

AMERICAN POTASH & CHEMICAL CORP.  
MAIN PLANT CYCLE

A THESIS  
SUBMITTED TO THE FACULTY  
OF THE UNIVERSITY OF NEVADA  
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF ENGINEER OF MINES

UNIVERSITY OF NEVADA  
LIBRARY

BY  
M. L. LEONARDI

1954

10242

Submitted by

MODESTO L. LEONARDI

Candidate for degree

Approved by

Vernon E. Scheid

Dean, Mackay School of Mines

Accepted by

Jac E. Moose

Chairman, Graduate Committee

# American Potash & Chemical Corp.

## Main Plant Cycle

by M. L. Leonardi

THE Searles Lake orebody is located in the northwest corner of San Bernardino County. It is a lake bed with an exposed salt surface covering an area of 12 square miles. Recoverable minerals are contained in the mother liquor below the surface of the lake. Stratification in the lake bed separated the brine into two bodies which differ in composition. Although liquor is processed from both bodies, this paper will discuss only the upper pure brine.

Fig. 1 illustrates a typical cross-section of the two commercial orebodies. The orebody is composed of a porous salt deposit 70 to 90 ft deep. The upper orebody is separated from the lower orebody by a 16-ft thick impervious mud seam, as shown in Fig. 1. These salt structures are composed of 55 pct phase salts and 45 pct voids which are filled with the original mother liquor.

Brine wells are drilled to the separating mud seam and cased to within 10 ft of the bottom. This is done to draw the brine horizontally from the bottom of the structure. It is pumped with multi-centrifugal pumps into the plant at the rate of 100 gal per day.

The first process that was successful was developed by Charles P. Grimwood for the recovery of potash. The first evaporator unit was built in 1916. In the early twenties, Dr. Morse worked out a process for the recovery of borax. This made the process more efficient, as the end liquor could be sent to the evaporators rather than being seweraged. In 1926 the American Potash & Chemical Corp. was organized as a new company, and the entire plant was re-evaluated. The plant at that time produced only potash, borax, and boric acid. Since then the American Potash & Chemical Corp. has added processes for the production of USP boric acid, refined potash, sulfate of potash, soda ash, salt cake, lithium carbonate, Pyrobor ( $\text{Na}_2\text{B}_4\text{O}_7$ ) bromine, phosphoric acid, and lithium carbonate.

The main plant cycle may be depicted as a closed cycle, see Fig. 2. The raw material, brine, enters the cycle to be mixed with the end liquor, known as mother liquor, from the pentahydrate borax crystallizers. The mixture of these two forms evaporator feed. The evaporator feed is pumped to the evaporators where it is concentrated, with respect to potash and borax. In the same operation water vapor, sodium chloride, gypsum salt, and clarifier salt are removed from the cycle, see Fig. 3 for potash plant product.

The evaporators produce a concentrated liquor which contains approximately 19.5 pct KCl. This liquor is diluted as it enters the potash plant to keep it in solution, except potash (KCl, 97.0 pct) in solution. The moist potash leaves the cycle at 100°F. The liquor, known as ML1, is pumped to the borax hydrate crystallizers, where crude borax pentahydrate is crystallized and removed as solid phase.

LEONARDI, Member AIME, is Crystallizer Superintendent, American Potash & Chemical Corp., Trona, Calif.

Information on this paper, TP 3728H, may be sent (2 copies) to the Editor before April 30, 1954. Manuscript, Jan. 2, 1953. Los Angeles, California, February 1953.

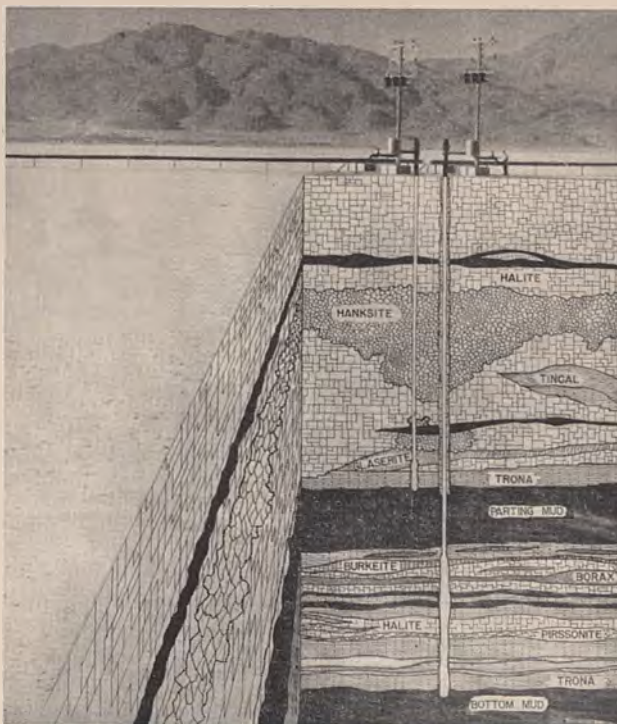


Fig. 1—Cutaway of Searles Lake salt structure.

The ML2 is sent back to pan feed to be reconcentrated, see page 207.

