Sustainable Solid Waste Management in New Zealand

One of a number of discussion papers produced by the IPENZ Presidential Task Committee on Sustainability during 2003 and 2004.

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> *"A mark of how civilised a population is: what they start worrying about when their ordinary needs are met. An advanced civilisation might start being concerned about spiritual or philosophical questions. We go shopping"*
>
> Anholt [1]

> *....."Fundamental changes in the way societies produce and consume are indispensable for achieving global sustainable development"*
>
> World Summit on Sustainable Development (2002)

1 Summary

Sustainable development is a recognised goal for New Zealand and will rely heavily on the engineering community to help our nation achieve it. The generation of waste at rates above what our environment can sustain and our natural resources can replenish is a critical factor indicating an unsustainable society.

Solid waste engineers have a crucial role to play in restructuring how materials flow in our societies to avoid waste generation and minimise toxicity. Policy initiatives at central and local government levels confirm that we need to work towards a more sustainable solid waste infrastructure. There a number of challenges and tasks that engineers and the engineering community must face and undertake in order to move New Zealand towards this goal. These issues include tackling consumerism, promoting and implementing sustainable technologies, working within the various interwoven governmental, industry and community sectors that influence resource efficiency and waste generation, and finding solutions that go beyond recycling and waste disposal. A checklist is included at the end of this paper to aid towards achieving this goal. This paper is a working draft and comments for improvements are welcomed.

2 Introduction

The increasing pressures of consumerism, availability of "cheap" resources and disposal methods, and the forces of globalisation have contributed to the massive solid waste volumes generated in New Zealand over the last few decades. These wastes are placing increasing pressure on the various waste sinks in our environment that are currently used to accommodate them. The increasing quantities of waste generated in New Zealand is one of the most overt indicators of an unsustainable society. There

[1] Anholt, S. *Branding New Zealand*. Interview with Linda Clark, National Radio, New Zealand. 13 June 2003.

is no definition of waste in NZ's legislation, however the Ministry for the Environment's New Zealand Waste Strategy [2] defines waste as "*any material, solid, liquid or gas, that is unwanted and or unvalued, and discarded or discharged by its owner".* This definition recognises that in fact "waste" is not necessarily a useless material but rather a resource unused.

Waste represents the loss of both material and energy resources and in efficient materials processing systems, "waste" is a sign of design failure. The solid waste industry in a future sustainable society will therefore represent a completely different industry from what we know today.

The purpose of this discussion paper is not to explain in detail why sustainable solid waste management is required in New Zealand but to accept sustainability as the political-social-environmental ethic by which future solid waste management will be based and by doing so, present ideas and guidance as to the future role of engineers in shaping a more sustainable (or "less unsustainable" (James, 1999)) society. It is noted that this paper presents information relating to solid municipal waste and does not attempt to discuss hazardous waste or associated contaminated sites.

3 Sustainability and Solid Waste

A framework for action towards sustainable development was first prepared over a decade ago at the United Nations Rio Earth Summit. Agenda 21 was the main outcome of the Summit and in Chapter 21 of this document a preventative waste management approach was first officially advocated on an international scale, one which focuses on changes in lifestyles, and in production and consumption patterns, as the best chance for reverting waste generation trends and promoting sustainable development.

The New Zealand Waste Strategy [3] (MfE, 2002) states that the reduction of waste is a cornerstone of the government's commitment to sustainable development and it has three main goals each relating to the three recognised spheres of sustainability (i.e. environment, social and economic):

- **Lowering** the social costs and risks of waste;
- **Reducing** the damage to the environment from waste generation and disposal; and
- **Increasing** economic benefit by more efficient use of materials.

Hawkens et al [4] (1999) in their book, Natural Capitalism, argue that the earth's natural capital (resources such as time, oil, water and clean air) are diminishing at an alarming rate and there is a need for a new industrial revolution which values human and natural capital as well as conventional economic values. They propose four strategies for natural capitalism:

- **Radical resource productivity** – using resources more efficiently;
- **Biomimicry** – eliminating waste though closed cycles and eliminating toxicity;
- **Service and Flow Economy** – a shift from an economy based on products to one based on services; and
- **Investing in Natural Capital** – reversing environmental destruction through investment in sustaining and restoring natural capital.

[2,3] Ministry for the Environment (MfE). (2002). *Policy instruments for Waste Minimisation and Management in New Zealand: A background document to implementation of the NZ Waste Strategy.* September, 2002, Wellington. NZ.

