA



LANDFILL / FOGO COMMITTEE TO BE HELD IN THE COUNCIL CHAMBERS ON THURSDAY, 5 JUNE 2025 AT 5:00 PM

1	Apologies		
2	Confirmation of Minutes		
3	Business Arising		
4	Declarations of Interest		
5	Items of Business		
CL01	р3	Induction of Committee Members - Mandatory	
CL02	p52	Terms of Reference	
CL03	p59	Proposed Meeting Dates 2025	
CL04		Recycling Bins for Businesses	
CL05		Extension of Recycling Bins into Rural Areas	
CL06	p60	FOGO Bin Process	
6	General Business		

7 Next Meeting

DISTRIBUTION LIST

Councillor Doug Curran (Chair), Councillor Christine Stead, Councillor Mark Dal Bon, Brian Irvin (Community Representative), Lisa Parker (Community Representative), Stephen Violi (Community Representative), Susan Forner (Community Representative), Wendy Borg (Community Representative)

Waste Operations Manager, John Roser and Minute Secretary, Antoinette Galluzzo

Quorum = 3

If you are unable to attend this meeting please notify the Minute Secretary prior to commencement of the meeting by email or by telephoning Council on 1300 176 077.

This Committee meeting may be attended remotely and recorded by audio or audio-visual means for administrative purposes. No other recording is permitted.

Acknowledgement of Country

Griffith City Council acknowledges the Wiradjuri people as the traditional owners and custodians of the land and waters, and their deep knowledge embedded within the Aboriginal community.

Council further pays respect to the local Wiradjuri Elders, past, present and those emerging, for whom we acknowledge have responsibilities for the continuation of cultural, spiritual and educational practices of the local Wiradjuri people.

Griffith City Council

COMMITTEE REPORT

CLAUSE CL01

TITLE Induction of Committee Members - Mandatory

FROM Joanne Bollen, Governance Officer

TRIM REF 25/27792

SUMMARY

Community members appointed to Council Committees are required to undertake the Committee Induction process as outlined in this report.

RECOMMENDATION

The Committee members note the Committee Induction requirements and complete induction process outlined in this report.

REPORT

Members appointed to Council Committees are required to undertake the Committee Induction process as outlined below:

Mandatory Induction Requirements:

- Code of Conduct Policy
- Model Code of Conduct at a Glance Committee Members & Delegates
- Code of Meeting Practice Policy
- Statements to the Media Policy
- Social Media Policy
- Information Protection Principles
- Child Safe Policy and Code of Conduct

Step 2: Complete the online Committee Acknowledgment of Policies Form after reading the above policies.

Conflicts of Interest

Your obligations to disclose and manage conflicts of interest that arise in your role will depend on what type of conflict of interest you have. Part 4 & 5 of the Code of Conduct policy describes Committee members' responsibilities for declaring Pecuniary and Non-Pecuniary conflicts of interests.

<u>Conflicts of interest forms</u> may be filled in on-line prior to the meeting or completed in writing at the meeting.

Gift and Benefits Register

Part 6 of the Code of Conduct policy deals with gifts and benefits and outlines requirements for Committee members to submit a <u>Gift and Benefits form.</u>

Social Media / Media Policies

- When discussing Council or Committee matters, only share publicly available information and participate in conversations where you have sufficient knowledge.
- The Chairperson of a Council Committee is the primary spokesperson for matters discussed by the Committee.
- Follow the Code of Conduct and treat all individuals and with respect.
- Be mindful that your comments do not bring Council's reputation into disrepute.
- You must not use or disclose information obtained in the course of Committee business in a manner that reveals confidential discussions.

Terms of Reference

The Terms of Reference for a Council Committee outline its purpose, structure, and operational guidelines, including its objectives, membership composition, meeting procedures, roles and responsibilities, decision-making authority and reporting obligations. They define how the Committee functions within the Council structure, ensuring clarity on delegation limits and governance requirements.

Agenda Items

Committee Secretary will confer with the Chair and responsible Director regarding Agenda items. Should Committee members wish to raise a matter as part of the Agenda, they may email the Committee Secretary 2 weeks before the meeting date.

Alternatively, matters may be raised for discussion during General Business.

Committee Recommendation Process



LINK TO STRATEGIC PLAN

This item links to Council's Strategic Plan item 3.1 Undertake Council activities within a clear framework of strategic planning, policies, procedures and service standards.

ATTACHMENTS

(a)	Code of Conduct At a Glance \underline{J}	6
(b)	OLG Code of Conduct Presentation J	12

MODEL CODE OF CONDUCT FOR LOCAL COUNCILS IN NSW 'AT A GLANCE' GUIDE FOR COUNCIL COMMITTEE MEMBERS AND DELEGATES

Introduction

This guide summarises the key elements of the *Model Code of Conduct for Local Councils in NSW* that apply to committee members and delegates of councils and joint organisations.

The Model Code of Conduct is available at <u>www.olg.nsw.gov.au</u>.

Each council's and joint organisation's code of conduct must reflect the requirements of the Model Code of Conduct and may contain additional requirements.

While this guide refers to "councils" for simplicity, all references in it to "councils" are to be taken as including local and county councils and joint organisations.

Committee members and delegates should familiarise themselves with their council's code of conduct and understand their obligations and the obligations of others.

Who is a committee member?

A council committee member is any person (other than a councillor or council staff member) who is a member of a council committee that exercises functions of the council under delegation. It may also include members of advisory committees if your council has extended the application of its code of conduct to members of advisory committees.

Who is a delegate?

A delegate of a council is any person (other than a councillor or council staff member) who exercises a council function under delegation.

Office of

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General Conduct

It is important that the local community has confidence in the council and those that serve it, whether as elected representatives, members of staff or as delegates or committee members.

As a committee member or a delegate of the council, you must ensure that your conduct and behaviour towards others meets the high standards that the community is entitled to expect of all council officials.

What conduct is expected of council committee members and delegates? (Clauses 3.1 - 3.21)

You **must**:

- act lawfully and honestly and exercise care and diligence in undertaking your functions
- consider matters consistently, promptly and fairly and in accordance with established procedures
- ensure land use planning, development assessment and other regulatory decisions are properly made and that all parties are dealt with fairly, and
- comply with your duties under the Work Health and Safety Act 2011 and take care or your own and others' health and safety.

You **must not** conduct yourself in a way that:

- will bring the council into disrepute
- is contrary to law and council policies
- is improper, unethical or an abuse of power
- involves misuse of your position for personal benefit
- constitutes harassment or bullying or is unlawfully discriminatory, or
- is intimidating or verbally abusive.

Submitting returns of interests

Delegates of councils or members of committees that exercise functions of the council that may give rise to conflicts of interest are required to disclose their personal interests in publicly available returns of interests.

These operate as a key transparency mechanism for promoting community confidence in council decision making, whether by councillors or by staff or others under delegation.

Do I need to submit a written return of interests?

(Clauses 4.8 - 4.10)

Delegates or committee members who are "designated persons" must complete and submit returns of their interests to the general manager.

When do I need to submit a written return of interests?

If you are a designated person, you must submit a return of interests within three months of your appointment and submit a new return annually (within three months of the start of each financial year).

If you become aware of any new interest that needs to be disclosed in the return, you must submit a new return within three months of becoming aware of the interest.

What interests do I need to disclose? (Schedule 1)

If you are a designated person you will be required to disclose, among other things, the following types of interests in your return:

- interests in real property
- gifts
- contributions to travel
- interests and positions in corporations
- whether you are a property developer or a close associate of a property developer
- positions in trade unions and professional or business associations
- dispositions of real property
- sources of income, and
- debts.

Conflicts of interest

As a member of the local community, it is inevitable that at some point you will have a conflict of interest in a matter that you are dealing with. What is important is that you are able to identify that you have a conflict of interest and that you disclose and manage it appropriately.

There are two types of conflicts of interest – pecuniary and non-pecuniary. Your obligations to disclose and manage conflicts of interest will depend on what type of conflict of interest you have.

What is a pecuniary conflict of interest? (Clauses 4.1-4.5)

You will have a pecuniary interest in a matter you are dealing with where there is a reasonable likelihood or expectation that you or a related person (eg a relative, your employer or business partner or a company you hold shares in), will gain or lose financially appreciably as a result of any decision made in relation to the matter.

How do I manage pecuniary conflicts of interest that I have in matters I am dealing with? (Clauses 4.10, 4.12 and 4.18)

lauses 4.10, 4.12 and 4.18)

You must disclose in writing any pecuniary interest you may have in a matter you are dealing with as soon as you become aware of it.

Model Code of Conduct for Local Councils in NSW – 'At a Glance' Guide for Council Committee Members and Delegates

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The general manager will decide how the matter will be dealt with.

If you are a member of a committee, you must disclose any pecuniary interest you have in any matter being dealt with by the committee at each committee meeting that the matter arises and leave the meeting while the matter is being considered and voted on.

What is a non-pecuniary conflict of interest?

(Clauses 5.1, 5.2 and 5.8)

Non-pecuniary interests are private or personal interests that are not pecuniary interests.

You will have a non-pecuniary conflict of interest in a matter you are dealing with if a reasonable and informed person would perceive that you could be influenced by a private interest that you have in that matter. This is also known as the "pub test".

How you deal with a non-pecuniary conflict of interest will depend on whether it is significant.

How do I know if I have a significant non-pecuniary conflict of interest in a matter I am dealing with? (Clause 5.9)

You will have a significant non-pecuniary conflict of interest in a matter you are dealing with where you have a:

- close relationship (including a business relationship) with a person who will be affected by any decision made in relation to the matter
- strong affiliation with an organisation that will be affected by any decision made in relation to the matter, or
- financial interest in the matter that is not a pecuniary interest, or you otherwise stand to gain or lose a personal benefit as a result of a decision made in relation to that matter.

How do I manage significant nonpecuniary conflicts of interest that I have in matters I am dealing with? (Clauses 5.9 and 5.10)

If you have a significant non-pecuniary conflict of interest in a matter you are dealing with, you must:

- disclose it in writing to the general manager
- disclose it on each occasion the matter arises, and
- not participate in any consideration of the matter.

If you are a member of a council committee you must also disclose your interest at each committee meeting that the matter arises and leave the meeting while the matter is being considered or voted on.

How do I manage non-pecuniary conflicts of interest that are not significant? (Clauses 5.6, 5.7 and 5.11)

Clauses 5.6, 5.7 and 5.11)

If you believe that you have a non-pecuniary conflict of interest in a matter you are dealing with that is not significant and that does not require further action, you must still disclose your interest in writing to the general manager as soon as possible and explain why you believe it is not significant.

The general manager will help you decide how to manage your interest.

If you are a member of a committee, you must also disclose your interest at each committee meeting the matter arises and explain why you believe it is not significant and no further action is necessary to manage it.

What if I am not sure? (Clause 5.4)

Remember, no one knows your personal circumstances better than you and for that reason, the onus is on you to identify and disclose any potential conflict of interest you may have in a matter you are dealing with and to manage it appropriately. If you are not sure whether you have a conflict of interest in a matter you are dealing with or what type of conflict of interest it is, always err on the side of caution. Disclose the interest in writing to the general manager and discuss with them whether you should continue to deal with the matter.

How do I deal with council in my private capacity as a resident or ratepayer?

(Clauses 5.28 and 5.29)

As a member of the community, it is inevitable that you will need to deal with your council in your private capacity. Where this occurs, you should deal with the council in the same way as other members of the public. You should not expect or seek any preferential treatment.

You must not use your position to obtain a private benefit for yourself or for someone else or to influence others in the performance of their functions to obtain a private benefit for yourself or for someone else.

Gifts and benefits

In the course of performing your duties you may be offered a gift or a personal benefit. There are strict rules that govern what gifts or benefits you may accept and those that you must refuse.

These rules are informed by the following principles:

- you must not benefit personally from the performance of your duties on behalf of the council other than through the remuneration and any other benefits you receive as a delegate or committee member, and
- you must not be influenced or be seen to be influenced in the performance of your duties as a result of the receipt of a gift or personal benefit.

What is a gift or benefit? (Clauses 6.1 and 6.2)

A gift or benefit is something offered to or received by you or someone closely associated with you for personal use or enjoyment. Gifts and benefits do not include:

- items with a value of \$10 or less
- a gift or benefit provided to the council as part of a cultural exchange or sister city relationship (provided it is not used for your personal use and enjoyment)
- attendance at a work-related event or function for the purpose of undertaking your council duties, or
- meals, beverages or refreshments that are provided to you while you are carrying out your council duties.

What gifts or benefits must I refuse? (Clause 6.5)

You must not:

- seek or accept bribes
- seek gifts or benefits of any kind
- accept any gift or benefit that may create a sense of obligation, or that may be perceived as intended or likely to influence you in undertaking your duties
- accept any gift or benefit that is worth more than \$100
- accept tickets to major sporting or cultural events with a ticket value of over \$100 or corporate hospitality at such events
- accept cash or cash-like gifts (such as gift vouchers, credit cards, debit cards with credit on them, phone or internet credit, lottery tickets etc) of any amount
- participate in competitions for prizes where eligibility is based on the council being a customer of the competition organiser, or
- personally benefit from reward points programs when purchasing on behalf of council.

What if I can't refuse a gift or benefit? (Clause 6.7)

If you are offered a gift or benefit that is worth more than \$100 that cannot be reasonably refused, you must surrender it to the council.

Model Code of Conduct for Local Councils in NSW – 'At a Glance' Guide for Council Committee Members and Delegates

What gifts can I accept and who must I report this to?

(Clauses 6.6, 6.8 and 6.11)

You may accept gifts with a value of under \$100. However, if you receive further gifts from the same person or another person associated with them in the next 12 months with a value which, when combined with the value of the first gift exceeds \$100, you must refuse to accept the additional gifts.

If you accept a gift of any value above \$10, you must disclose this promptly to the general manager in writing. The following details must be recorded in the council's gift register:

- the nature of the gift or benefit
- the estimated monetary value of the gift or benefit
- the name of the person who provided the gift or benefit, and
- the date on which the gift or benefit was received.

Use of council information and resources

Council resources (including council information) are public resources. You must use council resources ethically, effectively, efficiently and carefully when performing your duties.

You must not use council resources for private purposes, or convert council property for your own use unless you are authorised to do so.

What records should I keep? (Clauses 8.21 – 8.24)

All information created, sent or received in your official capacity (whether or not stored on a council device or a council email account) and any information stored in either soft or hard copy on council resources is considered to be a council record and must be kept in accordance with the *State Records Act 1998* and your council's records management policy.

Do not destroy, alter or dispose of records unless authorised to do so.

What are my obligations in relation to the use of council information? (Clauses 8.9–8.11)

You can only access and use council information for council business. You must not use council information for private purposes and you must not seek to privately benefit from any council information you have obtained in your role as a delegate or committee member.

You must only release council information in accordance with established council policies and procedures and in compliance with relevant legislation (including privacy legislation).

You must maintain the integrity and security of any confidential or personal information you have access to. In particular, you must:

- only access confidential or personal information that you have been authorised to access and only for the purposes of performing your duties
- protect confidential and personal information
- only release confidential or personal information if authorised to do so
- only use confidential or personal information for the purpose for which it is intended to be used
- not use confidential or personal information to obtain a private benefit for you or for someone else
- not use confidential or personal information to cause harm to the council or anyone else, and
- not disclose confidential information discussed during a closed session of a council or committee meeting or any other confidential forum (such as councillor workshops or briefing sessions).

What are my obligations when using my council computer or mobile device? (Clause 8.20)

You must not use council's computer or mobile devices to access, download or communicate any material that is offensive, obscene, pornographic, threatening, abusive or defamatory or could lead to civil or criminal liability and/or damage council's reputation.

Model Code of Conduct for Local Councils in NSW - 'At a Glance' Guide for Council Committee Members and Delegates

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Making code of conduct complaints

Your council's code of conduct is the key mechanism for promoting and enforcing the ethical and behavioural standards the community rightly expects of those who serve the council.

For this reason, it is important that your council's code of conduct is correctly used and that code of conduct processes are respected and complied with.

How do I make a code of conduct complaint?

(Part 4 of the Procedures)

Complaints alleging breaches of the code of conduct must be made in writing to the general manager. Complaints about the general manager must be made in writing to the mayor. Complaints must be made within 3 months of the conduct occurring or you becoming aware of the conduct.

To be dealt with under the council's code of conduct, a complaint must show or tend to show conduct by a member of staff, a councillor or a person exercising council functions under delegation or who is otherwise subject to the council's code of conduct in connection with their official role or the exercise of their official functions that would constitute a breach of the council's code of conduct if proven.

The following types of complaints must not be dealt with under a council's code of conduct and should instead be dealt with under the council's routine complaints management processes:

- complaints about the standard or level of service provided by the council or a council official
- complaints that relate solely to the merits of a decision made by the council or a council official or the exercise of a discretion by the council or a council official
- complaints about the policies or procedures of the council, and
- complaints about the conduct of a council official arising from the exercise of their functions in good faith, whether or not involving error, that would not otherwise constitute a breach of the council's code of conduct.

What happens if a code of conduct complaint is made about me? (Clauses 5.10 – 5.17 of the Procedures)

The general manager (or another member of staff authorised by the general manager) is responsible for dealing with code of conduct complaints about committee members and delegates.

In dealing with a complaint, the general manager may determine to take no action, to resolve it informally or to take disciplinary action. Prior to taking disciplinary action, the general manager must comply with certain procedural fairness requirements.

Where proven, code of conduct complaints may result in:

- censure
- requirement for an apology
- prosecution for any breach of the law
- removal or restriction of a delegation, and/or
- removal from membership of a committee

What are my responsibilities in relation to code of conduct complaints?

(Clauses 9.1 – 9.7, and 9.13)

You have certain obligations in relation to any code of conduct complaints that you make or that are made about you. These obligations are designed to safeguard the integrity of your council's code of conduct and the processes for investigating and dealing with alleged breaches by ensuring code of conduct matters are dealt with in a manner that is robust, fair and confidential. Breaches of these obligations may themselves constitute a breach of your council's code of conduct.

In particular you must not:

- make code of conduct complaints for an improper purpose
- take or cause reprisal action to be taken against someone for making or dealing with a code of conduct complaint
- disclose any information about a code of conduct complaint you have made or that has been made about you except for the purpose of seeking legal advice, or
- impede or disrupt the consideration of a code of conduct complaint and you must comply with any reasonable and lawful requests.

Model Code of Conduct for Local Councils in NSW – 'At a Glance' Guide for Council Committee Members and Delegates

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Model Code of Conduct Training Committee Members and Delegates





- General conduct
- Submitting returns of interest
- Conflicts of interest
- Gifts and benefits
- Use of council information and resources
- Code of conduct complaints





- A council's code of conduct sets the minimum standards of conduct for all council officials.
- Every council and joint organisation must adopt a code of conduct that incorporates the provisions of the Model Code of Conduct.
- It is important that the local community has confidence in the council and you.





General Conduct





You must:

- act lawfully and honestly and exercise care and diligence
- consider matters consistently, promptly and fairly and in accordance with procedures
- ensure regulatory decisions are properly made and that all parties are dealt with fairly
- take care of your own and others' health and safety





You **must not** conduct yourself in a way that:

- will bring the council into disrepute
- is contrary to law and council policies
- is improper, unethical or an abuse of power
- involves misuse of your position for personal benefit
- constitutes harassment or bullying or is unlawfully discriminatory
- is intimidating or verbally abusive.





Returns of Interests



Returns of interests disclosures by "designated persons"

- People who exercise council functions that may give rise to conflicts of interest (ie "designated persons") are required to disclose their personal interests in publicly available returns of interests.
- "Designated persons" must complete and submit returns of their interests to the general manager.
- A return of interest must be submitted:
 - within 3 months of appointment and then annually
 - within 3 months of becoming aware of any new interest.



Returns of interests What interests do I need to disclose?

A designated person is required to disclose:

- interests in real property
- gifts
- contributions to travel
- interests and positions in corporations
- whether you are a property developer or a close associate of a property developer
- positions in trade unions and professional or business associations
- dispositions of real property
- sources of income
- debts





Conflicts of Interest





- There are two types of conflicts of interest:
 - pecuniary and
 - non-pecuniary.
- Your obligations to disclose and manage conflicts of interest will depend on what type of conflict of interest you have.





You will have a **pecuniary interest** in a matter where there is a reasonable likelihood or expectation that you or a related person will gain or lose financially as a result of any decision made in relation to that matter.





- Where you have a pecuniary interest in a matter you are dealing with, you must disclose it as soon as you become aware of it in writing to the general manager.
- The general manager will decide how the matter will be dealt with.
- If you are a member of a committee, you must disclose any pecuniary interest you have in any matter being dealt with by the committee at each committee meeting that the matter arises and leave the meeting while it is being considered and voted on.





- Non-pecuniary interests are private or personal interests that are not pecuniary interests.
- You will have a non-pecuniary conflict of interest in a matter you are dealing with if a reasonable and informed person would perceive that you could be influenced by a private interest that you have in that matter.
- How you deal with a non-pecuniary conflict of interest will depend on whether it is **significant**.



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You will have a significant non-pecuniary conflict of interest in a matter where you have:

- a close relationship (including a business relationship) with a person who will be affected by a decision
- a strong affiliation with an organisation that will be affected by a decision
- a financial interest in the matter that is not a pecuniary interest, or you otherwise stand to gain or lose a personal benefit as a result of a decision

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Conflicts of Interest managing significant non-pecuniary conflicts of interest

- Disclose it in writing to the general manager as soon as possible,
- disclose it on each occasion the matter arises, and
- do not participate in any consideration of the matter.
- If you are a member of a council committee you must also disclose your interest at each committee meeting that the matter arises and leave the meeting while the matter is being considered and voted on.





Conflicts of Interest managing non-pecuniary conflicts of interest that are not significant

- A non-pecuniary conflict of interest will not be significant where it arises from a relationship or affiliation that is not particularly strong.
- You must still disclose your interest in writing to the general manager as soon as possible and explain why you believe it is not significant. They will help you decide how to manage it.
- If you are a member of a committee, you must also disclose your interest at each committee meeting the matter arises and explain why you believe it is not significant and no further action is necessary to manage it.





- The onus is on you to identify and disclose any potential conflict of interest you may have in a matter you are dealing with and to manage it appropriately.
- If you are not sure, always err on the side of caution.
 Disclose the interest in writing to the general manager and discuss it with them.





- You should deal with the council in the same way as other members of the public.
- You should not expect or seek any preferential treatment.
- You must not use your position to obtain a private benefit for yourself or for someone else or to influence others to obtain a private benefit for yourself or for someone else.





Gifts and Benefits





- A gift or benefit is something offered to or received by you, or someone closely associated with you, for personal use or enjoyment.
- Key principles:
 - You must not benefit personally from your work other than through the remuneration and any other benefits you receive as a delegate or committee member.
 - You must not be influenced or be seen to be influenced as a result of the receipt of a gift or personal benefit.





Gifts and benefits **do not** include:

- items with a value of \$10 or less
- a gift or benefit provided to the council as part of a cultural exchange or sister city relationship
- attendance at a work-related event for the purpose of undertaking your council duties
- meals, beverages or refreshments that are provided to you while you are carrying out your council duties.



Gifts and Benefits you must not...

You must not:

- seek or accept bribes
- seek gifts or benefits of any kind
- accept any gift or benefit that may create a sense of obligation, or that may be perceived as intended or likely to influence you
- accept any gift or benefit that is worth more than \$100
- accept tickets to major sporting or cultural events with a ticket value of over \$100 or corporate hospitality at such events
- accept cash or cash-like gifts of any amount
- participate in competitions for prizes where eligibility is based on the council being a customer of the competition organiser
- personally benefit from reward points programs when purchasing on behalf of council.





