The carbon constrained future and organic waste: a review of Federal legislation and policy setting with respect to Zero Waste SA goals.

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Report no: ZWSA200901 Date: 30th April 2009

Acknowledgements
A draft version of this report was reviewed by Zero Waste SA staff (Vaughn Levitske, John Blumson, Jessica Wundke and Angus Mitchell). Their review comments greatly improved the quality of the report.

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Executive Summary

This report presents the findings of a review into the existing and proposed legislation in Australia looking to reduce greenhouse gas emissions, and the implications of the legislation for the organic waste processing industry.

The National Greenhouse & Energy Reporting Act (along with subordinate legislation and regulation, collective known as the NGERS) came into effect on the 1st July 2008, and has requirements for the reporting of emissions and energy consumption or production by facilities or organisations. The thresholds occur when a company has operational control of a facility (effectively a single physical address) that emits 25 kilotonnes or more of greenhouse gases (CO_2e), or produces or consumes 100 terrajoules or more of energy; or their corporate group emits 125 kilotonnes or more greenhouse gases (carbon dioxide equivalent, CO_2-e), or produces or consumes 500 terrajoules or more of energy in 2008/09. For the waste industry, this means that landfills that treat waste and create methane (through anaerobic conditions at the landfill) and capture and combust the methane may need to report emissions if they trigger these thresholds. At the time of writing, it is unclear whether or not compost facilities are required to report under the NGERS if they trigger the thresholds, owing to some ambiguity in the wording of the legislation. While many operators in the compost sector believe that there are no CO_2e emissions from aerobic treatment of compost, the Intergovernmental Panel on Climate Change (IPCC) reporting on building national greenhouse inventories, which is directly referred to by NGERS, does include emissions accounting procedures for biological treatment of solid waste, including from composting. These emissions are in the form of methane and nitrous oxide. One tonne of methane produces 21 tonnes CO_2-e, and one tonne of nitrous oxide produces 310 tonnes CO_2-e. Any carbon dioxide emissions from composting (e.g. through aerobic biologically driven decay) are regarded as biogenic emissions (i.e. coming from naturally occurring "current cycle" carbon based sources, rather than from fossil fuel based sources) and are not included in carbon accounting.

In a simple comparison of two different ways of treating organic waste, a landfill that has been receiving 100,000 tonnes of municipal solid waste over the last 10 years in SA would have an emissions reporting liability in 2010 of approximately of 17,500 tonnes CO_2-e, if it was able to capture and combust 4 million cubic metres of landfill gas production. This represents a landfill gas capture efficiency of approximately 50%. This figure was derived from NGER Method 1 for determining waste emissions from landfill operations. If the exposure draft Carbon Pollution Reduction Scheme discounting for historical or legacy emissions is applied, then the theoretical landfill would have no emissions liability in 2010. In comparison, and if the NGERS guidance for estimating emissions applies to compost operations, an aerobic compost facility receiving 100,000 tonnes of organic material would have an emission profile in the year of receiving the waste of 17,000 t CO_2e from waste processing alone (ignoring electricity and fossil fuel based emissions). This is currently below the NGERS reporting threshold, but may trigger new lower thresholds for the Carbon Pollution Reduction Scheme (CPRS) for emission reporting and trading if the compost facility is within an urban area. If facilities directly emit greenhouse gases over the 10,000 t CO_2e limit under the CPRS in the waste sector within urban areas, they are likely to have to buy and retire Australian Emission Units (AEUs, or permits to pollute) under the CPRS. Having an emission liability for compost or landfill operations under the CPRS will very likely lead to increased costs of waste treatment at those facilities with a liability.

The utilisation of the landfill gas (methane) for the production of renewable electricity into the grid leads to a reduction in greenhouse gas emissions elsewhere, by displacing non-renewable power in the grid. As the cost of carbon increases (thereby placing an ever increasing economic value on renewable energy production), it can be expected that we will see development of novel or new technologies for waste treatment, such as Alternative Waste Treatment (AWT) type technologies, where both renewable energy and compost are produced through waste treatment.

It is possible that the Federal Government in the future may recognise soil carbon sequestration and other emission reducing benefits of the application of compost to soils. Funding for $32 million has been provided for research into the capacity for soils to capture greenhouse gases through the Government's Climate Change Research Program. This would then lead to an increased valuation of the application of compost to agricultural soil. At present, none of the greenhouse accounting procedures deals with the value of compost in improving agricultural productivity for human consumption purposes. This is of important consideration for the broader compost sector: is the potential for the inclusion of a voluntary carbon offset standard for the biosequestration of organic carbon in soils (from repeated and ongoing addition of organic materials such as compost or biochar to soils). This could potentially add another revenue stream to make emission reducing activity more viable, as well as assisting to improve agricultural productivity in Australian low carbon soils

This report proposes that Zero Waste SA and the composting industry undertake to get a ruling from the Department of Climate Change (DCC) to the question: "*do aerobic composting facilities that are not landfills need to report greenhouse gas emissions under the NGERS?".* If the answer is negative, the definition of waste in the legislation should be revised to specifically exclude the composting sector. If however the sector is required to report greenhouse gas emissions, then a second question needs to be addressed: *"will the Department of Climate Change work with the compost industry to develop higher order methods of determining emissions from compost activities that will allow for more accurate emission estimates, as allowed by the IPCC and United Nations Framework Convention on Climate Change?".*

