

*Pan American Health Organization (PAHO)
World Health Organization (WHO)*

Institutional Analysis and Cost-Benefit of a National Fluoridation Program

Ministry of Health of Grenada

Prepared by:

***Ramón J. Baez, DDS, MPH, Head
WHO Collaborating Center in Oral Health
University of San Antonio***



***Division of Health Systems and Services Development
Regional Program on Oral Health***

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Executive Summary

Background

The Regional Oral Health Program of the Division of Health Systems and Services Development, (HSP), PAHO/WHO is currently implementing the Oral Health Strategies in various countries of the Region¹. In order to properly assist countries to develop the most suitable oral health program, it is important to have updated information of the oral health situation in the country, dental treatment needs, human resources and facilities available, as well as an estimate of the cost of possible activities that might be contemplated for future development.

The situation of dental caries in some countries of the region is severe. Several measures are being undertaken by countries to achieve reduction of dental caries, particularly focusing on the use of systemic fluoride. Two public health methods in particular, water and salt fluoridation have proven to be safe, effective and relatively inexpensive. The Regional Oral Health Office has initiated a multi-year plan for salt fluoridation in the Region of the Americas in countries where water fluoridation has not been considered feasible. Various countries are at various stages of developing salt fluoridation programs with technical cooperation provided by PAHO².

The Ministry of Health of Grenada has requested technical cooperation, through the PAHO Caribbean Program Coordinator Office in Barbados, for conducting an institutional analysis and cost:benefit study for developing a national salt fluoridation program. The PAHO/WHO Regional Office of Oral Health designated Dr. Ramon J. Baez, PAHO/WHO Technical Consultant and Head of the WHO Collaborating Center in Oral Health for this mission.

The consultant visited Grenada between 19 and 25 November, 1997. All meeting arrangements with government officials and the private sector were arranged by Dr. Jerome Keen-Douglas, Acting Senior Dental Surgeon and Mr. Aldwyn Francis D.A. from the Dental Department, Ministry of Health.

A meeting with Ms. Lana McPhail, Permanent Secretary, Ministry of Health was held to review the purpose of the consultation and discuss the Government position on a salt fluoridation program for Grenada. Further, to explain the PAHO Regional Oral Health plan for fluoridation of the countries of the Americas, technical assistance and need to explore collaboration from other national or international institutions or organizations for developing a salt fluoridation program in the country, particularly in terms of economical support.

Other Government agencies that collaborated during the consultation were, the Chief Medical Officer, Dental Department, the Food and Nutrition Council, Bureau of Standards, National Water and Sewage Department, The Bureau of Trade and the Office of National Statistics. In the private sector, the Grenada Dental Association, The George

F. Huggins & Co. Ltd. Visits were also made to various supermarkets, grocery stores and the market square in St. George.

The information obtained was used for preparing the institutional analysis and feasibility study for developing a salt fluoridation program in Grenada. This report includes main conclusions arrived at from the information made available to the consultant, anticipated cost:benefit study, sensibility analysis, estimate of discounted savings and possible schedule of required activities.

Main conclusions

1. Government position on salt fluoridation for Grenada

The Permanent Secretary of Health, Madame Lana McPhail, referred that the proposal for developing a salt fluoridation program in Grenada has been approved by the Ministry of Health and the Grenada Cabinet.

2. Oral health status of the population of Grenada

Dental caries indices found from examinations conducted in 1022 children in 1991 are considered severe by World Health Organization criteria. In terms of dental treatment needs, survey findings indicate that 85.2% of children needed restorative work (fillings) which would not likely be met with the existing human resources and dental care facilities.

Although no oral health surveys have been conducted in Grenada to evaluate the adult population, it is estimated that their oral health is worse than that of children. This assumption is based on observations made at dental clinics and the type of dental services required by the adult population. The total number of tooth extractions reported for 1996 was 12,985. There is a need to institute oral hygiene educational programs and implement a comprehensive preventive dental program.

The dentist to population ratio in Grenada is approximately 1:7,000. In the public health sector there are 7 dental surgeons and 5 dental auxiliaries (dental nurses). Taking into account the present work load, condition and functions of the existing dental clinics, it would be difficult to meet the treatment needs of the population. Additional dental auxiliaries and acquisition of a mobile dental unit or portable dental equipment would permit more efficient provision of dental care to children at the school site.

Various foreign organizations have provided some type of dental services in the country, however, various post-treatment problems have been reported. The quantity of services provided is not considered that contribute significantly to the improvement of oral health of the population.

A meeting with staff from the Dental Department and general dental practitioners, was held to explain the purposes of the consultation. From comments and questions made

by participants, it was concluded that additional information on mechanisms of action and benefits of systemic fluoride would be appropriate. A general dental practitioner did not believe that there was need or benefits of systemic fluoride after calcification of tooth enamel had been completed. In addition to the explanations given at the meeting, the consultant offered to facilitate existing scientific literature on this regard. When asked about incidence of dental caries in Grenada, most Dental professionals attending the meeting indicated that with the present conditions, two new carious lesions were expected to develop per person per year.

Although the information obtained on prevalence of dental caries and other indicators of oral health is not up to date, the trend of dental disease reported in the three oral health surveys conducted since 1979, would confirm that no marked improvement has or can be achieved unless more efficient public health measures are implemented. It is not expected that the present dental treatment needs of children and adults can be met with the present number of dental professionals and the condition of existing dental clinics.

In order to properly assess the present oral health status, establish baseline information for fluoridation programs and estimate the number and type of dental professionals necessary to satisfy the needs of the population in Grenada, an oral health survey needs to be conducted. The survey obviously would include children from various age groups. Since no surveys have been conducted to study oral health status and dental treatment needs of adult population, it is recommended that a survey be conducted targeting at least two age groups. The WHO recommends to include subjects 35-44 and 65-74 years of age. Considering that the latest data on oral health status and treatment needs of children was obtained seven years ago, it is recommended to conduct a new survey.

3. Sources of fluoride ingestion and water fluoridation experience

No data exists on availability of fluoride in drinking water. There are multiple treatment facilities for water distributed throughout six Parishes not including Carriacou and Petite Martinique.

No fluoridation of water supplies exists at this time in Grenada. It was referred however, that in the mid seventies fluoridation of one source of water "Mardigras" in the Parish of St. George was attempted. The equipment was not properly maintained and fluoridation had to be discontinued.

Since data on the concentration of fluoride in the water for human consumption is non existent in Grenada, and further, since this is one of the components of chemical monitoring of the epidemiological surveillance system recommended by the PAHO for countries desiring to implement fluoridation programs, it is recommended that base line data be collected on fluoride concentration in water supplies being used for human consumption in all Parishes.

It was referred that potable water reaches 94% of the population of Grenada, which is considered an excellent coverage. Considering the elevated number (30) of treatment facilities being used for provision of potable water to the population of Grenada, it would be expensive to set up fluoridation equipment at each treatment facility, unless water sources could be channeled to a lesser number of treatment facilities. Further, strict monitoring of operation, proper dose and maintenance of fluoridation equipment would be imperative. Nevertheless, if economic resources were available and the other conditions mentioned above were met, the possibility of water fluoridation could not be ruled-out.

No data exists on other sources of possible fluoride ingestion. Use of fluoride tablets, drops or vitamins containing fluoride is limited mainly associated with its cost. No information was available on the use of fluoridated Toothpastes by pre-school children.

4. Nutrition status of children

No comprehensive nutritional surveys are available at this time. It is estimated that a 4 to 5% of children suffer from malnutrition. On the other hand, overweight is frequent in children. It is known however, that iron deficiency exists. A program to promote use of fortified flour exists, but monitoring tests are rather expensive and this prevents the Food and Nutrition Council from exercising a more strict monitoring of food products.

No studies have been conducted on other Micronutrients deficiency. No data is available on urinary fluoride excretion.

Concurrence with a national program to reduce dental caries in the country was expressed by the Director of the Food and Nutrition Council. It was expressed that some of the existing concerns on use of fluoridated salt might be due to insufficient information on metabolism of fluorides and program experiences in other countries. It is therefore recommended to make available such information for a better understanding of the mechanisms of action of fluoride. Development of educational material for the community at large would also be necessary. Further, recommendations for developing nutritional surveys targeting pre-school children were emphasized.

5. Salt industry

There are no salt processing plants currently in Grenada. All salt being used in the country is imported. Principal suppliers of Table Salt over the last four years have been Canada, England, Trinidad, The US and Jamaica.

Importation of Table Salt from Jamaica (which contains fluoride) was discontinued after 1994 due mainly to shipping time required and cost.

Although, the largest suppliers have been Canada and England, Trinidad is considered an important source due to its geographical proximity to Grenada, fast delivery of shipments and advantageous economics since Trinidad currency exchange rate is worth about half of the Eastern Caribbean Dollar.

Venezuela is emerging as supplier of Table Salt, although its contribution started in 1996 at a very low scale. Nevertheless, its vicinity to Grenada and the availability of fluoridated salt in that country should be taken into consideration. However, it is important to remember that the concentration of fluoride in salt in Venezuela is only 90 mg/kg, which has demonstrated to be too low to produce any benefit in preventive dental caries. Therefore, if fluoridated salt is to be purchased from Venezuela, it should be required that the concentration be adjusted to 250 mg/Kg as recommended by PAHO.

Estimates indicate that consumption of salt in Grenada per capita is approximately 9.7 grams per day. However, further research on this area is recommended. Nutritional surveys may be coordinated with the Food and Nutrition Council.

6. Legal framework

There are no regulatory standards for fluoride or iodine content in effect in Grenada. The only available standard is the Codex Food Grade Salt Standard which specifies requirements for sodium chloride content and other natural secondary products. It also specifies determination of the loss of drying.

The use of salt as a carrier for nutrients such as fluoride, for public health reasons is contemplated in the Codex Standard for Food Grade Salt, a world-wide Standard. Adding nutrients to salt is an acceptable practice that would not conflict with the world-wide standard. Consequently, requiring that salt imported into the country for human consumption shall contain fluoride in the recommended concentration would not constitute a barrier on trade.

The country can adapt standards used in other countries and follow established guidelines by the PAHO to design a standard that would include requirements to be met by salt producers as it relates to fluoride content and quality characteristics for all salt for human consumption to be imported into the country.

Institutional Analysis and cost:benefit Study for Implementation of a National Salt Fluoridation Program in Grenada

Introduction

The recommendation for implementation of salt fluoridation program in Grenada was initially made over twelve years ago. Various consultants who have visited the country and who have studied the severe conditions of dental caries concur that Grenadian children have been suffering for years. The consultants as well as the Senior Dental Surgeon of the Ministry of Health have recognized that improvement of oral health conditions can not be achieved unless effective and sustainable interventions are implemented in Grenada. The Pan American Health Organization Regional Oral Health Office has launched a multi-year plan for fluoridation of the countries of the Americas. Salt fluoridation has been used with much success in countries of the Region to reduce dental caries in a relative short period of time. Experiences such as that of Jamaica in the Caribbean confirmed that salt fluoridation is feasible, relatively inexpensive, effective and sustainable.

The Permanent Secretary of Health, Madame Lana McPhail referred that the proposal for developing a salt fluoridation program in the country had been presented and approved by the Ministry and the Cabinet of Grenada. Some considerations remained in terms of cost and requirements for implementation.

This report includes a summary of information obtained from various sources and agencies in Grenada. Data related is used to estimate feasibility of developing a salt fluoridation program as well as the cost and anticipated benefits expected, and legal measures that would need to be adopted and enforced. Also activities that shall be developed to assure success of the program are recommended.

2. Oral Health status in Grenada

Oral health status of the population is measured by determining the present condition of their dentition, intraoral soft tissues and extraoral surrounding structures, as well as the type and number of dental treatment needs. Since examining the entire population would be not only difficult but expensive and impractical, population samples are selected to be examined and thus obtain information on oral health conditions that can serve as a guide to determine the prevalence of existing conditions, dental treatment needs and effectiveness of oral care services. Depending on resources availability oral health surveys can be comprehensive or simplified. This means that clinical examination can include teeth, soft tissues, intraoral and extraoral structures. The examination can be complex or include limited types of indicators that can generate data on the most common dental diseases affecting the population.

One indicator of oral health is the total number of Decayed, Missing and Filled Teeth per person, usually expressed as the DMF-T index. Means of the DMF-T are obtained from age specific population groups examined in oral health surveys and are used to estimate prevalence and severity of dental caries as well as the degree of the individual component of such index.

