

Performance of using Techniques to achieve the Objectives of the Department of Meteorology



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1. **Executive Summary**

The nature of the atmosphere for a specified period of time in a given area is known as the weather. Notification of upcoming rain, lightning, strong winds, storms, wind direction, wind speed, pressure, sea level, temperature, humidity is weather forecasting. The Department of Meteorology which was established as a separate Department in 1948 is currently functioning under the Ministry of Defense.

Traditional Equipment and Automated Weather Equipment are used for earth surface observation and the upper air data. Therefore, the evaluation of performance of using techniques to achieve the objectives of the Department of Meteorology was the objective of the Audit.

The Ministry of Disaster Management had entered into a Trust Fund Agreement with the World Meteorological Organization on 24 May 2007 for installation of a Doppler radar system which is an Automatic Weather System in Sri Lanka. Accordingly, the contract for the procurement of Radar Equipment had been awarded by the World Meteorological Organization to an American Company. Although the works of installation of the System had been commenced on 10 October 2012, the Construction works had delayed due to the suspension of construction works on a number of factors, such as having a layer of rock when laying the foundations for construction due to lack of soil test. As a result, parts of the damaged equipment were shipped back to the American Manufacturing Plant, it had been concluded that the cost that had to be incurred for repairing would be too high. It had been impossible to obtain insurance compensation for the damaged Radar Equipment Parts. At present, the relevant location is unsafe and it could not be satisfied that the existence of the equipment is not satisfactory. Two Doppler Radar Systems are to be installed near the office premises of both the Puttalam and Pottuvil Meteorological Stations with the aids of the Japan International Cooperation Agency and it was observed that the extent of land required for this has not been specifically identified and also the survey plans in relation with them have not been prepared and land acquisition activities are being carried out in very slow manner.

It was observed that the operations of the Automatic Weather System have been disrupted from time to time, it has not provided accurate weather data by that and the data communications facilities had collapsed and also less attention has been paid on proper maintenance of these equipment. Even though it had been stated that the Mercury-containing products should not be allowed to be imported or exported after the year 2020 as per the Minamata Convention, it seems that the Department has not paid sufficient attention by maintaining automated weather systems in an unproductive manner. It was observed that the prediction on agro-meteorology was not in compliance with the World Meteorological Standards.

Recommendations such as finding the possibility of taking actions without incurring further financial loss to the Republic of Sri Lanka and act accordingly, conduct feasibility studies including a study on the environmental impacts of the Puttalam and Pottuvil sites, where new Radar Systems are expected to be installed, preparing guidelines for routine maintenance of Automated Weather Equipment and providing a maintenance list for that have been proposed to make effective the objectives of the Department.

Meteorological forecasts had been provided using modern techniques such as statistical weather forecasting and obtaining satellite information. However it is observed that the procurement, installation, documentation, safeguarding, maintenance of modern equipment and compliance with standards is not sufficient and it is also affected to the accuracy of the weather data.

2. Introduction

2.1 Background

The nature of the atmosphere for a specified period of time in a given area is known as the weather. Notification of upcoming rain, lightning, strong winds, storms, wind direction, wind speed, pressure, sea level, temperature, humidity is weather forecasting. The knowledge and experience of the Meteorologist will affect the subjective type weather forecasting and weather data on land, high atmospheric data, satellite imagery and thermodynamic data requires for this.

The Department of Meteorology which was established in 1948 as a separate Department is functioned under the Ministry of Defense at present. This Department is the only national institution authorized for early warnings of weather, meteorological services and weather disasters and tsunamis.

The Department of Meteorology is administered by a Director General. In addition to the Head Office in Colombo, the Department has 22 external offices including the offices located at the Katunayake, Mattala and Ratmalana Airports. In addition to this, data collection is being done at 16 other Collaborative Centers located in other places as well and 42 senior level officers, 9 tertiary level officers, 197 secondary level officers and 125 primary level officers are serving in the Department.

The Headquarters located in Colombo is consisted with National Meteorological Center, Research Division, Data Division, Climate Division, Rainfall Section, Agro-Meteorology Division, Radiosondes, Computers and Climate Change Technology. Similarly, Divisions for maintenance of Short Circuit, Electronic Equipment and Meteorological Equipment, Finance, Administrative and Warehouses are the other divisions located in the Head Office of the Department. Necessary meteorological services are provided for international and domestic flights by the offices are located at the Katunayake, Mattala and Ratmalana Airports.

Vision

To be the hub of excellence in connection with the weather, meteorological services and associated early warning services.

Mission

Services with national importance in relation with Meteorology, Aerodynamics, Marine Meteorology, Water Meteorology, Agro-Meteorology, Climatology and Astronomy and providing early warning services related to that with international standards to Public Sector, Private Sector and to the Public. The major milestones of the functions of the Department of Meteorology are as follows.

- i.** 1867 - Commencement of meteorological observations (Ratnapura, Badulla and Hambantota)
- ii.** 1907 - Establishment of Colombo Observatory
- iii.** 1922 - Obtaining Observations on Upper Air Weather Conditions
- iv.** 01 October 1948 - Establishment of the Department of Meteorology
- v.** 1951 - Obtaining the Membership of the World Meteorological Organization
- vi.** 2003 - Convert into a major Department

Functions

(a) Collecting of Data

- i.** Geological Survey
- ii.** Observation of high atmosphere data

(b) Preservation of Data

- i.** Summarization of the data

- ii. Preparation of data subjected to quality control daily, monthly, annual etc.
- iii. Computerization
- iv. Provision of necessary data to the public through computers.
- v. Provide necessary climatic information through analytical maps.

(c) Weather Forecasting for the Public

- i. Forecasts of rain conditions, temperatures and humidity up to 36 hours in the short term.
- ii. Rain forecast in the long term, expect months ahead

(d) Special Weather Forecasting for Inclement Weather Conditions

- i. On strong winds
- ii. Of lightning
- iii. On heavy rainfall
- iv. Special weather forecasting for hurricanes

(e) Forecasting the Condition of the Sea for Fishermen

- i. The Nature of the Sea (such as the height of the waves)
- ii. Wind Speed

(f) Weather forecasts for domestic and international flights

- i. Pressure, Wind Direction and Temperature
- ii. Wind directions, cloud conditions and temperatures at each level of the upper atmosphere
- iii. Weather conditions along the route

(g) Conducting Researches

In addition, the tsunami warnings have been issuing since 2005 . The data collected are used for forecasting, development activities, research, reporting for insurance claims and for legal purposes.

(h) Foreign Relations

The Department of Meteorology is functioned to maintain its International Relations as follows.

- Being Functioned since 1951 as the Permanent Representative of the World Meteorological Organization of Sri Lanka to the United Nations Weather and Climatic Affairs Authority.
- Act as the National Hub of Intergovernmental Panel on Climate Change (IPCC) .
- Being a Member of the Meteorological Organization of Tropical Cyclone Bay of Bengal and in the Arabian Sea Region Sub-committee from its inception.
- Being a Member of the Scientific Planning Committee of the Asia Pacific Regional Network for the Global Change Researches.
- Establishment of Relationship as the central agency of Sri Lanka with the Regional Integrated Multiple Emergency System (RIMES) .
- Act as Sri Lanka's Representative on warnings of the Indian Ocean Tsunami Warning Subcommittee on the International Maritime Commission.

2.2 Basis for Selection of the Title

Making aware of the public on adverse weather conditions such as cyclones, heavy rains, lightening, strong winds and tsunamis are the main services provided by the Department of Meteorology. The timeliness and accuracy of this information are directly influenced for the decisions made by the parties involved.

Providing accurate and timely weather forecasts help to minimize disasters and the following disasters have been recorded in Sri Lanka during the year 2017 as per the sources of the Disaster Management Center .

Nature of the Disaster	Deaths	Injured	Missing People	Completely Damaged Houses	Partially Damaged Houses	Affected People
Floods and Landslides	105	100	75	1,179	6,580	621,323
Drought	-	-	-	-	-	1,756,498

Since the number of affected people in disaster and the damages occurred in Sri Lanka due to adverse weather conditions is high as per the above information and also it is important that the techniques used to evaluate the extent to which the objectives of the above Department have been accomplished, this topic was selected for Performance Audit.

2.3 Audit Objectives and Criteria

The Main Audit Objective : Performance of using techniques to achieve the objectives of the Department of Meteorology.

Audit Sub Objectives

Criteria

Facilitate the use of modern techniques in the Department of Meteorology and up to what extent these modern techniques are being used in obtaining meteorological data

➤ General Meteorological Standards (Technical Regulations Basic Document No.02 Volume 01 – General Meteorological Standards and Recommended Practices)

➤ Guidelines of World Meteorological Organization for meteorological equipment, their accuracy and installation. (Guide to meteorological instruments and methods of observation)

Evaluation of achievement of Objectives of the Department of Meteorology

➤ General Meteorological Standards (Technical Regulations Basic Document No.02 Volume 01 – General Meteorological Standards and Recommended Practices)

➤ Action Plan- 2018

➤ Sustainable Development Goals

➤ Budget and Procurement Plans

2.4 Audit Approach

- (a) Checking of books and documents
- (b) Functions of equipment and analysis of data which can be obtained from
- (c) Physical inspection of selected Meteorological Centers
- (d) Obtain necessary clarifications and confirmations

2.5 Scope of Audit

I carried out my audit in accordance with the International Auditing Standards of the Supreme Audit Institutions (ISSAI 3000-3200) .

- (a) Our Performance Audit is carried out in accordance with the Guidelines issued by the International Organization for Supreme Audit Institutions (INTOSAI) and the provisions in Article 154 of the Constitution of the Democratic Socialist Republic of Sri Lanka and in terms of the provisions of the National Audit Act No. 19 of 2018 . Up to what extent can the stated objectives be achieved in order to obtain a conclusion based on the observations and recommendations of our performance audit, an understanding is gained in respect of institutional operations and internal control systems as a basis in achieving those objectives and for determining what risks are involved.

- (b) Our audit was carried out in respect of the selected sectors for the years 2017 and 2018 on the basis of limited staff, other resources and time allowed.
 - Selected Meteorological Stations
 - Colombo, Rathmalana, Katunayaka, Katugastota, Galle, Puttalam, Ratnapura

- Selected Agro-Meteorological Centers
 - Homagama, Deniyaya, Gannoruwa, Ratnapura, Kottawa
- Selected Automatic Meteorological Centers
 - Labugama Deniyaya, Thawalama, Wagolla
- Selected Automatic Rain Gauges
 - Established 2009 - Gannoruwa, Aninkanda, Mallikawatte
 - Established 2009 - Labugama, Shalikulawatta, Padukka, Avissawella
- Department of Fisheries

2.6 Limitation of Scope

Our work is pre-planned and linked to the Audit Plan. This may change depending on the results of our findings during carry out the Performance Audit. Accordingly, the extent of Performance Audit is limited to sample procedures on innovation of audit scope, availability of the time for audit and the human resources. Similarly, audit observations have been presented based only on data obtained from files and reports of the Department of Meteorology and the publications issued by the World Meteorological Organization and no expertise in meteorological techniques has been used for auditing.

2.7 Authority for Audit

This performance audit was carried out under my directions in terms of Article 154 (I) of the Constitution of the Democratic Socialist Republic of Sri Lanka and in terms of Sections 3 (1) (d), 5 (2) and 12 (h) of the National Audit Act.