[4]

All three of these documents advocate for more efficient production practices that eliminate or minimise waste generation. One of the fundamental goals of a sustainable society is to move toward a pattern of closed-loop material use so that materials, once extracted from the earth, are continually reused, remanufactured, or recycled providing for the more efficient use of materials and energy (refer Figure 1).

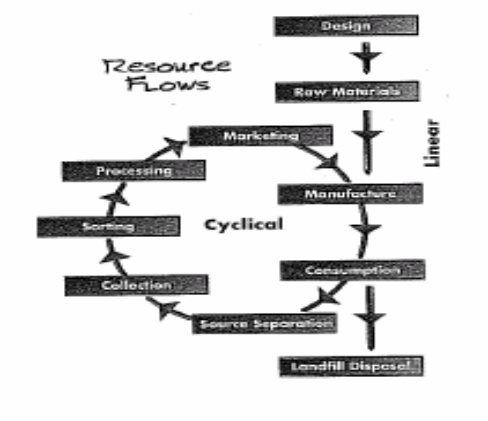

Figure 1 Material Flows in a Sustainable System (Zero Waste Trust 2002 brochure)

3.1 Zero Waste

It is unclear where the term Zero Waste was first conceived, but it is thought that in the early 1990s the idea was first incorporated into Canberra's "No Waste by 2010" policy (Zero Waste Trust [5]). Since then it has received a widespread following in New Zealand led by the funding and advocacy group New Zealand Zero Waste Trust (www.zerowaste.co.nz). Currently over half of New Zealand's City and District councils have adopted the Zero Waste vision into their waste management policies and / or plans.

The term, Zero Waste, is best considered as a vision rather than an ultimate target in a similar way as "Zero Accidents" is used on construction sites, or "SmokeFree NZ" has been used for public campaigns. In this way, the zero should not be viewed as the only indicator by which success is measured rather as a goal to focus creativity and resources on a journey of continuous improvement to change the way we think about and deal with waste. The Zero Waste vision aims to eliminate waste rather than just "managing" it.

Zero Waste thinking encompasses waste elimination at source through product design and producer responsibility, and waste reduction strategies further down the supply chain such as cleaner production, product dismantling, recycling, reuse and composting. Terminology used in Zero Waste literature refers to material flows instead of waste streams, and wasted resources instead of waste (Zero Waste Trust, 2003).

4 Changing Role of the Solid Waste Engineer

Solid waste engineers have traditionally been involved in activities relating to waste disposal practices, such as improving the sanitary and public health aspects of collection and disposal options, creating environmentally-sound waste management infrastructure designs, and more recently developing waste

[5] Zero Waste NZ Trust. (2003). *Getting There! The Road to Zero Waste.* Report prepared for Zero Waste Trust by Envision NZ.

minimisation systems and strategies for initiatives such as composting and recycling. What will be required by “solid waste engineers” in a sustainable future will be quite different, given that sustainable systems aim to eliminate waste wherever possible via product design, resource efficiency, closed-looped systems and resource recovery.

The role of the solid waste engineer in the future will need to reduce its focus on removing or minimising the harmful and adverse effects of solid waste by designing safer and improved sanitary collection and disposal practices and increase its focus on designing cyclic collection, recycling and reuse systems which transfer materials from one location to another efficiently and safely. At the same time, other engineers involved in product design and materials processing will take on greater roles to improve the design of goods and products that have complete life-cycles and use materials more efficiently.

Solid waste engineers have already been developing new thinking in the area of solid waste management, due to the promotion of integrated waste management and the waste hierarchy principles (reduce, reuse, recycle, recovery and disposal), which started over two decades ago. Waste minimisation actions linked to the waste hierarchy principles have become part of policy in recent years, and adopted by industry for obvious environmental reasons (i.e. improved resource, material and energy efficiencies, reduced environmental impacts from disposal) but also for practical economic factors relating to extending the lives of operating landfills and saving costs during material production via cleaner production techniques. The promotion of the waste hierarchy and the implementation of waste minimisation initiatives have transferred the onus of waste generation on to the community as a whole in addition to council and industry, which has created a whole new social component to waste management. This now means that engineers and council staff now control and manage waste in ways that must give consideration to the priorities and participation of local communities. Even though the waste hierarchy is now recognised by government, industry, educators, environmental groups and the community, the majority of energy and resources is still devoted to the lower tier of the hierarchy - waste disposal.

