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Air Quality Governance in the ENPI East Countries

"Action Plan and Recommendations for the Further Improvement of the Air Quality Assessment System"

Activity 5 Report

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Summary

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IMPLEMENTING ORGANIZATION

NAME	CENN
ADDRESS	27 Betlemi Street, Tbilisi, Georgia
TEL. NUMBER	+995 32 275 19 03 / 04
CONTACT PERSON	Nino Shavgulidze

SIGNATURE

DATE OF REPORT:	19/06/2014	
AUTHOR OF REPORT:	CENN	
	Dr Peter Walsh	Mariam Shotadze
NAME OF KE EXPERT MONITOR	AIGA KALA	

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1. INTRODUCTION

1.1 NATIONAL PILOT PROJECT FEASIBILITY STUDY

This report represents the summary of findings from the National Pilot Project feasibility study.

1.1.1 Air quality assessment in EU

Air quality within existing EU members states are governed through the implementation of two principle directives, these are Directive 2008/50/EC on ambient air quality and cleaner air for Europe and Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

Directive 2008/50/EC *on ambient air quality and cleaner air for Europe* (Air Quality Framework Directive) creates a framework for air quality assessment at the EU level and repeals and replaces the previous Air Quality Framework Directive (96/62/EC), three *daughter directives* (1999/30/EC, 2000/69/EC, 2002/3/EC) and Council Decision 97/101/EC.

Directive 2008/50/EC is supplemented by the **Directive 2004/107/EC** *relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air*, which provides for target values for As, Cd, Ni and benzo(a)pyrene as marker of PAHs with conditional compliance deadline December 31, 2012. In the case of Hg, no target value is laid down but measurements are required. (*Appendix 1* contains definitions of the main terms, used in both air quality directives).

1.1.2 Air Quality Governance Project

The Air Quality Governance project in (ENPI) East Countries is currently assisting Georgia with the preparation and implementation of a national pilot project to perform a feasibility study on the introduction of a national air quality monitoring system. The purpose of the pilot project was to allow Georgia to develop a national monitoring network and set relevant guidelines in compliance with EU standards.

Air quality monitoring and assessment systems in Georgia fail to meet EU Air Quality Directives standards. These failures are at every level including policy, legislation, institutional, instrumental and principally current air quality operations.

Current resources available for ambient air quality monitoring in Georgia are not sufficient to credibly meet EU CAFE Directives and the fourth air quality daughter directive. The number and type of ambient air monitoring stations in Georgia are too few and inadequate to meet the population coverage or data averaging requirements within either the CAFE or Fourth Daughter Directives. In addition there is no effective statutory and regulatory framework upon which CAFE Directive and Fourth Daughter Directives objectives can be delivered.

A gap analysis[1] of air quality governance in Georgia identified that the following priority actions were needed to improve Georgia's assessment of its air quality:

- Assessment of the country's potential to implement international regulations
- Assessment of the introduction of an air quality monitoring system in Georgia including development of the monitoring network and setting relevant guidelines in compliance with EU standards
- Air quality legal and institutional analysis including gap analysis of existing legislation (both national and international), regulations and institutions

This pilot project evaluated how Georgia's air quality assessment and management systems are operated, the policy framework and standards for air quality assessment and management, competent authorities in the field of air quality monitoring assessment and management and supporting institutions. In addition a preliminary air quality assessment for Georgia was undertaken as part of the pilot project providing a foundation for a recommendation on the number of air quality monitoring stations to meet CAFE directive requirements.

1.1.3 Objective of the Feasibility Study

The objective of the feasibility study is to seek to improve Georgia's current air quality legislation, ambient air quality monitoring network as well as the assessment and reporting of ambient air quality so that it converges with the above Directive and meets European regulations thereby contributing to the improved air quality, whilst strengthening implementation and compliance.

1.1.4 Existing Air Quality Standards in Georgia

Georgian air quality standards exist under an ***Approval of Environment Quality Norms*** and a number of Amendments. Current air quality limits are expressed as maximal allowable concentration (MAC) in both daily means and maximum values, which have been derived from Soviet standards. These air quality standards are, in theory, determined every 5 years. However, since 2003 last change in this direction was made only in 2010, when maximum value of Nitrogen dioxide (NO_2) was changed from 0.085 mg/m^3 to 0.2 mg/m^3, in line with both the EU and WHO hour limit value. Existing standards do not cover either PM_{10} or $PM_{2.5}$.

It can be concluded that existing air quality standards are out-dated and essentially irrelevant to the EU principles. It is necessary to renew these standards, taking into consideration Directives 2008/50/EC and 2004/107/EC.

1.1.5 Existing Air Quality Monitoring stations in Georgia

The National Environmental Agency (NEA), a Legal Entity within the Ministry of Environment Protection (MoENRP) operates 8 air quality monitoring stations across 5 cities in Georgia. Of these, 4 are situated in Tbilisi, and the remainder are located in Batumi, Kutaisi, Zestaphoni and Rustavi. Only one station in Tbilisi is fully automated and compliant with EU air quality monitoring requirements.

[1]Air Quality Governance in ENPI East Countries: General System Gap Analysis: 2012 Update. EuropeAid/129522/C/SER/Multi Contract Number 2010/232-231

Pollutant species monitored across the Georgia air quality network are outlined Table 1 below.

Table 1.Substances measured across the Georgian Air Quality monitoring network

Cities	Tbilisi				Batumi	Rustavi	Kutaisi	Zestaphoni
Number of Stations / Pollutants	1	2	3	4	1	1	1	1
Dust	✔	✔			✔		✔	✔
SO_2	✔	✔			✔		✔	✔
NO_2	✔	✔	✔		✔	✔	✔	✔
CO	✔	✔	✔	✔	✔	✔	✔	✔
O_3	✔	✔						
Pb		✔						
MnO_2								✔
NO	✔						✔	
NO_X	✔							
PM_{10}	✔							
$PM_{2,5}$	✔							

The existing air quality monitoring network is largely manually operated, collecting 3 sub-samples during weekday daytime periods. The Georgia air quality monitoring network, as it currently exists, fails to meet EU CAFE directive data quality objectives and requires a fundamental overhaul for this to succeed.

Lessons were learnt from the single existing modern automatic air monitoring station in Tbilisi, which uses reference method detection systems and calibration procedures. This station, which was installed in 2012, measures PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, O_3 and meets the EU monitoring standards *(Appendix 2 contains the air quality standards from both Directives)*.

2. SUMMARY OF THE PILOT PROJECT

2.1 OVERVIEW OF THE ACTIVITIES IMPLEMENTED IN THE COURSE OF THE PILOT PROJECT

The pilot project feasibility study for the implementation of the National Plan for the Development of the Air Quality Monitoring System in Georgia was delivered by the project team as five separate sequential deliverables. These were:

1. Comparative report (state of the art in the EU, Georgia and other partner countries) and guidelines for designing of National Ambient Air Monitoring Network in compliance with EU requirements,
2. Preliminary assessment of air quality in Georgia on urban, regional, and national scale,
3. Design of the air quality monitoring network for Tbilisi,
4. Draft National Programme for the Development of the Air Quality Monitoring System in Georgia,
5. Feasibility Study for the Implementation of the National Programme.

2.1.1 Activity 1.Comparative Report of current air quality monitoring systems with State of the Art system in the EU

This task provided a review of the legal requirements for air quality monitoring systems at the EU level and their practical implementation in two selected EU Member States comparable with Georgia, Greece and Denmark.

Major system gaps in air quality management were identified as follows:

- Underdeveloped systems of air quality monitoring (lack or insufficient number of automatic stations, no measurement of PM2.5, very limited measurement of $PM_{10}$and ground level ozone).
- Insufficient air quality data gathering, treatment and interpretation
- Limited access to actual information on air quality

2.1.2 Activity 2. Preliminary air quality assessment

A preliminary air quality assessment was completed which applied assessed the EU air quality directive requirements to the existing data and resources available in Georgia. This involved identifying zones and agglomerations to be designated for air quality purposes and determined the spatial distribution of pollutant concentrations across those zones.

The following data sources were used to assess national air quality and the distribution of pollution across Georgia:

- Monitoring data;
- Spatial concentration distribution of pollutants using modelling techniques;
- Principal pollution sources per region;
- Documentation of assessment methods.