3. Detailed Audit Findings

3.1 Providing of Weather Forecasts

The Department of Meteorology should act to provide necessary weather forecasts to the public for daily and economic activities, warnings of adverse weather conditions, provide required information to the government authorities to protect the lives and property of the public in accordance with the World Meteorological Standards and Guidelines.

The forecasts and decisions are delivered for the public, community related to various industries and to various organizations for the island at 5.30 a.m, 12 noon and 4 p.m and the forecasts on rain, wind, thunderstorms possible to be occurred during the next 24 hours in the surrounding sea at 5.30 am and 12 noon in every day through both printed and audio visual media by the National Meteorological Center under the Equipment Division of the Department. Warning of adverse weather conditions are being carried out by the Early Warning Center for Natural Disaster. The following matters were observed in this regard.

3.1.1 Delivery of Forecasts at Institutional Levels

(a) To Various Public Institutions

It was observed that the early warnings and forecasts are delivered to all necessary agencies including the relevant District Secretaries, Tri-forces and Police, Signaling Divisions, Presidential Secretariat, Prime Minister's Office and other areas affected by the Disaster Management Centers through Audio Visual Media Institutions, specifying safeguards in accordance with the World Meteorological Standards for areas where adverse weather conditions may occur .

(b) To the Ministry of Fisheries

At the examination of the activities of Ministry of Fisheries in respect of the special announcements delivered regarding the strong winds and heavy rains over the area around the island, it was observed that the ability of preventing the deaths by early warnings issued to these officers by the Department .

3.1.2 Expression of Agro-weather Forecasts

(a) In Compliance with World Meteorological Standards

Including weekly data from the Agro-meteorological Department, a report on Agro-meteorological data is published in the Department's website. As stated in sub-section 2.1.1 of the Technical Regulations Basic Documents No.2 of the World Meteorological Standards in the Agro-meteorological publications, the Department should look at how the data should be presented. The following matters were observed in this regard.

- i.** Although the frequency, time analysis, trends and statistical representations of Agro-meteorological parameters should be included in Agro-meteorological publications in accordance with the Sub-section 2.1.1.2 World Meteorological Standards, it had not been so done .

- ii.** Soil temperature data (type of soil , nature of soil / Soil cover and surface management, degree and direction of slope of ground) had not been presented in accordance with the World Meteorological Standards 2.1.1.3 .

- iii. Soil moisture data for paddy and other crops had not been presented in accordance with the World Meteorological Standards 2.1.1.4 .
- iv. Evaporation data had not been presented in accordance with the World Meteorological Standards 2.1.1.5 .

(b) Agro-weather Reports for Major Crops

Although the reports on productivity status, favorable and unfavorable weather factors for important crops, data on important meteorological parameters should be submitted in terms of the World Meteorological Standards 2.2 , it was observed that the Department had not so acted.

(c) Collection of Accurate Agro-meteorological Data

The following observations are made in the physical examination of a sample of equipment boxes belonging to the Agro-meteorological stations.

i. Agro-meteorological Station – Kundasale

Although the grass should be cut and cleaned in the Equipment Enclosure , it had not been so done and a Earth Thermometer had not been installed in the Soil Thermometer Enclosure.

ii. Agro-meteorological Station – Gannoruwa

Although the automatic rain gauge is still in operation, the dust covered solar panels which were used in this case were not cleaned, discolored evaporator disk due to dropped foliage , out of order in the autonomous rain gauge , lack of water in the wet bulb thermometer were observed .

3.2 Installation of a Doppler Radar System in Sri Lanka

Radar observing is more useful for detecting adverse weather conditions, stay in alert continuously on them, warnings, weather surveys and rainfall assessment. Radar is the only realistic strategy that can continuously monitor adverse weather conditions based on synoptic observations over a wide area. (World Meteorological Guideline - Guide to Meteorological Instruments and Methods of Observation -2008 Edition Updated in Section 9.1.3 of Part II, 2010)

3.2.1 World Meteorological Trust Fund Project

The provisions had been made from the year 2006/2007 by granting the approval of the Government of Sri Lanka for the installation of a Doppler Radar System in Sri Lanka. For this purpose, Sri Lanka had entered into a Trust Fund Agreement with the World Meteorological Organization on 24 May 2007 . The following matters were observed in this regard.

3.2.1.1 Selecting the Site to Install the Doppler Radar System

When selecting the site surrounding to install the Doppler Radar System, natural disasters such as floods and landslides have been identified covering the western and southern provinces as a major criteria. Accordingly, Gongala Mountains in Deniyaya area as the radar site and Mount Riveston in Matale as a back up site had been selected on experts' advice. Sub- section 9.7.1 in second part of the World Meteorological Guideline had emphasized the importance of optimal ground selection and the details with regard to the significant economic and technical factors and non- compliances with that appear below.

- i.** Having access roads
- ii.** Availability of electricity and communication facilities, lightning conductors

- iii. Cost of the land
- iv. Closer to the monitoring and maintenance facilities
- v. Avoidance of beam blockage
- vi. Removal of radar misleading resistors on the ground
- vii. Long range surveillance and if need a radar for tropical cyclone detection or other uses on the coast line, set it on a hill.
- viii. Unavailability of wind power plants nearby.
- ix. Carry out Investigation of electromagnetic interference to get far away from communication systems or other Radars as much as possible, such as television, microwave connections.

(a) Suitability of the Land Selected

The officials of the Department have submitted information on 10 selected locations to the World Meteorological Consultant who was involved in the selection of the land. Although the Gonagala Mountain was identified as an ideal land after inspecting these sites, consultants of the World Meteorological Organization and the representatives of the supplier of the Doppler Radar System as well had emphasized about the establishment of the Naval Radar Center in that area, lack of suitable access road and other infrastructure.

Although the Department has taken steps to remove these obstacles, it was observed that those were at failure condition as per the following matters.

- i. Even though the approval had been received to install the Doppler Radar System in high security zone from the Ministry of Defense and Telecommunication Commission, impose a condition as the Doppler Radar System cannot be used until the system is restored in the event of a disruption to the Navy System.

- ii. The access road is still in very difficult condition during the physical inspection conducted by the audit on 01 March 2019 .

(b) Ownership of the Land

Steps had been taken to take over the ownership of the land that was owned by Mathurata Plantations. There were no objections from Mathurata Plantation Company which was its owner and Sri Lanka Navy; the possessor, with regard to the acquisition of the extent of land for installation of the system and construction of the access road. However, actions had not been taken to prepare a survey plan surveying the required land area. Therefore, although arrangements had been made to take over the ownership of the land required for this Project, it was observed that such measures taken were not effective due to the matters such as the required land area was not properly identified.

(c) Consultation for Selecting of Land

Two places in Gongala and Rivastan mountains were identified by a consultant of the World Meteorological Organization staying in Sri Lanka for 7 days from 27 September to 3 October 2007 examining the feasibility of installing the system in 10 locations introduced by the Department. In this case, it was observed during the checking of files that it had acted without awareness in respect of the basic criteria to be considered when the Department identifies suitable locations to install the system and although it was concluded to conduct a feasibility study regarding the installation on the Gongala Mountain top and the Department had not taken steps to do so, and also a considerable consultation had not been received from the World Meteorological Organization which acts as the primary consultant in terms of Section 3 of the Trustee Fund Agreement regarding this.

An expenditure of US \$ 18,024 had been credited from the Trust Fund by 31 December 2007 and a sum of US \$ 8,640 and US \$ 9,323 had included as its consultancy fees and travel expenses respectively. However, it was observed that the advisers and representatives of the organization had failed to provide adequate consultancies. Due to less attention was paid to choose the right location which should do very carefully in accordance with the World Meteorological Guidelines, it was observed that the Project had failed since it had acted to install the system in an improper location.

3.2.1.2 Construction of Tower and Access Road

It had decided that the Doppler Radar System should be installed in a 20 meters high Tower. The construction of the tower has no connection to the Trust Fund Project and the total responsible of this had been assigned to the Department. The contract for the construction of the Tower and the transportation of the imported Radar Systems from the Port to Gongala had been awarded to the Central Engineering Consultancy Bureau in contrary to call open tenders as per the Decision of Cabinet of Ministers No. 10/0041/343/001 dated 13 January 2010. The Bureau had completed the construction of the Tower and access road on 11 March 2012. Since this road which was 700 meters long was a site that is prone to erosion and the relevant constructions had not been done to suit it and it was observed that these shortcomings remained the same when transporting equipment parts.

(a) Identifying the Scope of the Contract

The relevant work site had to be set properly for the installation of Radar System by March / April 2010 as above. Accordingly, it had been entered into a final decision on the design of the tower inspecting the work site by a representative of the production institute which had produced the System during his stay in Sri Lanka from 14 to 18 September 2009 after

discussing with a representative of the National Building Research Institute who works as the consultant for this construction project .

Although the initial cost estimate was Rs. 43,457,400 for the construction of the Tower and access road, the contract had been awarded to the Bureau not exceeding a value of Rs. 60,452,000 on 12 March 2010 with subsequent revisions. As a result of the relevant scope of the contract was not clearly identified as this, it was observed that the contract value could not be determined with certainty.

(b) Co-ordination of Relevant Government Institutions for Construction

Although the construction works of the Tower should have to be commenced by April 2010 , the foundation works; the first phase had been begun after making the access road. Even though all construction work should be completed within 4 months as per the contract agreement by July / August 2010, the foundation works for the Tower had been commenced in September 2010. It had stated that the reasons for the delay was the lack of permission from the Sri Lanka Navy to stay in the site at night and although this was discussed at the progress review meetings, the top Management of the Department had not taken prompt actions for that.

(c) Soil Testing

As a result of the designing of this Tower as a 20 meter tall building and to rely a heavy duty equipment system on it, carrying out a soil test at the site where it is being built is an essential task at the instance of designing the Tower. However, soil tests had not been carried out and construction of the building had to be halted along its works due to the identification of the instability of the soil when laying the foundations for

construction. Since a change should be made about 10 to 15 meters from the proposed site where the tower to be constructed after soil testing , it was observed that an unproductive costs had to be incurred because of redesigning of the building plan. Although the contract period had been extended for all construction works to be completed by 20 July 2011, only about 80 per cent of the foundations were laid by 31 May 2011 . Even though the contract period was later extended up to 19 December 2011, the Bureau had announced that the construction had been completed on 15 January 2012 .

(d) Obtaining Approval of Building Plan

Although the Survey Plan of the land and the Building Plan should be get approved by the Kolonna Pradeshiya Sabha before the commencement of the construction, any step had not been taken to do so. It was observed that these constructions were carried out without proper approval. The approval for this Project had been received by the letter No. 8/ NRM /TOWER /Radr /01/10 of the CEA dated 11 May 2010 and it had stated that the permit would be valid for one year. However, actions had not been taken to renew the permit of the Central Environment Authority . The approval for the construction had been obtained from the Civil Aviation Authority and permission had been granted from the 02 institutions above for the construction emphasizing that the height of the Tower should be 20 meters. It was observed that it has been stated that the height of the Tower is about 23 meters during the checking of the files and accordingly, the construction was not done as per the conditions.

