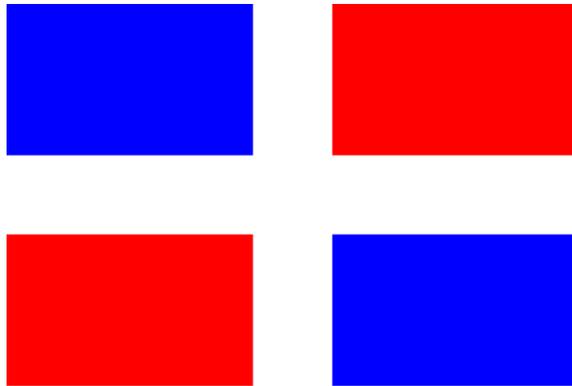


THE
SALT INDUSTRY
OF THE
DOMINICAN
REPUBLIC

AN ASSESSMENT

[PROSPECTS FOR SALT FLUORIDATION]



Prepared by: *Trevor A. W. Milner*
Fluoridation Engineering Consultant
Pan American Health Organization

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Dominican Republic Fact Sheet

Land Area :	49,655 sq. km (18,816 sq. mi.).
Population :	7.66 million (1997 estimate)
Population Growth:	2.5% per annum 1987-1996
Cities :	Santo Domingo pop 2,500,000 Santiago pop 280,000
Urbanization:	60% of population live in towns or urban centers.
Ethnicity:	73%-----Mixed 16%----- White 11%----- Black
Economy:	The traditional basis of economy has been agriculture. This is rapidly changing to one of export led growth with the setting up of free zones and the expansion of the tourist industry. A mixed economy exists with the export of agricultural, mineral and manufactured products.
Per Capita Income:	U\$1050 per year (1992)
External debt:	U\$ 3.7 billion (1995)
Exchange Rate	14 Pesos Dominicanos per 1 US\$ (Feb 1998)
Fertility	2.85 live births per woman
Infant Mortality	56 per 1,000 live births (1989)
Crude Death Rate	4.9 per 1,000 inhabitants (1990)
Life Expectancy at Birth	67 years (1991)
UNDP-HDI	0.638
DMFT	3.61 (1997)

1. Activity Summary

The PAHO consultant arrived in Santo Domingo at 12:30am on Monday February 09th. On Monday February 09th a meeting was held with members of the Department of Oral Health in the ministry of Health and Social Security. On Tuesday February 10th a meeting was held with the salt standards committee of DIGENOR, the local standards organization. Between Wednesday February 11th and Friday February 13th visits were made to the main crude salt producers at Montecristi and Bani, as well as the main salt processors in Santo Domingo, Haina and Bani.

2. Background

The Dominican Republic produces just over 32,000 ton of crude salt per annum, from solar evaporation of seawater. In addition another 30,000 to 40,000 ton per year of low-grade salt is extracted by near surface mining. All of the mined salt is exported to Canada and the Northern USA for use in highway de-icing, and does not enter the local distribution system. For the purposes of this study there is no further discussion of mined salt.

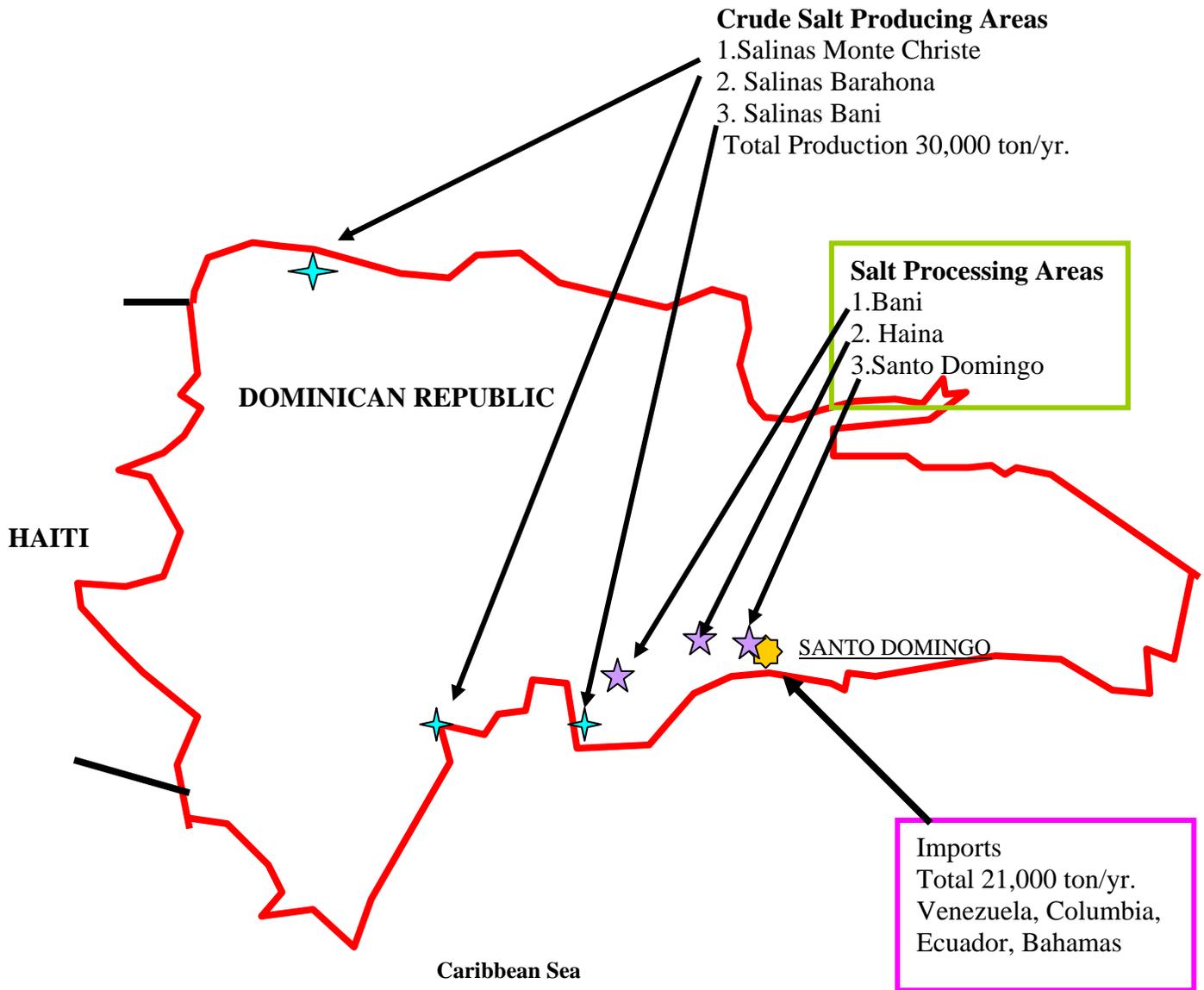
All of the solar crude salt is produced by small producers and small producer groups concentrated in four locations. These are, **Montecristi** on the north coast near Haiti, and **Bani**, **Azua** and **Barahona** on the south coast. A fifth location, formerly at **Oviedo**, is presently not in production. More than half of the crude salt production is consumed by Table/Domestic Salt or Household Salt categories. The rest is divided between the food and animal feed manufacturing, (Indirect Human), and the non-food industries, eg detergents (Non Human Consumption). **Table 1**, below and **Figure 1**, overleaf shows the salt flows of the Dominican Republic.

