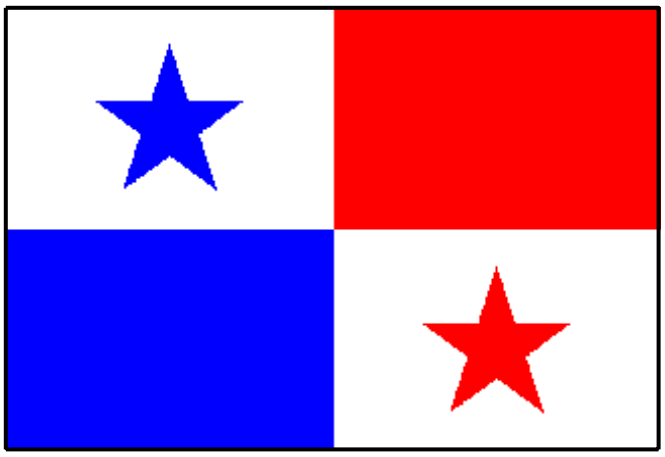
THE PANAMANIAN SALT INDUSTRY

AN ASSESSMENT

[PROSPECTS FOR SALT FLUORIDATION]



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Panama Fact Sheet

Land Area :	77,083 sq. km (29,208 sq. mi.).
Population :	3.0 million (1997 estimate)
Population Growth:	2.5% per annum 1987-1996
Cities :	Panama City, pop 719,421 Colon, pop 141,000
Urbanization:	56.1% of population live in towns or urban centers.
Ethnicity:	70%--------Mestizos 15%-------Black 10%-------White 6%------- Native Indian 4%------- Other
Economy:	The traditional basis of economy is service in international shipping, commerce and finance. Panama Canal serves as a global transit point. Mixed economy exists with the export of agricultural, mineral and industrial products.
Labor Force	921,000; agriculture 25%, services 28%, manufacturing, mining & construction 14%, Public Sector 27%, Other 6%, (1992).
Per Capita Income:	U$2420 per year (1992)
External debt:	U$ 7.2 billion (1993)
Exchange Rate	1 Balboa per US$ (Totally interchangeable and fixed)
Fertility	2.85 live births per woman
Infant Mortality	22 per 1,000 live births (1989)
Crude Death Rate	4.9 per 1,000 inhabitants (1990)
Life Expectancy at Birth	73 years; (1991)
UNDP-HDI	0.816
DMFT	3.61 (1997)

1. Activity Summary

The PAHO consultant arrived in Panama City at 1:30PM on Saturday October 11th. On Monday October 13th along with Dr Lucas Lopez and Dra Araceli Rudolfo of the Department of Oral Health in the Panamanian Ministry of Health the consultant met with and toured PANASAL, the main salt producer in Panama. The next day, Tuesday October 14th a meeting and a tour of FENCOSPA was held.

2. Background

Panama produces just over 18,000 ton of crude salt per annum, from solar evaporation of seawater. Most of the crude salt is produced by small producers and small producer cooperatives concentrated on the pacific coast of the Provinces of Cocle, Los Santos and Veraguas. More than half of the crude salt production is then processed or packaged into Table/Domestic Salt or Industrial Salt for the food, animal feed or manufacturing industries. Crude salt production has been an organized activity for many, many decades in Panama. Recently this traditional industry is under threat from lower cost crude salt from more efficient producers such as Mexico, Venezuela and Colombia who have the benefit of large scale mechanized production. Table 1, below shows the salt flows in and out of Panama.

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

IMPORTS		PRODUCTION		CONSUMPTION	
Mexico		Solar Salt (Sal Solar)	18,000	Household/ Domestic/ Table (Direct Human)	11,000
Colombia				Industrial Food/ Bakery/ Cattle Feed. (Indirect Human)	11,250
Costa Rica				Industrial Non-Food (No Human Consumption)	7,750
TOTAL IMPORTS	12,000	TOTAL PRODUCTION	18,000	TOTAL CONSUMPTION	30,000
TOTAL IMPORTS + TOTAL PRODUCTION	30,000			TOTAL CONSUMPTION	30,000

Figure 1, overleaf is a diagrammatic representation of the salt flows for the Republic of Panama.

3. Visit to Salt Producer, PANASAL

GENERAL

PANASAL or **Panama Sal** is the largest producer of processed salt in Panama. It has a modern salt processing plant based on the "**molida, lavada, secada"** or mill, wash, dry process. The plant is located in **Cocle** province at **Aguadulce** and has warehouse and distribution facilities in **Panama City**.

Managers Carlos Ivan Fernandez and Eric Castillo conducted a tour of the plant. The plant, which is situated within a security-fenced compound, is modern, well laid out and well organized and obviously weel managed. It recently underwent a close to U$1,000,000. upgrading where old equipment including a salt dryer was replaced. The plant design and machinery is by the firm Sierra Salt Machinery of Barcelona Spain. Plant housekeeping is at a very high standard.