The ADMS-Urban dispersion model was used to provide a city by city distribution of pollutants across Georgia. Input data included a 3 hourly mean data set from 2006 point source emissions data, traffic

data from national road schemes, road vehicle emissions factors derived from the UK Emissions factor database and spatial emissions of domestic heating using national fuel consumption records. Meteorological profile.

2.1.3 Activity 3. Recommendations for air quality monitoring network for Tbilisi

An air quality monitoring network design for Tbilisi was developed during this activity.
The design was based upon the population distribution, a detail emissions inventory for the city, existing ambient monitoring data and on the output from the ADMS-Urban model for Tbilisi.

The design was directly influenced by the output from the preliminary assessment which identified that pollutants regulated by the CAFE Directive on ambient air quality are likely to be exceed LAT, UAT and LV's throughout areas of Georgia. The air quality monitoring network design for Tbilisi therefore focused on the likelihood and location of the air quality exceedances in the city of Tbilisi, as this would best identity the most sensitive receptors and relevant sampling locations.

The data used in this study was as follows:

- National Network monitoring measurement data 2008 to 2013
- National Emission Inventory Data for Georgia 2012
- Dispersion modelling of point sources, area sources and mobile sources of air pollutants.
- Short term diffusion tube data

2.1.4 Activity 4 - Task 1. Preparation of the draft Programme for the National Ambient Air Monitoring Network in Georgia

A draft programme for the development of a National Ambient Air Monitoring Systemin Georgia was outlined as part of the Activity 4 – Task 1. The programme explored the minimum number of measuring stations required for both minimum and maximum exposure scenarios. It was proposed to supplement continuous monitoring within the air quality monitoring network with a number of passive sampling measurement sites. This will provide a greater understanding of the distribution of pollutants in both urban areas and in areas where continuous monitoring was not necessary under CAFE directive requirements.

Limiting factors in developing and sustaining the national air quality network were identified as budgets for capital expenditure items, operational costs, the availability of suitable technical skills and a communications infrastructure capable of data telemetry. All of the above would, as a minimum, require 24 months to train and put in place suitably qualified staff.

2.1.5 Activity 4 – Task 2. Feasibility Study for the implementation of the two scenarios of Ambient Air Quality Monitoring Network (AQMN) in Georgia

A feasibility study for the two scenarios of an Ambient Air Quality Monitoring Programme in Georgia was completed as part of Activity 4 – Task 2. This involved assessing the technical, management and

economic commitments involved in establishing a comprehensive national air quality monitoring network for Georgia.

Major challenges faced by the proposed network will be in identifying a secure for a budget sufficiently large enough to realistically meet all annual operational, calibrations, travel expenses, consumables and laboratory costs. This is second only to the challenge of securing sufficient technical staff with the right skill level and experience for the national network to succeed.

2.2 Recommendations Resulting from the Previously Implemented Activities

2.2.1 Activity 1 Comparative Report of current air quality monitoring systems with State of the Art system in the EU

Recommendations made in the Activity 1 report included using a diverse body of legislative instruments to organise the air quality monitoring and assessment at a national level, with the intention that these form complementary strands within an overall framework. These recommendations included the following key improvements to Georgia's the air quality monitoring network:

- Designating competent authorities at both national and regional/local levels;
- Introducing statutory ambient air quality standards and alert thresholds;
- Establishing and co-ordinating an ambient air quality monitoring and assessment programme;
- Reporting annually to the Commission and the public on the results of ambient air quality monitoring;
- Putting in place a system to ensure that the public is notified when alert thresholds are exceeded

The activity report also recommended that a national air quality strategy be developed as an essential tool to identifying existing legislation, regulations, institutions and practices which are appropriate in meeting EU air quality directives. This would assist in convergence and harmonise Georgia's legislation with the EU Air Quality Directives.

Key elements to be considered in Georgia's air quality strategy are outlined in Table 2 below.

Table 2 Key Elements of the National Air Quality Strategy

National Air Quality Strategy Key Elements
Air quality standards and objectives
Baseline and Pollutants
Developing the evidence base
Implementation of air quality objectives
Details of pollutants and objectives
Current air quality policies: International; National
Other Government policies that affect air quality
The need for new air quality measures

New policies to be considered
New measures to be considered
Measures requiring additional development work
Assessment of Additional Policy Measures
Regulatory Impact Assessment
Longer term view

It was recommended that the air quality evidence base continued to be developed, including source identification and emission inventories, allowing further improvements to the assessment of Georgia air quality. This will draw upon involve technical inputs from local government, national standards authorities, national meteorological institutes and NGO's, as institutional stakeholders, currently these include:

- Autonomous and Regional Governments: Republic of Abkhazia, Autonomous Republic of Adjara, Regional Georgia Governments, City Municipality of Tbilisi
- Georgia Hydro-meteorological Institute
- CENN
- Private companies engaged in air quality modelling and emission inventories
- Environmental Information and Education Centre, MoENRP

2.2.2 Activity 2. Preliminary air quality assessment

The preliminary air quality assessment observed that there was clear risk that levels of air pollution in parts of Georgia were above the concentrations thresholds which require fixed measurements to be made for compliance with the CAFE Directive. These observations were used to determine the identity of air quality zones and agglomerations for Georgia. Conclusions arising as a consequence of the preliminary air quality assessment were:

- Road transport is the main source of pollution effecting the majority of the Georgian population;
- There werepotential impacts upon resident populations as a result of pollutants from the emissions of point sources to the south east of Tbilisi, the area surrounding Kutaisi as well as Gori and Batumi;
- Fixed, long-term measurements of the pollutants regulated by the CAFE and 4th Daughter Directives have been monitored in part since 2002, though not to the required standards;
- Preliminary measurements of airborne benzene levels in Georgia are, as yet, inconclusive;
- That, given the limited temporal measurement data and lack of surrogate information from emissions inventories, there was little scope to reduce the fixed point monitoring burden via supplementary information; and
- There is a strategic need to characterise roadside, urban background and industrial components of air pollution with a view to improve the quality of input data for modelling purposes and for the development of a national monitoring network and national air quality to begin to improve air quality.

It was recommended that Georgia be sub-divided into 10 areas, or zones and agglomerations, for air quality management purposes, which each area characterising the variation in population exposure,

pollution emissions, topography, and reflecting regional administration. These recommendations were then presented to the stakeholder group for analysis, comments, revisions and/ or approval. As a further recommendation- a rural background monitoring station measuring NO_x, SO_2, PM_{10}, $PM_{2.5}$, ozone and meteorological data should be included in the network with the specific aim of:

- Protecting sensitive ecosystems in Georgia governed by the CAFE Directive;
- Assessment of contributions from transboundary pollution particularly for PM_{10}, $PM_{2.5}$ and ozone;
- Facilitating the development of national plans to improve air quality by identifying components of air pollution which are not directly controllable locally.

The continued broader assessment of Georgia's air pollution was also recommended through a rationalised diffusive sampler surveys, as well as the continued development of an emissions inventory from both domestic and dispersed sources.

2.2.3 Activity 3. Recommendations for air quality monitoring network for Tbilisi

Following specific monitoring requirements it was recommended that 5 fixed monitoring locations should be established, monitoring NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, lead, O_3, benzene. These monitoring sites included an urban background location in Tbilisi, a roadside location, an industrial/ traffic sampling point of road transport emissions in Agmashenebeli Street, Tbilisi and a suburban location and a maximum point of ground concentrations in the city.

2.2.4 Activity 4 - Task 1. Preparation of the draft Programme for the National Ambient Air Monitoring Network in Georgia

Outputs from Activity 4 - Task 1 included the recommendations that Georgia is divided into nine zones and one agglomeration for the purpose of air quality assessment. These divisions are based upon the geographical distribution of point sources, the country's population density, topography and climate.

Following consultations with the existing stakeholder group and beneficiary there was a recommendation to revise the Zones and Agglomerations identified in the preliminary assessment (activity 2). Greater regard was made of administrative boundaries and regional responsibilities, segregations between zones were harmonised with boundaries between the various regional or autonomous area administrations. In addition there was a recommendation, that for simplicity, there should be on one designate agglomeration, Tbilisi. It was felt that these changes would provide clarity to local governing bodies of the state of the air quality within their region, and encourage local governing bodies to contribute to Air Quality Action Planning.

