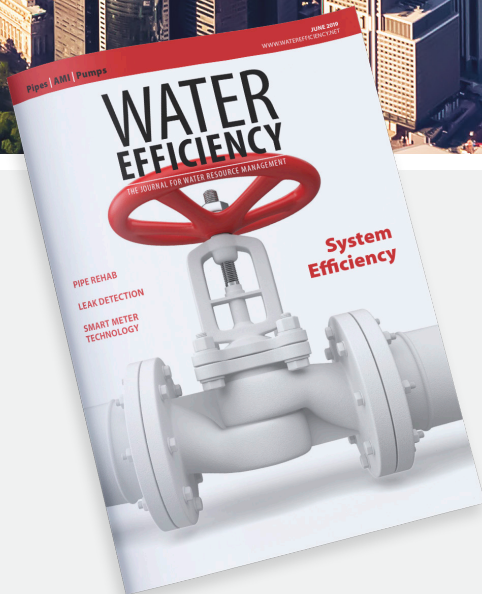


AQUARIUS SPECTRUM CASE STUDY IN SUEZ NEW-JERSEY



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ADVANCES IN LEAK DETECTION TECHNOLOGY

BY LYN CORUM (PP. 16-21)



Aquarius Spectrum's AQS-SYS monitoring leak detection system is permanently installed. In this case, underground. It has a 3G/4G SIM card to enable cellular transmission of data to the company's cloud-based system.

MULTITUDES OF LOGGERS IN USE

SUEZ Water New Jersey, a subsidiary of SUEZ Water North America, has a long history of tracking water leaks using the traditional method of listening to fire hydrants and valves and looking for non-revenue water loss. SUEZ New Jersey serves more than 1.5 million water users at 10 utilities across New Jersey from its headquarters in Paramus, NJ. When Jack McNaughton became manager of systems maintenance about 13 years ago, the Distribution Department was using 20 radio loggers in a “lift and shift” process where personnel would collect the loggers the morning after installation and move them to another location after uploading reports. Since that time, SUEZ has purchased 200 more radio loggers. When a city within SUEZ's service territory announces it is repaving a street, SUEZ's staff will use a radio logger to survey the street and repair any leaks found before repaving.

Further, when a water customer calls to have the water shut off at their home, SUEZ will do a leak detection test. The department found 107 underground leaks in 2014 and decided to invest in 1,100 acoustic non-correlating loggers. SUEZ began installing them at the end of 2014 and finished the job in early 2015. Furthermore, McNaughton says, “with the development of new technology, we decided to go with correlating loggers since they provide us addresses of the leaks, which the radio loggers did not.”

The correlating loggers he chose were the AQS-SYS loggers manufactured by Aquarius Spectrum and they have been working very well, McNaughton says. The department started installing 300 permanent underground correlators at the end of 2017 and finished in 2018. McNaughton indicates they will be moving these correlating loggers to another county this year after finding 13 leaks in 2018. These small leaks were repaired at a cost of between \$5,000 and \$10,000 each - less expensive than if they had gone unrepaired until the leaks surfaced.

The loggers correlate in multiple directions, McNaughton explains. “Based on sounds, they tell you the probability of a leak.” The loggers are programmed to stay dormant until told to wake up at a certain time, say at night when it's quiet. The sounds are automatically sent to Aquarius's cloud-based system. An Aquarius technician works with SUEZ and follows up on issues, he says.

McNaughton relayed an interesting story: At one point, the technician had passed on the sounds of church bells that the loggers had picked up through nighttime correlating. The recordings continued for several nights and were linked with the address of the church. “All we did was change the listening time of the correlators,” he says. McNaughton says they have ordered another 300 AQS-SYS loggers which will be joining the others when they are moved to the second county. The 600 loggers will be permanently installed but will still not cover the multiple communities SUEZ serves. Every year they choose a town where they do “lift and shift” with the radio loggers, he says.

McNaughton also uses the iQuarius™, the smartphone-based listening stick. “What is interesting is when we find a leak and do a sound bite and send it to the cloud, I can listen to it immediately on my smartphone. We use everything in our toolbox,” he says. “Every single day with no water surfacing is a success,” concludes McNaughton.

