

Clients and Applications – Case Histories

Teledyne Wah Chang Corp., Huntsville, AL

Ammonium Paratungstate

Teledyne uses a TURBO-Dryer to dry ammonium paratungstate prior to its being converted to tungsten oxide in rotary furnaces. The TURBO-Dryer serves perfectly because of its unique feature of being able to automatically compensate for wide variations in feed rates. Most other dryers need a constant and uniform feed, because a change in feed rate automatically affects the retention time, a big problem for units with very narrow turndown ranges. The self-compensating Wyssmont dryer features a broad, automatically controlled turndown range of 3:1 so that no adjustments have to be made by an operator. Retention time can also be adjusted through 10:1 with a variable speed drive, (20:1 with a simple sprocket change). The company reports that the dryer's gentle handling of the material produces a uniform, free-flowing product. Crystals are not broken and no dust is formed. The chance of metallic contamination of the APT by erosion, a potentially serious problem with this particular salt, is eliminated. The company is also very pleased with the easy-to-clean design of the unit and its trouble-free reliability.

Hoechst Celanese Corporation, Bishop, TX

Biological Sludge

Aerobic biological sludge blowdown from the clarifier in the wastewater treatment system previously had been discharged to solar ponds. However, this procedure became environmentally unsuitable. Hoechst Celanese then tried a belt-filter press, but because the product solids content averaged only about 20%, it was slow to dry in the landfill and couldn't support the equipment used to spread it. It also became readily rehydrated by rain and took too much of the limited landfill space that was available. The company tried combining the material with other waste solids and drying with compression type equipment or a number of gas fired units that required backfeeding. None of these techniques proved satisfactory. After testing a Wyssmont TURBO-Dryer, the company decided to install a 12 ft dia. by 16 ft high, 26 tray unit that can handle about 500 lbs/hr of 20% solids sludge from a filter. Natural gas heats drying air to 360-400°F. The operation has been extremely successful in reducing the sludge from 20% to 90% solids, exceeding specifications for dryness and requiring minimal supervision and maintenance and very low overall costs.

Aerojet Corporation, Sacramento, CA

Propellant Oxidizer

The plant needed to dry a fine, (3-5 micron), high energy oxidizer containing 1.5-2% moisture down to propellant grade «0.1 % moisture). The objective was to achieve discrete particles with minimum dusting, using a continuous drying process. Most attempts using standard approaches resulted in troublesome agglomerates. Traditionally, oxidizer products have been tray dried in batches. The tray dryer is a gentle way of handling material. Aerojet tried many alternatives before deciding on the Wyssmont dryer. The Wyssmont vertical rotary tray dryer simulated a tray-drying operation while also being a continuous process. The drying equipment selected also had to be safe for handling a potentially explosive material. Static electricity or sparks would be dangerous. To eliminate static discharge, the dryer was fitted with Teflon(R) wiper and sweeper blades and specially treated to ensure electrical grounding. Process conditions were set to eliminate or minimize agglomeration. The dryer is operated with an inlet air temperature of 135-140°F. The plant has been very satisfied with the operation of the dryer.

Lithium Corporation, Bessemer City, NC

Lithium Carbonate

In 1955 a Wyssmont TURBO-Dryer was installed to dry lithium carbonate. The dryer provided such reliable service that in 1968 another TURBO-Dryer was added to handle a capacity expansion. The second 12 tray dryer dries 75,000 lbs/day of Li_2CO_3 from 15% to less than 0.1 % moisture. The Li_2CO_3 particle size is very small, (100%/-40 mesh, 50%/-200 mesh), yet the product loss to the dryer dust collector is less than 1/2%. Drying air is heated with a natural gas fired heater to 400°F. Air is recirculated over each tray at a controlled velocity to minimize dusting. During the 30 plus years of combined operation of the dryers, the only significant maintenance requirement was when the burner controls malfunctioned and the trays overheated. The purchase of a third dryer for a similar process demonstrates Lithium Corporation's confidence in the mechanical reliability and effectiveness of the equipment.

Sentury Reagents, Charlotte, NC

Pyrophoric Reagents

The plant regularly dries 2,000-3,000 lbs/day of a pyrophoric crystalline product from about 2% moisture to near complete dryness. The product has the tendency to explode if not handled carefully. Labor intensive vacuum tray dryers were being used to dry the product. Each of the drying trays had to be manually filled, leveled and loaded into the dryer. During drying, a crust would form and lumps would have to be broken up manually and screened. Sentury decided to install a 4 foot dia., 20-tray TURBO Dryer. It provided precise temperature control and gentle material handling, on a continuous basis, in a sealed but cleanable environment. 185-200°F. Air dries the product to 99.9% solids. Teflon(R) blades are used on the scrapers to avoid any possibility of metal-to-metal contact. The biggest benefit of the Wyssmont dryer has been a tremendous labor savings. In addition, the dryer's continuous throughput virtually eliminates lump formation. Product quality is excellent.