Subsequently, and to assist in determining more accurately the actual emission intensity of a variety of different ways to treat organic waste, it is proposed to undertake a detailed greenhouse gas lifecycle analysis. The lifecycle analysis should investigate the emissions occurring as a result of different methods of organic waste treatment, and include all emission causing activity from the point of disposal of the waste (e.g. from the curb side), transport to a sorting facility, treatment of residual waste streams, fugitive emissions from waste treatment, energy production from waste treatment by-product gases, and productive uses of the final products of waste treatment (long term burial, long term sequestration, ability to displace fertiliser production and utilisation). These life cycle assessments should be done on a comparative basis for a suite of different waste treatment pathways, to determine with some level of accuracy which waste treatment pathway will lead to the greatest overall relative emissions benefit.

1. Background

This document represents a review of existing policy in SA with respect to waste management, and its interactions with the legislation and policy approaches of the Federal Government with respect to emissions reduction.

Zero Waste SA (ZWSA), established by the *Zero Waste SA Act 2004*, provides strategic policy advice and direction to government and stakeholders, in addition to undertaking programs and projects that will maximise waste reduction and promote recycling and ecological sustainability. It enlists other stakeholders in partnerships to bring about change. ZWSA is the SA State Government agency with the lead responsibility for working towards the goal of reducing waste (of all forms) to landfill by 25% in 2014. This five-year strategy is focused on five key aims.

1. Foster sustainable behaviour: information alone doesn't influence people to recycle or re-use material and resources sustainably.
2. Redirect waste: by redirecting materials to more beneficial uses, substantially less waste will go to landfill.
3. Establish effective systems: South Australia must establish, maintain and increase the capacity of its recycling systems and re-processing infrastructure in metropolitan and regional areas.
4. Enact policies: introducing economic, regulatory and other policy measures will encourage avoidance, reduction, re-use and recycling of waste.
5. Encourage cooperation: our targets can only be reached with the participants' cooperation.

As part of its remit to achieve the specified reductions in waste being sent to landfill, reducing waste production, promoting recycling and "ecological sustainability", ZWSA's 2008-2009 Business Plan also identified the role waste has in being able to potentially reduce greenhouse gas emissions. Within the 2008-2009 Business Plan, there is a clear identification that the waste sector has a role to play in the SA State Government agenda to reduce greenhouse gas emissions, and ZWSA has been charged, in association with other agencies and industry partners, to work towards this goal.

Specifically in the plan, there are a series of projects identified as projects to reduce the impact of the waste sector on greenhouse gas production. These are identified specifically here:

Project 2.1.6 Carbon offset options *presents the proposal to investigate ways in which soil carbon sequestration may be able to offer an economic incentive through a market based instrument to increase the amount of material sent to compost and effectively reusing composted materials to improve agricultural productivity and lead to long term carbon sequestration.*

Program 2.3 Communication and Education *has been established to help the broader community as to how their activities may contribute to a reduction in greenhouse gas emissions and climate change by producing less waste.*

Project 2.3.2: Corporate communications, education and marketing (plastic bag phase out) *aims to provide information and engagement on recycling got the broader public as to the importance of recycling, and "using less" (reducing consumption rates to reduce wastage rates)*

will be complemented by further emphasis on linking consumption with waste and climate change.

Project 8.1.2: Industry – Resource Efficiency Assistance Program
This is a broad based education and training approach for both business and government understand, develop and implement cost saving resource efficiency measures and in doing so build capacity to deal with a range of rapidly emerging environmental, financial and social consequences. ZWSA will initially partner three government agencies operating as the Business Sustainability Alliance (BSA), Department of Trade and Economic Development, SA Water and the EPA, to deliver the REAP. BSA will be well positioned to provide the key competencies for REAP in the areas of waste, water, energy, lean manufacturing, construction, compliance, climate change, and sustainability.

From these plans and programs, it is clear that ZWSA has the corporate desire and focus to ensure that climate change and greenhouse gas production are components of its strategy. When these strategies are enacted should assist in meeting the SA State Strategic goal of reducing greenhouse gas emissions, through effective ZWSA engagement in the waste sector. It is also clear that ZWSA intends to create a linkage between climate change and personal and business activity in creating waste to be sent to landfill, rather than recycling, in line with the State Strategic Plan for Waste.

The primary purpose of this document and review is to examine the ZWSA focus on reducing waste production (with additional potential benefits of improving agricultural production and improving business efficiency), existing business models in the waste sector, and how the ZWSA focus and existing waste treatment models interacts with emerging legislation and policy at the Federal Government level which aims exclusively to reduce greenhouse gas emissions.

It should be noted that in line with the broader use of the word “carbon” as an analogue for the specific term greenhouse gases, including the 6 groups of gases referred to in the Kyoto Protocol (as in the “Carbon Pollution Reduction Scheme”), the terms “carbon” or “emissions” in this document refers to the act of emitting greenhouse gases, unless otherwise specifically stated otherwise.

