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Carbon Footprint of the Helium Recovery System at the ISIS Neutron and Muon Source

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ISIS Neutron and Muon source is a scientific facility which welcomes over 3000 scientific and industrial users per year to carry out experiments across a range of scientific disciplines. Approximately 500 experiments per year require some form of cryogenic sample environment equipment for cooling the sample, and a significant proportion of these use 'wet'cryostat or magnet systems consisting of a liquid helium bath.

Helium is a global finite resource, which is becoming vitally important to recover and reuse as it continually diminishes. ISIS has a helium recovery and liquefaction system which allows for recycling of 96% the helium used in the facility for cryogenic applications. The Helium recovery and liquefaction process is well known and incorporates plant which consumes significant amounts of power, thus contributing to a facility's already large carbon footprint. The drive to reduce carbon footprint, and therefore lessen the impact of climate change, is gathering momentum. UK Research and Innovation, the parent body of Science and Technology Facilities council, is Committed to reaching net zero CO2 emissions by 2040.

In this work we have assessed the CO2 produced per liquid litre of Helium processed by the ISIS helium recovery facility. The main components have been taken into consideration, including high pressure compressors, instrumentation, Linde KryoTechnik TCF20 cold box, screw compressor, building infrastructure and safety systems. We also compare this carbon footprint for in-house liquid helium production with that of the supply from gas companies. To do this we have explored the liquefaction process of both liquified natural gas and helium, the methods of transportation that are employed, the time taken to transport and the liquid boil off rates during the delivery process. This allows us to comment on the contribution helium recovery can make in the pursuit of net zero.

Submitters Country

United Kingdom

Authors: JONES, Alexander (Science and Technology Facilities Council); LAWSON, Christopher (UK Research and Innovation); KIRICHEK, Oleg (STFC); DOWN, Richard (S)

Presenter: JONES, Alexander (Science and Technology Facilities Council)

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