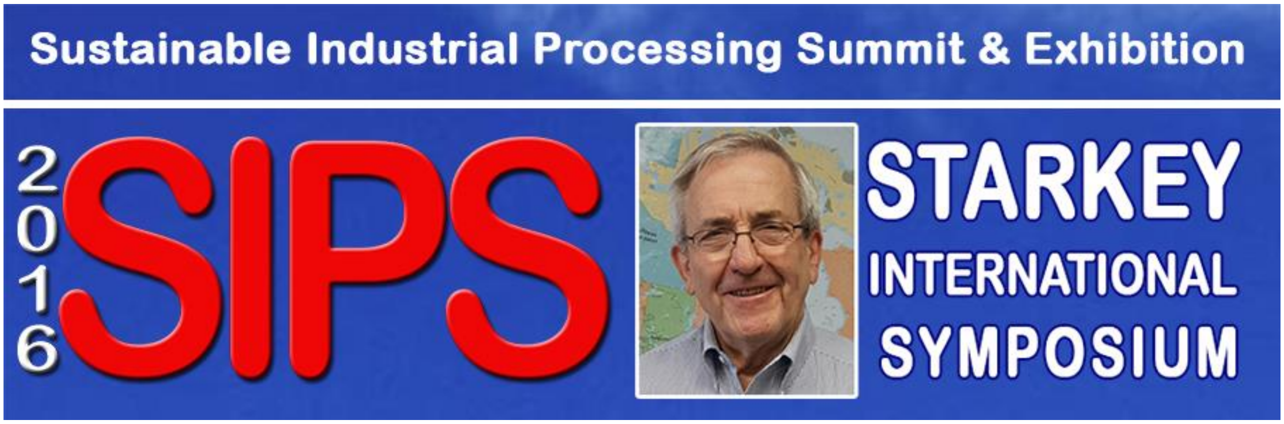

BIOGRAPHY:

In 1961, John Starkey graduated from the University of Toronto with a BASc. In Mining Engineering. The mining sector was slow so John took a job as Research Metallurgist at the Kam-Kotia Porcupine Mines' concentrator in Timmins, ON, Canada.

After three years, the zinc flotation research was complete, and a zinc flotation circuit with a disc filter and a thickener had been installed, using in house engineering design.

John was offered the position of pilot plant engineer at the Ontario Research Foundation's (ORF) pilot plant in Rexdale, near Toronto. The main client for grinding testing was Art MacPherson. Art brought all of his SAG and AG grinding projects to ORF. It was here that John learned how a SAG mill really operates, how it is controlled, and what can be expected when steel is added to the mill after start up in AG mode. Many fundamental do's and don'ts were learned at this time. These two years, 1964 and 1965 were the foundation of what would later become 'open technology' in testing for ore hardness and hardness variability, and how to properly design a SAG mill that works, for every project.

In 1966 John moved back to Timmins, to lead the metallurgical lab and pilot plant at Texas Gulf Sulphur's Kidd Creek Mine, before the mill start up. At Kidd Creek, John successfully tested the use of SO_2 to improve copper and silver recoveries on the heavy sulphide C ores, introduced standard flotation lab tests in order to predict plant recoveries using the chips from blast hole cuttings, and successfully recovered tin by gravity methods from the plant tailings. This work later led to a decision to build a tin recovery plant at the concentrator. By 1968, John had been appointed Chief Engineer in the Concentrator.

In 1971 John moved to Sudbury to take charge of the metallurgy, (operations and research), in the Copper Cliff mill. Pyrrhotite rejection from nickel concentrate was the first major accomplishment, so by the time the 'super stack' started up, the SO_2 gas emitted to the atmosphere had been reduced by about 50%. The environment in Sudbury changed rapidly and normal plant growth returned to the area. John also introduced a 4 product calculation to very accurately define the production of copper, nickel, pyrrhotite and silica (tailings) concentrates at the Copper Cliff mill. This upgrade was necessary to define how much pyrrhotite concentrate was being shipped to the Iron Ore Plant.