2. Carbon management and waste management

The basic principles applied in both carbon and waste management are the “base rules” or hierarchies of preferred action or activity. The carbon and waste management principle are compared here to determine whether or not there are significant misalignments between the two concepts, or whether there are logical alignments between the two.

While there are no hard and fast or even widely accepted core principles of carbon management, we can apply the Victorian EPA (Victorian EPA, undated) carbon management approach to give a view of how organisations may manage their emissions:

1. Measure (requires the application of a specified standard or legislation for how to go about correctly measuring greenhouse gas emissions)
2. Set objectives (for emission reductions)
3. Avoid (can you avoid emission production?)
4. Reduce (modify, recover process to reduce emissions)
5. Switch (to renewable or lower emission energy sources)

6. Sequester (what options are available to sequester emissions?)
7. Assess
8. Offset

These carbon management principles will apply equally to an existing organisation as it would to the development of a business activity or business model that was seeking to create a credible, low emissions alternative replacement for a more emissions intensive business activity. We can compare these principles for carbon management with the principles of the waste management hierarchy, as utilised by ZWSA. The principles of the waste management are hierarchical, rather than the more "cyclical" approach applied in the Victorian EPA carbon management principles. In order of preference, the waste hierarchy is currently presented as:

1. Avoid
2. Reduce
3. Reuse
4. Recycle
5. Recover
6. Treatment
7. Disposal

A cursory examination of the two sets of principles does not indicate a clash or contrast of requirements. Indeed, elements of the waste management hierarchy (especially components such as avoid, reduce reuse, recycle and recover) all *may* have a net positive outcome of reducing greenhouse gas emissions over a good or product lifecycle. However, as with many issues associated with the developing carbon economy, the devil is in the detail of the specified (waste management) project activity, and whether or not it is able to significantly reduce greenhouse gas emissions across a reasonable appraisal of the project lifecycle.

2.1 Identification of organic waste stakeholders

In terms of the issues surrounding the treatment of organic waste and carbon, there are a range of stakeholders in South Australia that will have cause for consideration of this report. They include:

- Organic compost producers
- Landfill operators
- Landfill gas to power producers
- Local governments
- Zero Waste SA,

and to a lesser or more indirect extent:

- agricultural producers
- SA State Government agencies
- Federal regulator

3. New legislation and regulation

The focus of the Federal Government and the Department of Climate Change (DCC) is to reduce greenhouse gas emissions over the short and long term through legislative change, which will lead to the development of market based instruments. However, the market based and legislative instruments developed to reduce emissions are not going to have a requirement to ensure that other aspects of the physical environment, such as natural resource management or waste management are positively impacted. While other environmental

impacts of any carbon reducing activity may be given some consideration, the principle goal of new legislation, such as the proposed Carbon Pollution Reduction Scheme (CPRS) is to reduce emissions in Australia at the lowest economic cost. As such, it may be possible that perverse or unwanted outcomes may occur as a result of the scheme regulators myopic focus on carbon management without engagement with relevant stakeholders.

This being said, it has been acknowledged by both the DCC and interested parties in South Australia, such as the Local Government Association (SA LGA) in it's submission to the CPRS Green Paper, that the proposed CPRS may cause unwanted or perverse outcomes in the waste sector. This was highlighted by the issue associated with the proposal to reduce the threshold for reporting under the NGERS Act(s) and the CPRS to 10,000 tCO_2e for waste treatment facilities. The SA LGA provided the following response:

> "Therefore we propose that, to circumvent the potential urban-rural disparities in terms of scheme thresholds, and to maintain the advances in rural waste management practices, within urban growth boundaries the scheme threshold should be 10,000t CO_2e, while in areas outside of metropolitan urban growth boundaries, the scheme limit should be maintained at 25,000 tCO_2e."

The justification for this was that significant effort has been focussed in the last decade to create effective sanitary landfills and waste management centres in regional areas, and the reduction in the reporting (under NGERs) and trading (under CPRS) thresholds in regional areas would have threatened the approach of developing effective regional waste management centres. The CPRS White Paper (December 2008) reflected and recognised the issues raised by the SA LGA, and has proposed a 25,000 tCO_2e threshold for regional centres, and a 10,000 tCO_2e threshold for urban waste management facilities. These thresholds were again seen in the exposure draft of the Carbon Pollution Reduction Scheme legislation, released on 10th March 2009. This example indicates that the Department of Climate Change as the carbon regulator does recognise that stakeholder consultation and the capacity to vary proposed scheme arrangements is important to ensure unwanted or perverse outcomes do not occur in the waste management sector as a result of the focus on reducing emissions. This simple example serves to highlight the importance of interaction and consultation with the DCC as new legislation and regulations are being proposed and developed.

3.1 National Greenhouse and Energy Reporting Act 2007

The aim of the NGER Act (and supporting legislation, regulations and technical guidelines, collectively referred to in this document as the NGERS) is to ensure emission inventories are transparent, comparable, accurate, consistent and complete, to streamline processes for inventory building across Australia, and to assist the Federal Government with providing timely and accurate emissions reporting under its responsibilities under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. It is also intended to create an accounting framework on which emissions trading activity can be based upon in Australia.