Note that the only water to leave the cycle is in the form of vapor and moisture in the solid phase products crystallized. Thus there is a constantly cycling volume of liquor to which brine is added. Since the volume of liquor cycled does not increase, the brine is, in effect, evaporated to dryness. This would be true if there were no liquor losses. But, as in all processes, there are always unavoidable and accidental losses which reduce the volume of cycling liquors. The losses must be made up with brine.

The concentration process is the beginning and the end of the cycling liquors. In this process there are three evaporator units of the triple effect counter-current type, that is, there are three pans in each unit and the heat flows in one direction while the liquor flows the other way through the evaporator pans, see Fig. 4.

During the evaporation process a great deal of sodium chloride, burkeite, some sodium carbonate monohydrate, and a little lithium-sodium phosphate are crystallized. The volume of these salts is so great that they must be removed as they are formed or the process would come to a standstill.

Brine and recycled mother liquor No. 2 enter the third effect evaporator pan from the evaporator feed storage tanks, see Fig. 5. A steady flow of liquor is removed from the bottom of the No. 3 pan and is pumped through the No. 3 cone of the salt trap, a clear liquor being returned to the No. 3 pan. A portion of this clear liquor is pumped to the second effect pan. This process is repeated in each pan. The liquor from the No. 2 pan is pumped through the No. 2 salt trap cone and returned to the No. 2 pan.

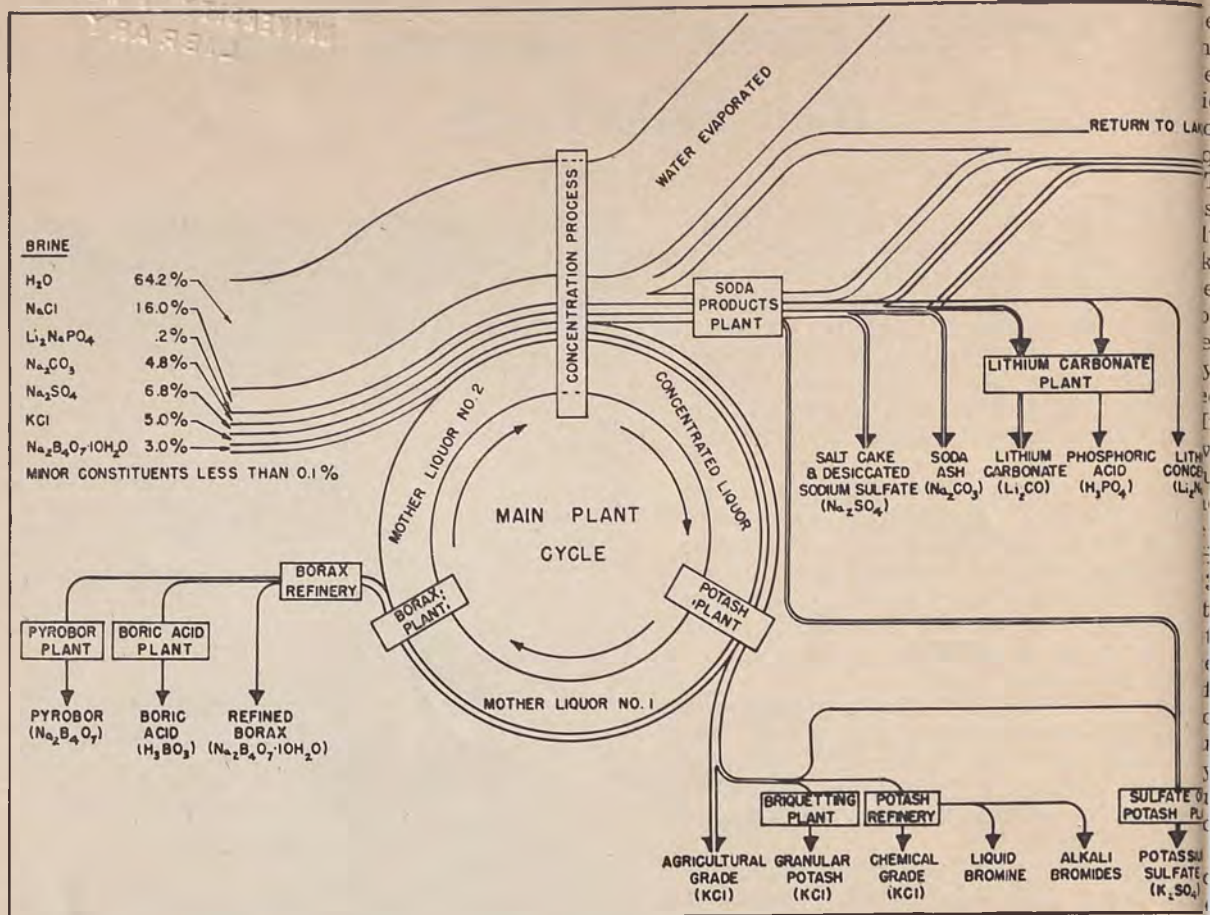


Fig. 2—Evaporator feed pumped to evaporators is concentrated, with respect to potash and borax, and in the same operation water vapor, sodium chloride, salt trap salt, and clarifier salt are removed from the cycle.

