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Memorandum

To: Rabbi Cohen

From: Sharona Lazar

Date: August 14, 2006

Re: Salt Brine Effects

The following six salt manufacturers were contacted again to confirm precisely how the salt brine solution is boiled. The question asked was as follows: does the entire salt brine boil in the first effect at near boiling temperatures, and is then transferred to the next effect, boiling at subsequently lower temperatures in each effect that follows, or is the brine divided up among the different effects in the system, so that some of the salt only boils at a mere 110°-120°?

The following is a list of the companies and their procedures:

All Brine in First Effect	**Brine Divided Among Effects**
Supreme Salt Co. - UK	British Salt Co. - UK
Solvay Salz GmbH - Germany	The Salt Union - UK
Sudwestdeutsche Salzwerke - Germany	Windsor Salt - Canada
Morton Salt - USA	IMC Sifto - Canada
	Cargill Salt - USA

Therefore, it seems that the majority of evaporated salt producers do not pour the entire salt brine into the first effect to be boiled at an elevated temperature before being transferred into the subsequent effects. Fifty-Six percent of the brine evaporation plants split the brine into the different evaporators and remove the remaining slurry from each effect.

Memorandum

To: Rabbi Juravel and Rabbi Morrison

From: Sharona Lazar

Date: March 3, 2000

Re: Salt Production - Is there kuahc

It was recently brought to the attention of Rabbi Juravel that salt is being manufactured in a more modern, energy-efficient fashion. Until now, it has been assumed that salt is evaporated from a purified brine simply by cooking off the water (above the boiling point of 212°F). Therefore, salt is halachically considered a "cooked" product and can be added on ,ca to a aud rcs or a iuatr hkf. Salt produced in Israel is not manufactured by this method, rather, it is processed by solar evaporation. Therefore, some ohexup in Israeli salt is not considered a "cooked" item for the purposes of ,ca kuahc, and is treated as such.

However, it seems that the evaporation method used by the majority of the salt manufacturers throughout the world, may not be "cooking" the salt at temperatures which would halachically be defined as kuahc. A multi-effect vacuum evaporation system is used to increase the energy efficiency of the evaporation systems, creating a lower boiling point for the salt brine. Therefore, the temperatures at which the salt brines boil must be considered in order for a exp on the status of salt for ,ca to be made.

Salt manufacturers were contacted throughout the world to determine what methods of salt production are used by which regions, and at what temperatures the brine is boiled when processed by the brine-evaporation method. The United States is the largest producer of salt, followed by China, Germany, Canada, India, Australia, Mexico, the United Kingdom, and Brazil. Unfortunately, no Chinese, Indian, or Mexican manufacturers responded.

This report discusses the different methods of food-grade salt production, lists the companies which use these methods, and specifies the temperatures at which the salt is heated by each company. From this information, a exp must be made to determine if salt can be considered a "cooked" product which can be put on a rcs aud or in a iuatr hkf on ,ca.

There are three main methods which are used to produce salt: solar evaporation, rock salt mining, and solution mining. Solution mining is the method most frequently used throughout the world, and the processing is quite similar by all the plants. The following is a general description of the three methods of salt production:

Solar Evaporation

Sea water and natural salt brine from lakes are the source for this type of salt production. Solar evaporation requires a warm and dry climate with little rainfall, and can therefore only be done by manufacturers located in geographical areas with such a climate. The brine is gathered in crystallizing ponds where the water slowly evaporates off, leaving the salt in a thick layer on the floor. The salt is then gathered and washed, and may simply be drained or else dried in a bed-dryer. The salt that is dried in the air dryer enters at about a 3% moisture content and is removed below 1% for sizing and packaging. This method is used in Israel, as well as in Australia, America, the Bahamas, and the Caribbean.

Rock Salt Mining

Large salt deposits are excavated for halite, also known as rock salt. The salt is blasted and lifted out of the mines, crushed, screened and packed. There is no heating process involved in the production of rock salt. Most rock salt is not used for food-grade purposes because of the level of impurities in most mines; however, there are a few mines in the U.S. and Germany which produce food-grade rock salt.