3.2 Carbon Pollution Reduction Scheme (CPRS)

The NGERS and CPRS are linked but do not necessarily have the same implications for liable parties. NGERS has been established so that parties that emit or cause emissions to occur at the level of 25,000 tCO_2e per annum for facilities (or lower levels for urban waste treatment facilities) have the responsibility to report Scope 1 (direct, such as from landfills) and 2 (indirect,

such as from non-renewable energy consumption) emissions. However, the CPRS legislation is creating a trade in emission permits. Only parties that directly emit greenhouse gases at the level of 25,000 tCO_2e (or lower for urban waste treatment facilities) will be liable to surrender permits at the end of the accounting period equal to their direct emissions under the CPRS.

The CPRS White Paper was released in December 2008, with the exposure draft legislation for the CPRS released in March 2009. The proposed CPRS would effectively create the potential for national and international emissions trading, in line with other nations that have ratified the Kyoto Protocol. The proposal is to cover 70-75 % of greenhouse gas emissions in Australia, by imposing as few potential points of liability as possible. In the waste sector, the points of liability for emissions trading will be waste treatment facilities that trigger specified direct emission levels from a given facility.

With respect to issues of concern for ZWSA, the CPRS will introduce an added cost to waste facilities and processes that are deemed to be creating emissions as per the NGERS. Given ZWSA's preference for the biological treatment of solid waste, and diversion of organic materials away from landfill operations, then how the CPRS impacts landfill, compost and alternative waste treatment operations is the point of consideration. This report summarises the potential impact of the CPRS on the management of organic waste in SA.

4 New legislation and regulation impacts

4.1 Landfill Operators

The focus of this paper is not to review specific case studies, but to highlight potential issues regarding emissions reporting and trading in the waste sector. Regulators and policy makers will need to implement effective policies that lead to a net reduction in emissions, as well as achieve the highest value utilisation of resources in the waste stream.

In the case of landfill operations, there are a range of issues that have been raised with respect to the application of Methods 1, 2 and 3 under NGERs for estimating emissions. They have been raised through a series of submissions to DCC, and it is understood that the DCC has engaged directly with landfill operator groups to further discuss the issues regarding landfill and the NGERS.

To this end, it does not appear that the DCC is yet prepared to allow more types of methodologies to the existing three methods for estimating landfill gas emissions. The reason for this is not clear. However, it should be noted that the parent documentation for the NGERs (UNFCCC Guidance on National Greenhouse Gas Inventories) discusses the opportunity to use more accurate, state or site specific data where it is available, including more accurate data on degradable organic content, or methane generating half life potential of waste in landfill.

Under the exposure draft of the CPRS legislation, the threshold for emissions trading in the waste sector (as a special case) is 10,000 tonnes CO_2e where the landfill is within the prescribed distance of another landfill facility that is open for the acceptance of waste, or 25,000 tonnes CO_2e in any other case. The prescribed distance will be determined in the regulations, but there is suggestion that this distance will be approximately 80km radius. Again, the legislation refers specifically to landfill operations, and it is not clear if this specification is meant to include other waste treatment facilities such as composting operations.

As composting is not in direct competition with landfill (for mixed waste), it should be exempt from the lower threshold in cases where in the facility is located within the prescribed distance.

The most pressing issue from a landfill operations perspective is how to charge for future emissions that will be occurring as a result of methane emissions released as a result of anaerobic decomposition of organic waste within a landfill. This again will be a function of the state the operation is in, the amount of waste in place at the time of reporting, the composition of that waste and the percentage of emissions that are captured and combusted (either in a flare or in a power generation plant). The relative permit liability cost of landfill at the time of waste acceptance will influence the attractiveness of other forms of waste treatment. A recent report in "Inside Waste" magazine by Hyder Consulting for the DCC presented a range of potential increases in gate fees required by landfill operators to cover future carbon permit liabilities from waste already in landfill at the start of the proposed CPRS scheme in 2010.

Using a simple assumption set (where a theoretical landfill opened in 1980, has been receiving 100,000 tonnes of waste per annum and applying the complex first order decay model Method 1 for determination of landfill gas emissions from the NGERS), the site would be expected to be producing approximately 62,000 tCO_2e in 2009. However, any landfill of that size would be required to have landfill gas management systems in place by the SA EPA licensing arrangements. If the site collected 4 million cubic metres of landfill gas at 50% methane during the reporting year (which assumes an approximate 50% landfill gas collection efficiency), then the site would be deemed to have a reportable emissions profile of 17,500tCO_2e. However, the draft CPRS legislation suggests that 100% of the legacy emissions from historical waste would be discounted, with an additional 50% of the emissions captured (flared, or for power generation) being discounted by the CPRS. In this case, the first year of permit liability would see the theoretical landfill with an emissions profile that is so low as to mean it would be unlikely to need to purchase permits in 2010.

If it was within urban growth boundaries, or within say 80km of another waste facility, then it is likely for this theoretical landfill site to have a liability under the CPRS. While some landfill operations claim better than 90% landfill gas capture, the NGERS legislation will effectively penalize those sites with proven very high collection efficiencies, and may actually present a case for proven highly effective landfill gas capture systems to be shut down by landfill operators once the predicted site gas capture exceeds 75% of the NGER predicted site gas generation.

