MERC In Focus

MERC: A day in the life

By Ward Peck
Staff Writer

Several months ago, and again on Nov. 15, Ken Robbins, general manager of the Maine Energy Recovery Center (MERC) provided the Courier with access to his facility. Robbins answered questions about the operation and provided a tour of the waste-to-energy plant following a load of trash from the truck to the transformer.

Robbins said because of recent advances in technology, and recyclable collection, he can't imagine a company building a refuse derived fuel (RDF) waste-to energy incinerator like MERC today. Since much of the efficiency created from a higher quality fuel source is offset by the energy and labor necessary to process that waste, such a facility makes little sense to build. It is impossible to convert a RDF incinerator into a less energy intensive, and less efficient mass-burn incinerator.

The facility consists of about four acres of buildings, sitting on a six-acre lot on the Saco River in downtown Biddeford.

A RDF facility processes waste by removing items that do not burn, or do not burn well, to increase the efficiency of the fuel. The other type of waste-to-energy incinerator is known as a mass burn facility, which incinerates refuse in the same form it is collected.

While characteristics of refuse vary wildly from load-to load on average a pound of unprocessed refuse delivers roughly 4,500 British Thermal Units (btus) of heat, whereas a pound of processed RDF delivers 6,000 btus. A btu is a unit of measurement used to calculate how much energy a material produces when ignited. One btu is equivalent to the energy needed to heat one pound of water one degree Fahrenheit. Simply put, RDF produces more energy than its equivalent of unprocessed refuse. RDF also produces less ash than unprocessed waste. Other the other hand, processing waste is labor intensive and requires a significant input of energy.

The process of turning 280,000 tons a year of unprocessed solid municipal waste—the equivalent of one quarter of Maine's municipal waste— into RDF begins in a parking lot off Lincoln Street. One hundred trucks, carrying five to 25 tons of municipal solid waste from Maine, New Hampshire and Massachusetts, arrive every five days.

The trucks line up to have their loads weighed and detected for radiation before driving into the facility to dump their load.

According to Robbins, the radiation detectors are extremely sensitive, able to sniff the radiation emitted by a driver undergoing cancer treatment. If any radiation is detected, the truck is turned away and the source of the waste is required to contact the Maine Radiation Control Agency to investigate.

If the truck is determined to be clear of radiation, it then drives into and airlock vestibule, down into the tipping building. The tipping building is a warehouse-style, building with a one-acre concrete floor. A series of powerful fans suck air out of the building, creating negative air pressure designed to prevent odor from escaping.

Once on the tipping floor, the truck tips its load and exits the building.

Heavy machinery, such as front-loader tractors, organize the garbage into huge piles while employees known as 'pickers' pick through the piles looking for large pieces of steel, propane tanks, car batteries and other non-processable waste, known as oversized bulky waste. Pickers receive the proceeds of revenue generated by recycling items they remove.

MERC sets a seven-day target as the maximum time waste is to sit on the tipping floor before being processed.

Waste is then loaded onto a conveyor belt where it is X-rayed for unprocessable waste missed by the pickers. An employee monitors the X-rays and a computer programmed to recognize such items. If such items are found they are pulled off the conveyor belt and removed.

Items remaining on the conveyor belt are fed into the primary shredder, a 1,000 horsepower machine consisting of shafts, wheels and hammers, which pummels waste into six to 10-inch pieces and extrudes those pieces onto another conveyor belt.

The primary shredder is contained in a rectangular building with one-foot thick concrete walls and a tarpaulin roof. The primary shredder is the point in the process where things tend to explode most notably, propane tanks. The thick walls and fabric roof are designed to vent explosions up.

The shredded waste then moves by conveyor belt to a magnetic separator where steel and other iron-based metals are removed. Iron-based metals account for three percent of MSW or about 8,000 tons per year. These metals are removed because they have no btu value and can be sold as scrap.

After separating the iron and steel, the trash moves to a trommel, which consists of a spinning cylinder with four-inch holes. The refuse that falls into the holes proceeds onto a disc screen. The disc screen consists of a series of discs aligned along a plane with gaps between the discs. Material falling between the discs, mostly grit, glass and dirt is collected in a trailer to be carted to a landfill.

Material that passes through the trommel move along conveyors to a second, 800 horsepower shredder, reducing it to pieces four inches and smaller.

Material expelled by the secondary shredder joins material passed through the disc screen and conveyed to a machine known as an Eddy Current Separator.

This process separates non-ferrous metal such as aluminum, and brass from the waste stream. The separator uses a negatively charged magnetic field that acts as a force field, repelling the metal as a conveyor belt moves the waste forward. The non-metals simply pass through the magnetic field, while the metals literally jump out of the waste stream and into a trailer.

The separator removes approximately 300 to 400 tons of recyclable metal a year, approximately 50 percent of the non-ferrous metal processed. This metal can be sold to recyclers at market price. The market price for recyclable metals fluctuates providing MERC with either revenue or an expense depending upon market conditions.

At this point the waste is now considered RDF, ready to fuel the boilers. Robbins estimates that the facility gets an 80percent yield of RDF from the waste, meaning for every 10 tons of waste processed, two tons do not get burned.

The whole process produces an average of 40 to 65 tons of RDF each hour, while the boilers only consume 25 tons per hour. The 15 to 40 ton surplus is stored and used when the production line is shut down for inspection, scheduled maintenance and breakdowns.

MERC houses two boilers, constructed as hollow boxes with pipes containing ultra-pure, de-mineralized water lining the walls. RDF is fed into the center of the boiler, some of which ignites in mid air and the rest falling to the floor, or grate, where it burns. The grate itself moves like a conveyor belt, dumping ash into a quench tank. The water in the pipes boils into steam and then superheated at high pressure to remove water vapor molecules. The high pressure, zero-moisture steam (650 pound of pressure at 750 degrees) is then sent to the General Electric turbine spinning the turbine blades, and powers the generator.

The water needs to be de-mineralized and moisture free; otherwise under such pressure minerals, sediment and water molecules act like microscopic bullets and would shred the turbine blades.

The whole process produces 528 mw/hours per day. MERC sells that energy to CMP at a contracted price Robbins considers proprietary information, but acknowledges is currently above the market rate. The electricity is then placed in the grid and used by consumers.

Once the steam passes through the turbine, it is collected in a condenser that uses Saco River water to cool it back into water and sent to the boiler. The boiler water and the Saco River water never mix, as that would introduce impurities into the system. The Saco River water is then flushed back into the river three to four degrees warmer than the ambient water temperature.

Waste products from the burn are collected at different points in the exhaust process before the gas is emitted from the 244-foot smokestack.

Some of the solids fall through grates in the bottom of the furnace into a quench tank, and then, eventually taken to a landfill. Other solids are suspended in the hot gasses and float up.

The flue gas, containing the particulate matter passes through a Zurn dust collector, knocking the large particulate or heavy ash out of suspension. The flue gas then moves to a spray dryer absorber, which uses lime and water mixture to scrub the gas of acidic compounds.

The flue gas moves from the scrubber to the bag house, which acts very much like a vacuum cleaner bag. The air passes through the bag, but the particulate, also called fly ash gets trapped in the fibers.

The ash and particles removed in these processes amount to about 50,000 tons a year. It is collected and dumped at the landfill in Noridgewock, Maine.

The stack is equipped with continuous emission monitors, which check the levels of Sulfur dioxide (SO2) Oxygen (O2) Nitrous Oxide (NOX) and Carbon Monoxide (CO) before emition.