It is argued that the solutions solid waste engineers have traditionally helped to create for New Zealand’s waste quantities have, in fact, fuelled the real issue of waste generation, while at the same time providing a necessary public health and environmental service. By designing and constructing landfills as our primary disposal option, the landfill becomes a council or private asset that requires more refuse to sustain its very existence and viability. This in turn removes focus from the up-stream issues of resource conservation, cleaner production, efficient product design and durability, and in many cases has marginalised community recycling and reuse initiatives.

Although there have been some clear shifts in the way waste is perceived by those within and outside the sector, there is still a long way to go when considering what the real implications of sustainability on the NZ waste sector will be.

5 Sustainable Solid Waste Practices

5.1 Issues and barriers

5.1.1 Consumer society

A number of fundamental challenges lie ahead for the solid waste industry. Our increased solid waste production in recent years is largely the result of stronger consumer trends in NZ. New Zealand's economic system has become based around maintaining and sustaining high levels of materialistic consumption and this consumption is fast becoming linked to our identities, aspirations and leisure activities. A recent document produced by the Parliamentary Commissioner for the Environment entitled *See Change: Learning and Education for Sustainability* [6], suggests that if people can learn to be consumers, they can also learn to resolve unsustainable practices and develop more sustainable ways of living. This social change is critical to order to manage the demand for waste disposal and recycling systems by eliminating the need for them.

New Zealand is a large importer of manufactured goods with extensive associated packaging and often short useable life spans [7]. While this reflects the consumer society we live in, it is also creating heavy demand for local recycling or final disposal options. Efforts to achieve sustainable urban waste management must tackle the difficult question of commodities and packaging arrived from distant sources, used and discarded locally, and processed and returned to distant manufactures and agricultural users. Engineers will not be able to tackle these issues alone and it must involve multi-disciplinary action.

5.1.2 Sharing Responsibilities

Reducing waste and changing the way materials are used and flow throughout society will need to be led by both central government as well as industry and community leaders using a range of market-based and educational instruments. Zero waste targets, dematerialisation, eco-efficiency, life cycle thinking and analysis, ecological foot-printing, sustainable consumption, design for the environment are all tools and approaches that are exciting, leading edge and potentially transforming: however in isolation their impact is limited and undeveloped. Engineers can adopt such practices into their work but it will require the support of associated sectors and communities for these efforts to be realised and meaningful.

A local council solid waste engineer currently has very little responsibility over production decisions and associated waste generation and therefore limited capacity to achieve source reduction. Industry has a large part to play in implementing more sustainable materials use and reducing the quantity of waste that councils' do not directly control. The many various stakeholders in each industry (including the consumer) make alternative, more sustainable production choices difficult to implement quickly (e.g. food safety and product marketing issues relating to packaging choices).

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7 Ministry for the Environment (MfE). (2002). *ibid*

At an international level, Gertsakis and Lewis [8] report that research, debate and policy development is striving to deal with the shift from waste management to resource efficiency. This shift clearly presents a major test to the fundamental nature of how society functions. A significant issue is how the concept of sustainability can be developed into programs and systems that are effective across sectors, disciplines, communities and professions. Strategic thinking and creative action ought to become a mainstream approach across all sectors

5.1.3 Sustainable technologies

One of the more significant challenges in realising a sustainable future is the interim process and how it can facilitate the desired outcome. Can incremental changes make the differences we require for a more sustainable society or do we need to make more significant "path-breaking" changes? Weaver et al [9] highlights the phenomenon of new technology being locked out of the marketplace by old technology and old technology being locked in. Not having sustainable technologies being here 'on the shelf' is a barrier to the general restructuring of incentives, while not having the incentives and framework conditions to make sustainable technologies viable means there is little business imperatives to develop such technologies. This Catch 22 is one that many other industries are grappling with as they strive to implement more sustainable, or "less unsustainable" technologies.

Gertsakis and Lewis [10] argue that sustainability thinking in regards to waste needs to go beyond waste hierarchy principles which tend to focus on incremental changes and look towards radical, innovative alternatives that consider eco-efficiency principles at all levels. A useful example taken from Gertsakis and Lewis illustrates how using a 'sustainability' decision-making framework can result in producing different solutions for a given waste recovery problem (Table 1).