The production of electricity by landfill gas (methane) to power operators would be required to be reported under the NGERS threshold of 100 terrajoules of energy. It will be up to each landfill gas power producer to determine whether or not the facilities they operate will trigger the electricity production reporting thresholds.

4.2 Composting operators

As with landfill, a similar set of issues associated emissions estimates under NGERS is apparent for compost facilities. This review has identified several issues with respect to the NGERs that are detailed here.

1. The National Greenhouse and Energy Reporting Regulations (2008) Regulation 4.17 pp 56 Greenhouse Gas Emissions – Waste Source specifically refer to solid waste disposal on land. Technically, composting activities do not represent "disposal", as the aim of composting is

to biologically transform the organic material to a more stable and pathogen free material that can be utilised elsewhere. The National Greenhouse and Energy Reporting (Measurement) Determination Chapter 5 Waste (pp162-173) refers to emissions related to solid waste disposal on land, and refers to the UNFCCC Category 6. Division 5.2.6 Biological treatment of solid waste, 5.22 Method 1- biological treatment of solid waste at the landfill method 1 (pp 173) refers to the 2006 IPCC Guidelines for National Greenhouse Inventories. The relevant section of the IPCC Guidelines (Volume 5) refers specifically to composting as such:

> "**Composting** is an aerobic process and a large fraction of the degradable organic carbon (DOC) in the waste material is converted into carbon dioxide (CO_2). (Methane) CH_4 is formed in anaerobic sections of the compost, but it is oxidised to a large extent in the aerobic sections of the compost. The estimated CH_4 released into the atmosphere ranges from less than 1 percent to a few per cent of the initial carbon content in the material (Beck-Friis, 2001;Detzel *et al*., 2003; Arnold, 2005)."

It needs to be noted that the IPCC guidelines also identify nitrous oxide emissions as an important source of greenhouse gas emissions from the composting process. The National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2008 v1.1 (October 2008) refers to the Measurement Determination at Division 5.2.6 "Biological treatment of solid waste; 5.22 Method 1 – *biological treatment of solid waste at the landfill*". Again, the reference seems to be explicit for landfill operations, rather than applying to compost operations.

From this, it is apparent that the UNFCCC requirements for reporting of waste processing, including from compost, are required for the purposes of having a complete national inventory (one aim of the NGERS Acts and regulations). If we assume the intention of the NGER Act and subordinate regulation and guidelines were meant to be inclusive of all emission sources in the waste sector, then it would be required that compost operators would be required to report emissions. However, 5.22 Method 1 refers specifically to "*biological treatment of solid waste at the landfill*". While some landfill operators may have compost licences in South Australia, it is unlikely for a compost producer to hold a landfill (i.e. permanent storage) licence. **It therefore may be questioned as to whether under the regulations as they currently stand, compost operators are required to report any emissions. As such, a ruling is required under these regulations as to whether compost facilities are required to report.**

2. The National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2008 v1.1 (October 2008) Section 5.22 sets out Method 1 for emissions released from the Biological treatment of solid waste. The method to be used is described in IPCC 2006 Guidelines for National Greenhouse Gas Inventories Volume 5, Chapter 4, and NGERs specifies the use of two emissions factors, rather than the use of the range of default factors specified in the UNFCCC Guidelines. These are for methane- prescribed at 0.02 tonnes methane per tonne of waste treated, and nitrous oxide- 0.09 tonnes of nitrous oxide per tonne of waste treated. These values need to be multiplied by the appropriate global warming potential (GWP) factor in accordance with the UNFCCC guidance for the reporting period. At present, the GWP for methane is reported as 21, and the GWP for nitrous oxide is 310. There is no allowance for the determination of emissions on a dry weight basis, as may occur for the treatment of dry wood products for mulch. This may have implications for determining emissions from compost material of differing moisture contents (e.g. food waste versus timber).

There is also no allowance for a higher order method for emissions estimation, such as a Method 2, 3 or 4 (e.g. direct measurement of emissions from composting activity, as there are

in other divisions of the Technical Guidelines). The approach to developing a higher order direct measurement (e.g. Method 4, or Method 3a, an indirect measurement with implications for more accurate emissions estimates) for the compost sector, if required to report under the NGERS, could be achieved by applying a statistically rigorous program for quantification of the component of the compost that holds an oxygen concentration of >10%. This could be used to effectively determine the proportion of organic waste at any given time that could be producing methane and nitrous oxide under anaerobic conditions. Approaches such as this have been accepted for the generation of carbon credits in developing nations by the UNFCCC Clean Development Mechanism (methane production avoidance by composting). **It is therefore appropriate to request clarification from the DCC for a variation under NGERS to allow higher order methods for the determination of emissions from composting activities, if composting activities are deemed to be captured under the NGERs.**

If compost operations are not considered liable entities for reporting under NGERs, then there will be no permit liabilities for composting facilities under the CPRS. However, if we take a conservative approach, and operate under the assumption here that the NGERS is applicable, then we can perform a base calculation for a theoretical compost facility that receives 100,000 tonnes of green and household organic food waste, using the process outlined by the NGERS Reporting (Measurement) Technical Guidelines, as we did for the "theoretical landfill" scenario previously. This requires the application of two default emission factors: 0.08 tonnes methane and 0.09 tonnes nitrous oxide per tonne of organic material treated. These factors are expressed as tonnes of CO_2e, and do not require further multiplication by the respective global warming potentials of methane and nitrous oxide. The emissions calculation for this amount of waste being composted (as the reporting guidelines currently stand) suggests an emissions profile for the compost facility from waste treatment alone of 17,000 tCO_2e. This suggests that the compost facility would have a higher reportable emissions profile than the theoretical landfill scenario presented above.