Information obtained from oral health surveys conducted in the country in 1979, 1984 and in 1991 indicated that the oral health condition of the children population of Grenada was very poor. The survey conducted in 1979 by PAHO as part of a regional survey included 645 children from Grenada from age groups 6, 9, 12 and 15. The respective number of children in each age group was: 6= 212; 9= 215; 12= 74 and 15=106. The mean number of decayed (d) and filled (f) primary teeth in the 6 and 9 year age groups was 3.66 and 1.97 respectively. Age specific mean (DMF-T) for the permanent dentition was 0.15, 1.66, 3.6 and 5.94 respectively. Caries prevalence in the permanent dentition was considered moderate for the 6, 9 and 12 year-olds, but severe for children in the 15 year old group. In this group, only 2.83% of children examined were caries free.

In 1984 a survey conducted by personnel from Project HOPE and the Ministry of Health of Grenada³ included 1349 children. Age distribution in the sample was, 6 = 468; 9= 488 and 12= 393. The mean number of teeth decayed (d) and filled (f) in the primary dentition for 9 year-olds was 4.17 and 3.30 respectively, indicating an increase of approximately 14%. In the permanent dentition, mean DMF-T for 12 year olds was 2.6. This would represent a decrease in caries prevalence for this age group. According to the discussion of results in the report of the oral health survey for 1991, the caries reduction from 1979 to 1984 could possibly be the result of a fluoride rinse program. An important finding in the 1984 survey was that only 7 of the of the 956 children examined in age groups 6 and nine had dental restorations and 622 had decayed primary teeth. In the permanent dentition, only 3 out of 1349 children had restorations, and 691 had decayed permanent teeth. Approximately 13.5% of 12 year-olds had lost permanent teeth possibly due to caries. This would indicate a large percentage of children with unmet dental treatment needs and obviously reinforced the urgency of implementing national public health programs for prevention of dental caries.

According to the last oral health survey conducted in Grenada in 1991³ the status of primary teeth in 6 year-olds and the permanent teeth in children 12 and 15 years of age was severe. This was expressed in terms of the total number of teeth decayed or filled in the primary dentition (df) and the total number of permanent teeth decayed (D), missing (M) and filled (F) or DMF-T. Examination of the primary dentition of children 6 years of age indicated a mean of 4.2 decayed (d) and 0 filled (f). The overall DMF-T mean for the 12 and 15 age groups was 5.52 and 7.22 respectively. According to the World Health Organization (WHO), DMF-T means between 4.5 and 6.5 are considered severe. The WHO oral health objectives set for the year 2000 for children 12 years of age are that the DMF-T should not be greater than 3.0.

Age specific means reported relate to the sample population as a whole, however some differences were observed by Parish. The lowest mean was observed in children from St. Mark's and St. John's and differences with other Parishes were significant. An explanation for the low DMFT in St. Mark's is attributed to a small sample size in this Parish according to the survey report. DMF-T results on children from other Parishes are somewhat similar, although a slight increase for the worse is observed in ascending order as follows: St. George's 4.26; Carriacou (including Petite Martinique) 4.58; St. Andrew's 5.05; St. Davis 5.26 and St. Patrick's 5.66. No significant differences in DMF-T values by sex.

Dental treatment needs were classified in two main groups operative (fillings) and surgical. An urgency scale from 0 to 2 was used to rate the degree of urgency. The report indicated that 85.2% of all children had restorative needs. These needs are not being met due in part to the high number of tooth extractions required to be performed in adults. In 1990 this number was 13,824.

The results of these surveys confirm that the situation of oral health of the population of Grenada is poor. Although current preventive dental programs are beneficial, with the present work load and condition of existing facilities and dental clinics they are insufficient to satisfy the present and future needs of the population. There is a need to expand these services and improve efficiency of delivery. Acquisition of a dental mobile unit or portable equipment would facilitate provision of services to children at the school site. A national public health prevention program for caries reduction is essential, if significant improvement of the oral health status of the population is to be achieved.

Dental fluorosis is not considered a disease, but rather an esthetic factor. Severe fluorosis can give teeth an unpleasant appearance and affected teeth may present areas of hypoplasia. It is imperative to establish baseline data on fluorosis in countries considering national fluoridation programs. The last oral health survey report indicates that "there was no fluorosis found in any of the children examined".

Dental caries and fluorosis are the two indispensable indicators that are recommended to be included in oral health surveys in countries implementing fluoridation programs. Usually, other indicators of oral health are included such as presence of dental plaque and calculus (tartar) on the teeth surfaces. The condition of the soft tissues surrounding teeth (gums) may also be included, particularly when adult populations are examined.

The survey conducted in 1979 used as indicator of oral hygiene (Russell's Plaque Index). Data indicated presence of soft deposits (plaque) in children in proportions ranging from 53% to 84% for 6 and 15 year-olds respectively. Hard deposits (calculus) were present also and its presence increased with age up to about 42% in 15 year-olds. Gingivitis (inflammation and irritation of gums) was also present but was not considered a serious problem.

No data on soft tissues was collected during the 1984 survey. In the 1991 survey, data was collected following WHO guidelines for Community Periodontal Index Treatment Needs (CPITN). Data collected indicated that approximately 12% of children in the population sample had good oral hygiene and 68% had plaque on their teeth on various degrees of severity. Calculus was found in 21% of children³. Since plaque and calculus may be predisposing factors to periodontal disease, emphasis on oral hygiene education is essential.

It is acknowledged that the information used to make conclusions on prevalence of dental caries and other indicators of oral health is various years old, nevertheless, the trend of dental disease reported in the three surveys conducted in 1979, 1984 and 1991 confirms that no marked improvement on oral health has, or can be achieved, unless more efficient public health measures are implemented in Grenada. It should be noted however, that in order to properly assess the present oral health status, establish baseline information for fluoridation programs and estimate the number and type of dental professionals necessary to satisfy the needs of the population in Grenada, an oral health survey needs to be conducted. The PAHO recommends inclusion of children of 6-8, 12 and 15 years of age in surveys intended to be used as baseline data for fluoridation programs. If resources are available, other conditions such as dento-facial anomalies and malocclusion could be included in the survey, since according to the 1991 results, this was a serious problem in children. Information on these indicators would need to be updated if orthodontic programs within the public health setting are contemplated for the future to satisfy the needs of children.

Since no surveys have been conducted to study oral health status and dental treatment needs of adult population, it is recommended that a survey be conducted targeting at least two adult age groups. This would conform with the WHO recommendations to include subjects 35-44 and 65-74 years of age. This survey may be conducted at the same time as the one targeting children, or can be programmed to be conducted at a later date.

Dental health professionals, dental clinics, type of services and cost

There are 14 dental surgeons in Grenada registered to practice dentistry. Assuming a total population of about 98,000, the dentist to population ratio in Grenada is approximately 1:7,000. In the public health sector there are 1 Senior Dental Surgeon, 7 dental surgeons and 5 dental auxiliaries (dental nurses). One dental auxiliary has also received training as a dental technician. There are also 3 dental orderlies. This personnel make up the Dental Department of the Ministry of Health. The organizational chart is enclosed in the appendix as part of the Corporate Plan prepared by the Department Senior Dental Surgeon⁴.

Functions of the Senior Dental Surgeon include responsibility for planning, administration, management of dental staff and provision of clinical procedures.

The seven Dental Surgeons are responsible for provision of services to adult population and children target groups. Dental Auxiliaries primary function is to provide services to the school population. Dental Orderlies assist dental surgeons and auxiliaries on provision of dental services.

There is a General Hospital in St. George's, a smaller hospital in Mirabeau on the east coast, and one in Carriacou. The Maxillo-facial Surgeon provides specialty services at the General Hospital in the operating theater and at St. George's Clinic on a voluntary basis. It has been recommended to establish a paid permanent post for this specialty; this would save cost for related services being paid to professionals in Trinidad. It was referred that between 10 to 20 patients require specialty services such as consolidation of fractures, cysts and tumor removals, cleft palate repair and other dental complications. Typical fees for each fracture treated in Trinidad are between \$ 6,000 to 9,000. Securing the services of the Maxillo-facial Surgeon would be an asset for the Dental Department since services on this specialty would be readily available, and would eliminate the need for patients to have to travel abroad with the consequent economic savings.

There are other dental clinic facilities available in the Tri island State of Grenada where dental services are provided. These are: St. George's, St. John's, St. John's Anglican School, St. Patrick's, Grand Bras clinic at St. Andrew's and Harvey Vale School clinic in Carriacou, St. Mark's and smaller clinics in Carriacou and Petite Martinique.

George's Clinic has three dental units, Grand Bras two. The rest of the clinics have single operatories. The clinic structure is part of the Corporate Plan and it is enclosed in Appendix.

Type of dental services

Members of the dental department provide three basic types of dental services: preventive, restorative and emergencies which includes relief of acute or chronic pain and some surgical procedures.

The most outstanding objective set forth by the Dental Department of Grenada is to be able to provide preventive measures rather than curative treatment.

One activity that must be highlighted on this regard, is the preparation and efforts towards implementation of a national fluoridation program. As noted elsewhere in this report, the Dental Department has worked for over a decade trying to achieve this goal. The proposal for developing a salt fluoridation program in Grenada, was prepared and endorsed by the dental department. The proposal for developing such program has been approved by the Ministry and the Grenada Cabinet.

A preventive program that must be mentioned since it has been in place for several years, is the fluoride rinse program. This program is provided at most primary schools in the nation. The target population is approximately 33,000 children. It is estimated that

supplies for this program in 1998 would cost approximately \$ 4,300.00 EC dollars, equivalent to about US \$ 1,610. Mr. Aldwyn Francis a Dental Auxiliary is in charge of this program. He has devoted over 19 years of his professional career to public health service in Grenada for which he deserves to be commended

Other preventive programs focus on prevention of periodontal disease by stressing oral hygiene practices to children and adults.

Two important aspects of prevention that are practiced by personnel of the dental department are the vaccination against Hepatitis B to all members of the dental staff and emphasis on asepsis and use of barrier techniques during provision of dental services to minimize cross infection possibility in the dental clinics.

In relation to restorative treatment (fillings and sealants), services are provided to children in ages 3-18 years. Adults are also treated, however, priority is given to children. It has been referred that with present financial and human resources it would not be feasible to provide restorative services to the entire population of Grenada.

Restorative treatment is an important component of the dental program. Fillings restore function of teeth, chewing of foods can be accomplished efficiently and without pain, improving nutrition. Esthetics and appearance are also improved and well being. In many cases phonetics can also be improved particularly when anterior teeth are restored. Fillings also reduce the number of teeth that could be lost due to caries if left untreated.

In 1990 7,930 restorations were provided. In 1996, a total of 10,763 restorations were provided by the Dental Department of the Ministry of Health. The projections for 1997 are to increase the number of restorations to 16,200 in 1997 and 21,000 in 1998. Two Dental Auxiliaries were employed by the Dental Department prior to October of 1995. Since then, three additional Dental Auxiliaries have been employed. Dental Auxiliaries are the main providers of restorations to the school children.

Emergencies is another treatment provided to the population to alleviate acute or chronic pain. It is interesting to note that the number of extractions have decreased since 1990, when a total of 13,818 teeth were extracted. This would give a ratio of 1:1.7 of teeth restored versus teeth extracted. In 1996, 12,985 teeth were projected that would be extracted, corresponding to a ratio of 1:1.2. In 1997 projections are that teeth extracted would amount to 11,200 which would correspond to a ratio of 1:0.7. For the year 1998 this ratio is projected to decrease to 1:0.5 meaning that more restorations than extractions would be provided, confirming the aims of saving more teeth.

Cost of services

Preventive services including prophylaxis are provided free of charge to children. In private practice, usual fees for prophylaxis ranges between \$ EC 60.00 to 80.00

Restorative treatment is provided basically subsidized by the Government. A nominal fee of \$ 5,00 EC (US \$1.90) is paid by the patient. In the private sector , amalgam fillings cost between \$ EC 65.00 to 80.00 and composite resins between \$ EC 75.00 to 90.00.

Extractions cost \$ EC 2.00 at the public health clinic and about \$ EC 40.00 to 50.00 in the private sector.

Other dental health programs

In addition to clinical treatment, the dental department has a dental health education program using mass media information systems. The department also supervises dental health education in schools and participates on community dental health education activities. Dental health education is stressed at all government clinics.

In collaboration with the Food and Nutrition Council, a brochure titled “A Healthy Mouth for a Healthy Body” has been produced to stress good nutrition and oral hygiene. This brochure targets literate population. Brochures with similar information but targeting illiterate population has been planned to be produced in 1998.

These educational programs are considered of vital importance in improving oral health of the population. It is contemplated that information on benefits of salt fluoridation should be included in future programs. Close collaboration with the Food and Nutrition Council is considered not only important but essential.

The dental department also participates in continuing education programs. In the past, some of these programs were facilitated by the American Dental Association through the Health Volunteers Overseas (HVO). Requests for funding have been made for dental staff to participate in scientific conventions abroad.

