NUKEM Technologies

Cutting techniques
for decommissioning nuclear facilities and conditioning of nuclear waste

Innovation

Nuclear facilities consist of a variety of different components that are made of different materials and installed under specific spatial conditions. Similar to the radioactive waste, these components must be safely dismantled into manageable parts. The choice of available cutting techniques is almost as wide as the number of different decommissioning tasks. NUKEM Technologies has the right technical solution for every task. A customized system including a suitable handling technique will be developed to address your specific needs.

Thermal cutting techniques

Our solutions for DISMANTLING

Mechanical cutting techniques

Hydraulic cutting techniques

Innovation Solutions Excellence

Our solutions: Mechanical cutting techniques

Band saw cutting

Band saw cutting is the most widely used method for dismantling nuclear facilities. Three different designs are used, each with specific process advantages.

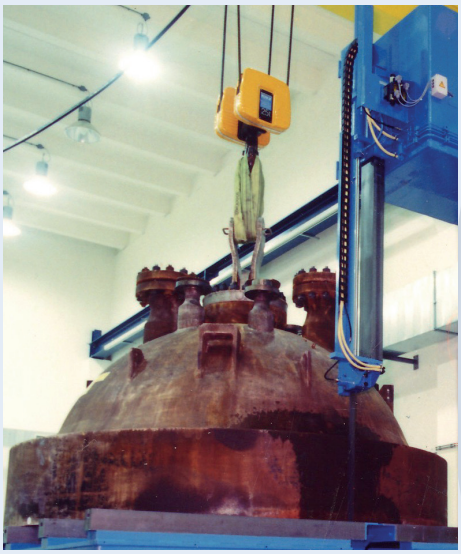
Band saw machines with a swing frame
The simplest and most common form are saws with a swing frame. A common area of application for this type of saw is the subsequent dismantling of components for the purpose of packaging and in preparation for subsequent conditioning steps. Thanks to their simple design, they can be used at relatively low cost.

Band saw with a dual-column guide
A widely used field of application for this type of saw is the dismantling of large reactor components. The dual-column saw has special guide systems for this purpose and carries out its separation tasks directly within the reactor cavity. The components to be separated are significantly larger than the band saw itself. Stainless steel versions of this type of saw are well suited for use under water.

C-shaped vertical band saw
The main area of application in decommissioning is the stationary cutting of larger components. These are guided by a movable table past the saw or the saw moves along its axis cutting through the fixed component.

A comprehensive analysis of the task is required for determining the ideal tool. This allows the optimum solution to be found with regard to technical and commercial aspects.

Band saw cutting at Kahl Nuclear Power Test Plant

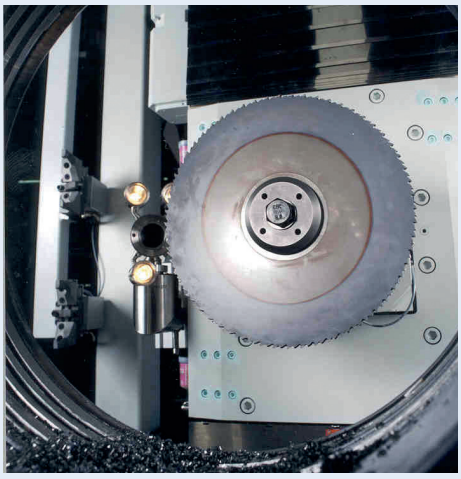


Band saw being used to dismantle large components

Circular saws

Thanks to their housing designs, circular saws are especially well-suited for use in limited spatial environments.

Circular saw with a swing frame
The main area of application for this type of saw is the subsequent cutting of components. Due to their simple design, they are very inexpensive, and provide a high level of technical reliability at the same time.