4.3 Recycling inorganic materials

Only facilities that recycle inorganic material that create over 25,000 tCO_2e through the use of fossil fuel or electricity would be required to report under the NGERS as, in theory, there are no emissions associated with recycling inorganic materials from the waste stream other than from energy input. However, any other direct emissions occurring as a result of waste processing (recycling) need to be identified by individual operators.

The CPRS White Paper has clearly identified that the cost driver for emissions reductions should (at least in theory) favor recycling of inorganic materials in new materials production, compared to the use of virgin materials. Under this assumption, it is expected that lower emission intensity products will have a market price advantage. This is based on the assumption that less emissions are created during the recycling process to re-use recycled materials than those made from virgin materials(over their lifecycle), thus there will be less emission related costs passed on to consumers of recycled materials. While there is yet to be an explicit examination of this supposition, it will not be further considered in this paper.

4.4 Comparison of landfill and compost under NGERS (and prediction of CPRS liability)

There are a suite of difficulties in making a direct comparison between landfill and compost operations from a theoretical basis. Difficulties for direct comparison of landfilling and compost

with respect to greenhouse emissions more broadly include the fact that emissions are assumed to be instantaneous from a composting site (i.e. during an annual accounting period), compared to timed release from landfill (likely to be up to 30 years in a dry state such as South Australia). The emissions from landfilling organics will be driven by the age of the landfill, the amount of waste already in place, and the state of operations (noting that the model does not allow for regional differences within a state). Alternative Waste Technology (AWT) plants generate electricity from landfill gas (or from controlled anaerobic reactions in a sealed vessel), are not explicitly considered in the NGERS/CPRS model, such technology is likely to be seen to be utilizing a renewable resource and has an emissions reduction benefit by displacing fossil fuel powered electricity in the grid. Emissions reporting will only be required for AWT type technology on the basis of methane emissions leaking from the sealed system.

AWT plants are operated with the understanding of the fact that the methane created by organic material in the anaerobic conditions of a landfill is a valuable commodity, and that intentional or controlled anaerobic digestion of organic materials from the waste stream can add economic value to the waste. The organic material once composted may then be available for alternative uses such as soil conditioner if the contamination rates are low enough.

The lack of publicly available, verified primary data regarding actual emissions reductions and power generation from AWT plants (and other waste treatment technologies, such as composting and landfilling) in Australia clearly indicates that detailed greenhouse gas lifecycle analyses (LCA) are required to be able to determine the most appropriate way to treat waste with the lowest possible emission profile. While it may be that the lowest emission profile waste treatment methodology is not the one that is chosen (say, on economic grounds), then that decision on preferred waste treatment approaches can at least be made with a full comprehension and understanding of the emissions likely to be caused by the choice of technology used.

The existing arrangements for emission estimates from compost facilities may not represent a true emission profile of this waste treatment process. Composting aims to biologically transform organic material through an aerobic process to a more stable and pathogen free material that can be utilised elsewhere. It is suggested that a lesser amount of carbon dioxide equivalent emissions are produced than if organic material is sent to anaerobic landfill conditions, but the current approaches to emissions reporting under NGERS does not allow for empirical tests of this proposition.

To date it has been considered, and is therefore the policy direction in SA, that compost production creates far fewer emissions and delivers greater environmental benefits than landfilling organic waste.

ZWSA is currently conducting a food waste trial with councils to divert household food waste from municipal waste bins to the organic collection bins to reduce the amount of waste going to landfill, improve recovery of organics to be used for improved soil conditioner and reduce greenhouse gas emissions that may have occurred at a landfill. Composting has been proven to have significant benefits greater than diverting a waste stream from landfill. Improved agricultural productivity, soil quality and reduced fertiliser utilisation (with further reductions in potential emissions of nitrous oxide from soils), water savings, increased flexibility with water management and disease suppression are the most significant benefits of composting, alongside any potential soil carbon sequestration benefits.

The current emission estimation arrangements for composting need to be reviewed and the process needs to be resolved empirically, and dealt with by allowing higher order methods for empirical quantification of compost emissions within NGERS to get an accurate report on emissions from composting facilities.

The outcome of having a higher reportable emission profile for any waste treatment activity under the CPRS will be that the waste treatment will be forced to pass on higher costs as a result of a higher emissions profile. No attempt to estimate how this could translate to how landfills or compost facilities may look to pass on costs of emissions trading is considered here, as this will ultimately be up to commercial considerations by individual operators.