If you are offered a gift or benefit that is worth more than \$100 that cannot be reasonably refused, you must surrender it to the council.





- You can accept gifts valued under \$100.
- But, if the same person, or someone associated with them, offers you another gift in the next 12 months, which, if added to the value of the first gift, has a value that exceeds \$100, you must refuse to accept the additional gift.
- You must promptly disclose any gift of any value over \$10 to the general manager in writing for entry into council's gift register.




Use of Council Resources





- Council resources are public resources.
- You must use council resources ethically, effectively, efficiently and carefully when performing your duties.
- You must not use council resources for private purposes, or convert council property for your own use unless you are authorised to do so.





- All information created, sent or received in your official capacity and any information stored on council resources is considered to be a council record and must be kept in accordance with the *State Records Act 1998* and the council's records management policy.
- Do not destroy, alter or dispose of records unless authorised to do so.





- You can only access and use council information for council business.
- You must not use council information for private purposes.
- You must not seek to privately benefit from any council information you have obtained in your role.
- You must only release council information in accordance with council policies and procedures and in compliance with relevant legislation.





You must maintain the integrity and security of any confidential or personal information you have access to. In particular, **you must**:

- only access confidential or personal information that you have been authorised to access and only for the purposes of performing your functions
- protect confidential and personal information
- only use confidential or personal information for the purpose for which it is intended to be used
- only release confidential or personal information if authorised



Use of Council Resources protecting council information

You must not:

- use confidential or personal information to obtain a private benefit for you or for someone else
- use confidential or personal information to cause harm to the council or anyone else
- disclose confidential information discussed during a closed session of a council or committee meeting or any other confidential forum.





You **must not** use council's computer or mobile devices to access, download or communicate any material that is:

- offensive
- obscene
- pornographic
- threatening
- abusive or defamatory
- could lead to civil or criminal liability and/or damage council's reputation.





Code of Conduct Complaints





- The council's code of conduct is the key mechanism for promoting and enforcing ethical and behavioural standards.
- It is important that the council's code of conduct is correctly used and that code of conduct processes are respected and complied with.





To be dealt with under the code of conduct, complaints must:

- be made in writing to the general manager, or if about the general manager, to the mayor
- be made within 3 months
- show conduct that would constitute a breach of the council's code of conduct if proven





Complaints about the following **are not** "code of conduct complaints" and should not be dealt with under the council's code of conduct:

- the standard or level of service provided by the council
- the merits of a decision
- policies or procedures of the council
- conduct in good faith, that would not otherwise constitute a breach of the council's code of conduct.



Code of Conduct Complaints How are complaints about delegates and committee members dealt with?

- The general manager is responsible for dealing with code of conduct complaints about committee members and delegates.
- The general manager may determine to take no action, to resolve the complaint informally or to take disciplinary action.
- Prior to taking disciplinary action, the general manager must comply with certain procedural fairness requirements.





Where proven, code of conduct complaints about delegates and members of committees may result in:

- censure
- requirement for an apology
- prosecution for any breach of the law
- removal or restriction of a delegation
- removal from membership of a committee





You must not:

- make code of conduct complaints for an improper purpose
- take reprisal action for making or dealing with a code of conduct complaint
- disclose any information about a code of conduct complaint
- impede or disrupt the consideration of a code of conduct complaint and comply with any reasonable and lawful requests





Questions?



Griffith City Council

COMMITTEE REPORT

CLAUSE CL02

TITLE Terms of Reference

FROM Joanne Bollen, Governance Officer

TRIM REF 25/27796

SUMMARY

Committee to review the Terms of Reference attached.

RECOMMENDATION

The Committee adopt the Terms of Reference attached to the report.

REPORT

Not Applicable

LINK TO STRATEGIC PLAN

This item links to Council's Strategic Plan item 3.1 Undertake Council activities within a clear framework of strategic planning, policies, procedures and service standards.

ATTACHMENTS

(a) (TOR-028) Landfill FOGO Committee - Terms of Reference J

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LANDFILL / FOGO COMMITTEE

(TOR-028)

1. Establishment and Guidelines:

1.1 The Landfill / FOGO Committee is established under section 355 of the Local Government Act 1993 which states:

A function of Council may, subject to this Chapter, be exercised: (b) By a committee of the council

1.2 The Landfill / FOGO Committee and its members are bound by practices as established in Council policies including:

GC-CP-402 – Council Committees GC-CP-404 – Code of Conduct GC-CP-413 – Code of Meeting Practice COMM -CP-401 - Media Policy COMM-PO-401 - Social Media Policy GOV-CP-316 - Child Safe Policy

Each Committee member will be required to sign an acknowledgment form indicating their acceptance of the above policies which are available on <u>Council's Committee Induction</u> webpage.

2. Authority to Act:

- 2.1 The Landfill / FOGO Committee does not have authority to implement actions in areas over which Council has responsibility. The Committee does not have any management functions and is therefore independent of management.
- 2.2 The Landfill / FOGO Committee has no delegated authority to make decisions, it can only refer or recommend matter to the Council for consideration. The Committee forwards the Minutes of every meeting, including any specific recommendations, to the next practicable Ordinary Meeting of the Council for determination.
- 2.3 The Landfill / FOGO Committee does not have any authority to commit or expend any Council funds that are not contained within an adopted budget or subsequent variation to that budget via resolution of Council.
- 2.4 Any recommendation for expenditure other than within an adopted budget must be endorsed by Council through adoption of Committee minutes at the next practicable Ordinary Meeting of Council and cannot be acted upon until the adoption of Committee Minutes at the next Ordinary Meeting of Council.

3. Purpose & Scope:

The Landfill / FOGO Committee will be established for the purpose of:

- 3.1 Guiding the management of landfill operations, waste disposal and recycling initiatives at Council's Landfill operations including expansion of facilities as required.
- 3.2 Implementation of the Food Organics and Garden Organics (FOGO) including planning and rollout of the FOGO program by 2030.
- 3.3 Rehabilitation of existing cells and construction of new landfill cells.
- 3.4 Relevant documentation includes:

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- Landfill Void Space Model Space Report (report to Committee)
- Griffith City Council FOGO Community Survey Report Survey Report (report to Committee)
- FOGO is GO GO in NSW
- NSW EPA Go FOGO Grants

4. Alignment to Community Strategic Plan

Objective 1.2 Actively engage with and seek direction from our community and stakeholders.

Objective 6.1 Provide, renew and maintain a range of quality infrastructure, assets, services and facilities.

Objective 7.2 Protect and improve biodiversity, biosecurity and sustainability.

Objective 8.1 Investigate and adopt environmentally sustainable practices.

Objective 8.2 Facilitate and promote effective waste management practices.

5. Frequency of Meetings:

5.1 Meetings will be held quarterly at dates and times as determined.

The Committee may also call a special meeting in extraordinary circumstances where a majority of members believes this to be necessary.

5.2 Meetings will normally be held at either the Council Administration Building at 1 Benerembah Street, Griffith, or at another accessible venue.

6. Membership and Quorum:

- 6.1 The membership of the Airport Committee will be:
 - 1 Mayor, Councillor Doug Curran (Chair)
 - 2 Councillor Christine Stead & Councillor Mark Dal Bon
 - 5 Community Representatives as endorsed by Council
- 6.2 Membership shall be appointed by resolution of Council.
- 6.3 The Mayor, by virtue of holding the office of Mayor, is appointed as a member to all Committees established by Council.
- 6.4 Minimum number for quorum will be 3.
- 6.5 Number of voting members will be 8.
- 6.6 A quorum is not required for meetings to take place. However, for a decision to be made at a meeting, a quorum of members must be present. If a quorum is not reached, the meeting can be held for information purposes only and discussion recorded as a Report of the Meeting (in lieu of Minutes of the Meeting).

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Committee Terms of Reference 2024 – 2028 LANDFILL / FOGO COMMITTEE (TOR-028)

7. Voting:

- 7.1 For the vote to be carried, a majority (more than half) of the voting members present is required.
- 7.2 In the event of a tied vote, the Chair will have the casting vote.
- 7.3 The Mayor will have a voting right at any meeting the Mayor attends.
- 7.4 Council staff do not have the authority to move or second motions nor vote on issues.

8. Chairperson:

- 8.1 Councillor appointed Chairperson is **Councillor Doug Curran**.
- 8.2 Duties of the Chairperson:
 - 8.2.1 Ensure preparation of agenda before the meeting.
 - 8.2.2 Chair meetings in accordance with Council's Code of Meeting Practice and agreed Terms of Reference. Ensure agenda items are discussed, decisions are made and recorded, as appropriate.
 - 8.2.3 Approve draft meeting minutes.
 - 8.2.4 Represent the Committee as spokesperson.
 - 8.2.5 Comment to the media on minor matters only. Media contact on larger projects are to be channelled through the Mayor's Office.
 - 8.2.6 The Chairperson may cancel scheduled meetings if there are no scheduled Agenda items for consideration.

9. Directorate and Staff Support

- 9.1 The Responsible Directorate is Utilities.
- 9.2 The Director Utilities will determine staff support to the Committee.
- 9.3 Duties of the Director:
 - Be the nominated contact officer for the Committee.
 - Be the main conduit between the Committee and Council.
 - Be the custodian of information required for the Committee.
 - Coordinate meetings.
 - Provide and or collect reports for inclusion in the Agenda.
 - Approve items for inclusion in Agenda.

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Monitor and follow-up Action Report.

10. Secretary:

- 10.1 Griffith City Council Governance staff will provide a Minute Secretary and administrative support to the Committee for the purpose of preparing Agendas, Minutes and Action Reports.
- 10.2 Duties of the Secretary:
 - Preparation and distribution of agendas.
 - Issuing notices for meetings (Agendas) at least three days prior to the meeting, ensuring all necessary documents requiring discussion or comment are attached to the Agenda.
 - Taking minutes and notes of proceedings and preparing and distributing minutes of the meeting. Minute taking at Meetings may be shared among Governance staff and technical staff attending the meeting depending on staff loads.
 - Update Action Report and distribute to responsible officer for action.

11. Responsibility of Committee Members:

- 11.1 Attend meetings and be punctual.
- 11.2 Send an apology if unable to attend a meeting.
- 11.3 Read business papers in advance and undertake necessary research.
- 11.4 Raise issues and concerns, and report on initiatives and issues which may be relevant to or of interest to other members.
- 11.5 Participate in discussions and decision making.
- 11.6 Follow through actions minuted and subsequently adopted by Council.
- 11.7 It is the responsibility of all Committee members to familiarise themselves with and follow practices as contained in the governing Council policies. Refer to Council policies Section 1.2.
- 11.8 Members must declare any real or perceived conflicts of interest at the start of each meeting or before discussion of a relevant agenda item or topic. Details of any conflicts of interest are to be recorded in the minutes. If members or those invited to Committee meetings find they do have a real or perceived conflict of interest or pecuniary interest they are not allowed to be a part of Committee discussions on the issue. Refer to Council's Code of Conduct for management of conflicts of interest.
- 11.9 Members must only use Council and Committee information for Council purposes and for the purposes for which it was collected. Members are required to maintain the integrity and security of confidential information for which they are responsible.

12. Attendance at Meetings

Attendance at meetings may be by audio visual (such as Zoom).

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13. Other Attendees:

Members of the public/agency representatives who are not Committee members may attend Committee meetings by invitation of the Chairperson or Committee only. Such persons shall not be entitled to vote on any decision arising out of that meeting. It is preferred that if a member of the public/agency representative wish to attend a meeting that they address the Committee in relation to the item and leave the meeting before any vote is taken on the matter.

14. Term of Office:

The term of office for Section 355 committees will be the same term as the current Council, unless established as a sunset committee i.e. with a finite time specified.

15. Reporting Framework:

The Committee will report to Griffith City Council via minutes presented to Ordinary Council Meetings.

16. Media Contact

The Chairperson of a Council Committee is the primary spokesperson on matters that have been discussed by a Committee. Priority should be given to the Chairperson to comment on Council decisions, projects and initiatives associated to the relevant Committee unless the Mayor elects to do so.

Contact with the media should be done in the first instance (where possible) by Media Release. All Chairpersons should notify Council's Communications and Integrated Planning team of any contact with the media that relates to Council matters.

Committee members may not speak to the media on behalf of the Committee or Council without approval in advance from Council's Communications and Integrated Planning team.

When communicating with the media, Council Committee members are not to use or disclose information gained during the ordinary course of business of Council in a way that may:

- (a) cause significant damage or distress to a person;
- (b) damage to the interests of Council or a person; or
- (c) confer an unfair commercial or financial advantage on a person or business when dealing with the media; and
- (d) disclose any confidential information discussed during a confidential session of a council or committee meeting or any other confidential forum (such as, but not limited to, Workshops or briefing sessions).

17. Expenses of Committee Members

Council will not generally authorise payment or provide remuneration to Committee members.

18. Insurance

Committee members are covered by Council's public liability and professional indemnity insurance.

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19. Recording of Meetings

Meetings may be recorded by audio or audio-visual means for administrative and minute taking purposes. No other recording is permitted.

20. Review of Terms of Reference

The Terms of Reference for the Committee will be adopted for the duration of the Council Term. Any amendment to the Terms of Reference as accepted by the Committee shall be forwarded to Council for consideration but cannot be applied until adopted by Council.

Adopted: Council Meeting – 11 March 2025

Minute No: 25/069

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Griffith City Council

COMMITTEE REPORT

CLAUSE CL03

TITLE Proposed Meeting Dates 2025

FROM Joanne Bollen, Governance Officer

TRIM REF 25/27795

SUMMARY

The proposed meeting dates for 2025 are:

- Thursday, 5 June 2025
- Thursday, 4 September 2025
- Thursday 4 December 2025

RECOMMENDATION

The Committee note the proposed meeting dates for 2025.

REPORT

As above.

ATTACHMENTS

Nil

Griffith City Council

COMMITTEE REPORT

CLAUSE CL06

TITLE FOGO Bin Process

FROM Graham Gordon, Director Utilities

TRIM REF 25/61051

SUMMARY

The NSW Parliament has passed legislation to mandate Food Organics Garden Organics (FOGO) collection services for households by July 2030, and for businesses and institutions in stages from July 2026. The EPA is working closely with Communities, Councils and Industry to ensure a smooth and effective transition

Go FOGO grants support NSW Councils to deliver new weekly Food Only (FO) or Food Organics and Garden Organics (FOGO) services to their communities. These may be households that currently have no kerbside organics bin service or households with only a garden waste collection.

Two grant rounds are planned for each year for four years starting in the second half of 2022.

The objectives of the Go FOGO grants are to:

- Support the effective rollout of weekly FOGO (or FO) services to 500,000 households that have no organics service
- Support the effective rollout of weekly FOGO (or FO) services to 1,500,000 households that have a garden only waste service
- Provide additional support to councils with a significant number of multi-unit dwellings (MUDs) to deliver additional tailored communication to these properties.

RECOMMENDATION

(a) The Committee explore the options of providing a FOGO service to the Griffith rate payers.

REPORT

Mandate requirements

- Local Councils will be required to provide all NSW households who receive a residual (red lid) waste collection service with a Food Organics and Garden Organics (FOGO) waste service by 1 July 2030.
- Relevant premises including supermarkets, some institutions and hospitality businesses will be required to have a source-separated food organics (FO) waste collection service in place, starting with the largest generators from 1 July 2026 and staggered to 2030 depending on how much waste they send to landfill each week.
- Large supermarkets will be required to record food donations across six categories, including meat, dairy, fruit and vegetables, frozen food and baked goods.

Why is the Government Introducing FOGO Mandates?

The NSW Government committed to halving organic waste being disposed of in landfill by 2030 under the Waste and Sustainable Materials Strategy 2041.

This commitment is part of the broader Australian Government's net zero commitment.

Greater Sydney is running out of ways to safely manage 'residual' (red bin) waste and is predicted to run out of landfill capacity by 2030 or earlier.

Eligible organisations

All NSW councils are eligible to apply for funding to roll out new weekly FOGO services or FO services to households that do not currently have a service. The service must be active within three years of the grant application approval.

Councils who have previously received funding under the <u>Waste Less Recycle More</u> <u>organics collections grants</u> or Go FOGO are eligible to apply for Go FOGO funding to provide a new weekly FOGO or GO service to households not covered by the previous funding. Councils with more than 10,000 MUDs, or where MUDs account for more than 20% of the housing stock across the local government area, may also apply to receive an additional \$50,000 MUD payment, introduced in 2025.

All NSW Councils that have not already received this funding in Round 1

For eligibility the following criteria must be met.

FOGO service must be for 7 years minimum

FOGO service must be serviced weekly

Includes a kitchen caddy

Community Education plan must be introduced in three stages.

- 1. Pre
- 2. During
- 3. Post

Grant Payment

60% of grant money will be paid on the signing of the grant 30% of grant funding will be provided when:

- Pre-Service Education Begins
- Collection contract comply with the grant eligibility criteria.

10% is paid on approval of final report – including data on outcomes achieved in the initial month of collection.

Grant Amount

\$50 per single unit dwellings (SUD) – Council has 8,824 = \$441,200 (potential grant amount)

\$25 per multi-unit dwellings – Council has 1,377 = \$34,425 (potential grant amount)

What Funding can be used for

- Project investigation /Planning
- Tender development
- Procurement of caddies and bins
- Delivery of education, audits and surveys related to the new weekly FOGO or FO service.

Only full-service rollouts are funded. Projects that only involve pilots are not eligible for funding.

On completion of the project, grantees will be required to report on the percentage of funding spent on:

- Preparation and planning
- Bins, caddies and other infrastructure
- Education
- Monitoring/evaluation
- Other.

Grant Process

The RAMJO Waste Group has made the offer undertake the grant application, also providing assistance with establishing the initial stages of the project.

Assistance can also be provided with the education process.

Regional Experience

Contact was made with Leeton's Waste Manager; and the following recommendations were provided.

- Have a strict Bin Collection Public Policy, which covers contamination etc.
- Invest in resourcing public engagement, possibly another FTE.
- Make sure that the data sets are up to date when and this is communicated to collection contractor.
- Leeton was part of a regional funding grant; their share of the grant was approximately \$200k. This monies went to pay for a RAMJO administration project support and public an education program. It was well worth engaging RAMJO in these roles due to the experience they bring.

The following figures were provided

- For the first three months of this service the Waste to Landfill has reduced by 48%
- Due to the strict Bin Collection policy, there is a contamination percentage of 1.7% (figure provided by Wormtec).

LINK TO STRATEGIC PLAN

This item links to Council's Strategic Plan item 6.1 Provide, renew and maintain a range of quality infrastructure, assets, services and facilities.

ATTACHMENTS

(a)	NSW guide to best practice FOGO $\underline{\mathbb{J}}$	63
(b)	NSW EPA - What's the GO with FOGO 🦺	101

NSW guide to best practice FOGO







The NSW Environment Protection Authority acknowledges the Traditional Custodians of the land on which we live and work, honours the ancestors and the Elders both past and present and extends that respect to all Aboriginal people.

We recognise Aboriginal peoples' spiritual and cultural connection and inherent right to protect the land, waters, skies and natural resources of NSW. This connection goes deep and has since the Dreaming.

We also acknowledge our Aboriginal and Torres Strait Islander employees who are an integral part of our diverse workforce and recognise the knowledge embedded forever in Aboriginal and Torres Strait Islander custodianship of Country and culture.

Introduction

This resource is a step-by-step guide for NSW councils to introduce food organics and garden organics (FOGO) kerbside collection services. It includes an overview of a best practice system and how to implement it from planning to ongoing delivery.

It is part of a broader suite of resources developed by the NSW Environment Protection Authority (EPA) to support NSW councils in the roll out of new food organics (FO) and FOGO services. It brings together local and international research as well as experiences from NSW councils which have introduced FOGO services with grant funding from the NSW Government.

About this guide

This guide is modelled on the South Australian Better Practice Guide: Sustainable Kerbside Services developed by Green Industries SA in collaboration with the Local Government Association of South Australia and the SA Environment Protection Authority. It has been adapted by the NSW EPA and Rawtec in consultation with NSW councils.

The guide's focus is the introduction of new FOGO services where households are transitioning from no service or garden organics (GO) green lid bin services to FOGO. Some content will also be relevant to councils introducing FO services. The NSW guide to food waste recovery in multi-unit dwellings also has guidance on food only collection services.

The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) is developing a comprehensive guide on steps to develop a business case and procure organics recycling infrastructure and systems. It has been developed to complement relevant state or territory FOGO implementation guides and will be made available on the DCCEEW website.

NSW Guide to best practice FOGO

Minister's foreword



Without action, NSW is on track to run out of landfill space by 2030. Recycling organic material – and diverting it from landfill – is the way of the future.

Currently, NSW sends around 1.7 million tonnes of organic material to landfill every year. This takes up valuable landfill space, releases methane gas that drives up our emissions and also adds to our waste burden.

Sending food waste and garden waste to be recycled makes sense whichever way you look at it. We can all do our bit to drive down emissions, reduce waste and create fantastic end products – including, compost, energy production and animal feed to name a few.

The NSW Government has introduced legislation requiring all councils to provide household food waste recycling services from 2030 and for most large food businesses to recycle their food waste from 2026.

The NSW organics recycling industry has grown in recent years and is strong, diverse and poised to expand further as it recognises the opportunity to build capacity to meet the increasing demand for the extra supply.

While the case for FOGO is strong, there are many challenges ahead to establish an economically viable, truly circular system for organics waste in NSW. The elimination of contamination is critical to producing high-quality end products. With household FOGO waste currently making up around two thirds of the organics waste being landfilled in NSW, councils and their residents are at the forefront of the transformation to come. The more successful each new service is, the more successful the transition to a circular economy for organics waste in NSW will be.

The NSW Guide to Best Practice FOGO draws on the experiences of councils across NSW and Australia to support waste professionals and others in local government to roll out effective new FOGO services.

All councils are different, and all communities are unique, with many starting at different points in the journey. This guide sets out the steps, stages and considerations at each part of the FOGO journey, with information and advice that can be tailored to suit unique community needs.

It's just one way the NSW Government is supporting councils transitioning to FOGO. The \$81 million implementation plan includes funding for one-to-one expertise, grants for infrastructure like bins, caddies and other resources, and the Starting Scraps FOGO education program.

The transition to statewide FOGO is the biggest change to household kerbside services in a generation. We know this will be a challenge, but we also know from the many councils that already have FOGO, that communities have welcomed it, contamination can be minimised with good education and the majority of people use services well. And using locally-produced compost for urban greening and sporting fields, gives residents first-hand experience of the circular economy in action.

The economic and environmental case for FOGO is clear. I'm excited to continue working with all of you to drive down emissions, reduce food waste to landfill and achieve our circular economy goals.

The Honorable Penny Sharpe MLC,

Minister for Climate Change, Minister for Energy, Minister for the Environment, Minister for Heritage

NSW Guide to best practice FOGO 3

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Section 1 Why go FOGO?

One of the most significant ways councils can reduce waste to landfill and act on climate change is to divert food and garden waste. Providing FOGO services:



reduces landfill volumes and associated greenhouse gas emissions



recovers nutrients for high value reuse within a circular economy



increases production of compost which improves soil health, increases water retention and boosts crop yields



provides more employment in the circular economy



gives councils an opportunity to receive Australian carbon credit units for source separated organic waste¹



aligns with state, national, and international policies, targets, and obligations.

1 See the Fact sheet for local government 2022-Carbon credit income from FOGO and Carbon credit income from FOGO manual on the NSW EPA's FOGO webpage.

6 Why go FOGO?

NSW Guide to best practice FOGO



Table 1: Relevant state, national, and international policies, targets, and obligations



To meet waste and net zero targets, the NSW Government requires:

- councils to provide food and garden organics collection services to all NSW households from 2030
- large food waste generating businesses to source separate food waste from 2026

Why go FOGO?