After the start-up of the Clarabelle mill, and a company reorganization which placed the mills under the mining VP's control, John received a transfer to the mine engineering group. Soon he was moved to the Copper Cliff North Mine and then to the Levack Mine, where he supervised all engineering functions at Levack and Levack West, including shaft inspections, creation of one, five, and twenty year mining plans annually, and was responsible for surveying and calculation of production. Under his supervision, vertical retreat underhand mining was first used here, to recover stope pillars.

Concurrently to underground work at INCO, John was a lecturer at Laurentian University. He taught introductory classes in mining and mineral processing to second year engineering students.

In 1977 John moved Toronto to accept a position as Senior Metallurgist at Kilborn Limited, a small but highly regarded engineering firm in Toronto. In the early 1980's Kilborn had 5 major design build projects in-house based on their reputation. The other major firms in Toronto had only minor projects at this time.

John left Kilborn in 1989 and formed Applied Ore Testing Inc. in Oakville. A SAG grinding and flotation pilot plant was built that featured a tailings pond to allow running recycled water for flotation projects. It was a one of a kind pilot plant that worked beautifully. It was here that John developed the 12" diameter SAG grinding test, which would later be known as SAG Power Index (SPI) or the Starkey Test (in Chile). This was created because up to that time, no SAG hardness test using public open technology existed and the need for such a test to allow independent verification of designs was clear.

The following 9 years were spent as an independent consultant. In 1992, a one year trip to Iran to help Davy (an engineering firm in Toronto), complete the construction of the Gol-E-Gohar (GEG) iron concentrator was made. A lab scale 12 inch diameter SAG mill was fabricated at GEG and a project completed to measure ore hardness variability in the three ore zones in the mine plan.

Although no calibration was available at that time, it was easy to see that the average ore in the soft ore zone of the deposit, would be about twice as hard as the rest of the same zone. Since the other two zones, used for design, were about three times harder, it was evident that the plan to double production without adding another SAG mill was wrong. Had Davy not discovered this truth before the 'soft' ore zone was encountered in the mining plan, the subsequent expansion to treat the soft ore would have been a disaster. A third SAG mill was added to accomplish the expansion and performed as required.

The GEG project in Iran created interest by Minnovex to assist in the development of the 12 inch diameter SAG test which became the SPI test. The SPI test was developed by doing a five plant study in Canada to allow calibration of the test in an operating plant context. To do this calibration, an important assumption was made. The work done to reduce an ore from 3.36 mm (D80) to 0.300 mm (D80) is measured by the Bond work index, no matter which mill does the work. This assumption has been proven to match benchmark performance over a range of product sizes and no reason to investigate it further has emerged.

In 2000, John left his consulting work at Minnovex and started Starkey & Associates which was incorporated in 2008 as Starkey & Associates Inc. In 2002, the SAGDesign Consulting Group was formed to create and develop the new and more robust SAGDesign Test to correct the shortcomings of the SPI test. Dawson Metallurgical Labs (now FLS), Outokumpu (now Outotec) supported the new creation. Dawson created the test procedure with John's guidance, and Outokumpu, provided funding and patented the newly developed test.

Ore SG measurement was added, the mill size increased to 1.6 foot diameter by 6.4 inches long, the feed charge was set at 4.5 liters of ore with 16 kg of steel (total mill filling 26% by volume), and a Bond BMWi was added on SAG ground ore to complete the test. Because of the larger scale, increased weight and particle size of the ore tested, and the constant volume of ore used in the test, the SAGDesign test was proven in round robin testing at eight labs worldwide, to be within +/- 5% of the average for the SAG test and within 10% for the Bond portion of the test. The test reports SAG results in kWh/t to grind ore from an F80 of 152 mm to a P80 of 1.7 mm. Results are easily checked and client participation in mill sizing is encouraged.

Presently there are 11 SAGDesign SAG mills installed at major labs worldwide. The final stage of development was to add the SAG Variability test (SVT) and the Bond Variability test (BVT) to the SAG Design testing suite so that competitively priced geo-metallurgical testing can be done at all of the partner labs.

The development of the SAGDesign test was completed because clients trusted our work. No other funding was used beyond that mentioned above, so the industry overall, deserves the credit for the development of SAGDesign technology. S&A has now completed more than 1000 SAGDesign tests on 189 projects and is proud of what has been accomplished. Achieving design production on day one is achievable on any project if a client is willing to follow the recommended testing, mill design program, and process engineering details.