Postgraduate training program in dental public health and orthodontics is considered a necessity by dental department staff. Presently, the Senior Dental Surgeon is on study leave pursuing training in one of this areas.

Two other activities were reported by the dental department, maintenance of equipment and procurement of supplies. Proper maintenance of equipment is obviously indispensable. Several issues that require attention and strengthening have been identified by staff from the dental department.

Acquisition of supplies also deserves consideration for proper and efficient delivery of health care to the population. Weakness in this area has been also identified. Delays in acquisition and insufficient quantities can be a limiting factor in providing adequate care.

Universal precautions to minimize risks of cross infections in the dental clinic must be fully implemented. This requires that adequate quantities of mechanical barriers, such as masks, gloves, equipment covers etc., chemical solutions and supplies be available to protect the patient and dental health professional.

Services provided through foreign organizations assistance

Various foreign organizations have provided some type of dental services in the country, however, various post-treatment problems have been reported. Often these organizations are allowed to operate without informing the Dental Department administrative officer. Individuals or institutions permitted to provide dental services should coordinate their activities through the Senior Dental Officer. The quantity of services provided through this arrangements is not considered that would significantly improve oral health of the population.

Requirements for practicing dentistry

Information available at the time of the consultation was somewhat vague. It was referred however, that in order to practice dentistry in Grenada, the individual must provide evidence of qualifications and duly register with the Ministry of Health.

Perspective for oral health improvement

Taking into account the present number of dental professionals, their work load, condition and functions of the existing dental clinics. It would be difficult to meet the treatment needs of the population. Additional dental auxiliaries and acquisition of a mobile dental unit or portable dental equipment would permit more efficient provision of dental care to children at the school site. The adult population also requires consideration for improving their oral health. Unfortunately their status and treatment needs is not well known at the present time. Special consideration should also be given to the elderly. Inclusion of these age groups in future oral health surveys would be essential.

3. Sources of fluoride ingestion and water fluoridation experience

In most populations water is considered one of the main possible sources of fluoride ingestion. Studies to determine the concentration of water supplies is therefore imperative prior to implementation of fluoridation programs. The availability of products containing fluoride has considerably increased over the last decades. Fluoride in products may be present in various concentrations. It is important therefore, to identify these sources particularly those available to young children. Some Toothpastes may contain a relatively high concentration of fluoride. Carbonated drinks prepared with fluoridated

water need also be studied. Fluoride supplements specifically made for prevention of dental caries such as drops, tablets or vitamins containing fluoride must also be identified, and their use by physicians or dentists need to be ascertained. Foods as a source of Fluoride need also be explored. Special diets or predilection for certain foods should also be taken into account. Information on other uses of fluoride in dental prevention programs need also be recorded.

No current data exists on availability of fluoride in drinking water in Grenada. There are multiple treatment facilities for water distributed throughout six Parishes not including Carriacou and Petite Martinique. Six types of facilities were described: Bore hole, mechanical pressure filter, protected shallow spring, reservoir, slow sand filter and fast sand filter.

It was referred that potable water reaches 94% of the population of Grenada, which is considered an excellent coverage. The National Water and Sewage Department has a laboratory equipped for performing routine tests on turbidity, chlorination and coliform bacteria (a sample of tests reports on water quality, distribution and type of water treatment facilities in the Parishes is enclosed in the appendix). No tests are conducted on fluoride concentration since this is not a requirement. It was noted however, that the laboratory could conduct fluoride analysis using a spectrophotometer.

No fluoridation of water supplies exists at this time in Grenada. It was referred however, that in the mid seventies fluoridation of one source of water, "Mardigras" in the Parish of St. George's was attempted. The equipment was part of a donation from the Canadian Government. There was no other information available to the consultant on the type of fluoride solution used, its concentration, population coverage and actual period of water fluoridation program. What it is known is that the equipment was not properly maintained, corroded, and fluoridation had to be discontinued, although no precise information is available of exact dates⁵.

Since data on the concentration of fluoride in the water for human consumption is not existent in Grenada, and further, since this is one of the components of chemical monitoring of the epidemiological surveillance system recommended by they PAHO for countries desiring to implement fluoridation programs, it is recommended that base line data be collected on fluoride concentration in water supplies being used for human consumption in all Parishes.

Considering the number of treatment facilities being used for provision of potable water to the population of Grenada, it would be expensive to set up fluoridation equipment at each treatment facility, unless water sources could be channeled to a lesser number of treatment facilities. Further, strict monitoring of operation, proper dose and maintenance of fluoridation equipment would be imperative. Nevertheless, the possibility of water fluoridation could not be ruled-out.

No data exists on other sources of possible fluoride ingestion. Use of fluoride tablets, drops or vitamins containing fluoride is estimated to be limited mainly associated with its cost. No information was available on the use of fluoridated Toothpastes by pre-school children. It was referred that dentifrices are imported from US or Trinidad where manufacturing facilities exist under concession from US companies.

Recommendations were made to conduct baseline studies on Toothpaste availability and use by pre-school children, availability over the counter and/or prescription by physicians and dental surgeons of fluoride supplements such as fluoride drops, tablets or vitamins containing fluoride and any other dental products containing fluoride and used in preventive dental programs in pre-school and school children.

The consultant recommended to approach the Board of Trade to explore availability of data regarding importation of toothpastes, fluoride supplements and other dental products that might be labeled to contain fluoride. This data could serve as starting point for the survey.

4. Nutrition status of children

No comprehensive nutritional surveys are available at this time. It is estimated that a 4 to 5% of children suffer from malnutrition. On the other hand, overweight is frequent in children. It is known however, that iron deficiency exists. A program to promote use of fortified flour exists, but monitoring tests are rather expensive and this prevents the Food and Nutrition Council from exercising a more strict monitoring of food products⁶.

No studies have been conducted on other Micronutrients deficiency. No data is available on urinary fluoride excretion.

Concurrence with a national program to reduce dental caries in the country was expressed by the Director of the Food and Nutrition Council. It was expressed that some of the existing concerns on use of fluoridated salt might be due to insufficient information on metabolism of fluorides and program experiences in other countries. It is therefore recommended to make available such information for a better understanding of the mechanisms of action of fluoride. Development of educational material for the community at large would also be necessary.

In consideration of the relationship between nutrition and oral health, and being a component of epidemiological surveillance system recommended by the PAHO, emphasis was made on the importance of developing nutritional studies targeting pre-school children.

5. Salt Industry

There are no salt processing plants currently in Grenada. A plant was operating years ago, but activities were finished due to expansion of the airport grounds. At this

time, all salt being used in the country is imported. Information provided in the Five Year Development Plan for the Dental Department of Grenada for 1990-1994, dated July 1988⁷ indicated that according to data corresponding to 1988, salt was being imported from four countries, Canada, Jamaica, United States and United Kingdom.

Two types of salt were described that were imported, Common Salt and Table Salt. Quantities and origin of Common Salt imported were: Canada 254 "Tonnes"; Jamaica 136 "Tonnes" and United Kingdom 40 "Tonnes". Table salt was imported from United States 1,584 kilos and from United Kingdom 891 kilos. No other information was available. According to the Census, the population of Grenada in 1981 was 89,088 and 95,597 in 1991. It is estimated that the population in 1988 was approximately 90,000.

From information facilitated by the Bureau of Standards and the Bureau of Trade, Yearly Statistics by Commodity⁸, Salt is imported under five classifications or commodities: Table Salt in retail packages of no more than 2.5 kilograms, (commodity 278310), Other Table Salt (commodity 278320), Rock Salt (commodity 278330), Salt Liquors (commodity 278350) and Other (commodity 278390). The following Tables have been prepared from this information and summarize the country of origin, type of salt, quantities imported per year and CIF cost in Eastern Caribbean currency for each of years 1993 through 1996. A calculation of unitary cost in US dollars at a rate of exchange of \$ EC 2.67 per \$ 1.0 US dollar was done for illustrative purposes.

**Sources of Imported Salt, Type, Quantity and CIF cost in SEC
in 1993**

Commodity	Country	Type	Weight in kilos	CIF cost in EC	Unit cost US\$*
278310	England	Table Salt	43	355	3.09
	USA		2,310	6,795	1.10
278320	Canada	Other Table Salt	191,936	144,036	0.28
	England		62,043	50,261	0.81
	Jamaica		145,151	82,550	0.57
	Trinidad		40,500	24,080	0.59
278330	England	Rock Salt	200	548	1.03
	Trinidad		3,600	882	0.09
	USA		567	2,398	1.58
278350	USA	Salt Liquor	13	5,404	155.7
278390	Barbados	Other	62	489	2.95
	Germany		75	804	4.01
	Ireland		37	1,929	19.5
	USA		17,421	17,205	0.37
Totals			463,958	337,736	

Adapted from Yearly Statistics by Commodity. Imports, Nomenclature SITC
Ranking by Commodity

The largest supplier of Table Salt in 1993 was Canada, followed by Jamaica. England ranked third and Trinidad fourth, and last USA at a much smaller scale.

In terms of Rock Salt, Trinidad ranked first, USA second although some five and one half times lower quantities and England with only 200 Kg.

Salt Liquors were not imported in large scale, only 13 Kg were reported to have been imported from USA.

No specific information was available as to the Other type of salt imported under commodity 278390. In this category, the USA was the largest supplier with 17,421 Kg compared to Germany 75, Barbados 62 and Ireland 37.

**Sources of Imported Salt, Type, Quantity and CIF cost in \$EC
in 1994**

Commodity	Country	Type	Weight in Kg	CIF cost in \$EC	Unit cost US\$*
278310	England	Table Salt	3,198	7,965	
	Trinidad		3,109	2,062	
	USA		8,806	12,625	0.54
278320	Canada	Other Table Salt	107,092	87,419	0.31
	England		82,850	48,740	0.22
	Jamaica		39,916	22,691	0.21
	Trinidad		92,290	65,493	0.27
	USA		21,342	14,968	0.26
278330	England	Rock Salt	200	462	0.87
278340	India	Pure Sodium Chloride	2,000	451	0.084
278390	Trinidad	Other	250	516	0.77
	USA		5,366	16,222	1.13

Adapted from Yearly Statistics by Commodity. Imports, Nomenclature SITC
Ranking by Commodity

In 1994, Canada remained the largest supplier of Table Salt. Trinidad ranked second with some 11,693 Kg less than Canada. England was the third largest supplier with some 24,000 Kg less than Canada. The quantity of salt imported from Jamaica, dropped about 105,000 Kg from the previous year figures. The USA was last with 21,342 Kg which correspond to about five times less than the largest supplier for this year.

The only supplier for Rock Salt in 1994 was England and the amount of salt imported was merely 200 Kg.

India supplied 2,000 Kg of pure Sodium Chloride. No information was available to the consultant as to the specific intended uses.

Other salt imported under commodity 278390 came from the USA as the main supplier followed by Trinidad with a fraction of the amount supplied by USA.

**Sources of Imported Salt, Type, Quantity and CIF cost in SEC
in 1995**

Commodity	Country	Type	Weight in Kg	CIF cost in \$EC	Unit cost US\$*
278310	England	Table Salt	1,974	5,233	0.99
	Trinidad		1,470	448	0.11
	Ukraine		11	54	1.84
	USA		3,377	6,170	0.68
278320	Barbados	Other Table Salt	2,319	14,710	2.37
	Canada		168,111	88,128	0.20
	England		127,500	73,288	0.22
	Trinidad		46,095	43,285	0.35
	USA		1,911	53,416	10.46
278330	USA	Rock Salt	1	224	83.89
278390	England	Other	40	977	9.15
	USA		365	2,079	2.13
Total			353,174	288,012	

Adapted from Yearly Statistics by Commodity. Imports, Nomenclature SITC
Ranking by Commodity

In 1995, Canada remained the largest supplier of Table Salt. England increased the supply by some 41,000 Kg from the previous year. Trinidad ranked third, but the supply was less than half from that imported during the previous year. The USA also contributed to the supply of Table Salt this year, although quantities were less than in 1994. Barbados supplied about half of the amount imported from USA. Some 11 Kg were also reported to have been imported from Ukraine.

Statistics indicate that only 1 Kg of Rock was imported from US. No other information was available to verify this figure.

Under Other Salt, USA supplied 365 Kg and England 40. Again, no specifics were available at this time as to the intended uses of this type of salt.