5. Developing waste management models that utilise "carbon accounting"

5.1 Landfill gas and renewable power generation

As the electricity generated by landfill gas utilisation for electricity generation is regarded as a renewable fuel source, landfill gas to power operations may be able to generate renewable energy certificates (RECs; which are sold into the market as GreenPower). As the power source is renewable, it is expected that under the CPRS, the renewable energy production facilities should have a cost advantage, once a critical market price of "clean" energy is achieved by an appropriate emissions price burden being worn by non-renewable power generators. Another regulation expected to drive up the demand for renewable energy generation is the Federal Government's target of a Mandatory Renewable Energy Target (MRET) of 45,000 GWh by 2020, at which point it is expected that the price of carbon will have increased to the point where renewable power generation should be viable of its own accord without further needs for price subsidies.

The Office of the Renewable Energy Regulator (ORER) holds a public registry so that it is possible to estimate how much renewable electricity has been produced by the combustion of landfill gas in SA over the past few years and used in the grid. The publicly available data is provided in Table 1. Note that each REC is issued for a verified megawatt hour (MWh) of electricity generated in SA.

Table 1. Amount of renewable energy generated in South Australia over the period 2002-2007 from the combustion of landfill gas and sold into the grid.

Year	RECs generated
2002	14,150
2003	20,016
2004	28,492
2005	37,209
2006	37,851
2007	30,544
2008	16,800
Total	185,026

If the number of RECs (MWh of renewable electricity) produced from landfill gas in SA is multiplied by the state average emissions intensity per MWh of 0.84 tCO_2e per MWh, then it can be claimed that the use of landfill gas to produce electricity has avoided 155,452 tCO_2e from being produced at non-renewable power stations over the period 2002-2007.

It should be noted here that the combustion of methane created during waste treatment processes represents the only renewable form of electricity where the fuel is actually a potent greenhouse gas that is destroyed during the energy creation process. As such, in some circumstances where the requirements for environmental, financial and regulatory additionality have been met or exceeded, some landfill methane flaring or landfill gas to power projects have been able to generate and sell "carbon credits", including under the existing Federal Government Greenhouse Friendly™ or New South Wales Greenhouse Gas Abatement Scheme (GGAS) programs.

5.2 Voluntary carbon credits from waste

Under the proposed CPRS, any sector that is covered by the scheme would not be eligible under the "cap-and-trade" nature of the scheme to develop projects to avoid emissions and create a tradeable "carbon credit" for the abatement. Under the existing proposal for the CPRS, waste, being a covered sector, would not be able to generate any "carbon credits" for emission reducing project activities. The best an operator could hope to do is avoid the cost of purchasing emission permits. However, the existing Federal Government Greenhouse Friendly™ scheme has created voluntary carbon credits for a variety of projects in the waste sector, such as methane flaring from landfills, anaerobic digestion, composting, and organic waste diversion to compost rather than landfill.

The significant issue with the existing projects in the waste sector under the Greenhouse Friendly™ program is the lack of transparency with respect to public disclosure of project boundaries, and details regarding the specific definition of the project baseline and thus relative emissions reductions created through the project activity. It may well be the assumption for the composting projects that if the organic waste was sent to a landfill, then there would be no methane capture and control systems in place at the landfill, and all the methane generating potential of the organic material would have resulted in methane emissions to the atmosphere. It may also have been the assumption (as is prevalent in the composting sector in Australia today) that few (if any) emissions are caused by the composting process. However, without transparent project design documentation, it is not possible to verify this issue. This indicates the need for clear, transparent and repeatable lifecycle assessment and project review according to international best practice for the generation of voluntary carbon credits, or any claims regarding emissions savings when comparing two different ways of treating waste, including alignment with project based mechanisms such as the UNFCCC Clean Development Mechanism.

With respect to the potential for the existing food waste collection trial to be able to generate carbon offsets within a voluntary market, the existing Greenhouse Friendly™ scheme could have potentially allowed such a project to run if it could prove a quantifiable emissions reduction. However, given the waste sector is covered by the CPRS, and under existing conditions, there is no potential for a voluntary emission reduction project status to be assigned to the food waste trial. The current status of Greenhouse Friendly program is unclear, with the Department of Climate Change not accepting any new applicants under the abatement component of Greenhouse Friendly™. The Department of Climate Change released a discussion paper on the National Carbon Offset Standard on 19 December 2008 for public

consultation. The Department is currently conducting public consultations, and Greenhouse Friendly™ has not yet been revised following this consultation process.

There have also been submissions to the DCC National Carbon Offset Standard discussion paper from organisations such as the Voluntary Carbon Market Association (VCMA) raising concerns about the inability of any voluntary actions ability to reduce the aggregate or national emission profile below that of the scheme cap. Submissions such as the VCMA submission have highlighted a way in which voluntary action under the CPRS could conceivably reduce Australia's aggregate emissions profile. In short, the VCMA has presented a way in which the CPRS could be modified to allow activities such as composting and conversion of methane to energy to generate a voluntary carbon credit for the non-compliance carbon market in Australia. The only reference to voluntary abatement in the exposure draft of the CPRS legislation is in Section 14(5)(c)(iv), which states that "*the Minister may have regard to voluntary action which is expected to be taken to reduce Australia's greenhouse gas emissions*".

There is no provision in the exposure draft legislation for the establishment of mechanisms or allocation of resources to support registration, certification and recognition of voluntary abatement required for the development of a voluntary carbon market. This is a point which requires consideration to be reviewed, as this view effectively means any voluntary action undertaken cannot lead to an aggregate reduction of emissions in Australia. To ensure that voluntary actions undertaken to reduce emissions in sectors covered by the CPRS in Australia will require consultation with the Department of Climate Change.

