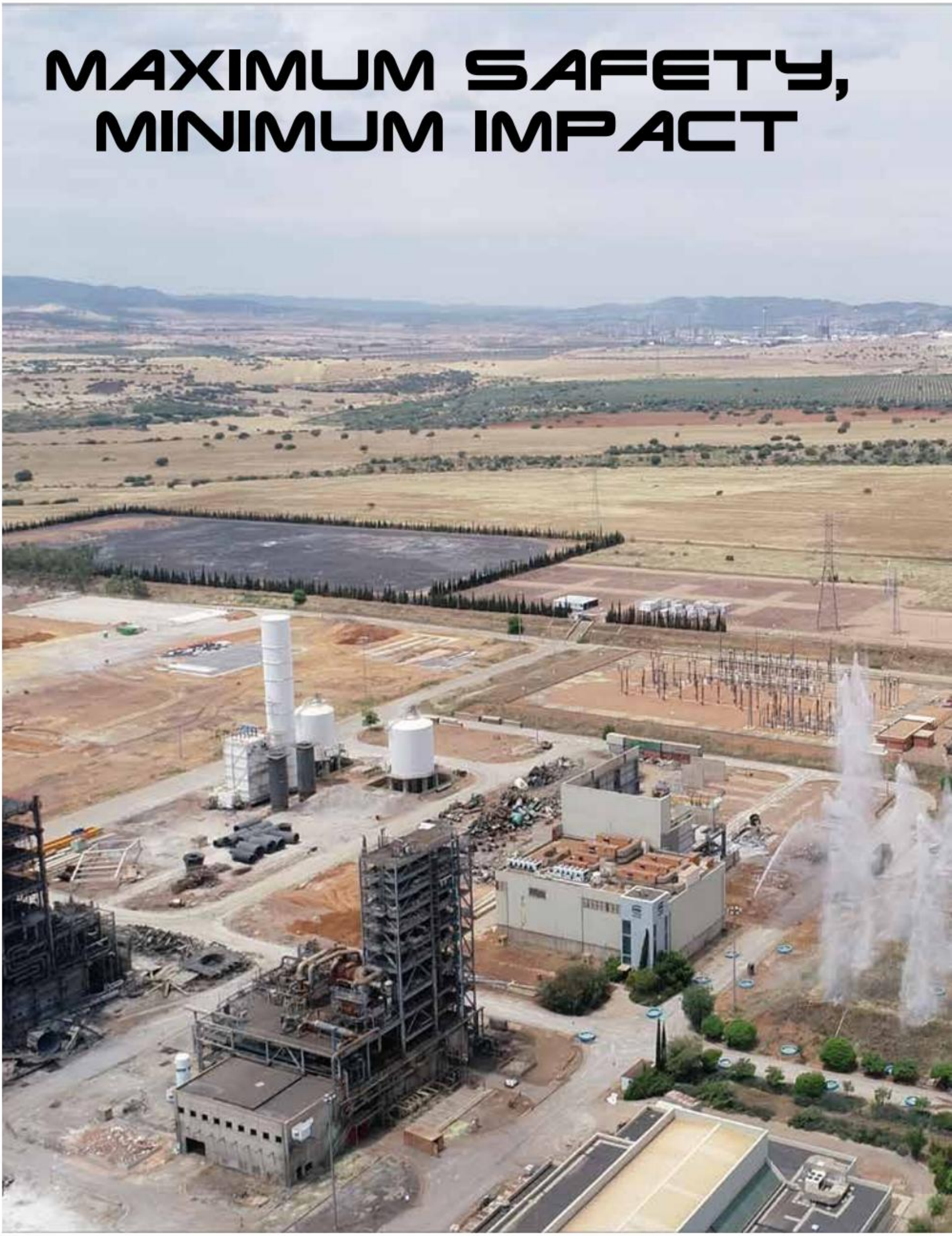
MAXIMUM SAFETY, MINIMUM IMPACT



Maxam was charged with the design and execution of the blasting to demolish the concrete towers at a thermal power station in Spain. It proved to be one of the most complex tasks the company has undertaken. Demolition magazine reports.complex tasks the company has undertaken. Demolition magazine reports.

The Elcogas plant in Puertollano was a power plant utilising integrated gasification combined cycle technology. The facility ceased activity in 2016, and Recifemetal Espana SL was charged with the dismantling project. The demolition of the power plant's concrete cooling and gasification towers was one of the most complex aspects of the dismantling process, and Recifemetal Espana elected to demolish them by means of a controlled blasting. The design and execution of that blast was awarded to Maxam which has carried out more than 100 demolitions of this type.