Zone and Agglomerations

It was recommended that the following identified areas be designated as air quality Zones

1. Abkhazia
2. Racha Lechkhumi, Kvemo and Zemo Svaneti
3. Samegrelo + Guria (Poti, Kulevi, Sufsa)
4. Adjara Region
5. Imereti Region
6. Shida Kartli + South Ossetia
7. Akhaltsikhe
8. Kvemo Kartli including Rustavi
9. Kakheti + Mtskheta – Mtianeti

It was recommended that the following area be designated as an air quality agglomeration

1. Tbilisi (unique pollution profile and a population of over 1 million)

Figure 1 Agreed Zones and Agglomerations for Georgia

Consultation with the Ministry of Environment has resulted in the recommendation that the national monitoring network follows the monitoring requirements of the maximum assessment scenario. Therefore it is recommended that fixed monitoring be undertaken at nine locations. Particulate monitoring is required for a total of 14 sampling points (Table 1. below), though these can include co-located PM_{10} and $PM_{2.5}$instruments.Use of single instruments capable of measuring both PM_{10} and $PM_{2.5}$ will reduce this requirement by 50%, down to 7 PM instruments.

Co-locating PM instruments with the NO_2 and SO_2 instruments will also reduce the number of monitoring stations required, down to 9.

It is recommended that 4 of the 9 monitoring stations are to be established in the agglomeration of Tbilisi.

Table 1. Regional Distribution of National Air Monitoring Stations in Georgia

Zone Number	Potential Monitoring Locations	Min Number Monitoring Stations			
		If Max Concentrations exceed UAT		If Max Concentrations are between the LAT and UAT	
		Pollutant SO_2, NO_2	$PM_{10+2.5}$	Pollutant SO_2, NO_2	$PM_{10+2.5}$
1	Imereti Region: Kutaisi Zestaphoni Chiatura	1	2		
5	Adjara region: Batumi	2	3		
8	Kvemo Kartli: Rustavi	2	3		
10	Tbilisi	4	6		

It was also recommended that in order to provide an air quality monitoring record with sufficient geographical coverage to test the above assumptions, whilst meeting the CAFE Directive data quality objectives for indicative measurements, supplementary monitoring is used across the low risk regions has been developed (Table 2.). Passive sampling for SO_2 and NO_2 should continue for a minimum of 12 months at all suggested sampling points. This would provide a solid monitoring record against which an air quality assessment of those regions can be undertaken.

Table 2. Regional Distribution of Supplementary Monitoring points in Georgia

Zone Number	**Potential Monitoring Locations**	**Supplementary Monitoring points**	
		Max Concentrations are either below LATs or no monitoring data exists	
		Pollutant SO_2, NO_2, Benzene*	$PM_{10+2.5}$* and Lead*
1	Abkhazia Region Sokhumi	Passive sample points 3 NO_2, 2 SO_2	Indicative Monitoring Points 1 Combined $PM_{10/2.5}$ sampler 1 Lead filter sample
2	Racha Lechkhumi, Kvemo and Zemo Svaneti	Passive sample points	Indicative Monitoring Points

	Regions Ambrolauri	3 NO_2, 2 SO_2	1 Combined $PM_{10/2.5}$ sampler 1 Lead filter sample
3	Samegrelo + Guria Regions Poti Sufsa Zugdidi	Passive sample points 3 NO_2, 2 SO_2 3 NO_2,2 SO_2 3 NO_2, 2 SO_2	Indicative Monitoring Points 1 Combined $PM_{10/2.5}$ sampler Lead filter sample 1 Combined $PM_{10/2.5}$ sampler Combined $PM_{10/2.5}$ sampler
6	Shida Kartli + South Ossetia Regions Gori Java	Passive sample points 3 NO_2, 2 SO_2, 1 Benzene 3 NO_2, 2 SO_2	Indicative Monitoring Points 1 Combined $PM_{10/2.5}$ sampler 1 Lead filter sample 1 Combined $PM_{10/2.5}$ sampler
7	Akhaltsikhe Region Akhaltsikhe	Passive sample points 3 NO_2, 2 SO_2, 1 Benzene	Indicative Monitoring Points 1 Combined $PM_{10/2.5}$ sampler 1 Lead filter sample
9	Kakheti + Mtskheta – Mtianeti Regions Mtskheta Telavi	Passive sample points 3 NO_2, 2 SO_2 3 NO_2, 2 SO_2, 1 Benzene	Indicative Monitoring Points 1 Combined $PM_{10/2.5}$ sampler 1 Lead filter sample 1 Combined $PM_{10/2.5}$ sampler 1 Lead filter sample

* Minimum 14% time coverage for each year as 4 x 2 week sampling periods evenly across a year.

An operational schedule was proposed for the national ambient air quality monitoring network. Once in the national ambient air quality network is in place, a series of routine operations, actions and reports were recommended to place at pre-determined intervals and on an ad-hoc basis when interventions are required.

2.3 SUPPLEMENTARY INFORMATION FROM MODELLING

It was recommended that in order to provide considerable cost savings from monitoring air quality modelling should be used to supplement the national air quality monitoring network.

Models are accepted as a legitimate compliance assessment tool and are able to calculate exceedences of Limit Values and other reportable metrics. Due to their ability to process scenarios in a manageably short timescale, models can rapidly assess the impacts of any statutory revisions or regulatory changes which may affect air quality. In addition models are able assess;

i. a range of pollutants,
ii. a range of averaging times from an hour to a year,
iii. the whole territory of the member State at a spatial resolution of a few kilometres and
iv. hotspots, in particular roadsides

It is recommended that dispersion models that comply with EU averaging requirements are employed, such as ADMS-URBAN.

Quality Control and Quality Assurance

Recommendations were made that all network procedures should be subject to objective and independent quality assurance. This is necessary in order that the Georgia National Air Quality Monitoring Network can meet EU data quality objectives.

In addition to quality assurance, quality control measures could also be put in place through a Georgian National Quality Plan. The plan would outlined and allocate roles and responsibilities for the national QA/QC programme. The main responsibility of the delivery of the Quality Plan will lie with the Department of Environmental Pollution Monitoring within the National Environmental Agency. They will be supported by several other bodies, including suppliers and technical service providers, such as a commercial maintenance and repair contractor as well as a calibration gas/ reference test suppliers.

The National Quality Plan requires close collaboration, with each participant playing a specialist contributing role to successfully deliver a National Quality Plan which ensures all monitoring data is capable of meeting EU Data Quality Objectives.

2.3.1 Activity 4 – Task 2. Feasibility Study for the implementation of the two scenarios of Ambient Air Quality Monitoring Network (AQMN) in Georgia

The feasibility study for the implementation of air quality monitoring networks in Georgia identified several opportunities in the existing network. Recommendations were made that existing current NEA staff be re-deployed to operate the proposed air quality monitoring stations. Though this transition of roles and duties would require significant retraining and an extensive period of additional support for all field staff. Some staff members' skills and technical understanding may not be suited to this change of working and redundancy or redeployment may be required in these cases.

It was recommended that there was an opportunity to coordinate and replicate the successes of the existing continuous air quality monitoring network in Tbilisi, as this station is already measuring the following pollutants: PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, and O_3 to CAFE directive monitoring standards.

Major weaknesses and risk were identified in the programme plan; these were mainly linked to the affordability of the proposed national network and the lack of technical capacities within Georgia.

It was recommended, that in order to overcome the NEAs resource and skills shortages that a secure and realistic funding stream would at first need to be identified. This would be required in order to upkeep annual labour budgets, supply of consumables, upgrade and maintain staff skills and most importantly maintain a rigorous routine instrument maintenance and servicing programme.

It was also recommended that capital investments and resources other than those from public finances should be sought, these could be from various external international donors, and in certain specific industrial settings, support from polluting industries may be forthcoming.

It was also recommended that financial support be explored from external sources (e.g. GEF, trust funds under the Convention on Long-range Transboundary Air Pollution (CLRTAP), USAID and bilateral cooperation). Furthermore, links with the planned activities of the Task Force for the Implementation of the Environmental Action Programme for Eastern Europe, Caucasus and Central Asia countries (EECCA) and the Regulatory Environmental Programme Implementation Network (REPIN) could be identified.

It was recommended that step-wise approach to developing the network be used to overcome the significant challenges it faces. The large capital and annual running costs required and the development of a suitable infrastructure as well as skills amongst technical staff could all be progressively phased. Activities such as identifying suppliers, procuring equipment and services, commissioning the network and staff training could be spread over several years, e.g. from 2015 through to 2018. It is, therefore, recommended that the air quality monitoring stations in Tbilisi should be the first to be established and operated, working as a pilot network, from which the national network could then be launched.