(e) Performance Security

Even though this construction contract had been awarded to the Bureau in contrary to call up open tenders by a Decision of the Cabinet of Ministers as specified in Paragraph 3.1.2 above, the contract administration should have been carried out in accordance with the procurement guidelines 2006 . Although it is necessary to submit a performance guarantee for not less than five per cent of the estimated contract price to protect the procurement process if the contractor violates the agreement in a contract work in accordance with Procurement Guidelines 5.4.8 , it had been stated that there was no need to submit the performance guarantee based on the above Decision of Cabinet of Ministers in the contract agreement with the Bureau.

(f) Quality of the Building and Other Installations

Although the Central Engineering Consultancy Bureau has completed the construction work, it was observed from the observations consisted in the Records of the Department that the building and the installation of equipment was not in proper quality (eg. generator, air conditioner) . Because of the components of the Doppler Radar System are very sensitive, they can quickly become unusable (eg, corrosives, fungus) and when storing and operating the system, the humidity in the surrounding environment should be at a minimum level. Although the weaknesses of the building and other installations had been shown at the time of checking the suitability of installing of the System by a representative of the manufacturing organization of the System, those corrections had not been made. It was observed that delay in construction of Tower and lack of proper quality was one of the main reasons for the failure of the Project.

(g) Construction of a Room for Officers

In spite of delays and shortcomings in the quality of the contract completed by the Central Engineering Consultancy Bureau a contract had been awarded to that contractor for the construction of rooms for officers on the 2nd floor of the Tower to a value of Rs. 6,035,176.47 in contrary to the Procurement Guidelines. In this case, it was observed that it had been acted beyond the Procurement Guidelines 2006 based on the Decision of the Cabinet of Ministers No. 10/0041/343/001 dated 13 January 2010 .

(h) Supervision of Contract Work

The Procurement Entity should responsible to ensure adequate supervision and assessment of work execution, delivery of goods or services for interim payments and final payments in terms of 8.12.1 (a) of the Guidelines 2006. Out of the value of work completed by contractor (Rs. 52,549,651.25) the amount paid to the contractor (Rs. 40,229,052.46) was 76 per cent by 10 October 2012 . The amount of work completed by the contractor as per the Bill of Quantity (BOQ) was (Rs. 44,243,238.40) 84 per cent and the value of additional work completed was (Rs. 5,804,048.50) 11 per cent . Although the payments had been made by the Department as above, it was observed that the implementation of the work, supply of goods and service was not adequately supervised and not assessed during the checking of the documents.

3.2.1.3 Purchase and Installation of the Doppler Radar System

In accordance with sub-section 3.3 of the World Meteorological Association's Trust Fund Agreement, the purchase of Doppler Radar Equipment, Weather, Communication and Workshop Equipment, Data Processing, Spare Parts, Vehicles, Training Equipment and Textbooks had been assigned to the World Meteorological Society on the instructions of the Sri Lanka Meteorological Department. It had stated in the agreement that the procurement should be done

in accordance with the procurements of the World Meteorological Organization ensuring proper conditions to project and certifying competitive prices. Accordingly, the tender process for the procurement of Radar Machine was started in late 2008. The contract had been awarded by the World Meteorological Organization on 18 June 2009 on a value of US \$ 1,681,017 to the American Institute of Enterprise Electronics Corporation for procurement of Doppler Radar Machines. The following matters were observed in this connection.

(a) Early Detection of Frequency Limit

As the Doppler Radar System was planned to be installed in Gongala by March / April 2010 as per the Work Plan of the Project, the purchase order had been submitted on 18 June 2009 and it had scheduled to be imported to Sri Lanka by July / August 2009. Even so, the electric wave border emitted by the Radar System had to be precisely identified and the approval had been received as the electric wave border was 2.78 ± 0.0159 GHz on 17 May 2010 after discussing with the Ministry of Defense. Although it was the responsibility of the Department to determine the electric wave border by 10 January 2009 as per the responsibility matrix, since the Department had not given priority to this, it was observed that there was a delay of over a year.

(b) Awarding of Contract

It had stated that the procurement of Doppler Radar Equipment should be done on the instructions of the Department of Sri Lanka in terms of Sub-section 3.3 of the Trust Fund Agreement. Accordingly, the Director General of the Department had participated in the Technical Evaluation Committee Meeting held in Geneva on 9 January 2009. The World Meteorological Association had awarded the contract for the procurement of Radar Equipment to the aforementioned Enterprise Electronics Corporation without subject to attention on the recommendations of the Cost Evaluation

Committee appointed by the Department. The Department does not own any documents relating to the contract entered into with the World Meteorological Organization and its supplier, only the proposal made by the supplier on 14 November 2008 had been included in the file. Accordingly, it was observed that the contribution of the Department had not been adequately received in the selection of the supplier.

(c) Factory Acceptance Testing

Factory Acceptance Testing should be carried out in the Factory to verify whether all the functions which should be performed are fulfilled by Radar Equipment. Accordingly, even though the Factory Acceptance Testing was carried out with the participation of the Chief Engineer of the Department from 29 September to 1 October 2010, since several problems with the equipment arose it was decided to do that test at a second time. The second test took place on 19 January 2011 with the participation of a World Meteorological Representative and since the result of the test was successful, it was decided to ship those equipment parts. Nevertheless, it was observed that the signature of the Quality Assurance Manager of the plant had not been put in the certificate issued by the supplier relating to that test.

(d) Importation of Equipment Parts into Sri Lanka

Even though the contractor should send the goods to the relevant address as soon as the acceptance test is completed as per the contract conditions, since the construction of the Tower was delayed, the Department had received the relevant stock of equipment on 03 October 2011. Accordingly, it was observed that it had taken more than 08 months for the Department to receive the relevant stock.

(e) Assurance of Workplace as Suitable for Installation of Equipment

The Department should provide a confirmation to the supplier whether the workplace is suitable for it before installing the Radar System. Accordingly, the Department had sent a confirmation that the work site was suitable for installation completing the checklist on 21 June 2012 sent by supplier. However, it was observed that the relevant work site was not suitable to be installed the system whilst the supplier visited the site to install the system as per the observation reports made by the officials of the Department from time to time .

Eg. Although it had stated in the above inspection report that the equipment room was sealed so as not to cause any adverse environmental impact, it was observed that the equipment room was waterproof when the supplier's agent arrived to assemble the equipment parts.

(f) Installation of Equipment Parts

A representative of the supplier had commenced the installation of the system on 10 October 2012 , as per the report certified that the workplace was suitable for installation of the system as above. Even though the parts of equipment had been brought to the site by then it was too late to bring in a crane required to install it. Therefore, the supplier's agent and staff had to stay idle for about one day. As the vehicle carrying the very heavy and large crane had crashed a part of its driveway and crashed down from the mountain, causing the driver being in danger , it had to stop installing the system. The contract value for the crane was Rs. 2,848,550 and a sum of Rs. 203,505 had been paid. Therefore, it was observed that the wages paid to the staff and the fees paid to the crane were ineffective expenses.

(g) Involvement of the World Meteorological Organization in the Installation of Radar Systems

The final decision had been given to install the Radar System arriving a representative of the supplier on 22 June 2013 and checking of the suitability of the work site more than 08 months delay after stopping of installing Doppler System as above and because of the access road was dilapidated after installing a deck instead of carrying a crane, it had been decided to move Radar Equipment to the top of the Tower. Accordingly, the supplier's industrial engineer had arrived and installed the equipment from 05 to 11 October 2013 and the electronic connection had to be provided on 19 October 2013 . However, it had stated that the above Radar System could not be provided the electronic connectivity in a letter sending to the World Meteorological Organization by the supplier on 17 October 2013 . Copies of the photographs of the instrument parts had been attached to the letter. It had been rejected stating that the “The supplier's agent did not mention anything when installing the equipment” without taking steps by the Department to verify the accuracy of the damages of the equipment which they had pointed out. It was observed that there was an opportunity to resolve this issue if there was a representation from the World Meteorological Organization that would do the consultation in terms of Sub-section 3.3 of the Trust Fund Agreement.

(h) Obtaining Advices on Installation

Although the documents such as instructions for installation , maps and specifications should be provided to the Department by the contractor before sending the relevant Radar Equipment parts to the Department as per the tender conditions, it was observed that these were not properly received to the Department.

Eg. Problems arise when the pits were prepared to set the piles for assembling Radome.

3.2.1.4 World Meteorological Trust Fund Account

It had expected to procure the Radar System, installation, specialists service and to train the staff of the Department of Meteorology under the Trust Fund Agreement and the World Meteorological Organization had appointed a Programme Manager to coordinate these activities. Accordingly, a sum of US \$ 2,884,274 has been deposited to the account held in Geneva, Switzerland of that Organization and the Department had obtained US \$ 95,108 from that deposit and a sum of US \$ 113,046.49 had been received as the deposit interest .

Although this agreement should expire on 24 May 2014 as the works of this project was not completed, the contract period had been extended on 12 August 2016 to 31 December 2018 . The Agreement of the Trust Fund had been extended as this at that time with the intend of repairing damaged Radar Equipment parts by the remaining deposit of the Trust Fund as per the Decision of the Cabinet of Ministers No. 16/1065/715 / 004-1 dated 22 June 2016 . The following observations were made in this regard.

(a) Classification of Trust Fund Expenses

The purpose of this Trust Fund Agreement had not achieved and it was observed that only the financial losses to be borne by Sri Lanka had only occurred by extending the contract period . A sum of US \$ 1,096,442.76 had been incurred from this Fund by 20 September 2019 and its cost classification was as follows.

Description of Expenditure	US \$
-----	-----
Weather equipment	994,876
Travelling Expenses	63,894
Consultation	32,781
Administrative Charges	3,916
Bank Charges	263
Exchange Difference	46
Other Direct Expenses	667

Total	<u>1,096,442.76</u>

(b) Difference in Expenses in the Account

The responsibility for keeping the accounts of the Trust Fund had been assigned to the World Meteorological Organization . Accordingly, the expenditure incurred up to that date was US \$ 1,836,652 as per the financial statement submitted on 25 April 2018 and that cost had been decreased by US \$ 740,209 by 20 September 2019 as above. Similarly, the composition of the expenditure had been changed as follows:

Description of Expenditure	Expenditure as at 25.04.2018	Expenditure as at 20.09.2019	Difference	Percentage
	(US \$)	(US \$)	(US \$)	(Per cent)
-----	-----	-----	-----	-----
Weather equipment	1,737,848	994,876	742,972	43
Travelling Expenses	59,814	63,894	(4,080)	(7)
Consultation	31,463	32,781	(1,318)	(4)

Administrative Charges	6,560	3,916	2,644	40
Bank Charges	254	263	(9)	4
Exchange Difference	46	46	--	0
Other Direct Expenses	667	667	-	0
Total	<u>1,836,652</u>	<u>1,096,443</u>	<u>740,209</u>	

3.2.1.5 Repair of Damaged Doppler Radar Accessories

The World Meteorological Organization had entered into an Agreement of United Nations Agency Contribution with United Nations' Office for Project Services - UNOPS on 29 April 2014 for project management with regard to the installation of Gongala Radar System in Sri Lanka and procurement evaluation of the World Meteorological Organization. That agreement was valid until 15 June 2014 and the contract was valued at US\$ 99,509 . As a result of the discussions made after handing over the relevant report by the United Nations Office it was decided to send the Radar Equipment from Gongala work site back to the Factory for repairs. Accordingly, even though the equipment parts were shipped back to the American Manufacturing Plant it had concluded that the cost of repairs would be too high. The following observations were made in this connection.

