A POLICY PAPER
ON
THE MANAGEMENT OF INDOOR AIR QUALITY IN BARBADOS

Prepared By:

Environmental Protection Department
Ministry Of Environment and National Beautification
L.V. Harcourt Lewis Building
Dalkeith, St. Michael
Barbados

Revised September 2020

ENVIRONMENTAL PROTECTION DEPARTMENT

Table of Contents

List of Tables

Executive Summary

In recent times Barbados has noted an increase in the number of reported cases of respiratory illness. Due to the length of time which the average person spends indoors it is pertinent that the quality of the indoor environment be maintained at a high standard in order to ensure that the health of a building's occupants is not negatively impacted.

The maintenance of good indoor air quality (IAQ) should be the responsibility of the building owner, Property Manager and the building occupants. The design, operation and maintenance of the building's ventilation and cooling systems are also critical to reducing potential indoor air quality issues. In order for Government to ensure that it plays a more prominent regulatory role in IAQ issues, there needs to be a rationalisation of the roles and responsibilities of various departments (namely the Ministry of Labour and Social Partnership Relations, the Ministry of Environment and National Beautification and the Ministry of Health and Wellness) to ensure that there is a more appropriate and effective utilisation of resources and that the governing legislation is adequate to effectively regulate these issues.

Due to the limitations of the Health Services Act CAP 44, and the mandate of the Environmental Protection Department (EPD) to regulate environmental pollution, it is strongly recommended that responsibility for indoor air quality issues should be conferred to the Occupational Safety and Health Section of the Ministry of Labour and Social Partnership Relations, which deals with occupational health and safety issues related to the workplace and which currently has the most appropriate legislation for addressing indoor air quality.

In addition, there needs to be discussion on, and clarification of, the responsibilities of regulatory agencies with respect to the numerous aspects of indoor air quality; namely the inspection of commercial kitchen ventilation systems, assessment of ventilation plans for proposed food establishments and the inspection of commercial operations to ensure that they adhere to environmental as well as health and safety standards.

It is therefore pertinent that the existing legislation be reviewed and the appropriate modifications made to ensure that all of the issues are adequately addressed. In addition, the Barbados National Building Code should be extended to encompass the construction and design of commercial buildings and the design and operation of their mechanical

ventilation systems, as these significantly impact on indoor air quality.

1 INTRODUCTION

1. In recent times, Barbados has experienced a dramatic change in the social, economic, cultural and environmental elements of its society. As might have been expected, these advancements have been accompanied by both environmental and public health challenges. Of note also, is that there has been a significant increase in the incidence of respiratory diseases. Barbadians of all ages, gender and economic strata have displayed increased occurrence of asthma, sinusitis and several other chronic respiratory ailments.

2. In the National Asthma and Allergy Study conducted in 1997, it was indicated that between 1980 and 1994, there was a fourfold increase in the number of asthmatic visits to the Accident and Emergency Department of the Queen Elizabeth Hospital. It was also indicated that there was an increased incidence of juvenile asthma, such that 16.8% of 6-7 year olds and 17% of 13-14 year olds were asthmatics. This prevalence rate was said to be one of the highest in the world. (Howitt, 1998).

3. As a result of the apparent increase in respiratory illnesses, as well as the ease with which persons can access information through the Internet, Barbadians have become more aware and concerned about the quality of air which they breathe. This concern is also evidenced by the increase in industrial action (both in the public and private sector) as a result of staff's perception of "poor indoor air quality" within their workplace.

4. Although it is evident that ambient air pollution is a concern in Barbados, it appears that contamination of the indoor environment may pose a greater risk to public health. This concern is supported by the fact that the average individual spends approximately sixty-six percent (66%) of his/her time indoors; be it at home, the workplace or in school. This view does not however negate concerns about ambient air since the quality of indoor air is directly influenced by the quality of the outdoor air.

5. The number of air pollution related complaints lodged at the Environmental Protection Department (EPD), Ministry of Environment and National Beautification steadily increased over the years. In order to address the needs of the public, an Air and Noise Pollution Section was created in 1998 (whilst the Department was a division of the then Ministry of Health). This section was established to deal primarily with the investigation, assessment and resolution of air and environmental noise pollution issues on the island. The Air and Noise Pollution Section conducts investigations/assessments of governmental

office buildings. Indoor air quality issues related to residential buildings and industrial operations are not addressed by the EPD.

6. In the twenty years since its establishment, the Air & Noise Quality Section has investigated hundreds of complaints related to indoor air quality issues in office buildings. These account for a significant portion of the total number of complaints investigated by the section. Additional information on the complaints received by the EPD is provided in Section 3. It is therefore evident that the quality of office environments in Barbados is an issue which needs to be addressed.

7. The purpose of this paper is to :
   i. inform Cabinet of the status of indoor air quality (IAQ);
   ii. outline the existing structure for addressing IAQ issues in Barbados;
   iii. highlight some of the challenges experienced with this current structure; and
   iv. outline a more appropriate management framework for indoor air quality.

2 UNDERSTANDING INDOOR AIR QUALITY (IAQ)

8. Indoor air quality (IAQ) refers to the characteristics of the indoor environment in a building. It is an interaction between the site, climate, building systems, construction techniques, contaminant sources and building occupants (Health Canada, 1995). The role of each of these factors must be understood in order to investigate and resolve indoor air quality problems.

2.1 Factors which Contribute to Indoor Air Quality Problems

9. The internal environment of a building may be affected by a number of factors many of which may be unrelated. In addition, persons may wrongly attribute symptoms (which manifest themselves at the office) to IAQ problems. For these reasons the study of indoor air quality can be an extremely complicated process. External and internal factors govern the quality of indoor air; the magnitude of these factors can affect the health and comfort of building occupants.

2.1.1 External Factors

10. IAQ can be affected by various external factors. These include external pollutants and odours that may infiltrate the building, as well as the ambient climate which is the condition of the outside air being drawn into the building.

2.1.1.1 External Pollutants

11. Pollutants which are generated on the outside may affect the internal environment of a building. For example, dust, carbon dioxide and carbon monoxide are some of the pollutants which can be produced in high quantities on the exterior, and based on the building's design, may impact on the interior whether it is mechanically or naturally ventilated (i.e. relies simply on pressure differences to move air through a building).

2.1.1.2 Ambient Climate

12. The design of a building's ventilation system can influence the extent to which the internal environment is influenced by ambient conditions. The temperature and relative humidity within a building are just some of the parameters which can be influenced by ambient conditions, especially if the building is naturally ventilated. The internal environments of naturally ventilated buildings are more susceptible as the external air is not treated or

conditioned before entering the building.

