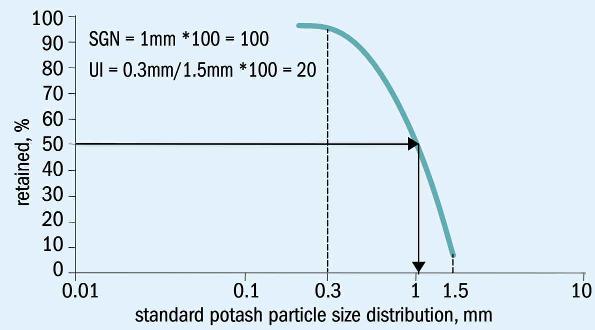
Meeting the needs of an exacting market

A typical potash production process.

PHOTO: APM SOLUTIONS

Fig 1: **Calculation of the SGN number and UI index**



The production of marketable potash from the basic ore may comprise a series of processes, including crushing and pre-screening, milling, flotation, salt leaching from the flotation concentrate, drying, granulation and refining. Developments in potash processing technology are described.

Most of the world's potash is extracted from evaporites by underground or solution mining. Another important source is brine from land-locked water bodies, as in the Dead Sea, Salar de Atacama and the Great Salt Lake.

Like most industrial minerals, potash is sold based both on its chemical composition and size distribution. Fertilizer-grade potash is typically marketed with a chemical composition of 60% K_2O minimum. Various potash fertilizer products are marketed based on their size distributions. The most common are granular, coarse, standard and fine. All four have the same chemical composition, but differ on their particle size distribution specifications. The coarser products are sold at a premium. (*Potash Processing in Saskatchewan – A Review of Process Technologies*, Carlos Perucca, AMEC Engineering & Construction Services Ltd.).

Particle size of fertilizer products is characterised by the two parameters of Size Guide Number (SGN) and the Uniformity Index (UI). SGN is defined as the particle size in millimetres, of which 50% by weight of the sample is coarser and 50% finer, times 100. The UI is the particle size of which 95% of the material is retained, divided by the particle size at which 10% of the material is retained, multiplied by 100. Fig. 1 shows the calculation of the SGN number and UI index.

In order to increase the concentration of KCl to 95%, three different beneficiation techniques are mainly applied in the potash industry: flotation, thermal dissolution-crystallisation (or hot leaching) and electrostatic separation.

The salt minerals in potash ores are intergrown with other salt minerals to varying extents. The most important minerals are sylvinite, sylvite mixed with halite, and kieserite. The ore most be sufficiently reduced in size, so that individual components are liberable, before the minerals can be separated and the useful components recovered. Potash salts are relatively easily size-reduced by grinding. In the crystallisation process, KCl is extracted and must therefore not be occluded inside other materials, which implies a size limit of 4-5 mm. (*Extraction, beneficiation and grinding of potash salt*, CPM LCA Database.) For flotation and electrostatic separation, liberation of the minerals must be complete, with the individual grains consisting of as much as possible of pure minerals.

In Canada, about 70% of the total potash and almost 90% of fertilizer-grade KCl is produced by froth flotation, sometimes supplemented by heavy media separation. Crystallisation is used mainly to produce industrial grade and speciality fertilizer grade (white muriate) potash. Fig. 2 shows the flotation route to obtain fertilizer-grade KCl.

For German sylvinite ores and hard salts, beneficiation is achieved by grinding to a maximum grain size of 0.8-1.0 mm. For the coarser sylvinite ores as found in Saskatchewan, a size reduction to <9 mm would give an adequate liberation.