(a) Determination of Repair of Damaged Equipment Parts Again

It was decided to send these Equipment Parts of this Radar System back to the Manufacturing Plant in Alabama, America to repair and the cost of this to be incurred to be borne by the Trust Fund as per the discussion held in Geneva from 01 to 03 June 2015 with the Representation of the Chief Engineer of the Department . It had concluded that the Radar Equipment could be repaired as per the report issued by the relevant United Nations' Office after inspecting the

Gongala Workshop from 18 to 19 August 2015 as per the United Nations' Representative Contribution Agreement. The time had elapsed for the Manufacturing Company to agree to repair the equipment parts. It was observed that this decision which was taken after more than one and a half years of installing Radar Equipment at Gongala site was ineffective.

(b) Inspection Conducted by UNOPS

Even though the agreement between the World Meteorological Association and the United Nations Office (UNOPS) was over on 15 June 2014, Representatives of the United Nations Office (UNOPS) had visited Sri Lanka for the inspection what they had conducted as per the agreement two months after the expiry of the said agreement period. It was observed that making decisions in delay when keeping very sensitive electronic devices remained without utilizing for long as this was not effective without paying attention to the equipment being damaged.

(c) Sending the Equipment Parts to the Supplier

More than an year and a half had elapsed by that time since the date of the decision made to send the Radar Equipment Parts back to the supplier for repair as per the above decision. Shipping of these Equipment Parts had been carried out on 26 April 2017 being delayed by 06 months on the instructions of the World Meteorological Association. Even though an order amounting to US\$ 361,629 had been placed on 20 December 2016 by the supplier for the repair of the Equipment Parts assembled at Gongala site to send back to the Manufacturing Plant, it had informed on 22 March 2018 the estimated cost for the repair was US \$ 1,095,935 by checking the condition of the Equipment Parts sent. Due to a delay of more than 3 ½ years to send back to the supplier for repairs thus after the assembling of these Equipment Parts, it was observed that the Equipment Parts were more likely to be damaged and the cost had increased.

(d) Security of Equipment Parts

Since the requirement for a Doppler Radar System is very high in weather forecasting, the ambition of the Department had been the installation of Doppler Radar System by re-repairing the Radar Equipment Parts which were not in proper condition for operation. However, it was observed that these equipment parts which were very expensive were unsafe according to the following matters.

- i. Stealing of few Radar Equipment Parts and several other items in January 2016 and later on.
- ii. Non-operating of air conditioners, leaking of rainwater at the installation of those Equipment and existing of wall moisture as per the observation reports prepared after the assembling of these Equipment .

Equipment parts valued at Rs.8,747,765 had been stolen on nearly 29 January 2016 and a Committee had been appointed on 12 February 2016 to conduct a preliminary investigation on it. However, there was no detailed investigation report on it. The site was under the influence of thieves even after that as stated in the observation report prepared on the inspection of Gongala on 17 May 2018 . It was observed that the attention had not been drawn by the Department on the safety of the Equipment and other items kept in the Tower until the equipment parts are sent to the production plant for repair .

(e) Packaging of Equipment Correctly when Sending the Parts Back to the Supplier

A private company had been awarded a contract valued at Rs. 4,300,000 for bringing Radar Equipment Parts from the Gongala site to the warehouse of M&M Transport Logistics Services, which had taken over the contract for the

shipment to send to the Production Plant. Although those were packaged on the instructions of the World Meteorological Organization, it was observed that these Equipment Parts were damaged.

3.2.1.6 Insurance Coverage

When transportation of these Radar Equipment which were equipped with very sensitive and expensive accessories from the Department to Gongala and from Gongala to the Port and in installation and storage, the Department had identified the risk of such equipment being damaged. Accordingly, a value of US\$ 1,303,014 (Rs. 142,680,033) insurance coverage had been obtained on 03 October 2011 from the Sri Lanka Insurance Corporation Limited. Even though these Radar Equipment Parts were damaged whilst storage and transportation, the Department had not been able to get insurance claims for that. The following observations were made in this connection.

(a) Extending the Period of Insurance

As the activities of this project have been delayed continuously in spite of there was an uncertainty about obtaining insurance claims as mentioned above, the same insurance coverage had been continuously extended. A sum of Rs. 1,611,236 had been paid as insurance premiums from the year 2011 to 2014 for that. It was observed that the cost incurred for the insurance premiums was not effective because insurance coverage had not been appropriately obtained and also the claims for insurance were in vain as this. The insurance period and the insurance premium paid were as follows.

Insurance Period	Insurance Premium
-----	-----
	Rs.
2011.10.03-2012.08.03	540,106
2012.08.03-2013.01.31	320,454
2013.01.31-2013.09.15	401,895
2013.09.15-2014.03.31	348,781

Total	<u>1,611,236</u>

(b) Terms of Insurance

When obtaining an insurance policy, it is necessary to obtain the insurance cover to suit their needs. The insurance coverage should be obtained according to the value of the goods identifying the instances of damages to be occurred to the goods. When checking the conditions set out in the insurance policy for the above mentioned insurance coverage it was observed that the many of those conditions are inconsistent with the requirement of the Doppler Radar Installation Project.

(c) Taking Actions to Obtain Insurance Claims

The supplier had stated that since these Radar Equipment Parts were damaged and could not be operated and it had been mentioned in the Report submitted by the United Nations Office (UNOPS) that those should be re-repaired. Despite there were such evidences available, the Sri Lanka Insurance Corporation had refused to pay the claims saying that there was no guarantee for the equipment would be functioned. Even though it was included in the scope of the agreement in between the United Nations Office (UNOPS) and the World Meteorological Organization finding out about claiming insurance for

financial loss caused by the failure of this project, any recommendation had not been provided from that report with regard to it. The supplier had also stated that it was possible to provide the necessary instructions and documents for obtaining insurance claims. It had stated in the report submitted on 31 May 2016 with the Cabinet Memorandum No. 9/2016 that since there is a possibility to repair the system as per the opinion of the technical officers of Sri Lanka Insurance Corporation, the Department has requested an estimate for repairs and as the Department was unable to provide such an estimate, the Insurance Corporation has informed that the file would have to be closed down. In spite of the opportunity to claim the insurance, it was observed that the Department had not taken effective measures for that.

3.2.1.7 Monitoring of the Project and Follow up

The task of the installation of the Doppler Radar System of this Project had not been fulfilled even at present. The financial value incurred for that has been a complete loss by now. Similarly, not fulfilling the need for a Doppler Radar System for early warnings is a big loss to Sri Lanka. Implementation of the Agreement of the Trust Fund of World Meteorological Organization is a key component of this Project and the Sri Lanka's main stakeholder in relation with this agreement was the Ministry of Disaster Management. Monitoring and follow-up actions are very important to the success of a project and the following observations are made in this connection.

(a) Compliance with the Procurement Plan

Before the commencement of any procurement process, a Plan of that process should be prepared in accordance with Chapter 4 of the Procurement Guidelines 2006 and all activities related to procurement should comply with that Plan. Although the responsibility of identifying and fulfilling of the functions such as obtaining relevant approvals, inspecting of construction works, certifying whether in compliance with specifications should be assigned to the officers of

the Ministry and the Department when fulfilling the role of Sri Lanka in this Project, it was observed that the actions were not so taken.

(b) Responsibility of the Ministry of Disaster Management

Monitoring the implementation of the Agreement of this Trust Fund had been mainly assigned to the Ministry of Disaster Management which is the signatory partner of the Agreement. Accordingly, although despite the monitoring of the Ministry was in operation from the beginning of the Project to the present, it was observed that no effective and right decisions have been made promptly to achieve its objectives.

(c) Appointing of a Steering Committee

Because of recognizing the importance of supervision at the very beginning of this Project, a Steering Committee comprising representatives of the following institutions had been appointed by the Secretary of the Ministry by the letter No.DR/WMO/01 dated 13 June 2007. Nevertheless, it was observed that it has not been working properly.

Institution -----	Designation -----
Ministry of Disaster Management	Additional Secretary
Department of Metrology	Director General
Department of Metrology	Director
Department of Metrology	Chief Engineer
Disaster Management Centre	Director General
Department of National Budget	An Officer
Department of External Resources	An Officer

(d) Responsibility of the Department of Meteorology

In carrying out the Project, the Head of the Department had established communication links with the representatives of the World Meteorological Organization and the supplier's representatives and the Directors and the Engineering Officers of the Department had participated in the relevant meetings and discussions. Although these officers had directly involved in making this project to be successful, it was observed that its main functions had been left to the contractors and that they have been away of their responsibilities. Even though the directives had been given as it should act as per the Decision of Cabinet of Ministers dated 22 June 2016 dated/16/1065/715 / 004-1 and the recommendations of the Minister of Finance , evidences that they have done so was not observed.

3.2.1.8 Skills and Trainings of Staff involved in this Project

The requirement of a skilled staff in the field of Electrical and Information Technology had been recognized in entering into the agreement for the operating and maintenance of the Doppler Radar System, which consists of electrical components function in automatically . Due to the focus on collecting weather data from Automated Meteorological Stations and Automated Rain Gauges, a Chief Engineer, an Electronic Engineer and Technical Officers had been recruited to the Department. The direct contribution of these officers had been obtained in this Project as well. The following observations were made in this connection.

(a) It was the responsibility of the World Meteorological Organization to train the staff of the Department on the Doppler Radar System as per the Agreement of Trust Fund. Accordingly, a two-year period and an estimate of US\$ 100,000 had been allocated and it had supposed to provide overseas and local training as individual , group or workshops. Hardware Engineers, Software System Engineers, Electricians, Meteorologists and Weather Observers were identified as the staff who should undergo such trainings. However, the designations of Hardware Engineers and Software Systems Engineers were not consisted in the approved staff of the Department and there were no evidences observed that the steps had been taken to create such posts.

(b) Training Course Conducted in America

Training for Departmental staff had been scheduled to carry out in their Manufacturing Plant and site by the supplier in terms of procurement conditions. Accordingly, the trainings such as Hardware Trouble Shooting and Maintenance and Software Maintenance and Theory of Operations had been conducted for 06 Officers from 06 September 2010 to 01 October 2010 . However, it was observed in later that the training was not effective when act in connection with this Doppler Radar System according to the subsequent events.

Eg. Lack of understanding on how to act on protection of these equipment.

Failure to separate the devices according to the instructions of the supplier when the equipment was returned to the Production Plant.

3.2.1.9 Current Status of the Gongala Site
(a) The Tower and its Storage Equipment

The audit examined the current status of the Gongla site on 01 March 2019. The following matters were observed therein.

- i.** The section of access road to the work site with a distance of 1km and 1 ½km was in very poor condition and there were several places that can be dangerous when traveling by vehicle.
- ii.** New construction of another institution next to the site.
- iii.** Cutting of the covering fence for easy access to any person.
- iv.** All the doors of the building were opened and the generator which was remained unsafe has decayed to the point that it cannot be reused.
- v.** Thieves had removed the fixtures of the Tower.
- vi.** Rain leakage from place to place of the building.
- vii.** Rusted staircase which was made of iron.
- viii.** Dispersion of items in the equipment room and that room being wet.
- ix.** Leaving bottles of liquor inside the rooms of the building.
- x.** Windows and doors were being in a dilapidated condition.
- xi.** Lack of water and electricity



Cutting of the covering fence for easy access to any person



Rain water leakage



The way of the bottles of alcohol have been dropped

(b) Utilization of the Building and its Environmental Impact

During this construction, the Tower was requested for the use of the security forces and the Disaster Management Center. However, it was observed that actions had not been taken to provide this building which was not in use for a long time and is being destroyed for other institutions. The Department had not drawn attention to the fact that the availability of containing the cancer-causing TR Limiter in these abandoned equipment parts and the possibility of dengue mosquito breeding.