**Sources of Imported Salt, Type, Quantity and CIF cost in \$EC
in 1996**

Commodity	Country	Type	Weight in Kg	CIF cost in \$EC	Unit cost US\$*
278310	England	Table Salt	61	429	2.63
	USA		6,665	8,721	0.49
	Venezuela		180	321	0.67
278320	Canada	Other Table Salt	86,377	61,703	0.27
	England		146,000	86,098	0.22
	Japan		7	10	0.54
	Trinidad		42,500	28,380	0.25
	USA		66,320	54,845	0.31
	Venezuela		2,000	13,889	2.60
278330	Trinidad	Rock Salt	11,986	3,727	0.12
278350	Japan	Salt Liquor	25	23	0.34
278390	Barbados	Other	944	1,509	0.60
	Jamaica		1,113	1,872	0.63
	USA		5,496	4,665	0.32
	Venezuela		250	56	0.08
Total			369,924	266,248	

Adapted from Yearly Statistics by Commodity. Imports, Nomenclature SITC
Ranking by Commodity

In 1996, England took the first place as the largest supplier of Table Salt. Imports increased by 16,526 Kg from 1995. Canada remained a strong supplier, although the total of salt imported in 1996 was about half from that of 1995. The USA considerably increased the supply of Table Salt last year, and ranked third with close to 73,000 Kg corresponding to an increase of almost 68,000 Kg over the previous year. Trinidad took fourth place, but the quantity imported reflected a drop of about 5,000 Kg from the previous year. Its total supply of Table salt was about one third of that imported from England. Venezuela supplied a lesser amount of Table Salt than other countries, the total Table Salt imported was 2,180 Kg.

The main supplier for Rock Salt was Trinidad. The quantity imported in 1996 was about three times of that imported in 1993. No Rock Salt was imported from this country in 1994 or 1995.

Salt Liquors imports in 1996 were merely 25 Kg from Japan.

The main supplier for Other Salt under commodity 278390 was the USA with 5,496 Kg, followed by Jamaica with 1,113 and Barbados with 994 Kg. Venezuela contributed with 250 Kg. As in previous year the intended use of this type of salt needs further clarification.

**Total Table Salt Imported in Grenada in retail packages and bulk from 1993-1996
Kg**

Country	1993	1994	1995	1996	Totals
England	62,086	86,048	129,474	146,061	423,669
Canada	191,936	107,092	168,111	86,377	553,516
USA	2,310	30,148	5,288	72,985	110,731
Trinidad	40,500	95,399	47,565	42,500	225,964
Jamaica	145,151	39,916			185,067
Barbados			2,377		2,377
Venezuela				2,180	2,180
Ukraine			11		11
Japan				7	7
Total	441,983	358,603	352,826	350,110	1,503,522

Adapted from Yearly Statistics by Commodity. Imports, Nomenclature SITC

From this Table it can be deduced that the largest suppliers of Table Salt over the last four years have been Canada, England, Jamaica, The USA and Trinidad. During 1996, England was the largest supplier of Table Salt and Canada the second. The USA gained considerable terrain, and it was the third largest supplier in 1996. Total Table salt imported from USA over the last four years amounts to 110,731 Kg.

Table salt imports from Jamaica (which contains fluoride), were high in 1993 and dropped two thirds in 1994, and it was discontinued thereafter. Reasons for such change were described to be related to delays in shipping and a more costly product.

Although, the largest suppliers have been Canada and England, Trinidad is considered an important and convenient source due to its geographical proximity to Grenada, fast delivery of shipments and advantageous economics since Trinidad currency exchange rate is worth about half of the Eastern Caribbean Dollar. From 1993 to 1996, Trinidad supplied twice as much salt as the USA, and in 1996 Trinidad occupied the fourth place as supplier of salt.

Venezuela is emerging as supplier of Table Salt, although its contribution started in 1996 at a very low scale. Nevertheless, its vicinity to Grenada and the availability of fluoridated salt in that country should be taken into consideration. However, it is important to remember that the concentration of fluoride in salt in Venezuela is only 90 mg/kg, which has demonstrated to be too low to produce any benefit in preventive dental

caries. Therefore, if fluoridated salt is to be purchased from Venezuela, it should be required that the concentration be adjusted to 250 mk/Kg as recommended by PAHO.

Since it is assumed that not only Table Salt is consumed and ingested by the population, Further, other countries are supplying salt in other forms. The following Table has been adapted to illustrate all forms of salt imported in Grenada with the corresponding countries of origin over the last four year period.

**Total Salt Imported in All Forms in Grenada Over a Four Year Period
Kg**

Country	1993	1994	1995	1996	Totals
England	62,286	86,248	129,514	146,061	424,109
Canada	191,936	107,092	168,111	86,377	553,516
USA	20,311	35,514	5,654	78,481	139,960
Trinidad	44,100	95,649	47,565	54,486	241,800
Jamaica	145,151	39,916		1,113	186,180
Barbados	62		2,319	944	3,325
Venezuela				2,430	2,430
India		2,000			2,000
Germany	75				75
Ireland	37				37
Japan				32	32
Ukraine			11		11
Totals	463,958	366,419	353,174	369,924	1,553,475

Adapted from Yearly Statistics by Commodity. Imports, Nomenclature SITC

The highest year of importation was 1993, but it decreased about 100,000 kilograms in 1994. In the period 1994 to 1996 imports were very similar.

The information presented in the Tables can be used to conclude that with a population in Grenada estimated at 98,000, the amount of salt that needs to be available for the country to meet the needs of the population equals the total amount imported. It is acknowledged, that not all salt would be used for human consumption. Some may have industrial type applications that are not precisely identified at this time. If calculations are based on the total amount of Table Salt imported, each person would consume approximately 3.57 Kilograms per year or 9.78 grams per day. This figure is close to what other countries in the Pan American Region have reported.

The amount of Rock Salt imported in 1993 was 4,367 kilograms and in 1994 only 200 kilograms. In 1995 only 1 kilogram was reported, but this data might be in error. If the 1996 data is used, Trinidad was the only supplier of this type of salt with 11,986 kilograms. Presumably this salt would be for human consumption, if amounts of Table Salt are added to those of Rock Salt, assuming a population of 98,000 each person would consume approximately 3.69 kilograms per year or 10.1 grams per day.

If all salt imported in Grenada would be used for human consumption, each person would consume about 3.77 Kilograms per year or about 10.3 grams per day. The intended purpose of Salt Liquors, Other salt under commodity 278390 would need to be clarified to confirm this assumption.

Population estimates for 1997 and 1998 are not expected to increase dramatically. The amount of salt being imported has been similar over the last four years and it is not expected that quantities consumed would change the present estimates. Thus, it seems reasonable to utilize a pattern of salt consumption per capita of about 9.7 grams per day. If marked changes are confirmed, proper adjustments can be made accordingly.

It must be taken into account, that only a proportion of the salt consumed is actually ingested. Part of the salt is used for cooking and also added to prepared foods. Some salt is lost during the cooking process. In actuality an adult individual may only ingest between 2 to 5 grams of salt per day, depending of preferences. Some countries in the Region however, claim that salt consumption in the Region might be as high as 5 to 7 grams. Studies are still needed to confirm these assumptions, but for general estimates, these figures can be used in planning process of fluoridation programs. Urinary excretion studies should assist on obtaining more accurate information on this particular issue.

If it is assumed that the daily consumption of salt is 9.7 g per day or 10 grams, with an estimated population of 98,000, a total of 346,969 Kilos (approximately 347 metric Tons) would satisfy the needs of the population of Grenada. This figure closely corresponds to the total amount of salt imported in 1996 (369,924 Kilos or approximately 370 Metric Tons). This amount would leave a about 23 Metric Tons possibly used in industrial applications not for human consumption. No data is available on the actual amount of salt ingested per person, but considering consumption patterns this amount is probably not much different to other countries of the Region.

Importers, Distributors of salt, distribution network and prices

Salt is imported directly from the suppliers by individual companies or individuals. As in other countries, importers sell to wholesale distributors, packers, supermarkets, small grocers, bakeries and restaurants. Salt is also sold to food caterers and food processors. Canning and other food packing is not considered an active industry at this time. Limited sales are made directly to institutions. In addition, some importers distribute the salt which had been re-packed in plastic bags directly to individual customers.

Importers and distributors of salt in Grenada.

George F. Hugging & Co. LTD, Mr. Christopher David, Managing Director
Jonas Browne & Hubbards LTD
Ross Foodstuff Traders LTD
Independence Agencies LTD

Food Processors

Capricorn Enterprises LTD
De La Grenade Industries
Grenada Foods LTD

Wholesale Grocers

Hubbard's Agency Dept
Huggins Geo F & CO LTDA
St. John Ruppert Trading Enterprise

Retail Grocers

There are approximately nineteen retail grocers, thirteen of which are located in St. George's parish, one in St. John's, two in Carriacou, one in St. Andrew's, one in St Mark's, and one in St. Patrick's.

Restaurants and Hotels

There about seventy seven restaurants varying in size some of which have operations in association with hotels. There are approximately thirty seven hotels also varying in size and availability of restaurant facilities.

Forms of salt available to the public

The forms of salt presented to the public correspond to the various commodities under which it is imported. The following Table describes some of the products available in retail stores, their presentation, country of origin, whether they contain or not iodine or fluoride, retail price and the possible corresponding commodity number.

Typical forms of salt available in retail stores, size, micro nutrient, country of origin, price and possible corresponding commodity number

Brand	Container	Size	Iodine	Fluoride	Origin	Price \$ EC	Possible Commodity
Morton	Carton	1.1 Lb.	Yes/No	No	USA	2.65* 2.75	278310
Valrico	Carton	1.1 Lb.	No	No	USA	2.86* 2.90	278310
Shurfine	Carton	1.1 Lb.	No	No	USA	2.10	278310
Cerebos	Plastic	750 grams	Yes/No	No	England	4.70	278310
IGA	Carton	1.1 Lb.	No	No	USA	2.25	278310
?	Bag	1 Lb.	?	?	?	0.54	278320
?	Bag	2 Lb.	?	?	?	1.08	278320
?	Bag	2 Lb.	?	?	?	1.16	278320
Morton Rock	Carton	3 Lb.	?	?	USA	3.65	278330
Morton Kosher	Carton	4 Lb.	?	?	USA	?	278330
? Crystals	Bag	1 Lb.	?	?	?	2.00	278330
Schwartz Hickory smoke salt	Plastic	104 grams	?	?	Canada	4.95	278320 ?
Garlic salt	Plastic	250 grams	?	?	Canada	4.95	278320 ?
Onion salt	Plastic	250 grams	?	?	Canada	4.95	278320 ?
Accent	Plastic	4.5 ounces	?	?		15.90	278320 ?

* Price Range

? Unmarked or not given

Quality Control

At the present time there is no strict control on the quality of imported salt. The assumption is that salt producers comply with established world-wide standards for food grade salt. Technical expertise is available in Grenada to reinforce quality control standards and to conduct chemical tests required in the standards. There is evidence that some tests have been conducted to determine iodine presence in salt.

6. Fluoruration of Salt for Human Consumption and Legal Framework

The recommendation for implementing a salt fluoridation program in Grenada goes back as far as 1985 when development of such program was recommended by the Senior Dental Surgeon. This recommendation was made again in 1989 as part of the Five Year Development Plan for the Dental Department⁷. In 1990 a PAHO consultant Dr. Rosalie Warpeha who visited Grenada also recommended to “implement a national salt fluoridation program soon”. At a higher level, in July of 1990, at the twelfth meeting of the Conference of Ministers responsible for health, the Conference endorsed the need for continued support of the salt fluoridation program for monitoring and evaluating the impact of fluoridated salt in prevention of dental caries in member states”. In 1991, Dr. L. Aponte-Merced who directed the oral health survey conducted in Grenada, also recommended the use of salt fluoridation and further recommended that “it would be appropriate to pass legislation that required that all salt imported to Grenada be fluoridated”.

In 1995 the Grenada Dental Association and Government Dental Department unanimously endorsed a proposal for a salt fluoridation program in Grenada. The Grenada Medical Association endorsed this proposal in 1996.

In 1997, Dr. Crofton Stroud, Senior Dental Surgeon of Grenada, provided preliminary information on oral health status of the population as well as preventive measures that are currently in place in an attempt to reduce dental caries in children. In spite of the limited success achieved and the magnitude of the problem throughout the country, and taking into consideration the success achieved by several countries that have implemented systemic fluoridation programs for caries reduction, a proposal for developing a salt fluoridation program was prepared and presented to the Ministry of Health and the Cabinet for consideration and approval for its implementation in Grenada.

The Ministry and the Cabinet approved the proposal for development of this program. The Dental Department requested to the Grenada Bureau of Standard, the preparation of a Regulatory Standard which would require that all salt imported into the country be fluoridated.

In 1997, the Dental Department of the Ministry of Health, endorsed by the Grenada Dental Association requested to the Grenada Bureau of Standards the development of a Standard for “Fluoridated and Iodized Salt”.