Solution Mining

Salt is extracted from mines as a brine, which is chemically treated to purify the sodium chloride. Hydrochloric acid, sulfuric acid, or chlorine is used as part of this purification process. There are generally three to five "effects" (calandrias, or boiling chambers) which constitute the system. The salt brine is poured into the system and is divided evenly among the different effects. The brine in the first effect boils first. Its steam is then transported to the second effect, thereby increasing the pressure in the chamber and lowering the boiling point of the brine in the second effect. Once the brine in the second effect boils, the accumulated steam is transferred to the third effect, and the brine in this effect now boils at an even temperature. The process continues, causing the boiling point of the brine in the last effect to be significantly lower than that of the first effect, since such a strong vacuum was created. The brine in the first effect boils between 250°F and 300°F, while the brine that was poured into the last effect boils between 110°F and 140°F (see diagram at end of report).

The salt is removed from the different effects and combined as a slurry, resulting in the mixture of the salt which boiled at 300°F and at 110°F. This slurry has at least a 30% moisture content and must be dried further before packaging. The salt is usually centrifuged at room temperature to lower the moisture content below 5%, and is then dried in a rotary kiln or on an air-bed dryer. The ovens heat the salt above 195°F, and the final moisture content is less than one percent. This method is used by most manufacturers in the United States, the United Kingdom, Canada, and most of the other main salt producers.

The following is a list of the companies contacted, and their methods of production.

UNITED STATES

Morton Salt - Illinois

They use a four-effect vacuum system.
The temperature of the brine in the last effect is approximately 100°F.
The slurry is dried on a rotary kiln above 250°F

United Salt Corporation - Texas

They have a four-effect vacuum system.
The brine in the last effect boils at approximately 130°F.
The slurry is then dried between 250°F and 300°F.
They sell the private labels Kroger Co., Gulf Salt, and Sysco Food Corporation

Cargill Salt - Minnesota

Most of their food grade salt is from solution mining, but some is solar evaporated (in their California plant).

The brine in the last effect boils at 110°F.
The slurry is removed at a 30-35% moisture level. It is centrifuged to 2% moisture, and then dried in a dryer at 300°F.
The final salt has a moisture content of less than 1/10%.

The solar evaporated food grade salt is removed from the ponds and put in the dryer at a 2-3% moisture level. The final product is also less than 1/10% moisture.

Redmond Minerals

They produce food-grade rock salt.
It is a simple process in which nothing is added (minerals, chemicals, etc.) and it is blasted and then crushed and screened to size specifications. No heat is applied.
It is sold as table salt, large crystal salt, and salt powder, and sells the private label "Real Salt."

GERMANY

Solvay Salz GmbH

They have a solution evaporation plant and two rock salt mines.
The vacuum system boils the brine in the last effect at approximately 131°F (55°C).
The slurry is then dried on a bed dryer at about 230°F (110°C).

Their rock salt mines produce pure salt which is crushed, sized and packed for food-grade purposes. There are no heating or purification stages used during the processing.

Sudwestdeutsche Salzwerke AG

They produce salt from solution evaporation as well as rock salt mining.
They use a five-effect system; the last system operates at 113°F (45°C).
The salt is then centrifuged and air dried between 194°F and 248°F (90°C-120°C).

Their rock salt is not heated; it is simply crushed and sized to the requested specifications.

CANADA

IMC Sifto Canada Inc. - Saskatchewan

They produce salt from a four-effect solution evaporation system.
The temperature of the last effect is 110°F.
The salt slurry is then centrifuged and filtered at high temperatures (the exact temperature was not provided).

The Canadian Salt Company - Headquarters

Their plants all have three to four effects in their vacuum systems.
Depending on the number of effects, the brine in the last chamber boils between 149°F and 185°F (65°C-85°C).

The Canadian Salt Company - Nova Scotia plant

They use a four-effect vacuum system.