2.1.1.3 Odours

13. Due to a building's location, design, layout and ventilation system; specific odour contaminants may adversely affect the indoor environment. In a number of the EPD's investigations, occupants of mechanically ventilated buildings have been impacted by offensive odours (generated on the exterior) which entered the building via the ventilation system. These odours may be produced from :

    i. activities which occur on the outside of the building (e.g road works, construction and open burning);
    ii. sewer systems and garbage disposal;
    iii. exhaust from vehicles on nearby roads, parking lots or loading docks;
    iv. exhaust from neighbouring buildings e.g. standby generators; and
    v. contamination from previous use(s) of the site.

2.1.2 Internal Factors

14. IAQ can also be affected by various internal factors, including the activities conducted within the space as well as the design and maintenance of the building and the components located within. Some of the key internal factors which can contribute to indoor air quality problems are; internal pollutants, odours, building ventilation design, office equipment and materials, the operation and maintenance of ventilation systems and human activity within the environment.

2.1.2.1 Internal Pollutants

15. Professionals in the field of indoor air quality have identified several causative agents that are directly and indirectly responsible for the majority of IAQ problems. Although these causative agents may have a variety of case specific sources, and may occur in different combinations, they remain key factors that arise in most assessments. Table 1 outlines the major parameters and pollutants associated with indoor air quality and possible sources. It should be noted that in the study of IAQ, carbon dioxide (CO_2), relative humidity and temperature are considered as comfort parameters. That is, extreme variations in these parameters will affect the comfort of persons in the indoor environment.

Table 1: Sources and Parameters Affecting Indoor Air Quality and Comfort

PARAMETER	SOURCES
Temperature and humidity extremes	Improper placement of thermostats, poor humidity control, tenant changes to building, office equipment and processes
Carbon dioxide (CO_2)	People, combustion of fossil fuels (diesel, gasoline)
Carbon monoxide (CO)	Tobacco smoke, automobile exhaust, combustion
Particulates	Dust, pollen, fungal spores, smoke, air inlets, paper, air conditioning duct insulation, fabrics, glues/adhesives, carpets, furnishings, carbonless copy paper and toner
Volatile Organic Compounds (VOCs)	Photocopiers, printers, computers, carpets, furnishings, cleaning materials, smoke, paints, adhesives, perfumes, hairsprays, solvents (e.g. Formaldehyde is released from glues, new carpets and furniture)
Ventilating and Air Conditioning (VAC) system	Improper system design or operation, occupant tampering with VAC system, poor office layout, imbalanced VAC system, inadequate ventilation (insufficient outside air, insufficient air flow, inadequate circulation)
Microbial Matter	Stagnant water in VAC system, wet or damp materials, condensate drain pans

(*Table adapted from Health Canada, 1995)

2.1.2.2 Odours

16. Odours originating within the office environment can also cause discomfort to staff. These odours can be generated from a number of sources which include sewage systems, cleaning chemicals, water damaged materials and pesticide treatments.

2.1.2.3 Building & Ventilation Design

17. The original design of a building and subsequent modifications to the structure and mechanical ventilation systems can influence both the amount of outside air introduced, as well as the circulation of air within the office environment.

18. The Building Development Section of the EPD is responsible for the review of applications for proposed building developments. The assessment of building ventilation plans is one aspect of this process. However, an issue may arise when developers construct buildings and install ventilation systems which vary from the approved design. To compound this issue, a number of building occupiers make modifications to the internal building structure (after occupation) which can also impact negatively on the operation of the ventilation system. These issues are discussed in Section 3.

2.1.2.4 Office Equipment & Materials

19. The equipment and materials which may be used within an office can significantly affect the nature of the environment if they are not properly controlled. For example, the compounds which are released from printing and copying machines as well as dust generated by and accumulated on large quantities of paper, can all impact on the indoor air quality and thus the health of the building's occupants.

2.1.2.5 Operation & Maintenance of Ventilation Systems

20. The Ventilating and Air Conditioning (VAC) System itself can be a source of pollutants. Improper system design or operation, occupant tampering, imbalanced VAC systems, inadequate filtration or inadequate ventilation (insufficient outside air/or airflow and inadequate circulation) are all important factors which can contribute to problems within the indoor environment.

2.1.2.6 Human Activity

21. Though generally overlooked, human activity can also impact significantly on indoor air quality. Cooking, body odours, cosmetic odours, maintenance activities (pesticide treatment and painting), house-keeping activities (use of cleaning agents, deodorizers, sweeping etc.) are all capable of causing significant impacts if not properly managed.

2.2 Health Effects

22. Due to the nature of IAQ and varying sensitivities amongst individuals, a single air pollutant may trigger diverse reactions in different people while some persons may not be affected at all. Persons with respiratory diseases, allergies, asthma and suppressed immune systems may be particularly susceptible to the effects of pollutants found in the internal environment.

23. The illnesses which occur as a result of exposure to indoor air contaminants can be classified as one of two types of illnesses; either Sick Building Syndrome (SBS) or Building Related Illnesses (BRI).

24. SBS, which is relatively common, refers to a situation where occupants of a building experience acute health effects that appear to be linked to time spent in the building, but no specific illness or cause can be identified. The complaints may be confined to occupants of a particular room or zone, or may be widespread throughout the building (EHC, 2003). With SBS the symptoms are mainly associated with discomfort. These symptoms cannot be

attributed to a clinically defined disease or specific contaminant. Furthermore, most complainants indicate that they experience relief on leaving the building (EHC, 2003). In general, for the majority of these IAQ complaints investigated, building occupants indicated eye, nose or throat irritation, headaches, fatigue, reduced mental action, irritability, dry skin, nasal congestion, difficulty breathing, nose bleeds and nausea.

25. In contrast, a BRI, which is uncommon, is a diagnosable, clinically recognized illness that can be directly attributed to exposure to a particular indoor air pollutant(s) and that has recognizable causes (Health Canada, 1995). Some examples of BRI are carbon monoxide poisoning, lung cancer as a result of radon exposure, Legionnaire's disease and Hypersensitivity Pneumonitis. Building-related illness generally involves prolonged recovery time, or may be an issue for the patient even after removal or remediation of the exposure that has caused the illness (Aerias, 2007).

26. To date, the majority of the complaints investigated by the EPD have been attributed to SBS. It is uncertain whether there have been any reported cases of building related illness in Barbados.

2.3 Controlling Indoor Air Quality Issues

27. The factors previously discussed must all be managed in order to prevent potential indoor air quality problems. This can be done through a combination of approaches, including general housekeeping , building maintenance and ventilation design and maintenance.

2.3.1 Housekeeping & Building Maintenance

28. Effective housekeeping and building maintenance regimes should be implemented in all office buildings. The majority of IAQ problems can be alleviated if the buildings and air conditioning systems are thoroughly cleaned and maintained on a routine basis. Cleaning agents and other chemicals used in the building may also become indoor contaminants so these should be chosen with care and used in a manner that would limit their impact on the indoor environment. In light of this, it is evident that Building and Property Managers need to be cognisant of their roles in preventing problems within their properties.