(c) Obtaining the Balance of the Trust Fund to the Government of Sri Lanka

Although the department had sent letters dated 06 December 2018 and 10 January 2019 to the Ministry of Disaster Management for obtaining legal advice on the Trust Fund Account, the Ministry had not given proper instructions for this. The Decision of Cabinet of Ministers No. අම/19/2130/120/033 dated 27 August 2019 had been received to the Government of Sri Lanka to obtain the remaining balance of the Trust Fund and the Department had forwarded the relevant information on 09 December 2019 including the Account Number to the Secretary General of the organization as per the request made in the letter dated 14 October 2019 issued by the Secretary

General of the World Meteorological Organization to provide an Account Number for transfer the balance.

3.2.2 Project for Installation of Two Doppler Radar Systems at Puttalam and Pottuvil Locations

The Japanese International Cooperation Agency (JAICA) had entered into an agreement with the Democratic Socialist Republic of Sri Lanka on 30 June 2017 for the installation of two Doppler Radar Systems very near to the office premises of the Puttalam and Pottuvil Meteorological Stations on the uncertainty about the success of the Gongala Doppler Radar System and the requirement of a Doppler Radar System for early warnings in Sri Lanka. The following matters were observed in this connection.

(a) Selection of Work Site

When selecting a site the focus on the economic and technical factors should be made (Reference - Paragraph 3.1.1) . It was observed that the two work sites were identified with paying greater attention on access roads, monitoring and maintenance capabilities in this Project. Similarly, it was observed that the less attention had paid on wave barrier, resistors of Radar misleading, and electromagnetic effects according to the following matters.

- i.** Availability of wave barriers in both Puttalam and Pottuvil work sites.
- ii.** Location of Puttalam work site near the wind power plants and availability of Television Towers in both Puttalam and Pottuvil area.
- iii.** Possibility of increasing of the construction of tall buildings in future in these areas located in the suburbs.

(b) Environmental Impact

The Pottuvil site is located on the coastal line and these sensitive Equipment Parts can be highly corrosive. However, it was observed that attention had not been paid to this in the Report (Preparatory Survey) prepared by MIC Institution which is the main contractor of the Project. Both of these sites are plains and populated areas as well. There are schools, shops, private and government offices where the people are frequent near this area. It was observed that a school is located adjacent to the Puttalam site during the physical examination conducted by the audit on 19 June 2019. It was observed in the checking of the report prepared by the MIC Institution mentioned above, the attention had not been paid whether the radar emitted from this system would adversely affect the people there. Although it had stated in the letter of Central Environmental Authority that these Towers, which are nearly 42 meters high can cause lightning damage to nearby homes and buildings, as per the letter issued by the Director General of Meteorology NO.EB/CC/25 dated 18 December 2019 it had stated that no such environmental impact would be occurred.



Located schools, shops, private and government offices which are frequented by the public.

(c) Acquisition of Lands

The extent of land required for acquisition should be clearly identified. However, it was observed that the extent of land required for the Pottuvil Project had not been identified and the survey plans as well had not been prepared. Similarly, it was also observed that the activities of acquisition of land is very slow.

(d) Obtaining Stipulated Approval

Approvals for the installation of Doppler Radar Systems should be obtained from the state institutions such as Central Environmental Authority, Civil Defense Department, Urban Development Authority, Department of Archeology and the relevant Local Authorities in a project like this . Obtaining these approvals is the responsibility of the Department as per the Agreement. Although all the approvals of the Project should be obtained as per the work plan of this Project, it was observed that the approvals had not been obtained including Coastal Conservation Approval for the Potuvil Project even by 18 December 2019 and only the approval of the Central Environment Authority and Urban Development Authority had been obtained for the Puttalam Project.

3.3 Use of Automated Techniques for Collecting Meteorological Data

Early warnings can be given on time and accurately by obtaining weather data automatically. The following matters were observed on the use of Automated Weather Stations for collecting weather data by the Department for that.

3.3.1 Automated Weather Systems (AWS)

An equipment designed for automatic measurement of data (collecting of data), storage and communication is called as an Automated Weather Station. The Department of Meteorology had received 38 automated Weather Stations in the year 2009 as a Japanese Grant known as the Improvement Metrological Information and Disaster Management Network. The following observations are made with regard to these instruments that can measure the weather features as wind speed, direction, temperature, air pressure, relative humidity, expansion of solar radiation and rainfall.

(a) Installation of Automated Weather Stations without Delay

Thirty one of these equipment were installed by the Japanese aid group at 31 selected locations in the country and the remaining 7 were due to be installed by the Department of Meteorology. Out of the 07 equipment scheduled to be installed by the Department of Meteorology 04 had been installed during the period 2010 - 2011 and the fifth and sixth devices were installed in the years 2012 and 2013 respectively. Accordingly, out of the 07 equipment which the Department of Meteorology had to be installed, a considerable time period had elapsed to install 04 of them and it is observed that the relevant equipment were in idle during that period.

(b) Covering All Areas as Expected

Although it has been stated as requirements that the installation of Automated Weather Stations in the areas that are inaccessible will increase the density of the existing network as per the World Meteorological Organization Standard 1.1.2 (a) , it was observed that the 19 out of 38 Automated Weather Stations installed in the Department of Meteorology, had been installed in Regional Meteorological Stations.

i. Regional Meteorological Center, Trincomalee

It was observed that the equipment which was supposed to be installed in Trincomalee by the Department of Meteorology had not been installed even by the date of audit 09 January 2019. Accordingly, the Department of Meteorology has not efficiently and effectively worked was observed towards achieving the objectives expected to obtain through the relevant grant .



The way of Storage of Mounting Pole of the AWS System to be installed at the Trincomalee Meteorological Center

ii. Ratmalana Airport

In the inspection of the matters such as obtaining weather data, communicate of them and maintain the equipment at the Meteorological Station located near the Ratmalana Airport with the objective of providing the weather data required for flights, the variances were observed when these data (META DATA) compared with the data directly taken by Meteorological Officers. Likewise, when checking the log notes maintained in relation to the AWS System, it was observed that the function of the AWS System had been interrupted periodically from the year 2009 to 2018 due to power failure and other clearly unidentified causes, being inactive of installed Communication Equipment from time to time in the year 2017 and the failure of providing the accurate metrological data due to dropping of communication facilities. In the absence of proper maintenance of equipment such as Rain Gauges belonging to the AWS System, the instances of the equipment were inactive, it had been focused on maintenance.

iii. Katunayake Meteorological Station

Due to the renovations in the Airport, the Automated Weather Station located at the Katunayake Airport had been removed in March 2017 and steps had not been taken to restore even by 13 of March 2019. Even though the data to be obtained by the Automated Weather System has been obtained through the system called AWOS which was facilitated by the Air Port, allowing the Automated Weather System of the Department of Meteorology to be deactivated is observed as an instance of not utilizing assets effectively.

iv. Katugastota Meteorological Station

Although there was a possibility of obtaining data from Automated Weather Station, it has been able to retrieve that data by accessing to the Data Logger only. Although the Central Processing Unit (CPU) belonging to the Automated Weather Station had been taken to the electronic section for repairs on 14 November 2017 because of the actions were not taken to repair it until 15 March 2019 the date of audit, the meteorological data could not be observed at the same time.

v. Puttlam Meteorological Station

The Automated Weather Station (AWS) has not been in operation for nearly two years and data access is available only through the Data Logger. The sensors for measuring wind speed, humidity and air pressure were in inactive at the examination carried out by the audit .

The Central Processing Unit (CPU) relevant to the AWS System had been taken to the Head Office for repairs and arrangements had not been made to hand over it to the office even by the date of audit. Although the communication equipment had been installed in the year 2017 through the facilities available via the Dialog PLC. to communicate AWS data to Head Office, data communication had not occurred due to an error in the AWS System as well as errors in the communication system. Although Electronic Division was notified as per the letter of Director General of Meteorology No. DOM /EB /IPVPN /01 dated 24 April 2019 to complete these repairs quickly, it was observed that the attention of the relevant parties had not been drawn on it as a result of the lack of repairs until the date of audit.

(c) Provision of Data in a Systematic Manner

Out of 38 Automated Weather Stations equipment owned by the Department of Meteorology 20 were located in the 19 Regional Office premises of the Department and the remaining 18 were installed in Collaborative Centers. During the audit inspection conducted in the year, 2018 whether the data collected from these equipment were received to the Head Office properly, the data was obtained through the Data Logger. It is necessary to go to that location to obtain the data from the Data Logger and , it was observed that the data is not automatically transmitted during the stipulated time period , as expected when installing the system. The ability of obtaining Automated Data is very important in case of emergency weather conditions and thus it was observed that the intended purpose of the system was not fulfilled.

(d) Using of Data for the Forecasting

Automated Weather Stations had been installed in 19 Regional Offices (M) and 18 Collaborative Centers of the Department of Meteorological since 2010 . The way of using the data such as rainfall, atmospheric temperature, humidity and pressure, wind speed and direction, and amount of solar radiation obtained from this by the National Meteorological Centres (NMC) and Early Warning Stations for the weather forecast are as follows.

Automated Weather Systems -----	2011	2012	2014	2015	2016	2018
Automated Weather Systems (M Type - 19)	-	-	-	02	09	06
Percentage	-	-	-	10	45	30
C Type (Collaborative Centers Systems - 18)	01	01	03	06	04	-
Percentage	5.55	5.55	16.66	33.33	22.22	-

Thus, when considering the data inflow of M-type centers, it is observed that the data in many centers had not been used for forecasting for over 4 years and as a percentage, it takes a less value in between 10 and 45 per cent. When considering for the C type centers in some years, the data collection by National Meteorological Center has limited to one instance was observed and it takes a less figure such as 5 per cent. Accordingly, it is observed that the minimum use of data of these centers for forecasting and it is observed that this is an instance of a failure of the Department to achieve the desired objectives by establishing the relevant system.

(e) Transmitting all Data to Head Office

It was observed that data receipts and non-receipts were recorded with regard to the 04,07 and 12 May at the test checks carried out during the period from 01 to 14 May 2019 to understand the current status of data receipts using Automated Weather Systems. Accordingly, it was observed only the data Communicate to Head Office from 04 out of the 19 equipment installed at the Regional Offices of the Department and 01 out of 18 Collaborative Centers .

When analyzing the above information, there is a minimal use in the prediction of data from the Automatic Meteorological Network and it was observed that the Department of Meteorology has failed to obtain a value for the government's annual expenditure on the maintenance and repair of these Centers.

(f) Obtaining IPVPN Connection through Dialog

The Department of Meteorology has obtained an IPVPN connection from Dialog organization to Communicate the data received from Automated Weather Stations (AWS) to Head Office of the Department of Meteorology . An IPVPN connection had been obtained to 20 Regional Offices of the Department, 18 Collaborative Centers and to the Mattala and Katunayake Airport and Head Office and following observations are made in this regard.