A portion of this liquor is advanced to the No. 1 pan. Finally, the liquor in the No. 1 pan is pumped to the No. 1 cone of the salt trap and clear liquor returned to the No. 1 pan. A portion is advanced to the clarifier cone, the amount being controlled by the KCl concentration in the liquor. It is desired to maintain a 36.5 g of KCl per 100 g of water.

The clarifier cone overflow is pumped to a 65-ft thickener. The clear overflow from the thickener is sent to two large storage tanks at the potash plant. The underflow from the salt trap is sent to a hydraulic classifier where the burkeite is separated from the sodium chloride. The underflows from the clarifier cone and concentrated liquor thickener contain burkeite, sodium carbonate monohydrate, lithium concentrates, and approximately 18 pct sodium chloride. These salts are sent to two 6x8-ft Oliver vacuum filters. To prevent flashing in the filters the temperature is reduced to 200°F by mixing with ML2. The salts are sent to the soda products system for processing and the filtrate is returned to the No. 1 pan for reconcentration.

The amount of concentrated liquor advanced to the clarifier cone determines the amount of pan feed pumped to the evaporators. It is necessary to maintain pre-determined levels in all the evaporator pans for proper operation. This is accomplished by transferring liquor ahead from the third-effect pan and controlling the level in the third-effect pan by feeding evaporator feed from the storage tanks.

The solid phase salts in the liquors from the evaporator pans are settled and separated from the liquors in the respective cones of the salt traps. Since the cones are superimposed in one vessel and are

open at their apices, the combined salts travel through the bottom of the salt trap. This liquor is either sent to 6x8-ft Oliver filters and then to a hydraulic classifier, or directly to the classifier. In either case the entrained brine is sent back to the No. 3 pan.

In the operation of the salt traps it is undesirable to return liquor from the first-effect pan which is highly concentrated to the third-effect pan where the liquor is weak. The salt trap is constructed to minimize this recirculating load. The liquor accompanying the salt as it enters the No. 2 cone of the No. 1 cone of the trap is displaced (or elutriated) from the salt by a flow of clear liquor from the No. 1 cone, which is returned, in part, to the No. 1 pan. This process of elutriation is repeated in each cone of the trap by pumping of the liquor from the bottom of the trap below into the stream of advancing salt to create a countercurrent flow, the salt down and the liquor up, in the same manner that the liquor is advanced in the evaporator pans.

The salt trap is rather small and will not settle the major part of the fine salts, namely, borax ( $2\text{Na}_2\text{SO}_4 \cdot \text{Na}_2\text{CO}_3$ ), sodium carbonate monohydrate and lithium-sodium phosphate present in the evaporator liquors. As a consequence these salts must travel on through and are settled in the clarifier cone and the concentrated liquor thickener. The underflows are pumped to 6x8-ft Oliver filters where the salts are removed from the liquor. The filtrate is returned to the system and the salts are sent to the soda products plant.

The losses in the evaporators are of three types: lost evaporation time, liquor losses, and dilution

the liquor with water which must be evaporated. The evaporators must be regularly boiled out and the heaters washed out on schedule. These operations cause losses in all the above categories, though with careful supervision and improved techniques the losses are reduced to a minimum.

There are losses also at the filters, since it is impossible to remove all the entrained liquor from the filter cakes being removed from the system. These filter cakes contain 12 to 16 pct moisture. The problem is one of balance; if the liquor is completely removed, too much wash medium enters the system. Brine is used to displace the liquor in the salt trap salt, since dry brine entering the system becomes evaporator feed, and this filtrate is returned to the No. 3 pan.

In this triple effect evaporator system the liquor flows countercurrent to the heat. The path of the liquor and salt has been previously described. The reader may now follow the path of the heat through the system, see Fig. 6.

Heat enters the system in the first-effect heaters 35-lb steam exhausted from the steam turbines the powerhouse. The liquor is pumped from the bottom of the evaporator pan through four-pass external heaters and is returned to the pan near the face, releasing water vapors. These vapors pass through separators, which remove any entrained liquor, and are sent to second-effect heaters where they heat the liquor in the second-effect pan. The liquor in this pan boils, releasing vapors which are used to heat liquor in the third-effect pan. Finally vapor in the No. 3 pan is drawn to a barometric condenser and is condensed in the circulating spray water. The water in the brine thus leaves the system as condensate in the second and third-effect filters and in the barometric tail water.

The humidity in Trona is normally low; therefore barometric condenser water is pumped over induced draft towers. Since the vapor pressure of water in the atmosphere is below the vapor pressure of water at the temperature of the tail water, the latter will evaporate, giving up heat until the temperature has gone down and the vapor pressure approaches that of the atmosphere. The old

natural draft towers have been replaced by induced draft types which are much more efficient.

In this concentration process 5 pct potash brine is combined with 11.5 pct potash ML2 to yield about a 7.5 pct potash evaporator feed, to produce about a 19.5 pct potash concentrated liquor, see Table I.