The Plant is rated at a capacity of 5 ton per hour. This is equivalent to 25,000 ton per year. Actual production is in the order of 20 to 25 ton per day equivalent to 500 - 600 ton per month, or between 7,000 to 7,500 ton per year. Only about one third of the plants capacity is therefore actually utilized.

The facilities consist of adjoining buildings totaling approximately 500 sq. m. There are separate areas for offices, laboratory, finished goods warehouse, processing plant and packaging area. A crude salt storage area is situated behind the main buildings and holds up to 500 ton of crude salt.

Crude salt is purchased from nearby local salinas or imported from Colombia. The trend is towards more importation from Columbia. This is in an effort to reduce production costs, as the price of locally produced crude salt is significantly higher than crude salt produced in countries such as Columbia, Venezuela, and Mexico. See **Appendix 2.**

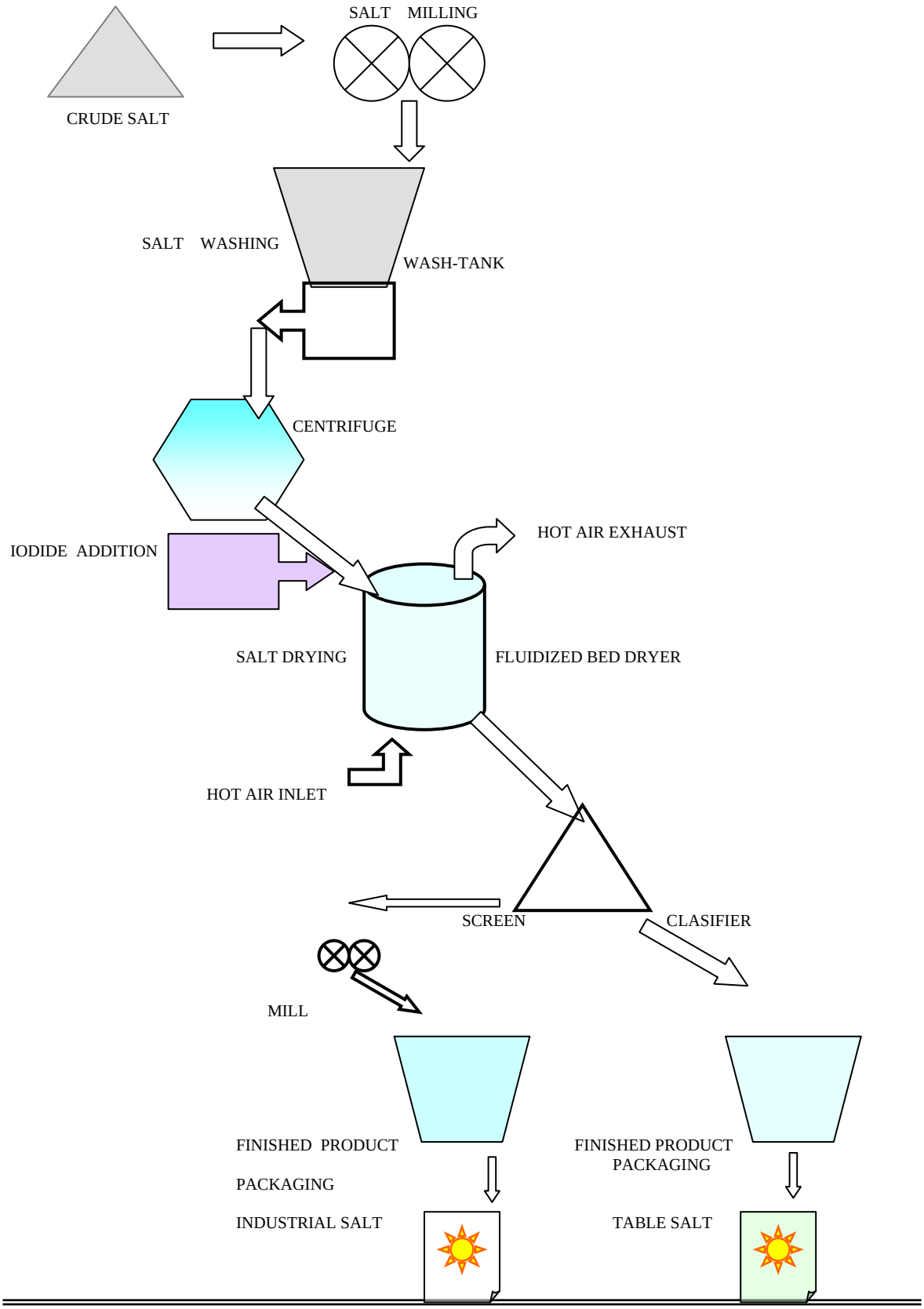
PROCESS

The process, which is shown diagrammatically in **Figure 2,** is as follows.