(i) Using IPVPN Connection

Similarly, when obtaining this connection, the bidder had to establish the proposed IPVPN connection, configure and also maintain during the contract period. Although the tender had been awarded to the contractor in the year 2017 for obtaining this connection, it had been impossible to complete 13 stations out of 39 stations even by January 2019 . As a result, not happening the data communications as expected and failure to use these systems to predict the data such as atmospheric temperature, humidity, pressure, rainfall, wind speed and direction effectively in prediction as well were observed in the audit .

(ii) Effectiveness of Using IPVPN Connection

Bill payments should have to be made by January 2019 to 20 systems out of the 26 systems installed . A sum of Rs. 854,293.82 for the year 2017 and a sum of Rs. 4,562,890.10 in relation to the year 2018 had been paid to Dialog by the Department of Meteorology . However, the following matters are observed in this regard.

Despite the data related to the stations were not received due to various reasons including technical errors, a sum of Rs. 81,000 and Rs. 792,449 had been paid respectively as total amount in the years 2017 and 2018 for 08 stations for IPVPN connections obtained. Details are shown below.

Centre	Date of receipt of data	The last date the data was received	Identified reasons for the lack of data	Amount Paid	
				2017 Rs.	2018 Rs.
Anuradhapura	16.11.2017	18.04.2018	Errors in Data Logger	-	68,483 (July – Dec.)
Badulla	03.10.2017	14.02.2018	- do -	27,000	143,000 (March - Dec.)
Bandarawela	-	-	-	27,000	173,000
Galle	-	-	AWS system has been removed on 21.06.2018	-	68,483
Jaffna	04/02/2018	14.07.2018	-	-	68,483
Kurunegala	15/03/2018	09.09.2018	Errors in Data Logger	-	45,000
Mannar	08/02/2018	31.08.2018	-	-	53,000
Puttlam	-	-	Errors in AWS System	27,000	173,000
				<u>81,000</u>	<u>792,449</u>

According to the letter dated 29 January 2019 addressed to the Chief Engineer by the Electronic Engineer of the Department, the errors in Data Loggers in AWS Systems and lack of proper preventive maintenance had caused for the lack of availability of data in relation to the above centers.

This situation of non - availability of data is furthermore ascertained as per the letter dated 24 January 2019 addressed the Director General by the Directress of the Forecasting Section. Only data from the Nuwara Eliya, Matale, Matara, Hambantota, Kurunegala and Wagolla centers were seen in the computer at the National Meteorological Center from time to time as per that letter and it has been further stated that nothing can be said about the accuracy of the data.

In the event that the data was not properly received and in a situation where the validity of the data received is also not confirmed, it was observed in audit that the institution had continued to pay its bills without drawn attention to correct the matters caused to that.

(g) Maintenance and Repair of Automated Weather System

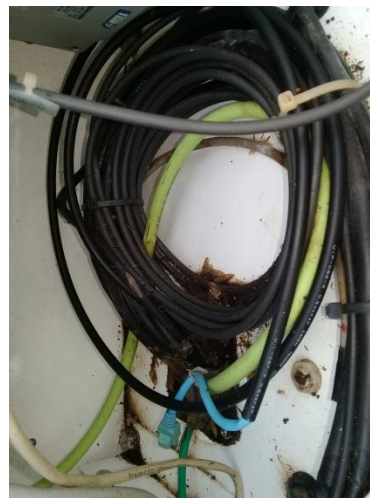
Since the Automatic Weather System is an expensive system, maintenance and repairs in this regard will ensure that the quality of the system is maintained properly. It had mentioned that maintenance should be done at least once in a year as per the Maintenance Manual of the Automated Weather System. The following observations are made in this connection.

i. Physical Observation

The following status were made at the physical examination carried out by the audit in relation with the maintenance works of 19 Stations of the Department of Meteorology.



AWS System located at Wagolla (2019.03.15)



The way of remains of the insects around the AWS Data Logger located at Galle Meteorological Station (2019.03.06)

ii. Number of Turns of Maintenance of Automated Weather Systems Centres

The inspection on the Stations in Anuradhapura, Galle, Jaffna, Mannar, Nuwaraeliya, Vaunia and Colombo had been carried out only one time in the year 2017 was observed in the checking of Records of the Electronic Division and the attention had not been drawn in order to maintenance of remaining 13 areas.

It was stated that the maintenance of the Collaborative Centres should be carried out once in every three months as per the Manual of the Department of Meteorology on Maintenance of Automated Weather System (AWS Manual Book – Regular Inspection Book) Doc 0605 (2) . However, carrying out the maintenance works in 18 Collaborative Centres by the Electrical Division from the year 2010 to 2017 had not been done once in three months and the participation for the maintenance works in the Collaborative Centres in the year 2017 was limited only to 04 centers were observed.

(h) Purchasing of Spare Parts for Automated Weather Systems

Maintaining a well- organized, planned maintenance plan will cause to minimize (Corrective Maintenance) maintenance work needed to correct equipment malfunctions were outlined in the Standards. This causes to reduce the frequency of applying of spare parts and to reduce the costs to be incurred for that as well. Despite continuous data from Automated Weather Systems had not reported and also absence of using these data to predict the weather, spare parts and accessories valued at Rs. 8,607,720 and Rs. 25,113,315 had been purchased respectively to install in AWS Systems in the years 2017 and 2018 .

Although the regulations enacted with regard to that should be followed at the time of procurement of goods, works and services in accordance with the

Government Procurement Guidelines, it was observed that the service was obtained from the same institution without calling quotations when selecting a qualified organization with respect to releasing of imported AWS spare parts from the customs in the years 2017 and 2018 . A sum of Rs. 274,262 in the year 2017 and Rs. 631,299 in the year 2018 had been incurred for that.

3.3.2 Establishment of 100 Automated Rain Gauges Network

The Project to install 100 Automated Rain Gauges was implemented under the Rs. 53 million of Ministry of Disaster Management with the objectives such as releasing emergency alarms, sharing data with institutions such as National Building Research Organization and Department of Irrigation by keeping attention on real-time rainfall conditions and depending on their results. The Department of Meteorology has installed 100 Automated Rain Gauges near 05 selected rivers. The following observations are made in this regard.

(a) Purchasing of Rain Gauges

i. Contract Agreement

Accordingly, decided for calling Bids for the Project and quotations have been called from 09 institutions. Bids have been called from the same institutions which have been called for installation of Rain Gauges previously for the National Building Research Institute.

One institution has been selected to carry out the Project as per the approval of the Technical Evaluation Committee and Department Procurement Committee out of the institutions that had submitted bids and the Department of Meteorology had entered into contract agreement on 25 June 2018. Although the amount payable for 100 Rain Gauges was Rs. 37,052,906 , actions were not taken to mention the value of the contract in the agreement. It has been shown the date on which the parties signed the agreement and the time period up to the date of the contractor completes the functions/services specified in the agreement as the validity period of the agreement. Accordingly, it was observed that the attention had not been

drawn in the agreement on completing the related tasks within a specific time period. Although the Director General of the Department and a Director of the relevant institution have signed the agreement as partners, actions had not been taken to sign it as witnesses.

ii. Identify the Requirement

Locations for installing 100 Automatic Rain Gauges have been made after calling quotations and suggestions had not been provided about these locations in the Project Proposal. Accordingly, it was observed in audit that the Department of Meteorology has taken steps to procure Rain Gauges before recognizing the requirement.

iii. Contract works should be completed within 04 months as per the evaluation method used to select the bidders. However, due to delays in selecting locations, these activities had delayed by 06 months period.

iv. Ensure the Quality

Although the measures taking to obtain a Calibration Certificate that provides an indication on accuracy and quality of such equipment should be made under good practice while purchasing of every Meteorological Equipment, it was observed in audit that an attention had not been drawn on a Calibration Certificate when purchasing of these equipment by the Department of Meteorology .

v. Payments Made for Rain Gauges

The total amount payable for 100 Rain Gauges is Rs. 37,052,906 and it had been stated in the document that the payments had to be made as follows.

- 100 Tipping Buckets, 100 Data Loggers and 100 Solar Power Systems and 60 per cent after providing the servers with all the money.
- 30 per cent on Payment basis after installation of equipment
- 10 per cent Retention

The agreement had entered into with the relevant entity on 25 June 2018 . However, actions had been taken to pay a sum of Rs. 20,008,569 or 60 per cent out of total amount by 02 April 2018 on supplying of 100 Tipping Buckets, 100 Data Loggers and 100 Solar Power Systems by 27 February 2018 . Accordingly, it was observed that transactions had taken place before the contract agreement was executed.

(b) Selecting Locations to Establish Rain Gauges

A Committee consisted of three officers has been appointed on 29 December 2017 by the Director General of the Department of Meteorology to select a suitable place to install Rain Gauges. As per the letter of appointment of these officers it had been expected to complete the relevant work within two months. However, it was observed that they have completed the relevant work by 19 November 2018 as per the letter of these officers who had addressed the Director General dated 19 November 2018 . Accordingly, it was observed that there was a delay in selecting the relevant locations. Likewise, it was observed that only the areas consisted of 05 river basins have been selected whilst installation of these Rain Gauges and the dry zone is not covered there as well.

(c) Construction of Fence for the Safety

Whilst installation of Rain Gauges, 100 Rain Gauges had been installed at selected locations by 18 February 2019 . Although a size of 2x2x2 meter fence should be installed around the equipment for the safety of them as per requirement of those equipment fixtures, actions had not been taken to install the fence in the following places.

- Cinnamon Research Institute - Kamburupitiya
- Bogoda Tea Factory
- Tea Factory at Adaradeniya

Ransevge Tea Factory and the Duwali Ella Tea Factory had built that fence in a smaller size than the requirement. The objections to the installation of the fence from the institutions belonging the premises where the equipment are installed had caused above situation and it is observed that the cause of these objections was lack of adequate awareness of those institutions when selecting of locations for related installations. The gross value of this equipment is about Rs. 310,000 and it is further observed that ensuring their long-term existence is essential to achieve the objectives of the organization.

(d) Obtaining Data

Similarly, just after receiving the equipment to the Department of Meteorology, no actions were taken to Calibrate the Equipment even up to 22 March 2019 the date of audit and it could arise a problematic situation for the accuracy of the data before or after the installation is observed.

Eighty seven different Rain Gauges are installed in different locations by 13 February 2019 and out of these, data of 86 were being received in Colombo. Nevertheless, except for the Rain Gauge installed by the Department at the Colombo Head Office premises, actions had not been taken to ascertain the accuracy of the data in other Rain Gauges.

(e) Rain Gauges taken into Inventory

When checking whether these equipment purchased at a value of Rs. 37,052,906 were included in the Register of Fixed Assets, actions had not been taken to be included the two sub servers worth of Rs 1,298,750 and the main server with a value of Rs. 819,125 and a 55” display unit in to the Register of Fixed Assets even by the 22 March 2019 the date of audit.

(f) Non-reconciliation of Data

Steps had been taken only to verify the validity of the data in Rain Gauge installed at the Colombo Head Office premises relating to the period from 11 April to 06 June 2018 (57 days) for the checking of how the Department has acted to verify the accuracy of the data from these Rain Gauges. Nevertheless, it was observed that there were instances of changes in those data as compared to the data obtained by the officers (manual data) .

(g) Training of Staff

It is stated in the contract agreement that the Departmental officers should be trained for the operation and maintenance activities under the services which should be carried out by the contractor. Accordingly, the training function should be carried out as follows.