Here is a typical concentrated liquor analysis:

KCl	19.5
KBr	1.1
Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub>	10.0
Na <sub>2</sub> CO <sub>3</sub>	6.3
Na <sub>2</sub> SO <sub>4</sub>	1.6
Na <sub>2</sub> S	0.7
P <sub>2</sub> O <sub>5</sub>	0.6
NaCl	7.0
H <sub>2</sub> O	52.7

Though losses are undesirable in the system, they do prevent other salts from reaching concentrations that might interfere if they were not removed. One measure of the losses in the plant is the concentration ratio of some of these minor constituents in the brine. If the brine were evaporated to dryness they would precipitate; therefore it is obvious that they must have been lost while they were still in solution. Since liquor is lost from the cycle, the brine must be evaporated to the point where its volume equals the volume of the liquor lost. The concentration ratio is used to indicate the liquor losses. This ratio varies from 28 to 36, which means that the brine is concentrated until 1/28 to 1/36 of the original water is left before it is lost.

In these triple-effect evaporators, the evaporator feed enters the third effect at 125°F and boils at about that temperature. However, the liquor entering the second effect must be heated to 180°F, and that entering the first effect to about 250°F. The heat required to raise the temperature of the liquor, plus the heat lost by radiation from the surface of the equipment, reduces the amount of water evaporated by 1 lb steam to about 2.2 lb.

The heart of the evaporator system is a group of external heaters. Heat must be quickly and efficiently transferred from the condensing steam to the liquor or the process will slow down. The heaters are composed of a vapor space into which the steam

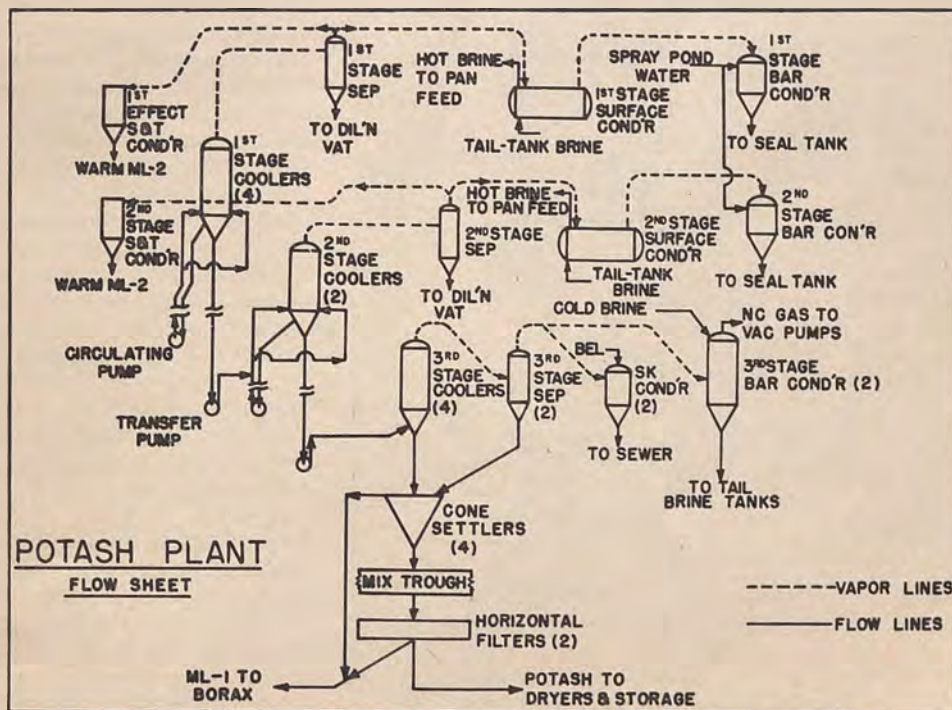
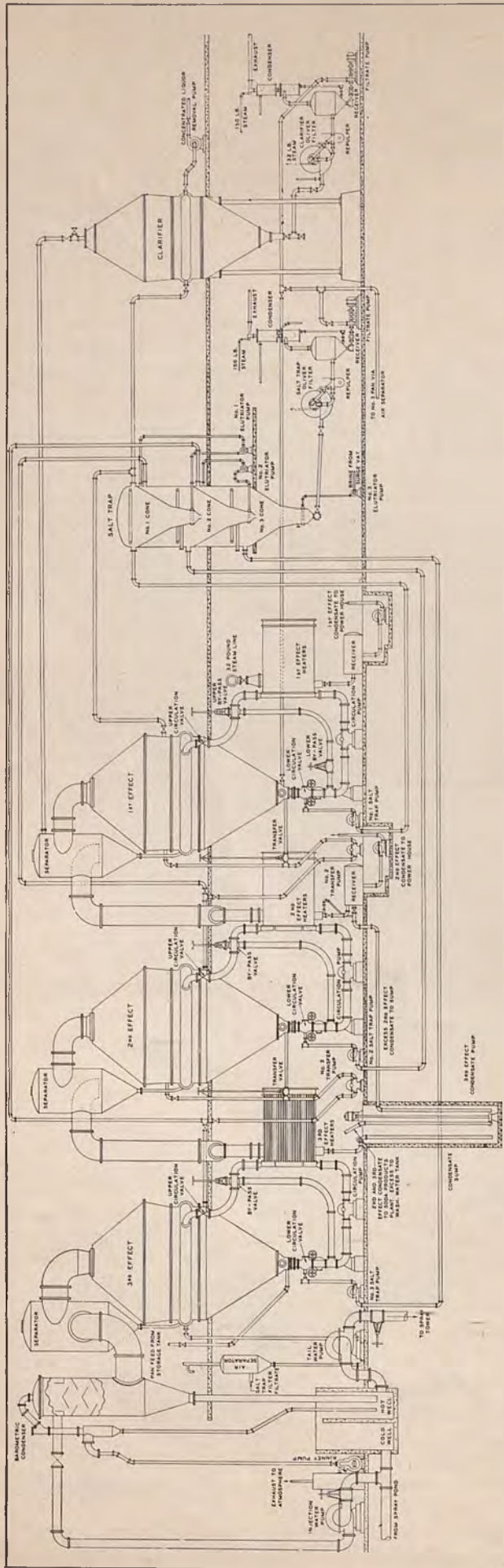