3. RECOMMENDATIONS FOR DEVELOPMENT OF LEGISLATION

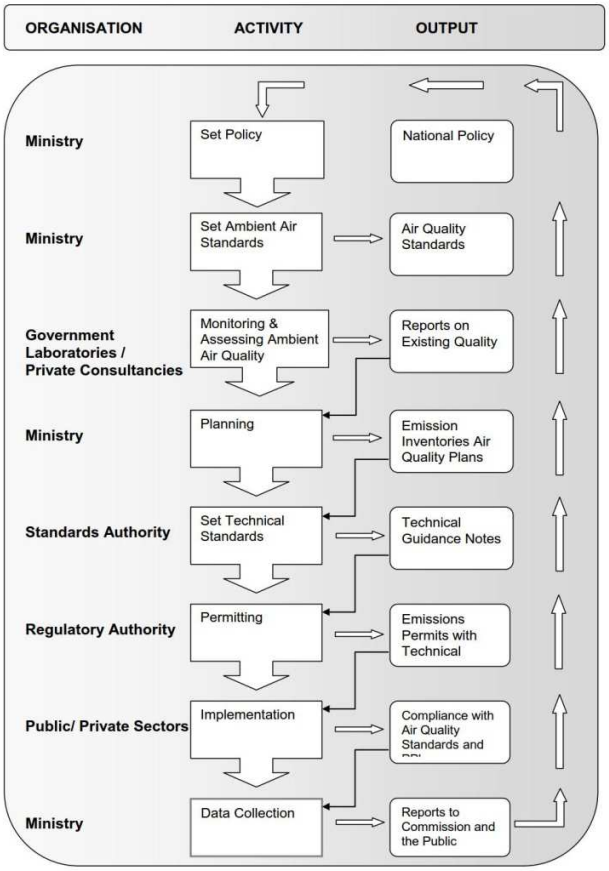
3.1 LEGISLATIVE ROLES

Central government are required to set overall policy within the context of the EC directives, e.g. incorporate air quality standards into legislation, provide fiscal incentives, delegation of duties or other measures that will assist in implementing air quality objectives.

An air quality process flow chart identifying the sequence of activities and responsibilities involved in implementing the air quality directives has previously been developed[2] and adapted for the air quality sector in Georgia (Figure 2.).

The specific roles of the standards authority and the regulatory authority could typically be combined within the National Environment Agency, involving both planning and data collection. It is not possible to show all the organisational options on a single flow chart, and the actual model adopted will depend upon the existing institutional structures in place.

Figure 2. Air Quality Process Flow Chart identifying the sequence of activities and responsibilities required to implement the air quality directives



[22] Handbook on the Implementation of EC Environmental Legislation Overview. Air Quality

3.1.1 Competent authority

A level of technical expertise already exists within the Ministry of Environmental and Natural Resources Protection Environmental Inspectorate and Air Protection Service. Strategically important roles or specialized technical expertise should also be established at the national level in order to provide a consistent approach and make efficient use of scarce resources, such as analysing and drafting legal frameworks, national planning and setting standards.

Practical expertise also exists within the National Environmental Agency, though, as previously reported, insufficient resource within the NEA could seriously impact upon the servicing and continuous operation of the air quality monitoring network.

Where appropriate, competent authorities' status can be assigned across several environmental sectors. Though drafting of legislation and regulations will always remain a ministry function, other functions such permitting industrial installations and their emissions to air, could be performed by another competent authority appointed in the air quality sector. Though these functions will naturally fall under the remit of The Ministry of Environmental and Natural Resources Protection NEA, there may also be a role for local government, beyond traffic management and development planning, particularly in the day to day management of air quality monitoring functions. This could be in partnership with the NEA or by integrating the regional functions of the NEA and local government, harness relevant knowledge established at the local level.

All of the above would be brought together under the umbrella of a national air quality sector strategy, which would carefully consider the relationship between ambient air quality criteria and emission limits from individual sources, regulatory responses and roles. A national monitoring strategy cannot exist in isolation without the acknowledgment of both emissions limits and emissions inventory.

Dispersion modelling links emissions inventories with the concentrations of pollutants in ambient air, allowing the contribution from different sources to existing air pollution levels to be quantified, as well as estimations of the benefits from reducing specific emissions. Statutory revisions or regulatory changes affecting air quality can also be assessed using modelling. Therefore modelling activity should be conducted and reported at a national level, allowing national air pollution priorities to be identified.

3.2 National Reference Laboratory and Quality Standards

An essential obligation in complying with the EU air quality directives is that all measurements are required to be traceable (according to ISO 17025) to a reference standard. There is existing capability for either of the above as no reference laboratory, accreditation laboratory or routine instrument calibration service exists within Georgia.

A national air quality standard laboratory and/ or delegated private sector resource is required to be established in order to provide a national air quality reference service which meets ISO 17025 traceability criteria. It is the expectation that all monitoring and detection systems can be traced back to a certified national reference standard. The national reference laboratory would be legally responsible for the quality assurance of air pollutant measurements in Georgia as well as the organisation of all national QA/QC programmes and the participation to European QA/QC programmes. It would also

validate measurement methods as well as provide 'type approval' of instruments which meet ISO reference method requirements.

3.3 Adoption of Technical Standards for Air Quality Monitoring and Analysis

National technical standards, which comply with EC directive requirements, must be adopted to provide a uniform approach. Standards need to take account of international best practice and must be upheld through the standards authority.

More stringent standards can be imposed than those contained in the directives, either for different averaging periods or for other additional pollutants. Though in order to do so, scientific advice based on knowledge of standards in other countries and health considerations are required which is typically provided by government institutes, scientific advisors or independent consultants.

3.4 Amendments or inclusions to existing Georgia Air Quality Regulations

Subject to the aspiration that Georgia wishes to comply with both the CAFE- and the 4th Daughter Directives, a series of model amendments and inclusions have been prepared which set out a regulatory framework upon which Georgia can begin to meet conditions within both Air Quality Directives.

These amendments and inclusions have been referenced against existing Georgia air quality statutory measures and standards (provided in Table 3. below).

Each of the model amendments in Table 3have a direct reference to the Annex and requirements of the EU CAFE-Directive 2008/50/EC and the 4th Daughter Directive 2004/107/EC.

Terms used within the amendments and their inclusions are a reflection of the UK Air Quality Standards Regulations 20103, which has been recognised as an effective transmission of the EU Air Quality Directives into National regulations.

Some or all of the model amendments and inclusions may be already in existence in some form within Georgia statutory measures and standards and may be disregarded, should duplication have occurred.

[3] 2010 No. 1001 ENVIRONMENTAL PROTECTION The Air Quality Standards Regulations 2010

Table 3. Model Amendments or inclusions to existing Georgia Regulations meeting allowing Compliance with both CAFE-Directive 2008/50/EC and the 4th Daughter Directive 2004/107/EC

Legislative Power	Issues regulated/addressed	Model Amendments or inclusions to existing Regulations Compliance with both CAFE-Directive 2008/50/EC and the 4th Daughter Directive 2004/107/EC
Law on Environmental Protection, Title VII, Article 26, 27, 27[1]	***Title VII contains*** general provisions on collecting, storing and disseminating environmental information. More specifically: - Article 26 defines components and responsible parties for maintaining state environmental registries, natural resources cadastres and spatial information databases. These registries and databases are managed and coordinated by the Ministries of Environment, Agriculture and Health within their own scope of work - Article 27 defines the system for ambient environmental quality monitoring and charges The Ministry of Environmental and Natural Resources Protection an Natural Resources Protection with overall coordination of the system - Article 27[1] tasks the Centre for Environmental Information and Education to collect available environmental	**Designation of competent authority** The Ministry of the Environment is designated as the competent authority— (a) for Georgia for the purposes of article 3(f) of Directive 2008/50/EC, and (b) save as set out in paragraph (a), for the purposes of Directive 2008/50/EC and for the purposes of Directive 2004/107/EC. **Power to give directions** For the purposes of implementing any obligations of Georgia Directive 2008/50/EC, Directive 2004/107/EC and Council Decision 97/101/EC establishing a reciprocal exchange of information and data from networks and individual stations, measuring ambient air pollution within the member States the Ministry of the Environment has the same power to give directions under these Regulations to: — local government authority in Tbilisi; — the Governor of Autonomous Republic of Abkhazia and the Governor Autonomous Republic of Adjara