2.3.2 Ventilation Design and Maintenance

29. With respect to building ventilation, indoor contaminants and odours can be controlled by the following techniques:
    i. Design and operation of the ventilation system;

- Dilution
- Local exhaust

ii. Room design and layout

2.3.2.1 Design and Operation of the VAC system

30. The effectiveness of VAC systems depends on equipment selection, installation, operation and maintenance. All VAC systems should include filtration devices (filters), which are generally designed to control particulate contaminants. In some cases, special filters can be used for odour control. In central air conditioning systems (which comprise a network of duct systems designed to serve sections of a building) the quality of the air which is provided can be affected by the type of material used to construct the ductwork as well as the condition of the system.

31. It should be noted that not all air conditioning systems allow for outdoor air to be introduced into a building. Mini-split system air conditioning units which are widely used in commercial buildings throughout Barbados are designed to simply cool the air within a room and circulate it. These units are not intended to introduce outdoor air into the space which they serve. Subsequently, other structural and engineering modifications would have to be made to the building in order to meet the requirements for adequate ventilation.

i. **Dilution** - Contaminants in the indoor environment can be diluted with clean outdoor (fresh) air. This technique is only effective if there is consistent and adequate flow of supply (fresh/outdoor) air that mixes effectively with internal air. The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) has published Standard 62, which outlines outdoor air and indoor parameter requirements for the general office environment as well as various types of special use, commercial or institutional buildings such as libraries, laboratories and hospitals.

ii. **Local exhaust systems** - Ventilation systems may be designed and operated in such a manner that they control the pressure relationships between rooms. It is recommended that areas where contaminants are generated (e.g. copying and printing stations, bathrooms, libraries, vaults and storerooms) be maintained at lower pressure than other rooms so that contaminants do not escape into the general work environment. Local exhaust systems are used to isolate and remove contaminants by maintaining negative pressure in the area around the contaminant source.

2.3.2.2 Room Orientation/Layout

32. The layout of an office is extremely important in the control of IAQ problems. Architects and builders must ensure that the design and orientation of rooms is compatible with the design of the VAC system of the building. Building modifications can alter ventilation patterns and where appropriate changes in the ventilation system are not made, IAQ problems may arise.

33. The building design, the design and operation of the VAC system and practices employed by the building's occupants are the main areas generally targeted for the implementation of control measures. However, education is also important to the resolution and prevention of IAQ problems. Building occupants, maintenance technicians and house-keeping personnel should be cognisant of the ways in which their actions contribute to IAQ problems and the control measures which they can employ.

3 STATUS OF INDOOR AIR QUALITY IN BARBADOS

34. The design of commercial office buildings in Barbados has seen a shift towards buildings which are completely enclosed and where ventilation is supplied mechanically. Although the architecture of these offices may be admirable, a number of measures must be taken in order to maintain the internal environment at a high quality.

35. The following section discusses the IAQ complaints received by the EPD and examines the main contributors to IAQ problems in Barbados. The current legislation that exists to address IAQ issues is also reviewed below.

3.1 Indoor Air Quality Complaints

36. During the period 1998 to December 2012, the EPD recorded three hundred and eighty-eight (388) complaints related to occupational/ indoor air quality issues. This was almost fifty percent (50%) of the total number of air pollution complaints recorded by the Department. It should be noted that these figures do not take into account the number of complaints recorded and investigated by the Ministry of Health and Wellness or the Occupational Safety and Health Section of the Ministry of Labour and Social Partnership Relations. Analysis of the complaints investigated by the EPD indicated that a large number were related to buildings occupied by Government agencies.

37. From their investigations, officers of the EPD have also discovered that a number of the Government departments affected were housed in older buildings (most of which have been converted from natural to mechanical ventilation). These buildings were generally inadequately maintained and lacked adequate space for occupants and storage of work-related material.

38. Over the years, the officers of the Department have also found that a large majority of the complaints which they have been called upon to investigate were related to the presence of mould (filamentous fungi) within the work environment. Although fungi are ubiquitous, growth on indoor surfaces is encouraged by conditions which generate high levels of moisture (such as leaks and condensation from air conditioning systems), inadequate ventilation and a source of carbon such as dust and wood.

3.2 Main contributors to IAQ problems in Barbados

39. Parallel with the rapid increase in construction of commercial buildings, regulatory agencies

have observed a number of disturbing trends, which could have negative impacts on building occupants. These trends include:

i. *The shift from functional windows to fixed glass panes* - Although this may reduce energy costs by reducing heat transfer, it may become problematic if there is a breakdown/failure of the VAC system, since there would be no alternative means of providing ventilation to the building;

ii. *Reduction in the quantity of outdoor air which is introduced into the building* – This can be caused by:
   - partial or complete blocking of the fresh air supply for the building or space, or
   - no provision of fresh/outdoor air

   This results in an accumulation of pollutants such as carbon dioxide, particulate matter and volatile organic compounds and inevitably leads to complaints from building occupants;

iii. *Altering building design during construction* – It has been observed that a number of persons alter a building's design (during construction), without the submission of revised plans to the EPD and the Town and Country Development Planning Office for approval; and

iv. *Altering building design during occupation* – During investigations, it is common to discover persons have conducted material alterations to buildings (during occupation) without the approval of the EPD. These modifications, which may change the internal layout of an office, have the potential to affect the ventilation within the room, and may include the erection of partitions or the change of use of rooms within the building. It should be noted that under the Health Services Act (Building Regulations) 1969, it is an offence to construct, extend or effect any material alteration to any building without the appropriate approval.

40. In addition to the issues listed above, the lack of adequate building maintenance, inadequately designed VAC systems and the inadequate or non-existent maintenance of these systems are some of the most common issues identified in Barbados.

3.3 Existing Legislation

41. Prior to 2001, the Environmental Protection Department functioned as a division under the then Ministry of Health. The EPD is currently a Department of the Ministry of Environment and National Beautification but has continued to function under the legislation of the Ministry of Health and Wellness, until the appropriate environmental legislation has been finalised. As a result, the Environmental Protection Department and the Environmental Health Department presently operate under the same legislation.

42. The EPD attempts to address indoor air quality issues under the ***Health Services (Nuisances) Regulations 1969***. These Regulations define a nuisance as *" any place, matter, thing, deposit or accumulation of liquid or solid matter that is full, in such a state, or so placed, made or left, as to be insanitary, injurious or dangerous to health or likely to become so;"*

43. Regulation 3 (16) (of the Nuisance Regulations) makes some provision for ventilation of workplaces. In this Regulation it is stated that *" any workplace-*

    i. not ventilated so as to render harmless to the workers employed therein all gases, vapours, dusts or other impurities generated in the course of the work carried on therein; or

    ii. *so overcrowded as to be injurious to the health of the persons employed therein*; are considered to be nuisances.