Staff from the Bureau conducted a pre-specification research for salt⁹. The research contemplated various issues such as: demand, present countries supplying salt, quantities, availability of fluoridated salt in the Caribbean, consumer complaints, standards stipulating fluoride concentration in salt, other data available from the WHO, probable sale of standards and prospects of implementation by purchasing agents (importers).

The Bureau's report of the pre-specification research on salt, concur that fluoridated salt would be an appropriate method to prevent dental caries in all population.

The following concerns were raised in the research report:

1. Supplies of fluoridated salt may not be available and price may increase
2. Importing only fluoridated salt would limit consumer's choice
3. "No Regional or International Standard was located which stipulates Fluoride concentration used in Food Grade Salt".
4. "From the Bureau's point of view, although this standard may be beneficial, this would not prove cost effective for GDBS (Grenada Bureau of Standards) because there is presently no manufacturer of salt in Grenada".

The Bureau of Standards through the Secretary of its Technical Committee, Mr.L Simeon Collins made the following recommendations:

1. "A Standard for iodized and fluoridated salt be delayed temporarily for the following reasons:

1.1 The development of a standard to ensure that the national population use only fluoridated and iodized salt would leave consumers with no choice to opt out of such scheme and use, if they wanted unfluoridated salt or uniodized salt.

1.2 There is only one manufacturer of fluoridated salt in the Caribbean and therefore it would be unwise to legislate that salt imported into Grenada be fluoridated since shortages may occur on the domestic market from time to time.

1.3 Fluoridation and Iodization of salt is likely to cause a significant increase in price of the salt.

2. Importers of salt and the MNIB should be approached to bring in fluoridated salt to Grenada and a public education programme be conducted to sensitize the population on the importance of using such salt.

3. A consumer awareness programme should be initiated in order to raise consumer awareness of the importance of iodized salt which is presently imported into Grenada."

The decision to delay temporarily development of a Standard for fluoridated and iodized salt was communicated on 10 October 1997, to Dr. Jerome Keens-Douglas, Acting Senior Dental Surgeon by Dr. Peter Radix, Director of Grenada Bureau of Standards.

Meeting with officials from Grenada Bureau of Standards

A meeting with Mr. Simeon Collins, Technical Manager, and another staff person from the Bureau was held on November 21 1997 at the Bureau Headquarters office in Grenada. Dr. Jerome Keens-Douglas, Acting Senior Dental Surgeon also attended the meeting.

The main purpose of this meeting was to clarify the Bureau's position on development of a standard for fluoridated salt as well as to clarify any questions that might exist on the nature of such program. Further, to describe the PAHO's multi-year plan for fluoridation of the Americas and explain the rationale for collecting information for the purpose of conducting an institutional analysis for a salt fluoridation program in Grenada.

The point raised in regards to limiting the consumer's choice to purchase unfluoridated or iodized salt is debatable. Most countries that have instituted fluoridated water instead of salt could face the same situation. It is true that anti-fluoridation groups have opposed public health administrators claiming infringement on free choice. As noted on the literature, "undoubtedly they are responsible for many of our children continuing to have bad teeth⁴".

Both forms of salt, fluoridated and unfluoridated can be made available into a country, but certainly the cariostatic effect will be greatly be reduced. It was emphasized that Ministries of Health have an obligation to protect the welfare of the population and also the right to select and implement the most suitable, cost-effective interventions for improving health.

The concern on possible shortage of supply of salt deems consideration. It is true that in the Caribbean, Jamaica is the only country with an established record of processing and exporting fluoridated salt. It is also acknowledged that distance and shipping may delay supplies, although understanding the country demands and consumption pattern, timely orders could be placed to minimize such problem. It was informed to the Bureau, that the Dominican Republic has initiated a program of salt fluoridation. Costa Rica, Venezuela, Mexico, Colombia, Peru, Ecuador, Bolivia and Uruguay also produce and export fluoridated/iodated salt. Other countries in the American Region are also at various stages of development such programs, these are: Honduras, Nicaragua and Panama.

This year work has also been initiated to establish fluoridation programs in Belize and Paraguay. These two countries do not produce salt and depend on imports to satisfy their needs.

It is acknowledged that shortages of salt supplies should be prevented and various sources of this product should be made available. As more countries decide to implement salt fluoridation programs, availability of this product in the international market undoubtedly increase. Considering that Trinidad is an important supplier of salt, and imports into Grenada more likely will increase, questions were raised as to the interest on

this country to fluoridate salt. This would greatly simplify matters if Grenada opts to implement a Standard that require that all salt brought into the country be fluoridated, with the concentration recommended by the Pan American Health Organization.

The issue of price increase was also discussed. The cost of fluoridating salt is very small and it is not expected to be a factor in price increase. According to information on quantities of salt imported and countries of origin, it was concluded that actually the CIF price per kilogram of fluoridated salt imported from Jamaica in 1993 was slightly cheaper than that imported from Trinidad without fluoride. Jamaica salt costs about \$ EC 0.57 (US \$ 0.21) compared to \$ EC 0.59 (US \$ 0.22). In 1994, CIF price per kilo of Jamaica salt was \$ EC 0.57 (US \$ 0.21) and Trinidad salt was \$ EC 0.71 (US \$ 0.27).

CIF price per kilogram of Canadian salt without fluoride in 1994 was \$ EC 0.82 (US \$ 0.30) which is considerable higher than fluoridated Jamaican Salt. CIF price of salt from England was \$ EC 0.59 (US \$ 0.22) which is still slightly higher than Jamaican salt.

Another issue discussed at the meeting was the non existence of regional or international standards which stipulates the fluoride concentration used in food grade salt. The consultant explained that various countries have enacted or were in the process of legislation or preparation of standards for this purpose. These Countries are, Colombia (200 ± 20 mg/Kg), Switzerland (250 ± 50 mg/Kg) Mexico (250 ± 50 mg/Kg), Venezuela (90 mg/Kg), Dominican Republic (250 ± 50 mg/Kg), Ecuador (250 ± 50 mg/Kg), Peru (250 ± 50 mg/Kg), Bolivia (250 ± 50 mg/Kg), Costa Rica (200 ± 20 mg/Kg), Jamaica (250 ± 50 mg/Kg), Honduras (250 ± 50 mg/Kg), Nicaragua (250 ± 50 mg/Kg) and Uruguay (250 ± 50 mg/Kg).

The consultant offered to request to the PAHO Regional Oral Health Office, that copies of existing Standards and Drafts or Regulations to existing Standards be made available to the Grenada Bureau of Standards to assist on the preparation of a Standard for Grenada as well as test methodology for determination of fluoride in salt.

Mr. Collins mentioned that if a requirement for fluoride in salt was part of an International Standard such as the Codex Standard for Food Grade Salt, a World-wide Standard (Codex Stan 150-1985)¹⁰, it would be easier for countries to require that all salt imported into the country would be required to have fluoride in the proper concentration.

A copy of Codex Standard was made available to the consultant. The Scope of this Standard “applies to salt used as an ingredient of food, both for direct sale and for food manufacture. It applies also to salt used as a carrier of food additives or nutrients. Subject to the provisions of this standard more specific requirements for special needs may be applied”.

The Scope is clear in its intended purpose. Use of salt as a carrier is also clearly permitted. In fact the Standard requires that “food grade salt shall be used when salt is used as a carrier for food additives or nutrients for technological or public health reasons.”

Examples of such preparations are mixtures of salt with nitrate and/or nitrite (curing salt) and salt mixed with small amounts of fluoride, iodide, iron, vitamins, etc., and additives used to carry or stabilize such additions.”.

It is important to note that the Standard requires that “Where salt is used as a carrier for one or more nutrients, and sold as such for public health reasons, the name of the product shall be declared on the label, for example “salt fluoridated”, “salt iodated”, “salt iodized”, “salt fortified with iron”, “salt fortified with vitamins” and so on as appropriate.”.

The Standard also mentions that an indication of the origin, or method of production may be declared on the label, i.e., sea salt, underground rock salt, or natural brine.

The above provisions of the Codex Standard should clarify matters about possible trade restrictions that could be brought up or challenged by salt exporting countries.

The inquiry on part of the Grenada Bureau of Standards about including a requirement for fluoride in a world-wide standard would not be appropriate. It is known that some countries have adjusted the concentration of fluoride in drinking water for prevention of dental caries. Others, may have adequate concentration of natural fluoride in the water for human consumption. Adding fluoride to salt would provide higher concentrations of fluoride than that considered optimum with serious consequences. The PAHO strongly recommends that there should only be a single source of systemic fluoride in a national fluoridation program. Based on the scientific information available to this date, the optimum concentration of fluoride to be added to salt is 250 ± 50 mg/Kg.

On behalf of the Grenada Bureau of Standards Mr. Collins expressed willingness to collaborate on the development of a Standard that would benefit the population of Grenada. He emphasized however, that supply of fluoridated salt would be a factor that could affect expediting development of a standard. He suggested that salt processing companies in Trinidad be contacted to explore the possibility of adding fluoride to the salt been exported or for their national consumption.

The recommendations for educational campaigns made by the Bureau are in agreement with the PAHO recommendations and as such form integral part of a national salt fluoridation program. It was emphasized that these campaigns should not also target the community, but should focus on re-educating the health professional on the benefits of systemic fluoride for all age groups.

7. Economic Feasibility of a National Salt Fluoridation Program

The economic feasibility study is one of the indispensable requirements prior to the implementation of any fluoruration program and it is one of the recommendations of the PAHO. It is very important to have an estimate of the health condition of the population, cost of curative treatment, costs of the elements used in the fluoridation program, number of processing plants, installation, equipment, production, demand, distribution of salt and

anticipated benefits that would be obtained if a program is implemented. The extent of coverage should also be taken into account as well as other elements inherent to the program.

In a cost:benefit analysis it is important to consider factors such as depreciation of currency, level of risk that could affect the intervention, social distribution of the anticipated benefits and other intangible factors¹¹. The following parameters are established in the present study:

1. The analysis is calculated using USA dollars because of the relative stability of this currency and to somewhat control inflationary effect.
2. The level of risk that could affect the intervention is considered minimal taking into consideration the technological resources required for developing the program, as respects to production and from the administrative aspect.
3. It is estimated that the benefits of the intervention will be heterogeneous, depending on age and socio-economic status of the beneficiaries. Therefore, it is necessary to consider dental morbidity and the benefits of the program in the sense that those who will benefit the most, will be groups of lower socio-economic level.
4. It is known that in absence of a preventive program, occurrence of dental caries and its associated complications cause indirect costs, such as loss in work productivity, missing school days, family suffering, pain and other intangible factors. In spite of their importance, these factors, as well as those considered as indirect factors, are not included in this analysis in order to maintain simplicity.

The cost:benefit analysis implies establishing a ratio between real estimated costs of a program and its anticipated or obtained benefits, both expressed in monetary terms. A program is considered successful or desirable if the benefits exceed its costs^{11,12}. The question whether it is worth or not investing in a program for prevention of dental caries from the public health point of view and that of the people who have to pay for dental services, depends of the cost:benefit ratio.

Taking into consideration programs developed in various countries of the Region, it can be affirmed that the anticipated cost will be less than the benefits obtained, as result of a reduction of curative and restorative procedures in the public health clinics as well as in the private sector, during a specific period, and in a specific population group. This is explained by the fact that, by implementing a prevention program with fluoridated salt with national coverage, significant savings of resources will be obtained, since if such caries preventive program was not existent, it would be necessary to intervene to cover the cost of clinical restorative procedures.

Costs of developing a salt fluoridation program in Grenada

The main costs of implementing a salt fluoridation program are related to equipment acquisition, maintenance, purchase of fluoride compound, additional personnel that might be considered necessary, required training, monitoring and quality control at the processing plant. All these costs would not be applicable to countries that do not produce salt and that consequently depend on imports. Costs of the program are related to baseline studies (studies on fluoride availability in drinking water, oral health survey including three age groups of children 6-8, 12 and 15 years of age, salt consumption, nutrition, urinary fluoride excretion, and use of fluoride supplements and dentifrices by pre-school children). In addition, acquisition of laboratory equipment and supplies for monitoring fluoride concentration in salt, and the corresponding cost of training of personnel.

Baseline studies:

1. Fluoride availability in drinking water. \$ 14,729

Costs estimated for this component cover:

a) Acquisition of laboratory equipment, (meters, specific ion electrodes, chemical solutions and supplies needed for determination of Fluoride). The equipment can be used for analysis of fluoride in water, salt and urine. (\$ 6,249)

b) Travel. This expense includes transportation of staff from the Ministry of Health of Grenada, to water collection sites, per diem expenses for team members and fuel for local vehicle. (\$2,080)

c) Technical assistance, training of personnel, census design, samples evaluation and travel expenses for consultant \$6,400

2. Oral Health Survey \$ 19,585

a) Dental instruments (WHO Probes), dental mirrors, consumable supplies (gauze, gloves, disinfectants), office supplies, communication (\$3,860)

b) Transportation of examining team to examination sites, per diem, fuel for vehicle (\$2,800)

c) Technical Assistance. Survey design, calibration of examiners for oral health surveys, data entry, data management, analysis and consultant travel (\$12,925). This cost would need to be adjusted if more than one consultant participates in the survey.

