

Report of the New Zealand Emissions Trading Scheme Waste Technical Advisory Group

March 2010

1 Objective of the Waste Technical Advisory Group

The relevant objectives of the Waste Technical Advisory Group (the TAG) as set out in its terms of reference are to:

- Develop an outline of New Zealand Emissions Trading Scheme (ETS) methodologies and emissions factors for the waste disposal sector.
- Provide expert comments on the outline of ETS methodologies and emissions factors for the waste disposal sector
- Respond to issues presented to it by officials during the course of the development of the ETS methodologies for the waste disposal sector.
- Assist officials with the preparation of reports that summarise the discussion and conclusions reached at each meeting.

2 Purpose of this report

The purpose of this report is to meet the first objective, namely to provide recommendations on the methodologies and emission factors proposed for the waste disposal sector.

3 Criteria used

The TAG considered the ETS methodological options for estimating total methane emissions from landfills against possible perverse outcomes and other assessment criteria. The method should:

- Account for the total anticipated emissions from operating landfills given that closed landfills are excluded from the ETS
- Estimate emissions to a defensible level of accuracy
- Provide a simple default methodology combined with optional more detailed alternatives
- Place the burden of evidence for non default alternatives on landfill operators
- Minimise compliance costs
- Consider what is fair and equitable
- Ensure the polluter pays
- Encourage behaviour to reduce emissions
- Allow incorporation of the latest knowledge on emissions

4 Overview

Waste generates landfill gas which, unless captured and destroyed by flaring, electricity generation or other means, is emitted to atmosphere as fugitive emissions. The TAG recommends a simple cost effective default methodology which estimates surface emissions and enables the determination of an emission cost per tonne of refuse received. This concept would be based on the assumption that all emissions from waste are emitted during the year that waste is received.

This method is described as a mass balance, or ‘anticipated emissions’ approach and takes into account the total anticipated emissions from any waste deposited in a landfill after the sector joins the ETS on 1 January 2013.

In addition the TAG recommends that the regulations include provisions for the application of non-default (site specific) parameters to determine emissions, albeit at greater effort and cost. Non default parameters would enable the reduction in fugitive emissions as a result of good landfill practices, such as landfill gas extraction and destruction, to be taken into account as well as variations in waste composition across the country.

This multi layer approach will provide simplicity and cost efficiency for small low cost landfills while also offering all landfill operators an incentive to proactively reduce emissions.

4.1 Closed disposal facilities and legacy waste

Waste generates landfill gas for many years after it has been deposited in a landfill. However, only emissions from post-2012 waste deposited at operating disposal facilities are covered by the ETS. This means the emissions from existing closed disposal facilities and any facilities that close after the waste sector joins the ETS will not be covered by the ETS. Thus, there is currently no ability to use a charge to provide an incentive to reduce emissions from either type of closed facility.

The criteria used by the TAG include provision of a method which takes into account the total anticipated emissions from any disposed waste. Therefore, as a result of the exclusion of emission from closed landfills the TAG recommends a method that brings those future emissions forward to the year that the waste is deposited. This method is described as a mass balance, or ‘anticipated emissions’ approach.

The exemption of emissions from closed facilities has meant the TAG cannot recommend methods that estimate actual emissions. While such methods, including direct emissions monitoring and first order decay models, would better match the current models used by NZ disposal facilities, the national inventory method, methods under other emissions trading schemes and the IPCC recommended methods, they do not account for future emissions from a given quantity of waste.

The TAG notes that the 2011 review of the emissions trading scheme could be an opportunity to revise the particular parts of the legislation so that disposal facilities closed after implementation of the scheme are included. If this occurs, the TAG recommends another stakeholder group be re-convened to analyse and amend the ETS methodological regulations.

The proposed method does not specifically address legacy waste (ie waste placed prior to 1 January 2013). The TAG has carefully considered the potential implications as follows:

- Closed facilities are not included in the ETS therefore any Legacy waste at closed facilities is not included in the ETS

- The proposed methodology is based on a simple cost effective rate per tonne applied on the day the waste is deposited and allows for the estimated total emissions that waste will emit during its decay process thereby maximising the emissions that are accounted for by the scheme
- The proposed methodology is based on the principle of polluter pays. As waste continues to generate landfill gas for some time after it is deposited in a landfill, legacy waste will continue to emit methane. However it is not possible to retrospectively apply a charge to the waste generator once the waste has been disposed of.

On balance the TAG consider the proposed approach maximises emission coverage whilst ensuring polluters are responsible for their emissions.