Crude salt is conveyed to a mill where the large crude salt crystals are reduced in size. The salt then falls into a wash tank where the dirt and extraneous matter are washed off by clean saturated brine solution. The clean salt forms a slurry with the brine solution and is pumped to a centrifuge that separates the salt from the brine solution. The resulting dewatered salt is at about 12-15% moisture.

It is at this stage that the present iodine dosification takes place. A previously prepared solution of potassium iodate is sprayed onto the salt as it exits the centrifuge. The rate of addition of the iodate solution is controlled by a metering pump and visual rotameter type flowmeters.

Figure 2: Diagrammatic representation of PANASAL's Mill, Wash and Dry salt process.



The salt is then conveyed to a fluidized bed dryer. The dryer is a vertical vessel where hot air, bubbles through, or fluidizes a bed of salt in the dryer. A Liquefied Petroleum Gas, (LPG), burner previously heats the air.

After exiting the dryer, the now dried salt is classified to separate the oversize particles. These larger particles are chuted to a small mill where their size is reduced. They then rejoin the fraction of salt being packaged for industrial salt.

The dried salt is stored temporarily in bins prior to being packaged. Packaging is done in a variety of sizes and package designs, the most popular being the 1 lb "stand up" pack. See **Figure 3**, below.

Figure 3: PANASAL's 1 lb PANASAL brand, "stand up" pack

The packaging facilities are quite sophisticated. They consist of a number of different types of packaging machines for different sizes and types of packages. Two **form fill and seal** machines package 1lb sizes in "stand up" packs. The machines are rated at 35 lb/min.

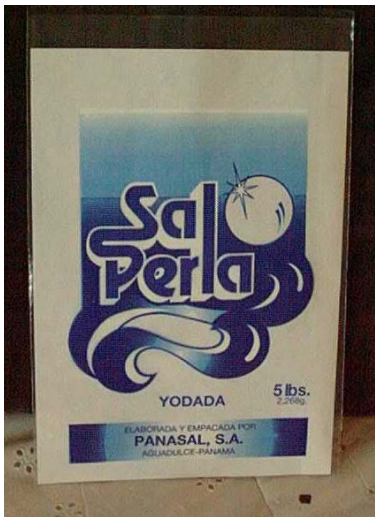
This is equivalent to 7 ton of salt packaged per machine, or 15 to 16 thousand 1 lb packs of salt filled, per 8 hour day.

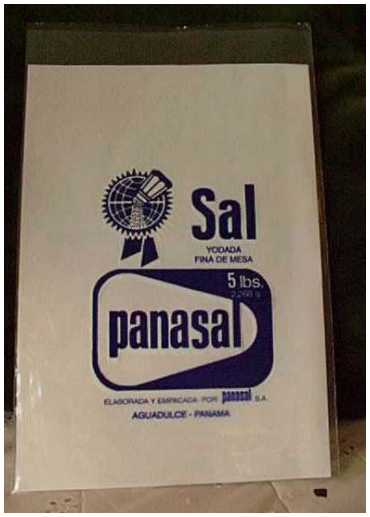
There is also manual filling of plastic canisters. See **Figure 4**, below.

Figure 4: PANASAL's 11b PANASAL brand, packaged in canisters

A rotary cup volumetric type filler, fills 1 lb and 5lb sacks. These are sealed on a manual heat sealer. The array of brands packed in 5 lb sacks is shown in **Figure 5**, overleaf.

Figure 5: PANASAL's Sal Perla, Crisal & PANASAL brands salt in 5 lb packages.





Production is normally 85% Table Salt and 15% Industrial Salt. Industrial Salt is a larger particle size and packaged in 50 and 100lb sacks.

QUALITY

The **PANASAL** laboratory is active in the maintenance of a high quality salt product. Routine samples are taken on a fixed schedule at various stages of the process. The main analyses carried out and the average results obtained are shown in **table 2** below.

Table2: Typical PANASAL Packaged Salt Analysis.

Description	Analysis wt %
Moisture	0.10
Insolubles	0.20
NaCl	99.5
Iodine	0.01

Full capabilities exist in performing a range of analyses on raw materials, in process and finished products. Equipment and protocols are available for the full range of titrometric determinations. A selective ion meter and electrode would have to be procured for Fluoride ion analysis.

Weight checks and the necessary adjustments are also done on package weights.

In summary, the **PANASAL** operation is of a high standard. They are in a position to begin the procurement of material for a plant test, in order to start the implementation of Salt Fluoridation immediately.