	information and make it available to the general public	— **Duty in relation to information and alert thresholds** Where any of the information or alert thresholds in Annex XII Directive 2008/50/EC are exceeded the Minister of the Environment must inform the public by means of radio, television, newspapers or the internet. In zones where the long-term objectives for ozone have been attained, the Minister of the Environment must, insofar as factors including meteorological conditions and the transboundary nature of ozone pollution permit — ensure that they continue to be met; — maintain the best ambient air quality compatible with sustainable development; — maintain a high level of protection for the environment and human health. **Duty in relation to information and alert thresholds** Where any of the information or alert thresholds in Annex XII Directive 2008/50/EC are exceeded the Minister of the Environment must inform the public by means of radio, television, newspapers or the internet. Duty in relation to critical levels for the protection of vegetation The Minister of the Environment must ensure that the critical levels set out in Annex XIII Directive 2008/50/EC are not exceeded.
Law on Atmospheric Air Protection, Title VII, Article 20, 21; Title XIV, Article 51	***TitleVIITitleVII contains:*** - General provisions on organizing ambient air quality monitoring system, including: i) definition of the ambient air quality system and its components; ii) responsible parties for monitoring; iii) criteria and principles for classification/division of Georgian regions for the purpose of air quality management; iv) various classes/categories of regions in accordance with pollution levels; v) requirements for	**Zones and agglomerations** The Ministry of the Environment must, for the purposes of these Regulations, divide the territory of Georgia into zones and agglomerations. A zone will be classified as an agglomeration if it is a conurbation with a population in excess of 250,000 inhabitants. In these Regulations references to a zone include a zone which has been classified as an agglomeration. Zones are to be identified on a map published by The Ministry of the Environment.(a) Assessment of ambient air quality for SO_2, NO_2, NO_x, $PM_{2.5/10}$, lead, benzene and CO. **Assessment thresholds** Classify each zone according to whether or not the upper or lower assessment thresholds are exceeded Review the classification of zones at least every five years. When reviewing the classification of zones in accordance with assessment thresholds, it

	calculating and reporting pollution indices; vi) responsibilities of state agencies for calculating pollution indices - Provisions on application of the requirements of 2008/50/EC &2004/107/EC directives for establishing and operating air quality monitoring systems, including: i) requirements for the minimum number, location and operations of monitoring sites/stations and; ii) requirements on measurement methods ***Title XIV contains:*** - Provisions related to public access and availability of air quality information, including the requirement for ensuring information availability through developing and publishing state of the environment report every three years	must comply with Section B of Annex II to Directive 2008/50/EC. **Assessment criteria** The Ministry of the Environment must assess the level of SO_2, NO_2, NO_x, $PM_{2.5/10}$, lead, benzene and CO in ambient air in all zones. In all zones where the level of those pollutants exceeds the upper assessment, fixed measurements must be used, but may be supplemented by modelling or indicative measurements. In all zones where the level of those pollutants is below the lower assessment threshold, modelling or estimation techniques or both may be used instead of measurement. In all other zones a combination of fixed measurements together with modelling or indicative measurements or both may be used. In addition, the Ministry of the Environment must measure $PM_{2.5}$ at rural background locations away from significant sources of air pollution. Measurements must be carried out in accordance with the Data Quality and QA procedures set out in Annex I and IV of Directive 2008/50/EC. All measurements must in accordance with reference measurement methods specified in Section A and Section C of Annex VI to Directive 2008/50/EC. Equivalent methods may be used. Where measurements are supplemented by modelling or indicative measurement then the Minister of the Environment must take account of the results of those supplementary methods in assessing ambient air quality for the purposes of these Regulations. "Chemical speciation concentrations" are the concentrations of different chemical components or species of $PM_{2.5.}$ **Assessment criteria** The Ministry of the Environment must assess concentrations of arsenic, cadmium, nickel and benzo(a)pyrene in ambient air in all zones. In zones where the levels of As, Cd, Ni and benzo(a)pyrene are above the upper assessment threshold referred to in section I of Annex to Directive 2004/107/EC, measurement is mandatory but may be supplemented by modelling techniques to provide an adequate level of information on ambient air quality. In zones where the levels of those pollutants are between the upper and lower assessment thresholds, measurement is mandatory but may be supplemented by indicative measurements as referred to in Section I of Annex IV to Directive 2004/107/EC or modelling, or both. In zones where the levels of those pollutants are below the lower assessment thresholds, modelling or objective estimation techniques may be used instead of measurement.

		Data quality objectives When assessing levels of As, Cd, Ni, benzo(a)pyrene, other polycyclic aromatic hydrocarbons or gaseous mercury, The Ministry of the Environment must apply the data quality objectives and other standards contained in Annex IV to Directive 2004/107/EC. Location and number of sampling points. The location and number of sampling points for the assessment of As, Cd, Ni and benzo(a)pyrene must be determined in accordance with Annex III to Directive 2004/107/EC. **Monitoring of polycyclic aromatic hydrocarbons** The Ministry of the Environment must monitor concentrations of other relevant polycyclic aromatic hydrocarbons in addition to benzo(a)pyrene.
# 297 Order of the Minister of Labour, Health and Social Protection on Ambient Environment Quality Standards (16/08/01), as amended by #38 (2003) and 350 (2010) orders	This regulation contains: - Goals and objectives for Maximum Allowable Concentrations (MACs) - Responsible agencies for meeting MACs - Types of MACs - Allowed annual frequencies of one-time maximum concentrations - The list of pollutants subject to MACs - MAC values	Duties of Ministry of the Environment in relation to limit values etc. **Duty in relation to limit values** The Ministry of the Environment must ensure that levels of sulphur dioxide, nitrogen dioxide, benzene, carbon monoxide, lead and particulate matter do not exceed the limit values set out in part B of Annex XI Directive 2008/50/EC. In zones where levels of the pollutants are below the limit values set out in set out in part B of Annex XI Directive 2008/50/EC, the Ministry of the Environment must ensure that levels are maintained below those limit values and must endeavour to maintain the best ambient air quality compatible with sustainable development. **Duty in relation to target values** The Ministry of the Environment must ensure that all necessary measures not entailing disproportionate costs are taken to ensure that concentrations of $PM_{2.5}$, ozone, as, Cd, Ni and benzo(a)pyrene do not exceed the target values in Annex I and Part B Annex VII of Directive 2008/50/EC and Annex I of Directive 2004/107/EC. The Ministry of the Environment must draw up a list of all zones where the target values for As, Cd, Ni or benzo(a)pyrene are met and in relation to those zones, must maintain the levels of those pollutants below those target values and must endeavour to achieve the best ambient air quality compatible with sustainable development. The Ministryofthe Environment must draw up a list of all zones where the target value for As, Cd, Ni or benzo(a)pyrene is exceeded, and in relation to those zones, must identify the areas where those values are exceeded and the relevant sources of pollutants. In relation to the zones to which where the target value for As, Cd, Ni or benzo(a)pyrene are exceeded, all necessary measures not entailing disproportionate costs are taken must be directed at the predominant sources of emission which have been identified, and where applicable will entail the application of best available techniques in accordance with Directive 2008/1/EC of the European Parliament and of the Council concerning integrated

		pollution prevention and control.
Joint Order of the Ministers of Health and Environment on Setting Ambient Air Quality Standards in Accordance with 2008/50/EC and 2004/107/EC Directives	This regulation will set ambient air quality standards in accordance with EU air directives	**National Exposure Reduction for $PM_{2.5}$** Average exposure indicator The Ministry of the Environment must calculate the average exposure indicator for $PM_{2.5}$ ("AEI") for Georgia for 2020. The AEI must be calculated as follows — an average annual measurement must be derived from measurements at all the sampling points in urban background locations which have been installed in accordance with Section B of Annex V to Directive 2008/50/EC; — the average annual measurement in paragraph (a) must be averaged over three calendar years. The AEI for 2020 must be based on measurements for the years 2018, 2019 and 2020. The Ministry of the Environment must ensure that the distribution and number of sampling points used for calculating the AEI adequately reflects the exposure of the general population. **National exposure reduction target** Based on the AEI for 2020, The Ministry of the Environment must establish the national exposure reduction target for the Georgia in accordance with the table in Part B Annex XIV Directive 2008/50/EC. **Duty of The Ministry of the Environment to limit exposure to PM2.5** The Ministry of the Environment must ensure that all necessary measures not entailing disproportionate costs are taken in relation to Georgia with a view to attaining the national exposure reduction target by 2020. The Ministry of the Environment must base assessment of the compliance of attaining the national exposure reduction target by 2020 on a comparison of the AEI for 2020 with the AEI from the first year of measurements taking place. The Ministry of the Environment must ensure that all appropriate measures are taken in relation to Georgia with a view to ensuring that the AEI for 2015 does not exceed 20 $\mu g/m^3$. Where it appears necessary and after consultation with the relevant administrations as appropriate, The Ministry of the Environment must take measures in relation to Georgia to: — attain the national exposure reduction target; — ensure that the AEI for 2015 does not exceed 20 µg/m3.