Table 1: Annual Salt Flows and Balance for the Dominican Republic (ton)

IMPORTS		PRODUCTION		CONSUMPTION	
Venezuela	15,000	Solar Salt (Sal Solar)	32,000	Household/ Domestic/ Table (Direct Human)	30,000
Columbia	4,500			Industrial Food/ Bakery/ Canning (Indirect Human)	23,000
Ecuador	1,000			Animal Feeds	
Jamaica	500			Industrial Non-Food (No Human Consumption)	
TOTAL IMPORTS	21,000	TOTAL PRODUCTION	32,000	TOTAL CONSUMPTION	53,000
TOTAL IMPORTS + TOTAL PRODUCTION			53,000	TOTAL CONSUMPTION	53,000

Although private operators produce crude salt, all crude salt production is required by law to be sold to **Distribuidora de Sal** or **DISSAL**, a government monopoly that controls the distribution of crude salt. **DISSAL** was created by Law # 125 dated February 10th 1966, and is a part of the **Corporacion de Empresas Estatales** or **CORDE**, a consortium of state owned companies. The existence of this monopoly has had the effect of reducing competition between producers by the guaranteed offering of stable prices. Unfortunately the net effect has been a lack of modernization of production with resulting inefficiency and high prices.

Figure 1: Diagram Showing Salt Flows for the Dominican Republic.



With the recent opening of the country to a regime of free trade, salt imports into the country from cheaper producers have begun to snowball. One is now witnessing a very fluid period in this country's salt industry's history. It is predicted that within a matter of months, abolishment of the government distribution monopoly or a collapse of local crude salt production could occur. The pressure of cheaper crude salt, available from more efficient producers in Venezuela, Columbia or the Bahamas will prove unstoppable.

The main characteristic of the salt consumption and distribution in the Dominican Republic is that over 60% of the domestic salt consumed is done so as **sal en grano** or coarse salt. This salt requires little processing and is normally packaged in bulk for distribution to wholesalers and shops.

3. Meeting with Public Health Officials:

a. Meeting with members of Department of Oral Health, Ministry of Health and Social Security.

The following persons were present:

Dra Elena Perez, Program Co-ordinator for measurement of Fluoride in water.

Dr Cesar Brea, Co-ordinator for Oral Health Prevention

Dra Annaras Rodiriquez, Human Resource Co-ordinator

Dra Belkuis de los Santos Co-ordinator for Orthodontological Services

The above persons were all from the Department of Oral Health. In addition the following persons were present:

Lic Julia Guzman, Micro-Nutrient co-ordinator, Department of Nutrition

Ing Freddy Lara, Co-ordinator, INDOTEC.

The meeting briefly discussed the status of dental health in the Dominican Republic. The most recent DMFT had actually found a decrease in the average for 12-year-olds compared to the last survey in 1985. In preparation for the introduction of salt fluoridation the survey of fluoride content in water had also been completed. Dra Elena Perez had competently carried out this survey. The results showed that the vast majority of water supplies had low levels of fluoride. Only two supplies in the center and north of the country had high levels.

The state of the salt industry was also discussed with Ing Freddy Lara. He shared his very wide and detailed knowledge of the local salt industry and its development. The discussion centered around the unique situation that existed in the Dominican Republic, that of over 60% of the household or domestic salt market consisting of "**sal en grano.**" It was the consensus that the universality of a salt fluoridation program would be dependent on being able to either fluoridate "**sal en grano.**" or convert the market away from "**sal en grano**", to processed salt that may be fluoridated. It was further agreed that price could be used as an incentive in helping to convert the market.

b. Meeting with DIGENOR

DIGENOR or Direccion General de Norma de Industria y Comercio is the organization in the Dominican Republic charged with developing and maintaining standards and analytical protocols for product validation. It is organized into three sections namely, standards, meteorology and protocols and validation.

Amongst those in attendance were the Director and Assistant Director of DIGENOR Ing Hugo Rivera and Ing Luisa Ozuna, along with Dr Fernando Guzman, Director of the Department of Oral Health. The discussion centered on the present salt standard that incorporates the addition of iodine to have iodized salt. A revision of the standard is necessary to incorporate the addition of fluoride for fluoridated salt. Lengthy discussions took place around the usual problems of co-ordinating all the various parties involved in standards development and the proposed transition and implementation period. The degree of compliance that could be realistically expected is also a thorny issue. It was admitted from all parties that co-operation is required to produce a successful program.

4. Visit to Salt Producer, Refineria Dominicana de Sal (REFISAL)

GENERAL

Refineria Dominicana de Sal or **REFISAL**, is the oldest salt processing plant in the Dominican Republic, having began operations in 1956. It is Government owned and is managed by Lic.Marcial Alcantara. It uses the dissolution and evaporative process for salt refining. Large quantities of coarse salt are also size-reduced and packaged for distribution as **sal en grano**.