Weaver et al highlight however that sustainable technologies, unlike many other new technologies, rely on fundamental cultural, social and economic reform. All markets are socially constructed and markets are subject to potential reconstruction by societies and their representatives to achieve societal objectives. The heavy dependence of sustainable technologies on market reconstruction to enable technologies to become cost-competitive makes for a special case. Uptake of sustainable technologies (e.g. a new service to replace a product, or a new process to deal with recycling composite materials) is likely to take longer compared to the uptake of other types of technology (e.g. internet and email) because of this reliance on market reconstruction. This would suggest we need to prioritise work on sustainable technologies immediately as the uptake of new alternative technologies will take time, but as Gertsakis and Lewis warn there is a risk of over-investing in recycling solutions which may be applying yesterday's solutions to a future desperate for progressive ideas, actions and leadership.

Table 1 Example of Waste Hierarchy Thinking versus Sustainability Thinking

What alternatives are there to conventional recovery / disposal options for clothes washing machines?	
A conventional approach using the waste hierarchy principles would consider the following:	*A sustainability framework for decision-making would focus on innovation and eco-efficiency:*

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9 Weaver, P., Jansen, L., Grootvelf, G.V., Spiegel, E.V., and Vergragt, P. (2000). *Sustainable Technology Development*. Greenleaf Publishing, Sheffield, UK.

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Can we eliminate unnecessary components or reduce the weight of components? (Reduce)	Do we need washing machines or find other ways to keep clothes clean e.g. considering new fabrics? (Avoidance)
Can we design components and overall appliance to extend product life? (Reduce)	Can we develop a completely new technology for cleaning clothes that has a much lower environmental impact (e.g. microware cleaning?) (Reduce)
Can we design for remanufacture so components can be reused ? (Reuse)	Can we shift the product to a service? (Reduce)
Can we design product for recycling and/or use recycled materials in the product? (Recycle)	Can we design machines for more effective remanufacturing and establish lease and take-back systems similar to those in place for office equipment? (Reuse)
Can we design of disassembly and recyclability to recover materials? (Recycle)	Can we establish product stewardship programs that establish closed loop programs and eliminate waste from washing machines? (Recycle)
Can we establish take-back, disassembly and recycling programs for obsolete appliances? (Recycle)	Can we eliminate or minimise related environmental impacts re energy, water and detergent consumption? (Avoidance and Reduce)

5.1.4 Beyond recycling

It is critical for engineers to remember that recycling can only be considered one component of the solution. It does not address issues of product design and can allow manufacturers to get away with unchecked resource consumption. There is currently more recycling than ever in the United States yet waste volumes are still raising (http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm).

Using life-cycle analysis to assess overall material and energy flows during a product's creation and life-cycle is an important tool to use when considering various production options. The actual waste generated at the point of reuse or disposal is a fraction of the materials used to process and transport the product through its life cycle. The greatest gains are therefore made during the products life rather than at the end. For example, a gold ring weighing 10 grams has generated approximately 3 tonnes of waste on a life cycle basis (cited in Gertsakis and Lewis). This is an example of the ecological footprint of a product which decision-making regarding resource-efficiency can be based.

Jacobsen and Kristoffersen [11] provide examples of the positive impacts producer responsibility initiatives in Europe have had on reducing the impact of packaging on overall waste quantities. In Sweden, particular waste fractions experience recycling rates of up to 90%. In Germany, the amount of packaging used has decreased by 15% while the recycling rate has increased by a factor of 6. Producer responsibility does not however only involve improving recycling rates and recycling opportunities but more importantly involves the design of more durable goods, or the establishment of product leasing or servicing arrangements.

[11] Jacobsen, H. and M. Kristoffersen. (2002). Case studies on waste minimisation practices in Europe. Copenhagen, European Environment Agency.

Designing products with longer lives so that excessive energy and material loss are avoided is considered an important part of sustainable development. Products such as fridges, computers, washing machines, vacuum cleaners etc that are designed for durability will however need to be designed alongside reformed industries and markets which can accommodate for the inevitable changes in fashion, materials and technologies that will occur during the life of the product. By leasing products or providing a service instead of selling the products, manufacturers retain ownership of the product throughout the product life cycle and therefore have the incentive to maximise and recapture the end-of-life value of their product, in turn reducing the need for virgin materials (Fishbein et al [12]).