Order of the Minister of Environment Protection on Setting Rules and Requirements for Minimum Number, Location and Operations of Ambient Air Quality Monitoring Sites as well as for Standard Measurement Methods	This regulation will set: - Requirements for defining minimum number and location of monitoring sites - Rules for operating monitoring sites/stations - Standard measurement methods	**Ozone Assessment criteria** The Ministry of the Environment must assess the levels of ozone in ambient air in all zones. The Ministry of the Environment must ensure that fixed measurements are taken in any zone where the concentrations of ozone have exceeded the long-term objectives specified in B of Annex VIII of Directive 2005/50/EC during any of the five years preceding those measurements. Measurements must be taken in accordance with the reference measurement methods specified in point 8 of Section A of Annex VI to Directive 2008/50/EC. Alternative methods may be used provided the conditions set out in Section B of that Annex are complied with. **Duty in relation to long-term objectives for ozone** The Ministry of the Environment must ensure that all necessary measures not entailing disproportionate cost are taken to attain the long-term objectives for ozone set out in section B of Annex VIII Directive 2005/50/EC. In zones where the long-term objectives for ozone have been attained, The Ministry of the Environment must, insofar as factors including meteorological conditions and the transboundary nature of ozone pollution permit— — ensure that they continue to be met; — maintain the best ambient air quality compatible with sustainable development; — maintain a high level of protection for the environment and human health.
Guidelines for Air Pollution Control, RD 52.04.186-89, «Руководствопоконтролюзагрязненияатмосферы» РД 52.04.186-89; Guidance Documents: РД 52. 04-56-89 and РД 52. 04-57-95	These documents set out: - Design and operating standards, rules and procedures for air quality monitoring network, including requirements for sites, minimum number and classification of monitoring stations/points - Principles and methodologies for identifying criteria pollutants - Sampling and analysis requirements and methods for operations and quality control of laboratory equipment	The Ministry of the Environment must install sampling points in accordance with Annex III of Directive 2008/ 50/EC for the assessment of SO_2, NO_2, NOx, $PM_{2.5/10}$, lead, benzene and CO. In zones where fixed measurement is the sole source of information for the assessment of air quality, the number of sampling points must be more than or equal to the minimum number specified in Section A of Annex V to Directive 2008/50/EC for the purpose of assessing compliance with limit values and alert thresholds. In zones other than agglomerations where fixed measurement is the sole source of information for the assessment of air quality, the number of sampling points must be more than or equal to the minimum number specified in Section C of Annex V to Directive 2008/50/EC for the purpose of assessing compliance with critical levels for the protection of vegetation. In zones where the information from fixed measurement is supplemented by information from modelling or indicative measurement or both, the number of sampling points in either Section A or C of Annex V, or both, may be reduced by up to 50% provided that the following conditions are met:

	- Requirements for data collection, analysis, storage and reporting	— supplementary methods provide sufficient information for the assessment of air quality in relation to limit values or alert thresholds, — supplementary methods provide sufficient information to inform the public as to the state of ambient air quality, and — number of sampling points to be installed and the spatial resolution of other techniques are sufficient for the concentration of the relevant pollutant to be established in accordance with the data quality objectives specified in Section A of Annex I to Directive 2008/50/EC and enable assessment results to meet the criteria in Section B of the same annex. For the measurement of PM2.5 in rural background locations, the Minister of the Environment must install a sampling point for every 100,000 km2. <u>Location and number of sampling points</u> The Ministry of the Environment must install sampling points in accordance with the criteria set out in Annex VIII to Directive 2008/50/EC. In zones where fixed measurement is the sole source of information for the assessment of air quality, the number of sampling points must be more than or equal to the minimum number specified in Section A of Annex IX to Directive 2008/50/EC. In zones where the concentrations of ozone have been below the long-term objectives for each of the previous five years of measurement, the number of sampling points must be determined in accordance with the criteria set out in Section B of Annex IX to Directive 2008/50/EC. In zones where the information from fixed measurement is supplemented by information from modelling or indicative measurement or both, the number of sampling points may be reduced provided that the following conditions are met: — the supplementary methods provide sufficient information for the assessment of air quality in relation to target values, long-term objectives, information and alert thresholds, — the number of sampling points to be installed and the spatial resolution of supplementary methods are sufficient for the concentration of ozone to be established in accordance with the data quality objectives set out in Section A of Annex I to Directive 2008/50/EC and to enable assessment results to meet the criteria specified in Section B of the same Annex; — there is at least one sampling point in each zone, with a minimum of one sampling point per two million inhabitants or one sampling point per 50,000 km2, whichever produces the greater number of sampling points; and — nitrogen dioxide is measured at all remaining sampling points except at rural background stations referred to in Section A of Annex VIII to Directive 2008/50/EC The Ministry of the Environment must ensure that nitrogen dioxide is measured at no less

		than 50% of the sampling points required under Section A of Annex IX to Directive 2008/50/EC. This measurement must be continuous except at rural background locations. The Ministry of the Environment must ensure that concentrations of the ozone precursor substances listed in Annex X to Directive 2008/50/EC are measured at least one sampling point. The Minister of the Environment may choose the location and number of sampling points for measurements of ozone precursor substances and must take into account the objectives and methods set out in Annex X to Directive 2008/50/EC. Arsenic, cadmium, nickel, mercury, benzo(a)pyrene and other polycyclic aromatic hydrocarbons Assessment thresholds The Ministry of the Environment must classify each zone according to whether or not the upper and lower assessment thresholds specified in Section I of Annex II to Directive 2004/107/EC are exceeded in relation to arsenic, cadmium, nickel and benzo(a)pyrene. .

3.5 ROADMAP FOR GEORGIAN LEGISLATION TO MEET EU AIR QUALITY DIRECTIVES

3.5.1 Recommendations

The following legislature changes are required for the Georgian ambient air quality monitoring network and assessment method to comply with EU air quality guidelines and Directives:

- Legal harmonization/approximation focusing on directives 2008/50/EC and 2010/75/EU with clear and distinct roles for the competent authority, air quality monitoring, assessments and reporting
- Determination of air quality species and averaging periods as prescribed by Directives 2008/50/EC and 2010/75/EU
- Designation of zones and agglomerations for ambient air quality in Georgia
- Statutory recognition of a National Reference Service Laboratory equipped with certified standards allowing all ambient air quality measurements to be traceable back to a reference standard as required under ISO 17025