4. Visit to Salt Producer FENCOSPA:

GENERAL

FENCOSPA or **Federacion Nacional de Cooperativas Salineros de Panama** is situated in the province of **Los Santos** at **La Honda.** This plant is the second largest processor and packager of salt in Panama. It is situated on a large compound a few miles from the salinas which provides the plant with crude salt. This enterprise is, as the name suggests a federation of crude salt producers. The purpose of this federation is to operate the salt processing facility to process and package table and industrial salt for the national Panamanian market. This operation therefore ensures a ready market for the crude salt production of its various members.

The management of **FENCOSPA** as articulated by Luis Carlos Gutierrez, Gerente General, is keenly aware of the need to modernize all aspects of the salt production and marketing process. They are making great efforts to become competitive. They have a good understanding that competitiveness depends on quality, price and reliability. Their philosophy is "**quality production for competition**". They are hoping that this will serve them well and allow them to export successfully to other countries in Central America.

Processing is done in a building of about 250 sq. m. This building also houses an office, packaging room and finished goods area. A laboratory is located in a building nearby. The facilities are undergoing extensive upgrading and modernization. FENCOSPA is installing better equipment to modernize their plant. Most of the equipment is of local fabrication, and from all appearances is of a very high standard. The cost of the present modernization effort is close to U$100,000.

Plant design capacity is 1.5 ton per hour, or 11.25 ton per 8-hour day. This capacity is equivalent to 8,300 ton per year. Production is about 3,000 ton per year.

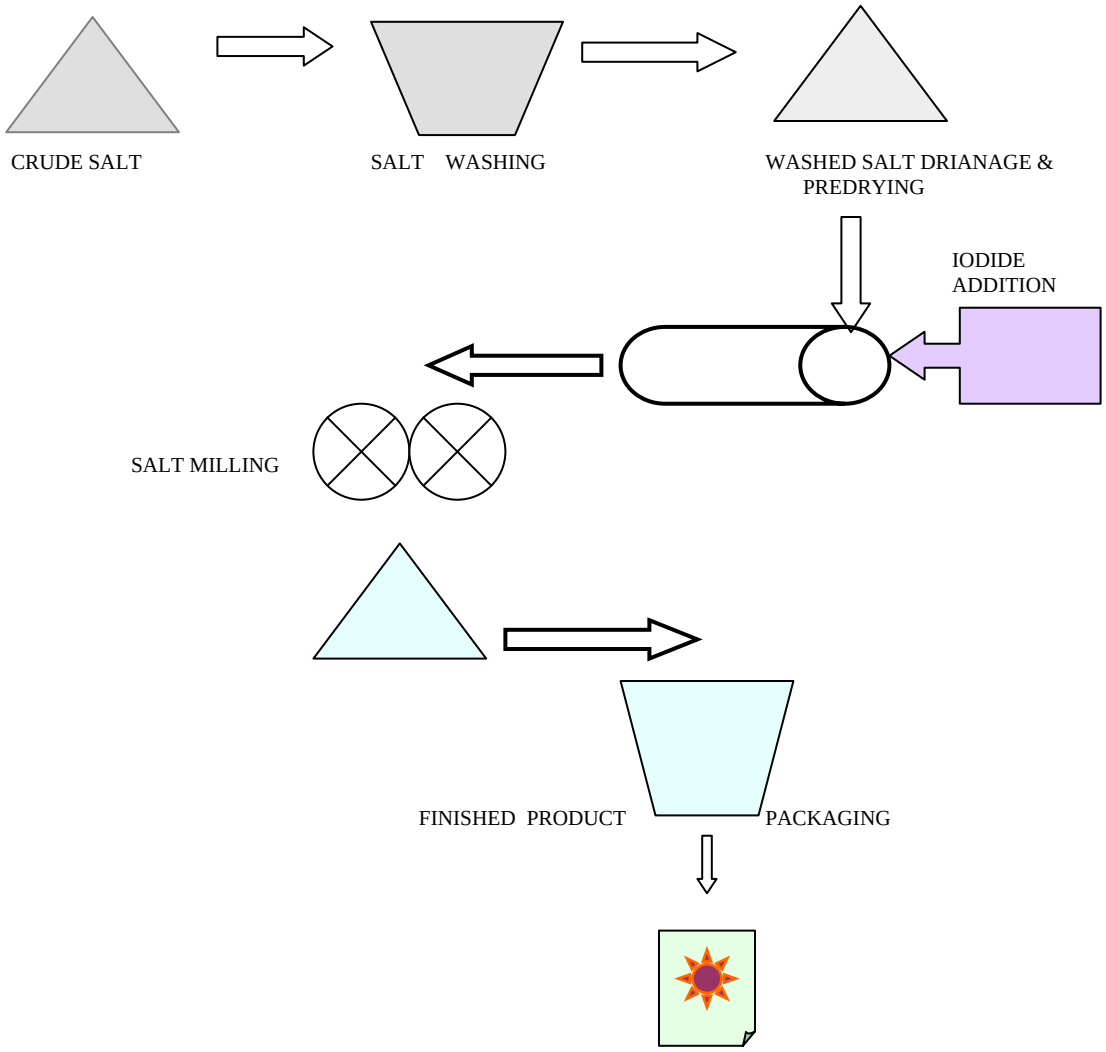
PROCESS

The process employed is a variant of the "**molida, lavada, secada**" process. See **Figure 6**. Crude salt is transported from the salinas in 1-quintal bags. These bags are stored in

sheds adjacent to the processing area. The process starts when the crude salt is first emptied into a wash basin where clean saturated brine solution removes dirt and extraneous matter. The salt washing is done in batches of 1.35 ton, and takes 25 minutes per batch.