Comminution, scrubbing and desliming

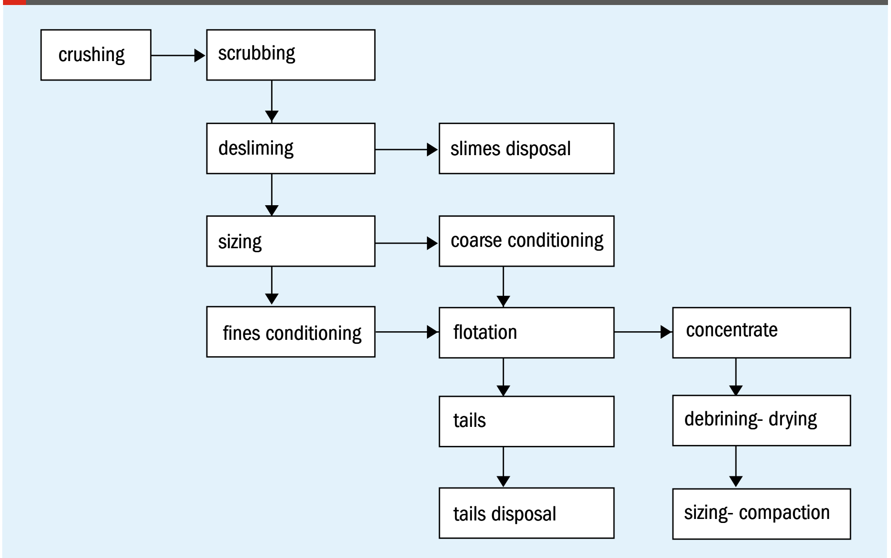
The sizing of the mill feed ore is a compromise between maintaining the KCl in as large a size as possible, obtaining a good liberation from the sodium chloride and facilitating the scrubbing of the insolubles released during the process. The run-of-mine ore is produced by continuous miners and is usually processed underground through a jaw crusher to reduce the largest lumps to the 150-200 mm range to minimise transportation problems underground and during skipping to the surface.

Potash ore is considered to be a soft rock. The simplest comminution circuits are single-stage dry crushing, using impactors in closed circuit with vibrating screens. More refined circuits comprise double-stage wet crushing in combination with wet screens and hydrocyclones. Dry crushing plants are simpler to operate, but present problems with dust collection. Wet crushing plants are cleaner, the screening is more efficient and allows for improved rejection of insolubles.

Rougher flotation tails are usually re-crushed in a secondary wet crushing stage. Rod mills were used for this purpose in older circuit designs, but recent installations (including the retrofitting of existing plants) have used rotating cage impactors. These are cheaper to operate, use less space, offer higher capacity and generate less fines. In most potash ores, there are liberated insoluble minerals which can be released by scrubbing the ore with saturated brine after crushing. During this stage, fresh water is added to the ores to dissolve magnesium chloride.

Scrubbing is usually accomplished in a series of highly agitated cells, normally

Fig 2: **Schematic block diagram of a conventional potash flotation plant**



at high percent solids (60-70% solids in a KCl-NaCl saturated brine), designed to liberate the insoluble attached to the potash particles. Two-stage scrubbing is common in mine areas with high insoluble ores. After scrubbing, separation of the insolubles may be done with cyclones, siphonsizers, teeter-bed separators, or wet screens, while the secondary separation is usually undertaken with hydro-separators, cyclones and thickeners.

Desliming by flotation of insoluble slimes from the ore may be undertaken in two stages. This method has the advantage of reduced capital expenditures for desliming equipment, but incurs higher reagent costs. In this method, a flocculant is added to the -100 mesh fraction to increase the size of the slime particles prior to flotation. Slimes flocculants are conditioned with a collector and floated in two stages in conventional flotation cells. The desliming stage is considered critical, as a virtually slime-free product is necessary to feed the potash flotation stage, in order to minimise reagent costs and to ensure good potash recovery.

