

Thermal waste processing systems





Hazardous waste processing facility in Israel.

Rotary kiln technology

Thermal waste processing systems

The rotary kiln is the most efficient processing system for the drying, volume reduction and destruction of almost all types of wastes. The rotary kiln is in an inclined cylinder, which slowly rotates along its axis. As it rotates, material in the kiln is slowly tumbled and mixed. This mixing ensures that all of the material is exposed both to the high temperatures in the kiln and to the oxygen needed for combustion. Because of its high efficiency, the rotary kiln is the primary system for the destruction of hazardous industrial wastes.

Rotary kiln systems built by Metso have been used to process a variety of solids, sludges, liquids and gaseous wastes, including:

- Hazardous
- Industrial
- Radioactive
- Chemical
- Pharmaceutical
- Contaminated solids
- PCB's
- Medical

Transportable rotary kiln combustion system for pcb contaminated soils. Performance test showed a destruction removal efficiency (dre) greater than 99.9999%.



The illustration shows the major components of a rotary kiln waste combustion system. Each part is designed based upon the type of waste to be processed.

Feed system

The feed system prepares wastes for feeding to the rotary kiln, monitors the rate of feed and isolates the feed from the atmosphere. The feed system can include solid waste loaders, sludge and liquid pumping systems, and gaseous injection systems.

Rotary kiln

The rotary kiln, through the slow tumbling action, dries the waste, removes the volatiles and burns the fixed carbon. The kiln speed, temperature and oxygen content can all be varied to provide optimal combustion of the waste materials.

Secondary combustion chamber (SCC)

The SCC provides 2 seconds of residence time for the combustion gases at temperatures of 850 to 1,200°C. Because of the excess oxygen and intense mixing, the SCC can provide a destruction removal efficiency (DRE) of 99.9999% or greater.

Waste heat boiler

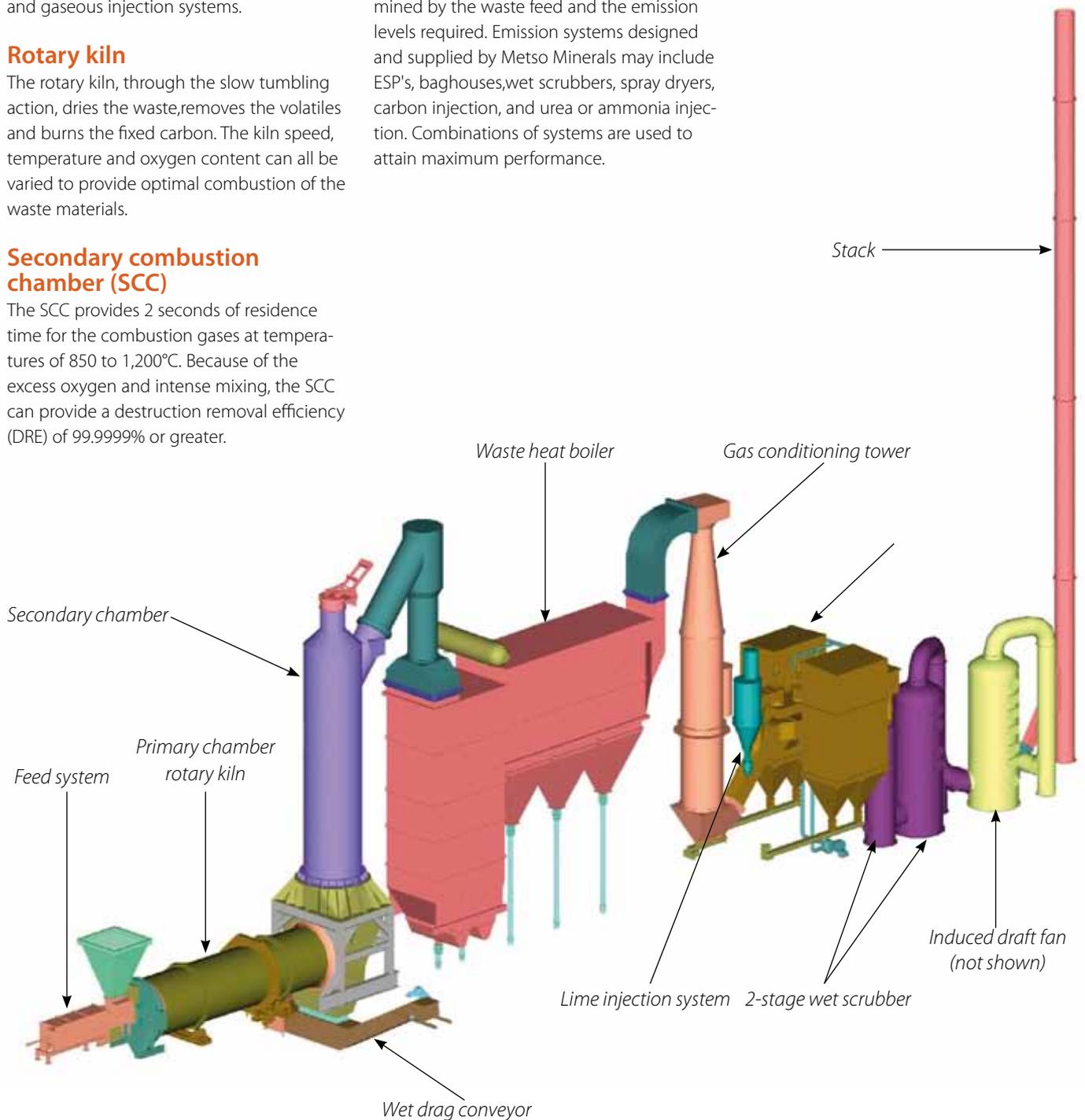
In the system shown below, a boiler is used to lower the temperature of the waste gases. The steam produced can be used for in-plant process use or to generate electricity. If a boiler is not used, a water quench can be used.

