BELGOPROCESS and MONTAIR PROCESS TECHNOLOGY offer extensive experience in plasma treatment of radwaste. We combine our expertise in plasma and flue gas treatment systems with design and engineering expertise and our operational experience in processing nuclear waste to offer safe, cost-effective and durable solutions for the challenging problems regarding treatment of problematic wastes.

Low and intermediate level radioactive waste is often mixed with hazardous waste and various non-combustibles. Historically, these wastes have been treated by separating the combustibles from the non-combustibles and processing them separately through incineration, supercompaction, cementation and other encapsulating technologies. However, this approach is costly and increases the risk of personnel exposure.

BELGOPROCESS and MONTAIR PROCESS TECHNOLOGY offer a proven plasma treatment technology that uses a high-temperature plasma processing technique with operating features that eliminate the personnel exposure and give a final product that meets most stringent acceptance criteria for final storage.

PLASMA TECHNOLOGY
Plasma is a highly desirable heat source for treatment of problematic radioactive waste. Plasma treatment uses an electric arc to generate temperatures in the gas stream that can achieve several thousand degrees centigrade causing the rupture of molecular structures of materials into their constituent atoms. Its high temperature range of 5 000 to 10 000 °C can treat the radioactive waste as is.

The non-combustible and other inorganic materials are melted into a glassy slag containing most of the radioactive isotopes, and subsequently transferred into an external drum and cooled. The organic materials are vaporized into a syngas and afterwards oxidized in an afterburner. The unwanted gaseous by-products of the combustion process are reduced to an acceptable level by using a proven dry scrub flue gas system, based on that of the BELGOPROCESS CILVA incinerator for radioactive waste.
Plasma technology offers a number of benefits and has a wider range of applicability compared to conventional methods of incineration:

- Applicable to solid organic and inorganic waste, including asbestos, and also to other waste types such as drummed spent resins and liquid waste
- One single process can treat the waste as generated (no prior treatment); this implies less dose uptake and risk for contamination
- The final waste form is robust, free of organic material, and suitable for long term storage and disposal
- High volume reduction factor that minimizes the overall costs of waste storage and final disposal:
  - VRF~6 waste containing mostly metals and debris
  - VRF~15 drummed mixed waste
  - VRF~80 primarily organic waste
- The heat source is a plasma, which produces less flue gasses and greenhouse gas CO2

In addition, as plasma technology can recondition previously conditioned waste packages that no longer meet the present acceptance criteria for final disposal, it offers a solution to the growing demand for improved quality of final waste forms. Therefore, even historical conditioned waste in a bituminous or concrete matrix, which doesn’t meet current acceptance criteria for conditioned waste can be retreated in a plasma facility, resulting in a conditioned product that does meet these criteria.

### PROVEN TECHNOLOGY

A first full-scale plasma system at the ZWILAG facility in Switzerland became operational beginning of 2004 and has been operating successfully. Two campaigns per year of about 10 weeks are organized to treat the waste. During each campaign about 500 drums or 100 tons are treated.

The Joint Venture IBERDROLA - BELGOPROCESS, with MONTAIR PROCESS TECHNOLOGY as a main subcontractor, has built a plasma melting facility for the Kozloduy Nuclear Power Plant in Bulgaria. The facility consists of a plasma treatment chamber containing a fixed furnace with tilt design, a 500 kW non-transferred arc plasma torch, a continuous feeding system through a two-stage shredder, and an off-gas system based on the off-gas system of the BELGOPROCESS CILVA facility. The installation will treat 250 tons per year, including its own secondary waste, spread over 40 operation weeks. It will be operational in 2017.

### AN OPTIMAL SOLUTION FOR LOW LEVEL RADIOACTIVE WASTE MINIMIZATION

As the plasma technology offers a single process solution for the treatment of radioactive and problematic chemical waste, there is no need for costly sorting or pre-treatment infrastructures or separate treatment facilities for non-burnable wastes. In addition, due to its high volume reduction factor, plasma technology significantly reduces storage and disposal costs.

ALARA principles are also applied. There is no need to open waste packages, which eliminates the risk for contamination to operational staff and limits dose exposure.

The final waste form is a glassy slag that is free from any organic material and liquid/sluide and is very suitable for long-term storage and disposal due to the physical-chemical and mechanical stabilization of the waste.