3. Fluoride Excretion in Urine studies. \$18,100

a) Laboratory glass and plastic ware, water baths, precision balance, chemical solutions and other consumable supplies (\$6,750)

b) Travel expenses for Ministry of Health staff. Transportation, per diem, fuel (\$1,500)

c) Technical Assistance. Consultant services, training in urinary fluoride excretion studies, survey design, data analysis (9,850)

4. Survey on use of fluoride supplements, dentifrices, salt consumption \$5,500

Another expense that should be contemplated is the cost of producing materials for community educational programs aimed to enhance understanding of benefits of ingesting fluoridated salt, and also educational programs targeting health professionals. The cost of developing this program is somewhat related to the collaboration from government agencies for production of television and radio programs. It is important that the design of this program includes not only talks, but group discussions and adequate audio visual supporting material. Thus there will be need to develop written material, information brochures, posters, radio announcements and television spots. It is estimated that such program could cost \$20,000 for the first year, and approximately \$43,000 over six years.

8. Anticipated Benefits of the Salt Fluoridation Program in Grenada

The following are the factors used in the calculation of anticipated benefits:

1. The population on which the benefits of the program are calculated is only on 25% of the total population of the country since access to dental services public and private is not universal.
2. Caries incidence is difficult to estimate, unless surveys conducted utilize the same criteria for examination and the same age specific population groups. Information available indicates that incidence rates might be greater than one new carious lesion per person per year. Taking into account the estimated coverage of the program to the population the number of caries prevented after the induction year, would amount to 24,500 with a 13.4% annual increase corresponding to population growth (according to the Annual Abstract of Statistics) and the expected increase in dental services demand. If the projected number of restorations per year (21,000) is added to the projected number of extractions as a result of caries, it would amount to 31,500 curative procedures that would not to have to be provided. Although, this figure is perhaps more realistic than 24,500 corresponding to one fourth of the population as noted above, the latter will be used for estimating cost:benefit of the program.

According to information provided by the Department of Oral Health, dental care services are offset by the Grenada government. A nominal charge of EC \$ 5.00 is imposed for restorative services and \$2.00 for extractions to children up to 18 years of age. It is emphasized that approximately 48% of the population in Grenada in 1996 were under 19 years of age; this corresponds to 46,159.

The cost of providing curative services includes actual cost of producing the service, this includes dental health professional salaries, materials and other inherent costs such as facilities, equipment, utilities and administrative expenses. For the purpose of estimating anticipated benefits of the salt fluoridation program, costs related to producing the service as well as an average of administration, equipment and utilities cost will be taken into account. It is acknowledged that dental health professionals providing the service might pertain to different seniority or rank, which could reflect variations in cost of producing the same type of dental curative service. Thus, an average cost including time required for its provision as well as utilization of ancillary personnel (orderly) and necessary materials and other consumable and disposable supplies will be used. It is known that in the private sector, the cost of producing curative treatment is much higher than in the public health sector. This cost ranges from US \$ 22.00 to 26.00 (EC \$ 60.00 - 70.00).

The actual cost to the government for providing a dental curative treatment (restorative extraction, palliative etc.) at the public health setting is estimated to be at least US \$6.50. This merely would cover the corresponding cost of time devoted by the dental health professional and ancillary personnel in producing the service. In reality, this figure corresponds to about 40% of the total cost of providing the service. The remainder 60% corresponds to administrative, materials, equipment and utilities and it is estimated to be an additional \$11.25 or a gross cost per service of US \$17.75. If all patients would pay US \$1.90 (EC \$5.00) for partial offsetting each service, the actual cost to the government for providing each service would be US \$ 15.85. This figure was used for calculating savings as result of not utilizing dental services. The worth of savings over the five year period of the program would be US\$ 2,536,505.

3. The net benefit or net savings estimated (benefit minus cost) for the five years of the program would be US \$ 2,380,350.

The cost:benefit ratio would be 1:16. If costs were estimated at \$ 24.00 for each caries prevented, the cost:benefit ratio would be 1:25.

4. The discount rate used to calculate the actual worth of the benefits is 12% per year, this figure is used by international financing agencies^{13,14,15,16}. The average amount of the estimated actual worth of the discounted savings would be US \$ 329,880 per each year during the five years of actual program development.
5. It is important to take into consideration that in the estimated benefits, the indirect savings as result of pain, family suffering, loss of income and productivity, transportation, school absenteeism etc. Like wise, benefits obtained from long term prevention of lesions like endodontic treatment, teeth loss and their respective replacement are not included. This calculations are considered unnecessary for the purpose of demonstrating the short term benefit of a salt fluoridation program for the prevention of dental caries.

9. Results

The main purpose of this study was to examine the economic feasibility of a program to fluoridate salt for human consumption as a public health massive method for the short term prevention of dental caries in the population of Grenada. The methodology used was an analysis of the anticipated costs and benefits of such intervention over a period of five years.

If the program was implemented, its total cost would be approximately US \$156,155. The benefits would be prevention of 24,500 dental caries (with an initial coverage of 25% of the population, this would be translated into savings of US \$ 388,325 for not utilizing curative dental services in the public health sector. According to this, the cost:benefit ratio would be 1:16. Therefore for each 1 dollar invested in the program, the country would save approximately US \$ 16 for not paying the costs of providing services, which would be unavoidable if the preventive program would not exist. Considering that providing curative treatment could cost US \$ 24.00, the cost:benefit ratio would be 1:25. Thus, the sensibility analysis demonstrates that the salt fluoridation program would have an excellent economic perspective in terms of the investment made.

Dental caries affects individuals from all socio-economic status, however, it is known that disease severity varies and that individuals from low socioeconomic population groups are more severely affected. Consequently, the salt fluoridation program would benefit on a higher degree the populations from this socioeconomic group, particularly children. Introducing a principle of equity and social justice which makes the program more desirable from the political point of view.

From experiences in other countries, it is known that the salt fluoridation program has a high degree of sustainability¹⁷. First, it is acknowledged that initial costs are relatively moderate. In countries that process salt, it has been possible to establish a financing mechanism through soft credits that allows the salt industry to purchase equipment and conduct indispensable personnel training, and be able to recover the money in a relatively short period of time. If financial sustainability is understood as the capacity of the health system to generate and assign sufficient resources to develop the envisioned activities and maintain an acceptable coverage level¹⁸, the salt fluoridation program has a high probability of becoming self sustainable in a short term. The resources necessary for its implementation and sustainability are reasonable, and a favorable predisposition exists from private industry as well as from philanthropic or financing institutions, to provide technical assistance. These favorable conditions have resulted from the successful experiences of the iodation of salt program, in which the costs have been recovered without difficulty.

The fluoridation of salt for human consumption is method acceptable by the community. Although water fluoridation has similar preventive effect, production, distribution and maintenance costs are higher, and coverage depends of the availability of water distribution networks. Thus, population groups that are located in rural or marginal areas may not have access to water and not benefit from the program.

Salt has been utilized as a vehicle for addition of micro nutrients such as iodine in several countries. Coverage reaches close to 100% of the population. The addition of iodide and fluoride to salt for human consumption has become one of the most desirable public health measures for controlling and reducing goiter and dental caries respectively. The great experiences and benefits obtained in other countries of the region and the favorable predisposition of various agencies give the program high probabilities of success.

Resources Available for Development of a Salt Fluoridation Program in Grenada

The salt fluoridation program for reduction of dental caries requires the economical and technical support of the agencies or institutions interested in promoting and looking after the oral health of the population. These would include government, private, local or international institutions.

The consultant had the opportunity to meet with the Permanent Secretary of Health, the Chief Medical Officer, the Senior Dental officer, The Director of Food and Nutrition Council, representative from the Grenada Bureau of Standards and the Bureau of Trade. These individuals expressed great interest in collaborating with the program. This is considered very important, since all these government agencies would have an important role in implementing and monitoring the program.

In the private sector also exists willingness to collaborate. The president of the Dental Association and individual practitioners considered that since the program would benefit the population of Grenada they would be willing to collaborate with it. A representative from one of the importing companies also expressed his willingness to cooperate for the benefit of the people of Grenada. It was discussed that perhaps international institutions that provide assistance for health programs such as USAID, UNICEF, the Rotary Club International, Kiwanis Club, and others could possibly collaborate. Unfortunately, these institutions do not have a local agency in Grenada and no meetings could be arranged during the consultant's visit. It was questioned whether the Pan American Health Organization could perhaps intercede or assist in locating funds from institutions such as the W. Kellogg Foundation for including Grenada in the multi-year plan for fluoridation of the region of the Americas. The consultant agreed to forward the request to the Oral Health Regional office to explore this possibility.

Another possible sources of funding that were suggested were, the World Bank, the Inter American Development Bank and foreign governments that have ongoing assistance programs in Grenada.

There are other resources in the country that could possibly collaborate with the salt fluoridation program. An example would be the Water and Sewage Department to identify the various sources of drinking water and distribution networks, and facilitate the acquisition of samples to determine the amount of fluoride present and establish a national census. The dental profession in general, particularly the Grenada Dental Association are important elements to give credibility and support to the program, since the activities for health promotion and prevention of dental caries are somewhat complementary to the

work provided by the dental profession for the welfare of the community. It is critical to take into account the need to emphasize the importance of the salt fluoridation program as a preventive measure, and seek the support of all health professionals of the country. To achieve this, it might be necessary to design refreshing courses that provide scientific sound information on the latest developments, experiences and benefits of salt fluoridation programs.

Possible Sources of Collaboration for Development of a Salt Fluoridation Program in Grenada

Location	Public	Private
Local	<u>Ministry of Health:</u> Medical Officer, Dental Department, Food and Nutrition Council, Bureau of Standards, Bureau of Trade, Water and Sewage Department. Hospitals and clinics	<u>Health Professions:</u> Dental and Medical Professionals. Allied Health Professionals <u>Industry:</u> Importers, Wholesale distributors, Grocers - Restaurants, Hotels. <u>Institutions:</u> Clinics
International	OPS, UNICEF, USAID, World Bank, Inter American Development Bank, Foreign Governments, CARICOM	W. K. Kellogg Foundation, Kiwanis Club, Rotary Intl. Salt Industry from Countries selling salt to Grenada

10. Conclusions

- 1. The Government of Grenada has approved a proposal for developing a salt fluoridation program in the country. The program contemplates requiring that all salt for human consumption imported into the country should have the recommended concentration of fluoride for the prevention of dental caries.**
- 2. The use of salt as a carrier for nutrients such as fluoride, for public health reasons is contemplated in the Codex Standard for Food Grade Salt, a world-wide Standard. The Standard also mentions that when salt is used as a carrier for one or more nutrients, and sold as such for public health reasons, the name of the product shall be declared properly on the label, for example, "salt fluoridated", "salt iodated".**
- 3. Adding nutrients to salt is an acceptable practice that would not conflict with the world-wide standard. The standard acknowledges the existence of such practice for public health reasons, consequently, requiring that salt imported into the country shall contain fluoride in the recommended concentration would not constitute a barrier on trade.**
- 4. The country can adapt standards used in other countries and follow established guidelines by the PAHO¹⁹ to design a standard that would include requirements to be met by salt producers as it relates to fluoride content and quality characteristics for all salt for human consumption to be imported into the country.**
- 5. A communication to this effect would need to be prepared by the Ministry of Health to be distributed to all importers so that they can in turn alert all salt producers from whom they conduct business. This communication should be issued with sufficient time ahead of the date on which the standard will become into effect.**

11. Recommendations

1. **Organize a commission for salt fluoridation with representatives from the Ministry of Health (Medical Department, Dental Department, Food and Nutrition Council), Bureau of Standards, Department of Trade, Private Industry (importers, distributors, grocers), Dental Association, Chamber of Commerce and other parties that might have interest and associated responsibilities.**
2. **Designate an individual who will coordinate activities of the fluoridation program.**
3. **Initiate as soon as possible the preparation of the standard.**
4. **Explore funding sources for development of baseline studies.**

These could be staggered, initiating with water analysis, oral health survey on dental caries and fluorosis, use of fluoride compounds and dentifrices by pre-school children, and urinary fluoride excretion.

