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DEPARTMENT OF MINES
SOUTH AUSTRALIA

PRODUCTION OF SALT BY SOLAR SALT LIMITED, NEAR PORT AUGUSTA

by

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Solar Salt Ltd. has made available a copy of a report prepared by Mr. J.O. Bovill after his overseas visit to a number of salt works.

The following comments are made on this report.

ESTIMATED ANNUAL PRODUCTION

Mr. Bovill quotes production figures from Lake Bonneville in Utah, and from the Lesie Salt Company in San Francisco. He uses the Lake Bonneville figures as a basis to estimate a possible production of 160 tons per acre from the salt leases near Port Augusta.

At Lake Donneville salt is not obtained fromsea-water, but from a highly concentrated brine. The recovery is 95 per cent and the yield 500 tons per acre, with an average net evaporation of 35 inches.

If reasonably pure salt is to be obtained from sea-water the recovery is unlikely to exceed 70 per cent as considerable magnesium salts are deposited when about 75 per cent of the sodium chloride has crystallised out.

As Lake Bonneville uses a highly concentrated brine, operations there correspond with evaporation in the crystallisers at Port Augusta and should be compared only with that part of the process.

The net evaporation at Port Augusta is taken as 59 inches per annum compared with 35 inches at Lake Bonneville.

Using the above figures the production per acre of crystallisers at Port Augusta would be:

$$500 \times \frac{70}{95} \times \frac{59}{35} = 620 \text{ tons.}$$

The ratio of concentrating to crystallising areas should be at least 11 : 1.

The production per acre of area utilized would then be

$$\frac{620}{12} = 51.7 \text{ tons.}$$

If the figures quoted by Bovill for the Leslie Salt Company are taken as a basis, the production at Port Augusta would be:

$$27 \times \frac{70}{70} \times \frac{59}{32} \text{ tons per acre} = 50 \text{ tons (approximately) per acre.}$$

In my calculations no allowance has been made for the difference in the initial salinity of the brine or sea-water, as I doubt Bovill's assumption that production varies directly with the initial concentration.

My figures are, however, similar to those obtained by present producers of salt from sea-water in South Australia.

It does not seem reasonable to expect, as Bovill does, that production per acre at Port Augusta will be three times greater than that of the established companies.

I see no reason, therefore, to alter my previous opinion that production at Port Augusta is not likely to exceed 60 tons per annum per acre utilized. This figure gives a possible production of 192,000 tons per annum from 3,200 acres. Bovill estimates a production of 500,000 tons.

The area enclosed with the present earth works amounts to about 1,500 acres. From this area the possible production would be 90,000 tons per annum.

PRODUCTION DURING 1955-1956

In his calculations for the production during the first year of operation Bovill assumes that the evaporation of sea-water and brine will be the same as for fresh water. He considers the increase in evaporation due to wind and wave action will be equal to the reduction in evaporation due to

the salt content as measured under laboratory conditiOns.

He proposes using No. 2 and No. 6 paddocks (746 acres at R.L. 112) for concentrating sea-water and an area of 112 acres for crystallising. The density of the brine admitted to the crystallisers will be 13.2 degrees Be.

Normal pracrice is to concwntrate the brine to 25 degrees Be before admitting it to the crystallisers. At this density practically all the gypsum has been deposited and sodium chloride is about to commence crystallising out. Bovill's proposals will result in an impure salt being obtained during the first year's operations.

During the initial stages it is considered that it would be better to reduce the crystallisers to an area of from 50 to 60 acres and to concentrate the brine to 25 degrees Be before admitting it into the crystallisers.

An estimate of the likely production during 1955-56 is difficult as no information has been obtained as to what losses will be caused by seepage.

Bovill estimates a production of 50,000 tons of salt. In my opinion the quantity is more likely to be between 25,000 and 30,000 tons.

CRYSTALLISERS.

It is generally accepted that the bottom of crystallise should be flat and with a gentle slope to facilititate the drainage away of the bitterns. The ground set aside for crystallisers at Port Augusta has a variation in level of about three feet. No provision has been made for any levelling or consolidation of the bottom of the crystallisers, although preparation of this nature has been found necessary at the other solar salt works in South Australia.

It is proposed that the area of each crystalliser will be approximately 100 acres. If the thickness of the salt crust

is five inches the quantity of salt in each crystalliser will be 55,000 to 60,000 tons. At the proposed rate of harvesring of 200 tons per hour or say, 10,000 tons per week, it would take approximately six weeks to harvest this salt. As all the brine must be drained from the crystalliser before commencing harvesting there will be no deposition of salt on this area of 100 acres for a period of 42 days.

If the area of each crystalliser were reduced to 25 acres the time lost for deposition of salt would be reduced from 4,200 acre-days to 250 acre-days. I believe that with these smaller crystallisers control of the density of the brine would be easier and harvesting of the salt could be less difficult. It is obvious that the quantity of salt deposited each year would be increased considerably by using the smaller crystallisers.

HARVESTING.