Sandoz Crop Protection Corporation, Jefferson County, TX

Herbicide, Methazole

This was an entirely new process that yielded a very high purity product with extremely low toxicity. The herbicide is temperature sensitive. Temperature must be carefully controlled or the product turns brownish and loses its efficacy. Most dryers had to be ruled out because they use elevated temperatures. The particles tend to stick together, so the product needs continuous and gentle agitation, but because the crystals are subject to dusting, it was necessary to minimize particle attrition. Tests showed that single or double-cone batch drying under vacuum would be too slow to handle the proposed commercial production. Paddle and screw type dryers caused too much product dusting and attrition. Sandoz selected a Wyssmont rotary tray dryer. The system uses a heated nitrogen atmosphere that is recycled. The drying system has met the design rate on throughput and all product quality specifications: purity, dryness, caking, dusting, and uniformity. The trays can be easily cleaned between production runs. The unit requires minimal operator attention and simple maintenance procedures.

Rogers Corporation, Manchester, CT

Glass-filled Phenolic Resin

This phenolic resin is thermally sensitive and the extruded intermediate is frangible. Particle size of the dryer feed ranges from 1/4" to 3/8". Moisture content is about 15%, dried product is specified at about 3% moisture. Drying must be carried out at a low temperature to avoid premature curing. Gentle handling is also necessary to prevent dusting. During product development, drying was done in rotary dryers. Particle attrition created a significant amount of dust. The engineers' arranged a test at Wyssmont's test facility. The trial showed that the product could be dried at a low temperature with good final moisture control. The rotary tray dryer purchased has consistently provided product dried to 3%. Particle size degradation and dusting is no longer a problem. The air temperature is low (180°F) and constant throughout the height of the dryer eliminating advanced product curing. The dryer handles feed rate variations with minimum operator attention and provides consistently high quality product. It also provides flexibility to start with 600 to 700 lb/hr and work up to a capacity of 1,500 lb/hr.

Lederle Laboratories division, American Cyanamid Company

Pearl River, NY

Mycelia Cake

Mycelia cake, the byproduct of Aureomycin production, contains 60% volatile butanol solvent vapors that made Lederle's use of ovens for drying dangerous. The ovens also resulted in loss of heat energy and solvent. After considering a number of other drying methods to improve the process, Lederle Laboratories decided on the use of Wyssmont TURBO-Dryers. They installed two units. They use nitrogen/carbon dioxide inert heating gas that is recirculated and the butanol is reclaimed in a condenser. The installation operates automatically. Oxygen content is held to less than 5%. Explosive-gas detectors are used for safety. To prevent leakage of solvent vapors, the dryers are operated under a slight negative pressure of less than 0.01 in. of water. The TURBO-Dryers have solved all the problems. The explosion hazard has been reduced to a minimum. The solvent is reclaimed. The product is very high in quality. The dried cake can be processed into animal feed. Profitability has increased because the unit handles many times the amount of cake per day than was possible with oven drying. Very little maintenance has been required and manpower has been dramatically reduced.

Hydrocarbon Research, Inc., Trenton, NJ

Pulverized Coal

Crushed, pulverized, finely ground coal (-60 mesh) was required for a hydrogenation process. Because certain coals are explosive when dry and finely ground, transporting "outside" coal was abandoned and an in-plant system sought. An inert atmosphere was required to prevent explosions and deterioration of the coal. A TURBO-Dryer was installed that was 6.0 ft dia. x 10 ft high with 18 trays. Operating temperature is 230°F. The drying medium is nitrogen (3% oxygen). Evaporated water is recovered in a separate condenser with the nitrogen being recirculated. The 30% moisture content coal powder is dried to 5% at 250 lbs/ hr. 10% moisture powder is dried to 2% at 580 lb/hr. Dust entrainment in exhaust gases is minimized as a result of gentle handling and low vertical drying-gas velocities.

