

Electrochemical Nuclear Decommissioning Technology

'A 10 Year Partnership with NNL'



A Step
Change
Solution

At ELCHEM Nuclear our experts have pushed the limits of innovation, we've developed patented technology that is a step change solution for Nuclear Decommissioning.

Suitable For
Existing
Decommissioning
Processes

Our technology can be applied to existing decommissioning processes, allowing for the decontamination of all metal surfaces that uses any mineral acid treatment method.

Safer, Quicker,
and more
Cost-effective

Using electricity to replace toxic and costly chemical reagents, our method significantly increases the rate of nuclear decontamination whilst significantly reducing the volume of waste effluent generated.

Technology Overview

EASD

- **Electrolytically Assisted Surface Decontamination**

Treatment of the radioactively contaminated surfaces of metallic pipework and vessels

- Electrolyte action in the presence of mineral acid dissolves the metal surface
- The specific AC waveform used gives faster and more consistent removal than conventional DC processes
- Rapid removal from surfaces of stainless steels, nickel alloys, titanium, aluminium alloys
- In situ treatment with no direct electrical contact to the treated piece
- Instantaneously controllable via control and electric current

ELENDES

- **Electrochemically Enhanced Oxidative Destruction**

Treatment of radioactively contaminated organic solids and liquids

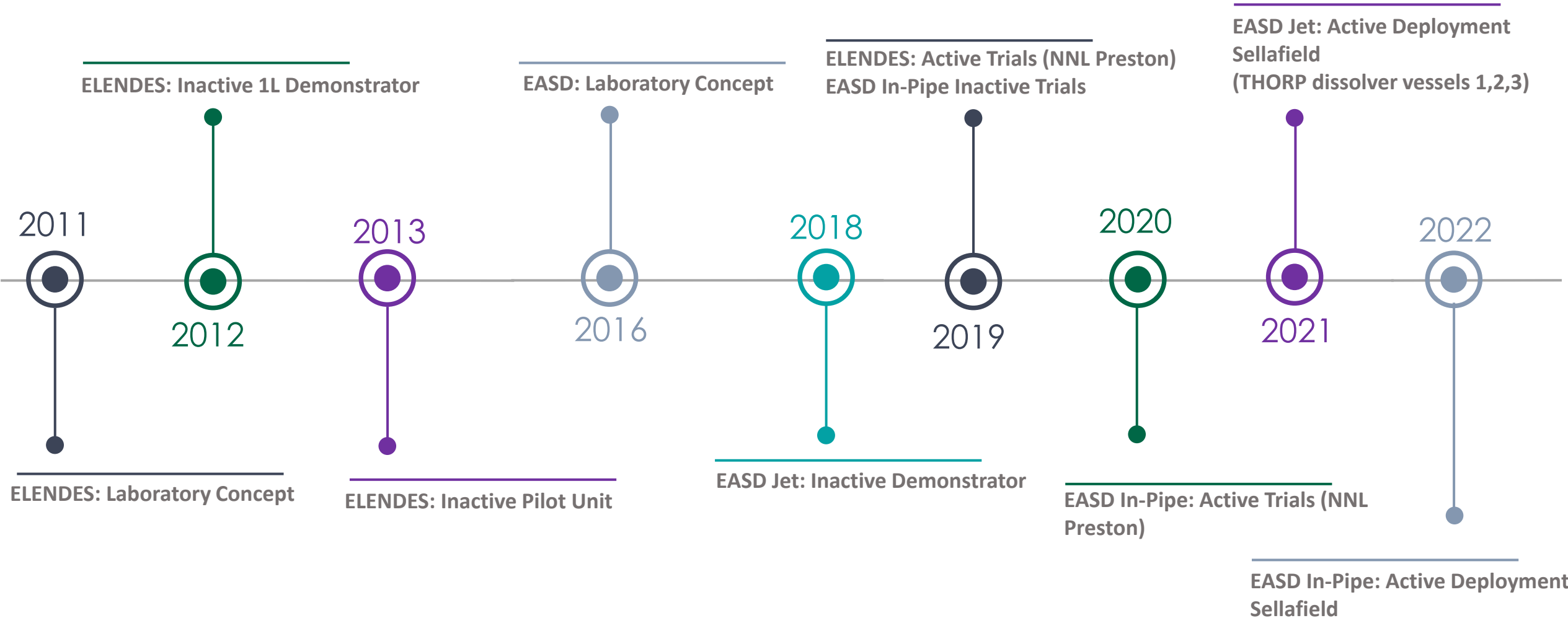
- Rapid low temperature oxidative destruction of contaminated organic wastes
- Suitable for the treatment of complex materials
- Radioactive contaminants retained in the aqueous phase
- Treated material is suitable for conventional downstream treatment
- Facilitates the use of complexing agents in the decontamination process
- High current efficiencies and destruction rates for a wide range of materials