NSW Guide to best practice FOGO

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Section 2

Best practice FOGO

There are many things that might influence a council's decision on the best service for them, including community attitudes and expectations, existing service provision, staff capacity and cost. The following information around best practice systems is drawn from NSW, national and international experience to recover the largest amount of food waste at the lowest cost.

The introduction of FOGO is a major change impacting every household in your community and each community is different. EPA research shows people are broadly positive about the introduction of FOGO, but most concerned about the switch of the red lid bin to fortnightly. When considering the information below and strategies to address those concerns, including staging the move to a best practice system, each council will need to consider their own community, needs, costs and objectives to determine the best solution for them.

What is best practice FOGO?

Best practice FOGO services recover the most amount of food waste, have minimal contamination, support a major reduction in waste to landfill and save councils money.

Bin size and collection frequency, when combined with quality education, have the most significant impact on the food recycling rate and overall landfill diversion. Reducing access to landfill disposal options leads to less food waste in the red lid bin, resulting in a higher landfill diversion rate and more in the FOGO bin.

Analysis of performance across all bin configurations used in NSW shows the best system for recovering the most food waste is as below. Councils may choose to phase the move to best practice implementation:

- large weekly FOGO bin
- large fortnightly comingled recycling bin
- smaller fortnightly residual waste bin.



8 Best practice FOGO

All food goes in the FOGO

bin, including meat, fish,

and dairy.

NSW Guide to best practice FOGO

CASE STUDY



In a partnership with the EPA, Hunter Joint Organisation worked with 100% Renewables to develop three FOGO scenarios that councils could aim for to reduce landfill gas emissions. The project used the EPA data from the Rawtec audit analyses and identified the practices needed to achieve each of these diversion efficiency levels.

Figure 1: Three FOGO Scenarios

Scenario (Diversion	efficiency level)	Food %	Garden %	Average % (unweighted)
AVERAGE	Average of entire sample (as reported in EPA kerbside audit report)	41	98	69.5
HIGH	Ambitious mid-point between average and best practice	57	99	78
BEST PRACTICE	Uppermost value in the sample from EPA kerbside audit report	73	100	86.5



Practices required to achieve average diversion scenario (41% Food, 98% Garden, ~70% FOGO diversion)

- Basic community engagement: Implement an initial education campaign focusing on the proper use of FOGO bins.
- Basic collection services: Maintain standard bin sizes and collection frequency. Introduce food waste collection but without additional tools like kitchen caddies or liners.

Practices required for high diversion scenario (57% Food, 99% Garden, ~78% FOGO diversion)

- Sustained community engagement: Ongoing education and basic outreach programs during establishment phase.
- Optimised collection services: Adjust collection frequencies and bin sizes based on waste generation patterns.
- Reduced residual waste collection frequency and/or providing smaller residual waste bins (120/140 litre).

Best practice FOGO

Practices required for best practice scenario (73% Food, 100% Garden, ~86% FOGO diversion)

- Advanced community engagement: Launch and maintain comprehensive and educational campaigns using diverse media.
- Advanced collection services: Tailor collection schedules, bin sizes, and service configurations to maximise both food and garden organics diversion for all dwelling types (including special arrangements for apartments). The service configuration that has the highest food waste diversion potential is small (120/140 litre) residual waste bins collected fortnightly and large (240 litre) FOGO bins collected weekly. Provide kitchen caddies and compostable liners to all households.

NSW Guide to best practice FOGO

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Customised solutions

Offering flexible services on request can lead to greater community acceptance of kerbside service changes. This could include:

- the option to upsize the red lid bin to 240 litres
- offering extra comingled recycling collections over peak periods to help manage higher levels of packaging and containers (e.g. Christmas/new year)
- offer a temporary weekly red bin collection service when there are specific needs like households with lots of disposable nappies or incontinence pads
- user selected services where residents can choose their bin size and/or collection frequency from a small number of options with variable costs.

Giving residents the choice to 'opt in' for a FOGO collection service is not recommended from a performance perspective and behavioural science research.

Opting in requires a decision and the effort to act upon it. Busy people may not opt in, even if they want the service. An 'opt out' system allows those with strong opinions to opt out, while retaining people who appreciate the service or are indifferent about it.

Any change to kerbside services has a large impact on the community and requires significant planning, resources and communication. Introducing weekly FOGO and moving to fortnightly red lid bin collections:

- means residents continue to take up to two bin types to the kerbside for collection not three
- avoids increases in bin lift costs (if currently offering a fortnightly garden waste service)
- delivers long term benefits for higher recovery rates
- links the benefits of food waste recycling with reducing red lid bin waste to landfill
- reduces the need for further changes later.

Some councils have chosen to keep weekly lid bin collections in the initial stages of the new service delivery to ease their community into the transition.



Choosing the right bin size



If you need to replace the red lid bins, the best choice for food waste recovery rates is to use smaller fortnightly bins, with the option to upgrade to larger ones for bigger households or those with nappies.

However, if your larger red lid bins are still functional, the cost benefits of recovering more food in FOGO with a smaller bin may not outweigh the replacement costs, and it may be better to transition to a smaller size over time.

NSW Guide to best practice FOGO
Strategies to address concerns



Rolling back the red lid bin

Households are usually most concerned about a reduced red lid bin service before the service starts and as they experience the change. For most councils, the concern quickly drops once people realise that their food waste is still collected weekly through the FOGO bin and that there is extra space in the red lid bin once food is taken out.



Community education

People's key concern is not having enough space for their red lid bin residual waste. Providing education on using the yellow lid bin before the FOGO service change can help reduce red lid bin volumes while improving recovery of recyclable materials. Offering the option for a larger red lid bin, capacity, supported with face to face and general education on using all three bins well can also help reassure residents about the change.



Flexible service options

Councils may choose to keep the red lid bin service weekly while the new service settles in. This may lead to a smoother initial transition to FOGO. It would need to be balanced against increased bin lift costs, lower performance efficiency and the need for another phase of education to support a future shift to fortnightly collection.



Seasonal impacts

The time of year matters when introducing a best practice system. Autumn and spring give councils the best chance of success as the extra volume of FOGO bins helps residents manage higher volumes of garden organics.

Making a service change over summer is not recommended, as residents are likely to have greater concerns about higher temperatures, odour, flies and other pests. Holiday periods are also a difficult time to capture the attention of residents and communicate service changes to them.



Best practice FOGO

NSW Guide to best practice FOGO

CASE STUDY

Inner West Council's fortnightly red lid garbage experience



fortnightly red bin collections



5[%] chose a weekly red bin







11% received flexible service options



Inner West Council introduced a best practice FOGO service to all residents in October 2023, after an earlier FOGO pilot with 1,000 households in 2016 and food only collections in unit blocks implemented in 2008 and expanded from 2021.

The switch to fortnightly red lid bin collection resulted in media attention and initial pushback from the community. However, the council's flexible service options, proactive education, and responsive customer service team reassured the community.

For residents concerned about fortnightly garbage collections, Inner West Council provided several options to increase garbage bin capacity:

- Larger wheelie bins (120L to 240L)
- Booked ad-hoc garbage collections (via clean-up booking portal)
- Opt-in weekly garbage collections

These additional services were initially offered to residents with extenuating circumstances, such as those with high volumes of incontinence products, medical waste, nappies and/or large households, before being made available to all households.

Additional support was provided to residents unable to access online services; this included council staff booking additional red bin collections, adding properties to opt-in weekly services, or ordering larger wheelie bins on their behalf. This provided essential support to residents who most needed it during the transition.

For all other residents, a larger red lid bin was available (120L to 240L), plus an opt-in additional garbage collection through the online portal. This reduced the number of distressed calls and allowed the customer service team to resolve calls regarding reduced garbage capacity. The additional garbage collections were made available as a temporary tool to support the transition to fortnightly collections.

In the 12 months to October 2024, the council delivered approximately 5,500 garbage bin upsizes, representing 7% (5,500/76,900) of total households in the local government area. Additional domestic waste charge costs were waived by the council for up to two years from the introduction of the service. Similarly, Inner West received approximately 3,300 requests for opt-in weekly garbage collections, representing less than 5% of the total households in the local government area.

The service transition emphasised the perceived garbage capacity concerns. By having support communicated clearly ahead of time, staff quickly resolved concerns, reassured residents about new collection frequencies, and reduced the risk of residents flooding inboxes, call centres, and front counter staff with requests. Despite the availability of upsized red bins and opt-in weekly collections, only 11% (8,800/76,900) of total households requested support. Since the introduction of the service, residents have adjusted to the new configurations and Inner West is proud of their organic diversion and overall contamination rate.

12 Best practice FOGO





Roadmap and timeline

Lead-in time

The amount of lead-in time for a FOGO service rollout depends on procurement needs and will be different for each council. If the introduction of FOGO includes building a new FOGO processing facility, lead-in times will be longer compared to the FOGO being processed using existing infrastructure.

Where a change includes construction of a new FOGO facility, councils need to allow time for identification of a suitable site, planning approvals and development of a procurement strategy. This can add more than three years to your timeline. Contact the EPA for expert advice and support for processing infrastructure procurement.

Collection and processing contracts that are more straightforward should still start at least three years before roll out of the new service. Rollout planning, communication, purchase, storage and delivery of kitchen caddies and liners should start at least 18 months before the start of the new service.

The key steps for communicating and rolling out changes to existing services are illustrated in Figure 2.

Timelines are indicative and councils may need to consider:

- council election cycles (it is preferable to introduce new services early to mid-term)
- budgeting cycles and the potential for EPA grant funding to help with the costs of service rollout and community education
- contract cycles for collection and processing, including possible joint procurement with neighbouring councils
- access to FOGO processing facilities or transfer stations
- completing a pilot before council-wide roll out (add 12+ months if piloting the service)
- the benefits or drawbacks of starting the service at different times of the year
- applying for Australian carbon credit units² before making a final financial commitment for the new FOGO service
- any potential changes that will happen to residual waste and comingled recycling services at the same time as FOGO services – e.g. collection days, bin sizes and frequency, or the expansion of organics collections to extra households.
- 2 The EPA guide and factsheet on carbon credit income from FOGO, available at <u>Guides to FOGO</u>. More information about Australian carbon credit units can also be found on the Clean Energy Regulator website.

14 Roadmap and timeline





Procurement

There are many items that may need to be procured for a FOGO service. The information below provides an outline of some of the considerations a council will need to make once the business case is established and the preferred service model is agreed upon.

Each council's situation will be different. Key procurement considerations are:

- collection contractor
- processing contractor
- kerbside bins, kitchen caddies
- liners (if applicable)
- education (if it will be delivered by a contractor).

Procurement for a collection or processing contract will need to start at least three years before your FOGO start date, while procuring for bins and kitchen caddies should start 18 months before. Given the anticipated demand on services and equipment purchases including collection vehicles, as FOGO services are rolled out across NSW, it is recommended you allow as much time as possible to procure what you need for a successful rollout and operating service.

There are a range of services and resources available to support councils. See Section 10: Extra Resources.

Procuring processing and collection services

Start procurement at least three years before service starts

There are many factors to consider when procuring for FOGO. The procurement strategy will include what will be procured, the approach to market and procurement objectives. It is also important to understand the market to service your council's FOGO tonnes, what infrastructure is available and where it is located.

To determine the amount of time needed to deliver a procurement project, you should consider the following elements:

- Will you be tendering for collection and processing together?
- Will you be using existing processing infrastructure?
- Will you require construction of a new processing facility to accept council FOGO material?
- Will you jointly procure these services?

Before preparing tender and contact documents consider:

- appointing an internal dedicated procurement team or steering committee and set up regular meeting times
- appointing external technical, legal, probity and financial advisors
- undertaking a market sounding before going out to tender.

When preparing the tender and contract documents consider:

- pricing for different kerbside options, including best practice bin configuration to allow you to compare costs of different service models
- pricing to be broken up into price per lift (inclusive of all costs excluding processing/disposal) and a cost per tonne (for processing/disposal cost) for greater cost transparency.

The collection contract should consider:

- collection of data and performance reporting e.g. contamination, bin audits, presentation rates and weighbridge data
- in-truck camera systems for collection vehicles,

including Radio Frequency identification (RFID) readers. To ensure flexibility and to evaluate cost implications, request pricing both with and without the specified technology

- key performance indicators for identifying, managing, and reporting gross bin contamination by households
- options for providing ongoing community education, including council-managed initiatives, partnerships where the council and collection contractor share financial contributions, or having the collection contractor lead delivery.
- options to transition from an initial service model to best practice FOGO during the term of the contract (e.g. after 6-12 months).

The FOGO processing contract should consider:

- processing technologies to support highest value recovery and reuse
- clauses for purchasing back the recycled product for use on parks and playing fields
- process for determining contamination rates and any penalty clauses
- data collection, reporting requirements, and collaboration on community education.

Table 2: Overview of procurement considerations:

Processing	Collections	Equipment and materials	Support services
 Contamination management Procuring back product Processing technologies 	 FOGO frequency Red lid bin collection and disposal Optional extra FOGO and or residual waste services e.g. weekly FOGO in apartment blocks, second residual waste bin for larger families Option for extra collections over holiday seasons 	 Bins (standard and upsize) Starter kits (inc. kitchen caddies, liners, collection calendar, how-to brochure) Letters, flyers, website, and other communications Bin stickers (or hot stamped lids) Compost (i.e. to giveaway to residents at education events) 	 Waste consultancy support Bin audits Market research (e.g. focus groups, community surveys) Communications/ marketing specialist support Customer service support Starter kit delivery Internal procurement from cross-council connections

Procurement

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Operational procurement

Start procurement for rollout needs at least 18 months before service starts

Planning for rollout includes the logistics for purchase, storage, and delivery of kitchen caddies, compostable caddy liners (if applicable), and education materials. Whether buying new bins or re-purposing existing bins, you will need stickers to brand bins to FOGO and incorporate that into your communication plans.

A contamination management plan should be part of the logistical preparation process. Will you want to remove bins if persistent contamination occurs? What will trigger that and how will that be communicated to the collection contractor and the community? Clarity on contamination management at this stage will also provide you with certainty on messaging when it comes to education and communication.

Considerations for bins

What flexible service options do you propose in the rollout and how will that impact on bin procurement needs? Will residents:

- Be offered a larger red lid bin on request?
- Opt into a weekly red lid bin service?

Will these options be available when FOGO services start or after a transition period?

Considerations for kitchen caddies and liners

- determine if replacement kitchen caddies will be supplied on demand or periodically
- specify the size of caddies to be provided: a standard 8L benchtop caddy for houses and a 5L slimline benchtop caddy for apartments

- decide whether to provide introductory rolls of liners or an ongoing supply
- choose between providing rolls of liners or flat packed: flat packs sit better in the caddy for delivery in a starter kit while rolls store better for longevity
- packets of 40 flat pack bags fit better in most letter boxes than packets of 80
- ensure the caddy liners fit the caddies
- plan how the liners will be delivered: in an introductory kit, available from service centres or libraries
- determine how the collection will be monitored
- many processors prefer flat top bags, as knots in singlet bags can take longer to decompose in some composting systems
- establish a method for storing the liners, considering their limited lifespan and the need for stock rotation in both storage and distribution.

Aspects to consider for an ongoing supply include:

- storage, joint procurement, multiyear or one-off supply contracts
- price supplied to residents at a cost, for a small fee, or free
- distribution residents could collect liners from council offices, have them delivered or mailed out, or access them through vending machines
- speciality printing customisation of the kitchen caddies and liners.

Request samples of liners and allow enough time to test compatibility with the caddy, particularly if going ahead with an 8L and 5L option. The majority are green and ensuring consistency of colour will make identifying non-compliant bags much easier.

Check your data

Councils that have rolled out FOGO recommend a thorough check in advance to ensure that property databases are aligned and up to date with the correct information. As a priority:

- confirm the definition of single-unit dwellings (SUDs) and multi-unit dwellings (MUDs) for all properties in your database. Determine if any SUDs are defined as MUDs and vice versa
- consider if special building types such as boarding houses, public housing, community housing and Aboriginal housing are captured in these definitions or if they need to be identified and included separately
- clearly define the service arrangements you are providing to these property types (e.g. SUDs, MUDs, and townhouses), especially if the service arrangements differ
- ensure that all properties have the correct collection calendar information (correct day and frequency for each stream) before considering changes to the collection schedules
- confirm the domestic waste charge matches the attributed containers/bins (e.g. 127 Fountain Street, Oldtown pays for 1 x 120L red bin, 1 x 240L recycling, 1 x 240L green bin).

Procurement assistance

The EPA's FOGO procurement masterclass focuses on procurement considerations specific to FOGO collection and/or processing contracts. You can watch it <u>on the EPA website.</u>

The EPA also provides a joint procurement facilitation service for councils that includes:

- Funded support to help councils access advice and help when exploring and carrying out the joint procurement of waste services. Up to \$500,000 worth of advice and help is available per project.
- A library of training and guidance materials is under development to help council and regional organisation staff develop the skills needed to navigate procurement challenges.

More information is available on the <u>Joint</u> procurement facilitation service webpage.

Caddy liner final checklist

If you decide to supply kitchen caddy liners make sure they:

- are certified as commercially compostable (AS 4736)
- are accepted by your contracted processor
- ✓ fit your chosen kitchen caddy
- are easy to open for your residents
- suit your delivery method e.g. fit in letterbox slots or caddies for delivery
- are stored in a dry, dark place to reduce risk of breaking down too early



Procurement



Stakeholder engagement and community education

Complete planning 12-18 months before the service starts. Implement 4-8 months out.

Early and ongoing stakeholder engagement is essential, for a successful rollout needs significant resourcing. Determine at the planning stage the resources you will need and whether you will deliver the plan in-house or if you require external expertise.

Once your plan is developed and endorsed you can start preparing communication materials early so messaging can be included on kitchen caddies and bin lid stickers, ensuring messaging is consistent and clear for everyone in the community from the start.

To ensure the iconography and key messages are well interpreted by everyone, including those with different levels of English literacy, test draft collateral with your community. Make sure your communications and service changes are inclusive for culturally and linguistically diverse (CALD) communities and people with disability.

FOGO perceptions across NSW CALD groups

The Ethnic Communities Council of NSW studied perceptions across FOGO among 10 diverse communities in Sydney. Key findings include:

- 84% support the FOGO service
- participants understand terms like leftovers and food scraps but are less familiar with terms such as FOGO, landfill, compost, and kitchen caddy
- participants expressed a high likelihood of participating in FOGO, interest in FOGO increases with detailed information about the service and its benefits
- challenges to adoption include language barriers, cost, odour, and pests
- the main motivator for food waste recycling is the promise of quality compost
- there is strong support for providing kitchen caddies and liners
- participants unanimously want culturally sensitive, multilingual communication methods.

See the research summary report here.

Stakeholder engagement and community education

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Education plan

Strong and consistent branding of education to support the new FOGO service is important to ensure residents recognise and recall messages. Multiple channels increase the likelihood of reaching all residents. Research shows positive and upbeat messaging is an effective tool for change.

Considerations for communication:

- know your audience research your community's attitudes, barriers and motivation to use FOGO, including what they need to know to feel positive about the change and how to use the service well
- use multiple formats to reach everyone (letters, social media, TV, radio, public place advertising, council, and collection contractor website) with consistent messages across all channels
- identify any specific cultural groups in the community and identify ways to communicate directly and effectively with them
- proactively communicate the service change, the rationale, and benefits to residents
- have enough staff and resources at rollout to manage communication and education, respond to questions, address resident concerns and collect data on engagement
- allow a long lead-in time for maximum engagement. Avoid significant events and holiday periods
- plan for questions and concerns that will arise before, during and after rollout, including:
 - tips for summer
 - guide to certified compostable kitchen caddy liners
 - alternative kitchen caddies
 - what to do with disposable nappies
 - qualifying and paying for alternate services
 - missed kitchen caddy or FOGO bin deliveries
 - what happens if a bin inspection shows the wrong items in the bin?
 - how do people new to the area learn about FOGO?
 - when will rural or apartment block households get FOGO?



Stakeholder engagement and community education

It's all in the name

Consider the terms you will use in communication and make sure you build awareness of them in the education delivery.

FOGO – food organics and garden organics' is an increasingly common term. However if you use it, you may need to build awareness of what 'FOGO' means, across your community.

Social research shows that the term 'FOGO' is well received by both non-English speaking individuals and the general community. When introduced, the community collectively learns and adopts this new term.



Don't call the kitchen caddy a 'bin', as people may get confused with the FOGO bin and put it out for collection with their other bins.

Don't call the kitchen caddy liners 'bags', as people are more likely to get confused with other types of bags such as plastic bags.

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Starting Scraps education campaign

The EPA's free 'Starting Scraps' education campaign helps councils guide the community through the upcoming changes and how to use the service effectively. It includes six stages of materials.

It was co-designed with council educators and BehaviourWorks Australia to address householders' perceived barriers to transitioning to FOGO and increase awareness, acceptance, and good use of the service.

It includes best practice behavioural change education principles to address barriers and concerns and inspire motivation for change. Even if you prefer to develop your own collateral, it is strongly advised you follow the staged messaging approach as guidance. This will ensure your education materials address all likely concerns and residents learn how to use the new service.

Starting Scraps spans six stages, each including videos, social media tiles, radio ads, flyers, bin stickers and pull up banners.

All of the collateral, a sample communication plan, and the behavioural research studies that informed it are available from <u>scraptogether.com.au</u>

Stages

1	What's FOGO?	Introduces the term FOGO and raises awareness that a new FOGO service is coming
2	Next Season's Soil	Educates the community about how compost made from FOGO helps the environment
З	Your weekly service starts soo n	Increases understanding of how to use the service
4	Your fortnightly red lid bin service	(if relevant)–explains the changes to a fortnightly service to dispel concerns and build confidence in the change
5	Your kitchen caddy	Educates people on what it is and how to use it
6	Your FOGO service is here	Praises the community for adapting to the change, providing an ongoing reminder and celebrating the achievement.

New phases of Scrap Together will continue to be developed in consultation with FOGO councils. At the time of publishing, there are currently two other phases:



Every Scrap Counts -targets behaviours to recover more food waste out of the red lid bin and in to the FOGO bin



How to FOGO – targets behaviours to keep contaminants out of the FOGO bin and in the right bin.



📁 What people think

Research to inform the Starting Scraps collateral showed 86% of residents were interested or very interested in having a FOGO service and 95% were able to identify at least one benefit. But they also have concerns.

The top concern was the red lid bin being switched to fortnightly, followed by:

- not believing that other residents will properly sort food scraps
- concerns about attracting vermin
- odours
- increased cost of the service.

These concerns can be addressed in the education, using positive, upbeat messaging to allay fears and explain how to overcome them.

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Stakeholder engagement and community education



Internal engagement

8-12 months before service starts

Internal engagement is crucial to prepare for the communication and education plan delivery.

Some councils recommend setting up a cross-council steering committee to provide updates and keep key departments informed throughout the FOGO journey. This could include representatives from economic development and planning departments, customer service, waste, sustainability and communication and marketing teams.

Engage early with community-facing council staff, including depot staff, customer service officers. councillors and library staff. It is important these key people understand the new service, the reason for its introduction, how it will work, timelines, key terms and proposed messaging. They will continue to be important ambassadors for the service as the momentum grows, so ensure they are informed and knowledgeable about FOGO in your community.

Publish a webpage with FOGO information that community-facing staff can become familiar with. This webpage can help them answer questions and they can direct residents to it for more information. Your community-facing staff will also be a useful source of information for feedback on community attitudes and knowledge around FOGO, to help compile a list of frequently asked questions.