44. Regulation 4 defines the term overcrowded which is used in Regulation 3 Paragraph 16 (ii) as; a workplace *"should be deemed overcrowded as to be injurious to the health of the persons employed therein at any time when there is in such a workplace less than three hundred cubic feet of space to every person employed within."*

45. The ***Health Services (Building) Regulations*** also make provision for the amount of natural ventilation relative to the floor area of a habitable room (room which is occupied by persons). However, it can be clearly seen that this Act does not address mechanically ventilated buildings. This proves to be a challenge to the Building Development Section of the EPD which is responsible for assessing mechanical ventilation systems for proposed building developments, extensions or material alterations (as mentioned in Section 2.1.2.3). Part of the aim of this assessment is to prevent or reduce the occurrence of health related problems once the building is occupied. The inadequacy of existing legislation is exacerbated by limitations in the ability of the Director of the EPD to enforce the Health Services Act CAP 44 and Regulations.

46. Given that the Nuisance Regulations only deal with natural ventilation, the EPD has adopted the standards set by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). This Society has established guidelines (for good indoor air quality) for mechanical ventilation systems based on the use of the space, the number of occupants, the equipment used and the floor area.

47. The ***Safety and Health at Work Act CAP 356 under which the Ministry of Labour and Social Partnership Relations functions*** was passed in 2005 and proclaimed in 2013. Consequently, this Act has superseded the Factories Act which was previously used by that Ministry. The regulations for this Act are in the process of being drafted. This Act is not restricted to factories, but governs all workplaces, and seeks to address the issue of indoor air quality under the umbrella of occupational safety and health.

48. Within the Safety and Health at Work Act, the duties of the Occupier (the person who has control over the workplace and the work that is done there) includes the keeping of a workplace in such a condition that the safety of the persons in the workplace is not likely to be endangered. Section 13 of the Act also requires a Health and Safety Committee to be established in workplaces where there are twenty-five (25) or more employees.

49. This committee would consist of representatives of the employer and the employees and would be responsible for "consulting with the employees or their representatives for the purpose of developing measures to promote health and safety at such workplace." In instances where there are less than twenty-five (25) employees, safety delegates may be appointed. With reference to IAQ, this committee or delegates may conduct tests or request that persons be hired to conduct tests within the workplace (Safety & Health at Work Act CAP 356).

50. As this Act puts the onus of maintaining good air quality on the occupier and employees, it therefore follows that the regulatory agency with responsibility for IAQ should only be consulted when:
    i. The company has attempted to address the situation and it has not been rectified;
    ii. Assessments have been conducted by (IAQ) professionals and the problem still persists; or
    iii. There is conflict between management and the employees (regarding IAQ and work conditions) which has not been resolved.

51. The following paragraphs outline sections of the Safety and Health at Work Act CAP 356 which relate to indoor air quality (IAQ).

52. Section 7 (1) of the Safety and Health at Work Act CAP 356 requires that every employer/occupier keep the workplace in such a manner that the safety of persons within the workplace is not endangered.

53. Section 47 of the Safety and Health at Work Act CAP 356 governs the removal of "gas, dust, vapour or fumes" from the workplace with the use of the appropriate exhaust and extraction systems.

54. Section 49, which deals with health, speaks to the cleanliness of workplaces and governs the frequency of cleaning, the times during which cleaning should be conducted in order to prevent 'contamination of the air with dust or noxious substances' and painting and varnishing of interior surfaces.

55. The Health and Safety at Work Act CAP 356 also makes provisions for specific parameters which affect indoor air quality, such as temperature, ventilation, overcrowding and lighting.

56. Section 51 (v) speaks to the maintenance of "reasonable temperatures":
"Effective provision shall be made for securing and maintaining reasonable temperature in each workroom, but no method shall be employed that results in the escape into the air of any workroom of any fume or substance of such a character and to such extent as to be likely to be injurious or offensive to persons employed therein."

57. Section 52 (1) requires the employer to make provision for "suitable and effective ventilation in every workplace":
    i. *for the adequate ventilation of every room in which work is carried on by securing and maintaining the circulation of fresh air within; and*
    ii. *for rendering harmless as far as practicable, all substances, fumes, dust and other impurities that are likely to be injurious to health and generated in the course of any process or work carried on in the workplace, in accordance with the guidelines and standards set by the Chief Labour Officer."*

58. Issues related to overcrowding and lighting are addressed in Sections 54 and 55 of the Act respectively.

59. ***Proposed Building Act & Draft Building Code***– It is anticipated that the proposed Barbados Building Act will provide the legislative framework for the establishment and

operation of the Barbados Building Standards Authority and the mandatory use of the Barbados National Building Code. The Act will have a number of legal requirements which include the mandatory use of the Building Code, the establishment of a Building Standards Authority, the registration of building practitioners and the charging of application fees.

60. The current version of the Building Code is a revision of the 1993 Building Code and provides guidelines for the construction of residential buildings in Barbados. These guidelines detail areas such as building ventilation, fire and safety, energy efficiency and site drainage.

61. It is anticipated that all residential buildings will be governed by the Regulations of the Barbados Building Act (once they have been finalised) and will have to meet the requirements which are outlined. In addition, the Building Regulations will make provisions for the inspection of buildings on completion, and the issuing of certificates to those which meet the outlined standards.

62. ***Indoor Air Quality Technical Standard*** – The Barbados National Standards Institution has drafted an Indoor Air Quality Technical Standard in conjunction with several stakeholders including the Environmental Protection Department and the Ministry of Labour and Social Partnership Relations. When published, this standard will outline the methods to be used to ensure that the indoor air quality within commercial buildings is acceptable. This standard addresses pertinent issues such as the design of ventilation system and filtration requirements. However, despite its usefulness, the standard will not be compulsory unless referenced in legislation.

3.4 Existing Organisational Framework

63. At present, the responsibility for investigating indoor air quality complaints is distributed amongst the Environmental Protection Department (Ministry of Environment and National Beautification), the Occupational Safety and Health Section of Ministry of Labour and Social Partnership Relations and the Environmental Health Department of the Ministry of Health and Wellness.

3.4.1 Environmental Protection Department

64. The Buildings Development Section of the EPD currently assesses all building plans submitted to the department for approval. These plans include those for new construction of buildings as well as those related to the modification of existing buildings. Upon completion of construction of large commercial establishments, EPD officers inspect the building to assess conformance with approved design.

65. The EPD conducts assessments of occupied office buildings based only on complaints and does not perform routine investigations/inspections. Although the Department a regulatory agency, the EPD's role with respect to IAQ cannot be seen as such, since IAQ assessments are conducted on request by management of the organisation which is experiencing problems. It should be noted that there is no obligation for management of the organisation being investigated to have made any previous attempt to address the issues. Therefore, persons anticipate that officers of the Department would identify the problems within the building and provide recommendations for solving the issues.