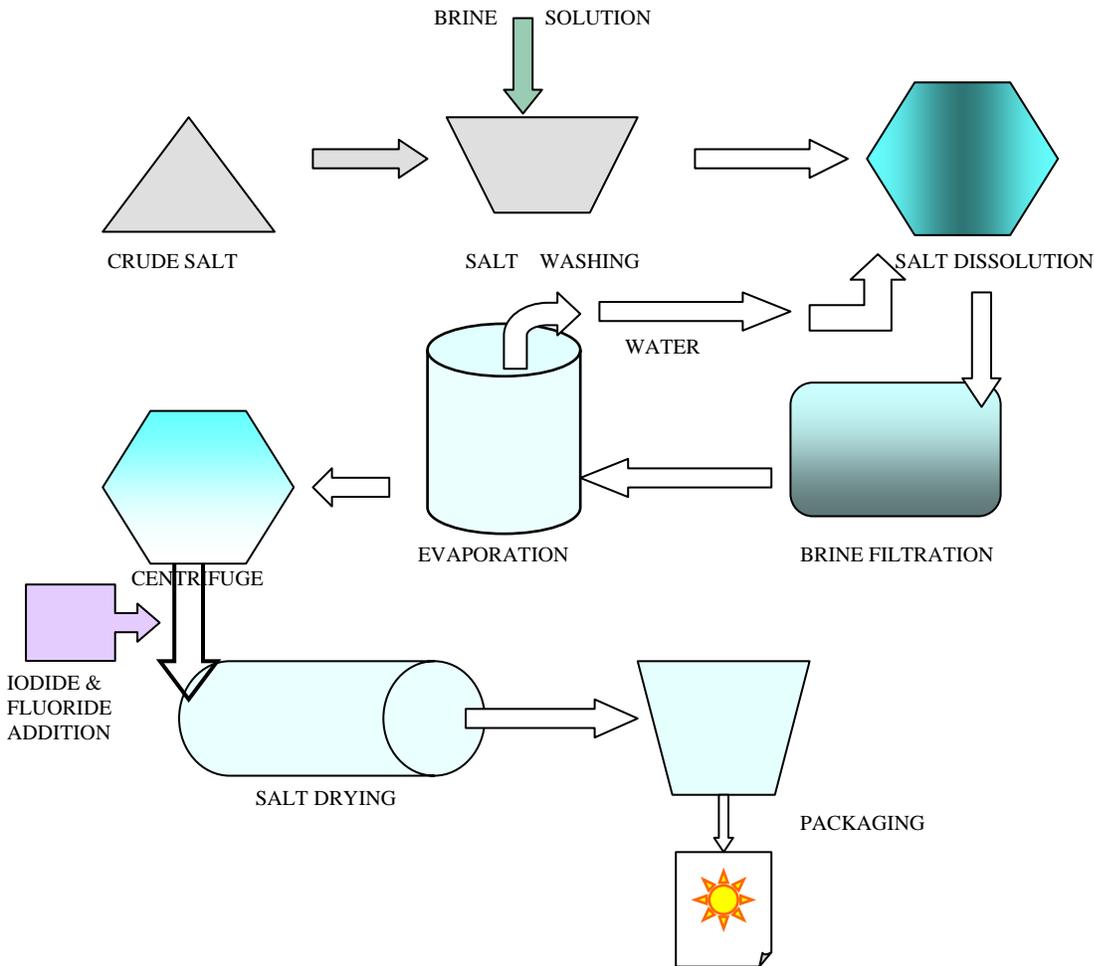
Figure 2: Photograph of Refineria de Sal Facilities at 158 Ave Maximo Gomez in Santo Domingo

PROCESS



The process employed is the dissolution, evaporative process for salt refining. This process is shown diagrammatically in **Figure 3**. In the process employed by **REFISAL**, 1 quintal bags of coarse salt which arrive via trucks from various salinas around Dominica are dumped into a dissolution tank. There, sodium hydroxide is added to precipitate iron and magnesium impurities.

Figure 3: Diagrammatic representation of the Evaporative Process for Salt Refining Used by REFISAL, Industria de Sal Dominicana & Bromo Industrial



After settling and precipitation of impurities has occurred, purified saturated brine solution is then pumped to a single effect evaporator where evaporation of water from the brine solution takes place. The conditions of the evaporator are 30-60 psi and 220^o F. The hot supersaturated brine solution is then sent to a crystallizer, where salt crystals precipitate out. The crystallized salt is then dewatered by means of a centrifuge, and is then sent to a dryer where moisture is reduced to negligible levels. In the case of **REFISAL**, a vertical standing fluidized bed dryer is used. The dryer temperature of



315 °C is provided by burning LPG. After drying, the salt is stored in a large storage hopper prior to packaging.

The addition of Iodide is done batch-wise in a ribbon mixer. See **Figure 4**, below. Two-ton batches of salt are placed in the mixer and a pre-measured amount of Yodocal added. The salt is mixed for 17 minutes. After mixing packaging of the salt takes place.

Figure 4: Two Ton Capacity Batch Ribbon Mixer, at Refineria Dominicana de Sal



In the case of **REFISAL** canister packaging is done in 1/2, and 1 lb sizes. A bulk 5 lb bag is also packaged. The product line up for packaged salt is shown in **Figure 5** below.

Figure 5: Refineria Dominicana de Sal Triple A Brand Canister Salt and 5lb Bulk



Packaged Salt

In addition to the refined salt, this company also mills about 8 ton per day, or 200 ton per year crude salt to **sal en grano**. The milling and storage facilities for **sal en grano** are shown below in **Figure 6**.

Figure 6: Mill and Warehouse for Sal en Grano at Refineria Dominicana de Sal



Overall plant capacity for refined salt production is 4000 ton per annum. Actual refined production is in the order of 2400 ton per annum or about 200 ton per month. In total 100 persons are employed, 77 being in direct production and the remaining 23 being administrative and supervisory staff. The necessity for this amount of personnel places **REFISAL** at a low level on the productivity scale, especially when compared to plants of a similar size in Venezuela, or even Panama.

5. Visit to Salt Producer, Industria de Sal Dominicana (Nereydo Duran y CiA)

The **Industria de Sal Dominicana** is a family run operation owned by Sr Nereydo Duran. The refinery is located in Calderas near Bani, but packaging and distribution of the salt is done at the firm's other location in Santo Domingo. **Figure 7** below shows a view of the production facilities.

Figure 7: View of Plant Entrance and Production Facilities at Industria de Sal Dominicana



PROCESS

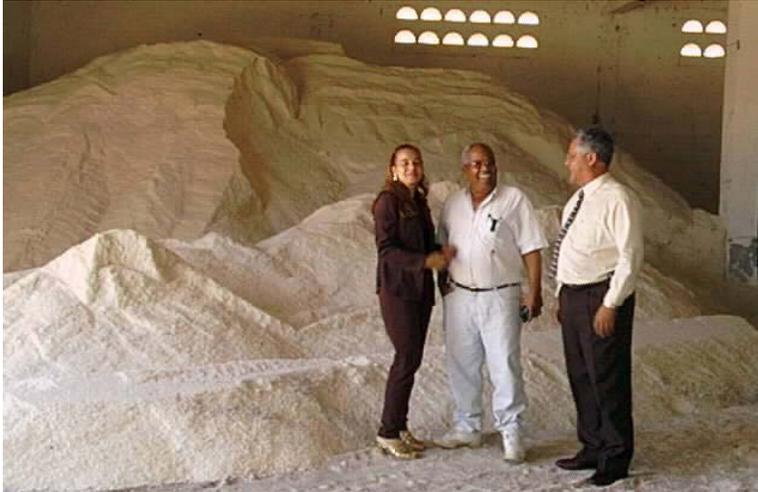
The production process is the conventional dissolution and evaporative salt refining process. In the case of **Industrias de Sal Dominicana**, production of refined salt is about 500 to 600 ton per month, ie 6,600 ton per annum. This represents a utilization of approximately 45 % of the 15,000 ton per year capacity plant.

The crude salt is first dissolved in large ponds to form brine solution. The raw material used was formerly locally produced salt from the salinas of Bani. The salt in 1 quintal bags were emptied in the dissolution ponds. At present, the company has begun the importation of salt from Venezuela, whilst looking for other sources. See **Figure 8**, overleaf. This is due to the high price of local crude salt, some 10 times more expensive on an FOB basis than crude salt from Venezuela.