At this stage, you might also look to identify and engage local community champions who are passionate about food waste, compost and sustainability to support the rollout of FOGO. You may be able to involve community groups who can promote the service to their networks or help to deliver kitchen caddies and brochures when the service starts. These and other community-driven activities can be a great opportunity for one-on-one engagement in trusted networks.

Connect with other key stakeholders including the EPA. councils that have already rolled out FOGO, and Local Government NSW. They might be able to help you in refining your stakeholder and community engagement plan or provide feedback on your communication. The EPA hosts regular Community of Practice sessions for Go FOGO grantees, which is a space for shared learning and networking. All council officers are welcome to join.

Stakeholder engagement and community education



The rollout phase

Education delivery

4-6 months before service starts

Start your public education 4-6 months before service launch, delivering information across multiple channels to reach all households. Enquiries about service changes are likely to be highest within the weeks before and during roll out time. Given the practical and operational logistics of the change–i.e. delivery of caddies, managing the new contract, changes in service days and frequencies -plan for these communication needs well in advance.

An organised communication plan will help everything run more smoothly. It can be very challenging for waste teams to divert resources and manage communication issues while rolling out the service, so where available, council communications staff are key.

A sample education plan is available for download from scraptogether.com.au

Delivery of FOGO starter kits

Complete 2-4 weeks before service starts

National and international research shows kitchen caddies are a critical tool in helping communities adopt new behaviours and use FOGO services well.

The arrival of kitchen caddies is the point where most residents will engage in the new service and take note of information provided. FOGO service starter kits should include:

- a kitchen caddy
- compostable caddy liners (certified to AS 4736 and the correct size for the caddy), and information on where to get replacements, if applicable
- information on the new collection schedule e.g. fridge magnet, calendar, QR code for an app
- FOGO information booklet detailing how the service will work and how to use it.

The timing of the arrival of kitchen caddy and starter kits is critical to success. If people receive them too early, they may start using them before collections start or put them aside and forget about them. Ideally, every home should have a caddy 2–4 weeks before services start, with clear instructions on how to use it, details of service changes and the date for their first kerbside FOGO bin collection. Confirm well in advance with the people who will be delivering the caddies and/or bins that the items you want to put in the kit can be included.

24 The roll out phase

The people delivering the caddy may have strict requirements for how the materials are collated. This may alter what you can put in the caddy, or you may need to plan to find support to collate the items. For example, flat pack bags of introductory liners may be more suitable for a delivery of everything in the caddy, rather than rolls. Also consider using 40 liner packs rather than 75 liner flatpacks for seamless delivery to varying letterbox sizes.

Delivering caddies to every home in large council areas is a logistical challenge. This stage is often the first interaction many residents have with the new service and ideally staff or volunteers who are delivering them need to be informed and able to answer questions from the community. Some councils have used community organisations, like the Men's Shed Association, to help with distribution with good results. Some councils have also delivered the caddies along with new bins with good success.

Leverage all communication channels to promote the delivery of the kitchen caddy, including social media posts and newsletter articles. Make sure all the information people need to know is included in the kit, for those not reached by other methods of communications. Have a plan in place for those who did not receive their kitchen caddy, including who to contact and how it will be delivered or re-delivered.

FOGO service underway

The new service might be rolled out to all homes at the same time or phased-in by area or collection districts, to allow collection contractors to manage the logistics of new service schedules. You may also choose to stagger start dates for houses and apartment blocks, tailoring education and delivery of kitchen caddies and bins to meet different needs.

In the rollout phase, be prepared to respond quickly to community questions and concerns and any logistical issues that may arise in kit deliveries and collections. Most councils find they need to roster on extra staff to manage enquiries.

Council customer service staff remain critical. Keep them in the loop throughout the journey and regularly check-in on what the most common concerns are from householders, then address these with communication staff.

Ongoing

Provide ongoing support to the community, monitor results (e.g. weight of collected material, contamination levels, customer inquiries and complaints), provide feedback to the community on how they are doing and manage any challenges or issues as they arise.



The roll out phase

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Introducing FO or FOGO in apartments

Introducing FOGO to apartment blocks requires tailored solutions and involves different considerations including:

- how to deliver the kitchen caddies and information kits to each unit
- whether the service is a food organics (FO) only or FOGO service
- what size bins and how many of them will be provided
- more transient populations
- potential language barriers
- less ownership and accountability for bins
- greater distances between where the food waste is generated and where the FOGO bins are located
- space limitations for caddies
- less control over bin washing and maintenance
- shared bins that are publicly accessible (i.e. bin corrals out the front of the building that can be contaminated or used by other residents in the street)
- mixed use sites where commercial tenants inappropriately use residential bins for the disposal of commercial waste
- FOGO waste may need to be taken to a basement or car park when it is different to what happens to other waste streams in the building, like disposal through chutes or at floor level facilities.

Generally, there are three types of bin services for apartments:

	small blocks where residents have their own set of kerbside bins
2	small blocks with shared kerbside bins (commonly 2-3 storey walk-up buildings)
3	medium to large, multi-storey blocks with bulk bins and possibly other infrastructure such as chutes and secondary waste management areas.

The guidance in Table 3 is relevant to Types 1 and 2. Type 3 requires different considerations.

26 Introducing FO or FOGO in apartments

Challenges	Solutions
Residents don't want a FOGO service due to lack of bin storage space and/ or they produce only small volumes of organics (type 1)	 Explain the environmental benefits of FOGO recycling, even small amounts Offer a smaller FOGO bin (e.g. 120/140 litres) or a slimline 5L caddy Provide shared FOGO bins where feasible Establish the social norm and that everyone is doing it
Residents share bins and are less incentivised to change their food recycling behaviours (type 2)	 Provide extra support to caretakers/strata management or building champions to educate residents on the value of FOGO waste - reduces odours, reduces emissions and increases recycling Tailor the number of bins and types to suit the waste practices and generation rates in the building. Monitor and adjust as needed Consider weekly collection of both red lid and FOGO bins to encourage participation and lower risk of overflowing red lid bins while the community transitions Install clear bin bay signage to encourage participation Engage building champions Seek pledges or other commitments from residents Show that bins are being monitored and good use of the FOGO bins is rewarded
Language barriers with higher numbers of people from non-English speaking backgrounds	 Use multi-lingual communication materials Work with local community groups to engage with others and distribute messaging Use images and symbols where possible that everyone can understand Tailor communications to the audience³ Integrate FOGO education/messaging into local cultural events
More transient population, which means that communications and/or the starter packs may not be available to new residents	 Work with real estate agents, strata, and property managers to distribute starter kits to new tenants Regularly repeat communication activities Provide signage for bin bay rooms and bins, with QR codes linking to council websites.

Table 3: Potential challenges and solutions for rolling out the FOGO service to apartment blocks

NSW guide to <u>food-waste recovery in multi-unit dwellings</u> also provides in depth information on providing FOGO services in apartment blocks.



3 EPA commissioned research into CALD community perceptions towards food waste is available from the EPA website.

Introducing FO or FOGO in apartments

CASE STUDY



Randwick's apartment block rollout

Randwick City Council, a local government area in Sydney's east, has 62% of residents living in apartments. Council rolled out a weekly FOGO service to apartment block residents in March 2021. At the same time, it changed the fortnightly garden waste service to weekly FOGO for all single unit dwellings and changed their red-lid bin collection frequency from weekly to fortnightly.

Each household was provided with a FOGO introductory kit which included an information brochure, kitchen caddy and set of certified compostable kitchen caddy liners. Randwick City Council used a variety of delivery options to distribute kits. The method chosen was selected based on the size of the apartment block. In smaller blocks, the council distributed kits door-to-door as a community engagement activity, gaining buy-in for the new service. In larger blocks, kits were delivered in bulk to buildings and building managers distributed kits to individual units.

A challenge for the council was space for the FOGO bins, because there is such a wide variety of unit types in the area. Many of the buildings are older and not designed to store three bin types. To overcome this, the council conducted individual site inspections to identify the best bin configuration (i.e. size, number, and location) for each building. These visits also helped to build relationships with building managers, residents and cleaners before the service started.

During site visits, the council also identified signage needed for each building. This included A2 corflute signs for outside bin bay areas, and A4 posters and bin stickers for communal areas. Signs were also placed near garbage chutes to remind residents to take food waste to bin rooms. Randwick City Council worked with building managers to install signs. Signs were coated to help them last longer, as maintaining 'goodlooking signs' helps maintain engagement.

Education materials were developed in six languages reflecting the common languages spoken in the area, allowing communications to be tailored to residents.

Two key lessons were learnt:

- allow 12–18 months for developing, consulting, and testing education materials before rolling out services
- maintain good relationships with building managers to ensure ongoing use of services as they have existing relationships with residents and cleaners that can be leveraged.









Pilots

Should you do a pilot?

You may be able to eliminate the need for a pilot by drawing on the insights and experiences of the many councils in NSW that have already rolled out FOGO. These experiences have been incorporated into this guide, as well as the <u>Guide to Food Waste Recovery in Multiple Unit Dwellings</u> and case studies on the EPA's <u>FOGO page</u>.

The content below outlines the pros and cons of conducting a pilot.

Table 4: Pros and cons of a pilot

Pros of piloting	Cons of piloting
 Builds community support, proving the new service can work in your community Reduces resistance to change by enabling the community to experience FOGO before council commits to a full rollout Provides a platform to test and refine the FOGO service before full rollout, to maximise participation, improve diversion outcomes, drive cost-efficiencies, refine communications approaches, and 'iron out' challenges Identifies champions and collects feedback and data to inform what messaging is needed in the full rollout communications (e.g. testimonials, outcomes) Helps identify and consider the scale of resources needed to support the service transition, e.g. staff to handle community queries. 	 Extra time for service transition (adds another 12-18 months) Extra cost depending on size and scope (the average cost of EPA- supported apartment block pilots was \$550,000) Pilots do not provide a realistic measure of what the participation and diversion rates will be for the entire rollout Expectation of residents that were part of the pilot need to be managed if there is a break before full-service rollout, as they may not like the service being taken away.

30 Pilots



Designing a pilot

Table 5 outlines considerations for designing a pilot. A pilot should reflect the service the council will roll out across the local government area.

	- ·· ··			
Table 5:	Considerations	for pilot	t design a	and delivery

Delivery	Considerations
Purpose	• The purpose of your pilot will affect how you design, measure and report back on its findings. For example, is the pilot to help decide whether to provide certified, compostable liners? Whether or not to offer multiple options for the residual waste bin? Or test whether the communication materials resonate with the local community?
Length	• Pilots should last at least six months, ideally 12, to cover all seasons. This will provide residents enough time to adjust and assess how long it takes to establish new behaviours.
Start date	• Avoid summer and holiday periods. It's challenging to capture the community's attention during these times, and they may be less open to change.
Selecting participants	 Consider piloting across all households or a representative sample within the council area. If piloting a sample of households, limit them to across 1-2 collection areas to make it more cost effective and efficient. Avoid opt-in trials as participants will probably not be a representative sample and the logistics of education and collections will be difficult as these will need to be delivered to specific households rather than everyone in a single street.

Pilots

Delivery	Considerations
Expenditure	 Ensure the budget allows for collection and processing of FOGO material, purchase and distribution of kitchen caddies, development and distribution of multiple forms of educational material before, during and after the pilot, monitoring and evaluation, and staff resources.
	• Monitoring and evaluation are essential to pilots and often expensive. Consider the cost of pre and post surveys, plus the incentives to increase survey response rates and visual or weight-based audits (aggregated or bin by bin) of residual waste and FOGO bins.
Stakeholder engagement	• Pilots need a higher level of community education than a full-service rollout as there is less opportunity for reinforcement of behaviours by other community members, family and friends.
	• You are unlikely to be able to use mass media (radio, television, and newspapers) due to the limited coverage of the pilot area so be creative in ensuring that pilot participants are fully aware of the FOGO service. For example, in-person engagements or geotargeting with social media advertising.
	Collect testimonials from pilot participants to support the full service rollout.
	 Seek reedback from council starr during the pilot. Keen councillors informed of the pilot's progress and outcomes
	 Inform the community about the pilot's progress to build awareness of FOGO and its benefits.
Record keeping	• Keep records on participation rates, complaints, queries, budgets, amount of organics waste collected, contamination, feedback on education materials etc.
Measurement and reporting	 Measure and track weekly bin collections and weighbridge data to track performance over time and observe diversion trends.
	 Undertake kerbside bin audits at the beginning, middle and end of the pilot to get insights on bin compositions, use of kitchen caddy liners, contamination, etc.
	 Do pre and post community surveys to monitor change in attitudes and awareness and to get feedback on any barriers, opportunities for improvement, which communications material worked best etc. to inform the broader rollout.
	• Ensure data lets you evaluate both average performance and performance variation. For example, determine if the average food recovery is due to everyone recycling a little or if it's because half the group recycles a lot.
Ending the pilot	 If transitioning to full rollout of the service, continue the service for the pilot participants until the new service begins. This will avoid disruption.

32 Pilots

CASE STUDY



Bathurst pilot

With the support of a Local Government NSW research and innovation grant, Bathurst Regional Council ran a pilot over four months to test the impact of seven interventions on FOGO service performance.

Variables included reducing the red lid bin from 240 to 140 litres, changing the red lid bin collection frequency from weekly to fortnightly, and repeating the delivery of kitchen caddies and compostable liners. Pre, mid and post pilot surveys, and compositional and visual audits were used to monitor impact on awareness, attitudes, and behaviour. Across seven trial areas, FOGO waste in red bins was reduced for all variables. This averaged a 35% reduction for households with a kitchen caddy, a 42% reduction for households with a 140L bin and a 46% reduction for households that had moved to fortnightly residual collection. An analysis to isolate the effects of each variable found that fortnightly collection was the most significant in reducing FOGO in the red lid bin.

The full report is available on the Local Government LGNSW website.



Pilots



<image>

Figure 3 Bin label

Section 9

Post rollout

To ensure the community continues to use the service well, provide feedback on progress, plan for ongoing monitoring, and maintain engagement and education.

Measuring performance

Tracking performance through activities like kerbside audits allows you to see if adjustments are needed. Metrics include:

- the amount of food and garden organics diverted from landfill through the FOGO service
- food waste generation (kg/household/year)
- food waste recovery rate (% of kerbside food organics in FOGO bins)
- garden organics efficiency (% of kerbside garden organics in FOGO bins)
- bin contamination rate levels (% weight) and common contaminants
- bin presentation rates
- comparisons between different areas in your council area, houses vs apartment blocks etc to identify where extra engagement is needed.

Community feedback surveys may identify areas where the service can be improved or provide testimonials or other statistics (i.e. X% of households use their FOGO bins) which can be used as part of the ongoing education activities.

These metrics provide rich content for ongoing community engagement, including messaging on the environmental benefits, community achievements and championing success stories.

New residents

Consider how new residents will get kitchen caddies, liners (if applicable), and information kits:

- Will new residents need to collect them from council?
- Can real estate agents or strata/building managers distribute them?
- What will happen to the old ones if previous tenants leave them behind? Will you provide replacements if previous tenants take them?

Consider the difference between rental turnover and newly constructed buildings, as this may determine whether residents receive their caddy and liners along with their new kerbside bins.

Set aside time to update the information booklet regularly to keep it current. Broad-scale communication isn't just for educating new residents; it also helps remind current residents about what can go in the FOGO bin.

34 Post roll out

There are multiple new behaviours you want new residents to adopt

New residents might come from places where only garden waste is collected. They might not realise that households in your area put both food and garden waste in the green lid bin. They may not have a kitchen caddy, know what FOGO means, or understand its benefits. It's important to educate newcomers to fill this gap in knowledge:

- sorting food scraps in the kitchen
- emptying the kitchen caddy into the FOGO bin
- putting the FOGO bin out for weekly collection.

Ongoing education

Regular education is important to maximise performance efficiency while keeping contamination at a minimum.

Some key considerations include:

- reviewing communications delivered during the service launch phase to identify which channels and messages worked best in your community
- working with local community groups or champions to help spread the message
- working with collection contractors and processors to tailor education campaigns to address local issues
- linking key milestones to education, e.g. service launch anniversary or collecting X tonnes of FOGO or making X tonnes of compost
- developing targeted campaigns or materials for specific issues
- considering the use of testimonials from farmers or sports field managers who use the FOGO product.

It is important to adequately staff and fund ongoing education. Regular reviews of channels, messages and their effectiveness will help achieve value for money. Building yearly education into your FOGO collection contract price helps ensure funds are available each year specifically for FOGO education.

After FOGO is well established and your residents are practicing good food waste recycling behaviours, consider increasing education on avoiding food waste.

Managing contamination

A contamination management plan needs to be part of the logistical preparation process. Will you want to remove bins if persistent contamination occurs? What will trigger that and how will that be communicated to the collection contractor and the community? This process will also provide you with certainty on messaging when it comes to education and communication Ongoing education is vital to keep FOGO bin contamination low. Multiple research studies have shown most people use services well and contamination is caused by a small number of households (Fight Food Waste et al, 2022).

The EPA's 2023 <u>Analysis of NSW Food and Garden Bin</u> <u>Audit Data</u> shows an average 2.2% contamination in FOGO by weight, ranging from 0.04% to 17.83%. The binby-bin analysis shows that a large proportion of bins have no contamination (49% to 92%).

The top five contaminants by weight were plastic, all other organics (leather, rubber, and oils), containerised food, other miscellaneous (bagged materials, household goods) and metals.

The EPA's <u>Scrap Together FOGO education program</u> targets contamination reduction behaviours. Councils can also use feedback loops to identify and notify households of contamination, for example:

- bin tags showing what can/can't go into FOGO bins
- letters to residents with photos of the contamination in their bins (provided by the collection contractor's in-vehicle cameras)
- home visits to discuss the importance of only putting food scraps and garden waste in the FOGO bin
- offering bin locks (if neighbours are contaminating bins)
- changing the location of bins in apartment blocks to reduce bin misuse.

BehaviourWorks Australia recommends providing constructive feedback on bin contamination privately, via letterboxes. This prevents shaming residents, maintains positive relationships with the council and avoids creating a social norm around contamination by making it seem common.

Where households continue to contaminate their bins, you can consider removing the FOGO service to prevent them from affecting the quality of the entire loads.

In NSW, only food organics (FO), garden organics (GO) and certified compostable caddy liners are allowed into the FOGO bin.

These requirements are published on the EPA <u>website</u> and follow findings from the <u>What's the Go with FOGO</u> study that showed low levels of PFAS and other contaminants in the compost made from FOGO materials.

Minimising FOGO inputs to only food organics and garden organics minimises the risk of contamination. Further information is available on the <u>FOGO Information</u> for Households webpage.

Post roll out



Extra resources

The EPA has a wide range of resources on its <u>FOGO Education webpage</u> to support councils with all stages of FOGO including:

FOGO Masterclass series	Six online masterclasses featuring Australian and international speakers covering planning, contracts and procurement, education, rollout, processing technologies and end uses. Each class has show-notes and resources.
Case studies	Ten case studies showing the process each council used to rollout new organics waste services, from GO to FOGO, to new services in apartment blocks.
Analyses of NSW Green Lid Bin Audit Data	Independent review and analysis of every green lid bin audit done in NSW. They show performance efficiency, contamination levels, performance against bin configuration, and the length of time the service has been in place.
NSW guide to food waste recovery in multi-unit dwellings	Information on infrastructure, education, and engagement specifically tailored to apartment blocks. It also includes links to national and international case studies and resources.
Research on FOGO	Includes EPA's 'What's the Go with FOGO?' study that looked at the characteristics of GO and FOGO composts and research into compostable plastics in FOGO.
Emissions of food waste recovery technologies fact sheets	Describes and compares the greenhouse gas emission profiles of six different food waste processing options.
Carbon credit income from FOGO manual and factsheet	Takes councils through the process of applying for Australian Carbon Credits from the Clean Energy Regulator's Emissions Reduction Fund scheme.

Local Government Procurement supports member councils procuring goods and services. It includes bulk purchasing price negotiation and advice on probity, governance, auditing, and legislation compliance. For more information email <u>info@lgp.org.au</u>.

The EPA has developed a model waste and recycling contract for councils to streamline the tendering process. It includes information on the conditions of tendering, advertising as well as the formal instrument of the contract. Section D Part 4 contains the organics specification. The tool is accompanied by a user guide and timeline tool.

Councils are often happy to share their experiences with others. Bega Valley Shire Council has developed a suite of resources following its Ready Set FOGO campaign including FAQs, kitchen caddy hot stamp, social media posts and FOGOmentary, which can be found on its <u>website</u>.

The Western Sydney Regional Organisation of Councils (WSROC) guide to the procurement of kitchen caddies and certified compostable liners. Available here.

Other WSROC resources on FOGO are available here.

Scrap Together FOGO education resources: www.scraptogether.com.au

For further assistance, contact the EPA Organics Unit at <u>organics.recycling@epa.nsw.gov.au</u>, or call 131 555



Extra resources

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Environment Protection Authority

What's the GO with FOGO?

Study of food and garden composts and other recovered organics in NSW



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The global shift to a circular economy is putting the spotlight on recovering food waste. In the Waste and Sustainable Materials Strategy 2041 the NSW Government has affirmed its commitment to divert organics from landfill by mandating food and garden organics collection for all NSW households and select businesses by 2030.

This study examined composts derived from food organics and garden organics (FOGO) and garden organics (GO) across NSW as well as some dehydrated food waste outputs. The aim was to provide an evidence base to inform any management considerations that may be needed to ensure the sustainable processing and supply of recovered organics in NSW.

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Executive summary

The NSW Government has been supporting the better use and recovery of organics in NSW since 2013 through a range of funding and investment initiatives. The *NSW Waste and Sustainable Materials Strategy 2041* (the strategy) was released in July 2021 to further guide this transition with targets for achieving a reduction in waste and emissions, reducing harm to our environment, and boosting innovation to help drive the economy.

The strategy also contributes to the *NSW Net Zero Plan Stage 1: 2020–2030* commitment for net zero emissions from organics waste in landfill by 2030. In addition, it aligns with the aims of the National Food Waste Strategy, which provides a framework to support collective action towards halving Australia's food waste by 2030.

The NSW Environment Protection Authority (EPA) conducted a study, known as *What's the GO with FOGO*? (the study), of recovered organics across NSW, particularly composts generated from **food organics and garden organics** (FOGO) and **garden organics** (GO). A preliminary study was conducted on composts from 10 FOGO facilities during 2019, and extended in 2020–21 to 13 FOGO facilities, five GO composting facilities and outputs from three on-site rapid dehydration food waste units (ORDUs). The study was undertaken in collaboration with the NSW Department of Planning and Environment's (DPE) Contaminants and Risk Team (DPE–C&R) and Chemical Forensics Team.

The study looked closely at the characteristics of several source-separated recovered organic materials with more than 260 parameters analysed. This is a much more extensive examination than 'normal' testing conducted nationally or internationally.

The purposes of the study were to:

- examine the physical, chemical and microbiological composition of FOGO and GO compost to ensure that the regulatory standards are appropriate and support safe and beneficial re-use of organic materials in NSW
- provide sound evidence for any management considerations that may be needed for the continued support and funding for source-separated FOGO collection and the sustainable recovery of organic materials in NSW.

Key findings

While most of the recovered organics met their current regulatory requirements in NSW, a number of chemical contaminants were detected in the composts that are not currently regulated. These have been traced back to seemingly innocent 'scope creep' in the materials that have been accepted as inputs in kerbside collections.

Microbiological findings included the frequent detection of viruses and human intestinal worm eggs. The source of these pathogens remains unknown at present, but ensuring pasteurisation is achieved consistently may require closer attention.

Precautionary measures have already been implemented to reduce the potential sources of chemicals and pathogens being disposed of in kerbside FOGO or food organics (FO) only bins. One measure has been an EPA position statement, *FOGO information for households*, on what can and cannot be placed into FOGO bins: this was released in July 2022. The pathogen risks identified by *What's the GO with FOGO*? can be reduced with good hygiene practices.