Lemon Products Division, Sunkist Growers, Inc., Corona, CA

Jelly-grade Pectin

Pectin, from lemon rinds, is both hygroscopic and heat sensitive. If heated over 150°F, there is loss of grade, and over 180°F, there is a loss of gelling strength. Over-drying produces undesirable odors. The former drying method was batch drying in a rotary vacuum unit that required constant supervision by several operators to ensure quality. The process was relatively slow, power requirements were considerable, and the processing generated an undesirable amount of air pollution. The two replacement TURBO-Dryers are 9.5 ft dia x 15 ft high with 28 trays. Operating temperature is below 150°F. First dryer removes all the isopropyl alcohol and most of the water, reducing 65% volatiles to 25%. Metered-in nitrogen prevents oxidation and prevents fires and explosions. The water-alcohol mix is condensed and recovered in a receiver; the drying gas is recirculated through a steam heater. The second dryer removes water only and uses filtered, heated air as the drying medium. Cost savings due to grade improvement are estimated at 50¢ per lb, approximately \$90,000 per year. Only one operator is required; automatic controls replace constant monitoring. Drying time and power requirements are reduced by 50%. Air pollution, secondary dust collectors and subsequent re-blending facilities are eliminated.

Wyeth Laboratories, Paoli, PA

Penicillin

Drying problems include air pollution by solvents, product degradation and packaging difficulties due to lumping. Extensive evaluation of different types of dryers narrowed to two contenders: a rotary vacuum unit operating at about 28 to 29 in/Hg and a TURBO-Dryer. Both recovered solvents satisfactorily and produced an acceptable dried product (0.5% or less volatiles). The TURBO-Dryer operating cost was less because its chilled-water refrigeration system for condensing solvents cost less than 75% of the cost of the direct-expansion 'Freon' system required for the rotary vacuum unit. The two closed-circuit TURBO-Dryers purchased are steam heated, stainless steel interior construction, 9.5 ft dia. Large unit is 10 ft high, 18 trays. Smaller unit, 6 ft high, 12 trays. The drying medium is nitrogen at a slight positive internal pressure; make-up rate is 5 scfm max. Oxygen levels are less than 5% by volume. The large unit reduces 30% volatiles to 0.5% at 300 lb/hr. The smaller unit is used for smaller batches and different grades and reduces 25% volatiles to 0.5% at 150 lbs/hr. Dried material is free-flowing and non-lumpy. No solvent odors can be detected by operating personnel.

New Jersey Zinc Co., Depue, IL

Zinc Sulfide

Company needed to obtain pellets suitable for processing into slab zinc from zinc flotation concentrates. 450 tons/day of zinc concentrates are mixed with a binder, recirculated fines, sulfuric acid and water to form 700 ton batches. At the disc pelletizers, water is added to form pellets sized between -4 and 20 mesh. The company installed a TURBO-Dryer with a gas-fired heating system. It reduced the pellets' moisture content to less than 0.5%. After processing by the TURBO-Dryer, pellets enter two triple deck vibrating screens. The results were that the preparation and pelletizing system achieved 85% pellet recovery from concentrates to roaster feed bin.

Proprietary

Waste Sludge

This company developed a waste treatment process to dry municipal and industrial sludge. The operation had to be sized for an on-site demonstration facility on a low bed trailer. A 12 shelf, 6 ft x 7 ft high TURBO-Dryer was selected. It processes sludge treated with a proprietary organic solvent to the desired dryness and recovers all liquids evaporated for reuse. Due to the danger of explosions or fires during processing, nitrogen gas is used as

a drying medium. A closed-circuit system with gas-tight construction results in low nitrogen makeup requirements. The TURBO-Dryer consistently dries to bone-dryness as a result of the true material plug-flow through the unit, assuring a positive residence time for all sludge solids. Automatic controls result in minimal attendant labor. The unit can operate as low as 20% of the maximum design rate without changing conditions. Cleanable observation ports allow viewing without operation interruption. Sludges processed include those from municipalities, pulp and paper plants, steel wool industries, wool-scouring operations, animal renderers, breweries, chemical plants and titanium operations.

Arapahoe Chemicals division, Syntex Corp., Boulder, CO

Organic Chemicals

Management at Arapahoe Chemicals estimated that over 1,200 man-hours normally needed for tray loading and handling have been saved in the three years that the Wyssmont TURBO-Dryer has been in service. All the advantages of batch tray drying and substantial savings in labor and space were realized with the TURBO-Dryer providing continuous transfer on its 12 vertically stacked trays. The unit provides uniform drying and high quality for a number of fine chemical products at Arapahoe. This vertical drying unit produces the amount of product in 100 sq. ft. of floor space that would require 500 sq. ft. if conventional trays and ovens were used. Drying action repeated on stacked shelves also results in mixing and repeated exposure of new drying surfaces. Incoming air can be heated by external steam coils to as high as 150 to 160°C. The products handled are wet with various solvents including methanol, water, and a combination of toluene and water. One product has been successfully dried at the rate of 6,000 lb/24 hr, from 10% to less than 0.5% toluene/water mixture (50/50).