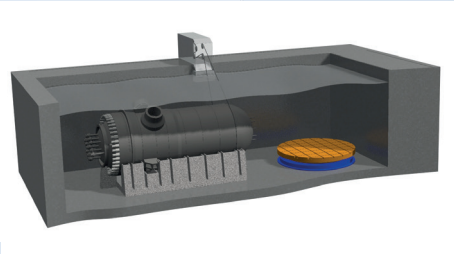


Mechanical circular saw

Circular saw with a linear drive
Circular saws with linear drives are used for nuclear decommissioning especially for separating larger components into sections. In comparison to a circular saw with a swivel arm, they have a much larger operating area and can therefore be used more flexibly. Stainless steel versions are also suitable for cutting under water.

Wire saws

The high level of flexibility of the cutting wire enables complex geometries and very large components to be separated. Normally, the wire saw is used with large metallic components with many cavities. Another field of application is the dismantling of concrete materials such as building structures.



Wire sawing of large components

Milling cutters

The areas of application for milling cutters are varied, however, compared to saws, milling cutters are not connected to a linear cutting guide. Different kinds of specific saw kerfs can be made. Therefore, milling is well suited, for example, to the targeted removal of welds or other joints.Two different types of milling cutter are used for dismantling.

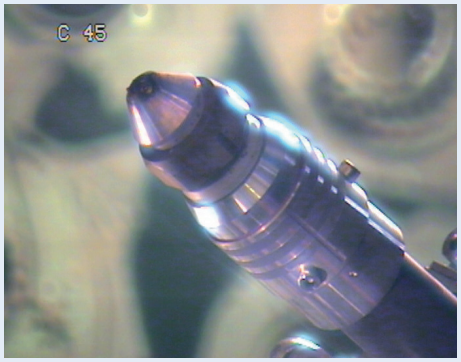
End milling cutters
These end milling cutters are made of high-speed steel material or carbide inserts. The kerf is produced by rotating the cutter while simultaneously being fed into a tool axis.
The component is fed in until it is cut through completely. The cutter length determines the limits of the cutting depth and is approximately 30 mm.The special advantage of end milling cutters as a separation technique is the high level of flexibility of the kerf form.
Side milling cutters
While end milling cutters produce relatively wide kerfs, the advantage of side milling cutters is that they produce a relatively narrow kerf. However, this can only be carried out as a straight kerf.

Gas-cooled end milling

Our solutions: Thermal cutting techniques

Flame cutting

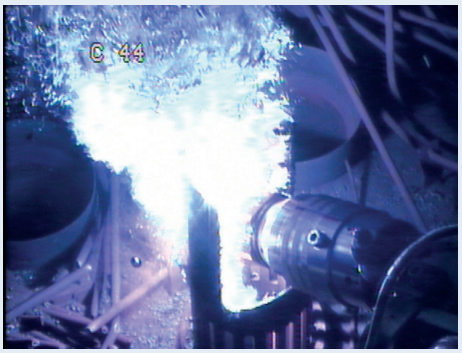
Flame cutting is a thermal cutting process for separating components made of construction steel. This method is used mainly for separating thick-walled components, such as a reactor pressure vessel. The necessary process gases oxygen, acetylene or propane are supplied via flexible hose lines to the oxy-fuel torch. With this relatively small burner, it is possible to flexibly separate components with complex geometries. The resulting process forces are very small, so that the mechanical requirements of the guide systems can also be relatively low. Overall flame cutting is therefore a very cost-effective technology.



Underwater plasma torch at Karlsruhe Multi Purpose Research Reactor

Plasma cutting

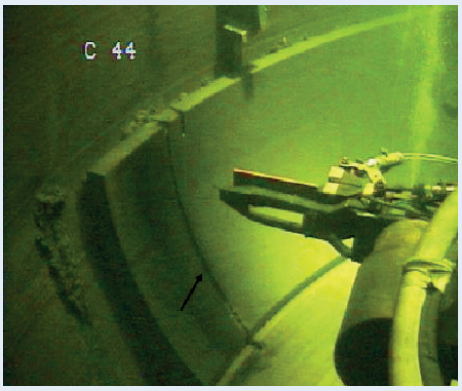
Plasma cutting is an electrothermal cutting process. Due to its operational flexibility and high cutting speed, plasma cutting has become one of the standard methods for separating metallic components. By selecting the appropriate cutting systems in conjunction with the optimally chosen plasma gases for the purpose, almost all of the separation tasks can be realized in the field of nuclear decommissioning and waste conditioning . This applies to both separation tasks in air and under water.