The salt is then settled and allowed to dewater by gravity. At this stage it is also predried by steam coils. A boiler provides the steam.

Figure 6: Diagrammatic representation of FENCOSPA's Mill, Wash and Dry salt process.



The salt is then added to a rotary dryer, heated by burning LPG. A new rotary dryer is being installed as part of the modernization program. It is expected that when the installation is completed a dryer product salt will be obtained. At present the moisture in salt is in the order of 1.6% - 2.0%.

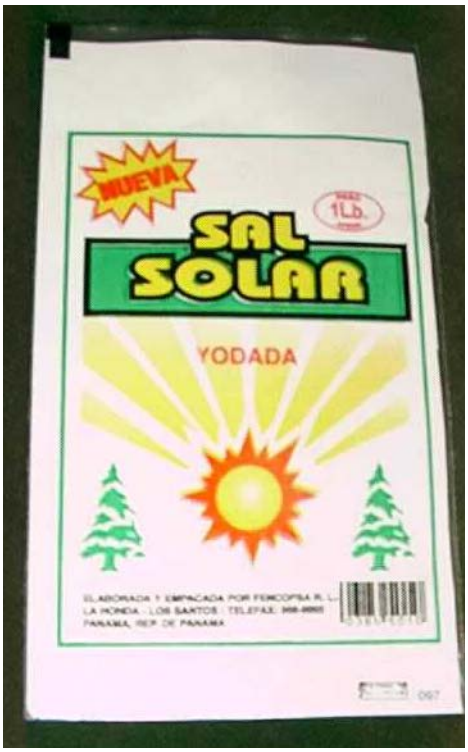
It is at the drying stage that iodide is added. This is done in the form of Yodocal, a mixture of potassium iodate and calcium carbonate in the ratio, 1: 9.

After exiting the dryer the salt is milled. This reduces the large particle size of crude salt to particles acceptable for use as table salt.

The salt is next transferred to the packaging room. It is placed on packaging tables and manually packed by women working in teams. Sealing is also manual by hand operated TEW brand heat sealers.

FENCOSPA produces the **SAL SOLAR** brand of salt. It is packaged in 6 oz, 1 lb, 5 lb and 100 lb sacks. The 6 oz to 5 lb sacks are bundled together for total weights of 30 lb and 50 lb respectively for wholesale distribution. **Figure 7** below, shows the **SAL SOLAR** brand 1lb sack.

Figure 7: FENCOSPA's SAL SOLAR brand, 1 lb pack



QUALITY

FENCOSPA is implementing many plant improvements, which will result in a higher level of quality. It is anticipated that when all of the proposed plant modifications are

