Memorandum

Professor Dr. Khunying Salard Tupavong and Liquid Oxygen at Siriraj Hospital

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Oxygen is the vital element in anesthesia. Anesthesiologists have been administering oxygen to patients more than any other professions. This intimate relationship has rendered the management of oxygen supply under the authority of the department of anesthesiology at Siriraj Hospital from the very beginning.

Formerly, oxygen was supplied from a G size cylinder [3,400 L, 39 kg, 1,320x178 (L x D) (mm)] to the flow meter and then to the patient directly. The same set up was also used in the operating room where G size cylinder connected to the anesthesia machine directly side by side. The first hospital pipeline was installed by Kian Nguan Company when the two new operating theaters (cardiothoracic and neurosurgical) were built in 1965. The oxygen was supplied from a cluster of G size cylinders located just outside of both operating theaters (OTs). This initial pipeline construction was the fundamental step toward an adoption of liquid oxygen (LOX) which came to attention of Professor Dr. Khunying Salard Tupavong since it is used primarily in large medical centers globally.

Three years later, oxygen and nitrous oxide pipelines were installed in every general OTs. The pipelines were connected to the gas supply center near the OTs, in close proximity to the emergency electrical power supply room. The oxygen was fed from a manifold system of 2 parallel banks of 10 oxygen cylinders each (total 20 cylinders). The nitrous oxide was also supplied from a manifold system of 2 parallel banks of 2 serial cylinders (total 4 cylinders).

The oxygen demands were increasing steadily. In 1973, the pipeline was extended to supply oxygen to the adjacent surgical intensive care unit, located on the first floor of "Sul Ying" building. The medical gases cylinders were increased 3-4 folds of the originals. In 1977, the oxygen cylinders were up from 20 to 79 and nitrous oxide cylinders were tripled from 4 to 12. Later on, the pipeline was expanded to other nearby patient buildings, including the new ophthalmology and otolaryngology OTs.

The major expansion of oxygen pipeline system occurred in 1976 under direction of Mr. Wattana Saipant, the faculty member of The King Mongkut's University of Technology North Bangkok (formerly known as Phra Nakorn Neau Technical College). Two additional sites include the coverage of obstetrics-gynecology unit (both OTs and inpatient wards) and the orthopedic OTs, which are located on the fifth floor of Salak building. The satellite medical gas supply station was also built on the same floor of Salak building in anticipation for conversion to LOX supply.

In 1978, Professor Dr. Khunying Salard initiated the installation of the first cryogenic liquid oxygen container, located between the nutrition and microbiology building. The container was the DTL-5, which can store up to 4,900 liters of LOX (equates 4.21 million liters of oxygen gas). The installation and conversion of gas supply process finished in the following year and the first LOX use began on July 21st, 1979 supplying oxygen to the main OTs (Sala Sulyagum), 72-year building and 84-year building. The complete LOX use to the entire hospital was completed in 1980. The Air Products Industry Co., Ltd. was commissioned by the hospital to provide LOX delivery, safety maintenance of both the cryogenic storage tanks and pipelines with an approximate cost at 4 Bahts/m^3 or 0.4 Satangs/L.

J Med Assoc Thai 2017; 100 (Suppl. 7): S259-S260
Full text. e-Journal: *http://www.jmatonline.com*

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By 1982, the Air Products Industry Company had installed more cryogenic LOX storage units in 3 different locations- (1) next to Vichitra building (access via Wanglang road), (2) next to Salak building (access via Arun Amarin road) and (3) next to the 84-year building (with no direct access from the outside). The oxygen demand mandated the refills of each container on a weekly basis and had saved the hospital's expense considerably.

In 2010, the management of medical gas supply and pipelines was transferred from department of Anesthesiology to the medical gas unit under direction of the hospital director. Currently, there are 5 LOX cryogenic storage containers with total capacity of 78,000 L of LOX to provide oxygen to both Siriraj and Siriraj Piyamaharajkarun hospitals via the intricate pipelines that tally up to 3.5 kilometers in distance. The system can provide more than 15 days of continuous oxygen without refills.

We owe a debt of gratitude to Professor Dr. Khunying Salard Tupavong, who has founded anesthesiology in Thailand. Her talents manifested in every aspects i.e. anesthesia service, academic, research and medical technology. Her leadership visionary, excellent managerial competency, mentoring and good governance had brought the department to be on par with other civilized nations. The establishment of medical gas system at Siriraj Hospital has been regarded as one of her masterpieces. Her industrious dedication to anesthesiology has gathered a group of refined and well-trained coworkers. Together as a department of anesthesiology at Siriraj Hospital, as a nation's well-recognized profession. The safety and quality of anesthesia care have improved to rival the other great nations. On July 19th, 2017, Professor Dr. Khunying Salard Tupavong has passed away peacefully at Siriraj Piyamaharajkarun hospital. This is an inevitable loss that strikes deeply in our hearts but she will always be in the core of our memory eternally as the great pioneer with lifetime achievement in anesthesiology.

Acknowledgements

The authors would like to acknowledge Clinical Professor Emeritus Kalapangha Bhavakula and Professor Ungkab Prakanrattana for sharing their cherished memories and supporting in writing this manuscript.