This is a manifestation of the price pressure from imported crude salt on locally produced crude salt. The salt processor's interest dictates as low a price as possible for the required quality crude salt. The crude salt producers' interest dictates as high a margin as possible

from the sale of his crude salt. These two interests can only be reconciled by the removal of unproductive middlemen and the improvement in production efficiencies.

Figure 8: Stockpile of Imported Venezuelan Crude Salt.



The salt quality of imported crude is as good or sometimes better than local crude. Coupled with the price advantage this is motivating local producers to substitute more and more local crude salt with imported crude.

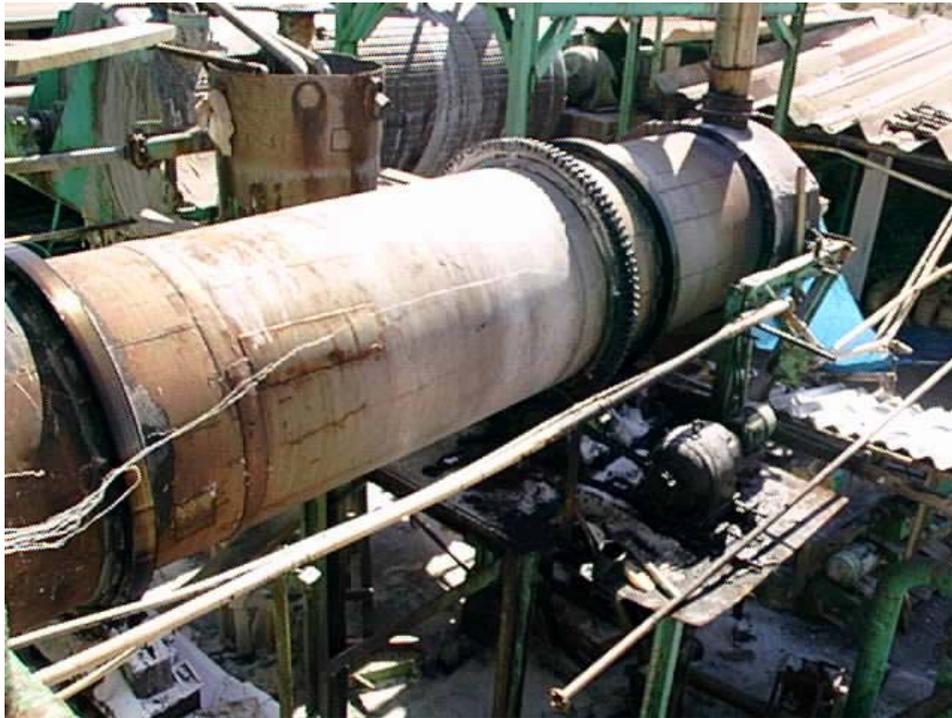
Following on dissolution and the precipitation of magnesium and iron impurities the brine solution is then pumped to the evaporation vessels. Here the brine solution is heated in tubular heat exchangers. 500 HP Cleaver Brooks boilers burning bunker C oil produce the steam.

After evaporation of the water takes place the saturated hot brine solution is allowed to flash cool and crystallize. After crystallization, the salt is dewatered to a moisture level of approximately 10% by means of a centrifuge. The moist salt is then conveyed by means of a screw conveyor, shown below, and elevator to a LPG fired dryer.

Figure 9: Discharge from Centrifuge to Screw Conveyor.



Figure 10: Rotary Kiln Type Salt Dryer



On exiting the rotary kiln dryer the salt is less than 0.1% moisture. At this stage the salt is then placed in bags for transfer to the mixer for addition of iodide.

Figure 11: Batch Rotary Salt Mixer



The mixer shown in **Figure 11** is filled with dry salt and the required quantity of iodide chemical added to give the desired dosage. The mixer, which gives the appearance of a large cement mixer, is constructed of stainless steel and

is known as a batch rotary mixer. The iodized salt is then repackaged in 1 quintal sacks and transported to the packaging facility in Santo Domingo for repackaging in sizes and brands for distribution to the consumer.

It should be noted that the fluoridation of salt in the case of the Government owned **Refinería de Sal** and Nereydo's **Industrias de Sal Dominicana**, fluoridation can be easily accomplished as most of the infrastructure is in place. It will be quite simple to add the required fluoride and iodide compound to the salt batch in the mixer.

The main product produced by **Industrias de Sal Dominicana**, the 2lb **Sal Polar** is shown below:

Figure 12: Industria de Sal Dominicana's Polar Brand Refined Salt



In discussion with Nereydo Duran, he enthusiastically supported the idea of adding fluoride to salt. He indicated that he would begin fluoridation in his own factory as soon as possible. It was agreed that all the information that he would require would be made available to him.

7. Visit to Salt Producer, Bromo Industrial SA

Bromo Industrial SA, is a family run organization owned and operated by Dr Juan Gonzalez. It is located at Haina, which is only 10 miles from Santo Domingo. Plant capacity is 3,000 ton per annum with production being about 1500 ton per year. Unfortunately we were not allowed to tour the facility, but by discussion with Sra Patricia Gonzalez de Carratalia, a brief description of the plant's operation was obtained. **Figure 13** below, gives an overview of the production facilities.

Figure 13: View of Bromo Industrial's Salt Refinery and their Product Line-Up



The process employed is the standard dissolution and evaporative process for salt refining, utilized by both **Refineria Dominicana de Sal** and **Industria de Sal Dominicana**. This process is shown diagrammatically in **Figure 3** page 10. Salt is dissolved in a saturated brine solution. Chemicals, such as sodium hydroxide are added to precipitate impurities such as calcium, magnesium, copper and iron.

The brine is then settled to allow precipitation of the impurities. The brine is then filtered. Heating of the purified brine then takes place. The heating is done by steam provided by bunker C burning boilers. Crystallization and dewatering of the salt crystals by centrifugation then occurs. The dewatered salt is then dried.

The hot dried salt is then cooled for 24 hours. Iodine is added to table salt. For the addition of iodide, potassium iodate is added to salt in a 600lb capacity mixer. The salt is then transferred to the packaging area for final packaging.

Industria de Bromo markets two grades of salt. They are table salt and industrial salt. Table salt has iodide and anti-humectants added and are packaged in a variety of brands and package sizes. This product line-up is shown above in **Figure 13**.

Industrial salt does not have iodide or anti-humectant additives and is packaged in bulk sacks. Ninety-eight percent of industrial salt is used by food processors, with 2% being used in the cosmetic industry.

7. Visit to Salinas in Montecristi and Salt Distributor DISSAL

Distribuidora de Sal or **DISSAL** is the government owned monopoly that purchases and distributes all locally produced crude salt. In Montecristi it has a relationship with the 281 saleneros who work the 350 salinas or ponds in the area. It is also responsible for the addition of iodide chemicals to the crude salt that will be distributed directly, or with minimum processing for use as household salt as **sal en grano**.