AMAX Base Metals Research & Development, Inc., Carteret, NJ

Pyrophoric Zinc Powder

AMAX wanted to dry a highly pyrophoric, water-wet, metallic zinc powder from 20% to less than 0.5% moisture as well as maintain 99.99% purity. Zinc, recovered electrolytically, requires drying before being cast into ingots for subsequent shipment or distribution. Conventional air drying techniques produce a white zinc oxide coating on the gray, sand-like particles, and in some instances, actual conflagration occurred when the dry state was approached. A closed-circuit TURBO-Dryer using recirculated nitrogen was installed. The unit provides intimate drying gas contact with the zinc powder, facilitating close temperature control and high heat and mass transfer rates. In addition, the gentle materials handling and low exit gas velocities eliminate the need for dust collection equipment. The system produces 150 lb/hr of 99.99% zinc with no white oxide impurities and without the danger of fire.

American Cyanamid Co., Linden, NJ

Crystals that melt near 100°F

This company had to dry a fine crystalline solid from 8 to 10% moisture to less than 0.5% without melting it to an unusable fluid mass, plus there must be positive containment of the fumes and dust to avoid air contamination. After Wyssmont laboratory evaluation, followed by the operation of a pilot-size unit at the plant, a full sized TURBO-Dryer was installed. For all areas of product contact, the unit was made of stainless steel. The manifold dampers maintain air temperature in lower portion of dryer at 100°F and the upper portion at 85°F. Negative pressure of less than 0.1 in/wg prevents escape of dust or fumes. Dust and water are removed from drying air by direct contact with cold water in a dehumidification scrubber. The cooled, dried air is then passed through a steam heater and recirculated through the dryer. The sensitive product is successfully dried through close temperature control. The same recycle-system equipment is used with inert gas in place of air to remove isopropyl alcohol from another product. The system reclaims the solvent gas economically. Full size access doors on the dryer allow thorough cleaning to avoid inter-product contamination at changeover.

United States Steel Corp., Clairton, PA

Prilled Pitch

Prilled pitch, used in making carbon electrodes and synthetic graphite, was introduced in 1965. It has become popular because the free-flowing prills are like buckshot which can be handled easily and loaded directly into railroad cars, trucks and barges and can withstand varying temperatures in transit. Prills are made by converting liquid pitch into droplets which are solidified by air and water. They were formerly dried and cooled in two separate steps. Two Wyssmont dryers each combine drying and cooling in one operation. This simple operation has doubled plant capacity and cut operating costs. Dust control and vapor collection are built in. With less dust, prills are now shiny rather than pebbly surfaced. Prill breakage and fines formation are practically eliminated, resulting in very little product caking in storage.

Proprietary

Phosphors

Electronic-grade phosphors for color TV tubes require precision processing to maintain high purity and uniformity. Phosphor "body slip" is a mixture of fine crystals with water and sometimes with dispersing agents. This slip is de-watered to about 90% solids by a rotary vacuum filter unit. The resulting paste-like materials was formerly dried by a batch method that required 25 to 40 hours and intensive labor. Three Model "K" TURBO Dryers were purchased so that different grades could be dried at one time. To prevent product contamination, construction is stainless steel throughout, and the small, 10-tray units can be dismantled, cleaned and reassembled easily. Drying time is reduced to only one hour, a reduction of more than 95%, with no crystal breakage and no lumping. Considerable savings are realized in floor space, labor, fuel and power. Product loss is minimal since less than 0.5% is entrained in the exhaust air prior to being recovered.

Monsanto Industrial Chemicals Co., Nitro, WV

Solvent-wet Organic Solids

The drying problem was the removal of aromatic solvents from several different, heat-sensitive, granular, organic-solids products. Thorough cleaning of equipment at changeover is required to avoid product contamination. Previous drying methods required two rotary vacuum dryers. Successful pilot-plant tests at Wyssmont proved to be very reliable in forecasting full-scale results. They resulted in the purchase of a TURBO-Dryer. The TURBO-Dryer's advantages include automatic operation that provides manpower savings of one operator per shift (\$25,000 per year). Large access doors allow quick, easy clean-up of dryer at product changeover and reduce downtime. Recovery of solvents substantially reduces operating costs. Precise temperature control provides uniform product quality.