66. It should also be noted that the EPD is presently constrained with regards to adequate staffing to conduct the necessary investigations. This limitation therefore eliminates the possibility of the EPD conducting routine unsolicited inspections in office buildings.

67. Prior to the physical inspection of a facility, the EPD may send out two types of questionnaires which must be completed and returned to the EPD for analysis. The Environmental/Health questionnaire is distributed to a randomly selected portion of the staff and covers various issues including the symptoms being experienced and any pre-existing conditions. The Building Maintenance questionnaire must be completed by the officer responsible for the coordination of maintenance of the building. This questionnaire covers the cleaning, pest treatments and VAC maintenance, among other things.

68. When conducting assessments of office buildings, officers of the EPD begin each assessment with a walkthrough of the building. During this inspection, officers seek to identify visible sources which may be contributing to the problem. Dependent on the findings of the initial walk-through, officers then determine the need for more detailed investigation, such as the measurement of indoor air quality parameters; carbon monoxide, relative humidity, temperature and carbon dioxide. In addition, if deemed to be necessary, assistance in addressing an IAQ issue may be sought from the Environmental Health Department and/or the Ministry of Labour and Social Partnership Relations.

69. In previous years, the Department conducted basic microbiological sampling as part of the IAQ assessment process. The samples would be taken by the officers of the EPD and sent for analysis to either a local laboratory (Ministry of Health and Wellness or the Ministry of Agriculture) or an overseas facility. However this sampling was quite costly and extremely time consuming, requiring meticulous preparation of monitoring programmes and equipment, as well as specialised expertise for the interpretation of results. The EPD no longer conducts this type of monitoring; but in cases where persons request microbiological sampling as part of an IAQ assessment, the matter is referred to the Microbiologist in the Ministry of Health and Wellness; who conducts the necessary sampling, analysis and interpretation of results.

70. The functions of the EPD with regards to IAQ are conducted by the technical officers of the Buildings Development and Air and Noise Sections. There are a total of eighteen technical posts across these two sections, however only fifteen are occupied at this time.

3.4.2 Occupational Safety and Health Section (Ministry of Labour and Social Partnership Relations)

71. The Occupational Safety and Health (OSH) Section of the Ministry of Labour and Social Partnership Relations seeks to fulfil their mandate of ensuring that persons comply with safety and health legislation and best management practices, in order to secure worker health and safety. The OSH Section conducts routine inspections to assess the occupational safety and health practices at workplaces. In addition, officers of the Section also provide training to company staff on request. Indoor air quality investigations are also conducted in response to complaints from building occupants. The OSH Section also has the capacity to monitor conditions within the work environment; including temperature, noise, wind speed and light.

3.4.3 Environmental Health Department (Ministry of Health and Wellness)

72. The Environmental Health Department of the Ministry of Health and Wellness also functions

under the Health Services Act CAP 44. The mandate of this department is to protect human health and to prevent the spread of communicable diseases on the island. The Environmental Health Department operates in six (6) catchment areas. The Environmental Health Officers (EHOs) for each catchment area are generally stationed at a Polyclinic in the catchment. EHOs are also stationed at the island's ports-of-entry. Environmental Health Officers/ Assistants are assigned to specific districts and are responsible for the routine inspection of the facilities, businesses and premises in the area. As part of these inspections, concerns such as sanitary conditions and mosquito breeding are addressed. In addition, issues such as microbiological growth, unsanitary office conditions and nuisance odours, (which may affect the indoor environment and thus the health of building occupants) may be reviewed.

73. The EHD is also responsible for the routine inspection and licensing of food establishments, restaurants, hair dressers and day-care facilities. These types of operations pose different types of IAQ challenges due to the activities which are being conducted. As a result more rigorous assessments of these operations may be required.

3.4.4 Proposed Barbados Building Standards Authority (BBSA)

74. The purpose of the BBSA, which is a division in the Ministry of Public Works and Transport, is to "safeguard persons in and around buildings, and also to promote energy conservation and efficiency and the suitable provision of facilities for disabled people. The BBSA will administer the standards system, enforcing regulations approved by parliament."

3.5 Discussion of Critical Issues

75. From the outline of the legislation and current duties which are undertaken by the various departments, it can be seen that there are a number of issues related to the management of indoor air quality which need to be addressed as a matter of urgency. The challenges which are currently faced with the management of IAQ are multi-faceted, and can be broadly classified as institutional, legal and policy related. These issues are highlighted below:
    i. Expanding roles of the EPD in environmental management;
    ii. Identification and execution of responsibilities by various agencies;
    iii. Enforcement capabilities of the EPD under the Health Services Act CAP 44;
    iv. Lack of appropriate standards for mechanically ventilated buildings;
    v. Establishment of the Safety and Health at Work Act CAP 356;
    vi. The need to strengthen government's approach to the regulation of IAQ issues.
76. These concerns are further discussed in the following sections.

3.5.1 Role of the EPD in Environmental Management

77. As previously stated, in 2001 the Environmental Protection Department was transferred to the then Ministry of Physical Development and Environment (MDPE). This transfer was in anticipation of the Department's role as the main environmental regulatory agency for environmental issues in Barbados. However, during the transfer of the Department to the MDPE, all of the EPD's functions (whilst under the then Ministry of Health) were also transferred.

78. In light of this change in responsibility and regulatory requirements, there is a great need for the government to streamline the regulatory structure. The government must also ensure that regulatory agencies are provided with the necessary legislative authority to effectively carry out their mandates.

79. The Barbados National Strategic Plan 2006-2025, outlines strategies for protecting the environment. These strategies are listed as "ensuring the development of accurate data and information systems through mapping, recording and evaluating of all environmental assets." The Plan also sets out strategies for enforcement of standards related to environmental protection. In order to accomplish these goals the Environmental Protection Department has begun an ambient air quality monitoring programme for the island. This programme includes the production of an ambient air quality policy paper; conducting studies of sources of ambient air pollution (such as industries and commercial operations), monitoring of ambient air quality at sites throughout the island, and work towards the establishment of ambient standards and regulations.

80. However, under the present administrative structure the response to, and investigation of indoor air quality complaints (by the EPD), occupies a significant portion of the Air and Noise Section's time and resources. As a result the ambient air quality programme is currently underdeveloped.

81. Another point of consideration is the environmental noise legislation which is currently being drafted. The production of this legislation is also in fulfillment of the National Strategic Plan for the country, which indicated that appropriate standards and an administrative and legislative framework to address noise pollution should be established (Min. Economic Affairs, 2007). When this legislation is completed, it is anticipated that the Environmental Protection Department would play a major in its implementation and enforcement. This would include the investigation of noise complaints made by the public. The ability of the Air

and Noise Pollution Section to adequately meet these expectations needs to be thoroughly examined considering the present staff complement (4 technical posts of which 3 are presently filled) and current responsibilities of the Department.