Conditioning

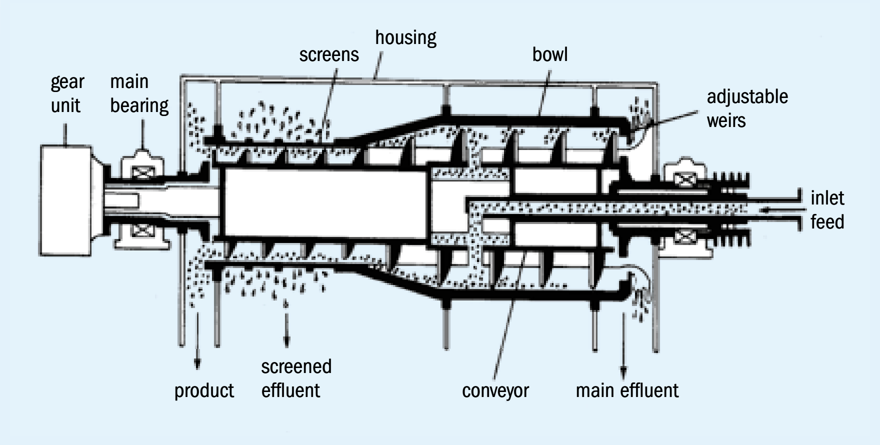
Coarse material is conditioned separately from fine material in order to optimise reagent usage. Both coarse and fine material are conditioned with a depressant and a potash collector. An extender oil is added to the coarse conditioner while alcohols and glycol frothers are normally used to promote the froth.

Some conditioning is required for tailings scavenger circuits where large particles require an optimum application of reagents, or flotation is preceded by secondary grinding to liberate the middling-sized material. The cleaning, re-cleaning and centrifuge scavenging circuit require no further reagent applications.

Polyelectrolytes (usually referred as slime depressants) are applied to reduce the harmful effect of clays on sylvite flotation. The main mechanism involves blocking off the clay surfaces for amine adsorption. Collector conditioning is thus always preceded by conditioning with the polyelectrolyte modifier.

Some operations employ heavy media separation using magnetite and cyclones. This process produces a separation of the run-of-mine at a very coarse size, typically about 12 mm into three streams: tailings, product and middlings. The latter are subsequently ground and subjected to conventional flotation, together with the fines generated in the initial crushing stages. Reagent costs are lower than with conventional flotation.

Fig 3: **Schematic diagram of a screen-bowl centrifuge (Bird Machine Co)**



Flotation, centrifuging and drying

Flotation essentially relies on the fact that fresh mineral surfaces can be induced to adopt either a hydrophobic or hydrophilic attitude in the solution through conditioning with specific surface chemicals. Air bubbles are then introduced into the solution and mineral particles, if they are hydrophobic, attach themselves to air bubbles and float up to the top of the flotation vessel, where they can be mechanically removed. Common collectors are hydrochloride and acetate salts of aliphatic amides with a carbon chain length of 12-24. Frothers are often added before the slurry enters the flotation cell.

The flotation process offers advantages over other processes, in particular the crystallisation process, in that total energy consumption is generally lower and maintenance and equipment depreciation charges are generally less than for other comparable processes.

Since potash ores contain water-soluble solids, flotation has to be carried out in saturated brine, a highly concentrated electrolyte system. The properties of an aqueous flotation system at such a high electrolyte concentration are very different from dilute aqueous solutions employed in conventional flotation processes. Coarse and fine material is floated using conventional flotation cells, ranging from 100- to 300 ft^3. Rougher concentrates are sized at around 0.84 mm (20 mesh), which is usually the final premium product. Material smaller than 0.84 mm is sent to the cleaner flotation stage to separate the entrapped fine salt.