4. FUTURE COURSE OF ACTION FOR THE ADOPTION AND IMPLEMENTATION OF THE AIR QUALITY MONITORING PROGRAMME

4.1 AMBIENT AIR QUALITY MONITORING NETWORK PROGRAM

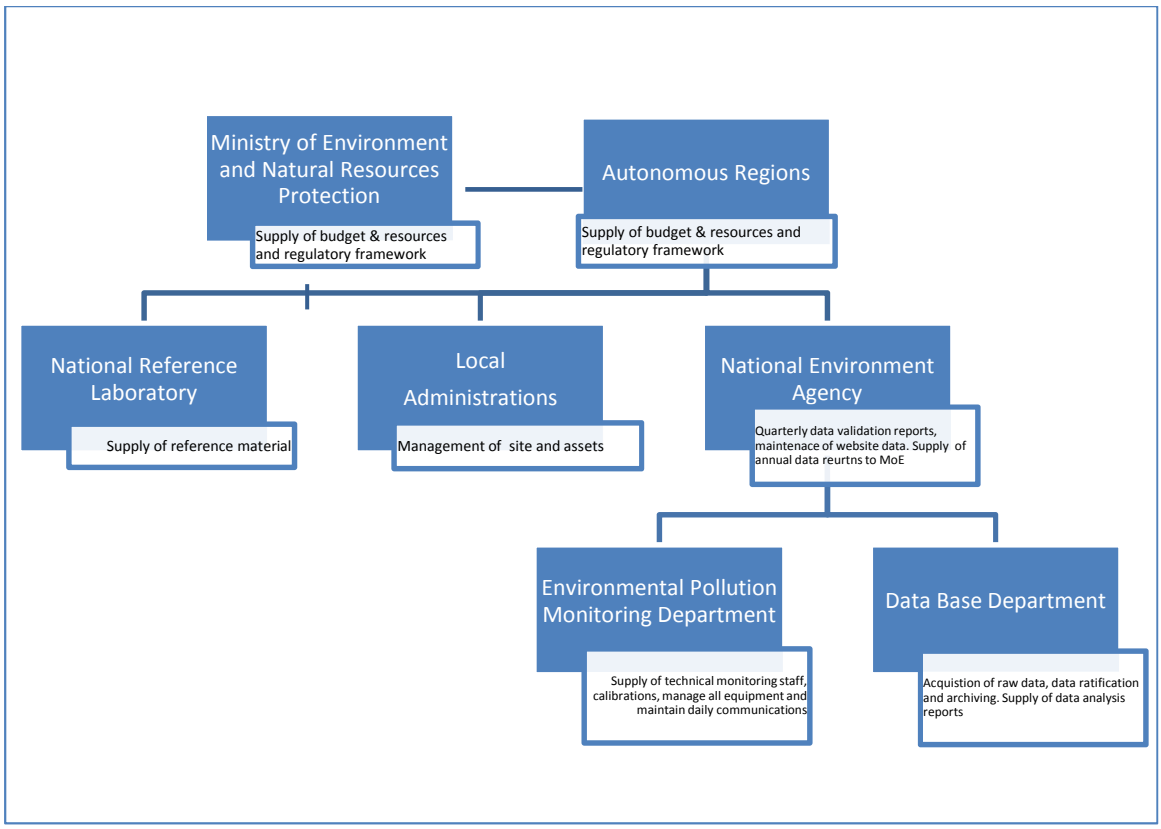
The air quality monitoring network is currently operated by the small Department for Environmental Pollution Monitoring, within the NEA. The department manages the stations, collects, processes, analyses and reports air quality data to the Ministry of Environment, with some assistance supplied from the Database Department of the NEA, where the central database is maintained.

The process falls short of the basic governance required to maintain quality control and transparency of data rules. As there is no neutral assessment or audit of the eventual data quality or consistency of records, to routinely screen the data for the presence of systematic errors or data manipulation.

It is proposed that the national air quality monitoring network is to be significantly expanded in terms of instrumentation, rate of data transfer and telemetry, data quantity, complexity of data validation processes and data analysis. This expanded national air quality monitoring network will require input from a wider partnership of specialists, stakeholders and regulatory bodies.

Division of the individual roles and responsibilities across the national air quality monitoring network are outlined the graphical representation below (Figure 3).

Figure 3. Organisational Chart Georgia's National Air Quality Monitoring Network



Entirely new roles have been proposed for the Autonomous Regions, National Reference Laboratory and Local Administrations. These new roles support the introduction of a national quality assurance

and quality control system, as well the additional support required to operate complex and sensitive equipment at multiple sites.

Local Administrations duties would effectively be custodians and managers of the site as an asset, e.g. assist in site selection, secure sites from their own land portfolio, provide security, attend to power interruptions, etc. Local Administrations will not be expected to participate in any technical duties, access to all monitoring instruments will be restricted to NEA sampling only.

A national reference laboratory will provide the calibration back-stop to all field measurements, providing six-monthly on-site calibrations as well as certifying all calibrations gases and flow meters prior to their use by field staff. All other roles will be operated as they currently are in the existing network.

4.2 Role and tasks of National Reference Laboratories

Across the EU, national reference laboratories are operated in a wide variety of ways. Within the UK the reference laboratory role is carried out by private sector scientific consultancies, whereas in the majority of EU member states government laboratories (e.g. Croatia, Czech Republic, Hungary), environment agencies (e.g. Bulgaria, Ireland, Latvia, Slovenia), central government departments (e.g. Cyprus, Greece, Malta, Netherlands, Poland) or research institutes (e.g. Estonia, Denmark, Italy, Portugal, Romania, Slovakia) perform the function of the national reference laboratory.

The role and task of a national reference laboratory is to verify and support the correct implementation of air quality directives, by:

i. Implementing a quality system in the laboratory
ii. Approving measurement systems (instruments, laboratories, networks)
iii. Ensuring the traceability of the measurements at national level, by providing/certifying reference materials to networks
iv. Organizing inter-comparisons/round robin tests at national level
v. Participating in EC QA/QC programmes (see official AQUILA position N 37 on organisation of inter-comparison exercises) and support the organisation of such programmes (see SOP for sampling for the EC/OC inter-comparison)
vi. Exchanging information through the organisation of training sessions, workshops, conferences and guidance documents (example: Guide to the Demonstration of Equivalence of Ambient Air Monitoring Methods

Minimum criteria for a national air quality reference service is outlined in AQUILA document National Air Quality Reference Laboratories and the European Network[4].

National reference laboratories are required to achieve accreditation to the ISO standard 17025 entitled "General requirements for the competence of testing and calibration laboratories". Ideally a separate organisation to that performing the operation of the national monitoring network should perform the role of the national reference laboratory. As the national reference laboratory is required to provide a calibration and method equivalence study service which is distinctly detached from the operations of the national network. At times the national reference laboratory may be required to scrutinise data and methods used by the national network. In the case of Georgia, the role of national reference laboratory could be undertaken by an established university department, research institute or a government agency other than the NEA, or effectively contracted out to an institution based within a neighbouring state, thereby sharing regional expertise, which is both cost effective and avoids the delays required to build a national institution such as a national reference laboratory.

4.3 Private Sector Involvement

The private sector within Georgia has a role to play in the resourcing, operation and reporting of the national air quality monitoring network. It is through the private sector that ambient air quality measurement equipment and systems are purchased and or hired. In general, the private sector are able to operate upon shorter time-scales and with a greater degree of flexibility than public sector bodies, such as government bodies, national laboratories and university research departments.

[4]Roles and Requirements for Measurement Traceability, Accreditation, Quality Assurance/ Quality Control, and Measurements Comparisons at National and European Levels.V2 Dec 2009 (http://ec.europa.eu/environment/air/quality/legislation/pdf/aquila.pdf).

Use of private sector companies for testing sampling and analysis is common practise throughout the EU, where former government laboratories have been transferred over to the private sector or established as semi-autonomous entities such as the NEA. Buying specialist services via a long-term government contract allows the private sector company to build a firm foundation upon which it can maintain the required technical skills and establish a greater knowledge base.

4.4 Communication and Consultation

Planning and implementation of air quality management legislation requires co-ordination between government and, competent authorities and other stakeholders. Communications are important for effective implementation of the legislation.

As an air quality strategy is developed, a clear and transparent communications programme should be conducted, gaining the views and opinions of all interested parties, in order to assess the acceptability and practicality of all aspects of air quality legislation and the proposals for its implementation.

In the long term, achieving compliance with the EU's standards and limit values, may require changes in the values and attitudes to the environment by various governments departments and other stakeholders (including the public). Education programmes and information campaigns are necessary to support this. These are typically undertaken using existing NGO's with European and national government support.

4.5 Stakeholders

Development and implementation of a of a national air quality monitoring network will ultimately have implications and impacts upon a broad range of stakeholders. These impacts and implications include those at design stage (such as exposure of the public and impacts upon the public health service), development stage (National Environment Agency resources etc) and outcomes (curbing of industrial and transport emissions). A list of the principle stakeholders is outlined in Box 1 below.