Figure 14: View of Activity at DISSAL in Montecristi



DISSAL performs the functions of a distribution company for coarse salt. It purchases salt directly from the salt pond operators. It stores the salt and sells it to salt refiners and **sal en grano** processors and packagers. It has administrative, storage and transportation facilities, and employs 63 persons. **Figure 14**, to the left, shows the facilities at **DISSAL** Montecristi. **DISSAL** targets to distribute 2713 ton per month. However recently distribution has only been in the region of a fifth of that amount or about 600

ton per month. There are two grades of salt produced by the salinas and distributed by **DISSAL**. These are 1st quality, white salt which is distributed to refineries and **sal en grano** packagers, and 2nd quality salt, which is distributed mainly for use in cattle feeds.

The 1st quality salt is purchased from the salt producers for RD\$895.69, or US\$60.72 per ton, and sold to refineries and packagers for RD\$1424.21, or US\$96.56. Second quality salt is purchased from producers for RD\$643.22, or US\$43.61 and sold to packagers for RD\$955.98, or US\$64.81.

DISSAL also has the responsibility of iodizing the coarse salt purchased.

Because of the unique tradition in the Dominican Republic of consuming most household salt in the form of **sal en grano**, see **Table 1**, most salt for human consumption does not get the opportunity of going through a processing and packaging facility whereby the salt could be iodized under controlled conditions. A scheme was therefore devised to add iodide to salt in the crude stage prior to distribution as **sal en grano**.

In order to do this 6 persons are employed to carry out the program of salt iodization. An iodide solution is made up using 435 gm potassium iodate to 4 gals water. Seawater is

used, as it is readily available in the field. The process then is quite simple. Crude salt prior to transportation to **DISSAL** is sprayed with the iodate solution by means of an agricultural backpack sprayer, see **Figure 15** below.

Figure 15: Iodization of Crude Salt by DISSAL personnel



Four gallons of spray are usually adequate to spray 60 quintal or 6780 lb of salt. However the process has its obvious weaknesses. This impacts on the efficacy. A recent survey disclosed to this consultant by PAHO has shown that only 14% of salt for human consumption in the Dominican Republic has adequate levels of iodide. This means that the people of the Dominican Republic are paying the costs for a program of salt iodization, but through incorrect implementation are not receiving the full benefits of one.

The salt ponds are arrayed along the coastline surrounding the town of Montecristi. Although they are owned and operated by private producers or co-operatives of individual producers the technologies and methods utilized are still highly manual and have not kept pace with modern developments in salt production technology. This lack of development has been in a large part due to the guaranteed price of salt paid by the state distribution firm. Consequently there has been no motivation on the part of producers to improve production methods and efficiency.

The result of all this is a salt that is below international standards of quality, at a high price that is unable to compete with imported salt. **Figure 16** below shows a view of the salt ponds and storage huts located near Montecristi.

Figure 16: View of Salt Ponds near Montecristi



8. Visit to Salinas Bani

Salinas Bani is the second largest producer of crude salt in the Dominican Republic. It would appear though that it is the best organized technically and would present the best prospects for privatization and development. **Figure 17** below shows a view of the salt stockpile at **Salinas Bani**.

It is a loosely organized co-operative and has about 150 workers. It is owned and managed by the local government in that area. It produces about 2000 ton per month or 24,000 ton per annum.

The layout and organization of production and salt storage is good and with relatively small investment could be improved to produce at yields and efficiency that could be internationally competitive.

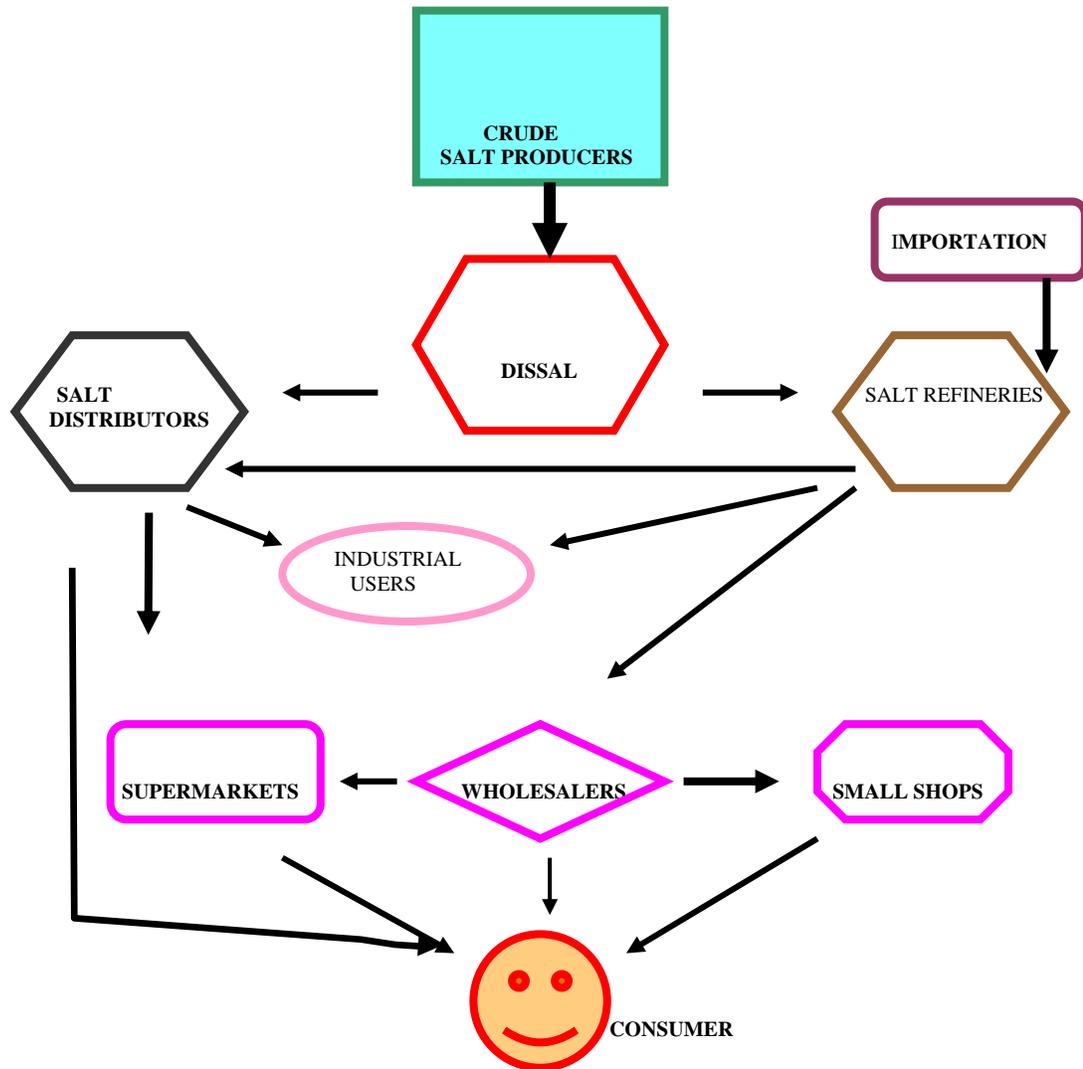
Figure 17: View of Stockpile Area at Salinas Bani



9. Salt Marketing and Distribution

The **Figure 18** shown below, outlines the distribution channels and marketing arrangements for salt in the Dominican Republic. More study is needed to accurately quantify the various streams. The trend is for greater levels of importation of crude salt in order to replace high priced local crude salt.