5. **Assign responsibilities for the agency that would be in charge of monitoring compliance with the standard.**
6. **Assure that proper equipment and elements are available for chemical and biological monitoring of fluoride, and adopt recommended practices for epidemiological surveillance of the salt fluoridation program.**
7. **Develop an educational program to inform the community on the benefits of ingesting fluoridated salt for prevention of dental caries, safety, effectiveness and efficacy of the program, and to clarify possible concerns on the use of salt as a vehicle. Government agencies or private institutions may collaborate with this type of activity.**
8. **Develop a schedule of activities and establish a quality control and progress report program to assure that activities are developed on time and in accordance with respective guidelines.**

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Analysis of the Anticipated Cost and Benefits of the Salt Fluoridation Program in Grenada
1998

YEARS OF EXECUTION

COSTS	0	1	2	3	4	5	TOTALS
Equipment	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Fluoride	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Personnel	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Training	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Maintenance	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Quality Control	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Monitoring and Evaluation	\$5,000	\$6,000	\$8,000	\$5,000	\$5,000	\$5,000	\$32,000
Baseline Studies	\$20,489	\$8,251					\$28,740
Technical Assistance including travel	\$19,325	\$9,850	\$8,705	\$3,076	\$3,076	\$2,050	\$48,081
Educational Programs	\$20,000	\$8,000	\$8,000	\$5,000	\$5,000	\$3,334	\$49,334
TOTAL COST	\$84,814	\$32,101	\$22,705	\$13,076	\$13,076	\$10,384	\$156,155

(thousands US)

BENEFITS

Country Population	98,000						
Carries prevented	25 % of population	13.4	%/year after induction year	31,508	35,728	40,515	160,032
Saved Costs	US \$ 15.85 for caries prevented			\$499,369	\$566,284	\$642,166	\$2,536,505
TOTAL BENEFITS	(US)	\$0	\$440,361	\$499,369	\$566,284	\$642,166	\$2,536,505

5 YEAR COSTS

\$156,155
2,536,505

(US)
(US)

Cost Benefit Ratio

16

SENSIBILITY ANALYSIS

ANTICIPATED COSTS AND BENEFITS OF THE SALT FLUORIDATION PROGRAM

GUENADA 1998

EXECUTION YEARS

COSTS	(US)	0	1	2	3	4	5	TOTAL	Benefit per \$1 Invested
TOTAL COST		\$64,814	\$32,101	\$22,705	\$13,076	\$13,076	\$10,384	\$156,155	
BENEFITS	(US)								
Population Caries prevented	98,000 25 % pop. + 13.4 % annual after year 1		24,500	27,783	31,506	35,728	40,515	160,032	
Saved costs US	\$15.85 per caries prevented	\$0	\$388,325	\$440,361	\$499,369	\$566,284	\$642,166	\$2,536,505	16
Saved costs US	\$24.00 per caries prevented		\$588,000	\$666,792	\$756,142	\$857,465	\$972,366	\$3,840,765	25
Caries prevented	50 % population + 13 % annual increment		49,000	55,566	63,012	71,455	81,030	320,064	
Saved costs US	\$15.85 per caries prevented		\$776,650	\$880,721	\$998,738	\$1,132,569	\$1,284,333	\$5,073,010	32
Saved costs US	\$24.00 per caries prevented		\$1,176,000	\$1,333,584	\$1,512,284	\$1,714,930	\$1,944,731	\$7,681,530	49

COSTS AND BENEFITS ASSOCIATED WITH A SALT FLUORIDATION PROGRAM FOR PREVENTION OF DENTAL CARIES IN GRENADA IN A FIVE YEAR PERIOD

	PROGRAM YEARS					
	0	1	2	3	4	5
Discounting annuity rate	A	0.893	0.797	0.712	0.636	0.567
TOTAL COSTS						
Costs of fluoridation (US\$)	B	\$32,101	\$22,705	\$13,076	\$13,076	\$10,384
TOTAL BENEFITS						
No. of caries prevented	C	24,500	27,783	31,508	35,728	40,515
Treatment Savings (US\$)	D	\$386,325	\$440,361	\$499,369	\$566,284	\$642,166
Net savings (US\$)	E	\$291,410	\$417,656	\$486,293	\$553,209	\$631,782
Actual value of the discounted savings (US\$)		\$280,229	\$332,872	\$346,241	\$351,841	\$358,220
TOTALS						
						\$156,155
						180,032
						\$2,536,505
						\$2,380,350
						\$1,649,403

A) Its calculated at end of year at 12% annual

B) Includes initial costs and first year.

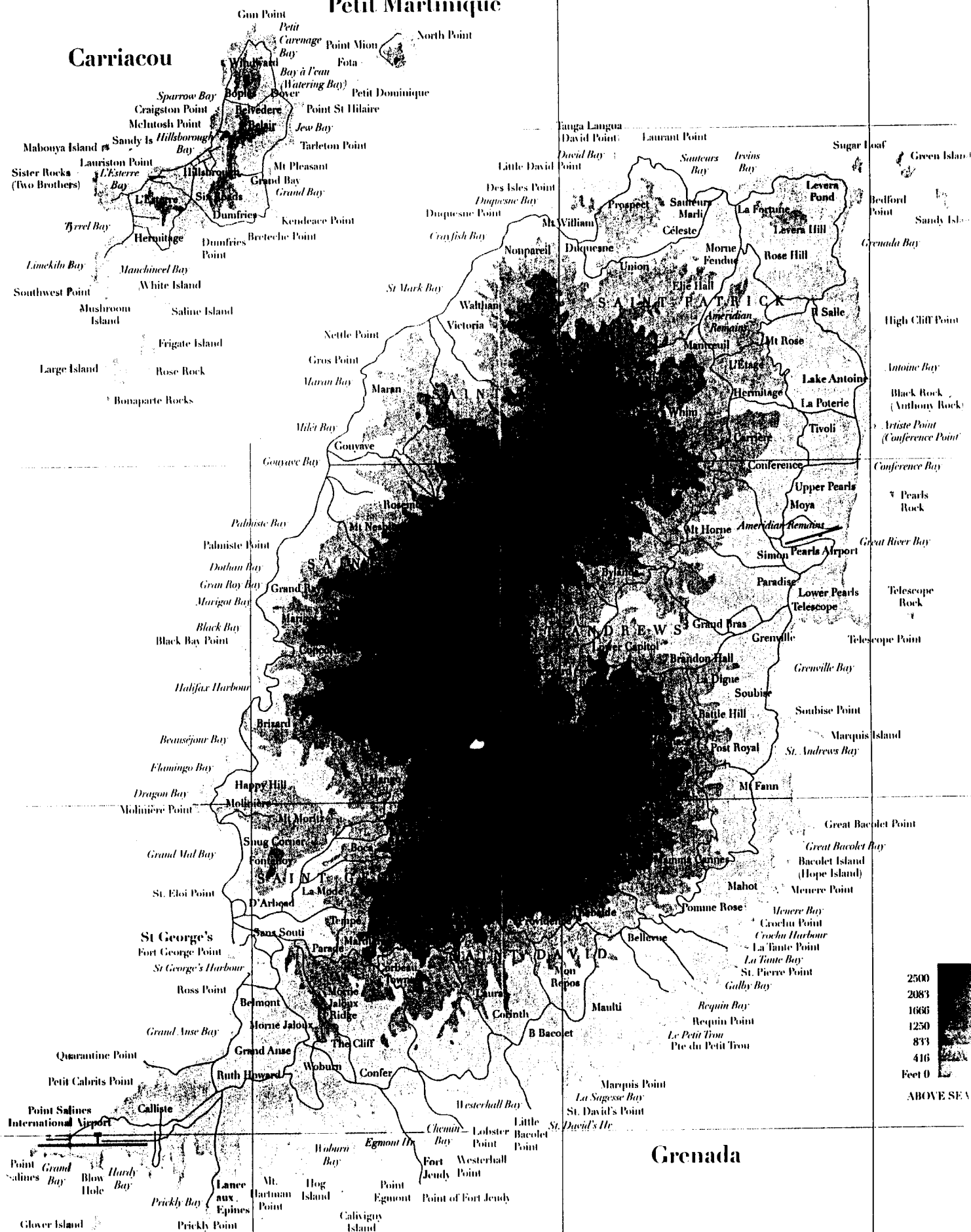
C) An initial impact on 25% of the total population of the country is assumed, beginning on the second year of the program, with an additional reduction of 13.4% on caries incidence.

D) A value of U.S. \$ 15.85 per caries prevented was calculated from data supplied by the Dental Department and estimates from other countries

E) Costs of year 0 and 1 are taken into account.

Carriacou

Petit Martinique



CODEX STAN 150-1985

Codex Standard for Food Grade Salt

World-wide Standard

1 Scope

This standard applies to salt used as an ingredient of food, both for direct sale to the consumer and for food manufacture. It applies also to salt used as a carrier of food additives and/or nutrients. Subject to the provisions of this standard more specific requirements for special needs may be applied. It does not apply to salt from origins other than those mentioned in Section 2 **1:10**, notably the salt which is a by-product of chemical industries.

2 Description

Food grade salt is a crystalline product consisting predominantly of sodium chloride. It is obtained from the sea, from underground rock salt deposits or from natural brine.

3 Essential Composition and Quality Factors

3.1 Minimum NaCl Content

The content of NaCl shall not be less than 97% on a dry matter basis, exclusive of additives.

3.2 Naturally Present Secondary Products and Contaminants

The remainder comprises natural secondary products, which are present in varying amounts depending on the origin and the method of production of the salt, and which are composed mainly of calcium, potassium, magnesium and sodium sulphates, carbonates, bromides, and of calcium, potassium, magnesium chlorides as well. Natural contaminants may also be present in amounts varying with the origin and the method of production of the salt.

3.3 Use as a Carrier

Food grade salt shall be used when salt is used as a carrier for food additives or nutrients for technological or public health reasons. Examples of such preparations are mixtures of salt with nitrate and/or nitrite (curing salt) and salt mixed with small amounts of fluoride, iodide, iron, vitamins, etc., and additives used to carry or stabilize such additions.

4 Food Additives

All Additives used shall be of food grade quality.

Where salt is used as a carrier for one or more nutrients, and sold as such for public health reasons, the name of the product shall be declared properly on the label, for example "salt fluoridated", "salt iodated", "salt iodized", "salt fortified with iron", "salt fortified with vitamins" and so on, as appropriate.

An indication of either the origin, according to the description on Section 2 (1:10), or the method of production may be declared on the label, provided such indication does not mislead or deceive the consumer.

7.2 Labelling of Non-Retail Containers

Information for non-retail containers shall either be given on the container or in accompanying documents, except that the name of the product, lot identification and name and address of the manufacturer or packer shall appear on the container. However, lot identification and the name and address of the manufacturer or packer may be replaced by an identification mark, provided that such mark is clearly identifiable with the accompanying documents.

8 Methods of Analysis and Sampling

8.1 Sampling

See Appendix (1:1)

8.2 Determination of Sodium Chloride Content

This method allows the calculation of sodium chloride content, as provided for in Section 3.1 (1:14), on the basis of the results of the determinations of sulphate (Method 8.4), halogens (Method 8.5), calcium and magnesium (Method 8.6), potassium (Method 8.7) and loss on drying (Method 8.8). Convert sulphate to CaSO_4 and unused calcium to CaCl_2 , unless sulphate in sample exceeds the amount necessary to combine with calcium, in which case convert calcium to CaSO_4 and unused sulphate first to MgSO_4 and any remaining sulphate to Na_2SO_4 . Convert unused magnesium to MgCl_2 . Convert potassium to KCl . Convert unused halogens to NaCl . Report the NaCl content on a dry matter basis, multiplying the percentage NaCl by $100/100-P$, where P is the percentage loss on drying.

8.3 Determination of Insoluble Matter

According to ISO 2479-1972 "Determination of matter insoluble in water or in acid and preparation of principal solutions for other determinations".

8.4 Determination of Sulphate Content

According to ISO 2480-1972 "Determination of sulphate content. Barium sulphate gravimetric method".

8.5 Determination of Halogens (6:29)

According to ISO 2481-1973 "Determination of halogens, expressed as chlorine. Mercurimetric method" (for the recovery of mercury from the laboratory waste, see Annex of ECSS/SC 183-1979).

8.6 Determination of Calcium and Magnesium Contents

According to ISO 2482-1973 "Determination of calcium and magnesium contents. EDTA complexometric methods".

8.7 Determination of Potassium Content

According to ECSS/SC 183-1979 "Determination of potassium content by sodium tetraphenylborate volumetric method" or alternatively according to ECSS/SC 184-1979 "by flame atomic absorption spectrophotometric method".

8.8 Determination of the Loss on Drying (Conventional Moisture)

According to ISO 2483-1973 "Determination of the loss of mass at 110°C".