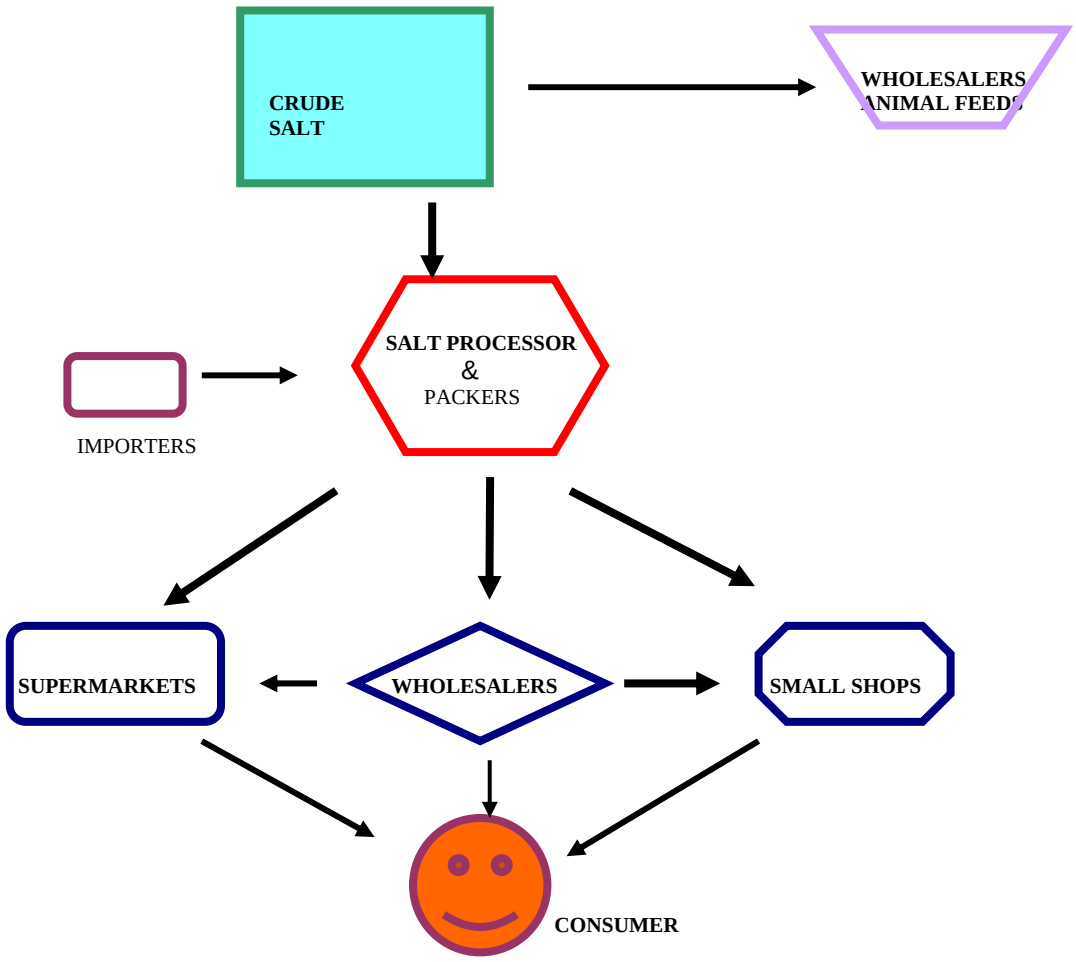
completed, by the 2nd quarter of 1998, their salt quality and presentation will be as good as any. Important to achieving and maintaining this goal is to ensure that their laboratory is equipped and fully functional.

In summary, **FENCOSPA** after completing their planned improvement program will be ready to begin the implementation of Salt Fluoridation. This should start off with a plant test. To accelerate implementation, it is recommended that FENCOSPA be given direct assistance with procurement of analytical equipment for Fluoride analysis.

5. Salt Marketing and Distribution

The **figure 8** shown below outlines the distribution channels and marketing arrangements for salt. More study is needed to accurately quantify the various streams. The trend is for greater levels of importation of crude salt to replace higher cost locally produced salt for processing and packaging. All salt for human consumption is iodized.

Figure 8: Salt Distribution Channels, Republic of Panama.



6. Analysis of the Panamanian Situation

The Panamanian Salt Industry may be characterized as being well established. It has the characteristics of an industry in advanced, albeit slow transition. Different levels, stages, and techniques of production coexist but the trend is to improvement and increased sophistication. The following lists the main characteristics of this industry:

1. **Operations are manual for crude salt production but fully mechanized for salt processing.**
   In the production of crude salt, operations generally follow the traditional manual process. Low labor productivity and high prices relative to neighboring countries is the outcome. In the processing plants modern processes and techniques are employed. The trend is for modernization and improvement.

2. **The industry is differentiated between crude salt production/producers, and processed salt production/processors.**
   The crude salt producers have been going through a process of consolidation. For example FENCOSPA which produces 12,600 ton or 70% of the total crude salt production is a federation of 3 co-operatives totaling 303 producers. There are a total of 9 salt processors. PANASAL and FENCOSPA are by far the largest salt processors. PANASAL has about 75% of the **"table salt"** market, whilst FENCOSPA has about 31% of the processed salt market. (this includes table salt, industrial salt, and bulk packaged salt.). Both PANASAL and FENCOSPA would be considered micro or very small processors on an international scale.

3. **The price of salt to the consumer is in the range of U$ 0.63/kg to U$ 0.53/kg.**
   The price varies depending on the brand and quality. Some imported brands from the USA are available at slightly higher prices.

4. **The salt quality is on par with what can now be considered normal international standards.**
   Salt from **PANASAL** is comparable in all respects with similar processed salt anywhere in the world. Packaging, presentation and weight control are all good. **FENCOSPA**'s moisture content will have to be reduced to below 0.5 % from the present 1.5% to be considered competitive internationally. This is to be implemented shortly. Iodide control in all brands is good.

5. **The capacity exists, with some producers, to carry out the full range of quantitative analyses on raw material and finished products**.

6. **They have a successful salt iodization program**

7. **The producers have demonstrated the capacity to change and improve.**

Panama has all the ingredients in place to begin a sustainable Salt Fluoridation program. In summary these are:

- Governmental backing and the will to implement the program.
- Institutional support for the program, ie PAHO, INCAP, Government Food Control Section monitoring.
- High quality salt production that has been iodized for many years.
- Marketing systems and traditions that allow high quality salt to reach all the population.
- No technical impediments to the addition of fluoride.
- Willing and enthusiastic salt processors, who are anxious to start the addition of fluoride.