Fig. 3—In the crystallization process, the second step of the main plant cycle, the concentrated liquor is cooled to 100°F, the crystallized potash is settled in settling cones, and the filtered material is filtered from the liquor in the 15-ft diam horizontal Oliver filters.



or vapor is introduced. Across the vapor space stretched a number of tubes which carry the liquor back and forth four times in its passage through the heater. Condensate and noncondensable gas are provided for the vapor space of the heater. Heat passes from the steam condensing on the outer surfaces to the liquor within the tubes. The rate at which this transfer takes place depends on the following factors.

1—Steel tubes are used in the first-effect heaters and lead-coated Admiralty metal tubes in the second and third effect heaters. Steel tubes are satisfactory in the first effect because the virtual absence of oxygen from the powerhouse steam eliminates the corrosion problem. Aeration of steam from the first and second effect evaporators makes the use of lead-coated tubes necessary in the second and third effect heaters to prevent formation of a rust scale which would retard heat transfer. The lead coating promotes dropwise rather than filmwise condensation which is desirable for better heat transfer. The scouring action of the salt prevents the formation of rust on the interior of the tubes.

2—The heater tube area was calculated to utilize all the 35 psi steam produced by the powerhouse refrigeration engines.

3—Heat transfer is effected by the difference in temperature between the liquor in the tubes and the steam condensing on the outer surface of the tubes. Since the temperature of the liquor is rising as it travels through the heater, the heat transfer depends on the average temperature difference. The accurate figure is the log mean temperature difference:

$$LMTD = \frac{T_{L2} - T_{L1}}{\text{Log}_e \frac{T_S - T_{L1}}{T_S - T_{L2}}}$$

This method takes into account the change in temperature of the liquor as it travels through the heater tubes.

4—The low pressure steam to the first effect evaporator heaters is held at 35 psi. A change of 2 lb in steam pressure would give about 2°F temperature change, whereas a change of 0.1 in mercury pressure in the third-effect evaporator would have a 2°F temperature change. For this reason it is important to maintain minimum pressure on the third effect pans. The vacuum of the system is maintained by circulating large volumes of water over the barometric condensers to cool the third effect vapors. Two Kinney pumps are used to remove the non-condensable gases during evaporation.

5—The liquor being a poor conductor of heat it is desirable to have all particles of liquor in contact with the tube surface to obtain maximum heat transfer to the liquor. This condition is maintained by circulating liquor through the tubes at a velocity of 4 to 5 fps.

6—The tubes are of 2-in. diam to give maximum surface and allow enough area to prevent plugging with salt.

Sodium chloride, burkeite, sodium carbonate monohydrate, and lithium-sodium phosphate continually crystallizing from the liquors on the pans, and on the surface of the heater tubes, it is necessary that the heaters and the evaporator be washed out on schedule to maintain the efficiency.

Fig. 4—Diagram at left indicates operating data of evaporator units, salt traps, and interconnected auxiliaries.

the vapor space  
which carry the  
passage through  
condensable gas  
of the heat  
cooling on the  
tubes. The rate  
depends on

first-effect he  
tubes in the  
are satisfactor  
absence of  
eliminates the  
from the first  
the use of  
second and third  
a rust scale  
lead coating

filmwise cor  
better heat tra  
prevents the fo  
tubes.  
calculated to  
the powerhous

by the differ  
in the tube an  
surface of the  
liquor is rising  
heat transfer de  
difference. The  
temperature

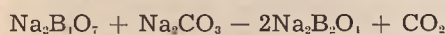
$T_{L1}$   
 $T_{L2}$   
 $T_{L3}$

the change in  
travels through  
deposits in the  
first effect heater  
tubes, necessitating  
periodic acid washes  
to remove this scale.

to the first  
addition to salting,  
the evaporators have  
trouble at 5 psi. A  
change of about 2°F  
causes losses from the  
concentration system.  
Streams of liquor, thrown  
above the liquor surface  
in violent boiling, are  
carried upward and out  
of the evaporator by  
streams of vapor. These  
droplets are caught in  
the vapor separators and  
returned to the respective  
pans, see Fig. 6.

