Peer review of *The full cost of landfill disposal in Australia*

prepared for

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Author
Dr Joe Pickin

Checker
Christine Wardle

blue environment pty ltd
abn 78 118 663 997
271 mont albert road, surrey hills vic 3127
email: blue@blueenvironment.com.au
web: www.blueenvironment.com.au
phone 0408 540 980

1. INTRODUCTION

The Department of the Environment, Water, Heritage and the Arts (DEWHA) commissioned the author to review a report titled *The full cost of landfill disposal in Australia* (BDA 2009).

This document reviews the methods, sources, scope, content and conclusions of the BDA work. The review opens in Section 2 with a contextual discussion on the conceptual framework of externalities and valuation in waste policy. The main review follows in Section 3, addressing key issues in three subsections. Section 4 provides additional minor comments on specific sections of the text that are not covered in the main review. Conclusions are drawn in Section 5.

2. EXTERNALITIES AND VALUATION IN WASTE POLICY

This section provides a discussion on the conceptual framework of externalities and valuation in waste policy. It is recognised that BDA's choice of analytical framework was limited by the project brief.

BDA evaluates the 'full cost' of landfill in two parts:

- private costs, comprising actual dollar costs
- external costs, including non-market costs or externalities, comprising costs (and benefits) of landfilling for which there is currently no market.

Where a policy option has significant social or environmental implications, economic assessment principles dictate that externalities should be evaluated and included in a cost-benefit analysis of the policy option. The Council of Australian Governments has agreed that in analyses of the consequences of government action, "costs and benefits are each as far as possible expressed in money terms" (COAG 2004 p.27).

BDA values landfill externalities using the recommended COAG approach of itemising each impact, estimating magnitudes, separately valuing each impact, discounting the values to present costs, and summing these to obtain the total external impact. There are a number of difficulties with this 'effect-by-effect' approach:

1. Valuing an impact can be very difficult. The damage costs of greenhouse gases, for example, are of uncertain magnitude, involve uncertain human impacts and will occur over an uncertain timeframe.
2. The effect-by-effect approach overlooks the path-dependent nature of technological development. Part of the goal of landfill diversion policy has been to steer technologies towards long-term resource efficiency but effect-by-effect valuation of landfill impacts is blind to this issue.
3. Discounting can be inconsistent with intergenerational equity preferences. For example, from a sustainability viewpoint, the 'dry tomb' philosophy of landfilling can be seen as bequeathing an unacceptable environmental risk to future generations. Using discounting, however, delayed impacts provide an unequivocal financial benefit.
4. Effect-by-effect valuation is poor in capturing costs associated with risk. The rare possibility of a significant impact (such as the recent gas leak from Cranbourne landfill) is not well covered.
5. Financial evaluation of impacts downplays moral responsibility and principle. River quality has improved over the past few decades as a cultural norm became established that industrial facilities, including landfills, should not discharge contaminated water to the environment. Cost-benefit analysis at particular facilities was largely irrelevant to this development.

6. Some potential costs and benefits cannot be readily valued, and there is a tendency for effect-by-effect valuations to ignore such costs and benefits (e.g. PC 2006a p.81 paragraph 3).

These weaknesses and uncertainties may be reflected in the fact that communities are often willing to pay far more for waste management improvements than effect-by-effect valuations indicate is 'rational' (Pickin 2008). And given these weaknesses and uncertainties, it is important that valuations aim to provide a broad view of the range of potential costs and benefits.

3. REPORT REVIEW

Within the constraints of the externality and valuation framework, BDA provide a well-written, clear, rational and well-supported report. However:

- it does not deal well with uncertainty – given the points made above, providing a single value estimate with sensitivity analysis on a single parameter (greenhouse costs) seems insufficient
- the range and scope of externalities seems somewhat restricted
- given the focus on single value estimates, some of the costs appear conservative.

These points are expounded in the following subsections, which cover firstly the private cost estimates, then the greenhouse gas estimates, and finally the other non-market costs.

Estimated private costs for Australian landfills

Determining average financial costs for landfills of different standards is difficult because:

- the information is often confidential and so hard to obtain
- tenders often include waste collection as well as disposal, masking the landfill component
- the operating standards of a landfill are generally uncertain.

In general, the prices cited in the report (p.47) look low. A current study on waste options for municipal waste in Melbourne is applying considerably higher estimates. A well-placed industry source suggests that it would be very difficult to run a landfill in the 50kt/yr range to best practice for less than $100/t. The same source suggests that a large best-practice landfill operation would typically cost at least $45/t.

Greenhouse gas emissions from landfills

BDA's estimates of the net greenhouse implications of landfilling have several problems.

Firstly, the Department of Climate Change (DCC) default methane potential values by material were amended in 2008/09 following industry complaints that the earlier figures were inaccurate. Following research by Hyder Consulting and GHD, the overall degradable organic carbon values were substantially reduced. The BDA approach, in the new figures, should generate an emission rate of around 1.1 rather than 1.4 or 1.5 t CO_2-e/t (see DCC 2009 pp.62, 63). BDA apparently used the older default values.