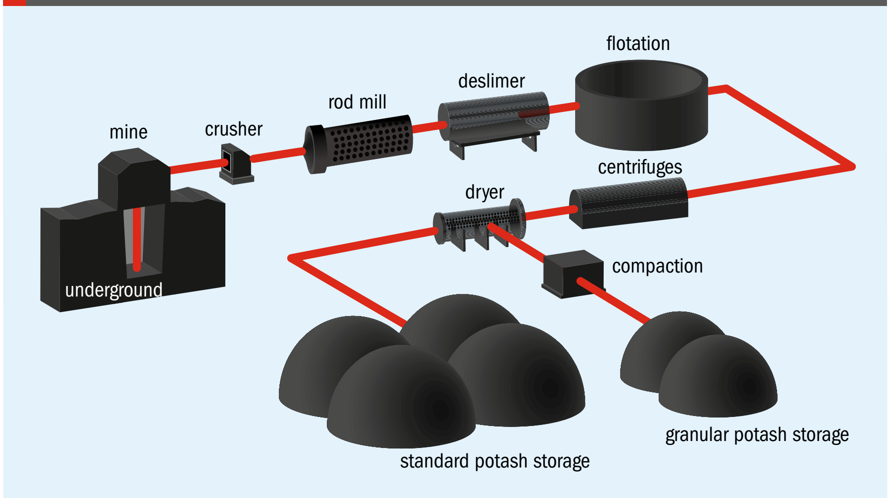
Potash rougher flotation tails usually consist of a coarse fraction (>1.41 mm, 20 mesh) that include liberated and non-liberated KCl particles that do not float, due to detachment caused by turbulence in addition to buoyancy limitations. The rougher tails also include a fine fraction (<1.41 mm) that consists of fine salt with no potash left. Potash rougher tails are screened on sieve bend screens. The -1.41 mm fraction is disposed of as tails and the +1.41 mm material is re-crushed and floated in conventional or column cells. Concentrates from rougher and scavenger potash flotation and re-cleaner flotation can be centrifuged, using screen bowl-type centrifuges down to 4-5% moisture. Flotation tails are thickened in hydrocyclones and pipelined to tailings ponds.

Potash flotation plants are designed to deal with very coarse material when compared with conventional sulphide flotation plants. In addition, brine equilibrium is temperature-dependent, which causes crystallisation when temperature drops or goes into solution as temperature increases. In order to cope with pumping problems derived from plugged lines and sanded-out pumps, potash processing plants are usually designed with a back-up set of pumps for each pump application. Water flush lines are also common and plentiful.

Screen bowl centrifuges are usually used to de-brine the flotation concentrates. In additon both co-flow gas-fired rotary and fluid bed dryers are common. (Fig. 3) Dryer exhaust gases are subjected to cyclonic dust recovery, usually followed by wet scrubbers. Electrostatic precipitators may be used for final gas clearing. Low pressure wet scrubbers can be effective when combined with tall stacks.

Potash obtained by flotation is usually standard- or fine grade, although some

Fig 4: **The potash production process**



coarse product may also be produced. In order to produce coarse and granular sizes, a compaction plant must be installed.

For the drying stage, rotary or fluid bed dryers may be employed. The design of the fluid bed dryer has been steadily improved over the years, and a modern fluid bed can process many types of bulk solid materials at a wide range of moisture levels and operating temperatures. The heat and mass transfer between the drying air and the material being dried is highly efficient, giving the fluid bed dryer a short residence time. It is also easy to operate, being able to run in batch or continuous mode, and has fewer mechanical components and a smaller footprint than other dryer designs.

A fluid dryer operates according to the phenomenon of fluidisation: this occurs when air or another gas of sufficient velocity is passed upwards through a bed of bulk material, suspending the material and causing the potash particles to move in random order. In this type of dryer, where the fluidising air is hot, this fluidisation effect provides extremely rapid heat and mass transfer between the air and the material.

In operation, the fluidising fan provides the motive force for the air that will fluidise the material. This fluidising air flows from the fan through ductwork to the combustion chamber, where the air is heated. The hot air flows from the combustion chamber to the fluid bed dryer's air distribution plenum, then flows upward through an air distribution plate (with a series of holes), evenly distributing the airflow upward into the dryer's drying chamber. A conveyor or rotary airlock valve at the feed inlet controls the wet feed to the drying chamber, where the material falls into a fluidised bed above the air distribution plenum.

In the fluidised bed, the potash particles rapidly move about in random order. Each particle is fully exposed to the hot fluidising air, which quickly transfers heat to the particle and promotes fast drying. As a result of the fluidisation effect and the direct contact between the particles and hot air, the bed forms a mixture of almost homogeneous temperature and moisture.