What's the GO with FOGO? | 1
Chemical and other attributes identified in the study

Nutrients

Food waste is generally high in nutrients such as nitrogen, potassium and phosphorous that are essential for healthy plant growth. The plant nutrient nitrogen was higher in FOGO than GO compost. This was expected as kitchen and food wastes have a higher concentration of nitrogen than garden waste. ORDU outputs had the highest nitrogen concentrations but also the highest salt content, which limits their application conditions.

Salts

All the recovered organics sampled were moderately to extremely saline, which will increase salts in the soils to which they are applied and may limit plant growth. The source of salt in the samples is predominantly food waste, as demonstrated by the increasing sodium and electrical conductivity (EC) from GO to FOGO to ORDU outputs. Salinity must be considered to guide appropriate use of recovered organics.

Metals

Metals were commonly detected in all FOGO, GO composts and ORDU outputs. The concentrations detected were generally below the upper limits recommended under the voluntary Australian industry standard for composts, soil conditioners and mulches (AS 4454) and the British Standards Institution's Publicly Available Specification 100 for compost (PAS 100).

Pesticides

From a suite of 93 pesticides tested, none were detected in ORDUs and six were detected infrequently in FOGO and GO composts. These were the organochloride pesticides (OCPs) chlordane, dieldrin and DDT, and the herbicides glyphosate, 2-methyl-4-chlorophenoxyacetic acid (MCPA) and clopyralid. Some of the OCPs were above the industry Australian Standard AS4454 for composts, soil conditioners and mulches. Further work is needed to determine if these are sporadic findings.

Phthalates and phenols

The only phthalate detected was diethylhexyl phthalate (DEHP) and it was detected in FOGO, GO composts and ORDU outputs. Review of the literature indicates that the presence of DEHP at the concentrations detected is unlikely to be of concern.

For the phenol group of chemicals, phenol, m-cresol and p-cresol were detected in FOGO composts only. There is limited terrestrial ecotoxicity data for phenols; however, they have low persistence and degrade readily in aerobic soils, which means they are likely to pose low long-term risks.

PFAS and PBDE chemicals

Per- and polyfluoroalkyl substances (PFAS) and polybrominated diphenyl ethers (PBDEs) were identified in both FOGO and GO composts. PFAS was not detected in the ORDU samples but PBDEs were detected very close to the limit of detection.

A human health risk assessment was conducted for PFAS and PBDEs by DPE–C&R, which identified potential risks to human health for some exposure pathways relevant to FOGO and GO compost use.

Potential risks identified with PFAS and PBDEs in both FOGO and GO compost were related to the consumption of milk and meat from a person's own property where compost is surface-applied to land without incorporation.

Risks from the consumption of homegrown fruit and vegetables grown in surface-applied compost, without incorporation, were low and acceptable for the assumption that a person's fruit and vegetable consumption from homegrown produce is 10%. Exposures may be higher where there is greater consumption of home produce grown in soils where compost has been surface-applied without incorporation.

Some manufactured chemicals, such as PFAS and PBDEs, are likely to be introduced from sources placed into GO or FOGO collections. These sources may include fibre-based food contact materials that consumers have been innocently encouraged to view as suitable inputs for FOGO bins. To ensure risks are managed and reduced, precautionary measures have already been implemented. The EPA released a position statement on FOGO inputs in July 2022 which clarifies what can and cannot go into FOGO bins.

While potential risks have been identified in composts sampled in the study, a food survey led by Food Standards Australia New Zealand (FSANZ) in 2021 confirmed the safety of the general Australian food supply with regards to PFAS levels.¹ Another study by FSANZ, published in 2007, concluded that the Australian public health risk arising from dietary exposure to PBDEs in food is unlikely to be of public health and safety significance.² The precautionary measures proposed by the EPA in this report aim to reduce contaminants at various stages along the pathway from FOGO collection through processing to end use as soil amendments.

Chemicals not detected in any sample

The chemicals that were not detected in any sample were:

- organophospate pesticides (OPPs)
- glufosinate (herbicide)
- multi-residue pesticides (mix of 38 herbicides, insecticides and fungicides)
- polycyclic aromatic hydrocarbons (PAHs)
- bisphenol A
- triclosan.

Physical contaminants

All facilities except one FOGO and one GO facility complied with the physical contaminant limits in the Compost Order 2016. Those that failed did so for the absolute maximum concentration for plastics: light, flexible or film > 5 mm.

There is currently little information about microplastics in recovered resources that have plastic as known inputs. Precautionary measures have already been implemented to reduce the potential sources of physical contaminants disposed of into kerbside FOGO or food organics (FO) bins with the release of the EPA position statement on FOGO inputs.

Pathogens

Pathogens including adenovirus, *Ascaris* and *Taenia* ova (intestinal parasitic worms affecting humans) and spore-forming bacteria (*Clostridium perfringens* and *Bacillus cereus*) were identified in both FOGO and GO composts. *Taenia* ova and *Bacillus cereus* were detected in the ORDU

² FSANZ 2007, Polybrominated diphenyl ethers (PBDE) in Food in Australia, Study of concentrations in foods in Australia including dietary exposure assessment and risk characterisation,

¹ FSANZ 2021, 27th Australian Total Diet Study (ATDS),

https://www.foodstandards.gov.au/publications/Documents/27th%20ATDS%20report.pdf

 $https://www.foodstandards.gov.au/science/surveillance/documents/PBDE_Report_Dec_07.pdf$

samples. The bacteria *Salmonella* spp., *Campylobacter* spp. and *Legionella* spp. and the viruses reovirus and norovirus were not detected in any sample.

As there are no guideline limits for some of these pathogens, a quantitative microbial risk assessment (QMRA) was conducted for adenovirus and *Ascaris*. QMRA modelling developed by the DPE–C&R team is considered a novel approach internationally.

The QMRA identified potentially unacceptable risks associated with adenovirus for all exposure scenarios involving surface application and soil-incorporated FOGO and GO composts. The potentially unacceptable risks with *Ascaris* ova in domestic scenarios were associated with handling FOGO and GO composts when potting plants and consuming unwashed homegrown vegetables. In the agricultural scenarios risks were associated with farmworkers handling FOGO composts. The risk associated with *Ascaris* ova is marginal to minor compared to that posed by adenovirus. The risks identified can be reduced with good hygiene practice – for example, wearing a mask and gloves, and washing hands.

Recommended measures to support sustainable composting in NSW

The learnings from the study indicate that certain measures can ensure that compost derived from FOGO and GO is of high quality and safe for humans and the environment.

Better control on inputs and initial processing is needed to reduce the likely sources of contaminants

This can be achieved by:

- ensuring that physical contaminants such as plastics, glass, metals and paper-based food contact materials are kept out of food and garden waste bins. The EPA's position statement released in July 2022 says that only food and garden waste should be placed in the FOGO bins, the only exceptions being fibre or compostable-plastic kitchen caddy liners
- 2. ensuring that any physical contaminants are removed before composting begins.

Improved process monitoring and record keeping are needed to manage pathogens

Better record keeping and monitoring of processing practices is needed to determine why pathogens have been detected in composts and how to remove or reduce them.

It can also help establish whether compost is being consistently pasteurised to inactivate pathogens and/or whether pathogens are being added at a later stage of the composting process.

Anyone handling compost should be encouraged to follow good hygiene practices, to minimise risks from pathogens.

Amendments to current monitoring requirements for final composts may be required

The EPA will further consider whether pathogens and key chemicals need to be monitored.

Introduction

The NSW Government is committed to net zero emissions of organics waste in landfill by 2030, halving organics waste to landfill by 2030 and recovering 80% of all waste by 2030.

Methane production from food, garden and textile waste accounts for 3.1 million tonnes of carbon dioxide equivalent (CO_2 -e) generated each year from landfills in NSW, accounting for 56% of the total waste emissions from landfill. Collected at the kerbside and processed into compost or used to generate energy, food and garden waste is a valuable resource. Composted organics reduce emissions and return carbon to soils.

Since 2013 the NSW Environment Protection Authority (EPA) has been supporting organics recovery through the \$105.5 million Waste Less Recycle More (WLRM) Organics Infrastructure Fund. This program has resulted in 70% of NSW households with a general waste red-lid bin now having access to an organics collection service (up from 56% in 2010–11), and an additional organics processing capacity of 800,000 tonnes a year.

The NSW Government has allocated an additional \$69 million to 2027 to deliver on the commitments under the Net Zero Plan Stage 1 and the *NSW Waste and Sustainable Material Strategy 2041*. These commitments include requirements for all households and certain large businesses that generate the highest volumes of food waste to source-separate organic waste for processing by 2030 and 2025 respectively. The source-separation requirements will divert up to 800,000 tonnes more organics waste from landfill per year by 2030, significantly increasing **food organics and garden organics** (FOGO) volumes.

This report presents the findings of an EPA study, *What's the GO with FOGO*?, of composts generated from FOGO, **garden organics** (GO) and outputs from **on-site rapid food waste dehydration units** (ORDUs) across NSW. The purpose of the study was to examine the physical, chemical and microbiological composition of these composts and other recovered organic wastes, to ensure that the regulatory standards are appropriate and support safe and sustainable resource recovery in NSW.

The study provides the evidence base to support a food-waste recovery pathway that is sustainable and which will deliver economic, employment and environmental benefits for NSW communities. This will be a circular-economy outcome for organics.

1. Scope of the study

The study focused on recovered organics, particularly composts generated from FOGO and GO, across NSW. It was done in collaboration with the Contaminants and Risk Team and the Chemical Forensics Team in the NSW Department of Planning and Environment (DPE).

The study's purpose was to examine the characteristics of composts and other recovered organics produced from source-separated food and garden wastes. This in turn was to generate a sound base of evidence for any management considerations that may be needed for the expansion of FOGO collections across NSW under the mandated targets of the *NSW Waste and Sustainable Materials Strategy 2041* (WaSM).

Under the EPA's Compost Order 2016, compost must be tested for three microbial organisms (*Salmonella, Escherichia coli* and thermotolerant (faecal) coliforms) and physical contaminants (light and rigid plastics, metal and glass). Little information has been available on many chemical and microbiological characteristics of compost produced in NSW. To address this knowledge gap, compost samples were analysed for approximately 260 attributes including chemicals, physical contaminants and microbiological pathogens that are relevant to human health. The range of attributes tested are in the study's data (a separate document, available on the EPA website).

1.1. Selected sites to represent facilities in NSW

The study assessed compost from a range of geographic locations and process types. In 2019, the EPA conducted a preliminary study by sampling FOGO composts from 10 facilities receiving food and garden organics waste from metropolitan, regional and rural areas of NSW. In 2020–21 the study was expanded to a total of 18 composting facilities processing GO and FOGO across NSW (including nine of the 2019 facilities). This represents approximately 26% of EPA licensed facilities in NSW that compost either GO or FOGO wastes. Facilities composting biosolids (or taking any waste other than FOGO or GO) and anaerobic digestates were excluded from the study.³ On-site rapidly dehydrated food-waste units (ORDUs) were added to provide further data for food-only wastes. The sites selected are shown in Figure 1 and comprise:

- 13 FOGO composting facilities process food and garden organic waste
- · 5 GO composting facilities process garden waste only and do not accept food waste
- 3 ORDUs these produce, not a compost, but a dehydrated food waste generated from cafes and similar businesses.⁴

A range of processing technologies was represented in the study. The study included FOGO compost generated using a mobile aerated floor (MAF) as part of an open windrow process; tunnel composting followed by windrow processing; and conventional windrow composting (with minor site-specific variations such as the use of covers and/or microbiological cultures). The GO compost was generated using MAF followed by conventional windrows; static aerated windrows with covers; and conventional windrows. The EPA also tested outputs from two types of ORDUs. ORDUs dehydrate food wastes by mechanical mixing and heating of food wastes for periods of up to 24 hours.

³ Anaerobic digesters processing FOGO waste were not available for sampling at the time of this study.

⁴ Composts are produced through managed biological transformations as defined in the Compost Order 2016.



Figure 1 The 2020–21 samples in the study were taken from a range of recovered organics facilities from metropolitan, regional and rural areas of NSW.

1.2. Sampling

Three independent replicate samples were collected from each facility in 2020–21 and two in 2019 for analysis of chemical and physical contaminants.

- Each replicate was a composite of five discrete (grab) samples.
- The only exceptions to this sampling design were due to errors on the sampling days, where only one independent composite sample was collected. The exceptions were:
 - $_{\odot}$ $\,$ one FOGO and one GO facility during the 2020–21 round
 - o one FOGO facility during the 2019 round.

Discrete (grab) samples were taken for microbiological analysis (bacteria, viruses and helminths) for both rounds of sampling in 2019 and 2020–21.

- In the 2020–21 sampling round, three discrete samples were taken randomly across the FOGO and GO compost piles with one taken at 30 cm depth and two at 60 cm depths.
- The only exception to this sampling design was at one GO facility where only two samples were taken for virus and helminth testing and three samples were taken for testing of bacteria. These exceptions were due to errors at the time of sampling.
- For the 2019 round, discrete samples were taken for microbiological analysis at both surface (30 cm below surface) and at depth (60 cm below surface). Sample numbers collected were:
 - o between two and four for virus and helminth analysis from all 10 facilities sampled

between two and four for bacterial analyses from six of the 10 facilities sampled.⁵

Samples for bacterial analysis were delivered to the laboratories within 24 hours of collection. Samples for virus, helminth, chemical and physical contaminants analyses were kept refrigerated and delivered within a few days of collection.

Questionnaires were done at the time of sample collection and included information on the sources of inputs, contaminants observed by facilities, type of processing and time frame required to produce final product, monitoring and testing conducted by the facility.

1.3. Wide range of attributes

A total of 266 chemical, microbiological and physical parameters were analysed for the groupings in Table 1. Two laboratories were engaged for the analysis of the chemical and physical attributes and two laboratories for the microbiological attributes. The full list of attributes analysed is provided in the study's data (a separate document, available on the EPA website). Each attribute group is discussed separately in this report.

Table I General grouping of attributes analysed for all samples conected in this stud	Table 1	General grouping of attributes analysed for all samples collected in this study
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Chemicals	Microorganisms	Physical contaminants
 Metals Pesticides (incl. OCPs, OPPs and herbicides) Per- and polyfluoroalkyl substances (PFAS) Polybrominated diphenyl ethers (PBDEs) Petroleum hydrocarbons (incl. PAHs and phenols) 	BacteriaHelminthsViruses	GlassMetalRigid plasticsFlexible plastics
Di thata ta ta		

- Phthalates
- Salts, pH and electrical conductivity (EC)
- Nutrients

⁵ Four of the 10 sites sampled during 2019 were omitted for bacteriological testing because samples could not be delivered to laboratories within the 24-hour sample holding times.

2. Chemical findings

The findings for each chemical group are reported separately in this section.

2.1. Nutrients

Sources of plant nutrients

Nitrogen, potassium and phosphorous are essential nutrients that plants need for healthy growth, and these are made available through microbiological breakdown of organic materials such as food and garden waste. These nutrients are also available to plants by adding inorganic fertilisers.

Study findings

Figure 2 provides a visual comparison for the range of concentrations found for the nutrients nitrogen, potassium and phosphorus in FOGO, GO and ORDU samples collected in the study. ORDUs had the highest concentrations of nitrogen followed by FOGO then GO. This is not surprising as kitchen and food wastes have higher concentrations of nitrogen than garden waste. ORDUs also had the highest salinity (see Section 2.2).

As expected, all of these amendments are a source of nitrogen, with increasing quantities of food waste inputs contributing to increased nitrogen in the output. Plants use nitrogen in the form of nitrate and ammonium. Nitrogen in compost is not immediately available and needs to mineralise before plants can access it. Mineralisation rates of approximately 15–20% are generally expected for composts in the first year after application.









2.2. Salts

Sources and significance of salinity and sodicity

Salinity is defined as the amount of soluble salts in soil or water, or in this case recovered organics. Where there is too much soluble salt, plant growth is affected. Where the cation composition in soil is dominated by sodium (known as sodicity), soil degradation can occur. All soil contains sodium, but it should be in proportion to other soil cations, including calcium, magnesium and potassium.

Sodium chloride can have severe adverse effects on soil by (a) raising the electrical conductivity (EC) and (b) changing the physical condition of the soil. Raising the EC leads to an increase in the osmotic potential of soil water, which can result in plants being unable to access soil water. The physical condition of the soil can also be affected by sodium, which can exchange with other cations (e.g. calcium, magnesium and potassium) on clay particles, leading to a greater propensity for soil dispersion. This in turn leads to soil structural degradation and a decrease in infiltration rate, hydraulic conductivity and air-filled porosity. The organic amendments (GO, FOGO, ORDU) do not contain clay and so the risk of physical problems such as clay dispersion is unlikely if they are used as a growing medium. Even when applied to land the application rates assumed for composts (25 tonnes/hectare) are low enough that dispersion is unlikely to be an issue. However, there are likely to be adverse effects on plant growth before soil structural decline becomes a problem. There is also a relationship between EC and sodium such that sodic soil with a high EC will stay flocculated (clumped).

Food waste contains salts, including sodium chloride from table salt. Food waste as an input to composting or other recovered wastes will increase the salinity and sodium concentration in the final recovered organic destined for land application. It is therefore important to consider salinity and sodium to guide appropriate use of recovered organics.

Findings

Table 2 summarises the results for the major cations (sodium, calcium, magnesium and potassium), electrical conductivity and pH of the FOGO, GO and ORDUs sampled. Figure 3 provides a visual comparison of sodium, electrical conductivity and pH between the FOGO, GO and ORDU outputs.

In the study, both the total cation concentration (TCC) and EC measurements have many extreme values, and show that all three amendments are too saline for crop growth. In soil, TCC values above 7 mmol (+)/L (i.e. millimoles of positive charge per litre) indicate saline conditions. All but one facility had TCCs above 7 (ranging from 14.7 to 121.6).

Interpretation of soil EC is dependent on clay content. Critical threshold values for EC (1:5) range from <0.07 to 1.87 dS/m, dependent on clay. This has limited relevance here because this is a non-soil matrix, however it is a guide to plant response to salts. The EC 1:5 values range from 6 to 9 dS/m for ORDUS, 1.1-5 dS/m for FOGO and 0.23-2.1 dS/m for GO. Using conversion factors to express EC1:5 as ECe and comparing the data to other critical thresholds for plant growth indicates that all samples except one will cause some limitation to plant growth with many in the extremely saline range.

The pH of ORDU outputs was acidic ranging from 4.4 to 5.1 with an average of 4.8. GO composts tended toward neutral pH with a range from 5.7 to 7.6 and an average of 6.7. The pH of FOGO composts ranged from 6.4 to 8.8 and averaged above neutral at 7.5 to 7.9 in the two sampling rounds.

All FOGO, GO and ORDU samples analysed in the study were moderately to extremely saline, which could increase salts in the soils to which they are applied and limit plant growth. The increasing sodium and electrical conductivity (EC) in samples from GO to FOGO to ORDUs supports the premise that food waste is predominately the source of sodium and salinity. The salinity of the GO, FOGO and ORDU samples analysed was at a level detrimental to plant growth. Therefore, the material could not be used as a growing medium alone but rather as a soil amendment. The negative effects of high salt content need to be balanced against other beneficial properties of the recovered material to ensure the benefits outweigh the risks.

Table 2 Range of salt concentrations, electrical conductivity and pH found in the study

Salt concentrations are not available for the 2019 FOGO sampling event. Note that the concentrations of salts are based on an acid digest and are larger than the soluble fraction.

Chemical or parameter	Dataset	No. of samples	Minimum	Median ¹	Maximum	Average ¹
Calcium	FOGO (2020–21)	37	10,700	22,000	44,800	23,100
(mg/kg)	GO (2020–21)	13	5490	13,100	18,900	12,300
	ORDU (2020–21)	7	1620	10,400	25,700	11,500
Magnesium	FOGO (2020–21)	37	2580	4400	8730	4630
(mg/kg)	GO (2020–21)	13	1130	2020	3840	2440
	ORDU (2020–21)	7	980	1200	1310	1210
Potassium	FOGO (2020–21)	37	4800	9780	23,400	9660
(mg/kg)	GO (2020–21)	13	1330	5130	6210	4560
	ORDU (2020–21)	7	7700	8270	11,700	8690
Sodium	FOGO (2020–21)	37	520	1790	3880	1870
(mg/kg)	GO (2020–21)	13	240	1260	1730	1140
	ORDU (2020–21)	7	4370	4400	8100	5010
Electrical	FOGO (2019)	17	1.1	3.1	5.5	3.3
Conductivity	FOGO (2020–21)	37	1.0	2.9	5.6	2.8
(dS/m)	GO (2020–21)	13	0.23	1.3	2.5	1.3
	ORDU (2020–21)	7	5.7	7.6	9.3	7.2
рН	FOGO (2019)	17	6.6	8.0	8.7	7.9
(pH units)	FOGO (2020–21)	37	6.4	7.3	8.8	7.5
	GO (2020–21)	13	5.7	6.6	7.6	6.7
	ORDU (2020–21)	7	4.4	4.7	5.1	4.8



Figure 3 Comparison of sodium, electrical conductivity and pH findings between FOGO, GO and ORDU samples from sampling rounds in 2019 and 2020–21







iv) Legend example



2.3. Metals

Sources of metals

Metals occur naturally, and vary in concentration in soils according to regional geology. Metals are considered persistent chemicals that can cycle in the environment: even if they change in form, they remain in the environment. Increased metal concentrations following land application of recovered materials are of concern as they can affect plant and animal health and reproduction, and soil function; they may also contaminate the food chain and water supplies.

All samples collected in both sampling rounds of this study were analysed for the same metals: antimony, arsenic, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, molybdenum, nickel, selenium, tin, vanadium and zinc.

Findings

Metals were detected in all FOGO, GO composts and ORDU outputs. Table 3 shows their concentrations. Most were generally below the upper limits set in the Australian voluntary industry standard AS 4454-2012, *Composts, soil conditioners and mulches*, or the British Standards Institution's *Publicly Available Specification (PAS) 100* for compost, or within background concentration ranges in soils where other limits were not available.^{6,7} Most samples met the AS 4454 upper limits for metals: the exceptions were one sample of FOGO that exceeded the arsenic upper limit of 20 mg/kg (the concentration was 25 mg/kg) and eight samples of FOGO that exceeded the zinc upper limit of 300 mg/kg (330–980 mg/kg).

Some metals (arsenic, boron, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, tin, vanadium and zinc) were detected more frequently than others (antimony, beryllium, cadmium, mercury and selenium) in both FOGO and GO composts. Fewer metals were detected in the ORDU samples (boron, chromium, copper, manganese, nickel, tin and zinc) than in the composts; however, it must be noted that the ORDU data is from a smaller sample size of seven samples from three units.