8.9 Determination of Copper Content

According to ECSS/SC 144-1977 "Determination of copper content, Zinc dibenzylthiocarbamate photometric method".

8.10 Determination of Arsenic Content

According to method ECSS/SC 311-1982 "Determination of arsenic content. Silver diethyldithiocarbamate photometric method".

8.11 Determination of Mercury Content

According to method ECSS/SC 312-1982 "Determination of total mercury content. Cold vapour atomic absorption spectrometric method".

8.12 Determination of Lead Content

According to method ECSS/SC 313-1982 "Determination of total lead content. Flame atomic absorption spectrometric method".

8.13 Determination of Cadmium Content

According to method ECSS/SC 314-1982 "Determination of total cadmium content. Flame atomic absorption spectrometric method".

Method for Sampling of Food Grade Salt for Determination of Sodium Chloride

1 Scope

This method specifies the sampling procedure to be applied when determining the main component in order to assess the food grade quality of sodium chloride (salt) as provided for in the Codex Standard for Food Grade Salt, Section 3: "Essential Composition and Quality Factors" (1:13).

The criterion to be used for acceptance or rejection of a lot or consignment on the basis of this sample is also provided.

2 Field of Application

This method is applicable to the sampling of any type of salt intended for use as food, either prepacked or in bulk.

3 Principle

This method represents a variables sampling procedure for mean quality: blended bulk sample analysis.

A blended bulk sample is produced in such a way that it is representative of the lot or consignment. It is composed of a proportion of items drawn from the lot or consignment to be analyzed.

Acceptance criterion is on the basis that the mean value obtained from analyses of those blended bulk samples must comply with the provision in the Standard.

4 Definitions

The terms used in this sampling method refer to those in the "Instructions on Codex Sampling Procedures" (CX/MAS 1-1987).

5 Equipment

The sampling equipment used should be adapted to the nature of the tests to be carried out (for example: sampling by borer, sampling equipment made of chemically inert material, etc.). The containers used for collecting the samples should be made of a chemically inert material and should be air-tight.

6 Procedure

6.1 Prepacked Salt

Sampling may be carried out by "random sampling" or by "systematic sampling". The choice of the method to be used depends on the nature of the lot (for example: if the packages are marked with successive numbers, systematic sampling may be suitable).

6.1.1 Random sampling

Draw the n items from the lot in such a way that each item in the lot has the same chance of being selected.

6.1.2 Systematic sampling

If the N units in the lot have been classified and can be numbered from 1 to N , the 1-in- k systematic sampling of n items can be obtained as follows:

1. Determine the k value as $k = N/n$. (If k is not an integer, then round to the nearest integer).
2. From the first k items in the lot take one at random and then make every k th item thereafter.

6.2 Salt in Bulk

Here, the lot is fictitiously divided into items (strata); a lot with a total mass of m kg is considered to be composed of $m/100$ items. In this case, it is necessary to draw up a "stratified sampling" plan appropriate to the lot dimension. The samples are selected from all the strata in proportion to the stratum sizes.

Note: Stratified sampling of a population which can be divided into different subpopulations (called strata) is carried out in such a way that specified proportions of the sample are drawn from the different strata.

6.3 Constitution of the Sample

The size and the number of the items forming the sample depend on the type of salt and the lot magnitude. The minimum size to be taken into account should be in accordance with one of the following specifications according to the circumstances:

- 250 g of salt in bulk or prepacked in more than 1 kg packages;
- one package for prepacked salt in 500 g or 1 kg packages.

Concerning the number of samples to be drawn from the lot, an example of minimum sample number that would be picked up, can be found in the document CX/MAS 1-1987, Appendix V, Table 3, taking into account the magnitude of the lot and appropriate inspection level, in this case generally level 4 (see paragraph 8.4 in the same document).

Combine and mix well the different items drawn from the lot. This blended bulk sample constitutes the laboratory

sample. More than one laboratory sample may be composed in such a manner.

7 Acceptance Criterion

Determine the NaCl content (%) of at least two test portions of the laboratory sample.

Calculate the average of the results obtained for the n test portions of the laboratory sample using:

$$\bar{x} = \sum x/n \quad (n \geq 2)$$

In accordance with the provision for the relevant NaCl content (%), a lot or a consignment shall be considered acceptable if the following condition is verified:

- \geq minimum level specified

8 Sampling Report

The sampling report should contain the following information:

1. type and origin of the salt;
2. alterations of state of the salt (e.g. presence of foreign matter);
3. date of sampling;
4. lot or consignment number;
5. method of packing;
6. total mass of lot or consignment;
7. number, unit mass of packages and whether the mass is given net or gross;
8. number of items sampled;
9. number, nature and initial position of sampled items;
10. number, composition and mass of the bulk sample(s);
11. and the method used to obtain and conserve it (them);
12. names and signature of people who have carried out the sampling.

9 Basic Reference

Document CX/MAS 1-1987.

10 Remark

"Laboratory sample" is the "blended bulk sample" described in CX/MAS 1-1987, Appendix IV, paragraph 4-B.

27 Footnote: ■ Sodium and potassium ferrocyanides, maximum level may be 20mg/kg when used in the preparation of "dendritic" salt.

29 Footnote: ■ An alternative method for the determination of halogens by using silver nitrate is being studied.

NATIONAL WATER AND SEWERAGE AUTHORITY

Engineering Division - Production & Quality Control Section

WEEKLY REPORT ON ANALYSIS OF DRINKING WATER SAMPLES FOR THE PERIOD 3rd - 7th November, 1997

NO.	TREATMENT FACILITY	TYPE	QTY. OF SAMPLES COLLECTED			PARAMETERS (Average)					REMARKS	
			Neg	Pos	Total	Pos Samples Code No.	Total Coliform (1/100 ml)	Fecal Coliform (1/100 ml)	Free Chlorine (mg/L)	Turbidity (NTU)		pH
ST. GEORGE'S												
1	HANNANDALE	RSF	5		5				0.52	3.24	7.30	Chlorination Satisfactory
2	IRON ACCORD	SSF			0							
3	3 CHEMIN VALLEY I	BH			0							
4	4 CHEMIN VALLEY II	BH			0							
5	5 CHEMIN VALLEY III	BH			0							
6	6 CHEMIN VALLEY IV	BH			0							
7	7 CHEMIN VALLEY V	BH			0							
8	8 CHEMIN VALLEY VI	BH			0							
9	9 CHEMIN VALLEY VII	BH			0							
10	10 CHEMIN VALLEY VIII	BH			0							
11	11 CHEMIN VALLEY IX	BH			0							
12	12 CHEMIN VALLEY X	BH			0							
13	13 CHEMIN VALLEY XI	BH			0							
14	14 CHEMIN VALLEY XII	BH			0							
15	15 CHEMIN VALLEY XIII	BH			0							
16	16 CHEMIN VALLEY XIV	BH			0							
17	17 CHEMIN VALLEY XV	BH			0							
18	18 CHEMIN VALLEY XVI	BH			0							
19	19 CHEMIN VALLEY XVII	BH			0							
20	20 CHEMIN VALLEY XVIII	BH			0							
21	21 CHEMIN VALLEY XIX	BH			0							
22	22 CHEMIN VALLEY XX	BH			0							
23	23 CHEMIN VALLEY XXI	BH			0							
24	24 CHEMIN VALLEY XXII	BH			0							
25	25 CHEMIN VALLEY XXIII	BH			0							
26	26 CHEMIN VALLEY XXIV	BH			0							
27	27 CHEMIN VALLEY XXV	BH			0							
28	28 CHEMIN VALLEY XXVI	BH			0							
29	29 CHEMIN VALLEY XXVII	BH			0							
30	30 CHEMIN VALLEY XXVIII	BH			0							
31	31 CHEMIN VALLEY XXIX	BH			0							
32	32 CHEMIN VALLEY XXX	BH			0							
ST. ANDREW'S												
1	1 BELLEVUE	SSF			0							
2	2 BRANDON HALL	SSF			0							
3	3 BRABEAU	SSF			1				0.80	1.18	7.70	Chlorination Satisfactory
4	4 BURNING	SSF			1				1.00	0.81	7.00	Chlorination Satisfactory
5	5 BURNING	SSF			1							
6	6 BURNING	SSF			0							
7	7 BURNING	SSF			0							
8	8 BURNING	SSF			0							
9	9 BURNING	SSF			0							
10	10 BURNING	SSF			0							
11	11 BURNING	SSF			0							
12	12 BURNING	SSF			0							
13	13 BURNING	SSF			0							
14	14 BURNING	SSF			0							
15	15 BURNING	SSF			0							
16	16 BURNING	SSF			0							
17	17 BURNING	SSF			0							
18	18 BURNING	SSF			0							
19	19 BURNING	SSF			0							
20	20 BURNING	SSF			0							
21	21 BURNING	SSF			0							
22	22 BURNING	SSF			0							
23	23 BURNING	SSF			0							
24	24 BURNING	SSF			0							
25	25 BURNING	SSF			0							
26	26 BURNING	SSF			0							
27	27 BURNING	SSF			0							
28	28 BURNING	SSF			0							
29	29 BURNING	SSF			0							
30	30 BURNING	SSF			0							
31	31 BURNING	SSF			0							
32	32 BURNING	SSF			0							
ST. DAVID'S												
1	1 APRES TOUTE	SSF			1				0.80	0.53	7.00	Chlorination Satisfactory
2	2 BAILES BACOLET I	BH			0							
3	3 BAILES BACOLET II	BH			0							
4	4 BAILES BACOLET III	BH			0							
5	5 BAILES BACOLET IV	BH			0							
6	6 BAILES BACOLET V	BH			0							
7	7 BAILES BACOLET VI	BH			0							
8	8 BAILES BACOLET VII	BH			0							
9	9 BAILES BACOLET VIII	BH			0							
10	10 BAILES BACOLET IX	BH			0							
11	11 BAILES BACOLET X	BH			0							
12	12 BAILES BACOLET XI	BH			0							
13	13 BAILES BACOLET XII	BH			0							
14	14 BAILES BACOLET XIII	BH			0							
15	15 BAILES BACOLET XIV	BH			0							
16	16 BAILES BACOLET XV	BH			0							
17	17 BAILES BACOLET XVI	BH			0							
18	18 BAILES BACOLET XVII	BH			0							
19	19 BAILES BACOLET XVIII	BH			0							
20	20 BAILES BACOLET XIX	BH			0							
21	21 BAILES BACOLET XX	BH			0							
22	22 BAILES BACOLET XXI	BH			0							
23	23 BAILES BACOLET XXII	BH			0							
24	24 BAILES BACOLET XXIII	BH			0							
25	25 BAILES BACOLET XXIV	BH			0							
26	26 BAILES BACOLET XXV	BH			0							
27	27 BAILES BACOLET XXVI	BH			0							
28	28 BAILES BACOLET XXVII	BH			0							
29	29 BAILES BACOLET XXVIII	BH			0							
30	30 BAILES BACOLET XXIX	BH			0							
31	31 BAILES BACOLET XXX	BH			0							
32	32 BAILES BACOLET XXXI	BH			0							
ST. PATRICK'S												
1	1 PEGGY'S WHIM	SSF	4		4							
2	2 UNION	SSF	1		1				Trace	3.50	6.40	Chlorination Satisfactory
ST. JOHN'S												
1	1 CLOZIER	PSS		1	1				Trace	3.50	7.70	Chlorine tablets needed recharging
2	2 CONCORD	MPF		1	1				0.70	1.70	7.70	Chlorination Satisfactory
3	3 DORRINGTON	SSF		1	1				1.20	8.01	8.20	Chlorination Satisfactory
4	4 GRAND ROY	SSF		1	1				0.70	2.71	7.80	Chlorination Satisfactory
ST. MARK'S												
1	1 HUTTON HALL I	SSF	1		1				0.20	0.54	7.00	Chlorination Satisfactory
2	2 HUTTON HALL II	PSS		1	1				0.20	0.53	7.00	Chlorination Satisfactory
Quantitative Samples Collected												
			34	2	36							
Percentage Positive Samples Collected			94.4%	5.6%	100.0%							

W.H.O. Guidelines for Drinking Water

Total Coliform 0/100 mL
Fecal Coliform 0/100 mL
pH Range 6.5 to 8.5
Turbidity 0 to 5 NTU
Free Chlorine 0.2 to 0.5 mg/L

RES - Reservoir
SSF - Slow Sand Filter
RSF - Rapid Sand Filter

KEY: Treatment Facility Type
BH - Bore Hole
MPF - Mechanical Pressure Filter
PSS - Protected Shallow Spring

Data Entered by: D. Ambrose

Certified Correct:
Date:

CIRCULATION: Manager & Engineer O. & M. NAWASSA
CAG & CHIO - Ministry of Health