5 Recommendations

5.1 Structure of regulations

The TAG recommends that there be a simple and easily understandable default method to be used by landfill operators. This method would give a conservative (ie, erring to higher emissions), but still reasonable, estimate of emissions. Alternative options should be provided in order to allow for site specific data.

The TAG also assessed the need and potential for different tiers of methods to be used by landfill operators where:

- More advanced landfill management and landfill gas management practices are adopted.
- More accurate measurement of emissions and estimated parameters are available and deemed appropriate.

The TAG considers that the methodology identified below allows for the recognition of unique landfill characteristics and provides incentive for emission- reducing activities.

5.2 Coverage

No consensus decision was reached by the TAG. There was however a strong majority preference for there to be no threshold.

The TAG noted the following issues in relation to a threshold:

- That emissions must be treated equitably across all sources
- That any basis for exemptions would create a precedent and could lead to arguments about other criteria that would increase the number of exemptions
- That a threshold could create perverse incentives such as waste flight or fly tipping
- That the proposed method, along with the requirements of the waste levy regulations, will result in minimal compliance costs for participants
- That ETS implementation on some small, isolated disposal facilities could lead to undesirable social and environmental outcomes. However, the ETS is probably not the best way to manage the issues facing those communities

The special circumstances of remote communities are acknowledged by the TAG. Although the Act requires landfill operators to pay a charge in relation to their emissions, it does not require each landfill to pass ETS charges to customers. In some situations where the landfill

operator is a TLA, a wider base of ratepayers could absorb the ETS costs relating to a smaller landfill if there was doubt about the ability of actual landfill users to manage costs and / or if there was high risk of fly-tipping. In cases where a wider base of ratepayers are already covering all disposal costs for a TLA operated landfill, and where early closure of a landfill for a geographically isolated small community could occur from imposition of further charges, careful consideration of site-specific circumstances and risks (financial, logistical and environmental) is recommended.

The TAG was not explicitly tasked with making recommendations on thresholds to the Government and noted that such work will not be part of the methodological regulations to be consulted on later this year. As a result, the TAG suggests additional consultation be carried out with stakeholders on the desirability, practicality and nature of any threshold for ETS coverage on disposal facilities.

5.3 Default method

The TAG recommends that a mass balance, or ‘anticipated emissions’ approach is used in the regulations. This method assumes emissions are released in the year that the waste is received. It has the advantages of assisting landfills in recovering the full amount of ETS costs from landfill users on waste receipt. It is also considerably simpler than alternative methods and therefore minimises compliance costs. The TAG noted that the mass balance approach contains sufficient flexibility for landfill operators to have unique landfill management practises reflected in estimates of emissions reported to the ETS administrator.

A concern remains that a mass balance method could result in (1) reduced emission reduction because of the lack of incentives to continue use of emission reduction measures in the future, or (2) extensive computer modelling of methane generation, collection and emissions to estimate future methane emissions, which could lead to high costs continuing indefinitely in the future. Future reductions in emissions could mean that the charge put on waste today to reflect its impact in 20 years’ time could overestimate the actual emissions. Similarly, a rapid decrease in the cost of site-based estimation of methane emissions could mean that waste operators are locked into a system where ongoing modelling must be used even though less costly site-based emission measurement methods might have become available. The TAG recommends that the Regulation is reviewed in 5 to 10 years to reassess the viability of allowing participants to opt for a direct emission charge that would reduce social costs.

The formula recommended for entry in the regulations as the default method is:

$$tCO_{2eA} = AA \times DEF \times (1 - LFG_d) \times (1 - OX)$$

Where

tCO_{2eA}	is the tonnes of carbon dioxide equivalent emissions reported in year A
AA	is the tonnes of solid waste disposed into the waste disposal facility in year A
DEF	is the default emissions factor which incorporates methane potential per tonne of waste (based on waste composition), methane density and CO _{2e} conversion factor
LFG_d	is the adjustment for the modelled efficiency of any landfill gas collected and destroyed, if any, or zero as default

OX	is the adjustment for the oxidation of uncaptured methane in the landfill cover / cap, where the default value is 10%
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5.4 Waste Tonnage

The TAG recommends that the ETS regulations include the same waste tonnage assessments and adjustments as the waste levy regulations in order to determine the value of A_A for each year. It is noted that a clarification is being developed by the government on the treatment of cover and diverted materials in the levy. It is also noted that the ETS could lead to perverse behaviour such as the use of organic materials as cover materials which might not be counted as 'waste' under the levy, but may result in emissions. The net methane emissions from the use of organic materials as cover is complicated and depends on its methane generation potential, the length of exposure of the cover (days or years), and its ability to develop a microbial community to oxidise methane. For example, organic cover material has been reported to increase methane oxidation of primary waste emissions (Barlaz et al., 2004), and therefore the net emissions associated with using organic cover material may be negative. It is expected that the organic materials most likely to be approved under consent regulations for cover would be those with lower methane potential and higher potential to oxidise methane (eg, compost), and so the TAG believes little risk that any such perverse behaviour would have a material impact on the potential for emission reduction. However, the issue should be monitored once the ETS is in place.