The brine in the last effect boils at approximately 110°F.
The salt slurry is then dried with hot air at 350°F.

AUSTRALIA

Dampier Salt Ltd.

Their salt is produced by solar evaporation.
Heating their salt above 212°F (100°C) will cause the magnesium chloride to begin to decompose, therefore, there is no heat applied during their processing. However, the manager observed some of the salt they had shipped to Indonesia where they heated it in a kiln to dry it completely before selling it as food-grade salt. She said she picked up the salt (obviously not above uc ,skux sh) as it emerged from the kiln, and would estimate that it was heated to about 122°F-140°F (50°C-60°C).

Cheetham Salt Company

They produce solar evaporated salt (as is the method used for all Australian salt production they claim).

The food grade salt evaporates in the ponds and is then gathered and washed. It is then spin dried and heated (dry heat) to above 212°F (100°C). It is then crushed and screened to size.

UNITED KINGDOM

The Salt Union

They have a five-effect system.
The temperature of the brine in the last effect is 140°F (60°C).
The slurry is then centrifuged and heated in a dryer at 230°F (110°C).

Supreme Salt Company

They have a six-effect vacuum system.
The temperature of the brine in the last system is 122°F (50°C).
The slurry is then dried in a fluid bed dryer at 302°F (150°C).

British Salt Ltd.

They use a six-effect vacuum system.
The temperature in the last effect will vary slightly based on the amount of brine being evaporated, but is usually around 130°F (55°C).
The salt slurry is centrifuged and dried on the fluid bed dryer at 392°F (200°C).

FRANCE

Mines des Potasses d'Alsace/SCPA

They use a five-effect vacuum system.
The temperature of the last effect is 120°F (49°C).

Salins du Midi (Morton)

Most table salt in France is produced by solar evaporation.
Most solar evaporated salt is fine dried at 356°F (180°C) to a .015% moisture (from 2.5-3% from the wash). Some salt is just sold as is though, without the drying step, such as the product "fleur de sel."

ISRAEL

Israel Salt Industries - Eilat

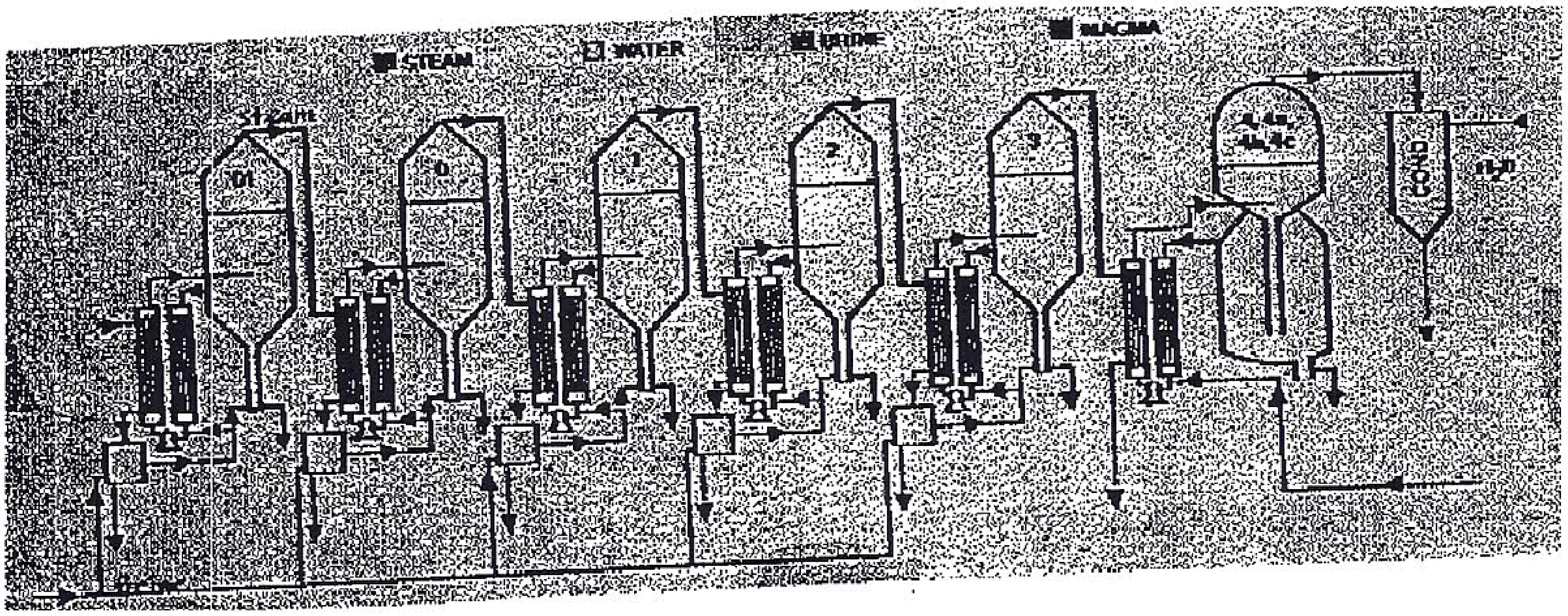
They produce salt by the solar evaporation method. The other two plants in Israel, on the Dead Sea and the Mediterranean Sea, produce salt by the solar method as well.
The salt is taken from the pond, washed, then dried in an oven at 248°F (120°C).