⁶ Berkman DA 1989 (3rd edition), Field Geologist's Manual, Australasian Institute of Mining & Metallurgy

⁷ South Australian Health Commission 1995, Contaminated Sites Monograph No.4: Trace Element Concentrations in Soils from Rural & Urban Areas of Australia

Chemical	Dataset	No. of samples	No. (%) of detections	Minimum (mg/kg)	Median¹ (mg/kg)	Maximum (mg/kg)	Average ¹ (mg/kg)	AS4454 upper limit criterion (mg/kg)	No. (%) of samples above upper limit criterion
Antimony	FOGO (2019)	17	0 (0)	<5	-	<5	-	-	-
	FOGO (2020–21)	37	9 (24)	<0.5	0.25	1.1	0.39	-	-
	GO (2020–21)	13	4 (31)	<0.5	0.25	1	0.38	-	-
	ORDU (2020–21) ³	7	0 (0)	<0.5	-	<0.5	-	-	-
Arsenic	FOGO (2019)	17	11 (65)	<5	8.0	25	7.4	20	1 (6)
	FOGO (2020–21)	37	37 (100)	3.9	6.7	17	7.7	20	0 (0)
	GO (2020–21)	13	13 (100)	3.1	4.9	11	6.4	20	0 (0)
	ORDU (2020–21) ³	7	0 (0)	<0.5	-	<0.5	-	-	-
Beryllium	FOGO (2019)	17	0 (0)	<1	-	<1	-	-	-
	FOGO (2020–21)	37	7 (19)	<0.5	0.25	0.83	0.32	-	-
	GO (2020–21)	13	5 (38)	<0.5	0.25	0.88	0.46	-	-
	ORDU (2020–21) ³	7	0 (0)	<0.5	-	<0.5	-	-	-
Boron	FOGO (2019)	17	2 (12)	<50	25	80	31	100	0 (0)
	FOGO (2020–21)	37	37 (100)	10	20	75	22	100	0 (0)
	GO (2020–21)	13	13 (100)	4.5	17	20	15	100	0 (0)
	ORDU (2020–21) ³	7	7 (100)	6.3	7.5	8.1	7.3	-	-
Cadmium	FOGO (2019)	17	1 (6)	<1	0.5	1	0.5	1	0 (0)
	FOGO (2020–21)	37	5 (14)	<0.5	0.25	0.73	0.30	1	0 (0)
	GO (2020–21)	13	0 (0)	<0.5	-	<0.5	-	1	0 (0)
	ORDU (2020–21) ³	7	0 (0)	<0.5	-	<0.5	-	-	-
Chromium	FOGO (2019)	17	17 (100)	10	15	34	18	100	0 (0)
	FOGO (2020–21)	37	37 (100)	11	20	80	25	100	0 (0)

Table 3 Range of metal concentrations found in the NSW EPA study

Chemical	Dataset	No. of samples	No. (%) of detections	Minimum (mg/kg)	Median¹ (mg/kg)	Maximum (mg/kg)	Average ¹ (mg/kg)	AS4454 upper limit criterion (mg/kg)	No. (%) of samples above upper limit criterion
	GO (2020–21)	13	13 (100)	7.4	12	16	12	100	0 (0)
	ORDU (2020–21) ³	7	5 (71)	<0.5	0.82	1.8	0.8	-	-
Cobalt	FOGO (2019)	17	17 (100)	2.0	6.0	12	5.8	-	-
	FOGO (2020–21)	37	37 (100)	2.3	5.3	16	6.3	-	-
	GO (2020–21)	13	12 (92)	<0.5	3.9	14	4.2	-	-
	ORDU (2020–21) ³	7	0 (0)	<0.5	-	<0.5	-	-	-
Copper	FOGO (2019)	17	17 (100)	24	38	138	50	150 ²	0 (0)
	FOGO (2020–21)	37	37 (100)	20	42	140	48	150	0 (0)
	GO (2020–21)	13	13 (100)	10	29	47	28	150	0 (0)
	ORDU (2020–21) ³	7	7 (100)	4.3	12	12	11	-	-
Lead	FOGO (2019)	17	17 (100)	10	41	62	37	150	0 (0)
	FOGO (2020–21)	37	37 (100)	11	40	59	38	150	0 (0)
	GO (2020–21)	13	13 (100)	7.4	21	26	20	150	0 (0)
	ORDU (2020–21) ³	7	0 (0)	<0.5	-	<0.5	-	-	-
Manganese	FOGO (2019)	17	17 (100)	166	377	783	398	-	-
	FOGO (2020–21)	37	37 (100)	170	350	4690	518	-	-
	GO (2020–21)	13	13 (100)	94	230	360	223	-	-
	ORDU (2020–21) ³	7	7 (100)	13	24	31	25	-	-
Mercury	FOGO (2019)	17	0 (0)	<0.1	-	<0.1	-	1	0 (0)
	FOGO (2020–21)	37	0 (0)	<0.2	-	<0.2	-	1	0 (0)
	GO (2020–21)	13	0 (0)	<0.2	-	<0.2	-	1	0 (0)
	ORDU (2020–21) ³	7	0 (0)	<0.2	-	<0.2	-	-	-
Molybdenum	FOGO (2019)	17	0 (0)	<2	-	<2	-	-	-
	FOGO (2020-21)	37	35 (95)	<0.5	0.89	1.3	0.9	-	-

Chemical	Dataset	No. of samples	No. (%) of detections	Minimum (mg/kg)	Median¹ (mg/kg)	Maximum (mg/kg)	Average ¹ (mg/kg)	AS4454 upper limit criterion (mg/kg)	No. (%) of samples above upper limit criterion
	GO (2020–21)	13	10 (77)	<0.5	0.89	1.4	0.8	-	-
	ORDU (2020–21) ³	7	0 (0)	<0.5	-	<0.5	-	-	-
Nickel	FOGO (2019)	17	17 (100)	4.0	11	16	10	60	0 (0)
	FOGO (2020–21)	37	37 (100)	5.1	12	42	15	60	0 (0)
	GO (2020–21)	13	13 (100)	3.7	5.7	13	7.2	60	0 (0)
	ORDU (2020–21) ³	7	7 (100)	0.59	0.83	1.4	0.9	-	-
Selenium	FOGO (2019)	17	0 (0)	<5	-	<5	-	5	0 (0)
	FOGO (2020–21)	37	4 (11)	<0.5	0.25	0.65	0.3	5	0 (0)
	GO (2020–21)	13	1 (8)	<0.5	0.25	0.85	0.3	5	0 (0)
	ORDU (2020–21) ³	7	0 (0)	<0.5	-	<0.5	-	-	-
Tin	FOGO (2019)	17	3 (18)	<5	2.5	14	3.8	-	-
	FOGO (2020–21)	37	36 (97)	<0.5	2.1	8.8	2.6	-	-
	GO (2020–21)	13	12 (92)	<0.5	1.4	13	2.4	-	-
	ORDU (2020–21) ³	7	4 (57)	<0.5	0.8	1.5	0.76	-	-
Vanadium	FOGO (2019)	17	17 (100)	7.0	22	41	23	-	-
	FOGO (2020–21)	37	37 (100)	9.9	22	980	52	-	-
	GO (2020–21)	13	11 (85)	<0.5	11	15	8.7	-	-
	ORDU (2020–21) ³	7	0 (0)	<0.5	-	<0.5	-	-	-
Zinc	FOGO (2019)	17	17 (100)	84	231	493	237	300 ²	3 (18)
	FOGO (2020–21)	37	37 (100)	93	210	980	236	300	5 (14)
	GO (2020–21)	13	13 (100)	36	120	160	113	300	0 (0)
	ORDU (2020–21) ³	7	7 (100)	13	16	20	15	-	-

Notes

1. Where concentrations were <LOR, half the LOR was used to calculate median and average values. 2. Note on Table 3.1(C) in AS4454 states: A product that contains levels of copper (Cu) greater than 100 mg/kg but less than 150 mg/kg and/or total zinc (Zn) greater than 200 mg/kg but less than 300 mg/kg (dry weight), whilst not exceeding the limit values for all other contaminants listed in Table 3.1(C), shall provide a warning label in accordance with the labelling requirements of Clause 5.3 (of AS4454).

3. Outputs from ORDUs are not composts but dehydrated food wastes, hence AS4454 limits do not apply.

2.4. Pesticides

Source of pesticides

Pesticides are chemicals that control pests by physically, chemically or biologically interfering with their metabolism or behaviour. Pesticides include herbicides, fungicides, insecticides, fumigants, bactericides, rodenticides, baits, lures and repellents.

Findings

Table 4 provides a summary of the pesticides detected and the number of sites at which each pesticide was detected. The full set of analytical results for the study is in the study's data (a separate document, available on the EPA's website).

A total of 47 organochlorine and organophosphate pesticides were tested in FOGO compost samples collected during the 2019 sampling round. One herbicide, MCPA, was detected in two samples of FOGO compost collected from one site during this round.⁸ There were no other detections above the laboratory reporting limit for this sampling round. However, the laboratory limit of reporting for the 2019 round was less sensitive than for the 2020–21 round.

An expanded set of 93 pesticides was tested during the 2020–21 sampling round. Substances tested for included organochlorine and organophosphate pesticides, phenoxy acid herbicides, glyphosate, AMPA and glufosinate. A mix of 38 herbicides, insecticides and fungicides was also analysed, using a multi-residue method.

In the 2020–21 sampling round, six pesticides were detected in FOGO and GO composts, and none were detected in ORDUs. The pesticides detected were the organochloride pesticides (OCPs) chlordane, dieldrin and DDT and the herbicides glyphosate, MCPA and clopyralid. Most were at concentrations near the laboratory reporting limits.

No pesticides were detected in the dehydrated food waste samples from the three ORDUs included in the study.

Organochloride pesticides (OCPs)

Two pesticides (chlordane and dieldrin) were infrequently found at concentrations above the upper limits of 0.02 mg/kg set in the industry standard for composts, AS 4454-2012. The laboratory limit of reporting for these OCPs was <0.02 mg/kg. The OCPs chlordane and dieldrin were banned in Australia during the mid-1990s and the late 1980s respectively. They are known to persist in the environment for decades.

Chlordane was detected only as trans-chlordane isomer in three FOGO samples from one facility (minimum 0.025 mg/kg, average 0.029 mg/kg, maximum 0.032 mg/kg) and in one GO sample (0.03 mg/kg). All four samples exceeded the upper limit for chlordane in AS4454-2012, which is 0.02 mg/kg.

⁸ MCPA was detected in both FOGO compost samples collected from the same site in 2019 at 0.15 mg/kg and 0.1 mg/kg (limit of reporting was <0.04 mg/kg).

Dieldrin was detected in 17 of 54 samples collected from nine FOGO facilities (minimum 0.021 mg/kg, average 0.050 mg/kg, maximum 0.120 mg/kg) and in three of 13 GO samples taken from two GO facilities (min 0.025 mg/kg, average 0.030 mg/kg, maximum 0.039 mg/kg). All detected concentrations were at or above the 0.02 mg/kg upper limit in AS4454-2012.

DDT was detected in four FOGO samples from two facilities (minimum 0.02 mg/kg, average 0.05 mg/kg, maximum 0.098 mg/kg). All the detected values were below the upper limit for DDT/DDD/DDE in AS4454-2012, which is 0.5 mg/kg. DDT pesticides were banned in Australia in the mid-1990s and are known to persist in the environment for decades.

Herbicides

The herbicides glyphosate, MCPA and clopyralid were detected infrequently in FOGO and GO composts at concentrations of less than 4 mg/kg. None were detected in the ORDU samples. Further work may be needed to determine the relevance of these findings - for example, whether the findings are sporadic or if detections would continue over time.

Glyphosate was detected in 7 FOGO samples at three facilities (minimum 0.52 mg/kg, average 1.07 mg/kg, max 1.80 mg/kg) and in three GO samples from one facility (min 1.70 mg/kg, average 1.97 mg/kg, max 2.10 mg/kg).

Glyphosate strongly sorbs onto soil minerals and is readily degraded by soil microbes to aminomethylphosphonic acid (AMPA). AMPA was not detected in any samples. Glyphosate's halflife in soil ranges between two and 197 days, with a typical soil half-life of 47 days.⁹ The carcinogenic potential of glyphosate has been very much debated internationally and currently there are no institutions or agencies in the world that have established screening levels in soils.

In the 2020-21 sampling round, MCPA was detected in three FOGO samples (minimum 0.2 mg/kg, average 0.27 mg/kg, max 0.35 mg/kg) and in one GO sample (0.14 mg/kg). The concentrations detected at one FOGO site in 2019 were 0.15 mg/kg and 0.1 mg/kg. MCPA has moderate persistence in the environment with a soil degradation half-life reported to range from 15 to 50 days.¹⁰ It has the potential to leach from solid material and be transported with water. A screening criterion of 2.67 mg/kg was established for MCPA as part of the risk assessment conducted for mixed-waste organic outputs, indicating that the concentrations detected in these samples are unlikely to be of concern.11

Clopyralid was detected in three FOGO samples from two facilities (0.10 mg/kg, 0.11 mg/kg and 0.12 mg/kg). These detections are very close to the laboratory limit of reporting at 0.1 mg/kg. There are no screening criteria for clopyralid in soils and the U.S. Environmental Protection Agency (US EPA) classifies this herbicide with toxicity class III (low toxicity to human and animal health).¹² While clopyralid does not accumulate in animal tissues, it can be very toxic at low concentrations to plants in the bean family, the potato/tomato family and the sunflower family. It resists breakdown in compost and soil and may be present in animal manures. Concentrations of 0.003 mg/kg in soils

⁹ National Pesticide Information Center 2010 (revised March 2019), Glyphosate technical fact sheet, http://npic.orst.edu/factsheets/archive/glyphotech.html

¹⁰ Health Canada 2022, Guidelines for Canadian Drinking Water Quality MCPA, https://www.canada.ca/content/dam/hcsc/documents/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technicaldocument-2-methyl-4-chlorophenoxyacetic-acid-mcpa/27-21-3021-Guidelines-Water-Quality-MCPA-EN-02.pdf

¹¹ NSW Office of Environment and Heritage 2015, Alternative waste treatment research program: Project 3: Assessing the toxicity of mixed waste organic output leachates, https://www.epa.nsw.gov.au/-/media/epa/corporatesite/resources/recycling/mwoo/0486-resource-recovery-inw-awtproject3.pdf?la=en&hash=462A2F7E4962DC1D1FF3640B1A574D96E2689943

¹² U.S. EPA classifies Transline (the herbicide product with clopyralid as the sole active ingredient) as toxicity class III (low toxicity) with a signal word of CAUTION.

are considered as 'plant safe' to these sensitive plant families.¹³ However, the laboratory limit of reporting for this herbicide was 0.1 mg/kg, hence it is unknown if clopyralid may be present in other samples that returned a non-detected result.

¹³ Michel FC & Doohan D (n.d.), *Clopyralid and other pesticides in composts*, Ohio State University Extension, https://www.global2000.at/sites/global/files/Clopyralid_Factsheet.pdf

Chemical	Dataset	No. of samples	No. (%) of detections	Minimum (mg/kg)	Maximum (mg/kg)	No. (%) of facilities with detections	AS4454 upper limit criterion (mg/kg)	No. (%) of samples above upper limit criterion
Trans-	FOGO (2020–21)	37	3 (8)	<0.02	0.032	1 (8)	0.02	3 (8)
Chlordane	GO (2020–21)	13	1 (8)	<0.02	0.03	1 (20)	0.02	1 (8)
Dieldrin	FOGO (2020-21)	37	17 (46)	<0.02	0.12	9 (69)	0.02	16 (43)
	GO (2020–21)	13	3 (23)	<0.02	0.039	2 (40)	0.02	3 (23)
DDT	FOGO (2020-21)	37	4 (11)	<0.02	0.098	2 (15)	0.5	0 (0)
	GO (2020–21)	13	0 (0)	<0.02	-	0 (0)	0.5	0 (0)
MCPA	FOGO (2020-21)	37	3 (8)	<0.1	0.35	1 (8)	-	-
	GO (2020–21)	13	1 (8)	<0.1	0.14	1 (20)	-	-
Glyphosate	FOGO (2020–21)	37	7 (19)	<0.5	1.8	3 (23)	-	-
	GO (2020–21)	13	3 (23)	<0.5	2.1	1 (20)	-	-
Clopyralid	FOGO (2020–21)	37	3 (8)	<0.1	0.12	2 (15)	-	-
	GO (2020–21)	13	0 (0)	<0.1	-	0 (0)	-	-

Table 4 Summary of pesticides detected in FOGO and GO facilities in 2020–21 sampling round

Note: No pesticides were detected in the FOGO (2019) sampling round, except for two detections of MCPA (0.1 mg/kg, 0.15 mg/kg) from one facility. No pesticides were detected in the ORDU samples.

2.5. Phthalates

Sources of phthalates

Phthalates are a group of chemicals used to make plastics more flexible and harder to break. They are often called plasticisers. They are found in TVs, furniture, computers and vinyl flooring, and also in adhesives, detergents, lubricating oils, plastic clothes and personal-care products such as soaps, shampoos, hair sprays and nail polishes.

Findings

Phthalates were not detected in FOGO compost during the 2019 sampling round. Bis(2-ethylhexyl) phthalate (DEHP) was infrequently detected during the 2020–21 sampling round in FOGO, GO and ORDU outputs.

In the 2020–21 round, DEHP was detected in 12 FOGO samples from six facilities (average concentration of 3.9 mg/kg and maximum of 21 mg/kg), in two GO samples from one facility (average 1.5 mg/kg, max 1.7 mg/kg), and in three ORDU samples from one unit (average 2.9 mg/kg, max 4.7 mg/kg). The highest concentration was found in one FOGO compost sample, with the remaining samples at significantly lower concentrations of less than 4.4 mg/kg. Ecological and human health screening criteria are available for DEHP as 13 mg/kg and 30 mg/kg respectively.¹⁴ Other than the single detection of 21 mg/kg at one facility, all other samples have concentrations below the ecological and human health screening criteria, indicating that these samples are unlikely to be of concern.

DEHP may be present in plastics and can leach into food from plastic packaging (particularly foods with a higher fat content). The surveys received from the facilities sampled as part of this study and the discussions held with the facility operators indicate plastic food packaging is commonly found in feedstocks used for composting. This may be a potential source of the DEHP found in these samples.

2.6. Phenols

Sources of phenols

Phenols may be present in herbicides, food waste (via flavouring agents), wood (via incomplete combustion, phenolic resins) and human excretions. They are also produced through the degradation of organic matter such as that found in composts. These chemicals can originate from both anthropogenic and natural sources.

Findings

Phenols (phenol and 2-methylphenol (o-cresol)) were detected infrequently in FOGO composts in the 2020–21 sampling round. None were detected in the 2019 samples.

Phenol was detected in two FOGO samples from two facilities (average 1.2 mg/kg, max 1.5 mg/kg).

2-Methylphenol (o-cresol) was detected in seven FOGO samples from three facilities (average 2.0 mg/kg, max 4.8 mg/kg).

¹⁴ These screening criteria were used in a previous risk assessment undertaken for a report on mixed-waste organic outputs by the NSW Office of Environment and Heritage, Environment Protection Science Branch 2019, *Alternative waste treatment research program: Project 3: Assessing the toxicity of mixed waste organic output leachates* (Table 6, page 47). (Available on the EPA website.)

Detections were infrequent: just four facilities detected either or both of the two phenolic chemicals.

Microbial biodegradation is the dominant pathway for degradation of phenol in the environment. Phenols have a low bioaccumulation potential and under aerobic conditions degrade readily in soils (e.g. ECHA reports that the aerobic biodegradation half-life (DT50) in soil is 7 days). Degradation in anaerobic soils can be much slower. The ecological 'predicted no-effect concentration' (PNEC) for phenol in soil is 0.136 mg/kg, according to the European Chemicals Agency (ECHA).¹⁵ While the concentrations of phenols detected in the composts sampled are higher than the PNEC, there is also some uncertainty in the PNEC value due to limited ecotoxicity data. The low persistence of these phenols and their likely rapid degradation under aerobic field conditions means they are likely to pose a low long-term risk.

2.7. PFAS and PBDEs

PFAS and PBDEs are persistent chemicals that bioaccumulate, do not easily break down in the environment, and can adversely impact the environment and human health. These chemicals are not found in the environment from natural sources, only from anthropogenic sources.

All Australian governments have agreed that further release of PFAS into the environment from ongoing use should be prevented where practicable: see the <u>National per- and polyfluoroalkyl</u> <u>substances (PFAS) Position Statement</u>.

Several PBDE chemicals are listed under the Stockholm Convention on Persistent Organic Pollutants (POPs), to which Australia is a signatory. The Stockholm Convention requires its parties to take measures to eliminate or reduce the release of POPs into the environment.

Sources of PFAS: PFAS are a large group of chemicals used for their fire-retardant, waterproofing and stain-resistant properties and are found in products such as paints, roof treatments, hardwood floor protectant, surface protection products (e.g. carpet and clothing treatments) and coatings for cardboard and packaging, including containers and packaging used for food. Some PFAS chemicals were also used historically in firefighting foams.

Sources of PBDEs: PBDEs are also a large group of chemicals and are used as flame retardants in a wide variety of products, including plastics, furniture, upholstery, electrical equipment, textiles and other household products. Such household items can release PBDEs, and so they can be present in house dust and become concentrated in household vacuum-cleaner dust.

Study findings

The 2019 study of NSW FOGO compost identified the presence of some PFAS and PDBE chemicals. Both groups of chemicals have the potential to bioaccumulate and biomagnify in agricultural food chains and no soil guidelines are available for these pathways. Therefore, a preliminary human health risk assessment of the 2019 data was undertaken. This assessment identified potential risks that required additional investigation. Further sampling in the extended study conducted in 2020–21 found these chemicals in all FOGO and GO composts analysed. PFAS were not detected in samples from the ORDUs, while PBDEs were detected at considerably lower concentrations than in FOGO and GO composts.

Each sample collected in this study was analysed for 35 individual PFAS compounds in 2020–21 and for 16 individual compounds in 2019. The PFAS compounds detected most frequently were perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorohexane sulfonate (PFHxS) and perfluorohexanoic acid (PFHxA). For PBDEs, 34 individual chemical compounds were analysed in both sampling rounds. The non-fully brominated diphenyl ethers (Br1-9) and the

¹⁵ European Chemicals Agency, Phenol, https://echa.europa.eu/registration-dossier/-/registered-dossier/15508/6/1

fully brominated (Br-10) are discussed separately, as these have different transfer factors and toxicity reference values.

The range of concentrations of PFAS and PBDE chemicals detected in FOGO, GO and ORDU samples analysed in this study are presented in Table 5 and Table 6, respectively.

The complete analytical results for PFAS and PBDE chemicals are presented in the study's data (a separate document, available on the EPA's website).

Chemical	Dataset	No. of samples	No. (%) of detections	Minimum (µg/kg)	Median (µg/kg)	Maximum (µg/kg)	Average (µg/kg)
PFOS ¹	FOGO (2019)	20	16 (80)	<0.2	0.9	3.3	1.0
	FOGO (2020–21)	37	37 (100)	0.4	1.3	6.0	1.7
	GO (2020–21)	13	11 (85)	<0.1	1.3	2.5	1.2
	ORDU (2020–21)	7	0 (0)	<1	-	<1	-
PFHxS ¹	FOGO (2019)	20	7 (35)	<0.2	0.2	0.5	0.2
	FOGO (2020–21)	37	37 (100)	0.1	0.3	0.9	0.4
	GO (2020–21)	13	10 (77)	<0.1	0.2	0.8	0.3
	ORDU (2020–21)	7	0 (0)	<1	-	<1	-
PFOA ¹	FOGO (2019)	20	15 (75)	<0.2	0.5	4.9	0.9
	FOGO (2020–21)	37	37 (100)	0.1	0.6	2.6	0.8
	GO (2020–21)	13	8 (62)	<0.1	0.3	0.5	0.3
	ORDU (2020–21)	7	0 (0)	<1	-	<1	-
PFHxA ¹	FOGO (2019)	20	17 (85)	<0.5	1.1	8.2	2.0
	FOGO (2020–21)	37	37 (100)	0.3	1.7	18	3.2
	GO (2020–21)	13	11 (85)	<0.1	0.6	1.2	0.7
	ORDU (2020–21)	7	0 (0)	<1	-	<1	-
Total PFAS ^{2,3}	FOGO (2019)	20	17 (85)	<0.5	3.9	12	4.9
	FOGO (2020–21)	37	37 (100)	2.6	7.5	24	8.9
	GO (2020–21)	13	12 (92)	<0.1	5.2	15	6.3
	ORDU (2020–21)	7	0 (0)	<1	-	<1	-

Table 5 Range of PFAS concentrations found in the study

Notes

1. Where concentrations were <LOR for PFHxS, PFOS, PFHxA and PFOA, half the LOR was used to calculate median and average values.