The formula recommended for entry in the regulations for the calculation of waste tonnage is:

$$A_A \text{ (tonnes)} = \text{Gross tonnage} - \text{Diverted tonnage}$$

Where

A_A (tonnes)	is the tonnes of solid waste disposed into the waste disposal facility in year A
Gross tonnage	is the tonnes of waste received by the disposal facility as per the same requirements as regulations under the Waste Act
Diverted tonnage	is the tonnage of waste or diverted materials previously measured as gross tonnage that is reused, recycled or removed from the disposal facility within 6 months as per the same requirements as regulations under the Waste Act

5.5 Default emissions factors

The default emissions factors should be based on the latest published data on composition of mixed municipal waste deposited in NZ landfills. In the absence of NZ specific information default 2006 IPCC values should be used (except for waste composition).

Should new information on waste composition to landfills be used in the inventory, then this should be reflected in a change to the default emissions factor in the ETS regulations.

5.6 Application for the use of non-default parameters

The Regulations should set out a separate methodology that would enable a landfill operator to apply for site-specific values of LFG_d , or OX, or DEF. The use of one or more non-default parameters would require a separate application by the landfill operator for approval by the Administrator.

For special wastes not covered by the 2006 IPCC values, application can also be provided for use of special decomposition values.

The regulator should have the ability to reject applications when it believes that the selection of parameters for site-specific evaluation has led to an overall underestimate of methane emissions.

A separate approach combining multiple non-default parameters is termed the use of a 'unique emission factor' and is described in Section 5.7.

5.6.1 Non-default destruction efficiency

The recommended formula is:

$$\text{LFG}_d = \text{Destruction Factor} \times Q / \text{Estimated gross generation of methane}$$

Where

LFG_d is the efficiency (in fraction) of the landfill gas collection system

Destruction factor is the adjustment that reflects the destruction efficiency of the landfill gas destruction equipment. Default values are stipulated for candle flares, enclosed flares, and generation plants

Q is the metered quantity of methane passing through the collection system in a year

Estimated gross generation of methane is the modelled estimate of total methane emissions generated by the total waste in place at the end of the period. The method should use IPCC 2006 defaults to the extent that they reasonably fit the data and either default or approved site specific waste composition data.

Notes:

i. Destruction Factor

The destruction factor should be supported by UNFCCC and LFTGN03 defaults or manufacturer's equipment specifications for the type of combustion or generation equipment.

ii. Q

In determining Q, attention should be given to the type of installation, and the calibration of the flow meters.

Five years of gas collection system data (methane composition and gas volume data) would be required prior to use of this method.

iii. Gross Generation of Methane

Any estimate of 'Gross Generation of Methane' would need to follow a protocol similar to protocols used elsewhere or one based on NZ conditions.

The gross generation of methane would be calculated using a first order decay model such as the Scholl -Canyon. The operator would have the option to adopt the default parameters for waste composition or propose site-specific composition data.

The default methane generation potential (L_0) generation rate constant (k) would be taken from 2006 IPCC values.

The analysis would need to include the following:

- Reliable estimates of mass of waste placed in the landfill by waste/cover type.
- If non default waste composition was proposed estimates of waste composition on an annual basis would be required. This should be supported by site-specific and waste stream specific data collected using a mass balance (not visual) SWAP survey based on a minimum of two waste sort and weigh surveys over a twelve month period. Weighbridge data should be used to take into account expected seasonal variability by waste stream.
- Consideration of the methane production potential of any daily cover.
- Best estimates of mass and composition of uncharged, legacy (pre-2012) waste.
- Selection of a first-order decay constant appropriate to the weather and operating conditions. This would need to fall within bounds provided by the protocol.
- Selection of a first-order lag-time appropriate for the site-specific conditions and within bounds provided by the protocol.
- An expectation that IPCC 2006 defaults would be used to the extent that they reasonably fit the data.
- Acceptable qualifications of those responsible for the resulting estimate.
- An expectation that a reassessment of non-default parameters by the applicant or by ETS audit would occur every five years, or more frequently if site conditions change.