The vacuum  
caused much trouble  
at first, when these  
condensers were developed.  
After much study, a  
mixture of fatty acid,  
containing lauric acid,  
was continually added.  
This weakens the surface  
film and eliminates the  
foaming trouble.

In the evaporators  
some carbon dioxide is  
driven off as liquor of  
the brine by a reaction  
which may be extended  
to obtain maximum  
efficiency in the following  
manner:



Due to increased  
alkalinity, borate in  
the liquor becomes  
more soluble. This  
reaction is prevented  
by the addition of the  
carbonation plant  
which contains 20 to 30  
pct  $\text{NaHCO}_3$ .

The second step  
of the main plant cycle  
is the crystallization  
process. Here the  
concentrated liquor is  
evaporated to 100°F  
and a crop of potash is  
recovered, see Fig. 6.

Checking it is obvious  
that concentrated liquor  
contains more KCl and  
 $\text{Na}_2\text{B}_4\text{O}_7$  than pan  
feed, and auxiliary

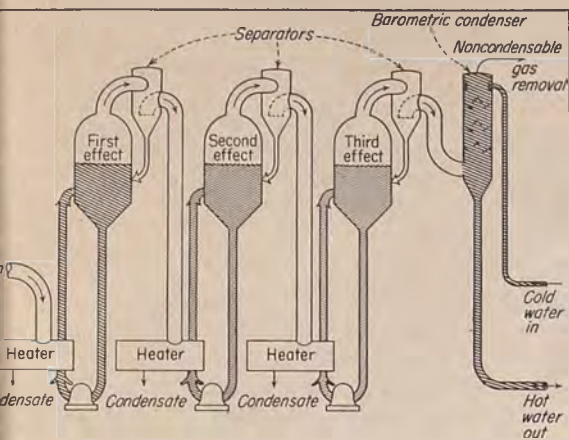


Fig. 5—Liquor advancement through triple-effect evaporators.

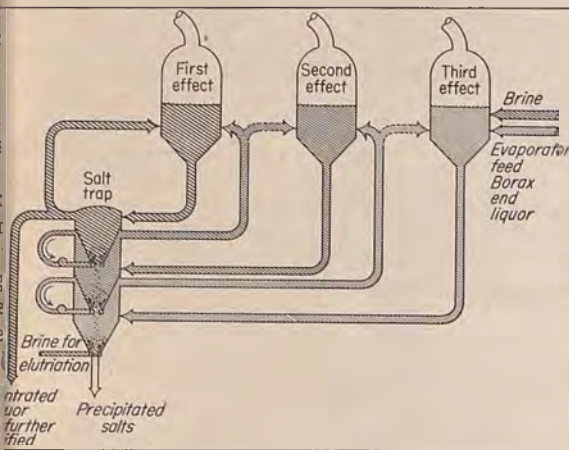


Fig. 6—The triple-effect evaporator unit heating arrangement.

contains less  $\text{NaCl}$ ,  $\text{Na}_2\text{SO}_4$ ,  $\text{Na}_2\text{CO}_3$ , and  $\text{H}_2\text{O}$  than pan feed. This is the result of evaporating  $\text{H}_2\text{O}$  and precipitating and removing the above salts from solution in the evaporating units.

The potash crystallization process is composed of cooling, settling, and filtering operations. This is accomplished by cooling the hot concentrated liquor to 100°F in vacuum coolers, settling the crystallized potash in settling cones, and filtering the settled material from the liquor in two 15-ft diam horizontal Oliver filters.

It is important to have a concentrated liquor almost saturated with respect to KCl. Since the liquor is saturated with  $\text{NaCl}$ , if KCl concentration is low there must be extra dilution to keep  $\text{NaCl}$  from crystallizing during KCl crystallization.

Table 1. Analysis of Concentrated Liquor

Item	KCl, Pct	$\text{Na}_2\text{B}_4\text{O}_7$ , Pct
Pan feed	7.5	3.8
Concentrated liquor	19.5	10.0
Mother liquor No. 1	11.5	9.8
Mother liquor No. 2	11.4	7.5
Brine	5.0	1.6

For example, if the liquor contains 37 g KCl per 100 g of water it would require only enough addition of  $\text{H}_2\text{O}$  to replace the amount lost from the liquor by evaporation in the potash vacuum coolers. On the other hand, a low-gram liquor (34 g per 100  $\text{H}_2\text{O}$ ) would require extra dilution to keep the sodium chloride in solution during crystallization in the vacuum coolers, thereby reducing the yield of potash and borax per cycle. The extra water must be evaporated in the concentration cycle.