6 Influencing legislation and guiding documents

The purpose of this section is to summarise examples of New Zealand documents and agencies that influence, restrict and/or encourage solid waste engineers to incorporate sustainability principles into their work. The range of influencing documents has been listed under the following headings: Central Government; Local Government; Standards, Guidelines, Best Practices; and Professional Associations.

6.1 Central Government

The solid waste sector in New Zealand has no central government "home" unlike other industry sectors such as the building sector or transport section (e.g. Building Act or the Land Transport Act). There is no definition of "waste" in our legislation that makes for an even more disconnected legal framework. The management of solids waste and its effect on the environment (socially and economically) are partially addressed by a range of legislation including:

- **Resource Management Act 1991** – recognises and promotes the goal of sustainable management of natural and physical resources; requires that developments avoid, remedy, mitigate impacts on the environment; establishes a framework for resource consents for air, land, water discharges. The focus of the RMA can therefore only be about the environmental effects of waste rather than regulating how waste activities are carried out. Specifically, regional councils are given responsibility to manage the effects of discharges from waste disposal activities.

- **Local Government Act 2002** – encourages sustainable development and requires Councils to "promote the social, economic, environmental, and cultural well-being of communities, in the present and for the future" (Part 2, 10 (b)); territorial authorities are required to produce Long Term Council Community Plan (LTCCP) which have a long-term view (i.e. 10yrs).

- **Local Government Amendment Act 1996** – requires local authorities to produce waste management plans that focus on the waste hierarchy (i.e. reduce, reuse, recycling, recovery and residual) however it does not provide clear roles and responsibilities for central, regional and local levels in regards to waste minimisation and the roles of the private sector in waste management.

- **Hazardous Substances and New Organisms Act 1996** – controls hazardous substances but not hazardous waste.

[12] Fishbein, B.K., McGarry, L.S., Dillion, P.S. (2000). *Leasing: A Step Towards Producer Responsibility*. Inform Inc., New York.

- **Health Act 1956 –** promotes and conserves public health and secures the abatement of any nuisance or removal of any condition likely to be injurious or offensive to health. Council statutory obligations for the collection and disposal of refuse arise from the Health Act.

6.1.1 Ministry for the Environment (MfE)

Managing solid waste involves managing the many associated environmental issues and therefore the Ministry for the Environment (MfE) has played the main central government role in regards to the development of policies and strategies to deal with it. The MfE recognises that the concept of sustainable development and disciplines such as life cycle and materials flow analysis, ecological foot-printing, and environmental resource economics have gained in credibility and are now actively being incorporating into waste policy internationally [13] .

Some of the strategy documents, technical reports, and best practice guides relating to solid waste minimisation, management and landfill design/management that the MfE have produced are listed below:

Waste Minimisation

- **Review of Targets in the New Zealand Waste Strategy** (MfE, November, 2003) – reviews progress with the NZ Waste Strategy document released in 2002. Among the various findings, the review found good progress had been made by councils in adopting various waste reduction targets as proposed by the strategy although some targets were recognised as currently being very difficult or impossible to achieve by some local authorities given current technology and information available (e.g. organic waste). Recommended that none of the waste minimisation targets be altered. Next review is to be undertaken in 2008.
- **The New Zealand Waste Strategy: Towards Zero Waste and a Sustainable New Zealand** (MfE, 2002).
    - A joint waste minimisation initiative between the Ministry for the Environment and Local Government New Zealand. The strategy document sets waste minimisation, hazardous wastes and waste disposal targets (albeit voluntary targets) for example, by 2008 the quantity (in weight) of construction and demolition sent to landfill will be reduced by 50% (of 2005 figures).
    - The strategy has been acclaimed for the example it gives for the vision, consultative process, and sound principles it is based on, but lacks regulatory "teeth".
- **Development of a Regional Waste Recovery / Processing Sector** (MfE, October, 2003).
- **Policy Instruments for Waste Minimisation and Management in New Zealand** (MfE, September, 2002)
- **Guidelines for the Safe Application of Biosolids to Land** (DRAFT) (NZWWA, MfE, MoH, MoF, 2003)
- **Business and Employment Opportunities from Waste Minimisation** (MfE, 2002)
- **Packaging Accord 1996 –**the MfE and the then Packaging Industry Advisory Council signed this accord in 1996 which lasted 5 years and is to be renewed this year. The objective being *"to minimise adverse environmental effects arising from packaging waste by the adoption of efficient and effective practices to reduce waste.*". The Council's main role is to collect data on paper, plastic, aluminium, steel and glass materials for consumption, collection and disposal and to support waste

[13] Ministry for the Environment (MfE). (2002). *ibid*

management and minimisation options for packaging. The next accord will have a greater focus on Extender Producer Responsibility although it is a voluntary accord which will not enforce any requirements on any waste packaging producer.

