

Present status of liquid-helium supply and recovery system

T. Dantsuka,^{*1} H. Okuno,^{*1} M. Nakamura,^{*1} S. Tsuruma,^{*1} M. Ohshima,^{*2} H. Shiraki,^{*2} H. Hirai,^{*2}
K. Kimura,^{*2} A. Mikami,^{*2} M. Nagano,^{*2} H. Shiba,^{*2} and H. Hazama^{*2}

A liquid-helium supply and recovery system,¹⁾ which can produce liquid helium at a liquefaction rate of 200 L/h from pure helium gas, has been under stable operation since the beginning of April 2001. However, because of the increased operational failures caused by deterioration over time, a duplicate liquefier was installed in 2017. The new liquefier can produce liquid helium at a liquefaction rate of 220 L/h from pure helium gas. Although the older helium liquefier has been failing since the summer of 2018, the new helium liquefier provides a constant supply of liquid helium, and older helium liquefier was repaired in February 2020.

The liquid helium volumes supplied each year from 2001 to 2023 are illustrated in Fig. 1. From 2001 to 2013, a gradual increase in the supplied volume is observed, with two decrements in 2009 and 2011. In 2014, the supplied volume decreased because of a system malfunction. However, in 2015, it returned to its original value. In 2016, the supplied volume decreased, increasing slightly in 2017 and significantly in 2018. In 2019, approximately 140,000 L of liquid helium was supplied despite the high price of helium gas. In 2020, a supply volume decreased of approximately 15,000 L was caused with the emergence of the new coronavirus. In 2021, the supply volume increased

slightly and decreased approximately to 17,000 L in 2022. In 2023, with liquid helium prices rising, supply slightly decreased.

Moreover, the purity of helium gas recovered from the laboratories has gradually deteriorated. The main cause of this problem was determined to be the age-related deterioration of the inner membrane of gas holder E. The contamination caused by air reduced the purity of the recovered gas to approximately 95%. As a result of replacing the diaphragm of gas holder E, the purity of the recovered gas reached almost 100%. Furthermore, the volume of helium gas recovered from each building in the Wako campus as well as the volume transported to the liquid-helium supply and recovery system were measured. The recovery efficiency was calculated as the ratio of the amount of recovered helium gas to the amount of supplied liquid helium. The recovery efficiency at the helium liquefaction facility building was maintained at almost 100%.

Reference

- 1) K. Ikegami *et al.*, RIKEN Accel. Prog. Rep. **34**, 349 (2001).

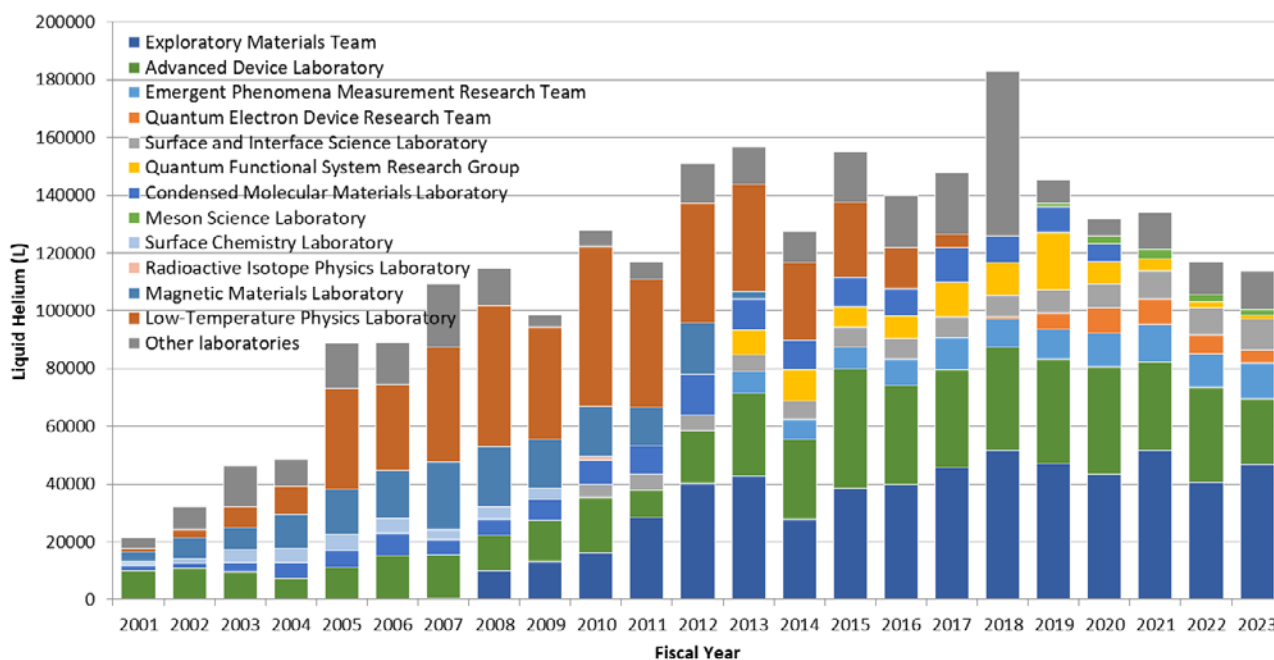


Fig. 1. Volumes of liquid helium supplied to various laboratories for each fiscal year from 2001 to 2023.

^{*1} RIKEN Nishina Center

^{*2} Nippon Air Conditioning Service K.K.