2. Due to the large number of individual PFAS chemicals measured, when concentrations were reported as <LOR, these data were excluded from the summed concentration for total PFAS (i.e., <LOR was assumed to be zero, and total PFAS is a summed value of all detected PFAS concentrations). LOR are not presented for 'Total PFAS' due to variation of individual PFAS LORs – refer to the study's data (separate document) for PFAS LORs.

3. For 2019 samples, total PFAS calculated reflects the measurement of the minimum recommended analysis suite for PFAS (WA DER List).

Chemical	Dataset	No. of samples	No. (%) of detections	Minimum (µg/kg)	Median (µg/kg)	Maximum (µg/kg)	Average (µg/kg)
PBDE Br1-91	FOGO (2019)	17	17 (100)	1	18	123	23
	FOGO (2020–21)	37	37 (100)	2.1	11	30	12
	GO (2020–21)	13	13 (100)	1.1	3.9	186 ³	37
	ORDU (2020–21)	7	3 (43)	<1	0.4	0.4	0.3
PBDE Br10 ²	FOGO (2019)	17	16 (94)	<2	29	1010	87
	FOGO (2020–21)	37	29 (78)	<6	22	80	29
	GO (2020–21)	13	5 (38)	<7	15	460	61
	ORDU (2020–21)	7	0 (0)	-	-	-	-

Table 6 Range of PBDE concentrations found in the study

Notes

1. Due to the large number of individual compounds in the Br1–Br9 range, when concentrations were reported as <LOR, these data were excluded from the summed concentration (i.e., <LOR was assumed to be zero). This was done as use of half the LOR (as done for other compounds) can lead to unrealistically elevated estimated concentrations due to the large number of compounds in the Br1–Br9 range.

2. Where concentrations were <LOR for Br10, half the LOR was used to calculate median and average values.

3. One GO facility (facility O) had considerably elevated concentrations of Br1–Br9 (99, 169 and 186 µg/kg) compared to the other facilities, which had typical concentrations of less than 20 µg/kg.

Risk assessments for PFAS and PBDEs

PFAS and PBDEs have the potential to bioaccumulate and biomagnify in agricultural food chains; however, there are no soil guidelines available for these pathways. Therefore, as there are limited environmental guideline values for PFAS and PBDEs for the exposure pathways relevant for compost use, DPE–C&R undertook a human health risk assessment to help interpret the data.

The risk assessment considered several potential exposure pathways associated with the use of FOGO and GO composts. The ORDU data was not considered in the risk assessments due to the low or no detections of PFAS and PBDEs.

Three land-application scenarios were assessed for the composts:

- 1. no incorporation (no-dig surface application) into soil
- 2. incorporation to 2 cm (representing cattle trampling compost into the soil)
- 3. incorporation to 10 cm into soils.

The key exposure pathways of egg, meat (beef) and milk consumption were assessed. For meat and milk consumption scenarios, these were assessed further as exposure to grazing animals from soil and pasture, and from fodder (i.e. pasture only). Repeated applications of compost were not considered in the assessment.

Although a number of PFAS compounds were detected in FOGO and GO composts, the risk assessment focused only on PFOS, PFHxS, PFOA and PFHxA. The summed PFAS chemicals PFOS+PFHxS and PFOA+PFHxA were assessed. There are currently only human health toxicity reference values available in Australia for PFOS+PFHxS and PFOA. The DPE–C&R risk assessment noted that, on review of the analytical data obtained in this study, some FOGO samples had high proportions of PFHxA.¹⁶ To account for this, PFHxA was summed with PFOA for the assessment. This approach provided a conservative assessment as PFHxA is thought to be less toxic than PFOA.¹⁷

For the PBDE assessment, data were separated into two groups, Br1-Br9 (sum of PBDEs with between 1 and 9 bromine atoms) and Br10 (the fully brominated deca-BDE compound). This was done due to differences in toxicity and environmental fate between these groups.

For the groups of PFAS and PBDEs assessed, there were significant differences in concentrations across the facilities sampled. Risks were therefore assessed separately for each facility.¹⁸

A risk quotient (RQ) approach was used, where a calculated value above one (1) indicates that the estimated daily intake of a contaminant is above a toxicity reference value (i.e. a value considered a safe dose) and may present an unacceptable risk. The pathways assessed and the assumptions used in the calculations were conservative but realistic. The risk assessment only considered home consumption of produce.

A risk assessment was also conducted for the consumption of homegrown fruit and vegetables for PFAS and PBDEs.¹⁹ The risks for FOGO and GO application in homegrown fruit/vegetables were

¹⁶ NSW Department of Planning and Environment, January 2023, *Risk assessment of PFAS and PBDEs in food organics and garden organics composts (2020–21)*, and NSW Department of Planning and Environment, January 2023, *Addendum to risk assessment of PFAS and PBDEs in food organics and garden organics composts (2020–21)*

¹⁷ Luz et al. 2019, Perfluorohexanoic acid toxicity part 1: Development of a chronic human health toxicity value for use in risk assessment, *Regulatory Toxicology and Pharmacology* 103:41–55

¹⁸ The dataset from the 2019 round was smaller with less variation in concentrations and the results were combined to calculate risks. The 2020–21 data was statistically different and could not be combined, hence risk assessments were calculated individually for each facility. The risk assessment for the 2020–21 results supported the risk assessment findings from the 2019 round. Assessment report: Risk assessment of PFAS and PBDEs in food organics and garden organics composts (2020–21)

assessed for scenario 1 only (surface application of compost without incorporation) as the realistic worst-case scenario. This risk assessment used screening criteria from the PFAS National Environmental Management Plan (PFAS NEMP) and the National Environment Protection Measure (NEPM) health investigation levels for residential areas with garden accessible soil. These screening criteria consider exposure via multiple pathways such as ingestion, inhalation and dermal contact with soil and dust as well as ingestion of homegrown fruit/vegetables. They assume 10% of total fruit and vegetable consumption comes from home gardens. The risk assessment noted that there may be some settings where consumption above 10% may occur, e.g. rural/agricultural properties. Consistent with the risk assessment for eggs, milk and meat, the RQs for homegrown fruit/vegetables consumption were calculated for each facility.

The assessment of homegrown fruit/vegetables pathway did not consider the consumption of herbs grown in the home garden. In general, herbs from the home garden are unlikely to be consumed in sufficient quantities to warrant concern.

General findings from the PFAS and PBDEs detected

There were higher concentrations of PFOA, PFHxA, Br1–Br9 and Br10 in FOGO waste samples than in GO waste samples. Although this result was based on a small dataset, it suggests that there may be sources of these chemicals in FOGO that are not present in GO. Further work was conducted to identify potential sources: this is discussed in Section 5.

Data from two facilities (one FOGO and one GO) resulted in RQs less than one (1) for both PFAS and PBDEs, indicating that a final product that poses a low risk to human health can be achieved. The two facilities differed, in that the GO facility does not take kerbside collections but selects its feedstock from residential, parkland or commercial gardening projects, while the FOGO facility is a small regional operation.

Risk assessment results for PFAS

The risk assessment for PFOS + PFHxS indicated that for some exposure pathways/facilities, there may be an unacceptable risk. The highest-risk pathways were for meat and milk consumption where FOGO and GO compost is land-applied without incorporation and the meat and milk is primarily sourced from home/own farm produce. For PFOS + PFHxS egg consumption presented a low and acceptable risk for all scenarios.

Similarly, the risk assessment for PFOS + PFHxS for homegrown fruit/vegetables pathway resulted in RQs of less than one (1), and presented a low and acceptable risk for all scenarios with 10% consumption.²⁰ If more homegrown produce were consumed, the RQ would increase. For example, if it is assumed that someone consumes 50% of their fruit and vegetables from homegrown produce, which may occur on rural/agricultural properties, the RQ would be five times higher than that calculated for 10% consumption. This increase could result in an unacceptable risk for some FOGO composts and some GO composts.

The assessment of PFOA + PFHxA indicated that the risks were low and acceptable for all scenarios for egg, milk, meat and homegrown fruit/vegetable consumption. However, for one

¹⁹ NSW Department of Planning and Environment, January 2023, Addendum to risk assessment of PFAS and PBDEs in food organics and garden organics composts (2020–21)

²⁰ The risk assessment in the report 'NSW Department of Planning and Environment, January 2023, Addendum to risk assessment of PFAS and PBDEs in food organics and garden organics composts (2020–21)'uses the assumption in the National Environment Protection (Assessment of Site Contamination) Measure, and therefore is considered conservative for the scenario of residential areas with garden-accessible soil. This is a standard assumption. In settings where a higher percentage (i.e. >10%) of fruit /vegetables ingested are sourced from the residential backyard where FOGO and GO have been applied, the RQs will increase. There is a potential that such scenarios for the home consumption of produce may occur in rural/agricultural properties.

FOGO facility the calculated RQ was only marginally below the thresholds. Table 7 provides a summary of the risk assessment findings for PFAS chemicals.

Risk assessment results for PBDEs

The assessment for PBDE compounds Br1–Br9 indicated that there may be an unacceptable risk present for some exposure pathways/facilities from FOGO and GO composts. The highest-risk pathways for Br1–Br9 were for meat and milk consumption where FOGO and GO compost is land applied without incorporation and the meat and milk is primarily sourced from home/own farm produce. Egg consumption presented a low and acceptable risk for almost all exposure pathways/facilities, except for one GO facility that had a high concentration of PBDEs. Risk assessment for Br1–Br9 for homegrown fruit/vegetable consumption showed a low and acceptable risk at 10% consumption.

The assessment of the PBDE compound Br10 indicated that the risks were low and acceptable for all scenarios and all pathways (i.e. eggs, milk, meat and homegrown fruit/vegetables).

Exposure pathw	ay scenarios¹	No soil incorporation	Soil incorporation
Egg consumption	-	Risk is low and acceptable with one exception ⁴	Risk is low and acceptable with one exception ⁷
Meat consumption	Grazing (exposure via soil and pasture)	Risk may be unacceptable for compost from some facilities due to PFAS (PFOS + PFHxS) compounds and from most facilities due to PBDE (Br1–Br9) compounds ^{5,6}	Risk is low and acceptable with one exception ⁷
	Fodder (exposure via pasture only)	Risk may be unacceptable for compost from some facilities due to PFAS (PFOS + PFHxS) and PBDE (Br1–Br9) compounds ^{5,6}	Risk is low and acceptable with one exception ⁷
Milk consumption ²	Grazing (exposure via soil and pasture)	Risk may be unacceptable for compost from some ⁵ facilities due to PFAS (PFOS + PFHxS) and PBDE (Br1–Br9) compounds ⁶	Risk is low and acceptable with one exception ⁷
	Fodder (exposure via pasture only)	Risk may be unacceptable for compost from some facilities due to PFAS (PFOS + PFHxS) compounds and from one facility due to PBDE (Br1–Br9) compounds ^{4,5}	Risk is low and acceptable with one exception ⁷
Fruit and vegetable consumption	Standard assumption: 10% of fruits and vegetables ingested are homegrown ³	Risk is low and acceptable	n/a ⁸

Table 7 Summary of PFAS and PBDE risk assessment findings for FOGO and GO compost, for two landapplication scenarios

Notes

1. Exposure pathway assumptions are consistent with the preferred assumptions for generic risk assessment in NSW.

2. One FOGO facility was very close to exceeding the acceptable risk threshold for PFOA + PFHxA concentrations for the no soil incorporation scenarios (calculated RQ were 0.99 and 1.00).

3. The use of 10% is consistent with assessment in the National Environment Protection (Assessment of Site Contamination) Measure

4. Risk may be unacceptable for compost from one GO facility where elevated PBDE (Br1–Br9) concentrations were found.

5. 'Some facilities' means 50% or less of facilities, while 'most facilities' means more than 50% of facilities.6. Risk is low and acceptable for compost at all facilities for other PFAS (PFOA + PFHxA) and PBDE (Br10) compounds.

 Exception: risk may be unacceptable for both (meat and milk consumption) grazing scenarios when compost is incorporated into top 2 cm of soil, as at one GO facility where elevated PBDE (Br1–Br9) concentrations were found.
 Not assessed; however, risks are considered to be low and acceptable, based on the 'no soil incorporation' scenario.

One GO facility had PBDE (Br1–Br9) chemicals at higher concentrations (more than two orders of magnitude higher) than other findings in FOGO or GO composts. Sources of PBDE include plastics, manufactured timbers, upholstery, electrical equipment, textiles and other household products. Discussions with the facility indicated that engineered wood composites may have been the likely source in these samples. Table 7 summarises the risk assessment findings for PBDE chemicals.

Potential sources of PFAS and PBDE in composts

In NSW the Compost Order 2016 regulates the types of inputs to GO and FOGO compost. It defines compost as any combination of mulch, garden organics, food waste, manure and paunch that has undergone composting. However, information sought at the time of sampling from the composting facility operators indicated that a broader list of materials was being received along with this feedstock, including plastic contaminants, residual paper, cardboard, soil, compostable plastics, disposable cups and cutlery, and treated timber.

To better understand the potential sources of PFAS and PBDEs in FOGO and GO composts, the EPA commissioned a review of international literature. WCA Environment Ltd (WCA) prepared a report, *Brief literature review of potential sources of PFAS and PBDEs in food organics and garden organics composts.*²¹

In summary, the WCA report noted that probable sources of PFAS in composts were paper-based food contact materials, including baking papers, beverage cups, coffee filters, food paper bags, food paper boxes, food paper wrappers, milk bottles with concentrations being significantly greater in microwave bags and paper tableware. The most probable sources of PBDEs in composts were food of animal origin, house dust and possibly engineered timbers mistaken for wood wastes.

A follow-up survey was conducted with all the facilities that were part of this study to gather information on the observed presence and frequency with which some of the potential sources of PFAS and PBDEs were encountered in the feedstock. See Section 5.

PFAS sources

PFAS is used in paper products to make them oil and water resistant (and therefore suitable for food contact materials).

The WCA report showed that the probable sources of PFAS in FOGO composts are paper-based food contact materials used as food and beverage containers. Considerable quantities of PFAS have been found in older (pre-2010) and (some) recycled paper materials used in food and beverage containers. PFAS chemicals may have been added to paper-based packaging materials unintentionally, the source being residues from recycled fibre and paperboard used in manufacturing new products.

²¹ WCA 2021, Brief literature review of potential sources of PFAS and PBDEs in food organics and garden organics composts, final report to NSW EPA August 2021. (Available on the EPA website.)

The report included discussion of international studies where food materials and yard (garden) waste were assessed as potential sources of PFAS. Trees and shrubs tended to have maximum concentrations of PFAS chemicals that were greater than those of food sources (fish, seafood, eggs and vegetables) but lower than those of paper-based food contact materials. Other studies have found that composts with and without paper-based food contact materials in their feedstocks differ in PFAS content by an order of magnitude, especially in their content of short-chain compounds (those with six or fewer carbons perfluorinated).

Non-stick cookware and utensils are an unlikely source of PFAS.²² The international literature showed that PFAS were only released on the first use of the materials, not repeated use, and it did not matter which cooking oils or methods were used.

A comparison between the maximum concentrations of PFOS, PFHxS, PFOA and PFHxA from the NSW EPA FOGO samples with similar organic materials internationally showed the values found in NSW to be two orders of magnitude lower.

A report released by the Australian Packaging Covenant Organisation (APCO) identified the presence of PFAS in a various fibre-based, food contact packaging used in Australia.²³ PFAS is added to food packaging material as a barrier to heat, grease and water. The APCO report further supports the findings of the study on the identified potential sources of PFAS in composts.

The US EPA report *Emerging Issues in Food Waste Management, Persistent Chemical Contaminates* (released in August 2021) also demonstrates the presence of PFAS in food contact packaging and composts produced from food waste.²⁴

PBDE sources

The WCA report identified that the potential sources of PBDEs in composts were house dust, food of animal origin, accidentally included engineered timbers, and possibly other unknown sources.

Household dust derived from furniture, textiles and electronic devices is an acknowledged source of PBDEs. It is possible that this is a source of some of the PDBE concentrations measured in compost from FOGO and GO facilities.

PBDEs bioaccumulate in the fatty tissues of animals and are expected to be to present in fatty foods of animal origin. It is anticipated these will be present in food waste inputs into composts. However, food itself is unlikely to be the primary source of the concentrations of PBDEs observed in FOGO and GO composts.

Further information obtained from facilities was that many councils encourage the inclusion of household vacuum dust into FOGO bins. PBDE concentrations were higher in FOGO composts than GO composts when the one GO facility with exceptionally high PBDE concentrations was omitted from the dataset. However, the concentrations of PBDEs in GO indicate an unknown source.

The WCA report noted that the FOGO samples from the NSW dataset contain considerably higher concentrations of PBDEs than the GO samples, approximately 10 times higher (excluding the samples from the one GO facility that had unusually high PBDEs). This indicates that there is a source of PBDEs in the FOGO that is not present in the GO. The initial thought – that this was

²² Choi H, Bae IA, Choi JC, Park SJ & Kim MK 2018, Perfluorinated compounds in food simulants after migration from fluorocarbon resin-coated frying pans, baking utensils and non-stick baking papers on the Korean market, *Food Additives and Contaminants: Part B*, https://doi.org/10.1080/19393210.2018.1499677

²³ APCO 2022a (version 2 November 2022), *PFAS in fibre-based packaging*,

https://documents.packagingcovenant.org.au/public-documents/PFAS+in+Fibre-Based+Packaging

 $^{^{24}\} https://www.epa.gov/system/files/documents/2021-08/emerging-issues-in-food-waste-management-persistent-chemical-contaminants.pdf$

likely to be the food waste itself – was reconsidered with the available evidence of very low concentrations of PBDEs detected in the dehydrated food waste. The PBDE concentrations in the NSW FOGO are much higher than those previously reported in food samples from Australia and around the world, i.e. FOGO contains ~40 ug/kg total PBDEs, whereas even the most contaminated foodstuffs such as meat and fish generally contains PBDE concentrations about two orders of magnitude lower, typically ≤0.4 ug/kg. Partial dehydration during composting could result in an increase in concentration in comparison to wet-weight food but this does not explain the levels of PBDEs measured in FOGO-derived compost.

A recent review of studies relating to the US population concluded dietary exposure did not explain the current PDBE body burdens, and exposure to house dust was estimated to account for 82% of the overall estimated intake (from FSANZ 2007).²⁵ The WCA report surmises that dust from residential properties, and possibly also from dust generated in the FOGO and GO processing facilities, may be contributing the bulk of the measured PBDEs; however, this requires further investigation before it can be accepted as an explanation for the elevated PBDE concentrations determined in FOGO-derived compost.

The WCA report also noted that PBDE concentrations in GO-derived composts are an order of magnitude higher than those observed in food surveys, despite the lack of lipid-rich material (e.g. fatty foods) or potential input of PBDE-containing dust in GO. This suggests that there may be a currently unexplained source of PBDEs or a contribution from the processing facilities that could serve as a source of PBDEs in both GO- and FOGO-derived composts. The compost from the GO facility with the extremely high levels of PBDEs is likely to have been from a source material such as engineered wood composite that may have been accidentally added to the garden organics.

Facility-reported observations

Follow-up surveys were conducted with all the sampled facilities to gather information on the observed presence and frequency with which some of the potential sources of PFAS and PBDEs were encountered in the feedstock (see Section 5). These responses are self-reported observations from staff experiences from the sites sampled and were requested several months after the sampling events took place. It provides a general indication of likely sources in the feedstock and is not a reporting of the contaminants that may have been present in the feedstock of composts that were sampled as part of this study.

With respect to potential PFAS sources, fibre-based food contact materials or other paper products, food packaging, paper towels, cardboard and office paper were reported to be received more frequently by more of the facilities receiving FOGO feedstocks compared to GO feedstocks. Except for office paper, all the other paper-based products were still reported as being frequently present at most of the GO facilities surveyed.

For potential PBDE sources, dust was reported as a frequent input in FOGO but infrequently for GO facilities. As expected, meat was reported as a highly regular input at FOGO facilities and mostly as infrequent or never in GO feedstocks.

Hard and soft plastics were reported as received with every load or weekly at both FOGO and GO facilities.

2.8. Other chemicals not found in any samples

The following chemical groups/chemicals were not detected in FOGO, GO or ORDU wastes:

organophosphate pesticides (OPPs)

²⁵ Food Standards Australia New Zealand (FSANZ) 2007, *Polybrominated diphenyl ethers in food in Australia*, https://www.foodstandards.gov.au/science/surveillance/pages/fsanzstudyofbrominat4997.aspx, accessed July 2021

- multi-residue pesticides (a mix of 38 herbicides, insecticides and fungicides)
- glufosinate (a herbicide related to glyphosate)
- polycyclic aromatic hydrocarbons (PAHs)
- bisphenol A (used to make polycarbonate plastics)
- triclosan (used in soaps and some kitchenware).

Organophosphate pesticides are a group of manufactured chemicals that poison insects and mammals. They are used in agriculture, the home, gardens, and veterinary practice.

A multi-residue method using liquid chromatography and mass spectrometry (LC-MS) was used to test for a mix of 38 pesticides including herbicides, insecticides and fungicides. A full list of these pesticides is in the study's data (separate document).

Glufosinate was not detected in any sample. It is a herbicide similar to glyphosate which was detected is some samples.

PAHs occur naturally in coal, crude oil and their products. They are also produced when fossil fuels, wood and tobacco are burned.

Bisphenol A (BPA) is used to make polycarbonate plastics and is found in various products including water bottles, lining of metal food cans, bottle tops and waste supply pipes.

Triclosan is an antibacterial and antifungal agent used in some kitchenware such as cutting boards and ice-cream scoops, and in soaps, toothpaste, cosmetics and deodorants.

3. Physical contaminants findings

Both the Compost Order 2016 and AS4454 require testing for the physical contaminants of glass, metal, and rigid and flexible plastics. The analysis is based on the amount of glass, metal and rigid plastics retained on a > 2 mm sieve (the allowable maximum is 0.5% dry weight) and the amount of light, flexible or film plastics retained on a > 5 mm sieve (the allowable maximum is 0.05% dry weight).

All FOGO and GO facilities complied with the glass, metal and rigid plastics > 2 mm limit set in the *Compost Order 2016*, while all but two facilities (one FOGO and one GO facility) complied with the plastics – light, flexible or film > 5 mm test in the *Compost Order 2016*. One ORDU also exceeded the light plastic maximum concentrations. Physical contamination is not permitted in the outputs of ORDU units.

Figure 4 and Figure 5 show photographs of two FOGO compost samples and the anthropogenic physical contaminants identified within them. The compost sample shown in Figure 4 did not exceed either of the two physical contaminant limits set in the *Compost Order 2016* but had a high number of visible plastic pieces within it. The compost sample in Figure 5 exceeded the limit for light, flexible or film plastics but contained less visible plastic than the compost in Figure 4.

These anomalies are possible as this test relies on measuring the gravimetric weight of plastic material retained on a sieve, rather than the number of individual plastic pieces present, which can lead to compliant compost containing more pieces of lightweight plastic film than may be desirable. Other methods to test plastics impurities in waste material are emerging and are discussed at the end of this section.

Reducing plastic in composts remains a key problem for operators and impacts the quality of composts produced.