3.5.2 Enforcement Capabilities of the EPD under the Health Services Act CAP 44

82. As previously mentioned, the Director of the EPD has limited enforcement capabilities under the Health Services Act CAP 44. As a result, during an investigation, the Department mainly highlights the (IAQ) issues which are identified and draws them to the attention of the landlords and managers.

83. Further to this, the Health Services (Nuisance) Regulations is not very specific and does not explicitly address the numerous factors (such as temperature, humidity and the introduction of outdoor air) which currently affect indoor air quality. There are no specific standards or codes of practice attached to the Regulations that can be enforced at this stage.

3.5.3 Lack of Appropriate Standards for Mechanically Ventilated Buildings

84. As mentioned in the previous section, the Health Services Act CAP 44 does not provide specific standards or guidance for maintaining IAQ in mechanically ventilated buildings. The Health Services (Building) Regulations only addresses mechanical ventilation in sanitary facilities. As a result the EPD references the standards which are established by ASHRAE. However, in Barbados there are no national standards with respect to the design, assessment and maintenance of ventilation systems.

85. It is therefore critical that the Barbados National Building Standards Regulations not only govern residential structures but seek to regulate the construction and design of commercial buildings and their ventilation systems. It is also recommended that the Indoor Air Quality Technical Standard being developed by the BNSI be referenced in legislation to make compliance mandatory. The regulation of areas such as private homes and barracks is important since persons may develop sensitivity to factors not present in the workplace. Thus, symptoms that are being experienced may be as a result of persons being exposed to contaminants at a combination of locations.

3.5.4 Identification of Responsibilities and their Execution by Various Agencies

86. With respect to IAQ, there is clearly a lack of distinction between the areas of responsibilities

for the Environmental Health Department, the Environmental Protection Department and the Occupational Health and Safety Section. This is highlighted by the fact that the Occupational Health and Safety Section and the Environmental Protection Department essentially conduct the same type of inspection. It is therefore not surprising that the public is also uncertain about the functions of the various government agencies and frequently forward the same complaint to numerous departments.

87. The Air and Noise Pollution Section of the Department has also been called upon to investigate issues related to ventilation within commercial kitchens. This again highlights weaknesses in the IAQ management structure and uncertainty with respect to responsibilities for particular issues. Although the Building Development Section of the EPD is currently responsible for assessing plans for proposed kitchen ventilation systems at the design stage, the Ministry of Health and Wellness is responsible for inspecting and issuing licenses for the operation of food establishments and commercial kitchens/restaurants.

88. As part of this licensing system, issues such as sanitary conditions, food handling practices, storage and presence of ventilation systems are evaluated. However, the inspection/licensing does not currently involve the inspection of the kitchen ventilation system to ensure that is it effectively removes heat and odours produced during cooking. Effective operation of these systems is essential to maintaining sanitary conditions within the kitchen and reducing negative impacts on staff and patrons. Appropriate design and maintenance of these systems is also critical to the regulation of internal temperature and reducing the emission of smoke and odours to the exterior.

3.5.5 Establishment of the Safety and Health at Work Act CAP 356

89. As discussed in Section 3, the Safety and Health at Work Act CAP 356 seeks to cover all areas related to occupational health and safety, and as such has made provisions for issues which may impact on IAQ. It is also anticipated that any subsequent regulations attached to this Act will make specific provisions for guidelines with respect to health and safety and indoor air quality issues.

90. As a result of the establishment of this Act, the Ministry of Labour and Social Partnership Relations, more specifically the Occupational Safety and Health Section, appears to have the legislative power to regulate indoor air quality issues. It would therefore be redundant for other Departments to continue to attempt to address the IAQ issue with inadequate legislation, whilst this area is specifically covered under the legislation held by the Ministry of

Labour and Social Partnership Relations.

3.5.6 Regulation of Indoor Air Quality Issues

91. As mentioned in Section 3, the Environmental Protection Department does not currently "regulate" indoor air quality in Barbados. That is, the Department does not have the legislative power to ensure that landlords provide acceptable indoor air quality within their buildings.

92. It is therefore evident that government needs to play a more regulatory role in the management of indoor air quality issues in Barbados. As discussed in Section 3, the Safety and Health at Work Act CAP 356 places the onus for maintaining good occupational health and safety standards on the occupier of the building. As such the Ministry of Labour and Social Partnership Relations would be responsible for inspecting the premises and reviewing workplace practices to ensure that standards are maintained. However, it should be noted that mechanisms should be put in place to address issues in areas not covered by the SHaW Act, such as living quarters. As discussed in Section 3, enforcement of the Barbados National Building Standards Regulations and the BNSI Indoor Air Quality Technical Standard would ensure adherence to minimum standards, thus pre-empting IAQ issues in these areas.

4 National Indoor Air Quality Policy

4.1 Policy Vision

93. As the Government of Barbados and its partners progress towards achieving a Green Economy it is envisioned that *"the built environment, particularly structures used for habitable purposes, shall be of a sustainable nature, designed to promote safe and wholesome occupation and facilitate productive output from its occupants"*.

4.2 Policy Objectives

94. The primary objectives of this policy are:
    i. Sustainable design;
    ii. Assessment and Maintenance;
    iii. Regulation; and
    iv. Communication.

4.2.1 Sustainable design;

95. The policy objective of sustainable design is *"to ensure that buildings and ventilation systems are designed in accordance with applicable standards, green building strategies and practices, and taking local climatic conditions into consideration in order to provide a healthy working environment"*.

96. To achieve this objective, applicable national standards must be developed or adopted, implemented and enforced. The AHSRAE suite of standards relevant to this area can be considered for adoption by Cabinet with subsequent translation into a national standard through the BNSI standards development process. The Health Services (Building) Regulations shall be reviewed and updated to include relevant provisions for vetting VAC systems. It is recognized that ASHRAE standards may have to be modified to Barbadian climatic conditions and as such all stakeholders should be encouraged to conduct relevant research in these areas.

    Fostering a culture of sustainable design and building practices amongst stakeholders is crucial to the success of this objective. This culture can be built or enhanced by introducing green building concepts as core modules in relevant courses at national tertiary and vocational institutions.

    The Government of Barbados shall explore options such as green building certification programmes similar to the Leadership in Energy and Environmental design (LEED). These strategies would all be in keeping with the drive towards a Green Economy and be consistent with the government's

renewable energy policy. As is the case in the renewable energy sector, appropriate incentives to encourage green building practices should be identified and investigated. However, the health of occupants shall not be compromised from the use of green building practices or to realize savings in the cost of energy from the operation of VAC systems.

4.2.2 Assessment and Maintenance

97. The policy objective is to *"develop and implement a framework for the continuous assessment and maintenance of habitable buildings to prevent conditions that impact negatively on indoor air quality which includes a flexible mechanism to respond to health and safety hazards"*.