If a voluntary carbon market is able to be established in Australia, with appropriate alignment with the CPRS, and alignment with project based mechanisms such as the UNFCCC Clean Development Mechanism (CDM) or Joint Implementation (JI), then it may be possible for such projects to generate voluntary carbon credits for sale into voluntary markets for organisations wishing to go carbon neutral.

Also, and of important consideration for the broader compost sector, is the potential for the inclusion of a voluntary carbon offset standard for the biosequestration of organic carbon in soils (from repeated and ongoing addition of organic materials such as compost or biochar to soils). This could potentially add another revenue stream to make emission reducing activity more viable, as well as assisting to improve agricultural productivity in Australian low carbon soils. If such a voluntary market does evolve in Australia, then activities that can demonstrably reduce emissions against a valid baseline may be commoditised through the sale of voluntary carbon credits. This will be entirely contingent on how the Federal Government chooses to engage with or facilitate the creation of a voluntary carbon market based on projects reducing emissions in Australia.

6. Summation and issues for further consideration

To use an oft quoted phrase, "you can't manage what you don't measure". In the case of examining the relationship between the waste hierarchy and the basic carbon management principles presented at the start of this document, measurement of emission outcomes is important in waste projects. This will be critically important into the future, as it becomes increasingly likely that there either may be a cost associated with emissions (under the proposed CPRS cap and trade scheme), or a potential financial revenue stream if a project can

prove an emission reduction compared to an alternative activity in the waste management sector (potentially through the sale of carbon credits under a voluntary carbon credit scheme).

With respect to issues of specific concern to ZWSA, we rank the following issues as to be of significant concern, and require immediate attention. We have also suggested potential ways to deal with the issue as raised.

1. *Get a ruling on whether or not compost is treated as an emission causing activity even if it does not occurs "at the landfill".* This may be simply resolved through consultation with the relevant officials at the DCC.
2. *If compost (as an activity in the waste sector) is required to report emissions, then there should the development of a higher order method in the relevant sections of the Measurement Determination and Technical Reporting Guidelines to allow more accurate emission estimates, rather than the potentially coarse estimates derived from the application of a pair of emission factors*. This may simply be resolved through consultation with the relevant officials at the DCC. However, it may also require changes to legislation, which would be a lengthier process than just modifying the Technical Guidelines. If agreement cannot be reached, it may be required that compost industry participants engage in direct dialogue with the DCC, and may also require the engagement of dialogue through COAG.
3. *It is recommended that a study be undertaken to effectively compare emission estimate figures compost facilities and landfill facilities using the appropriate and up to date figures under the NGERS for a variety of plausible scenarios, including future emission scenarios for alternative waste treatment technologies or processes.* This may fall outside of the remit of ZWSA, and may simply be a commercial consideration for operators in the waste sector.
4. *It is also recommended to undertake a lifecycle assessment of waste more broadly using directly acquired primary data rather than coarse estimates to examine the emissions benefit-cost implications of all existing business models for organic waste treatment, including compost, landfill, renewable energy production at the landfill, and renewable energy production from anaerobic biodigester technology where the residual stream is composted aerobically and effectively utilised to promote agricultural productivity.* This may be undertaken in consultation with industry participants, or through a government department. The study should include activity from the point of disposal of the waste (e.g. from the curb side), transport to a sorting facility, treatment of residual waste streams, fugitive emissions from waste treatment, energy production from waste treatment by-product gases, and productive uses of the final products of waste treatment (long term burial, long term sequestration, ability to displace fertiliser production and utilisation) to determine with some level of accuracy which waste treatment pathway will lead to the greatest overall relative emissions benefit.

Alongside these pressing issues, further consideration should be given to engagement with the DCC on issues such as:

1. *The value and requirement in the agricultural sector for the use of organic materials such as mulch, compost and biochar, given the poor productivity of many soil types in SA, and how ZWSA can develop effective instruments to enhance primary productivity.* This is broadly in alignment with the goals of reducing landfilling of organic materials, if a quantifiable emissions benefit can be derived from these outcomes.

2. *An engagement and consultation with the DCC with respect as to how soil carbon from compost and biochar and their potential carbon sequestration values may align with the evolution of a potential voluntary carbon market or future compliance market.* This is already acknowledged as project activity in the 2008-2009 ZWSA Business Plan, but ZWSA should acknowledge the existing position of the DCC with respect to a voluntary carbon offset scheme, as well as engage in consultation to ensure outcomes are in alignment with ZWSA goals.
3. *A study is recommended to determine how composting and other activities that may have emission reduction potential, such as renewable power generation from organic waste (e.g. anaerobic digestion and methane conversion to power) align with the potential voluntary carbon market, and ZWSA goals to reduce the volume of landfilled material, and to reduce emissions. This will assist ZWSA in consideration of working with the business sector to develop models and infrastructure that are able to reduce the emissions from waste treatment, create renewable energy and allow improved agricultural productivity and enhanced ongoing carbon sequestration, and reduced reliance on artificial fertiliser sources.* This review represents a starting point for consideration of these issues by ZWSA.

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