The 122 metre tall cooling tower was made up of a reinforced concrete slab with a thickness between 17.5 and 19 cm. The slab base progressively widened starting at 19 cm and reaching a maximum of 90 cm at the last 9.80 metres of the slab's bottom. The slab was supported by 56 inclined cylindrical pillars of 80 cm diameter, and 8.28 metres in height.

The gasification tower was a rectangular prism with 22.40 x 10.20 metre sides. It was

81.2 metres tall at its highest point. The walls were made of reinforced concrete with a thickness of 40 cm. Inside the tower there were several walls containing the staircases and lift.

According to Maxam's plans, the cooling tower was supposed to implode keeping the rubble approximately within the same area originally occupied by the tower. The gasification tower was designed to fall in a north-westerly direction, using its long side (22.40 metres) as a hinge line.

The main concern of the three companies involved in the project was the safety working crew, as well as of any person who wished to watch the demolition. Another priority was to mitigate the four main environmental effects caused by the demolition's blast: the possible generation of vibrations, air overpressure, flyrock and dust. Several structures located in the towers' surroundings required protection during the blast.

Tailor-Made Solution

Before initiating boreholes drilling in both towers, structural engineering studies were conducted on both to certify stability during drilling and other required preparatory work before the shot.

A total of 466 individual loads of Riodin explosives were used in the cooling tower and 426 in the gasification tower. These loads were confined in blasting boreholes stemmed with polyurethane foam to reduce the airblast. The explosive charges were initiated using Riotronic DT electronic detonators to ensure a correct and precise initiation. A total amount of 275 kg of Riodin explosive and over 1,000 Riotronic electronic detonators were employed in the demolition of both towers. The timing of the blast lasted 285 ms in the cooling tower and 3,000 ms in the gasification tower.

After several coordination meetings with companies in the area, neighbours and local and provincial authorities, a safety and communications plan was prepared. This plan explained in detail the safety and evacuation procedure to follow during the blasts. A safety perimeter was designed with a

radius greater than 1.0 km. This could only be accessed by the explosives engineers who would be in charge of firing the shot from a safe position provided with emergency escape routes. The evacuation perimeter was properly secured by the relevant authorities.

To minimise and monitor the environmental impacts, four seismographs were installed: one in the electrical substation, two in the solar power plant and one in the closest house. These were deployed to ensure that vibration levels did not exceed the limits established by Standard UNE 22-381-93.

To avoid flyrock, a layer of single-twist wire mesh and another layer of geotextile mesh with a density of 500 g/m2 was installed around each explosive charge. Lastly, dust collectors and hydrants were installed to trap the dust. In addition, a study of the area's prevailing winds was conducted in order to establish the best time for blasting.

Challenge Accomplished

The cooling tower fell vertically, and the resulting debris remained in the planned area, concentrated inside the pit and near the tower's base. After eliminating the pillars, the structure fell about 9.0 metres vertically. The top, already weakened in its thicker parts due

to the explosive placed in the boreholes, impacted against the floor, generating large transverse and longitudinal cracks in the thinner areas of the slab. These cracks instantly caused the structure to collapse entirely.

The gasification tower fell in the planned direction thanks to the breaking wedge generated by the explosive. By reducing its maximum height to 10 metres above floor level, the tower became more accessible and safer to be demolished using mechanical means.

Seismographs records reflected lower vibration values than those established in Standard UNE 22-381-93.

From the gasification tower, flyrock flew to a distance of approximately 100 metres, well within the 1,000 metre exclusion one. The only infrastructure that was hit by the flyrock was the CR504 road when the cooling tower was shot. The road was blocked to traffic and was quickly cleaned after the blast. The adopted dust control measures were successful, as the dust that was not contained by the hydrants and collectors travelled north-east towards the neighbouring hills and road. The electrical substation and the thermal power station's solar panels were not affected at all, as subsequently confirmed by their respective owners.

Key Figures

Location	Puertollano, Spain
Client	Recifemetal and Elcogas
Exclusion Zone (metres)	1,200
Blasting boreholes	892
Explosive employed	275 kg of Riodin dynamite
Detonators	More than 1,000 Riotronic DT electronic detonators
Blast sequence (milliseconds)	3,285