IP Portfolio

Our intellectual property portfolio demonstrates our consistent efforts of being leaders in our field by protecting our innovations. We have invested significantly over the years and our current patent portfolio consists of 8 patents.

Technology	Reference Number	Title	Description
ELENDES	Patent PCT/GB2017/052162	Electrolytic treatment for nuclear decontamination	The use of EASD and ELENDES technologies in combination, allowing the use and subsequent destruction of added chelating agents without compromising downstream effluent treatment.
ELENDES	Appl. PCT/GB2020/050266	Method for the destruction of organic material	A design for an electrochemically mediated oxidation process that overcomes issues of slow rate of reaction and large reactor volumes by means of phase contactor and phase disengagement devices.
ELENDES	Appl. GB2103500.1	Radioactive liquid processing apparatus	Electrochemical cell design featuring lightweight sealed and disposable electrochemical cells that allows the operation of the process in confined spaces such as gloveboxes.
EASD	Appl. PCT/GB2019/053059	Electrolytic treatment system for nuclear decontamination	The use of two electrodes in close proximity, avoiding the need for a direct electrical contact with the metallic surface being treated.
EASD	Appl. PCT/GB2020/051547	Electrochemical surface treatment	EASD with multiple jets, avoiding the need to make a direct electrical contact with the body of the surface being treated.
EASD	Appl. GB2103823.7	Electrolytic interior surface treatment apparatus	A design of electrochemical pig for treating the interior surfaces of pipes that overcomes the problem of maintaining the correct spacing of electrodes despite pipe bends and imperfections.
EASD	Appl. GB2103827.8	Electrochemical surface treatment apparatus	A design of electrochemical pig for the treatment of pipe interiors that overcomes the problem of blinding of electrodes by gas generation, without a requirement for circulating large volumes of electrolyte.
EASD	Appl. GB21xxxxxx	Exterior surface electrochemical treatment apparatus	A design of electrochemical nozzle that allows for the even treatment of the exterior surfaces of pipes despite limited access within the confines of tanks and vessels.

Technology Development Timeline



EASD Jet

- For treating the interior surfaces of a vessel or the exterior surfaces of a pipe or structural element
- Two acid jets are directed from nozzles to the workpiece. The acid collects in the bottom of the vessel is returned to the nozzles
- There are electrodes in each nozzle. Electrical current from a power supply flows from one nozzle, along one jet, through the workpiece, and back to the supply through the other jet
- The jets are directed to move in a raster pattern across a surface, or up and down a pipe
- Treatment rate of 1.2 m² per hour for 10 μm removal using 30 % nitric acid, for jets illustrated. Other electrolytes can be used



EASD In-Pipe

- For treating the interior surfaces of pipework in situ
- The operating principal is as for EASD Jet, but the geometry and current path lengths differ
- Treatment takes place in a pipe flooded with acid. No liquid flow is required in the pipe
- The treatment head has two cylindrical electrodes, separated by an insulated spacer
- Electric current passes along an umbilical, out from one electrode, through the electrolyte to the pipe, along the pipe, back through the electrolyte to the second electrode then back to supply
- Treatment rate of 3 - 5 m pipe per hour for 10mm removal of the interior surface of a 50mm diameter pipe



ELENDES

- For the destruction of organic matter, including solvent extraction reagents, solvents, ion exchange resins, other dispersed solid organic matter
- The electrochemical oxidation is mediated by a species such as silver (II). The silver is oxidised in the cell
- Two configurations possible: organic matter either dispersed in the aqueous phase with silver (II), or as separate phases and using a mixer-settler device
- Organic matter can be added until the level of aqueous contamination reaches a limit
- Silver is recovered if required in a separate cell, prior to waste treatment