98. One of the critical factors in management of the indoor environment is a proactive approach to property management. A framework for the continuous assessment and maintenance of buildings will be instrumental in maintaining indoor air quality that is satisfactory for the health of occupants. This framework will include legislated instruments, a structured education programme for property/building managers and regulatory inspections to ensure compliance with legislation.

99. Once published as a standard by the BNSI, the draft Guidelines for Good Indoor Air Quality- Code of Practice would form a component of this framework. It will provide general guidance to property managers and building owners on improving the indoor air quality of office premises. This should be supported by mandatory training for property managers in indoor air quality assessment.

100. To support the assessment and maintenance process the Property Managers' Guidebook for Managing Indoor Air Quality developed by the EPD will be used as a reference for property managers to identify areas of focus for indoor air quality management, conduct assessments and prioritise maintenance in the interest of safety and health.

101. The elements of the framework related to legislated instruments and regulatory inspections are elaborated in Sections 4.2.3 and Section 5 respectively.

4.2.3 Regulation

102. The policy objective is to *"ensure that the existing regulatory framework is enhanced such that there is adequate national legislation, standards and enforcement mechanisms which encourage stakeholders to go beyond compliance and emphasizes the shared responsibility of stakeholders"*.

103. The Government is committed to a comprehensive review and update of the Health Services (Building) Regulations to include relevant provisions for vetting VAC systems. The Guidelines for

Good Indoor Air Quality- Code of Practice will be adopted as a national standard and referenced in the Health and Labour legislative instruments to address the operational phase in the life of buildings.

104. The existing mechanism that links processing of loans by financial institutions to the certificate of compliance issued by the Town and Country Development Planning Office needs to be expanded to incorporate EPD's conditions of approval with respect to ventilation design and adopted National Standards for VAC.

105. Relevant legislative instruments should also be developed that support a system of audits by registered competent persons. These competent persons will use a structured system of inspections and report findings to the regulatory authorities for enforcement.

106. Regulatory agencies will conduct periodic compliance inspections. The intent will be to assess the competent persons and the building for compliance with applicable procedures, standards and legislation. Any infractions will be addressed through enforcement of the appropriate legislative instrument.

107. Arrangements should be made between regulatory authorities and the Ministry of Finance, Economic Affairs and Investment to facilitate concessions to ensure compliance with legislation. The intent of this initiative would be to encourage continuous assessment and maintenance of VAC systems.

108. These strategies will accrue national benefits by reducing the level of absenteeism due to Building Related Illnesses and or Sick Building Syndrome.

4.2.4 Communication

109. The policy objective is to *"to promote interactive communication amongst all stakeholders to improve the indoor air quality management system"*.

110. Holistic management of the indoor environment requires interactive communication amongst all stakeholders so that they are aware of applicable standards, best practices, legislation and policy that support sound indoor air quality management. This will be achieved through establishing and maintaining dialogue amongst critical stakeholders such as the regulatory agencies, building and property managers, architects, engineers, designers and occupants.

111. The regulatory agencies shall provide avenues for public consultation and feedback on proposed

standards, legislation and policy. This will be facilitated through social media, print and electronic media, focus groups and or town hall meetings.

112. Government will encourage organisations such as the Barbados Estate Agents And Valuers Association Inc., Barbados Association of Professional Engineers, the Barbados Institute of Architects and other recognized professional organisations use these avenues to access information. These organisations will be then be expected to conduct training and disseminate information to their peers and clients.

5 PROPOSED MANAGEMENT STRUCTURE

113. As a result of the information previously presented, it is recommended that indoor air quality be placed with the agency responsible for health and safety issues, and that has legislation applicable to indoor air quality issues in Barbados.

114. It is proposed that the involvement of the EPD in indoor air quality be restricted to the planning phase of a development. That is, the Building Development Section of the EPD should continue to review all ventilation plans for proposed developments. However the legislation and standards used to conduct these assessments, namely the Health Services (Building) Regulations 1969, should be reviewed and updated as necessary, in order to be applicable to the issues which are currently being experienced. In addition, the officers should be provided the training necessary to efficiently conduct these ventilation reviews.

115. In light of the current role of the Building Development Section, there also needs to be a review of the roles and responsibility of the Building Standards Authority and its relationship with the work of the Building Development Section.

116. Following the approval of an application by the (EPD), a procedure should be established to review the built design to determine if it conforms to the plan which was approved. With respect to kitchen ventilation systems, the responsibility for assessment of proposed systems should remain with the Environmental Protection Department and approval of the system (by the EPD) should be mandatory for the establishment to be licensed by the Environmental Health Department. However, once operational, it is proposed that the Environmental Health Department and the Occupational Safety and Health Department be responsible for ensuring that the system is maintained and operated in such a manner that there are no negative impacts on staff, customers or neighbouring establishments. That is, the inspection of the ventilation system of an operational

kitchen should form part of the licensing process conducted by the Environmental Health Department.

117. It is recommended that the Air and Noise Pollution Section of the Environmental Protection Department be responsible for fulfilling their mandate of "monitoring and controlling environmental pollution." This can be achieved only by the development of ambient air quality and environmental noise management programmes for Barbados. As such the Section would no longer be responsible for indoor air quality.

118. It is also anticipated that once the Environmental Management Act is completed the EPD will function under that legislation which will be enforced by the Ministry of Environment and National Beautification. This legislation, which makes provisions for the control of environmental pollution, addresses areas such as noise pollution, marine pollution, water pollution and hazardous materials, all of which fall under the mandate of the EPD.

Table 2: Existing and Proposed Administrative Framework for Indoor Air Quality Management

Ministry/ Department	Existing Responsibility	Recommended Responsibility
Environmental Protection Department, Ministry of Environment and National Beautification	1. Assess building plans for all proposed developments. 2. Assess ventilation plans for all proposed building developments. 3. Investigate complaints related to indoor air quality of office buildings.	1. Assess building plans for all proposed developments. 2. Assess ventilation plans for all proposed building developments. 3. Inspect commercial and industrial operations on commissioning to verify compliance with approved plans. Provide certificate of satisfactory design and installation of ventilation system in industries such as kitchens, vehicle maintenance facilities and laundries.
Occupational Health and Safety Section, Ministry of Labour and Social Partnership Relations	1. Conduct routine inspections of factories to assess occupational health and safety practices. 2. Conduct indoor air quality assessments of workplaces on request. 3. Address concerns related to temperature and ventilation in commercial kitchens. 4. Conduct training on occupational health and safety on request.	1. Conduct routine inspections of all workplaces to assess occupational health and safety practices. 2. Conduct indoor air quality and occupational health and safety assessments of workplaces to ensure that standards are being met. 3. Provide assistance to Ministry of Health and Wellness in assessing the functionality of commercial kitchen ventilation systems.