A reversion to a default LFG_d of zero in cases where no re-application is made after five years or after a material change occurs that affects system efficiency, such as landfill coverage.

5.6.2 Non-default emission factor

Individual sites using the default method can substitute site-specific composition values for NZ-wide composition defaults only if the composition data:

- Are taken using a mass balance (not visual) SWAP method given in the NZ Waste Analysis Protocol
- Have taken representative samples and accounted for seasonal variability
- An assessment of reliability of the data is provided
- A plan for ongoing monitoring of waste composition is provided
- A minimum of two waste sort and weigh surveys over a twelve month period.

5.6.3 Non-default oxidation factor

The TAG recommends that the regulations include the option for a landfill operator to apply for and use a unique oxidation factor, instead of the default 10% value. The TAG considers that this number is low for properly engineered caps, but there is not currently enough site-specific information available for New Zealand. This default should be open to review before the 1st January 2013. Inclusion in the regulations of the ability to use a non-default value would encourage operators to commit to using and maintaining emission-reducing capping materials, which are expected to advance technically at a rapid rate in the next ten years.

This should lead to the development of a Standard for estimating the oxidations of methane emissions, and also a Standard for minimum cap requirements. The development of these standards would likely include recommended modifications to the regulations required for ETS in 2011.

Similar to the LFG_d and DEF approaches, the TAG recommends that the continued use of a unique OX factor should be dependent on the landfill operator confirming that practices have not changed, and that there are no other circumstances that made the revised parameter invalid.

Any adjustment from the default value of OX would need to be supported by field monitoring of methane emissions with and without cover. The regulations should propose the use of a protocol that follows components of similar protocols used worldwide. The regulations should allow for a process of adapting overseas protocols to New Zealand conditions after experience with New Zealand measurement conditions is gained. Any protocol would need to consider the following:

- The design of the flux box or other equipment used
- The qualifications of those taking the measurements
- The calibration of the emission measurement equipment and the QA/QC methods recommended
- The number of locations needed per sampling campaign (eg, 5 per hectare for the first hectare and 2 per hectare for sites of larger size)
- The method of selection of sampling locations including a need to sample locations with a variety of cover types (daily, intermediate, final)
- The weather conditions appropriate and inappropriate for sampling campaigns
- The frequency of sampling required to account for seasonal variability
- The collection of supporting information (eg, soil temperature, moisture content, antecedent rainfall, antecedent atmospheric pressure)
- The ability to use data from previous years' measurements to develop rolling weighted average estimates of methane oxidation
- The qualifications of those supervising and responsible for the resulting estimate
- The conditions under which it is appropriate to have peer review of the resulting estimate

5.7 Application for a Unique Emission Factor (UEF)

Due to the uncertainties inherent in estimating waste composition, waste degradation, gross generation of methane, and methane oxidation, it is foreseeable that some facilities could want an option to estimate 'anticipated emissions' using a set of reliable actual emission data. It is suggested that the regulations also provide this option, while recognising that it would not likely be used until further advances in technologies and understanding can support it.

Any such regulation would need to clarify that any UEF method would have the following features:

- It would be based on an approach where all future expected emissions are charged in the year of disposal.
- A complete, year-by-year methane mass balance would be required

- The approach would require a minimum of five years of good estimates for methane emissions, methane oxidation, and methane destroyed through combustion
- The approach would have the same requirements related to waste quantities and composition as for the method involving first-order parameter adjustments
- The approach would consider the various types of cover and their extent
- The approach would account for spatial and temporal variability in emissions
- The approach would explicitly account for uncertainty using Monte Carlo analysis with the UEF based on a specified upper percentile value for the UEF
- Calibration and accuracy of gas collection system data are ensured
- Those responsible for the estimate would need certain acceptable qualifications
- The estimate of a UEF would undergo a peer review by a nominee of the ETS at the cost of the emitter

5.8 Matters for application to ETS administrator

At all times, including when reporting, the TAG recognised that a landfill operator could be subject to an audit. The onus will thus remain on the operator to notify any change in operation from what has been accepted by the Administrator when used in an application for OX or DEF or LFG_d in situations where such a change might result in a change in emissions. The Administrator would have the opportunity to demand the surrender of additional permits in cases where changes have not been notified, and the opportunity to request prosecution in cases where wilful avoidance of payment is suspected.