Activity	Period (Days)	Number of Departmental Officers to be Trained
-----	-----	-----
Operational training	03	20
Maintenance training	03	10

Even though all the 100 Rain Gauges had been completely installed by 18 February 2019 , it was observed in the audit that actions had not been taken to carry out the training activities .

3.4 Using Other Techniques for Collection of Meteorological Data

Modern techniques and traditional methods are being used by the Department for collecting Meteorological Data. The following observations were observed in this regard.

3.4.1 Upper Air Observation Made by Radiosonde Equipment

Data on air pressure, temperature, humidity, and wind speed and wind direction are obtained from this. The Radiosonde Equipment IMS 100 which was manufactured by the Japanese Company called Meisei Electric supplied under the Volunteer Cooperate Programme of the World Meteorological Organization in 2009, and Data Processing Computer are used for high air observation. The meteorological data is stored in the computer after the calculation takes place and becomes one of the high air observation reporting codes in the world meteorology. The data thus prepared by the Communication Division of the Department is included into the Global Telecommunications System (GTS) of the World Meteorological Organization.

In this regard, the following observations are made.

(a) Obtaining Data at Standard Times

The high atmospheric observation data on temperature and humidity are used as primary data for numerical weather prediction models used in weather forecasting. It had been recommended for observing Radiosonde in high air for all member countries during the Universal Timescales at 0000 UTC and 12 00 UTC or at least once in daily in accordance with the instructions of the World Meteorological Organization. That is, Radiosonde Observations should be done at 5.30 p.m and 5.30 a.m in Sri Lanka time.

However, in Sri Lanka, these observations are carried out only in three days a week on Mondays, Wednesdays and Fridays at 11.30 a.m only. These observations are carried out in other countries also around Sri Lanka in accordance with the Guidelines of the World Meteorological Society. It was observed that the quality of the Radiosonde surveillance data obtain in Sri Lanka is diminishing.

(b) Compliance with Expert Advice

The attention had been drawn in a report submitted on 20 June 2016 by the Expert on Meteorological Observation, Weather Forecasting & Dissemination Project which had been carried out with the aids of the Japan International Cooperation Agency and the Officer In Charge in the Radar Division had requested the facilities to conduct such observations at standard times on 28 May 2018 . However, it was observed that the Top Management of the Department had not drawn attention to this.

Conclusion 1 of Sub- section 6 of the above report stated that Radiosonde observations should be carried out daily during the Monsoon Season and the two Inter-monsoon periods, which increases the risk for severe rainfall. Even so, it was observed that the Department does not do Radiosonde observations daily during monsoon.

Although the Radiosonde Balloon should be released in every Monday, Wednesday and Friday at 11.30 a.m as per the prescribed procedure of the Department, it has been observed that high atmospheric observations were not obtained on 13 and 30 days in the years 2017 and 2018 respectively.

Year -----	2017 -----	2018 -----
The number of Radiosonde Observations to be obtained	157	157
The number of Radiosonde Observations obtained	144	127
Number of Observations not obtained	13	30

As a result of sending the Signal Receiver to the relevant Company in Japan in the years the years 2017 and 2018 for the repair as per the Table above the Radiosonde Observations could not be able to perform and it was observed that the Department did not have any additional equipment to be used in these repairs.

(c) Purchase of Radiosonde Balloons

Radiosonde Balloons for the years 2017 and 2018 had been purchased as follows.

Year -----	2017 -----	2018 -----
Number of purchased	200	130
Price per unit Rs. (Approximate value)	1000	1,180
Agency and Country Purchased	Pawan Rubber Manufacturing Company India	

i. Compliance with Standards

As per the Section 10.1.3 of Part II of the World Meteorological Guideline the diameter of the neck of the balloon should be in between 1 and 5 cm according to the size of the balloon. Even so, it was observed that the diameter of the neck of the Balloon had not been considered when calling

tenders and evaluating of tenders. Similarly, since the supplier has specified a storage duration was 12 months, the attention should be drawn on the date of manufactured of the Balloon. However, it was observed that neither the Procurement Committee nor the Technical Evaluation Committee had paid any attention to the date of manufactured of the Balloon.

ii. Lifespan of the Balloon Stock

- Although the supplier had stated that the lifespan of a Balloon was 12 months, it was observed that the Balloon with a lifespan of more than 12 months are being used for Radiosonde Observations as per the following matters.
- Remaining of 80 balloons out of the 220 Balloons received to the Radar Division on 24 November 2017, and storage of 130 balloons (26 boxes) stock received on 09 November 2018 without opening them at the time of the physical examination carried out by the audit on 04 January 2019 .
- The bidders had submitted the price and specifications of the Balloon stock as at 31 May, 2017 and since the samples had been submitted with regard to that stock, 31 May 2017 can be considered as the nearest date of manufactured.
- There were 183 Balloons had left over from the above stock as at 10 January 2018 and remaining of 122 Balloons by 31 May 2017 elapsing 12 months from 31 May 2017, had expired 61 per cent .

(d) Purchase of Radiozond Equipment

Radiosonde Equipment for the years 2017 and 2018 had been purchased as follows.

Year	2017	2018
Amount purchased	175	130
Unit Price Rs. (Approximate value)	25,337	28,215
Purchasing agency and country	Meisei Company,	Japan

i. Lifespan

There were 80 Radiosonde Equipment stock was available at the physical examination carried out by the audit on 04 January 2019 and the date of manufactured of the equipment had been shown as February 2017. The Radiosonde Equipment which is an IMS 100 GPS type is with very sensitive two temperature and humidity sensors. It was observed that the lifespan of the this equipment stock was nearly two years by that time.

ii. Quality of Equipment

The 200g Balloon was flown with a Radiosonde Equipment with the Code No. 6015059 at 11.30 a.m on 04 January 2019, by the Officers of the Radar Division in front of the Auditors. However, because of defects of the temperature and humidity communication in that Equipment, the data were not retrieved from that equipment. The Radiosonde Equipment is calibrated before setting up it. Thirteen instruments were found to have failed during the calibration as at 04 January 2019. Similarly, it was also observed that 09 Equipment had failed after taking off. Accordingly a financial loss of Rs. 566,414 had occurred. The defects in the Balloon and not receiving of

underground signals emitted from Radiozonde had caused to fail after setting up to air.

3.4.2 Observation in Upper Atmosphere by Pilot Balloons

A meteorologist measures the speed and direction of the wind from low level to medium level using a theodolite for moving a Balloon in air. These Pilot Observations are carried out at four meteorological stations in Mannar, Trincomalee, Hambantota and Colombo in each day at 5.30 a.m, 11.30 a.m and 17.30 p.m by these observations. As the Radiosonde Observations are taken place only on Mondays, Wednesdays and Fridays in Colombo, the Pilot Balloon Observations are not carried out at 11.30 a.m only on these days. Although these Observations should have to be carried out at three times in a day as a per the routine of the Department, it was observed that 1,032, 646, and 109 Pilot Balloon Observations had not been obtained until 2017, 2018 and 30 April 2019 respectively.

Year	2017	2018	Up to 30 April 2019
-----	-----	-----	-----
Number of pilot balloon observations to be obtained	4,329	4,329	1,389
Number of pilot balloon observations obtained	3,297	3,683	1,280
Difference	1,032	646	109
Difference as a percentage	23	15	8

3.4.3 Filling of Hydrogen Gas

Hydrogen Gas is used to fill Radiosonde and Pilot Balloons and the Hydrogen Generators are used to produce Hydrogen Gas in Colombo. since the Hydrogen Gas Production process is very dangerous as per the Sub-section 10.6 of the World Meteorological Society's Guidelines, safety measures should be taken for that. The following observations were made during the physical examination carried out in the Colombo Meteorological Center.

- i. Establishment of Hydrogen Production Plant adjacent to buildings where the frequent of public.
- ii. Not taking safety measures at the Hydrogen Plant.
- iii. Lack of protective clothing for the officers during the production of Hydrogen and sending of the balloon.



Unsafe filling of the Balloon



Unsafe sending of the Balloon

3.4.4 Obtaining Rainfall Data from Traditional Rainfall

There are about 500 rainfall data collection stations were located island wide. Rainfall Observations are being done by government or non-governmental organizations at 8.30 a.m on daily basis. Rainfall data are collected daily from 230 Stations among them and those data are used for forecasting. The rainfall report sent to the Rainfall Section at the end of each month is sent to the database after checking by two qualified Meteorological Officers. This data is used by various parties for research and construction purposes. In this connection, following observations were made.

(a) Obtaining of Data Continuously

The rainfall data received should be sent monthly by every station to the Head Office as above. However, it was observed that rainfall reports from the years 2016 to 2018 have not been continuously provided by these stations. The details are as follows.

Year	Total Number of Rainfall Stations	Stations where Data is not Provided Continuously	As a Percentage
2016	500	54	11
2017	523	64	12
2018	509	40	9

Out of these, the number of stations for which no rainfall data were provided in the years 2016,2017 and 2018 were 21, 33 and 11 respectively.

(b) Contribution of Data

Collection of Data is one of the main functions of the Department and it is important for the data users to use it. As a result of decline in the contribution of accurate data continuously as above , it was observed that the contribution to weather forecasting from the data is minimal.

(c) Supervision of Rainfall Centers

Although each station should be inspected at least once in every two years in accordance with Sub-section 1.3.5.1 of Part I of the World Meteorological Guideline, it was observed that it has not been so done and only 57 Rainfall Stations have been inspected and corrected the shortcomings due to lack of human resources, lack of financial resources and inadequate transport facilities.

Rainfall data should be taken in accordance with the World Meteorological Standards. However, it was observed at the physical examinations carried out by the audit that, these Rain Gauges were not in compliance to the relevant standards at the examination of the Rain Gauges located at Aninkanda and Tea Shakthi Tea Factory.



Aninkanda Tea Factory



Tea Shakthi Tea Factory

(d) Inclusion into the Board of Survey

Since Rain Gauges are the assets owned by the Department for rainfall data collection stations, they should be considered in the Board of Survey of the Department. Nevertheless, it was observed that the Rain Gauges were not included in the Board of Survey of the Department. The price of a Rain Gauge is Rs. 16,000 and 05 of such Stations were closed from the year 2018 to 2019. It was observed that the actions had not been taken to obtain the Rain Gauges of these Stations back to the Department.

3.4.5 Traditional Equipment

The traditional equipment such as thermometer, barometer, anemometer, rain gauge and evaporation pan are used in addition to Automated Meteorological Equipment for the collection of ground and high atmospheric data and continuous data collection had been done with traditional equipment. In this connection, the following matters are observed.

(a) Collection of Data

As a result of lack of 232 traditional equipment as mentioned below in 23 Meteorological Stations where the data is collected, it was observed that the data such as wind speed, sunlight hours, grass temperature and soil temperature were not obtained.

Traditional Equipment	Number of Meteorological Centers	Unavailable weather data
Gust wind recorder	19	The speed of the wind Sunlight Hours
Sun shine recorder	14	
Soil thermo meter - 5cm	15	Grass temperature and soil temperature
-10cm	15	
-20cm	15	
- 30cm	15	
-60cm	22	
-90cm	22	
120cm	22	
Evaporation pan	14	Evaporation
Evaporation Anemometer	15	
Evaporation thermo meter	14	
Hook gauge	15	
Steel well	15	
	----- 232 =====	

(b) Equipment Utilization

It was observed that the 68 traditional meteorological equipment had remained in idle without utilization. The details are as follows.