Figure 18: Salt Distribution Channels, Dominican Republic.



Marketing of refined salt is highly competitive in the Dominican Republic as evidenced by the number of brands. The standard of packaging is very high. Almost all refined salt is presented in plastic canisters. Other packaging presentations of refined salt are rejected in the market place. **Figure 19**, overleaf, shows the variety of brands and packaging available at a typical supermarket in Santo Domingo.

Figure 19: Selection of Salt Brands at a Supermarket in Santo Domingo



See **Appendix 1** which gives an analysis of salt prices at the retail level.

10. Analysis of the Dominican Republic Situation

The Dominican Salt Industry is full of contradictions and paradoxes. On the one hand crude salt production methods are artisan and outdated, whilst refined salt production uses modern methods and is of high quality. On the one hand over 60% of table salt is sold as **sal en grano**, whilst there is a sophistication of marketing of refined salt. The following points list the main characteristics of this industry.

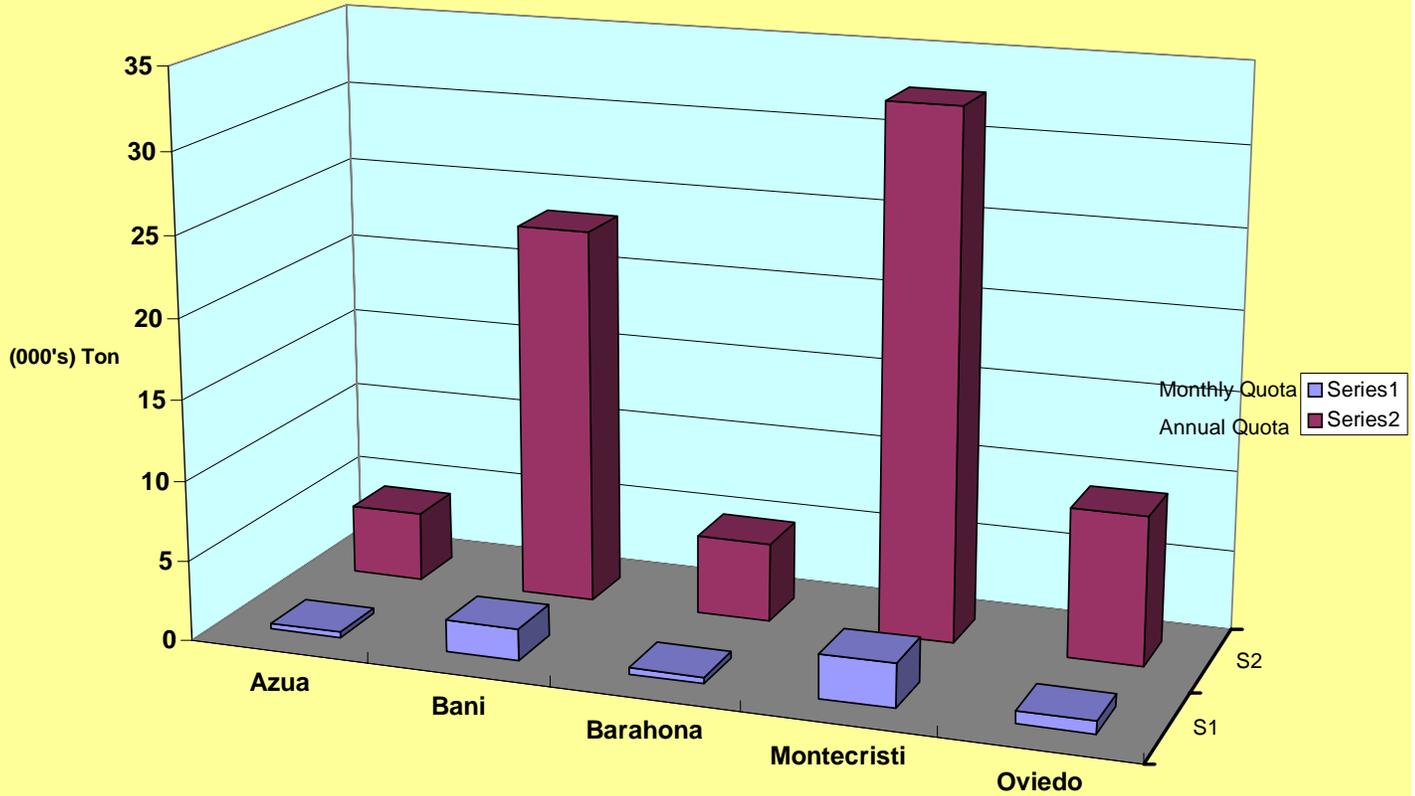
1. Operations in crude salt production are highly manual.

Although crude salt production is organized into production regions and co-operatives, they have failed to modernize over the years. A big contribution to this has been the protection given by the DISSAL monopoly.

2. The existence of the DISSAL monopoly has had a severe impact on the salt industry.

All crude salt produced in the Dominican Republic is required by Law # 125 dated February 10th 1966, to be sold to DISSAL. This involves specific quotas to each salt producing area in the Dominican Republic. **Table 2** below shows the quotas for each salt producer from DISSAL.

TABLE 2
DISSAL's Monthly & Annual Quotas for Crude Salt Production



The impact of DISSAL has unfortunately been a negative one. The existence of protected prices and set quotas has stifled development and modernization of crude salt production. At the present time therefore production costs are high and quality low. What will be the likely result is a virtual wipe-out of the local crude salt production as cheaper, higher quality crude salt becomes available from Venezuela, the Bahamas or Columbia.

3. The production methods employed for salt refining are fairly modern

The island's salt refineries manufacture good quality salt. Management however has to work on improving efficiency and overall plant productivity. In an effort to cut costs and improve profitability the highest contribution to cost is being dealt with at first. That is the cost of crude salt. The possibility of obtaining imported crude at one-fourth the price is too much to ignore.



4. Over 60% of the market for domestic or table salt is in the form of sal en grano.

This long standing tradition will have implications for salt fluoridation.. The quality of **sal en grano** is such that it would not be suitable for fluoride addition. Also the fragmented nature of its distribution would effectively erase the advantages of salt fluoridation vis a vis other fluoridation interventions.

5. The presentation and quality of refined salt is of high standard and apart from price can compete internationally.

The overall marketing of refined salt in the Dominican Republic is quite sophisticated and highly competitive. If other aspects of the production-supply chain are freed up, dynamism in the industry will spread.