In conclusion, 17 companies were contacted throughout the world, and none of the solution mining companies boil the salt above 170°F, the more rhnjn opinion of tc ,skux sh. All salt produced in this fashion is also heated in a kiln or on a bed dryer at least above 195°F, yet this process would be considered vhpt rather than kuahc.

Furthermore, three companies were contacted which produce food-grade, rock-mined salt. This salt is never exposed to any heat whatsoever - it is merely crushed and sized for packing. Solar salt is not boiled, but there is always a dry-heating process (at least for Israeli produced solar salt) at nearly 250°F to dry it to the specifications of a food-grade product.

Not all salt is boiled above 212°F, as had once been assumed. All three types of salt are available as table salt and salt used by the food industry. Rock salt is most frequently used as the large grained pretzel salt, yet it is also available as table salt. Unless one knows from which plant their salt was made at, it could have been evaporated at temperatures below uc ,skux sh, solar dried and baked in an oven, or simply crushed to the desired size. Only one plant in Canada stated that their salt may possibly be cooked in the vacuum system at a temperature above uc ,skux sh; the vast majority of salt manufacturers only *bake* the salt slurry in ovens above 195°F.

It must be discussed whether salt is halachically considered baked or cooked based on the temperatures and techniques used during its processing. This is imperative so it can properly be used on ,ca without ktrah kkf being ,ca kkjn.



Standard five-effect vacuum system

A Vacuum Plant is a series of closed vessels with conical bottoms. Each of these effects as they are called, has a steam chamber or calandria, which contains a number of tubes through which the brine is circulated, an arrangement which exposes a large surface area for transferring the heat of the steam to the brine.

The first effect receives steam into its calandria from a Power Station and the brine in the first effect begins to boil. The steam in the calandria is condensed into water and returned to the Power Station. The steam generated by the boiling brine is piped over to the calandria in the second effect and transfers its heat to more brine. And so on. The steam released from the brine in the last effect is condensed by cold water.

The condensation of the steam from the boiling brine produces a reduction in pressure and thus the brine boils at temperatures lower than at ordinary pressures. Pressures and hence boiling temperatures become successively lower throughout the series. The latter effects operate below atmospheric pressure.

The value of these heat exchanges is that fuel economies are achieved compared with the old open pan process. Vacuum Plants lend themselves more to large scale production and modern handling methods. The salt crystals which form are taken from the bottom of the effects and pumped to centrifuges which operate on the same principle as spin driers. They separate the salt crystals from the brine which is recycled to the Evaporation unit. The crystals are further dried using a flow of heated air.