After drying, product is screened on double-deck rotary screens into coarse (8 x 20 mesh), coarse (14 x 48 mesh) and fine (35 x 100 mesh). Compactors are fed with a well blended, hot material (>130ºC), previously dedusted. High-pressure rolls compact the feed into flake, up to 16 mm thick. The flake is then crushed in impactors and screened into the premium coarse and granular products. Typical efficiency of a well-operated compaction plant, measured as the conversion factor (tonnes of final product as a percentage of tonnes of feed to the plant) is around 30%.

Coarse and granular products can be mixed with a small amount of water and dried again in a glazing circuit, with the objective of filling cracks inside the particles and to eliminate sharp corners to reduce dusting problems during shipping and handling. Coarse and granular products can be easily blended with other fertilizers for tailor-made formulations, while standard- and fine-grade products are most widely used in Asian markets.

Crystallisation

Crystallisation is the process used to obtain industrial-grade KCl of up to 62.5% K_2O. The basis of the dissolution-crystallisation method of beneficiation is that KCl is much more soluble in hot water than in cold, whereas sodium chloride is only slightly more soluble at 100°C than at 20°C.

The process consists of mixing the potash with hot water while agitating at 100-110°C to selectively dissolve sylvite from halite. Undissolved sodium chloride and insolubles are later removed in a clarifier. Clarifier overflow is fed to the crystallisation circuit, comprising several vacuum units. Both gravity flow and pumping are used to transfer liquor between stages while the solids are pumped out. Inside the crystallisers, the brine liquor is cooled down to 20°C and high-purity KCl is obtained by differential crystallisation.

Crystallisation is also used as a side process to recover potash fines generated during crushing and scrubbing. These are usually too fine to be efficiently compacted and so are upgraded by crystallisation to a standard-size material.

Electrostatic separation

Electrostatic separation is a dry technique in which a mixture of minerals may be differentiated according to their electrical conductivity. For potash minerals, which are not naturally conductive, the separation must be preceded by a conditioning step that induces the minerals to carry electrostatic charges of different magnitude and, if possible, different polarities. In Germany, researchers have developed a process for dry beneficiation of complex potash ores. Particle size, conditioning agents and relative humidity are used in the electrostatic separation zones to separate ore into three fractions. The components are separated in stages, using up to four stages, and the particles pass from one stage to another. This process consumes less energy than conventional wet separation processes, avoiding the need to dry out the beneficiated potash as well as avoiding associated problems of tailings disposal.

Common beneficiation practices

In Canada and the United States, flotation is predominantly used, with the exception of two solution mines. Some plants operate small hot leaching facilities, in which product fines are recrystallised or KCl is extracted and crystallised from the flotation residues and clay slurries. In Germany, the hot leaching/crystallisation process predominates. Electrostatic separation has also gained ground. In Spain and the United Kingdom, flotation has been used exclusively for the separation of KCl from sodium chloride. FSU potash producers rely generally on the hot leaching process, but newer plants have adopted the flotation process, except when potash ores contain high levels of clay or when MgCl levels exceed 30%.

Where potash is produced from brines (as in Great Salt Lake and the Dead Sea), brines are concentrated in multiple-effect evaporators, and crystals of the final product are grown in multi-stage vacuum crystallisers. The brine may also be concentrated by solar evaporation.

Environmental aspects

In addition to the consumption of energy, the main environmental problem with potash ore processing is the disposal of waste. When processing potash ore to saleable product, three types of waster product are generated:

- Liquid and solid salt tailings
- Insolubles or slimes
- Dust.

Salt tailings are generally the main environmental concern and the composition of the waste depends on the type of ore treated. Waste from sylvinite processing consists mainly of halite, while waste from the treatment of hard salts comprises halite and kieserite. Halite and carnallite are the main wastes from the treatment of carnallitic ore. Concentrated salt is a toxic waste that does not decay and requires dilution to be non-toxic.

Until relatively recently, the main methods for disposing of waste were:

- Stacking
- Backfilling
- Pumping into the ground
- Discharge into natural water systems.

