

Producing Clean Energy From High-Sulfur Coal At Milliken Station

(Continued from page 1)



UPKEEP - Mechanic Mark Fenner maintains the primary hydrocyclone. After the sulfur dioxide that's been scrubbed from the flue is processed into a gypsum slurry, this machine separates the slurry so it can be dried into useful gypsum.

Thanks to the rehab, Milliken had already exceeded the Jan. 1, 1997 Clean Air Act standards by 20 months.

The Chef's Tour

Let's now trace both the power production and environmental protection sides of the Milliken Station plant.

Several times a week, 80-100 car trains with 100 tons of coal per car roll into Milliken from western Pennsylvania and West Virginia. One by one, the coal cars go onto a rotary platform that dumps the entire load in under three minutes.

From the outdoor coal pile, the fuel is fed to pulverizers that crush the coal to a fine powder. When blown into the boiler, the granules of coal are so tiny that preheated air drawn into the boiler by a forced draft fan easily ignites the coal at maximum temperature and efficiency.

The combustion chamber is lined with water-filled pipes which absorb the heat, turning the water to steam. This steam passes to superheaters which raise the steam temperature from 650 to 1,000 degrees Fahrenheit.

The superheated steam goes to the turbine where it blasts through the turbine blades to provide the mechanical energy needed to turn the generator's rotor. The rotor contains electromagnets which spin in-

side giant coils of copper wire. The spinning electromagnets inside the coiled wire create a flow of electrons that leave the generator as electricity.

The exhaust steam from the generator goes to a condenser unit. Here the steam hits 68 miles of copper tubes containing water drawn from Cayuga Lake. When the steam hits the cold tubing, it condenses into water and is recycled for reuse in the boiler. After it picks up about 15° from the steam condensation process, the lake water in the copper tubes goes back to the lake. During the entire condensation process, the lake water never comes into contact with any product other than the copper piping and several steel valves.

Not all the coal burns during combustion; about 7 1/2 percent is ash. The heavier particles, called "bottom ash" collect in a hopper at the bottom of the boiler and are recovered for resale to highway departments for use on icy roads. The lighter materials, called "fly ash" remain suspended in the flue gas that exits the boiler.

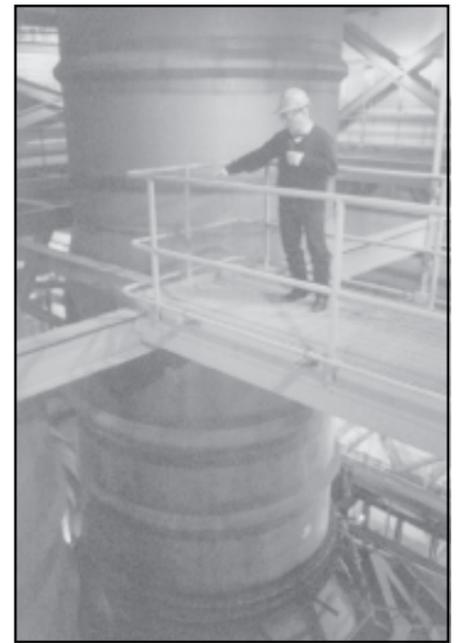
The first step in purifying the flue gases is the removal of the fly ash. The gas leaving the boiler is passed through electrostatic precipitators that transfer an electrical charge to the suspended fly ash particles. Static electricity causes these charged fly ash particles to be attracted to collection electrodes and *voila* ("There you have it." in French cooking terms), 99.5 percent of the fly ash suspended in the flue gas is removed.

Another by-product of coal combustion is sulfur dioxide (SO₂), a key component of acid rain. The fly ash-free, sulfur dioxide-laden gas is carried to a giant Flue Gas Desulfurization unit where it is sprayed with a limestone slurry that "scrubs" the SO₂ from the gas. Clean water vapor, with up to 98 percent of the SO₂ removed, exits the stack into the atmosphere.

But clean air is not enough, because the desulfurization process also provides a way to transform the formerly harmful gas into a social useful and economically viable product.

As the limestone slurry spray "strips" the SO₂ from the flue gas, the SO₂ reacts chemically with the limestone to produce calcium sulfite. (Stay with this even if chemistry class is a dim memory.)

By injecting oxygen into the calcium sulfite, the chemical soup changes again into calcium sulfate ... which every reader already knows as gypsum - the primary ingredient



PRACTICALLY ON THE ROOF - Thirteen levels off the ground, Herb Beckwith points down at the absorber module where flue gas is sprayed with limestone slurry to remove SO₂ gas. The stack in front of him continues more than 100 feet further up through the roof. in sheetrock.

The almost-gypsum soup travels through several de-watering processes until it's converted into a dry solid that's stored before being sold and shipped to several states and Canada for transformation into sheetrock and concrete additives. Every day approximately 300 tons of gypsum are the tangible result of the chemistry that transforms dangerous SO₂ into a useful product.

No transformation process, whether the simple miracle of breathing in oxygen and exhaling carbon dioxide or the most complex industrial act, is without by-products or risks.

Diagnosing problems; evaluating the risks; developing technological remedies; and having the initiative to follow through are the continuing adventure of any society.

NYSEG's new Milliken Station power generating plant will undoubtedly face new challenges as our knowledge of problems and ultimate solutions progresses. But it is nice to know that the state-of-the-art in environmentally concerned power production is here... in our little town.



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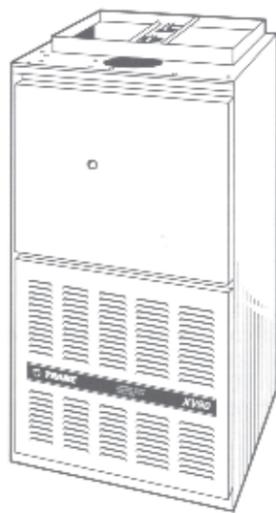


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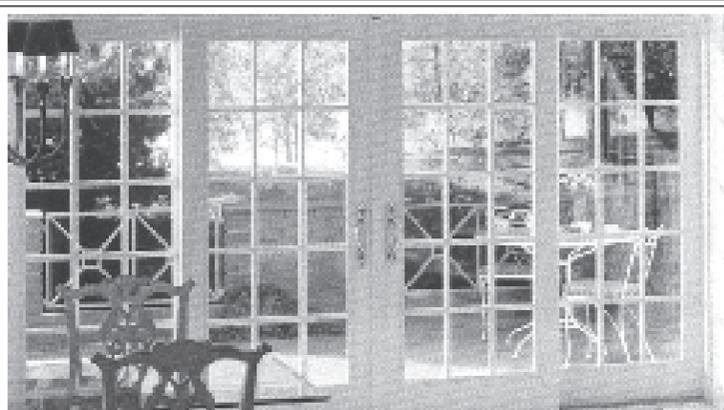


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