Underwater plasma torch at Karlsruhe Multi Purpose Research Reactor

Contact Arc Metal Cutting

Contact Arc Metal Cutting is the most robust thermal cutting process that is used under water in nuclear decommissioning. The cutting electrode, which is resistant to different water pressures, can be used to separate almost every component geometry. Due to the defined geometry of the cutting electrode, exact kerfs can be created and a clear distinction made between which structures are to be separated and which are not. Contact Arc Metal Cutting combines the technological advantages of a mechanical cutting method with the advantages of thermal cutting.

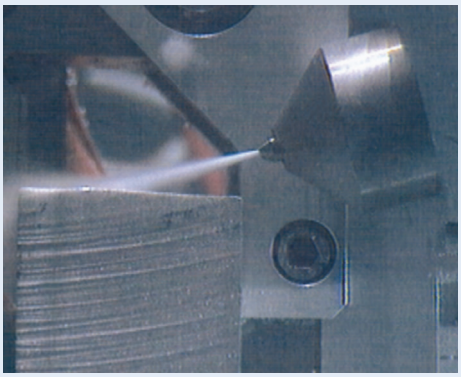


Manipulator with CAMC tool at Karlsruhe Multi Purpose Research Reactor

Our solutions: Hydraulic cutting techniques

Water Abrasive Suspension Jet Cutting

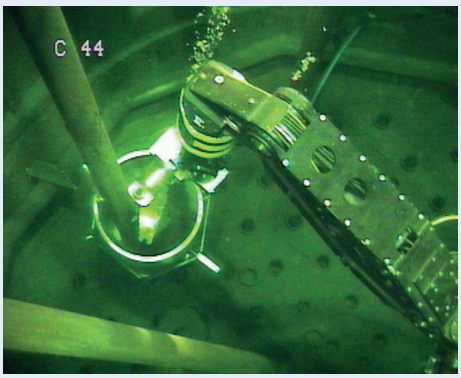
The Water Abrasive Suspension Jet Cutting works with the force of the water and reaches a significantly greater cutting depth than other water-jet cutting methods. This method is mainly used for cutting under water.



Water abrasive suspension jet cutting at Kahl Nuclear Power Test Plant

Hydraulic shears

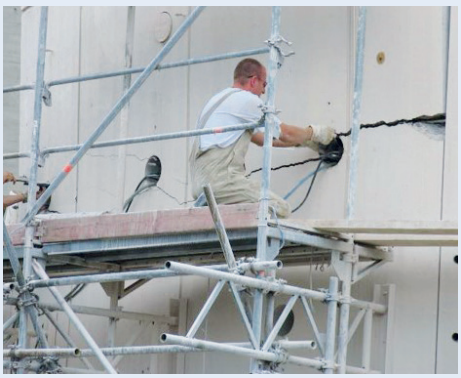
The major advantage of hydraulic shears is their versatility. During dismantling, it can be guided by hand both directly by the operator and via a manipulator system for underwater use. The types of shears range from standard tools to special designs for specific tasks.



Hydraulic shears at Karlsruhe Multi Purpose Research Reactor

Hydraulic bursting

One variant of hydraulic shearing is hydraulic bursting during dismantling of concrete components. This allows concrete structures to be dismantled quickly and without much dust.



Hydraulic bursting at Kahl Nuclear Power Test Plant

Characteristics of different cutting techniques at a glance

	Flexibility	Production of secondary waste	Field of application
Band saws	++	++	in air under water
Circular saws	+	++	in air under water
Wire saws	+++	++	in air under water
Oxy-fuel cutting	++	+++	in air
Plasma cutters	+++	+++	in air under water
Contact arc metal cutting	++	+++	under water
Water abrasive suspension jet cutting	++	+	under water
Hydraulic shears	+	+++	in air under water
Hydraulic bursting	+	+++	in air

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