United Catalysts, Inc., Louisville, KY

Zinc Oxide Pellets

The company wanted to utilize hot exhaust gas from a nearby kiln to uniformly dry and cure 1,500 to 2,000 lb/hr of moist, claylike pellets from 25% moisture down to less than 5% without pellet breakage and attrition. The previous dryer was a batch type box unit. Several types of new dryers were considered. Tests were run by Wyssmont to ascertain that product specifications, especially hardness and attrition, would be met and to determine size of final unit. The TURBO-Dryer selected has 18 trays. Construction is carbon steel except for a stainless steel hot-inlet-air manifold.

Hot flue gas is delivered by a blower and automatically controlled by dampers. The TURBO-Dryer provides greater product uniformity. Savings in fuel, by use of waste heat, is equivalent to 6 million scf/yr of natural gas and there are substantial savings in manpower in operation and maintenance.

GTE Sylvania, Towanda, PA

Calcium Carbonate

Calcium carbonate is used to make phosphor powder for lamps. Dryness of product is critical. The former method of drying was batch-type rotating vacuum dryers that required maintenance of vacuum pumps and steam jacketing, both costly. Obtaining high vacuums required careful scrutiny of entire system. Operation was time consuming for personnel. The company purchased a 12-shelf rotary tray TURBO-Dryer that operates continuously and automatically. Little operator attention is necessary. By controlling speed of tray rotation, residence time can be varied to adjust dryness of the final product. Dryer is heated with air, and a recycle system reclaims heat that would otherwise be lost. Moisture laden air from the dryer goes to a baghouse to retain any entrained fines. Air stream is then split. A percentage is exhausted; the rest goes to an electric heating coil, where it is supplemented by heated make-up air to control humidity. Moisture content of the carbonate powder has been reduced satisfactorily from about 30% to 0.01%. GTE now has a continuous operation that yields product at a higher rate than was previously possible.

Dan River Chemical Productions, Danville, VA

Boric Acid

Boric acid is a dry, friable, white crystalline product that has to be dried from a crystalline solution. Ground-up newspaper, used in cellulose insulation, is impregnated with boric acid, which acts as a flame retardant. The new production line had to be designed with multi-product flexibility. Project specified a production rate of 2 to 3 million lb/yr. the problem was solved with a TURBO-Dryer that provided careful temperature control, gentle product handling and flexibility. The system consists of a 316 stainless steel TURBO-Dryer, centrifuge and product collector, all with explosion-proof motors and controls. Conditions in the dryer can be modified to suit varying product needs. The TURBO Dryer safely dries boric acid and other chemicals such as sodium formaldehyde bisulfite and agricultural chelates. Dry product moisture content of the boric acid is less than 0.2%. Keeping the entire line in operation 24 hrs per day requires only 3 people, one each shift.

Nabisco, Naperville, IL

Fragile Cereal Products

Cereal production at this plant involves a wide range of particle sizes, shapes and moisture levels. Belt dryers, if used, would be 300 ft long in some cases to provide adequate capacity. Several TURBO-Dryers solve the problems of floor space, versatility and achieving specified product color and moisture levels. Two 15-tray, 20 ft dia. units are used to dry grits for "Team" flakes. Two 12-tray units dry extruded, puffed and expanded products. A huge 32-tray dryer, 20 ft in diameter, dries a variety of products.

Two 16-tray units dry bran from 15% moisture to 3-4%. For bran drying, two heating zones are maintained by using dampers to control the air flow to each zone: 275°F in the upper zone and 210°F in the bottom zone. Operating experience has shown these TURBO-Dryers to be essentially maintenance-free and highly efficient in terms of heat, power usage and reliability.