Figure 4 Photographs of a 2 kg FOGO compost sample and the physical contaminants identified within it

The sample was compliant with all physical contaminant limits set in the *Compost Order 2016*. It reported 0.2% for glass, metal and rigid plastics > 2mm (limit set is 0.5%) and 0.05% for 'plastics – light, flexible or film > 5mm' (limit set is 0.05%). The photos are sourced from the commercial laboratory commissioned by the EPA to conduct physical contaminant testing.



Figure 5 Photographs of a 2 kg FOGO compost sample and the physical contaminants identified within it

This sample was compliant with the glass, metal and rigid plastics limit of 0.5% set in the *Compost Order 2016* (result = 0.1%), but exceeded the 'plastics – light, flexible or film' limit of 0.05% (result = 0.07%). The photos are sourced from the commercial laboratory commissioned by the EPA to conduct physical contaminant testing.



The physical contaminant tests in AS4454 and the Compost Order 2016 both focus on fractions greater than 2 mm for glass, metal and rigid plastics, and greater than 5 mm for plastics – light, flexible or film. Currently there are no established methods to analyse the fraction less than 2 mm and address the knowledge gap on potential microplastic contamination in compost.

Method development is under way in several specialist science institutions nationally and internationally. New methods to measure plastic contamination in waste material could address the challenges of gravimetric determination of lightweight materials (such as estimating the total surface area of plastic in a material).²⁶ Pyrolysis gas chromatography mass spectrometry (pyrolysis-(GCMS)) is an emerging technique for quantifying the total mass and type of plastic (irrespective of size).²⁷

4. Microbiological findings

4.1. Microbial organisms analysed

Microbiological testing for this study included the microbiological tests required under the Compost Order 2016 but was broadened beyond any current regulatory requirements in NSW or

²⁶ Kehres B & Thelen-Jüngling M 2006, Methodenbuch zur Analyse organischer Düngemittel, Bodenverbesserungsmittel und Substrate, Bundesgütegemeinschaft Kompost e.V., Köln

²⁷ Okoffo ED, Ribeiro F, O'Brien JW, O'Brien S, Tscharke BJ, Gallen M, Samanipour S, Mueller JF & Thomas KV 2020, Identification and quantification of selected plastics in biosolids by pressurized liquid extraction combined with doubleshot pyrolysis gas chromatography–mass spectrometry, *Science of the Total Environment*, 715, 136924

internationally. As food waste is a key input in most of the samples collected, pathogen risks are potentially different to those present in GO alone. The study sought to gather more information to assess whether there were any potential risks relevant to human health.

The study included additional tests for viruses, helminths (parasitic intestinal worms), sporeforming bacteria (*Bacillus cereus* and *Clostridium perfringens*, both known as food-poisoning risks), *Legionella spp.* (known to be a risk with compost) and *Campylobacter spp.* (a known foodpoisoning risk).

The viruses analysed in this study (adenovirus, enterovirus and reovirus) represent a range of virus families that are relevant to human health. In addition, adenoviruses are sufficiently persistent and infectious to humans that they can also be used as a 'reference pathogen' for other enteric viruses. Adenoviruses cause a wide variety of illnesses in humans including eye infections, respiratory infections and diarrhoea.²⁸

The ova of helminths (e.g. of the genera *Ascaris* and *Taenia*) and bacterial spores (e.g. *Bacillus cereus* and *Clostridium perfringens*) are very resistant to high temperatures and other environmental conditions (e.g. UV radiation and desiccation), and can survive for years once formed.

Grab (discrete) samples were taken for microbiological analyses from the same FOGO, GO and ORDU sites sampled in the study (see Section 1.2). Two replicate grab samples were collected during the 2019 sampling round and three replicates during the 2020–21 round. Grab samples were taken at surface (up to 30 cm below surface) and at depth (approximately 60 cm below surface). Table 8 lists the microorganisms analysed.

Group	Microorganism	Unit of measurement	
Bacteria	Salmonella spp. ¹	Present or absent /25g	
	Thermotolerant coliforms ¹	MPN/g	
	Escherichia coli ¹	MPN/g	
	Clostridium perfringens	CFU/g	
	Bacillus cereus	CFU/g	
	Campylobacter spp.	CFU/g	
	Legionella not L.pneumophila	CFU/mL	
	Legionella pneumophila SG1	CFU/mL	
	Legionella pneumophila SG2-15	CFU/mL	
	Total Legionella count	CFU/mL	
Helminths	<i>Taenia</i> sp. ova (eggs)	/40 g ⁴	
	<i>Ascaris</i> sp. ova (eggs)	/40 g ⁴	
Viruses	Enteroviruses ²	/40 g ⁴	
	Adenoviruses ²	/40 g ⁴	
	Reoviruses ²	/40 g ⁴	
	Noroviruses ³	/10 g	

Table 8 Bacteria, helminths and viruses analysed in FOGO and GO composts and dehydrated food wastes

²⁸ NSW Department of Planning and Environment, January 2023, *Quantitative microbial risk assessment of adenovirus* and Ascaris in FOGO and GO composts, page 4. (Available on the EPA website.)

Notes

1. Required to be tested under the NSW Compost Order 2016.

2. Viable counts

3. Noroviruses were analysed by PCR tests and were not detected in FOGO samples in the 2019 round. Samples collected in 2020–21 were not tested for norovirus.

4. Units for samples tested in 2019 were /20 g, and for samples tested in 2020-21, /40 g.

4.2. Microbiological findings

Microorganisms that were detected and not detected in the sampling rounds of both 2019 and 2020–21 are listed in Table 9.

Table 9 Microorganisms detected and not detected in FOGO and GO composts and dehydrated food wastes from sampling events in 2019 and 2020–21

Detected	Not detected
Thermotolerant coliforms ¹	Salmonella spp. ¹
Escherichia coli ¹	Campylobacter spp.
Clostridium perfringens	<i>Legionella</i> spp.
Bacillus cereus	Reoviruses
<i>Taenia</i> spp. ova (eggs)	Noroviruses ²
Ascaris spp. ova (eggs)	
Enteroviruses	
Adenoviruses	

Notes

1. Required to be tested under the NSW Compost Order 2016.

2. Only tested during 2019 sampling round

The Compost Order 2016 requires three microorganisms – *Salmonella* spp., *Escherichia coli* (*E. coli*) and thermotolerant (faecal) coliforms – to be tested for in final composts ready for supply. It sets maximum upper limits of non-detected (*Salmonella* spp.), 100 MPN/g (*E. coli*) and 1000 MPN/g (thermotolerant (faecal) coliforms).

Of the 10 FOGO facilities sampled for the study in the June 2019 round, six were tested for compliance against the microbiological parameters set out in the *Compost Order 2016* and all 18 composting facilities were tested during the 2020–21 round. The combined results from all the facilities tested showed that none of the facilities had a positive detection for *Salmonella* spp. and none exceeded the upper limits for *E. coli*. However, three of the facilities sampled during 2019 exceeded thermotolerant (faecal) coliform limits and all were compliant in the 2020–21 round.²⁹ Detection of thermotolerant coliforms, above the 1000 MPN/g limit as set in the *Compost Order 2016* serves as an indicator of the likely presence of other bacterial pathogens that may have survived the pasteurisation process.

The pathogen testing requirements for the outputs from ORDUs differ from those specified by the *Compost Order 2016*. The resource recovery orders for ORDUs require that *Salmonella* spp., *E. coli, Clostridium perfringens* and *Bacillus cereus* are all absent at the limit of reporting if the outputs are to be directly applied to land. Two of the three units tested were compliant, with one unit exceeding the limit for *Bacillus cereus*.

²⁹ The method used by the commissioned laboratory for the detection of thermotolerant coliforms in 2019 was an in-house modification of AS5013.15 (2006) for *Escherichia coli*.
While most composting facilities over the two sampling rounds complied with the microbiological limits set in the *Compost Order 2016*, other pathogens from the suite tested were detected in both sampling rounds in FOGO composts, and were also detected in GO and ORDU samples that were added for the second round of the study.

The general findings from the microbiological analyses were as follows.

Bacteria

Bacterial pathogens and bacterial indicators, including *Clostridium perfringens*, *Bacillus cereus*, thermotolerant coliforms and *E. coli*, were detected in compost (FOGO and GO) and – infrequently – in dehydrated food-waste organics. The bacteria *Salmonella* spp., *Campylobacter* spp. and *Legionella* spp. were not detected in any sample.

Helminths

Helminth ova (intestinal worms), of the genera *Taenia* and *Ascaris*, were frequently detected in both composts (FOGO and GO) and dehydrated food wastes. Helminth ova are stable structures that persist in the environment.

Viruses

Viruses, including enteroviruses and adenoviruses, were detected in compost (FOGO and GO) but not in dehydrated food-waste organics. Reoviruses were not detected in any sample collected for this study in 2020–21. Noroviruses were not detected in FOGO samples from the 2019 round and analysis for this virus was not done for samples collected in 2020–21.

Most of the microorganisms detected were the more resistant groups of spore-forming bacteria (*Bacillus cereus* and *Clostridium perfringens*), adenovirus, enterovirus, and helminth ova of the genera *Taenia* and *Ascaris*. **Table 10** gives numbers of facilities that had positive detections for these organisms.

Microorganisms		FOGO ² (n=6–10)	FOGO ³ (n=13)	GO ³ (n=5)	ORDU ³ (n=3)
Bacteria	Bacillus cereus ¹	1	7	3	1
	Clostridium perfringens ¹	1	2	2	0
Helminths	<i>Taenia</i> spp. ova (eggs)	10	11	5	2
	<i>Ascaris</i> spp. ova (eggs)	4	3	2	0
Viruses	Adenoviruses	4	7	4	0
	Enteroviruses	1	2	2	0

Table 10 Number of facilities that had positive detections of microorganisms less commonly analysed in recovered organic wastes

Notes

1. Bacteria that form spores which are extremely adept at surviving in the environment for years.

2. Ten FOGO facilities were sampled and tested in 2019. Bacteria were sampled and tested at six facilities, while helminths and viruses were tested at ten facilities.

3. Thirteen FOGO facilities, five GO facilities and three ORDU units were sampled and tested in 2020-21.

4.3. Quantitative microbial risk assessments

Quantitative microbial risk assessment (QMRA) modelling was developed by DPE–C&R to enable consideration of the pathogens analysed in the compost samples for potential risk to human health. This is novel science and is based on internationally accepted QMRA methodology developed as an assessment framework for the water industry. The QMRA was developed for adenoviruses and ova from the helminth *Ascaris*.³⁰ While the helminth *Taenia* was more frequently detected than *Ascaris* in FOGO and GO composts and ORDU outputs, currently there is insufficient scientific literature to enable the development of a QMRA.

QMRAs use data derived from epidemiology to determine the dose-response relationship for each microbial pathogen. Importantly, there is a probability of infection at any dose, as each single organism has the potential to initiate infection. The 'single hit' theory is adopted within current QMRA methodology, replacing a historical assumption that an 'infectious dose' is required for infection to occur.

The probability of infection is combined with the probability of becoming ill as a result of infection. For each pathogen, there is a range of illness outcomes varying in severity and duration. These illness outcomes are characterised within QMRA, and compared with a health-based target. The disability adjusted life year (DALY) is used as the health-based metric to weigh illness outcomes in QMRAs. The DALY is a measure of population health: it incorporates the different severities and durations associated with various illnesses for that fraction of the population made ill due to infection. A disease burden of 1 DALY per million people per year is an established target known as one micro-DALY or 1 μ DALY, representing a level of disease burden in the community that does not pose an unacceptable risk to human health. A disease burden greater than 1 μ DALY indicates a potential unacceptable risk to human health, requiring further consideration and investigation. Further information about the QMRA methodology is provided in the QMRA report.³¹

³⁰ NSW Department of Planning and Environment, January 2023, *Quantitative microbial risk assessment of adenovirus and* Ascaris *in FOGO and GO composts*. (Available on the EPA website.)

³¹ NSW Department of Planning and Environment, January 2023, *Quantitative microbial risk assessment of adenovirus and Ascaris in FOGO and GO composts.* (Available on the EPA website.)

Five exposure scenarios were developed for the microbial risk assessment (Table 11) with pathways for exposure being through the ingestion of pathogens from hands after handling compost and consumption of unwashed food crops that have been in contact with compost.

Three scenarios representing residential use of composts were:

- 1. surface incorporation by hand trowel in the domestic garden for growing plants, with exposure via ingestion
- 2. surface incorporation by hand trowel in the domestic garden for growing home garden crops, with exposure from ingestion and consumption of unwashed crops
- 3. home potting (in pots) using undiluted compost, with exposure from ingestion.

Two scenarios representing agricultural use were:

- 4. field incorporated compost to 10 cm depth, with exposures to farmworkers by ingestion
- 5. field incorporated compost to 10 cm depth, with exposures to public consumers by ingestion of unwashed vegetables.

Risks to human health were modelled for both adults and children in all scenarios, except for the exposure to farmworkers in scenario 4: it was assumed that full-time farmworkers are adults.

Unlike the chemical risk assessments undertaken in this study, exposure through consumption of eggs, milk or meat was not considered in the QMRA and only direct exposure scenarios were assessed. These scenarios also do not include specific consideration of the use of preventative measures such as wearing gloves and masks, or washing hands after using composts.

Table 11 summarises the results from the QMRA. For adenovirus there is a probability of exceeding the health-based target through the use of FOGO and GO composts in all scenarios. For *Ascaris* ova the probability of exceeding the health-based target were through the use of FOGO and GO composts in home gardens used to grow garden crops (scenario 2), potting plants (scenario 3). In agricultural settings the probability of exceeding the health-based target for *Ascaris* ova was for farmworkers through the use of FOGO composts (scenario 4).

The QMRA concludes that there is a potential risk of harm to human health from microbial pathogens in the sampled FOGO and GO composts, primarily due to the levels of adenovirus detected, with a minor contribution from *Ascaris* ova.

The exposure scenarios did not specifically consider the use of gloves, masks and hand washing. Practising good hygiene when using composts would be expected to reduce the risks identified. Good hygiene practice is already recommended for the use of bagged compost and should be followed whenever handling composts or dehydrated food wastes.

Location	Modelled exposure scenario	Human receptor(s) (pathways)	Probability of exceeding health-based target of 1 µDALY for adenoviruses
Home gardens	Plants Surface-incorporated ¹ (hand tilling)	Resident (hands \rightarrow ingestion)	High (38–95%)
	Home garden crops Surface-incorporated ¹ (hand tilling)	Resident (hands \rightarrow ingestion and unwashed vegetables \rightarrow ingestion)	High (76–99%)
	Potted plants (compost only)	Resident (hands \rightarrow ingestion)	High (88–99%)
Agriculture	Crops Field-incorporated ² (10 cm depth)	Farmworkers³ (hands → ingestion)	High (87–98%)
		Public consumers (unwashed vegetables \rightarrow ingestion)	Low to high (1–57%)

Table 11 Pathogen exposure scenarios modelled for human-health risk assessment with results of QMRA – adenoviruses

 Table 12
 Pathogen exposure scenarios modelled for human-health risk assessment with results of QMRA – Ascaris ova

Location	Modelled exposure scenario	Human receptor(s) (pathways)	Probability of exceeding health-based target of 1 µDALY for <i>Ascaris</i> ova
Home gardens	Plants Surface-incorporated ¹ (hand tilling)	Resident (hands \rightarrow ingestion)	Meets health-based target (0%)
	Home garden crops Surface-incorporated ¹ (hand tilling)	Resident (hands → ingestion <i>and</i> unwashed vegetables → ingestion)	Low (0–0.8%)
	Potted plants (compost only)	Resident (hands \rightarrow ingestion)	Low (0.1–14%)
Agriculture	Crops Field-incorporated ² (10 cm depth)	Farmworkers³ (hands → ingestion)	Low (0–4.2%)
		Public consumers (unwashed vegetables \rightarrow ingestion)	Meets health-based target (0%)

Notes

1. 'Surface incorporated' represents home garden tilling by hand, using garden tools such as hand trowels.

'Field incorporated' represents commercial agricultural practices of incorporation using farm machinery.
 For commercial agriculture it is reasonable to assume that only adult farmworkers would be exposed (i.e. exposure was not modelled for children).

The finding for adenoviruses is surprising, as adenoviruses are human pathogens of faecal origin and so would not be expected to routinely be in the source material accepted by facilities to make

either FOGO or GO compost. None of the facilities sampled accepted biosolids. The contracted laboratory undertook additional analyses and established that the source was not from food or garden organics, but was of human origin.³².

Follow-up investigation into materials-handling processes and operations at the facilities sampled has not revealed obvious sources, and further work is required.

The microbiological data shows that pathogens were detected in FOGO and GO composts and in dehydrated food wastes. It is unclear if the pathogens have survived the pasteurisation process or whether they have been introduced at a later stage of the process, after pasteurisation. Unlike bacteria, viruses and helminth ova cannot multiply outside a host, so the number of viruses or ova would not be expected to increase during the composting process.

³² NSW Department of Planning and Environment, January 2023, *Quantitative microbial risk assessment of adenovirus* and Ascaris in FOGO and GO composts. (Available on the EPA website.)

5. Post-sampling survey

5.1. Discussions with facilities

The EPA met with each facility included in the study to present an overview of the preliminary findings, to ask about contaminants the facilities saw in their feedstock, and to gather more detail of the facilities' operational practices. This information was used to develop a survey that was sent to the facilities soon after the meetings. The survey sought information about: the sources and frequency of potential chemical and microbiological contaminants, potential cross-contamination opportunities at the sites, monitoring and testing for the processes undertaken, and the main destination of the compost generated.

5.2. Sources of contamination reported by facilities

Contaminant types in feedstock

The responses received were observations based on memory, or were impressions of the types of contaminates received, that provide an indication of feedstock composition. They should not be taken as quantitative estimates of contaminant types.

FOGO facilities reported receiving more contaminant types that are potential sources of PFAS (fibre-based food contact materials in particular) and PBDE (fatty meat, vacuum dust, engineered timbers) than GO facilities. **Figure 6** presents the responses for all types of contaminants observed in feedstocks by both FOGO and GO facilities.

Potential PFAS sources – fibre-based food contact materials or other paper products, food packaging, paper towels, cardboard and office paper – were reported by more of the facilities receiving FOGO feedstocks than by facilities receiving GO feedstocks. However, most of the GO facilities still reported that paper-based products other than office paper were frequently present.

Among potential PBDE sources, dust was reported as a frequent input for FOGO but an infrequent one for GO. As expected, meat was reported as a very frequent input for FOGO but a mostly infrequent or non-existent one for GO.

Hard and soft plastics were reported as received with every load or weekly at both FOGO and GO facilities.

Further investigation showed that in an effort to minimise waste entering landfill and increase the recovery of organically derived materials, many councils that supplied the FOGO in this study, as well as some facilities themselves, encouraged putting a wide range of wastes into FOGO bins. These wastes included kitchen paper wastes, pizza boxes and other cardboards, compostable food packaging, pet waste, vacuum dust, dryer lint and human/pet hair. Many organically derived products have chemicals that may become contaminants in compost. The inclusion of these additional products has likely led to the contamination of FOGO composts with chemicals such as PFAS and PDES, and some of the microorganisms detected in this study.



Figure 6 Responses from FOGO and GO composting facilities on observed waste types and frequencies of appearance in incoming feedstocks

Potential pathogen sources

The survey included questions on possible sources of pathogens that may be accidentally introduced to the operational site. These included proximity to operations that may use biosolids, position of toilets at the site, observations of nappies or pet waste in feedstock, sources of water used to irrigate composts, and whether on-site machinery or delivery trucks may be used for other purposes and so introduce pathogens to the site. The information from discussions with facilities and the responses to the survey was inconclusive and further work is needed to explore this issue.

5.3. Time and temperature data

Very few of the facilities sampled kept records of the time and temperature conditions of their processes, meaning the processes could not be analysed and compared with the pathogen data found at each facility. As part of the measures to support sustainable composting, the EPA has started reviewing pasteurisation practices, to ensure pasteurisation is achieved consistently in NSW.

5.4. Land-use application

The facilities were asked who their main customers were for their compost. The most-reported consumers for both FOGO and GO facilities were landscape suppliers, followed by councils and then farmers. Mine rehabilitation and roadside maintenance or construction were the least-nominated end uses.

This data supports findings in the *NSW Organics Market Analysis 2020*, commissioned by the EPA.³³ The study showed that most compost (68%) was being used in the urban amenity market. The agriculture sector is the second-largest market, with growth accelerating. The mandated separation of FOGO will lead to an increase in the supply of recovered organics for land application, with demand for land application in agriculture and other markets expected to increase in line with supply.

³³ NSW EPA 2020, NSW Organics Market Analysis 2020. (Available on the EPA website.)

6. Conclusions and recommendations

Conclusions

This study explored the composition of compost derived from food and garden organics beyond what is normally required, to ensure that future regulatory settings support the establishment of a sustainable recovered organics industry in NSW. It has provided insights and learnings that are novel in both Australia and internationally.

The study found that both FOGO and GO composts contain a number of chemical contaminants that are not currently regulated in NSW or most other Australian jurisdictions. These include PFAS and PBDE chemicals, which are probably due to 'organically derived' materials being innocently placed in FOGO and GO kerbside bins. The potential sources of PFAS are fibre-based food contact materials, such as baking papers, paper bags and wrappers for food, beverage cups, coffee filters, and paper tableware such as serviettes. The most likely sources of PBDEs are house dust derived from furniture, textiles and electric devices, and engineered timber mistaken for wood waste.

Microbiological findings included the frequent detection of viruses and helminth eggs in FOGO and GO composts and, less frequently, spore-forming bacteria. It is unclear whether the detected pathogens have survived the pasteurisation process or whether they are introduced at a later stage of composting. Helminths and spore-forming bacteria were also detected in ORDU outputs.

Recommendations

The EPA will use tools and approaches from its regulatory strategy to address the study's findings. Some steps have already been taken. Recommendations to support sustainable composting in NSW target every point along the compost chain, from collection and preparation of materials for processing to treatment and verification of the final compost's quality.

To improve controls on inputs and initial processing to reduce the likely sources of physical and chemical contaminants

- 1. Place only food and garden wastes in FOGO bins, the sole exception being fibre or compostable-plastic kitchen caddy liners. The aim is that feedstocks for composting are as contaminant-free as possible from the point of collection, from both domestic and commercial sources. The EPA took action on this step by releasing its position statement on the matter in July 2022.
- Focus on removing physical contaminants from feedstocks before composting begins. Many facilities shred feedstocks and try to remove contaminants at the end of the process. Potential physical contaminants, and the chemicals associated with them, are more difficult to remove once they are mixed throughout a compost.

To improve process monitoring and record keeping, to manage pathogens

- 3. Monitor processing practices better and improve record keeping. This will help show why pathogens have been detected in composts and how to remove or reduce them.
- 4. Verify pasteurisation procedures. This will help show if pathogens are inactivated during pasteurisation and if they are accidentally being added at a later stage of the composting process.
- 5. Encourage good hygiene practices when handling composts. This will minimise health risks from pathogens.

To consider amendments that may be appropriate for current monitoring requirements for final composts

- 6. In due course, review and update where necessary statutory instruments and guidelines such as the *Compost Order 2016* and Composting Guidelines.
- 7. In future, possibly monitor final composts for pathogens and key chemicals found in the study.

The EPA's final regulatory approach will take into account the study's findings and also align with the recommendations of the Resource Recovery Framework and works initiated at the national level, such as the National Chemicals Regulatory Framework (e.g. PFAS NEMP 3.0). Furthermore, the EPA will share its learning and seek national consistency on best practices in the area of recovered organics.

The EPA is committed to maintaining a learning mindset, and to listening and actively engaging with people to understand the issues affecting them. We will continue to consult with the industry, councils, businesses and the community to ensure that the recovery of valuable food resources is sustainable.