THE CLOUD & GPS

Founded in 2009 in Israel, Aquarius Spectrum has created two types of acoustic correlating sensors to monitor entire water distribution networks and detect leaks. The first, AQS-SYS, is a continuous monitoring leak detection system that is permanently installed along a water trunk line

either underground or above ground. Every sensor contains a 3G/4G SIM card to enable cellular transmission of data to the company's cloud-based system. Automatic notifications are sent to facility engineers, indicating the location of the fault on a GIS map. The second type of sensor is the iQuarius, a modern listening stick for smartphone-based leak detection for surveys and pinpointing leaks. The technician can walk the length of the trunk line, listening, while the leak detection equipment surveys and correlates suspected points using synchronization GPS technology. It saves data locally and can instantly upload all information to the cloud. It can also download the leak noise information captured by the sensor. Teams of technicians walking on separate areas of the trunk lines can monitor them simultaneously. A leak alert means good correlation based on constant noise heard more than one time from the same location.

The company's founders came from an extensive background in the Navy and were no strangers to acoustics, says Oded Fruchtmann, the company's CEO. “They wanted to do something different.” In order to improve leak detection, the technology has to be automatic, with correlating occurring 24 hours a day, so they

“EVERY SINGLE DAY WITH NO WATER SURFACING IS A SUCCESS”

Jack McNaughton from SUEZ Water New Jersey, speaking about Aquarius' leak detection system's implementation.

designed an algorithm to do just that, he says. Once the AQS-SYS sensor was established three years ago, the company designed the mobile leak detection sensor - the iQuarius. This was a game-changer, says Fruchtmann. “Up until then, a truck full of equipment was needed [to find leaks],” he says. In contrast, in England, listening sticks have been used since the 1950's, Fruchtmann says. “We designed our stick to bring something more digital to the job.” Very simple to operate, the user connects the mobile sensor to his or her smartphone, presses a button on the handle, and colors - shades of orange, pink, and yellow - appear on the screen of the smart phone, indicating the quietness or loudness of flowing water. When red appears, it signals a leak. Fruchtmann explains that the company worked with Thames Water in London, England, to develop its first pilot for the newly created iQuarius mobile solution. “The United Kingdom market is the most advanced leak detection market in the world, so it is a good place to start,” he says. Fruchtmann says 3,000 sensors were installed above ground in Jerusalem.

When asked if the company had experienced any issues with the above ground sensors, he recounted the problem with 500 sensors being stolen for the SIM cards, which were removed from the sensors so that they could be inserted into smartphones and used to search the web. Not only did Aquarius Spectrum install new above-ground sensors with SIM cards that could not be used to search the web, they then developed below-ground sensors that could be installed in manholes and pits.

Fruchtmann says that the company has installed its sensors for pilot and permanent use in several US municipal utilities - at the Los Angeles Department of Water and Power; Suez New Jersey; Arlington, TX; Duluth, MN; and Miami, FL.


Aquarius Spectrum has developed two types of sensors. The first are accelerometers that sense vibrations and monitor asbestos cement or ductal iron pipes for leaks. The second type is the hydrophone which can pick up and pinpoint leaks in PVC and plastic pipe. Both types can be installed either underground or above ground.

In July 2018, Aquarius Spectrum announced it was collaborating with TaKaDu, also headquartered in Israel, to provide utilities with a centralized cloud-based event management system. TaKaDu's system, based on big data analytics and tailored algorithms, is being integrated with Aquarius's automatic leak detection and monitoring system.

This integration enables users to receive two independent indications about the same problem in the same area. “TaKaDu may know of a leak problem before we do,” says Fruchtmann. “So, we can accelerate our analysis to determine the specific location of the leak,” he says. The centralized platform allows operators to validate, track, prioritize, and resolve events more easily, even coordinating with other departments in the organization. Aquarius Spectrum will be expanding its relationship with TaKaDu, Fruchtmann says, and adds it is already strong in Australia.

“We have seen much more interest in our fixed sensors,” says Fruchtmann. In the UK, there is more interest in the mobile sensors where they traditionally walk to identify leaks. But in the US, it's the other way around, he concludes.

In mid-2018, Aquarius Spectrum began providing pipe condition assessments for utilities based on their history of installed sensors. The company offers an analysis of when pipes need to be replaced, Fruchtmann says. “We have two big projects in Israel and are offering pipe condition assessments to other utilities,” he says.



So far **53 major leaks** were identified and repaired which contributed to achieving more than **1 billion gallons** of water savings for SUEZ NJ and a reduction of 9% to their NRW rates.

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