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Interface
LINAC
ID 11 - Handling of Chemical Products and Compounds

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1. HANDLING OF CHEMICAL PRODUCTS AND COMPOUNDS

This document presents the chemical substances expected to be used and stored during the construction and operation of the ESS accelerator. All substances and the anticipated amounts that will be used and stored are summarised in Table 1.

1.1 Construction

The demands on cleanliness for the accelerator and its constituent parts is very high. Although all equipment will be delivered on site thoroughly cleaned and packaged, some parts such as flanges and gaskets will need to be cleaned with acetone or isopropanol. Hence a supply of a few hundred litres of electrical grade acetone and isopropanol needs to be kept on site from the start of installation. On site welding will result in the presence of gas bottles with e.g. argon shielding gas.

Buildings and support structures will be either painted or given protective coatings. Leftovers and spills from these processes shall be collected and disposed of in an adequate manner. If paints or coatings are used that are not water soluble, the required solvents will need to be handled adequately, adding to the waste.

1.2 Operation

During operation, all the accelerator equipment will use different chemical substances. Alcohol and weld gases must be available for maintenance and repair. New parts as well as parts removed for maintenance must be cleaned before being (re)-installed. Welding will be required for both assembly and disassembly. Some gaseous helium will likely be need for leak detection.

1.2.1 Ion source

The ion source produces protons from a hydrogen plasma, and consequently consumes hydrogen. To maintain the plasma, a hydrogen flow of a few standard cubic centimetres per minute (sccm) is required [1]. A hydrogen tank will be connected to the ion source. One cubic metre will last several months, so the tank should hold around 1-3 m^3. Refills might be scheduled every third month, according to experience from SNS. The storage of hydrogen will in all likelihood be limited to the active tank and a small number of spares - with replenishments delivered from off-site sources as needed.

1.2.2 Accelerator

There are no particular chemicals associated with operating the linac itself, only those which are used by the related subsystems.

1.2.3 Klystron gallery

The modulators supplying power for the klystrons contain insulating mineral oil. The amount depends on the modulator supplier chosen, but will typically be of the order of 1-3 m^3 per modulator, or about 200’000 - 600’000 litres stored in the appx. 200 modulators [2]. The

amount of oil shall be kept to a minimum, preferably below 1 m^3/modulator. Each modulator is housed in a tank of its own. If needed, each tank could be placed in a collector vat to avoid any oil escaping the facility in case a tank should leak. Alternatively or additionally, the whole klystron gallery could be made into a giant collector vat.

No additional chemical substances are foreseen to be used for the klystron gallery or the RF distribution system.

There is an option, albeit not a preferred solution, to use SF_6 gas to reduce risk of arcing at critical positions along the waveguides, such as coupler windows. There might be use for other substances like glycol in the loads and cooling circuits.

1.2.4 Cryogenic system

The superconducting linac requires large amounts of helium, which is an inert, non-toxic gas. The cryoplant will require large amounts of synthetic oil as a lubricant for the screw compressors.

Table 1: Summary of chemical substances expected at the ESS linac

Substance	Annual consumption	Stored	Application
Acetone		200-400 l	Cleaning of vacuum parts
Propanol		200-400 l	Cleaning of vacuum parts
Hydrogen	2.5 m^3	≤ 3 m^3	Source substance
Synthetic oil		10 m^3	Cryogenics
Moderator oil	0	200 m^3	Klystron moderators
Weld gas (e.g. Ar)		1-2 bottles	Assembly/disassembly

2. REFERENCES

[1] Gobin *et al., ECR Light Ion Sources at CEA/Saclay*
[2] Rathsman, Persson, *Re: Kemikalier och annat i klystroner och vågledare,* private communications, 2010
[3] Howell, *Re: Helium for cryogenics,* private communications, 2010