Introduction
As the MATS rule (Mercury and Air Toxics Standards) take effect, electric generating units (EGU’s) nation wide will be required to tighten up their emission standards of mercury. Many of these EGU’s were designed and built many years ago before the notion of mercury abatement was conceived. That can make implementing a new mercury abatement injection system very difficult due to space constraints. Injection locations can vary from one injection location near grade level to twenty or more injection locations 100 feet or more above grade. With each site subject to such variation, the ‘norm’ of using eductors to convey powdered activated carbon (PAC) or new generation mercury abatement materials is becoming increasingly difficult. Eductors have advantages and can be a perfect solution for some EGU’s with a short injection run, low injection rates, or a small number of injection locations. However, eductors also have many shortcomings and leave a large demand for a new technology for those EGU’s which require a more complex solution.

Background in Mercury Abatement Technology
Many EGU’s will need mercury abatement across multiple units and ducts in order to be in compliance. As injection runs, injection rates, and injection locations increase, eductor sizes will need to increase in order to meet the pneumatic conveying demand. As the eductor size increases, convey pipe length, convey pipe diameter, and blower sizes will need to increase in proportion, due to the large pressure drop through the eductor. Even when these systems are scaled up, many eductor systems will not be able to reach all units from a single location, due to the limitations of the technology. This means an eductor system will need to be designed for each of the EGU’s unit,s not allowing all pneumatic equipment to be staged in a single, central location. This increases capital and operating expense.

In anticipation of these unique needs in the mercury abatement market, one leading pneumatic conveying provider challenged its engineers to design a new single system that would have the capacity to deliver mercury abatement materials over long distances, using high injection rates, and supporting a large number of injection locations. This supplier company has developed a new generation technology which utilizes pressure technology to overcome the challenges which an eductor system simply could not do on its own. This next generation technology is a portable silo unit which uses a dual weigh hopper configuration. Each hopper uses a rotary valve to meter material into the convey line. What makes this system unique, is that each weigh hopper is pressurized to the convey line pressure, which nullifies the pressure differential between the convey line and the hopper. With no pressure differential across the rotary valve, there is no air leakage up through the rotary valve, which can cause inconsistencies.

Case Study – Mercury Abatement Testing

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in material flow at high line pressures. This technology allows for a single system to convey material as much as 1,000 feet away, to 20 injection locations at injection rates of over 1,000 pounds per hour, while maintaining a four-inch main convey line size. With this system, convey piping and blower sizes are kept down, which reduces capital and operational costs. In addition, in today’s mercury abatement market, many different sorbents are used which can vary greatly in bulk density. Since eductor systems are designed around a single bulk density, those systems are limited to the variety of sorbents that can be used. The provider company’s next generation technology is much more flexible than an eductor system, in terms of using various sorbents, as the technology can overcome the differences in bulk densities. EGU’s can now be provided with systems that offer the flexibility and reliability needed in a changing and developing market.

Mercury Abatement Case Study

The provider company was recently challenged by a confidential client to take on one of the most challenging mercury abatement trials in their history. The challenge was to accurately and reliably inject five different materials used in mercury abatement over many different injection rates through twenty injection lances. The injection lances were located approximately 70 feet above grade, with the two end most injection lances being approximately 60 feet apart. Using approximately 500 CFM of motive air and without injecting any material, this particular configuration yielded a convey line pressure of approximately 3.5 PSig. During injection, convey line pressures were between 4 and 5 PSig, depending on the injection rate and material. Of the five materials that were injected, the bulk densities of the sorbents varied from 18 – 33 pounds per cubic foot.

The provider company’s goal for their next generation technology was to achieve the target injection rate for each sorbent within ± 5% of the target rate, and maintain the error margin for more than three hours. Sorbent #1 was tested for a total of eight days with four different injection rates in which were maintained for more than three hours: 400, 600, 800 and 1,000 pounds per hour. Figure 1 shows results and the actual injection rates, which are 15 minutes averages for the entire duration of that test run.

![Sorbent #1 Injection Rate Graph](image_url)

*Displays 15 minute average injection rate for entire test run of sorbent #1*
Sorbent #2 was tested for a total of four days with four different injection rates, which were maintained for more than three hours: 300, 600, 900 and 1,200 pounds per hour. Results are shown in Figure 2.

Displays 15 minute average injection rate for entire test run of sorbent #2

Sorbent #3 was tested for a total of three days with four different injection rates, which were maintained for more than three hours – 500, 600 and 1,400 pounds per hour. Results are shown in Figure 3.

Displays 15 minute average injection rate for entire test run of sorbent #3
Sorbent #4 was tested for a total of 519 minutes at various injection rates. The provider company was able to maintain the error margin of less than 5%. However, none of the test runs met the three hour minimum run length and were not included in the injection error analysis.

Sorbent #5 was tested for two days with two different injection rates, which were maintained for more than three hours – 400 and 800 pounds per hour. The 400 PPH run was tested for 390 minutes continuously, achieving an error margin of 0.9%. The 800 PPH run was tested for 268 minutes continuously, achieving an error margin of 0.7%.

Conclusion
In the final analysis, the provider company’s technology achieved the goal of under 5% error margin for all five sorbents. Without changing any equipment or convey routing, the provider company was able to overcome the differences in bulk density and material characteristics between the five different sorbents and inject reliably and accurately. Mercury abatement regulations can be met with greater flexibility and efficiency with this new, next generation technology – and test results fully support the claim.

Michael Thiel is the Technical Services Manager of Nol-Tec Systems, Inc. in Lino Lakes, MN. Nol-Tec is a supplier of pneumatic conveying systems and dry sorbent injection technology known as Sorb-N-Ject®. For more information about Nol-Tec’s testing process, please contact Michael at MichaelThiel@nol-tec.com or 651.780.8600. For more information, go to www.nol-tec.com.