Disposal

- **Waste Acceptance Criteria for Class A Landfills** (MfE, September, 2003)
- **A Guide to the Management of Cleanfills** (MfE, 2002)
- **A Guide to the Management of Closed and Closing Landfills in New Zealand** (MfE, 2001).
- **Landfill Full Cost Accounting Guide for New Zealand** (MfE, 2002).

Future Priorities

Waste work within the Ministry is now spread across three major policy groups with the overall responsibility for the implementation of the NZ Waste Strategy sitting within the *Sustainable Industry Group*. The priority areas of work for the MfE in 2004 and coming years are the following (MacLeod [14]):

- **Special wastes** – priority is being given to recovery of used oil and tyres and development of an Extended Producer Responsibility policy for New Zealand.
- **Monitoring and evaluation of progress** – as started with the recent review document (MfE, 2003)
- **Organic wastes** – the recent review identified some of the challenges involved with meeting the NZ Strategy target for organic waste (i.e. conflict with landfill gas generation, contamination in compost and biosolids products, market creation). MfE plan to address these issues with local government and industry.
- **Landfills** – progress towards closing or upgrading sub-standard landfills and further work on landfill acceptance criteria and for landfill gas collection.
- **Packaged Goods Accord 2004** – continued work with the NZ Packaging Council to establish a new accord (replacing the 1994 accord) which will form a voluntary agreement with specific action plans to reduce environmental effects of packaging and quantities going to landfills.
- **Govt3** – new programme designed to reduce waste generated by government agencies and imbed "environment" into everyday activities.
- **Unwanted Agrichemicals** – developing a national programme for the collection of unwanted agrichemicals which supports current Regional council-led agrichemical collections.

6.2 Local Government

A large proportion of the work that solid waste engineers undertake in New Zealand relates to the solid waste services that local government own, operate and / or manage. Therefore the majority of solid engineers work within local government, for them or have to report to them (e.g. via resource consents). Examples of local government documents which promote and/or influence sustainability principles in the solid waste industry include:

- Regional Policy Statements and Plans:
    - e.g. Auckland Regional Policy Statement (1999), *"…minimise the quantity of waste….to promote the sustainable use of natural and physical resources;*
- District Council Plans and Strategies:
    - e.g. Rodney District Council Zero Waste Plan: *"vision is to protect Rodney's special environment by working to reduce waste with the aim of Zero Waste to landfill by 2020";*

[14] MacLeod, M. (2004). Priorities for 2004 waste work in the Ministry for the Environment. *Waste Awareness*. Journal of WasteMINZ. January, February.

- Tauranga /Western Bay of Plenty Waste Management Plan: *"Sustainable waste management that protects the environment…promoting waste minimisation to achieve zero waste target by 2015".*

6.3 NZ Standards, Guidelines, Best Practices

The lack of specific NZ standards, guidelines and/or best practice documents in the areas of resource efficiency and recycled products presents an obvious gap and potential barrier to the implementation of sustainable technologies and improved waste management and waste minimisation. While there have been some comprehensive documents produced detailing best practice guidelines for waste disposal activities such as MfE's Guide to the Management of Cleanfills (2002) or CAE's Landfill Guidelines (2000), there are few examples of best practices for waste minimisation initiatives.

Construction and demolition waste management / minimisation best practice guidelines are currently in development, and various standards (or process best-practice guidelines) for recycled or compost products do not exist in New Zealand. Such documents should help to assist with the creation of markets, credibility of products and sound production efficiency practices in the areas of material efficiency, waste minimisation and waste disposal practices.