The proposed method of harvesting and transport of the salt to stacks has been proved by the Leslie Salt Company. It is pointed out, however, that the Leslie Salt Company has a number of harvesting machines operating and that only one is proposed for Port Augusta. A major break-down of this one machine during the main harvesting months could result in a big reduction in the output for the year. The provision of a spare machine, even one considerably smaller should be seriously considered.

Transport of the salt is to be done in rakes of twelve 2-ton trucks drawn by a diesel locomotive. Two of these trains are being provided.

It will take seven minutes to load one train. This means that the other train will have to transport and dump the salt and return to the harvester in seven minutes if there is to be no delay in harvesting operations.

It may be found necessary to use three trains, or alternatively, more trucks in a rake if the salt crust will support the additional weight. In either case a spare locomotive

and a number of spare trucks will be needed to avoid delays in harvesting.

CAPITAL REQUIREMENTS

It is considered that Bovill's estimate of the capital requirements is too low. Very detailed information would be required and much work would be involved in revising the estimate. The following reasons are given for the opinion expressed above.

Crystallisers.-

No provision has been made for any expenditure on the crystallisers. It has been explained earlier that this may be available. With present day costs the expenditure could amount to £100 per acre.

Roads -

There is to be no further expenditure on roads during the initial stages and an amount of £1,000 only in the later stages.

For a project of the size contemplated by Solar Salt Limited operating throughout the year, all-weather roads will be necessary. The present roads quickly become impassable for ordinary vehicles after moderate showers of rain. They may dry in a short period butrain could cause costly delay.

Harvesting Equipment -

Bovill estimates a total of £21,000 for the equipment which would include a harvester, diesel locomotives, and bottom dumping trucks.

It is believed that the Leslie Salt Company harvesters cost around $40,000 pre-war; their cost now would be much greater.

Three diesel locomotives and at least 30 trucks

would be required. I estimate that the cost of these would be:-

Three (3) diesel locomotives at £3,000	£9,000
30 2-ton bottom dump trucks at £200	£6,000

The cost of the locomotives and trucks are likely to amount to £15,000 leaving only £6,000 for the harvester, rails, and any other equipment necessary for harvesting and transporting.

Ship Loading Equipment.-

Ships will be loaded with bulk salt transported by an aerial ropeway for a distance of about one mile at the rate of 300 tons per hour. The ships will be moored to dolphins in a deep water channel.

Bovill estimates the ropeway to cost £70,000, and the dolphins £15,000.

The amount provided for the ropeway appears low for an installation that will handle 300 tons per hour, especially as all the foundations for loading and unloading stations and the intermediate towers will be on piles.

Motor Vehicles -

No provision has been made for motor vehicles, of which a number will be required for handling stores and transporting personnel.

COST OF PRODUCTION

Bovill has divided his estimates of the cost of production into:-

(1) Direct costs,

(2) Indirect costs.

and then adds overhead charges including rents, rates, and fuel for vehicles.

Direct Costs.-

Bovill assumes an 80 per cent recovery of the salt in the sea-water, but if reasonable pure salt is to be harvested, the recovery is unlikely to reach 70 per cent. The estimate should be adjusted accordingly but the difference would be realtively small.

The estimated cost of 13.2d. per ton for loading onto ships is thought to be on the low side.

Also it does not see, correct that the cost per ton should be the same for outpurs ranging from 20,000 tons to 800,000 tons per annum.

Indirect Costs -

If, as I think, an increase in capital expenditure is necessary, the allowance for depreciation must be increased. For a production of 90,000 tons per annum depreciation is more likely to be 10/- oer ton than the 7/- estimated by Bovill.

The cost per ton for maintenance will also be higher with an increased capital expenditure.

Overhead Charges. -

I have no information as to how the items "Lease Rent","Crown Rent", and "Water Rates" have been determined. They appear to be high as the amount due to the Crown for rent on the salt leases and for royalty would be approximately sixpence per ton for an output of 90,000 tons.

Total Cost of Production. -

Bovill estimates that, for a production of 100,000 tons, the total cost will be 19/8d. per ton loaded onto ships at Port Patterson.

It is believed that this cost is considerably lower than that of salt into stacks produced by large companies operating at present.

For this and other reasons given previously it is considered that Bovill's estimate for the cost of production is too low.

CONCLUSIONS.

1. The basis used by Bovill for calculating an estimated production is not considered to be sound.
2. At Port Augusta a production greater than 60 tons per acre could not be expected.
3. The area of 1,500 acres now enclosed by embankments could yield 90,000 tons of salt per annum if loss by seepage is not extensive.
4. If the area utilized is increased to 3,200 acres the annual production could be 192,000 tons.
5. Bovill's estimates for capital expenditure and cost of production are considered to be too low.
6. The capital expenditure is a vital factor in determining the cost of production and hence in deciding whether the project would be a success.
7. The estimating oc capital expenditure requires detailed information and expert knowledge not only of salt production but of many branches of engineering including the erection of marine structures.
8. The Company should obtain an independent expert opinion on all aspects of the project.

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