CIBA-GEIGY, Cranston , RI

Anti-oxidant

The process required a continuous, closed-circuit drying operation to upgrade quality and lower costs for proprietary, heat-sensitive agricultural chemicals. The former drying method used vacuum tray units handling feed rates of 500 lbs/hr of solvent/ water-wet, heat sensitive crystals. The TURBO-Dryer that replaced them is 10 ft dia. x 15 ft high, stainless steel, 22 trays. The evaporated solvent/water vapors are exhausted from the top of the main drying chamber together with the inert drying gas to a secondary cyclone collector and to a scrubber-condenser. This dehumidified drying gas is then recirculated to a steam heating coil and then back to the TURBO-Dryer through a manifold in one side panel. Gas tightness maintains the low oxygen level requirement of 1/2% by volume. Higher oxygen concentrations can result in product deterioration as well as hazardous explosive conditions. Nitrogen gas purge make-up requirements are well under 10 scfm (17 cubic meters/hour). Volatiles in feed are reduced consistently from around 10% to 0.5%. Uniformly dried material is continuously produced utilizing temperatures of 100-200°F. The savings from the continuous TURBO-Dryer stem from lower fuel and power requirements, as a result of reducing heat loss and eliminating vacuum requirements, as well as reduction of labor due to automatic controls. The compactness of the unit also resulted in a reduction in space.

Allied Chemical Co., Syracuse, NY

Calcium Chloride Flakes

Because of its high 94-97% assay, about 25% less "Superflake (R)" is generally required for the same application as the more conventional 78% assay calcium chloride. Thus, there are savings in material, handling and shipping. Attaining this 94-97% assay from a 73% assay, water-wet, sticky melt-flake, without melting or breakage, is not easy. In fact, only the TURBO-Dryer can do it in one pass. The TURBO-Dryer being used is 31 ft dia. x 50 ft high, 48 trays, carbon steel construction. Operating temperature inside dryer: inlet air at 800°F heats top 2/3 of tray stack up to 500°F. Ambient air supplied to the lower 1/3 zone cools product as low as 160°F to allow packaging in bags. Spent drying and cooling streams are exhausted to an impingement scrubber where the minimal amount of entrained fines are recovered from the wash water. Control is automatic; operators need only check and log conditions periodically.

Certified Processing, Hillside, NJ

Caffeine

Caffeine, obtained from de-caffeination of coffee beans, is purified for use in soft drinks and pharmaceuticals. The process produces a centrifuge cake with about 35% moisture to be dried to 0.25% moisture. Drying must be uniform because moisture content above 0.25% requires reprocessing. Attrition of the crystal must be negligible since substantial breakage renders the product unacceptably dusty and non-free-flowing. Previous drying method was vacuum batch process. TURBO-Dryer data: 9-1/2 ft dia. x 15 ft high, 28 trays. Constructed of Type 304 stainless steel. The drying cycle was reduced from 10-12 hours to less than 1 hr. Fuel cost was reduced 33%. Labor requirements were reduced. Product loss from tray handling and cleaning is eliminated. The TURBO-Dryer also uses half the floor space.

Essex Chemical Co., Clifton, NJ

Fluoride Salt

The application required the drying of the corrosive salt from 6% down to 0.1% moisture without product degradation, dusting or air pollution. The Wyssmont dryer is 6 ft in dia. x 8 ft high, 12 trays. Monel is used for parts in contact with the salt, coated carbon steel for parts exposed to vapor. Standard dust-tight construction. No vented safety enclosures required. Operating costs are low (1 mil/lb) due to automatic operation, with power less than 1 hp. Quality of product is +325 mesh with very few fines.

Estimated saving in investment and operating costs is 20 to 30%.

American Cholesterol Products, Inc., Edison, NJ

Barium Lanolate

Dried barium lanolate is an anti-rust additive, pigment dispersant and anti-caking agent for paints and coatings. It is also an intermediate used to make purified fatty acids of lanolin for conversion into emulsifiers, emollients and dispersants in cosmetics and pharmaceuticals. Before drying, barium lanolate filter cake contains a low boiling point, flammable~ solvent. Above a certain temperature, it decomposes into fatty acid components. It also forms a sticky, resinous mass when subjected to severe mechanical action. Even after drying, the product, if too hot, is tacky, prone to compact, with the potential of spontaneous combustion. The previous drying method was simply storage in open containers, but quality control was difficult. Compaction during storage produced agglomerated lumps. Tests at Wyssmont pinpointed design parameters for a full size unit, including optimum temperatures for fast drying without thermal degradation. The TURBO Dryer used is 6 ft dia. x 10-1/2 ft high, 24 shelves. Drying medium IS nitrogen introduced at a level that maintains oxygen in the unit at about 7%. Slight negative pressure in the housing prevents leakage of solvent odors. Some of the recovered nitrogen is unheated and fed into the lower part of the unit to cool the dry lanolate to about 100°F prior to discharge. Dryer control is 100% automatic. Solvent recovery is virtually 100%. Solvent content of dried material is 0.3%. Nitrogen make-up is only 1.5 scfm. Dried product now has uniform composition and particle size and a sponge-like particle structure with better solubility.