Secondly, no recognition is given for the carbon storage benefits of landfill. Carbon entering the facility and not being emitted must be stored, and this is equivalent to removing CO_2 from the atmosphere. Most life cycle assessments credit carbon storage in this way (e.g. Hyder Consulting 2009, US EPA 2006).

The effect of both of the above issues is to exaggerate landfill emissions. A third and conceptually more difficult issue with the BDA report does the opposite i.e. tends to downplay the significance of the emissions. This relates to BDA's discounting of values calculated using a fixed global warming potential (GWP) for methane. The GWP applied is 21, a value derived by the Intergovernmental Panel on Climate Change on the basis that warming effects in each year for the next 100 have equal value and those thereafter have no value. This basis is a compromise that recognises the short-term intense warming effect of methane (which is removed from the atmosphere in about a decade) and the long-term warming effects of carbon dioxide (which can remain in the atmosphere for hundreds of years). But after using the GWP_{100} to quantify emissions, BDA applies a discount rate to reflect an assumption that emissions in the near future have a higher cost to those that come later. In evaluating the greenhouse costs of landfills, then, BDA simultaneously assumes that methane emitted in a few decades time has the same cost and also has a much lower cost than that emitted in the near future.

It is questionable if and how discounting should be used in greenhouse calculations. Discounting implies a preference for future emissions over current emissions, but given that climate change is projected to worsen over time this may not be the case. However, if discounting is to be used in the calculation, a higher GWP value could be applied for emissions close to the present. The IPCC uses a value of 72 for the GWP_{20} of methane. Dessus and Laponche (2008) provide GWPs for a range of timeframes.

Finally, BDA (2009) uses an electricity offset value for NSW (1.06 kg CO2-e/t) rather than a weighted average for Australia, which would be closer to 0.9 (see DCC 2009 pp.59,60). Correcting this would tend to increase emission impacts above those presented by BDA.

Other non-market costs for Australian landfills

BDA (2009) evaluate three other types of landfill externality: air emissions (other than greenhouse); water emissions (leachate); and amenity costs encompassing "noise, dust, odour and pests" (p.15). The methods for evaluating these impacts appear sound but some of the valuations seem low and their scope constrained.

BDA's 'anchor' value for air and water emissions is $2,700/t for PM_{10} particulates (p.39). This compares with range estimates from the CSIRO's Beer (2002) of $108,000 to $221,000, and from Murdoch University's Cockroft and Pryor (2006) of $4,300 to $11,600. The estimates for leachate exclude many parameters that are often key indicators for licence conditions, such as nitrogen, total dissolved solids, pH or manganese. The implication is that these other parameters are subsumed in those listed or have no impact.

In relation to amenity costs, BDA (2009) draws on values from the Productivity Commission (PC 2006b) report into waste management for its best practice landfill estimates. The Commission referenced a range of studies and gave prominence to a NSW study that valued amenity impacts at $3.70 per tonne. PC (2006b p.441) concluded, without clarifying why, that the impacts are worth "less than $1" per tonne – the value applied by BDA (2009).

If most urban landfills are considered best practice, then the amenity costs of putrescible landfills in Australia would amount to some hundreds of thousands of dollars per year. While the recent landfill gas problems at Cranbourne landfill are clearly an extreme case, the compensation understood to be under negotiation could soak up all of BDA's estimated landfill amenity costs for the whole of Australia for years or decades!

BDA (2009 p.39) dismisses the notion that there is a scarcity externality associated with landfills because higher levels of scarcity will "increase the relative cost-competitiveness of alternative waste management options". It is doubtful that this level of faith in market processes would be uniformly shared. Certainly many local governments feel the need to conserve landfill airspace. New landfills typically cost more to run than those they replace, implying an externality gap between the interests of a private landfill operator and those of the owner of the waste supply. It is important to recognise, too, that there are no true 'alternatives' to landfill, but rather only ways of slowing down the rate of landfill inputs.

4. MINOR ADDITIONAL COMMENTS

p.8 Collection is listed as a cost for recycling and composting. Why not for residual wastes?

p.13 BDA asserts that landfill prices in Europe "would be expected to include much higher landfill values". This may be correct, but some supporting evidence would be beneficial. House prices in Australia are apparently higher than many areas of Europe.

p.43 The fact that "there is little information" on a potential externality is not a good reason for dismissing it. If it is a valid externality that cannot be valued, then it should be listed as an additional unvalued externality alongside those that have been valued.

p. 45 The report states that inert landfills "do not have significant air emissions or leachate impacts". This is not necessarily the case. There are examples of 'inert' sites with flares and even gas engines. Inert landfills in NSW accept commercial waste that is rich in office paper, which is readily degradable.

p.46 The average rainfall figures given in Table 4.2 appear low. Were they weighted by population centre?

5. CONCLUSIONS

BDA (2009) provides a well-written, clear, rational and well-supported report within the framework of effect-by-effect valuation of externalities. However:

- It does not deal well with uncertainty. Use of range values or probabilistic measures would have been more appropriate given the level of uncertainty.
- The range and scope of externalities seems somewhat restricted.
- Given the focus on single value estimates, some of the costs seem conservative.
- The greenhouse gas estimates contain some errors.

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