Independence of the verifier should not be mandatory if the verifier is a member of a relevant professional organisation. An independent assessment should occur at some point during the application for non-default parameters of a UEF.

6 Other matters

The TAG wishes to note the following issues raised during the TAG discussions. In doing so the TAG recognises that these issues have relevance to the ETS, but are outside the scope of the TAG's terms of reference.

- i. The TAG seeks recognition from the government of the national (and global) emissions benefit from offsetting thermal electricity generation by landfill gas generation plants. While the ETS is expected by some to affect the electricity price (which would in turn benefit landfill based generation), this might be limited due to 67% of NZ generation is already coming from renewable sources. As such the government should be aware of the particular issues faced by landfill generation plants, including the manner in which landfill operators are charged for lines fees, the difficulty to negotiate "renewable electricity rates", the inability to receive recognition of the benefits that embedded generation brings to the grid and the current system which permits non-competitive behaviour by line companies in the form of arguments that distributed, renewable generators add excessive risk to electricity supply. The TAG recommends an urgent evaluation of a way to separate the evaluation of risk of supply from the current large suppliers.
- ii. The TAG seeks greater enforcement of the National Environmental Standard on Air Quality, where it includes emissions from landfills. The TAG noted that reporting emissions under the ETS might result in self-incrimination of under-achieving landfills where they are required by the NES to meet certain performance levels in emissions.

The TAG noted that enforcement of the NES is largely a Regional Council responsibility, but feel that central government have a role to play in addressing the current under-enforcement of this Standard.

- iii. The TAG considers that given the inclusion of methane emissions from all landfills under the ETS (assuming no threshold) the government should review use of thresholds in the NES with a view to removing the relevant clauses.
- iv. The TAG requests that research be performed in order to improve understanding of the values of degradable organic carbon of waste materials disposed in NZ.
- v. The TAG notes that the wastewater and composting industries are not included in the ETS. There is a danger that including landfills within the ETS might lead to the diversion of organics from landfills to substandard anaerobic composting (including home composting) and wastewater treatment facilities. The TAG is concerned that this could result in an inaccurate measurement and false declaration of reduced emissions by the NZ government.
- vi. The TAG wishes to note that the ETS should reconsider the NZ Waste Strategy's goal of a reduction in organic waste to landfill. The introduction of the ETS will accelerate moves to recover landfill gas as energy, and so enhance the ability of landfills to responsibly manage organic wastes. It is important to recognise that modern landfilling, composting and energy generation are all alternative beneficial uses of organic waste, and the processes can and should continue to co-exist where sustainable.
- vii. The TAG notes the current lack of national enforcement mechanisms for effective cleanfill regulation, and considers that application of the ETS to licensed landfill sites is likely to further increase waste flight to poorly regulated cleanfill operations. The TAG recommends that a technical advisory group be established to review options for establishing national guidelines, standards or other mechanisms for the effective regulation of cleanfill operations by TLA's.
- viii. The TAG recommends the government consider the ability for landfill operators to reduce their ETS obligations by receiving credit for carbon sequestration. Even though the current international emission protocols do not as yet acknowledge sequestration in landfills, the rapid increase in technical understanding of sequestration mechanisms makes this an obvious offset that should be acknowledged in regulations.
- ix. The TAG suggests additional consultation be carried out with stakeholders on the desirability, practicality and nature of any threshold for ETS coverage on disposal facilities, noting the special circumstances of remote communities where accelerated closure of small, community-based landfills in isolated areas could lead to undesirable outcomes including environmental risks and adverse social and economic impacts.

7 Process followed

The TAG was formed through a public nominations process in late 2009, conducted by internet and targeted communications materials.

A first meeting was held in Wellington on the 4th of February 2010 where the Terms of Reference, objectives and role of the TAG were discussed.

A second meeting, run as a full day workshop, was held on the 24th of February 2010. The focus of the workshop was on technical criteria, perverse outcomes and recommendations on methodologies. A draft TAG technical report was developed following the workshop.

A third meeting discussed the draft technical report and resolved the remaining technical issues and confirmed the objective of finalising this technical report for submission to the government by early April 2010.

8 TAG membership

Simonne Eldridge, Tonkin & Taylor Ltd (Chair)

Scotia Boelee, New Plymouth District Council

Marcus Herrmann, Auckland City Council

Ian Kennedy, Transpacific Industries Group (NZ) Ltd

Mike Mendonca, Wellington City Council

Mark Milke, University of Canterbury