Proprietary

Food Grade Crystals

Drying and cooling a very fragile food grade crystal. Problems:

Highly corrosive. Wet crystals cake if left undisturbed. Requires minimum crystal disintegration. Results: Dried from 3.3% to 0.1 %. TURBO-Dryer allowed for upgrading in screen size. No dust losses. Negligible lumps. Negligible corrosion of carbon steel parts. Heat consumption 0.1 lb steam per pound of dried product. Power consumption 0.5 HP per 1,000 lbs of dried product.

Proprietary

Filter Cake

Drying and solvent recovery of a very heat-sensitive material. Wet material forms balls. Dried lumps disintegrate readily to powder. Material very abrasive. Problems: No overheating. Recover solvent. Operate with

minimum inert gas to maintain drying atmosphere below 5% oxygen. Results: TURBO-Dryer output as-says very high. Outdoor dryer meets insurance company requirements. 1.5 to 2 cf inert gas per pound solvent. High butanol recovery. Dried product in small lumps; negligible powder or dust. Minimal wear after 4 years.

Proprietary

Plastic Granules

Drying and heating. Will fuse into solid if not agitated. Highly hygroscopic. Problems: Remove last traces of moisture, heat uniformly. Granules must be free-flowing. No batch contamination. Plasticizer fumes. Results: Very uniform heating. Capacity of extruders increased. No fumes or odors in working space. Quick and complete cleaning. Little corrosion. Low operating costs.

Proprietary

Bleach, thick flake

Low temperature drying. Bleach material formerly dried in vacuum dryer. Problems: Very corrosive, very dusty. Readily ignitable. Produce non-dusting product with high chlorine assay. Results: After three years operation of TURBO-Dryer, all requirements were met or exceeded and operating costs lowered.

Proprietary

Drug powder

Subliming. Refining an obnoxious drug formerly produced by batch sublimation. Problems: Change to continuous production, improve purity, eliminate bad working conditions. Results: Dust free operation, high yield of high purity product. Reduced explosion hazard. Low operating costs. After 6 years, two units show minimal wear.

Proprietary

Deoxidizer powder

Drying with solvent recovery. Remove and recover alcohol from highly toxic and obnoxious deoxidizing agent that disintegrates readily into a fine powder. Problems: Dry without dust or fumes escaping into working space and atmosphere. Results: TURBO Dryer operates in closed loop system without fumes or dust. Good alcohol recovery. Maintenance negligible.

Proprietary

Sewage sludge

Drying without backfeeding. Corrosive and abrasive sewage sludge with 84% water. Wet material highly plastic, balls readily. Problems: Eliminate backfeed. Only small space available outdoors for installation. Avoid objectionable odor. Results: Dryers operating since 1950 with high efficiency. Greatly reduced fire hazard. Heat consumption: 3 cu. ft. gas per pound water. Power consumption: 3.5 hp per 1000 lbs water. Nominal corrosion and wear due to abrasion. Operation odorless.

Proprietary

Filter cake paste

Drying without backfeeding. A thixotropic, highly plastic filter cake, 12% solids, corrosive, disintegrates into fine powder when dried in rotary with back feed. Problem: Dry without backfeed with a minimum of dust. Dust loss must be kept to 0.2% of solid through-put without dust collectors. Only small space available outdoors for installation. Results: Discharge is granular with few fines. Dust losses below 2 lbs per hour for 1,000 lbs output. Power consumption 4.5 HP per 1,000 lbs evaporation.

Proprietary

Catalyst pellets

Curing and drying. Problems: Uniform drying with minimum breakage. Results: Breakage negligible. Very uniform drying provides high test values for dried product.

Proprietary

Ceramic-Wax Mixtures

Major supplier of automotive electrical parts. The new dryer takes a wet feed with 10% free moisture and discharges a uniform granular mixture with less than 0.3% moisture. Drying temperatures are carefully controlled to prevent melting the binder while drying the shortest possible time. An interesting design modification for the new dryer is the "D-breeching" fitted to the roof. This attachment extends the roof of the area of the exhaust flange, thus minimizing turbulence and reducing dust carryover. By preventing caking during the drying stage, the dryer avoids the needed for further processing before molding and sintering. The dryer is ideal for blended feeds because the components of the blend remain well mixed. The low vertical air velocity also results in lower dust carryover than most continuous

dryers. The dryer can easily handle unplanned changes in feed rate because the essential drying parameters of temperature, layer depth and transfer frequency remain unchanged. Prior to implementing the new dryer, drying at the automotive parts facility was accomplished by manually spreading a bed of material on the drying trays and loading them into a static oven. The product suffered from non-uniformity due to over-drying at the top of the bed and underdrying at the bottom of the bed. The new dryer offers reliability and low maintenance for the automotive parts facility. The dryer runs 24 hours per day, 7 days per week and is only shut down for scheduled maintenance when the entire plant is closed.

