Over the years the development of society and industry, coupled with growing awareness of environmental issues, has led to the application of increasingly sophisticated technological methods for handling waste.

Between the 1970's and the 1990's disposal technologies took on an air of self-sufficiency often forcing operators to take sides, in much the same way as occurs with sport fans. Those in favour of incineration were contrary to landfilling and recovery, whilst individuals supporting landfilling defamed the other methods, and so on. At times the echo of the irrational discussions which took place can still be heard today, with people continuing to reason in extreme terms, either in favour or contrary to a given system, without any reference to the specific context.

I recently attended a meeting with the Governmental Committee for the Environment of the Valle d’Aosta Region, in Northern Italy. This region is located in a small mountainous territory, with very limited space available for siting of a landfill. During the meeting I was asked whether I was in favour of incineration. I replied that the question was incomplete. It was rather like being asked whether I was in favour of travelling by train. When I have to move, as a general rule I prefer to walk; if the distance to be travelled is slightly longer, living in a flat area, I might go by bicycle, otherwise I would travel by train. If, however, I need to reach a distant destination not served by public transport, then I would choose to travel by car. I know, the exhaust emissions contain GHG, VOC, etc., but I cannot avoid using it.

Of course the above is only possible if I can count on economic resources sufficient to permit me to own a car, a bicycle or to pay for my train ticket. Otherwise, the sole resource available would be to go on foot or, worse, to use some dangerous, unreliable form of transport.

Beyond metaphor, solid waste management today should meet numerous requirements stemming from an increased awareness and perception of environmental issues by the public and from scientific developments focusing on the increasing pressure worldwide of unavoidable ecological matters (limited resources, climate change, widespread pollution, demographic growth, depletion of non-renewable energy sources, etc.).

The requirements include the following:

- decrease in waste production,
- guaranteeing an efficient service of collection and disposal,
- optimisation of material resource recovery,
- emphasis on climate change and minimisation of GHG,
- reduction of waste volumes destined to landfills,
- optimisation of energy balance with use of energy from waste,
- reduction of emissions, monitoring of toxicological effects and minimisation of health risks,
- environmental sustainability.

It is mandatory that these requirements should be integrated and evaluated in the various geographic contexts in which a series of economic, social and geomorphologic situations may influence choices.

With the aim of identifying the driving forces underlying the choice of waste management options, a graph originally presented by Cossu (2007), may be used, modifying it on the base of the available updated sources (UNPD, 2000; OECD, 2007; Eurostat, 2008).

The graph represents a triangular diagram illustrating the state of waste management in various countries referring to the use of the three main types of waste treatment: material recovery and biological treatment, thermal treatment and landfilling.
The term “Landfilling” comprises the various forms of waste to land disposal (e.g. open dump, simple landfilling, dry tomb, landfill bioreactor, predominantly inorganic landfilling, ash and slag, MBP landfilling) even although it is not always clear which data refer to which form of landfilling. The term “Material recovery and biological treatment” includes source segregation, mechanical and manual sorting, composting, anaerobic digestion, and “Thermal treatment” accounts for incineration, pyrolisis, gasification and RDF production and use.

The graph also illustrates the point of “Zero Waste” (ZW) indicating the “ideal” solution whereby no waste is landfilled or thermally treated.

At first glance it appears clear that sanitary landfilling is the main “driving force” of all modern waste management strategies applied today in industrialised countries. There is a growing need to reduce the volumes of waste referred to landfills. This is largely a consequence of issuing sites as well as short and long-term environmental complications (e.g. GHG emissions, odour and traffic nuisance, leachate emissions). Consequently, the European Union has mandated the hierarchical development of integrated management procedures (minimisation, recovery of materials, recovery of energy, safe landfill). As a result an increasing number of national strategies seem to assess the decline of sanitary landfilling as a strategic option, displaying a general trend to move away from large-scale landfill sites of untreated waste, towards source separation and recycling and intensive thermal and/or mechanical biological treatment of waste before landfilling. In some countries, such as the Netherlands, landfilling rates are lower than 2%. A delay in this trend can be observed for some new EU countries, which still relies heavily on landfilling.

In other parts of the world, although a small number of countries has established a strong thermal treatment policy, sanitary landfilling continues to be the most widely applied option (Australia, Canada, United States, China, New Zealand, Korea, South Africa, South America) and is on an upward trend in developing countries, particularly close to the main cities, thanks also to the opportunities offered by the CDM (Clean Development Mechanism) for methane recovery projects. This choice is often coupled with increasing programmes of source segregation and material recovery. Nations making exclusive use of landfilling (in general open dumps) are identified in low income developing countries (DC’s), and the choice is, of course, dictated by economic restrictions.

As a result of these different approaches, landfill engineering and management varies dramatically from one area to another, both in terms of conceptual design and technology. To avoid confusion and problems of public acceptance, these aspects should lead to the definition and standardization of a new terminology for the different forms of landfilling.

All countries are far from achieving Zero Waste targets. Despite the fact that several people consider “Zero Waste” a practical alternative to final disposal, this concept only represents a desirable approach and trend on which all waste management strategies should be based. Similar indeed to the principle of “zero disease” aiming to limit the onset of disease through application of prevention measures, correct nutrition, improvement of lifestyle, etc. Nobody would ever consider it an alternative solution for their health problems, replacing physicians and hospitals!

The implementation of thermal treatment is driven more than by energy production by the dramatic reduction of waste volume (residues are approximately less than 10% of the initial volume). This is the case of countries such as Japan, Switzerland, Denmark, the Netherlands, Singapore, and Luxembourg, where the space for landfilling is virtually nil. Industrialized countries with high energy requirements such as much of the USA, Canada and Australia, are able to count on a wide availability of open spaces. As a result, there is no or relatively little use of thermal treatment.

In some countries, such as Greece, where from a political point of view thermal treatment has not to date been considered a viable option for waste management due to the critical situation regarding lack of space for landfilling in the larger metropolitan areas, such as Athens, the positions taken are currently being reconsidered (Karagiannidis and Themelis, 2008).

At a local level waste management decisions may be strongly influenced by several other factors including the famous syndromes:

- NIMBY (Not In My BackYard). The best known syndrome representing a widely spread public attitude towards the installation of waste management facilities close to any given residential area.
- NIMO (Not In My Office time). It is still common practice among politicians and administrators to avoid or postpone decisions that may adversely impair their careers.
- BANANA (Building Absolutely Nothing Anywhere Near Anybody). This syndrome represents an extremely radical conclusion to the approaches described previously.

A combination of these syndromes coupled with extreme environmentalist positions against landfilling and incineration, associated with lobbying, illegal or criminal interests may result (as happened in the Naples area in Italy) in a total paralysis of all technical and environmental management of waste. As the readers of the journal who know better, we should take the opportunity to educate our family, neighbours, teachers and our elected representatives: only through education will cost-effective rational solid waste management plans be reached without NIMBY, NIMO or BANANA and with negligible influence of negative interests.

Ultimately, however, in evaluating the various waste management strategies available, it should be kept in mind that although appropriate solutions to any problem should invariably be sought, there will always be someone, frequently with no expertise in the field, ready to find problems for any solution!

References


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