In the diagram, Fig. 7, two polytherms are shown: one is the solubility curve for KCl in the temperature range of the KCl crystallization process; the other is the solubility curve for borax through the same range. Points A and A' represent the percentage of KCl and  $\text{Na}_2\text{B}_4\text{O}_7$  in the concentrated liquor. Points B and B' represent the percentage of these two substances after dilution water has been added. Points D and D', E and E', and F and F' represent the percentage of KCl and borax respectively in the liquors leaving the first, second, and third stages of cooling. Point C represents the approximate tem-

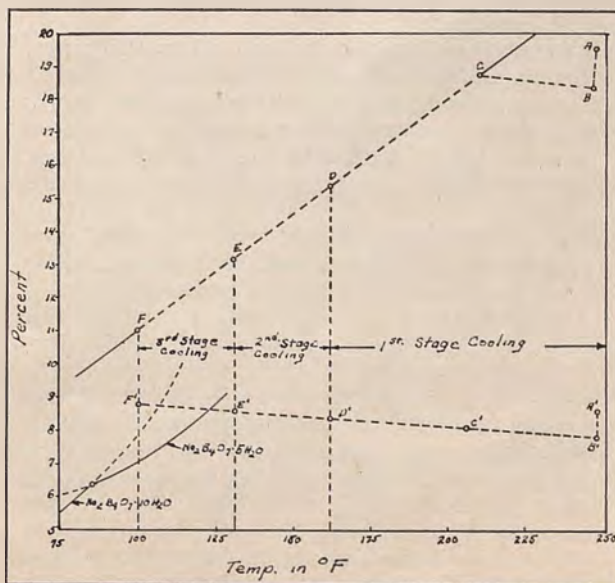


Fig. 7—Solubility curves for KCl and borax—see text.

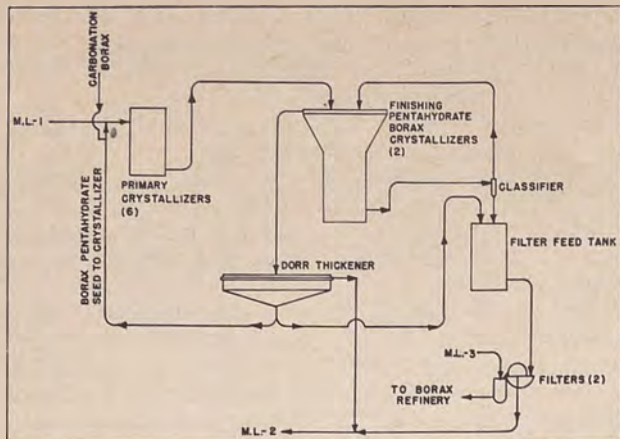


Fig. 8—Pentahydrate borax plant.

perature at which the diluted concentrated liquor becomes saturated with respect to KCl.

The line B' E' represents the path of borax concentration during the cooling process. Note that the concentration of borax remains almost the same between B' C' and increases slightly between point C' F'. The reason for this increase in concentration is that water is evaporated and potash is removed, causing a reduction in the total weight of the liquor. Note also that the line C' F' passes through the borax solubility curve instead of following down the curve to lower concentrations as in the case of potash (KCl). It is evident that potash begins to crystallize from the liquor at about 205°F and continues to crystallize throughout the cooling range, while borax remains in solution. Furthermore, it is evident that the liquor becomes supersaturated with respect to borax while passing through the final stages of the KCl crystallization process. The reasons for the supersaturation are that in the tetraborate pentahydrate field there is an extremely slow rate of nucleus formation. The linear rate of pentahydrate crystal growth is also slow in these liquors.

The tendency for a hydrated salt-like borax to crystallize as a metastable solid phase at a temperature above its stable range is much more than at temperatures below its transition point. Thus because of high rate of liquor flows through the third-stage potash coolers, short retention time, and lack of violent agitation, the supersaturation conditions are easily maintained.

In vacuum cooling heat is removed by the vapors in the vacuum crystallizer; thus the liquor is cooled. The reasons for cooling this liquor in three stages instead of one are as follows: more efficient use of the coolant, better control of the borax impurities, and smaller vapor lines from coolers to condensers, see Table II.

Note that volume of vapors from the third stage is approximately five times that of the first stage.

Raw brine is used as a cooling medium instead of H<sub>2</sub>O for two reasons: 1—Brine coming from the lake at 76°F is cooler than any available cooling H<sub>2</sub>O during the summer months. 2—Brine has a lower vapor pressure than H<sub>2</sub>O and thus is equivalent to H<sub>2</sub>O of 64°F when used in a barometric-type condenser.

The brine is used through two barometric condensers on the third stage and then pumped in series through two tube condensers: first through the second stage, then through the first stage, thus recovering a maximum amount of heat from liquors being cooled. The brine is heated to 125°F while cooling the liquor to 100°F. In recent years, owing

to increased capacity of the concentration process it has been necessary to supplement the third-stage cooling with 400 gpm of soda products plant liquor (BEL) which is sent to the coolers at 72°F.

The potash end liquor (known as ML1) at 100°F is pumped to the borax plant. This liquor is saturated with potash and supersaturated with respect to sodium tetraborate pentahydrate. This liquor is seeded with fine sodium tetraborate pentahydrate from the borax plant Dorr thickener underflow. The liquor is then pumped to the carbonation plant borax and sodium bicarbonate plant. This liquor is fed into two parallel sets of primary crystallizers connected in series. The flow from the primary crystallizer is pumped to two large agitated crystallizers operated in parallel. These tanks have approximately 45 min retention time and maintain sludge density of 40 to 50% sodium tetraborate pentahydrate as a seed mixture.