New plants have been required to eliminate most of these practices. In the case of stacking, measures must be taken so that salt solutions run off the deposited material and not harm the environment when they are absorbed in the ground. If the ground underneath the stack is not impermeable, layers of clay or plastic sheets must seal it. In Germany, the solid waste is formed into steep conical heaps to reduce the amount of run-off formed by rainfall and to minimise the required ground area. If mining methods are suitable and certain geological requirements are met, solid waste can be backfilled in the mines. This is the main method of waste disposal in the German potash mines, and the method is also practised in some mines in Canada.

PHOTO: ERIEZ FLOTATION DIVISION

An Eriez flotation unit.

Leading equipment suppliers

Rexnord is a leading supplier of critical mechanical and conveyance systems tailored for the specific needs of the potash industry. Recognising that the processing mill is one of the central operations, the company supplies a comprehensive range of equipment. This includes gear drives, bucket elevators, drag and flight conveyors, bearings, chains and couplings. Rexnord's range of equipment for ore processing includes power transmission product lines, the *Falk V-Class*™ gear drive.

The demanding environment of potash ore processing demand reliable high-performance gear drives: they must be able to withstand shock loads, providing enhanced torque capacity to withstand the heaviest loads. A long seal life, solid thermal performance and increased operating life are enhanced by cooler operating temperatures. The Rexnord range is supported by drag and flight conveyors for the ore that are tailored to handle dusty and abrasive potash materials. Rexnord also offers bearing and gear-end caps, coupling guards and high-performance breathers to protect critical performing components from the heavy salts, dust and contamination in potash mining.

The **Eriez Flotation Division (EFD)** of Eriez Manufacturing Co., Canada is a leading supplier of column and non-conventional flotation cells to the international potash industry. The company has developed the *CavTube*® flotation column for typical flotation feed. EFD has also developed the *HydroFloat*® for treating coarser feeds up to 3 mm. This latter device differs from intensive mixing devices, such as mechanically-agitated cells. Using an aerated fluidised bed, the mixing is reduced, along with both particle detachment and buoyancy restrictions. In bubble-particle systems, collision occurs in mechanical cells by their relative movement within turbulent vortices or at their boundaries. This turbulent regime is counter-productive for the recovery of coarse particles by flotation. As velocities of both bubbles and particles during the attachment are slower under quiescent conditions in the *HydroFloat* system, the contact time is generally higher. The probabilities of both collision and adhesion are therefore improved when compared to the mechanically-agitated process.

With the Eriez *HydroFloat* system, the height-to-diameter ratio is significantly different than with mechanical units. As a result, control and consistency of flow is more critical, and the *HydroFloat* unit requires much less floor space to operate. The Eriez unit also offers mechanical advantages, including improved recoveries and concentrate grades. Power costs are typically up to at least 40-50% lower than the equivalent mechanical flotation circuit. In addition, with no moving parts, maintenance is minimised.

The long-established US company, **Heyl & Patterson** supplies the *Renneburg* range of dryers and coolers for potash processing plants, relying on either rotary or fluid bed methods of heating. Several different design options are available, including counter-current air-swept, internal and external water-cooled, or a combination of air- and water-cooled. The company markets some of the largest fluid bed dryers in the world and offers the some of the most efficient and cost-effective fluid bed drying in the market. Renneburg fluid bed dryers and coolers are available in two types, Trough-Type Fluid Bed and Circular-Type Fluid Bed. A circular dryer has a small footprint.

Each Renneburg unit includes a stand-alone or integral cooler that can be specified with one of the following designs: tough air-swept, in-bed plate, pipe coils and evaporative water spray.

Feeco International has provided potash processing and handling systems and equipment for over 60 years. The company works with Sahut-Conreur of France to provide customers with the highest quality compaction granulation systems. Feeco utilises corrosion and rust resistant techniques to maximise the potash processing equipment's resistance to the corrosive effects of potash, using high-specification stainless steel or nickel alloys. In addition, the equipment may be covered with *UHMW* (Ultra-High Molecular Weight Polyethylene) to prevent further contact between potash and the metal of the equipment.