Air Quality Controls System (AQCS)

The AQCS removes particulates, dioxins, furans, acids and heavy metals from the flue gas stream. The design of the AQCS is determined by the waste feed and the emission levels required. Emission systems designed and supplied by Metso Minerals may include ESP's, baghouses, wet scrubbers, spray dryers, carbon injection, and urea or ammonia injection. Combinations of systems are used to attain maximum performance.

Stack / Continuous Emissions Monitor (CEM)

An ID fan provides draft control through the combustion system, with the clean, cooled gases exiting the stack. Systems may include a continuous emissions monitor (CEM). A CEM for a hazardous incinerator can provide real time monitoring of opacity, CO, O₂, CO₂, SOX, NOX and HCl.





Turnkey, direct-fired 15 X 10⁶ KCAL/HR waste incineration system, including boiler and air quality control system.

Direct and indirect fired Kiln systems

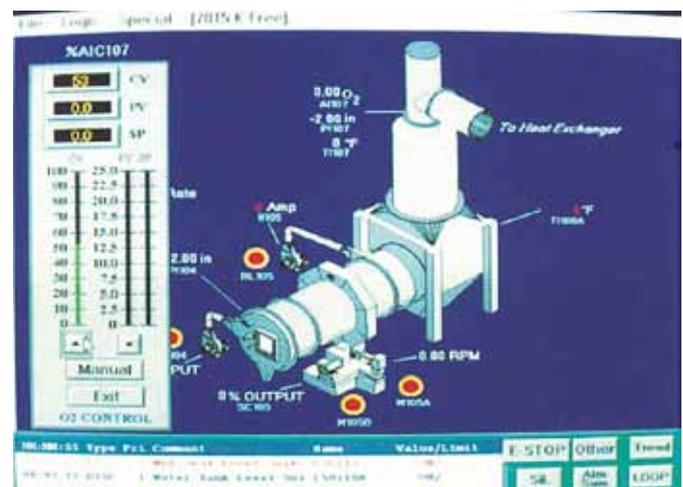
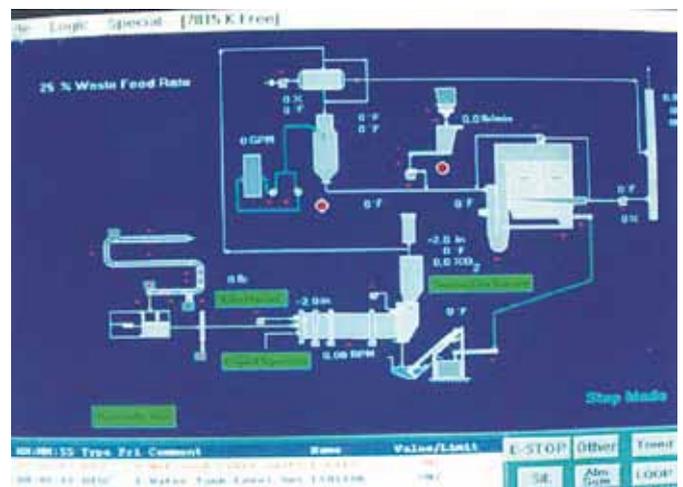
Process Flow and Controls

The successful operation of a rotary kiln combustion system is very dependent upon all components of the system operating together. Starting from the waste to be processed, Metso Minerals utilizes its proprietary Heat and Mass balance program to model the system. The type of equipment to be used for gas tempering and the AQCS are selected and modeled. After the H&M balance is complete, a Process Flow Diagram (PFD) is developed. This allows Metso to optimize the design and provide a totally integrated system.