In this manner the stable sodium tetraborate pentahydrate is brought to equilibrium in solution. The coarse crystals are removed from solution by circulating the sludge from the bottom of the crystallizer through two cyclone classifiers. The fine crystals are discharged from the bottom of the classifiers into a filter feed tank, whereas the fine sludge is returned, as seed, to the system with the overflow from the top of the cone separators, see Fig. 8.

Table II. Volume of Vapors

Stage	Vapor Temp.	Liquor Temp.	Specific Volume of H <sub>2</sub> O Cu Ft
3rd stage	80°F	100°F	63
2nd stage	110°F	130°F	26
1st stage	140°F	160°F	12

The overflow from the main crystallizers contains 8 to 15 pct fine suspended solids. This liquor is pumped to a 60-ft Dorr thickener. The overflow from the thickener, ML2, and the filtrate from the Oliver filters is combined and pumped through the Potash plant where it is used as a coolant in the first stage vertical tube condensers, then pumped to pan feed tanks where it is mixed with hot brine to form feed for the evaporator units. The underflow from the thickener is pumped back to the primary crystallizers as seed, see Fig. 8.

The crude tetraborate pentahydrate can be processed crude by pumping it directly to the centrifugals and drying it (this is sold as Tru-crystal) or it can be pumped on to two 13-ft diameter horizontal Oliver filters, dewatered, washed, redried, filtered to remove physical impurities, and recrystallized as refined tetraborate pentahydrate or decahydrate, depending on market requirements for these products.

#### Acknowledgments

This paper was condensed from company department files and from W. A. Gale's report on the geology of Searles Lake presented at the meeting in Los Angeles, February 1953. The process and equipment has been modified, designed, and adapted to process Searles Lake brine by many engineers who have worked in the industry and production organization since 1916, with Grimwood built the first evaporator unit. Dunn, Vice President in charge of technical operations, and R. W. Mumford, Vice President and Sulfate Engineer for American Potash & Soda Corp., made it possible for the writer to prepare this paper and helped plan and organize the potash symposium presented at the AIME meeting in 1954.





AMERICAN INSTITUTE OF MINING & METALLURGICAL ENGINEERS

29 WEST 39TH STREET

NEW YORK 18, N. Y.

March 25, 1954

REPLY TO:

Mr. William I. Smyth, Chairman  
Mining Department  
University of Nevada  
Reno, Nevada

Dear Mr. Smyth:

Referring to my paper, "American Potash and Chemical Corp. Main Plant Cycle", which was published in the February issue of Mining Engineer, the section of the paper dealing with Searles Lake was condensed from Mr. W. A. Gale's paper at the request of the A.I.M.E. publishing committee.

This paper contains the first published description of our heat transfer and salt removal systems with illustrative diagrams, temperature ranges, liquor velocities, liquor analysis and the tube materials of construction. All this information is written up in detail in our technical reports on file.

The crystallizing phases of the main plant cycle have been radically changed during the past three years. I have worked in the development of these processes through pilot plant stages and I was in charge as crystallizer superintendent when these expansions were installed. First change was the installation of the crude pentahydrate crystallization step in borax. We tuned this up and brought it in to full production and made several simplifications which increased recovery and reduced the amount of equipment necessary for this operation. Second change was the necessity of increasing the cooling in the potash plant. We worked this out by bringing in Borametric end liquor from the Soda Products plant. My section in trouble shooting worked this out. The third phase was the design and development of the new dewatering and drying stage of our aghi plant. This installation made possible the reduction of 20 men from my work force. I worked with the design section of Stearns Rogers Manufacturing Company and was in charge of tune-up and bringing these sections into full production. My section also tested and adapted the use of automatic Sharples centrifugals to our borax and chemical refineries.

Whenever a change is recommended, it is necessary to prepare a justification for its installation based on a fair return to the Company for the money invested; therefore, it must be borne in mind that all developments in the Trona processes are due to collective agglomeration of ideas and changes followed with much hard work on the part of production

UNIV  
3 123  
Minc  
Univ  
Reno



AMERICAN INSTITUTE OF MINING & METALLURGICAL ENGINEERS

29 WEST 39TH STREET  
NEW YORK 18, N.Y.

INDUSTRIAL MINERALS DIVISION

REPLY TO:

Mr. William I. Smyth

3/25/54

Page 2

and research engineers, before large expenditures can be approved.

The potash and borax flow sheets were changed and brought up to date for the publication of this paper. In fact the new potash plant was not in operation at the time this paper was presented in Los Angeles; therefore, the paper was re-written for publication to include this change.

In order not to slight anyone in this publication full credit was given to our Production and Research Engineers for the development of these processes and for altering our equipment to best serve our needs in processing Searles Lake brine.

If you and your committee need any more information, please feel free to call on me.

Original 1311

Respectfully submitted

M. L. Leonardi

MLL:bg

102945