6.4 Professional Associations and Educational Institutions

The various professional and non-governmental organisations that engineers belong to and work with (including the organisation they work in) represent another area-of-influence for the promotion of sustainability principles in engineers' work. Examples of such groups include:

- **Waste Management Institute of NZ (WasteMINZ)** – is a non-profit organisation that aims to promote sustainable waste management practices, provide a forum for presentation and dissemination of information and to act as a facilitator for the waste management industry in New Zealand. In 2002 WasteMINZ developed the 'Life After Waste Programme' which seeks to involve all sectors, organisations, initiatives and individuals to change actions and "close the loop" on waste. http://www.wasteminz.org.nz
- **Zero Waste NZ Trust** – as discussed in Section 2.1, the organisation is currently promoting the following five key recommendations:
  1) A National Target Date for Zero Waste by 2020
  2) Introduction of a Landfill Levy
  3) Landfill Bans
  4) Industry Stewardship Programmes to ensure that the principle of Extended Producer Responsibility (EPR) is fully implemented.
  5) A National Zero Waste Agency.
- **BusinessCare** – is a not-for-profit trust which promotes, supports and encourages the implementation of sustainable management and cleaner production practices by local businesses nationwide. http://www.businesscare.org.nz/
- At a business, organisation or council level e.g. development of company-policy relating to sustainability principles; consider joining a 'sustainability-linked' organisation, for example the Sustainable Business Network, www.sustainable.org.nz
- **Institute of Professional Engineers in New Zealand (IPENZ)** – the Code of Ethics; Sustainability Task Committee work. www.ipenz.org

- **New Zealand Society for Sustainability Engineering and Science (NZSSES)** - a Technical Interest Group of IPENZ www.nzsses.org.nz
- **Centre for Advanced Engineering** - a not-for-profit organisation which aims to enhance engineering knowledge within New Zealand by technology transfer and the application of NZ and overseas research to engineering-related issues of national importance. www.caenz.com

6.5 Recommended Tasks for Solid Waste Engineers and Engineers in General

Central government recognises that reducing NZ's solid waste generation is a cornerstone for sustainable development [15] . Solid waste engineers have many opportunities to be involved in this process and in the future will need to modify their working roles to focus on designing cyclical materials flow instead of just end-of-pipe solutions. Engineers also have professional responsibilities to do so, as noted, for example, in the IPENZ Code of Ethics:

> *"Members shall be committed to the need for sustainable management of the planet's resources and seek to minimise adverse environmental impacts of their engineering works or applications of technology for both present and future generations."*

Members of IPENZ, their engineering colleagues, and others engaged in materials efficiency, solid waste management and minimisation, are encouraged to learn what they can about sustainability and apply it in their day-to-day actions at work and in other aspects of their lives. Much information is already available both from New Zealand and internationally. The engineering profession should be seen to lead the way towards a more sustainable future. There are many ways in which solid waste engineers and the engineering community can help move New Zealand towards a more sustainable society - some suggestions are given in the checklist below.

[15] Ministry for the Environment (MfE). (2002). *ibid*

7 Sustainable Solid Waste Checklist

1. Have you taken all reasonable steps within the scope of the project (and/or work environment) to eliminate, reduce or manage demand for materials use to avoid the production of waste? ☐

2. Have you included materials efficiency and waste minimisation requirements into Requests for Proposals from contractors (e.g. specify tenders use recycled-content, reusable materials or reduce waste generated by project as much as feasible? ☐

3. Have you written solid waste contracts that incentivise waste reduction and introduce differential pricing to promote waste reduction? ☐

4. Can you evaluate proposals or potential jobs with some consideration given to materials efficiency and waste production? ☐

5. Can you establish a preference for materials and products that are made from renewable, sustainably acquired materials, have recycled content, are durable, low maintenance, non-toxic or low toxic, recyclable, and low polluting in manufacture, shipping, and installation? ☐

6. Can you amend policies, rules and regulations to support alternative methods of production, or more sustainable technologies? ☐

7. Can you use your knowledge of sustainability to educate and suggest alternatives for product production, materials use and waste management options (e.g. using life-cycle analysis tools to guide decision-making process on best use of materials and energy)? ☐

8. Have you considered all the various initiatives that could assist with waste minimisation? e.g. taking direct action like recycling or composting; education and consultation; legislative changes; research and development; and monitoring and feedback. ☐

9. Can you quantify and apply the real costs of materials use and waste generation and disposal to your project? ☐

10. Can you use the discharge from one process as a resource for another (e.g. application of biosolids to land for soil conditioning; wastewater as heating)? ☐

11. Have you provided specifications and dimensions that minimise waste? ☐

12. Can you establish targets for waste toxicity reduction and monitor them? ☐

13. Can you design your product or asset for disassembly of materials and systems? ☐