Ministry/ Department	Existing Responsibility	Recommended Responsibility
Environmental Health Department, Ministry of Health and Wellness	1. Conduct routine inspections of premises to ensure no conditions exist which may endanger public health. 2. Conduct preliminary indoor air quality assessments. 3. Conduct routine inspections of all food establishments. 4. Inspect and license all food establishments.	1. Conduct routine inspections of premises to ensure no conditions exist which may endanger public health. 2. Conduct indoor air quality assessments and provide assistance to Ministry of Labour and Social Partnership Relations with respect to medical/health aspect of investigations. 3. Conduct routine inspections of all food establishments. 4. Assess the operation and conditions of commercial kitchen ventilation systems, as part of licensing process for all food establishments.

6 CONCLUSION & RECOMMENDATIONS

119. The importance of a healthy indoor environment to the maintenance of good public health and productivity in the work place cannot be overemphasized. Since the average individual spends a large percentage of his/her time in the work place, employers and government regulatory agencies must ensure that they exhaust all possible means of ensuring that a healthy working environment is maintained.

120. Although there are a number of issues associated with Ventilating and Air Conditioning systems, it is possible to attain and maintain high standards of indoor air quality in buildings where these systems are utilized. Adequate indoor air quality can only be achieved if all involved; management, architects, technicians, building occupants and regulatory agencies are appropriately informed and equipped with the necessary knowledge and skills to prevent, reduce and address indoor air quality problems. In light of this, it is therefore critical that legislation (such as the Barbados National Building Code) which would seek to ensure that specific standards are maintained in building design and construction be finalised and enforced.

121. As highlighted in this document, the issues and problems related to IAQ are diverse and of critical importance in the protection of public health in the workplace. Indoor air quality complaints are mainly a health issue and therefore require the input of persons with medical, occupational health and safety and epidemiological expertise to interpret data and establish cause and effect relationships.

122. With respect to the operation of commercial kitchens, it may be more efficient and practical to include the inspection of operational kitchen ventilation systems as part of the licensing process currently conducted by the Ministry of Health and Wellness. This inspection would include a review of the ventilation system to ensure that the filters are present, the system is working efficiently and that it is kept clean. The maintenance of the systems also reduces the potential for the impacts of smoke and odours on neighbouring establishments.

123. A review of the Health Services Act CAP 44 is also necessary in order to ensure that the areas which are to be enforced by the Ministry of Health and Wellness are adequately covered by that legislation. Steps should then be taken to make the appropriate modification to the Act.

124. In view of the transfer of the Environmental Protection Department to the Ministry of Environment and National Beautification and the Department's mandate to address environmental issues, there needs to be an urgent rationalization of the roles and responsibilities between the Ministry of Environment and National Beautification, the Ministry of Health and Wellness and the Ministry of Labour and Social Partnership Relations with respect to indoor air quality.

125. Formalised policy and administrative arrangements are necessary to ensure that adequate communication occurs amongst departments (EPD, Ministry of Labour and Social Partnership Relations, Ministry of Health and Wellness and the Building Authority) in order to regulate indoor air quality through planning, design, construction, commissioning and operation of the working environment. This is particularly necessary for the Labour Department and the Ministry of Health and Wellness to ensure efficiency in the allocation of resources and the execution of required inspection duties.

126. Cabinet is therefore invited to:

i. Note the Policy Paper on indoor air quality issues in Barbados;
ii. Note the limitations of the Environmental Protection Department (EPD) to enforce the Health Services Act CAP 44 and the inadequacies of the Act relative to indoor air quality issues;
iii. Note the mandate of the EPD to address environmental issues such as ambient air quality and the challenges which the Department currently faces as a result of inadequate environmental legislation;
iv. Agree that the Government should be amend existing legislation or enact new legislation to facilitate the EPD to execute its functions in a more effective and efficient manner;
v. Note the provisions within the Safety and Health at Work Act CAP 356 for the Ministry of Labour and Social Partnership Relations to address indoor air quality and other occupational health and safety issues;
vi. Agree that the Government should adopt the suite of American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standards: Standard 62.1-2013 - Ventilation for Acceptable Indoor Air Quality, 62.2-2013 - Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings, and Standard 170-2013 - Ventilation of Health Care Facilities as guidance documents;
vii. Agree that the Government should adopt the Barbados National Standards

Institution's Indoor Air Quality Technical Standard as a national standard when it has been published, and make it a mandatory standard through reference in appropriate legislation such as the Safety and Health at Work Act CAP 356;

viii. Agree that the Environmental Protection Department will retain lead responsibility for the processing of development applications;

ix. Agree that the Ministry of Labour and Social Partnership Relations is best suited to assume responsibility for indoor air quality issues;

x. Agree that indoor air quality in Barbados needs to be managed in a more efficient manner, and that the structure outlined in this paper seeks to address some of the current deficiencies and proposes a holistic approach to IAQ management;

xi. Agree that there shall be urgent discussions between the Ministry of Environment and National Beautification, the Ministry of Health and Wellness and the Ministry of Labour and Social Partnership Relations to rationalize the responsibility for regulating indoor air quality by November 30, 2018.

xii. Agree that there should be full transfer of the responsibility for investigating indoor air quality complaints to the Ministry of Labour and Social Partnership Relations by 1st January 2019.

7 REFERENCES

1. Aerias, Air Quality Sciences, IAQ Resource Centre (2007) http://www.aerias.org, last accessed November 8th, 2007
2. Ejimofar, Patience (1997). "Control, not cure, answer to asthma". Nation Barbados Limited, Weekend Nation, Friday, July 4, 1997.
3. Environmental Health Centre (EHC), Division of National Safety Council (2003) http://www.nsc.org/ehc/indoor/sbs.htm last accessed May 7th, 2007;
4. Headley A. S. "Strategic Plan 2000 - 2010". Environmental Engineering Division, Ministry of Health, Barbados.
5. Health Canada 1993. "Indoor Air Quality in Office Buildings: A Technical Guide".
6. Health Canada 1995. "Fungal Contamination in Public Buildings: A guide to Recognition Management". Federal-Provincial Committee on Environmental and Occupational Health.
7. Howitt ME, Roach TC, Naidu R (1998): Prevalence of asthma and wheezing illnesses in Barbadian school children: The Barbados National Asthma & Allergy Study (Abstract). West Indian Med J 1998, 47(suppl 2):22-23.
8. Research and Planning Unit, Economic Affairs Division (2007), The National Strategic Plan of Barbados 2006-2025
9. Safety and Health at Work Act CAP 356 Barbados (2005);
10. The Barbados Advocate (1997). "High rate of asthma in school children", Monday July 14, 1997.
11. The Health Services Act CAP 44 Barbados (1969)
12. US EPA, NIOSH (1991). "Building Air Quality: A Guide for Building Owners and Facility Managers", December 1991.