Equipment	The number
Thermo graph	19
Hydro graph	27
Pluvio graph	12
Baro graph	10
	----- 68 =====

(b) Using of Mercury Containing Equipment

It has been stated obtaining appropriate action by each party in terms of A of Article 4 of the Minamata Convention, the production of the Mercury-containing products mentioned in Annexure A therein should not be allowed to import or export after the year 2020 .

The following traditional equipment stated in the Annexure are used by the Department of Meteorology to obtain data for forecasting and, an alternative should be used in respect of those equipment as per the terms of the Convention 2020. The Department of Meteorology is used the following equipment in the quantities indicated in that list for the obtaining of data at present.

Equipment	Quantity of Equipment used for Data Collection
----- Barometer	----- 08
Thermometers	173

Although the Automated Weather Systems are a suitable alternative for this, it is observed that a sufficient attention has not been paid to the above situation by the Department by maintaining Automated Weather Systems in a productive manner.

3.4.6 Meteorological Stations

(a) Ownership of Lands

There are 22 Regional Offices belonging to the Department of Meteorology and since the Regional Offices of Katunayake, Mattala and Ratnapura are located at the Airport premises, and the land where the Galle Office located belonging to the Department of Archeology and also the land of the Hambantota Office premises is

to be developed as a Tourist Zone and it was observed that the ownership of the land could not be taken over by the Department of Meteorology.

Activities of acquisition of lands in Jaffna, Moneragala, Nuwara Eliya, Puttalam and Trincomalee has been completed and it was observed that correspondence are being exchanged among the affiliated institutions for the takeover of the remaining 12 Offices.

(b) Meteorological Equipment Enclosures

A sample of equipment box belonging to Meteorological Offices has been physically examined and the following observations are made.

i. Meteorological Center in Ratmalana Airport

The METAR and SPECI data provided from the Meteorological Center in Ratmalana Airport are useful information for flights and although the obstacles that block weather parameters such as buildings, trees, walls should not include close to the place where the meteorological Equipment Enclosure is located in terms of 1.3.3.1 (C) of the World Meteorological Guidelines, the buildings were located near the site where the Ratmalana Airport Equipment Box was located.

ii. Galle Meteorological Station

A tree that branches grown high had located near the Rain Gauge inside the equipment box, without complying with Paragraph 1.3.3.1 (C) of the World Meteorological Guidelines.

iii. Puttalam Meteorological Center

In case of malfunctions in Meteorological Equipment in accordance with the log book, and the instances of applying of equipment for that and repaired were as follows.

Equipment	Date of Inactive	Date of application of repaired new equipment
-----	-----	-----
1. Automated Thermograph	2017.01.12	No
2. Automated Thermometer and Automatic Hydrometer	2017.01.16	No
3. Self-Hydrograph	2017.03.14	Self-Hydrograph has been provided
4. Pluviograph	2017.07.16 (Clock is inactive)	
5. Evaporation Pan	2017.07.24	2018.03.09

iv. Katunayake Airport Meteorological Station

Obtaining of weather data such as temperature, atmospheric pressure, wind direction and speed, nature and type of clouds, pressure difference, humidity, rainfall, visibility, fog are being carried out by the Airport Meteorological Offices once in three hours and once in every half an hour and half an hour in special cases through the Equipment Enclosure and then the weather forecasts are being distributed for 04 parties using these data.

A vital role is being carried out in providing the weather information in respect of the weather conditions from the start of the flight to the end of the flight available at airports and airways to the airlines by the Met Briefing Report released by the Airport Meteorological Center. The following audit observations are made at the examination of the Office of the Airport Meteorological Center in audit.

The Met Briefing Division is functioned consisted of 04 member Roster System and only one officer serves at a time. Since that office premises is a place where the lack of adequate ventilation with little space, the officers are occupying in a difficult environment and although the air conditioner has been inactive since March 2018, it had not been restored.

The Met Briefing Division issues 95-110 number of reports to private airline companies. It was observed that reports are being issued free of charge to private airlines incurring a sum of Rs. 479,143 annually for toner and drums .

Although the adequate internet facilities should be provided to carry out the activities of the Airport Weather Centre efficiently, it was not available so and lack of photocopier was also observed.

3.5 Human Resources Utilization

3.5.1 Approved Staff

It is important that no shortage of human resources to perform the duties of the Department of Meteorology and the information relating to approved staff and existing staff as at 31.12.2018, the answer given by the Department of Meteorology on 04.12.2019 is as follows.

The Nature of the Post	Approved Staff	Existing Staff	Shortage
Seniority level	54	43	11
Tertiary level	29	10	19
Secondary level	238	197	41
Primary level	139	125	14
Total	<u>460</u>	<u>375</u>	<u>85</u>

The observations in this regard are revised as per the answer.

The Deputy Meteorological Director of the Sri Lanka, 1 Grade of Scientific Service has been appointed for the post of Meteorological Director General which was in vacant in the year 2018 on acting basis as per the Decision of the Cabinet of Ministers dated 05 November 2018 . Even though an interview was held on 04.07.2019 for the post of Director General , the appointment had not been made until 04.09.2019.

It has been observed that 04 Director posts, 02 Deputy Director posts, 3 posts of Senior Meteorologists and a Civil Engineering post in Senior Level were in vacant. It was observed that there are 05 other posts including 14 Senior Meteorological Officers consisted in the 19 posts of Tertiary Level vacancies.

3.5.2 Trainings for Meteorological Staff

It is very important to have a trained Meteorological Staff to apply the necessary and appropriate techniques to provide quality and timely data to the World Wide Network.

(a) Compliance with standards

Newly recruited officers to the posts of Meteorological Observer (Training Grade) of the Sri Lanka Technological Service are provided a two year training and that includes one year of in-service training. Although the World Meteorological Standards and Guidelines are being updated time to time , it was observed that the training course has not been updated accordingly.

(b) Participations in Training Courses

Because of Mercury contented Meteorological Equipment will be out of use in accordance with the Minamata Agreement, a 12 days training on Electronic Course had been provided to 30 Meteorological Officers / Observers of the Sri Lanka Technical Service by the University of Colombo from 12 May 2018 to 28 July 2018, at a cost of Rs. 1,000,000 for the Officers of Department of Meteorology with the objective of providing the knowledge in Automated Weather System.

Out of the 30 officers who had participated in the course, 9 were the officers represented the various Divisions of the Head Office and 21 were from the Regional Metrological offices. Even though the continuous participation in the course had helped the training to be successful, the number of officers participating in the total 12 days was 9 and it was observed that there were the weaknesses in the participation of 21 other officers to the course.

3.6 Implementation of Sustainable Development Goals

It is important to draw attention on the 2030 Agenda of Sustainable Development Goals introduced by the United Nations as Sri Lanka moves towards development goals and there is a special role to the Department of Meteorology in moving towards Sustainable Development of the country. The Sustainable Development Agenda is consisted of 17 objectives and 169 goals that are essential to Sustainable Development and a relevant government agency should identify its goals and contribute in the process of moving towards the Sustainable Development Goals of the country.

Accurate meteorological, climatic, hydrological, and marine information has become a determining factor in the human life. The International Meteorological Association (IAEA), which is also a member of Sri Lanka, has focused on the goals to what purpose that can be contributed towards achieving Sustainable Development Goals and accordingly, the Sustainable Development Goals such as 01,02,03,06,07,08,09,11,13,14,15,17 identified by the United Nations Organization has been identified as the goals relevant to their own institution.

(a) Identifying Sustainable Development Goals

Although the International Meteorological Organization had recognized the contribution of the Organization for its Sustainable Development as above, the Department of Meteorology had identified only 1,2,3,7,11 and 13 Goals as related to its scope. Therefore, it is observed that the Department of Meteorology needs to draw more attention to its scope while contributing to the Sustainable Development Goals.

(b) Provide Information Relevant to the database for the Sustainable Development Goals Indicators

It has been requested to prepare information on the Sustainable Development Criteria in relation with their scope by all government agencies under the heading of 'Base Data for Sustainable Development Goals Indicators' to provide the Special Selection Committee on Sustainable Development in order to implement the Sustainable Development Goals in Sri Lanka by the letter dated 16 March 2018 and No. PS/SP/SB/3/201, addressing all Ministry Secretaries and Heads of Departments by the Secretary to the President with the objective of successfully implementing Sustainable Development Goals in Sri Lanka. However, the Department of Meteorology had not responded to these requests also until 31 July 2018 .

4. Recommendations

- 4.1** Formulate an Action Plan for maintenance of all Weather Equipment to ensure that data is continuously and accurately received and develop a suitable model for monitoring the maintenance process and reporting on maintenance activities, appointing of responsible officers for reviewing such data for a specific period of time, taking prompt actions in order to correct the variations identified in the review.
- 4.2** Make applicable the comparison of weather forecasts and actual weather conditions not limit with regard to rainfall forecasts but also to other weather conditions.
- 4.3** When applying for financial provisions, properly identify the requirements for maintenance of Weather Equipment to make adequate provisions for carrying out the continuous maintenance works by requesting necessary provisions.
- 4.4** To obtain the statement of financial position of the World Meteorological Trust Fund Account as at 31 December 2018 and checking of the accuracy of it and transfer the remaining deposit to the Sri Lanka Treasury Account immediately.
- 4.5** Estimate the cost and financial loss incurred on the Project and act in accordance with the Financial Regulations 103 & 104.
- 4.6** In accordance with Subsection 13 of the Trust Fund Agreement , explore the possibility of taking actions so that not to occur financial losses furthermore to Republic of Sri Lanka and to act accordingly.
- 4.7** Identify all assets purchased (including the cab) in relation to this Gongala Radar System Project and be included in the Register of Fixed Assets .
- 4.8** Conduct a feasibility study, including a study on the environmental impacts of the Puttalam and Pottuvil sites, where the new Radar Systems are expected to be installed.

- 4.9** Obtaining a Report on the current balance of the Bank Account opened as per the JAICA Agreement, taking action to obtain a bank statement in relation to that bank account continuously once a month and handing over the responsibility in writing to the officers for the tasks assigned and grant the targets as well by the Department in accordance with the agreement .
- 4.10** Procurement of Radiosonde equipment and Balloons (Pilot and Radiosonde) in a manner of not to be expired , proper storage of them and use of safe methods for filling of hydrogen in balloons.
- 4.11** Setting up the Pilot Balloons and Radiosonde Balloons on prescribed times according to the World Meteorological Guideline and create a system to establish a continuous Meteorological Data System.
- 4.12** Inclusion of Automated Rain Gauge and Traditional Rain Gauges to the Inventory Register and applying them to the Annual Board of Survey.
- 4.13** Check whether the data is being collected according to the prescribed standards and formulate and implement an Annual Plan to inspect locations where voluntary rainfall data are collected in order to advise data collectors.
- 4.14** Obtaining Confirmation of proper carrying out of maintenance activities of installed IPVPN system by the Company for the data communication in Automated Weather System .
- 4.16** Focusing on a suitable alternative for Mercury-containing Meteorological Equipment that should be disposed of by 2020, as per the Minamata Convention.
- 4.17** Provide a mechanism to verify the validity of the data obtained by Automated rain Gauges.

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Auditor General