Whiting Equipment Canada Inc. supplies **Swenson** crystallisation equipment. Swenson was a pioneer in the development of crystallisation technology. For superior control over particle size when excessive fine crystals are present, Swenson has devised the DTB (Double Tube Baffle) crystalliser. This type of crystalliser is built in both the adiabatic cooling and evaporative types and comprises a body on which growing crystals are circulated from the lower portion to the boiling surface by means of a slow-moving propeller circulator. An annular settling zone surrounds the suspended magma, from which a stream of mother liquor bearing fine crystals can be removed. These fines are separated from the growing suspension of crystals by granular settling in the annular baffle zone.

Fines leaving the baffle zone are sent to a following stage or heat exchanger in the case of an evaporative DTB crystalliser. The mother liquid is returned to the suction of the propeller circulator after the fines have been destroyed by heating or mixing with dilute feed or water.

The baffling allows control of the slurry density. Swenson DTB equipment is especially useful in multiple stage crystalliser applications, where cooling of the feed solution limits the natural slurry density to a few per cent. The basic principles of the Swenson DTB crystalliser are:

- Growing crystals are brought to the surface are brought to the boiling surface, where super-saturation is most intense and growth is most rapid.
- The baffle permits separation of unwanted fine crystals from the suspension of growing crystals, thereby affecting control of the product size.
- Sufficient seed surface is maintained in the boiling surface to minimise harmful salt deposits on the equipment surfaces.
- Low head loss in the internal circulation paths make large flows at low power requirements feasibile.

The advantages of the Swenson DTB crystalliser include:

- Capable of producing large singular crystals
- Longer operating cycles
- Lower operating costs
- Minimum space requirements
- Adaptable to most corrosion-resistant materials of construction
- Can be easily instrument-controlled
- Simplicity of operation, start-up and shutdown
- Produces a narrow crystal size for easier drying and less caking
- The product size varies only slightly with large changes in production rate.

Table 1: **GEA Barr-Rosin: innovations in potash processing technology**

Innovation	Benefits
Partial gas recycle (PGR) fluid bed dryer for standard grade potash.	Reduces energy consumption about 20% leading to more efficient drying and reduced exhaust gas treatment requirements.
All-metal, high temperature fluid bed design.	Metallic inlet plenum for reduced down time and easy wash-down with water. No refractory damage.
Partial gas recycle (PGR). Ring dryer for fine potash.	Separation and drying of fines, reduces product losses, reduces energy consumption.
GEA Barr-Rosin conditioning system for granular potash.	Improves product quality and reduces product losses during shipping/handling.
Evaporative cooling fluid bed dryer for granular potash.	Eliminates or significantly reduces energy consumption.
Exhaust gas recycle for fluid bed cooler.	Improve downstream coating process by managing final product temperature during summer, winter and capacity turn down. Furthermore, by further introducing an air conditioning concept, this system is also suitable to operate in areas of high ambient humidity.
Direct-contact column cooler.	In addition to the plate-type column cooler design, the tubular-type design with removable coils to further simplify maintenance/cleaning has been enhanced.

One of Whiting Equipment Canada's most recent orders for potash crystallisation equipment came on stream at Qinghai Salt Lake in Western China. The company has also supplied alloy materials to fabricate an evaporation/crystallisation facility for the K+S Potash One Legacy Project potash solution mine in Saskatchewan.

In June 2013, Whiting Equipment Canada entered into an agreement with Karnalyte Resources Inc. for the engineering and design of evaporators, potash crystallisers and auxiliary equipment at Karnalyte's planned potash solution mine in Wynyard, Saskatchewan.

GEA Barr-Rosin has been active in the potash industry for almost 40 years, with references in the Middle East, Africa and Canada, most prominently during the last ten years as the Saskatchewan potash industry expanded its capacity, with a focus on upgrading technology selections, improved process operations, lower energy consumption rates, and lower operational costs.