6. The processed salt producers will be able to upgrade their analytical facilities to do fluoride analysis.

The present salt processors operate at a fairly sophisticated level. There should be no problem for them to improve their analytical facilities to include fluoride analyses.

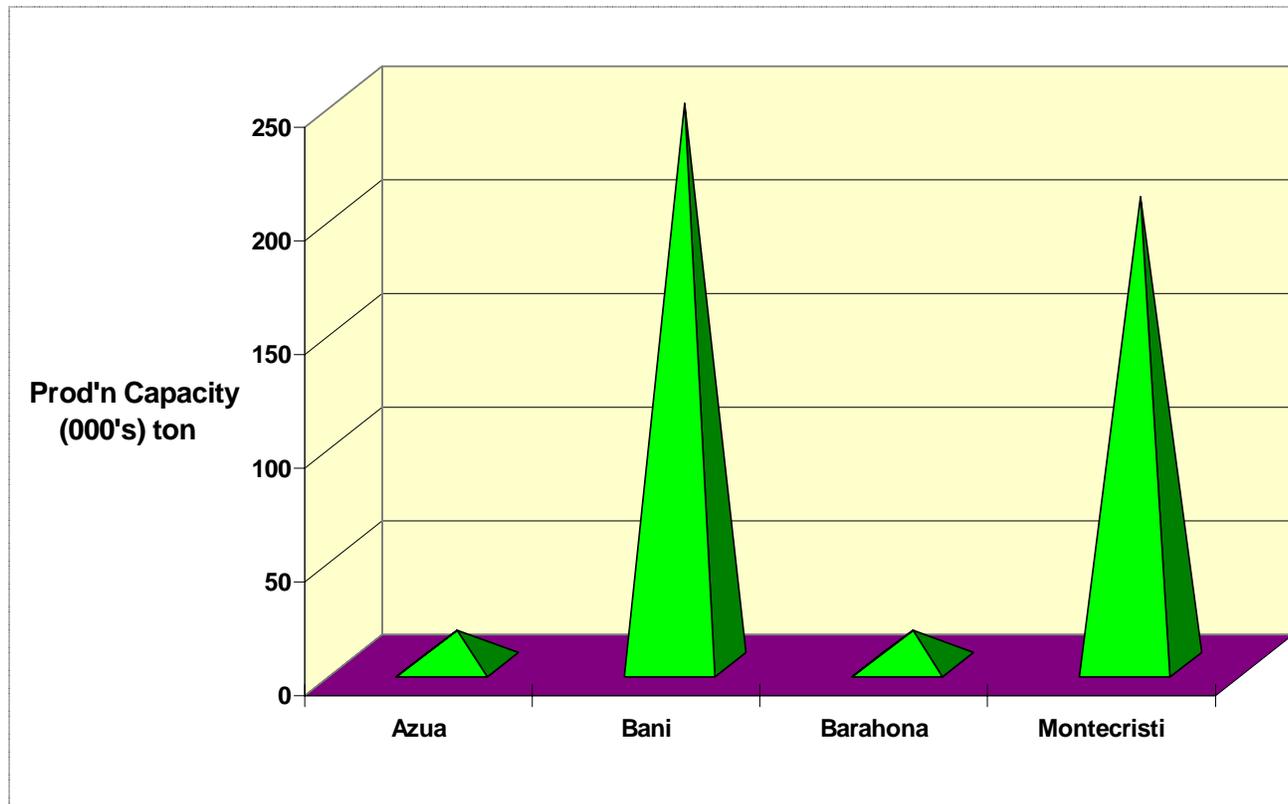
11. Recommendations

The main obstacle facing a program of salt fluoridation in the Dominican Republic would be the low level of universality, relative to other countries, that such a program would have. This is because a majority, over 60% of household salt is sold as **sal en grano**. It is logical to conclude therefore that only 40% of the population would benefit from a program of salt fluoridation if the present market conditions do not change. In addition the lower socio-economic levels would benefit least as they consume less refined salt. A strategy must therefore be formulated to convert the salt market in the Dominican Republic, away from **sal en grano** and towards the consumption of more processed salt, which can be fluoridated. The lynch-pin of any strategy to convert the market must have processed salt competing with sal en grano on the basis of price.

1. That the Government of the Dominican Republic examines and reassesses the role, costs and benefits of DISSAL. From the limited vantage-point of this consultant it is clear that DISSAL does not add any value to the salt production supply chain. Indeed what it has ended up doing is creating an unsustainable artificial environment of high prices for the salt producers, which has resulted in the lack of technical and organizational development.
2. It is the considered opinion of this consultant that Salinas Bani has the best potential from a technical point of view to convert to an efficient crude salt production operation. **Table 3** below shows the potential of each existing solar salt site for salt production. The strategy should therefore be to convert one of those sites to efficient production so that it can compete with crude salt from anywhere in the Caribbean Basin.



TABLE 3
Production Capacity of Salinas



3. That the present salt processors be given every encouragement and assistance to improve their production processes and thereby reduce the cost of refined salt to the consumer. Amongst this should be attendance of their technical personnel at the intended PAHO sponsored travelling seminar in Venezuela later in 1998.
4. That **Refinera de Sal Dominicana** and **Industrias de Sal Dominicana** be given every assistance to begin the addition of fluoride to their salt product. This should include carrying out plant trials at the earliest possible opportunity.
5. That the present **sal en grano** producers and packagers be exposed to the technology of small-scale **mollida, lavada secada** salt processing, along the lines of the Venezuelan micro-plants. This would be so as to encourage them upgrading their product offering away from **sal en grano** and towards a higher quality, but economical to produce processed salt, which may be fluoridated and iodized.

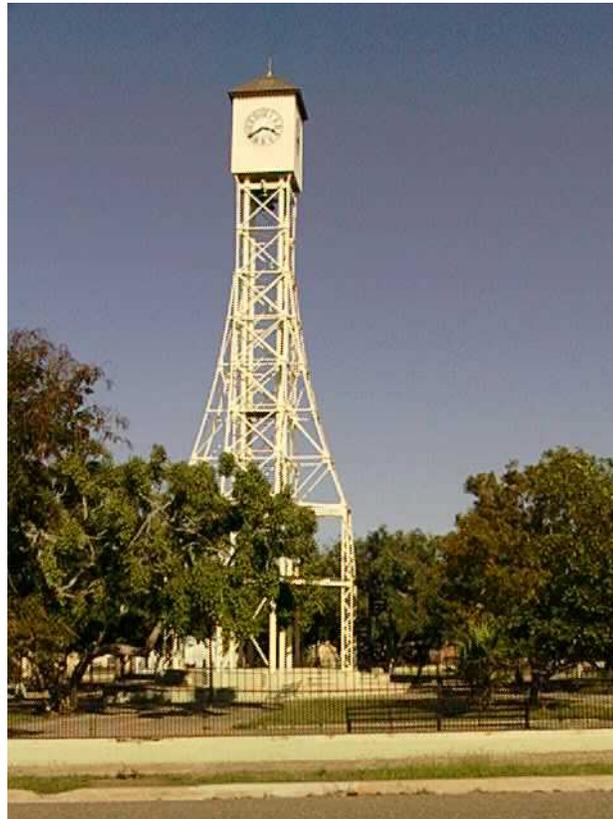


6. That a detailed study of the salt distribution and marketing system be made. This study should focus on ways of converting the market away from **sal en grano** and towards refined salt.