Metso uses PLC based control systems on its rotary combustors. The control systems integrate equipment monitoring, safety interlocks, operation algorithms and operation records. The control systems have user friendly interfaces, to help the operator visualize the system and enhance his ability to monitor the operations.

In waste processing the feed is nonhomogeneous and varies on an ongoing basis.

Because feed characteristics are not steady, monitoring is difficult. Therefore each waste stream must be evaluated individually and as a composite when designing a waste processing system.



PLC based control system with graphic user interface (GUI) for combustion system.



Integrated indirect-fired rotary kiln and indirect-water film rotary cooler.



Indirect heat rotary dryer used for waste processing.

Typical installations

Metso indirect-fired rotary kilns consist of a rotating shell enclosed by a stationary chamber or furnace. The material to be processed is fed into the rotating shell generally by a screw conveyor extending inside the shell. The shell contains tumblers which are normally welded in the inside surface of the shell. The tumblers extend through the length of the shell. The primary purpose of the tumblers is to mix the material and to minimize wear on the inside surface of the shell.

The stationary combustion chamber is refractory-lined and serves as a passage of hot combustion gas generated from an external burner system. The combustion chamber is divided into distinct zones to allow for specific process oriented temperature controlled sections. Heat is transferred principally by radiation. One advantage of this type of kiln is that a minimum volume of off-gas is generated. This minimizes particulate entrainment and thus would require a smaller AQCS.

Indirect-fired rotary kilns have been applied for a variety of waste materials, whether for recycling, recovery of product values or destruction of the hazardous elements. Indirect-fired rotary kilns are most applicable to bulk solids waste materials which are temperature sensitive, affected by direct contact with combustion gases or where it is undesirable to mix the volatiles being driven off with the products of combustion. This equipment is also used by drying and pyrolysis.

On some specialized applications, the indirect-fired kiln is integrated into a water film cooler. This is accomplished by extending the rotating shell beyond the stationary furnace and into an enclosed water-showered compartment. This approach allows better temperature control from heating to cooling, minimizes air leakage and eliminates the need for two units and hot solids transfer equipment.



Hazardous waste incinerator under construction in Thailand.

Exceeding a century of expertise in Pyro Processing

Our leadership in process systems technology has evolved through the integration of some of the world's best known brands.

Increase the economic values of ores, minerals, wastes, and related materials by changing their mechanical and/or chemical properties through Metso's expertise in pyro processing systems and equipment.

We are the only company that has the original drawings, specifications and calculations for pyro processing systems and equipment that have been installed under the following trade names:

- **Allis Chalmers**
- **Kennedy Van Saun (KVS)**
- **Svedala**
- **Allis Minerals Systems**
- **Boliden Allis**
- **MPSI / Hardinge**
- **Armstrong Holland**
- **Joy Energy Systems (JES)**
- **Pyrotherm**





Product support

Project management

Our project management group executes engineered projects worldwide with the goal of meeting customers' requirements and expectations on schedule, cost, and quality. This group has a pool of qualified technical staff experienced in project management, process engineering, product design, plant layout and design, electrical and civil engineering, plant construction, plant start-up, and training of customer operators. Over 200 large engineered projects have been successfully completed for such systems as cement making, lime recovery kiln, iron ore pelletizing, lime production, coke calcining, specialty calcining, and waste processing.

Over 500 engineered projects have been successfully completed for thermal waste systems. These include soil decontamination, Superfund sites, industrial wastes, medical wastes, chemical wastes, municipal solid wastes, fly ash recycling and carbon regeneration.

Test facilities

Our Process Research and Test Center is a fully equipped facility which can perform material testing to simulate complete commercial flow sheets. One area of this facility is dedicated to testing of thermal systems for waste. Pilot-size equipment are available including direct-fired rotary kilns, indirect-fired rotary kilns, rotary dryers and coolers, fluid bed dryers and gas-cleaning systems.

Material testing optimizes the performance parameters used in designing thermal waste systems. It also forms the basis for providing the most cost-effective commercial warranty for a system.

Parts supply and field services

We maintain the original drawings and specifications of waste systems we have built over the years. These equipment were originally sold under the name: Allis-Chalmers, JES, KVS and Stansteel.

Thus, we can provide repair parts to the original tolerances and specifications, incorporate the latest design improvements and perform cost-effective field repairs and services. Our computerized drawings retrieval system allows us to quickly respond to emergency needs of our customers.





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