Nevertheless, although the overall situation is decidedly optimistic, an analysis of the price competitiveness of Panamanian salt, see **Appendix 2**, will lead to the conclusion that this industry will be threatened in the near run by the increasingly aggressive, lower cost producers of Mexico, Colombia and Venezuela. Today they are exporting crude salt to Panama, tomorrow it will be processed salt. From the perspective of ensuring a sustainable salt fluoridation program in an environment of free trade, the following measures should be taken.

- Ensure that salt that is imported is fluoridated and iodized, except for salt used in the manufacture of industrial or chemical products.
- Encourage further restructuring and the mechanization of Panama's crude salt production so as to ensure a reduction in the price of crude salt to compete with imported crude salt.

7. Recommendations:

It is recommended that the following strategies be pursued.

1. That **PANASAL** begin a plant test as soon as is practical. This test should be approximately one week's duration and would serve to test the addition and laboratory systems under real production conditions. Any shortcomings revealed during the plant test should be rectified.

2. That following on the outcome of their plant test **PANASAL** incorporate the improvements required and proceed to full time implementation of salt fluoridation. See **Appendix 3**, for details.

3. That in the case of **PANASAL**, Potassium Fluoride be used to fluoridate. The addition point should be at the present iodide addition point. The fluoride solution should be made up with the present iodide solution, in the present mixing tank or **receptor de disolucion**. See **Appendix 4**, for details.

4. That as soon as their plant improvements leading to dry salt is completed **FENCOSPA** make preparations to begin a fluoridation test.

5. That every assistance be given to **FENCOSPA** in the form of improvements to their laboratory facilities. Specifically, it is recommended that PAHO explore the possibility of obtaining funding of equipment and the first years supply of chemicals for fluoride analysis for **FENCOSPA**. See **Appendix 3,** for details.

6. That a detailed study of the salt distribution and marketing system be made.

APPENDICES

APPENDIX 1

LIST OF PANAMANIAN SALT PROCESSORS

NAME OF PACKAGER	BRANDS PACKAGED	LOCATION	ANNUAL PRODUCTION
1.PANASAL	PANASAL, Sal Perla CRISAL, Star Light	Aguadulce	6,000 ton
2.FENCOSPA	Sal Solar	La Honda	3,000 ton
3.B.R.Metalicas, S.A.	Sal Cristalin, Sal Hada, Sal Domino	Chitre	No data
4.Refineria Atencio	Sal Atencio	Guarare	No data
5.Sales de Panama	Sal Caracol	Los Santos	No data
6.Refineria Tita	Sal Tita	Aquadulce	No data
7.Gregorio Marin	Sal Populi	Los Santos	No data
8.Refinadora Melamed	Sal Melamed	Santiago	No data
9.Dist. y Proces ABA, S.A.	San Pablo	Guarare	No data
TOTAL	14		10,000 ton

APPENDIX 2

COSTS COMPARISON OF PANAMANIAN AND SELECTED COUNTRIES CRUDE SALT

a) Cost of Production = U$41 per ton

b) Selling Price to Processors = U$83 per ton

c) Present Cost Price, **CIF**, of

Imported, (Colombian), Salt to Processors in Panama = U$31 per ton

d) Price of Crude Salt at various Locations: **FOB**

Bahamas (Inagua)	=U$15 per ton
Venezuela	=U$12 per ton
Bonaire	=U$18 per ton

A conclusion that may be drawn is that the price that Panamanian 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.

Local crude salt producers will therefore have to counter this by lowering their cost of production by producing more efficiently, and reducing the margin between cost of production and selling price. This lowering of costs will have to be achieved by merging enterprises that are too small, ie increasing economies of scale, employing machinery, and possibly new production techniques.

APPENDIX 3

FLUORIDE CHEMICAL & ANALYTICAL EQUIPMENT COSTS AND SUPPLIERS

1. Fluoride Costs:
Technical grade Potassium Fluoride with 98% + purity is approximately U$ 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

APPENDIX 4

SPECIFIC RECOMENDATIONS FOR SALT FLUORIDATION PLANT TEST AT PANASAL

1. Chemical to be used : Potassium Fluoride, KF technical grade.

2. Method of application: Spray on 20 % solution by weight of KF

3. Point of application: To approximately, 7-10% moisture salt as it exits the centrifuge, prior to salt being dried, at present point of application of potassium iodate solution.

4. Potassium fluoride and potassium iodate solution is to be made up in same dosing tank and sprayed on together.

Procedure for make-up of Potassium Fluoride solution.

