

The Phasing Out of Mercury Thermometers

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Air temperature, one of the most commonly reported parameters in weather reports and forecasts, is a measure of the hotness and coldness of the air. It is closely related to our daily life and affects all living species on earth. Although there is a wide range of temperature-sensitive physical phenomena such as change of electrical resistance in a conductor that can be used to measure temperature, the liquid-in-glass thermometer is the simplest and cheapest solution conventionally deployed to measure air temperature (Figure 1). Such a thermometer consists of a glass tube of very fine bore, at the end of which a bulb is filled with liquid such as mercury or alcohol. The liquid will contract on cooling and expand when heated. Through expansion and contraction, the liquid column moves up and down, and the corresponding temperature of the surrounding air is read off from the scale engraved on the tube.

In the old days, mercury liquid-in-glass thermometers (or simply mercury thermometers) or whirling psychrometers (Figure 2), a type of hand-held hygrometer with two mercury thermometers mounted side-by-side used for determining relative humidity, were provided to Voluntary Observing Ships (VOS) on a loan basis by meteorological authorities in many countries for conducting weather observations. As mercury is a highly toxic substance, leakage from broken thermometers may seriously affect human health and the environment. On 29 August 2016, the Minamata Convention on Mercury was signed by 128 Signatories with 29 Ratifications. The Convention is a global treaty to guard against the adverse effects of mercury and requires countries to take measures to phase out products that contain mercury by 2020. As a result of the Convention, all VOS recruitment countries are required to ensure that mercury meteorological instruments on loan to VOS are removed and/or replaced before the deadline.

There are various options to replace the mercury thermometers, e.g. alcohol thermometers (Figure 3), mechanical thermometers (Figure 4), electronic hand-held instruments, fixed installation electronic temperature probe (Figure 5) and automated weather systems (Figure 6). It should be noted that hand-held digital instruments need to be returned for calibration frequently. Moreover, electronic devices are not suitable for tankers and gas carriers for safety reasons, in which case alcohol thermometers can be used instead.

Some countries such as the New Zealand Met Service is in the engineering phase of creating its own temperature probe. Although all Hong Kong VOS are using alcohol thermometers provided by their shipping companies, the Hong Kong Observatory will keep a close watch on the latest development in the VOS community and may also consider replacing conventional instruments with digital devices in the future.

Reference:

1. [Minamata Convention on Mercury](#)
2. [List of Signatory Countries of the Minamata Convention on Mercury](#)



Fig 1 Liquid-in-glass thermometer



Fig 2 A whirling psychrometer



Figure 3 Alcohol liquid-in-glass thermometer onboard a VOS



Figure 4 Mechanical thermometer onboard a VOS



Figure 5 Electronic thermometer



Figure 6 Automatic weather system with sensors to measure temperature and other elements