Sentury Reagents, Inc. Charlotte, NC

Pyrophoric Material

Regularly dries 2000-3000 lbs/day of pyrophoric crystalline product from about 2% moisture to near complete dryness. The product has the tendency to explode if not handled carefully. Vacuum tray dryers were being used to dry the product. Each of the drying trays had to be manually filled and leveled, then put into the dryer enclosure where heat and convection would remove moisture. Lumps had to be broken up in a grinding-screening process before the product could be loaded into drums for shipment. The drying process was time-consuming and labor-intensive. Sentury installed a 4' dia. vertical, rotary 20-tray dryer that is designed to provide continuous processing of small quantities of materials. Precise temperature control and gentle material handling in a sealed (but easily opened) environment is facilitated. Plastic (Teflon®) blades are used for the scrapers to avoid any possibility of metal-to-metal contact. The biggest single benefit realized from the use of the vertical rotary tray dryer has been a tremendous labor saving over the use of the vacuum tray dryers. In addition, the dryer's continuous throughput virtually eliminates lump formation. Only a final screener is needed and very little over-sized material is screened out. Product quality is excellent; the capability to precisely control the temperature of the dryer is very helpful. Control with the vertical rotary tray dryer is much better than it was with the vacuum tray drying system.

Sierra Aluminum Co., Riverside, CA

Aluminum Hydroxide

Many of the company's processes involve acid cleaning and etching of aluminum. The resulting waste solution is neutralized and precipitated out as aluminum hydroxide. After squeezing out the excess moisture in a filter press, what remains is a filter cake with approximately 70 percent free moisture. Because the filter cake was quite sticky and difficult to handle, continuous drying was sure to be a daunting task. The continuous drying system they needed seemed out of reach - that is, until the company tested a TURBO Dryer from Wyssmont Co., Fort Lee, N.J. The 32-shelf rotary tray

dryer is fed 70 percent wet filter cake at the top of the dryer and discharges a primarily granular product at uniform product moisture below 10 percent at its discharge. The complete drying system consists of a 12' dia. 18' tall dryer; a filter-cake-breaking feeder; discharge rotary air-lock; external gas-fired heating system; exhaust cyclone and fan; and interconnecting ductwork. Sierra found that Wyssmont was able to provide a drying system that could be efficient in terms of operating costs while meeting the stringent emission requirements of Southern California. The heating system was required to have an ultra-low NO_x gas burner (20 ppm maximum NO_x emission) with less than 2 million BTU/hr capacity. "The Wyssmont design team was able to meet this requirement by implementing an exhaust recycle loop that increased the efficiency of the system through heat recovery." The result is a drying operation with efficiency in the range of 1,200 to 1,300 BTU per pound of water evaporated.

Limtech, Shawinigan, Quebec

Lithium Carbonate

Produces high-purity lithium carbonate that's used for manufacturing lithium ion battery cathodes, electrolyte salts, and semi-conductors. One important process step - drying the lithium carbonate - proved to be a challenge when the producer decided to move from pilot to full-scale production. The producer found that its spin flash dryer was inefficient, introduced contaminants, and couldn't dry the material to spec at higher production rates. Through print advertisements and the Internet, the firm learned of Wyssmont's K-20 TURBO-DRYER®, a continuous rotating tray dryer. Limtech sent the equipment supplier 10 pounds of wet-cake lithium carbonate for testing. The dryer was shipped assembled to Limtech's new plant in late March 2000. The dryer operates at 400°F. The dryer's installation was easy, and within 1 week the dryer was operating. Material enters the continuous rotating tray dryer with 7 to 20 percent moisture and discharges with less than 0.01 percent moisture. Since installing the dryer in its full-scale lithium carbonate process, the dryer has consistently dried the wet-cake lithium carbonate well below the producer's initial requirements while maintaining the material's particle size. The producer has also seen a substantial decrease in its dryer operation costs. "Our energy consumption is around one-tenth of what it used to be per kilogram of material processed." And because of the dryer's low airflow requirements, the producer no longer worries about material contamination during drying.