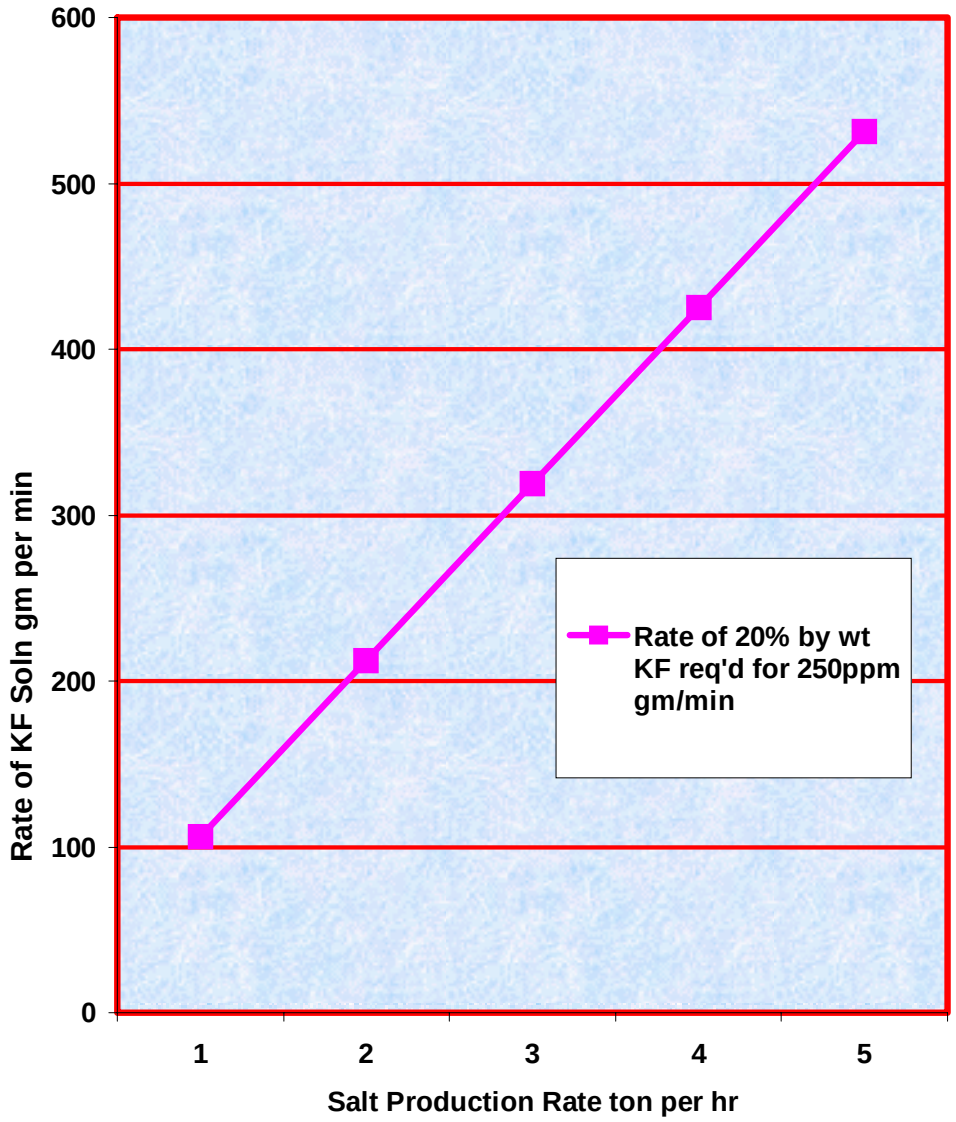
As high a concentration as possible of Potassium Fluoride should be used to minimize water addition to the salt. With the solubility of Potassium Fluoride in water being 50gm KF per 100 gm solution at 25 ^{0} C, then it should be possible to make a 50% by weight solution. In practice, a 20 to 25 % solution is used, especially when dosing prior to the dryer.

Table 3.1: Weight of KF for a resulting 20% by weight Potassium Fluoride solution

Volume of Water, L	Weight of Water, kg	Weight of Potassium Fluoride, kg.	Total weight of Solution kg
1	1	0.25	1.25
5	5	1.25	6.25
10	10	2.5	12.5
15	15	3.75	18.75
20	20	5.0	25
25	25	6.25	31.25
30	30	7.5	37.5
40	40	10	50
50	50	12.5	62.5
60	60	15.0	75
70	70	17.5	87.5
80	80	20	100
90	90	22.5	112.5
100	100	25	125

NB for a mixture of KIO_3 & KF this table will have to be modified to take into account the weight of KIO_3 in mixture.

GRAPH 3-1: Rate of 20% KF required to give 250 ppm F in Salt at different production rates



Please note that this graph can only be used for uni-component systems. Modifications to it will have to be made to accommodate bi-component dosing solution of KF plus KIO_3.

APPENDIX 5

Map of PANAMA

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