Historically, the potash industry has relied on traditional technology and processes with little development or improvement for operational efficiency. Over time, working together with key players in the industry, analysing the needs and executing intensive R&D and pilot plant testing, GEA has implemented market-driven, robust, innovative new solutions and upgrades to the potash industry. GEA Barr-Rosin has quickly become a technology leader implementing these new, innovations and concepts in Canada and throughout the world. Table 1 lists some of these innovations.

GEA Barr-Rosin is a leading, innovative supplier of thermal process systems and drying technology for the potash industry, offering proven technology complete with process/project engineering and design services for complete rotary drying and cooling systems, as well as fluid bed dryer/coolers, rotary conditioning/glazing with fluid bed dryer/coolers, as well plate and tubular direct-contact column cooler systems.

Agrium Inc. turned to GEA Barr-Rosin for the provision of a potash conditioning and polishing system at its mine at Vanscoy, Saskatchewan. This is the fourth such installation since 2005 for GEA Barr-Rosin. The system comprises a GEA Barr-Rosin conditioning drum that smooths the sharp edges from particles and adds water to treat and permit surface re-crystallisation. A GEA fluid bed dryer then completes the process with drying, cooling and dedusting to achieve the required cleanness, moisture and temperature.

A GEA Barr-Rosin conditioning drum.

In the GEA Barr-Rosin potash conditioning and polishing system, the product potash feed is introduced to the conditioning drum at a continuous and stable feed rate with consistent moisture content and temperature. As the particles travel through the drum, spray water nozzles glaze and condition the potash with a fine misting of water for uniform product coating, while the drum promotes rapid product tumbling for optimal polishing. The wetted product is then discharged directly into the fluid bed dryer through a discharge chute. The material is distributed across a sloped directional fluidising bed plate to propel the material towards the discharge end of the fluid bed. The plate is dimensioned to provide plug flow, allowing an optimal degree of fluidisation and upward airflow while preventing material from falling through to the lower plenum. An adjustable underflow discharge gate valve controls the bed depth of material to vary the total retention time required and enables rapid and complete emptying of the unit.

Under thermal drying configuration, the hot process air for the fluid bed is supplied by a forced draft fan through and air heater. The exhaust gas is sent to a baghouse for dust collection. Under an evaporative cooling configuration, the hot process air for the fluid bed is also supplied by a draft fan but requires only a small amount of heating during cold conditions to control the fluid bed exhaust temperature and prevent condensation and elated maintenance issues.

Slightly sub-atmospheric conditions are maintained above the bed by a balanced system of forced and induced draught fans to prevent the escape of gases and to eliminate the need for air seals at the feed and discharge points. Exhaust gases are drawn through a centrifugal exhaust fan, which discharge to atmosphere through to vent stack.

In February 2014, GEA Barr-Rosin won the contract to supply drying and conditioning equipment for the Elemental Minerals potash project in the Republic of Congo. Special focus will be on the conditioning systems, which will each include a conditioning drum, a fluidised bed dryer/cooler and a rotary coater.

Veolia Water Technologies has recently supplied Dead Sea Works (DSW), Sdom, Israel with a potash crystallisation system. The new system has successfully operated at a minimum nameplate capacity of 153 t/h of KCl crystals, at greater than 98% purity. Veolia Water Technologies designed a five-train system, using *PIC*™ (draft tube baffle) *HPD*™ crystalliser technology, and is one of the largest KCl crystalliser trains in the world. The design has provided for efficient heat recovery while achieving significant savings in energy consumption. As well as undertaking project management, installation and construction management, process and mechanical engineering, Veolia also provided all major equipment to support the crystalliser plant, including hotwells, feed tank, pumps and a custom agitator for all five stages. The new crystallisation facility has enabled DSW to increase production of KCl by almost 30%.

In April 2014, Veolia Water Technologies delivered *HPD*™ evaporation and crystallisation technology to K+S Potash Canada's Legacy project in Saskatchewan. The process equipment will enable K+S to purify and produce up to 2 million t/a of KCl from solution-mined potash at the Legacy facility from 2017. The individual vessels that make up the crystallisation system range in size up to 30 m in length, a diameter of nearly 10 m and weigh up to 180 tonnes. ■