

Waste disposal

Integrated waste management

In compliance with Legislative Decree 152/06, the term management includes all the activities regarding collection, transport, recovery and disposal of waste, while the term integrated waste management indicates all the activities aimed at optimizing the said management. An integrated management system is the practical transposition of the principles set out in the Italian Laws, and the European Directives.

There are many different aspects that must be considered in the correct planning of an integrated management system and all these contribute to the choice of the most suited solution for disposal of the waste produced in the situation which is being examined. First of all it is important to evaluate the qualitative and quantitative characteristics of waste, the aims of separate waste collection must be established, and also the transportation utilized, waste treatment and disposal plants that can receive the waste must be identified. Having evaluated these variables, the next step is the examination of the available operative instruments, with different possible options: separate waste collection, plants for pre-treatment of waste before disposal, plants for energy recovery, (such as incinerators, gasifiers, etc.) material recovery plants, and controlled dumps. When all the data has been collected, the appointed technicians and engineers and researchers will choose the best solution using a series of instruments such as: mass and energy flow, environmental impact assessment (EIA), economic assessments, life cycle analysis (LCA) and risk analysis. According to the latest ISPRA report, in Italy, landfills still account for 26% of municipal waste produced. Recycling of the various parts coming from sorting or from mechanical biological treatment (MBT) of municipal waste reaches, overall, 44% of production: 18% consists of recovery of the sorted organic part (food waste+garden cuttings) and over 26% of recovery of the other parts. 19% of municipal waste produced is incinerated, while 2% is sent to manufacturing plants, such as cement plants, power plants, etc., to be used in the production cycle and to produce energy (co-incineration); 1% is used, after adequate treatment, for covering landfills, 3%, consisting of waste resulting from MBT plants, is sent for further treatment, and 1% is exported. Finally, the "other" item includes, for example, the quantity of waste remaining in storage at the end of the year at treatment plants.

Recycling

By the word recycling, we mean the set of operations, strategies and methods that are used in order to recover the materials and to reduce the quantity of waste sent to the dumps and incinerators. As pointed out before, man has always been used to recover his goods or to recycle his waste up to the industrial revolution. Starting from that time, the massive production of consumer goods and the great availability of resources did not make modern man feel the need to give his waste a second life. Everything started changing from the Seventies when the costs of energy and the awareness of living on a finite planet with limited resources led to the application of measures to reduce human pressure. As noted before the European Directives and the Italian Legislation indicate prevention and reduction of waste upstream, as the first feasible choices in the area of waste management (waste hierarchy). In case this is not possible, measures for the preparation and reutilization of waste follow, and subsequent to these, measures to recycle waste.

Only some waste, of specific categories of materials, can be recycled. These categories of materials usually follow a separate course and are collected through a specific system of separate waste collection that we have started to experiment daily in our homes. The separate collection systems that are proving to be more efficient and economically sustainable are those related to raw materials that the packaging is made of (paper, glass, plastic, aluminium and wood). In order to simplify the management, collection and disposal procedures, specific consortiums have been created for each of these categories of materials. The efficiency in the recovery is often very high. This success can be explained in two ways: firstly, even after having carried out their function, these materials have a sufficiently high market value which justifies the investment effort; furthermore, as a result of the commitment of the consortiums, of the producers and distributors and also us consumers, very high levels of efficiency have been reached, over the years.

Incineration

Incineration, with energy recovery (Waste to Energy systems) is another solution to dispose of waste and consists in the combustion of waste in order to:

- decrease the volume and weight of the material;
- to completely oxidize the waste into CO₂ and H₂O;
- recover the energy content of the waste;
- sterilize the residues

The characteristics of waste produced in our homes is such that other fuel is not required for its combustion, the waste that is fed into the incinerators is sufficient, alone, for the combustion. What happens to the waste during the process? The carbon, hydrogen and sulphur content of the waste is oxidized forming CO₂, H₂O and SO₂. The humidity in the waste is transformed into steam, while the presence of halogens (Cl, F, Br) and Nitrogen produce acid substances and Nitrogen oxide (NO_x) respectively. Lastly the metals may undergo phenomena of volatilization and inert matter becomes slag. A simplified Waste to Energy plant includes a front pit, i.e. a separate area where the waste arrives that limits the spread of bad odours, an accumulation and mixing pit, where the waste is dumped and the incinerator. Incineration provides a series of advantages among which maximum reduction of the volume of the waste and energy recovery, but also a series of disadvantages that involve numerous problems, such as control of the polluting substances produced during combustion, disposal of the residues and a particularly complex management.

Even though in Italy this solution has often been prevented and is scarcely utilized (only 19% of the waste at present is incinerated), in Europe it is a widely prevalent type of plant solution and many cities use the energy produced by their waste, in order to guarantee operation of their systems.

The waste dump or landfill

In the controlled type of dump, waste is deposited in layers on the ground, in a suited and monitored manner, so as to minimize the negative effects on the environment and on human beings. Thus pollution of surface and underground water is prevented and controlled, as also emissions of unpleasant or toxic substances, and all efforts are made to reduce the aesthetical impact. Even though the disposal of waste in dumps is the least efficient type of waste management, in Italy this is still the solution that is mostly adopted in almost one case out of two.

Dumps can be subdivided into three different areas: an internal mass, which is the largest area, where degradation of putrescible waste takes place in absence of oxygen (anaerobic degradation with the formation of biogas), a superficial layer, that acts as an interface between the solid mass and the air; the leachate, the liquid produced by rain water percolating in the waste and the humidity content of the waste. Waste dumps are created by successively filling layers of a suited height (maximum 2.5 m) starting from a bottom layer that has been suitably waterproofed with natural materials (clay or a mixture of sand and bentonite) or artificial materials (geomembrane made of PE and PVC). Once the layer of waste has been laid down, it is compacted with mechanical equipment (bulldozers or compactors) to decrease the volume these occupy, up to a density of about 800 kg of waste per cubic metre. Every day, the waste is covered with inert material such as soil or gravel, and when the dump is fully filled, it is entirely covered with vegetative land, and usually it is converted into a green area. An important element of the dump, are the drainage system and the system for the collection of biogas and the leachate, to avoid contamination of the area.

All this occurs in controlled waste dumps, however often the dumps are associated with very negative characteristics,

because of the risks involved for the environment and human health, besides their unpleasant aesthetical problem. This is true with regard to non-controlled and illegal dumps that are very dangerous. Controlled waste dumps, per se, are not negative, but their utilization must be limited as much as possible and only where valid alternatives are not available. As we have pointed out before, in fact, the waste dump is the last solution in the hierarchy of waste management alternatives. There are many reasons for this: first of all waste sent to the waste dump is no longer useful and from this waste nothing can be recovered neither as a material nor as energy; furthermore the waste dump needs large amounts of space in order to be constructed, and a large effort with regard to the costs and for management of the same. The space and the resources that are available on the planet are not infinite and in this view, use of waste dumps implies a large amount of wasted resources.