APPENDICES



**APPENDIX 1****PRICES OF SELECTED SALT BRANDS**

	BRAND	TYPE	PACKAGE	SIZE	TOTAL PRICE		UNIT PRICE	
					RD\$	US\$	RD\$/kg	US\$/kg
1	Linda	Refined Iodized	Plastic Canister, Cylindrical	10 lb	68.75	4.82	15.16	1.06
2	Linda	Refined Iodized	Plastic Canister, Conical	225 gm	5.75	0.40	25.56	1.79
3	Linda	Refined Iodized	Plastic Jar	560 gm	8.45	0.59	15.09	1.06
4	Sal Perla	Refined Iodized	Plastic Canister, Cylindrical	5 lb	32.5	2.28	14.33	1.01
5	Sal Perla	Refined Iodized	Plastic Canister, Conical	24 oz	8.95	0.63	13.15	0.93
6	Uson	Refined Iodized	Plastic Canister, Cylindrical	5 lb	37.5	2.63	16.53	1.16
7	Uson	Refined Iodized	Plastic Canister, Conical	1 lb	9.25	0.65	20.39	1.43
8	AAA	Refined Iodized	Plastic Canister, Cylindrical	18 oz	7.45	0.52	14.60	1.02
9	Espicias de Oriente	Sal en Grano	Plastic Canister, Cylindrical	560 gm	6.75	0.47	12.05	0.85
10	Sal Premium	Refined Iodized	Plastic Canister	18 oz	8.45	0.59	16.56	1.16
11	Morton*	Refined Iodized	Fiber Canister	26 oz	9.75	0.68	13.22	0.92
12	Carey*	Refined Iodized	Fiber Canister	26 oz	9.95	0.70	13.49	0.95

*Imported brands from the USA



**APPENDIX 2**

LIST OF SALT PROCESSORS IN THE DOMINICAN REPUBLIC

NAME OF PROCESSOR	BRANDS PACKAGED	LOCATION	ANNUAL PRODUCTION
1.Refineria Dominicana de Sal	AAA	Santo Domingo	6,000 ton
2.Industria de Sal Dominicana	Sal Polar	Bani	3,000 ton
3.Bromo Industrial		Haina	1,000 ton
4.Sal Cristal		Santo Domingo	No data
5.Turey Industrial		Santo Domingo	No data
6.Industria de Sal Princesa		Santo Domingo	No data
TOTAL			10,000 ton



APPENDIX 3

QUALITY OF DOMINICAN SALT

Standards or Normas from their National Bureau of Standards or DIGENOR govern the quality standard of Dominican Salt. Specifically, **NORMDOM #14**, establishes the characteristics of salt destined for domestic consumption.

It recognizes 3 types of salt. **Sal de cocina**, or kitchen salt, **Sal de molida**, or milled salt, and **Sal refinada** or refined salt.

The table below shows some of the analysis of Dominican brand salt compared to imported salt and the standard required.

Table Showing Analysis of Dominican Brand AAA Salt and Imported Brand Carey, Compared to Analysis Required under DIGENOR Normdom # 14.

<i>Component</i>	<i>AAA</i>	<i>Carey</i>	<i>Sal de Cocina</i>	<i>Sal Molida</i>	<i>Sal Refinada</i>
<i>NaCl</i>	97.7	98.7	97.5	97.5	99.0
<i>Sulfates</i>	0.54	0.14	1.4	1.4	0.5
<i>Ca & Mg Chlorides</i>	n.d	0.07	.5	.5	.3
<i>Insolubles</i>	0.04	0.06	0.3	0.3	0.2
<i>Moisture</i>	0.91	0.09	0.7	0.7	0.1



APPENDIX 4

COSTS COMPARISON OF DOMINICAN AND SELECTED COUNTRIES CRUDE SALT

a) Price to DISSAL, ex salinas	= U\$60.72 per ton
b) Selling Price to Processors	= U\$96.56 per ton
c) Present Cost Price, CI F, of Imported, (Bahamian), Salt to Processors in Dominican Republic	= U\$23 per ton
d) Price of Crude Salt at various Locations: FO B	
Columbia (Inagua)	=U\$20per ton
Venezuela	=U\$12 per ton
Bonaire	=U\$18 per ton

A conclusion that may be drawn is that the price that Dominican processors pay for local crude is much higher than what may be obtained from abroad. Pressure will therefore build to import more and more crude salt for processing.

Decisions will have to be made in the short run as to the role and future of DISSAL. In addition, the local salinas will have to produce at a competitive price and quality or they will gradually not be able to sell any salt. One possible scenario would be to privatize the salinas with the best technical potential and invest in upgrading production efficiency.





APPENDIX 5

FLUORIDE CHEMICAL & ANALYTICAL EQUIPMENT COSTS AND SUPPLIERS

1. Fluoride Costs:

Technical grade Potassium Fluoride with 98% + purity is approximately US\$ 3.00 per pound FOB Miami. It is available in a variety of packaging sizes and types.

2. Supplier:

A reliable, competitive supplier from the Miami area is,

Taurus (Int'l) Traders, Inc.
8335 NW 66th Street,
Miami, Fl 33166.
USA
Attn: Mr. Leon Wray
Ph: 305-477-2522
Fax: 305-477-6553

3. Analytical Equipment List:

Recommended Orion Selective Ion Meters, any of which may be used, with associated supplies for the measurement of fluoride and iodide in salt.

Meter model # 720A, \$1,500,
Meter model # 710A ,table model, \$ 850.00
Meter model # 290A, portable, \$ 591.00

Electrode for fluoride 9409BN, \$555.00
Reference filling solution, 900061, (59ml), \$53.00
Calibration standard, Fluoride
100 ppm #940906, (500ml), \$41.00
1 ppm # 940911, (500ml), \$41.00
2 ppm # 040907, (500ml), \$ 41.00
10 ppm # 040908, (500ml), \$ 41.00
TISAB # 940909, \$71.00 per gallon

Electrode for Iodide 9653 BN, \$525.00
Reference filling solution 90063, (59ml) \$60.00
Calibration standard Iodide,
0.1 M NaI, 945306, (475ml), \$ 70.00

Analytical equipment may be obtained through; Taurus (Int'l) Traders, see 1. above or through Orion Research Inc, 500 Cummings Center, Beverly, MA 01915-6199 USA, Tel: 978- 922-4400



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