Stakeholder	**Role**
Central Government (e.g. Ministry or Department)	Implementation and maintenance of compliance with EC policies and legislation on air quality. Determine national policy on the environment, energy, transport, etc. Transpose and implement legislation. Set technical standards. Determine fiscal incentives or taxes.
Environmental agencies working on behalf of central government (e.g. regulatory authority, national standard laboratory, national meteorological institute)	Provision of planning, regulation and technical assistance. Industrial and pollution control. Monitor weather, collect data on meteorological conditions and air quality, compile data inventories, and modelling. Measurement and accreditation services.
Public Utilities	Use fuels. Emitters of air pollution.
Regional and Local Government	Traffic management. Regulation of emissions from small sources. Undertaking local air quality assessment including monitoring. Evaluation of trading standards, e.g. checking fuel quality checking.
Industry and commercial sector	Significant emitters of air pollutants. Provision of pollution control equipment
Consultants	Provision of advice to public and private sector
NGO's, media and trade unions	Representing the public the or workers interest or specialists or experts in the field of air quality
Public	Significant of air pollutants.
Research institutions	Research on pollution abatement

4.6 PROGRAM FOR A NATIONAL AIR QUALITY MONITORING NETWORK

An opportunity exists to phase the existing Ambient Air Monitoring Network into the updated National Ambient Air Monitoring Network. The requirements for establishing a National Ambient Air Monitoring Network are significant and require resources, expertise, training and expert technical capacity.

A programme for developing an emerging national ambient air monitoring network will require:

- Selection and installation of new instrumentation and monitoring stations
- Development of a communications network
- Training and development of a data analysis and reporting system
- Management of Resources
- Modelling and assessment
- Preparation of national and regional institutes to support the National Ambient Air Monitoring Network

The following five stage action plan and event dates are necessary in order to establish a national air quality monitoring network by 2018 and to ensure that the air quality network fulfils basic QA/QC requirements, such EN 17025 for traceability of measurements.

Preliminary Stages to Complete by March 2015

- Complete Feasibility Study to establish a National Air Quality Monitoring Network
- Complete Air Quality Monitoring Station Pilot Project
- Identify national staff resources and training needs

Preparatory Stages to Complete by December 2015

- Identify monitoring equipment, site infrastructure and communication infrastructure needs
- Secure/ identify capital budget, training and annual operating budget for the national Air Quality Monitoring Network

Foundation Stages to Commence by June 2016

- Tender an opportunity for the supply of pilot project sites in Tbilisi
- Embark upon national staff training/ recruitment programme for the NEA, Environmental Pollution Monitoring Department
- Secure sites and infrastructure for individual Air Quality Monitoring Network pilot sites
- Agree Terms of Reference between NEA, Ministry of Environment and Autonomous Regions
- Secure management contract with Local administrations as well as equipment servicing and maintenance supplier
- Establish central data archive team in NEA, Database Department

National Reference Laboratory to Commence by June 2016

- Identify supplier of national reference laboratory service
- Training needs analysis and mentoring scheme with existing European national reference laboratory service
- Calculation of Uncertainty Budgets throughout all pollutant species against CAFE directive Data Quality Objectives
- Site Audits and Commissioning of Accredited Body

Final Stages to Commence by January 2018

- Tender an opportunity for the supply of remaining air quality monitoring sites.
- Expand national staff training/recruitment programme for the regional NEA, Environmental Pollution Monitoring Department
- Secure sites and infrastructure for remaining individual Air Quality Monitoring Network sites
- Secure management contract with Local administrations as well as equipment servicing and maintenance supplier

Site audits by an external accredited inspection body are required to ensure that all standard operating procedures and relevant records are being met.

Table 4.Proposed Program for a National Air Quality Monitoring Network for Georgia

Action	Responsible Authority	Deadline	Resources Required
Preliminary Stages			
Complete Feasibility Study to establish a National Air Quality Monitoring Network	CENN	March 2015	None
Complete Air Quality Monitoring Station Pilot Project	CENN	March 2015	None
Identify national staff resources and training needs	NEA Environmental Pollution Monitoring Department	March 2015	Process of matching current NEA staff skills against tasks and duties. Will take air quality scientist approximately 1 month to complete.
Preparatory Stages			
Identify monitoring equipment, site infrastructure and communication infrastructure needs	NEA Environmental Pollution Monitoring Department	To Complete by December 2015	Input from a monitoring specialist, input from current NEA communications team. Will take 2 – 3 months to complete Network design Euro 228,850
Secure/ identify capital budget, training and annual operating budget for the national Air Quality Monitoring Network	NEA Environmental Pollution Monitoring Department	To Complete by December 2015	Extended discussions with EU/ JICA/ other donors. Budget required over 10 years Euro 4.8 million
Foundation Stages			
Tender an opportunity for the supply of pilot project sites in Tbilisi	Ministry of Environment	To commence by June 2016	NEA/ Air Quality Monitoring specialist. Will take approximately 2 weeks to complete –Purchase 3 multi-pollutant analyser&PM samplers for Tbilisi Euro 864,000
Embark upon national staff training/ recruitment programme for the NEA, Environmental Pollution Monitoring Department	NEA Environmental Pollution Monitoring Department	To commence by June 2016	External training body to deliver training programme to technicians, air quality modellers, data and assessment analysts – Euro 20,000
Secure sites and infrastructure for individual Air Quality Monitoring Network pilot sites	NEA Environmental Pollution Monitoring Department	To commence by June 2016	NEA to negotiate, collaborate with local administrations
Agree Terms of Reference between NEA, Ministry of Environment and Autonomous Regions	Ministry of Environment	To commence by June 2016	Ministry of Environment to negotiate with NEA &Autonomous Regions

Secure management contract with equipment servicing and maintenance supplier and local administrations	NEA Environmental Pollution Monitoring Department	To commence by June 2016	Calibration standards+auxiliaries: 2015 Euro 80,000; 2016 Euro 90,000; Euro 140,000 every year after
Establish central data archive team in NEA, Database Department	NEA Database Department	To commence by June 2016	Data team already in place. Resources will form part of staff training budget
National Reference Laboratory			
Identify supplier of national reference laboratory service	Ministry of Environment	To Commence by June 2016	NEA to utilise existing resources
Training needs analysis and mentoring scheme with existing European national reference laboratory service	NEA Environmental Pollution Monitoring Department	To Commence by June 2016	Resources to be scaled against level of need.
Calculation of Uncertainty Budgets throughout all pollutant species against CAFE directive Data Quality Objectives	National reference laboratory/ NEA Environmental Pollution Monitoring Department	To Commence by June 2016	Will requires 10 days for a monitoring specialist per monitoring method to complete
Site Audits and Commissioning of Accredited Body	NEA Environmental Pollution Monitoring Department	To Commence by June 2016	Each site Audit requires 5 days of an independent monitoring expert. Resources required for commissioning of accredited body to be scaled against level of need.
Final Stages			
Tender an opportunity for the supply of remaining air quality monitoring sites	Ministry of Environment	To commence by January 2018	Input required from NEA Environmental Pollution Monitoring Department.
Expand national staff training/recruitment programme for the regional NEA, Environmental Pollution Monitoring Department	NEA Environmental Pollution Monitoring Department	To commence by January 2018	Requires training of approximately Euro 40,000
Secure sites and infrastructure for remaining individual Air Quality Monitoring Network sites	NEA Environmental Pollution Monitoring Department	To commence by January 2018	NEA to negotiate, collaborate with local administrations
Secure management contract with Local administrations as well as equipment servicing and maintenance supplier	NEA Environmental Pollution Monitoring Department/ Local Administrations	To commence by January 2018	Ministry of Environment to negotiate with NEA &Autonomous Regions

5. FURTHER CONSIDERATIONS ON THE IMPROVEMENT OF THE AIR QUALITY MONITORING SYSTEM IN GEORGIA

Major weaknesses have been identified in the establishment of the air quality network is the affordability and the lack of necessary in-country capacities.

Establishing a national air quality monitoring needs significant amount of capital investments, consumables, expenses and labour budgets, system operations, maintenance, necessary staff qualifications and skills to smoothly operate the system that the NEA is lacking.

A major challenge faced by the proposed network is in identifying a source for a budget sufficiently large enough to realistically meet all annual operational, calibrations, travel expenses, consumables and laboratory costs. This is only second to the challenge of meeting staffing resources for the national network to succeed.

Current NEA staff, including field operators and chemists, who routinely collect and analyse samples from the existing national monitoring sites 3-times a day, could feasible be re-deployed to operate the fully automated air quality monitoring stations which are being proposed to replace the manual systems. This transition of roles and duties would require significant retraining and an extensive period of additional support for all field staff. Some staff members' skills and technical understanding may not be suited to this change of working and redundancy or redeployment may be required in these cases.

Central to the programmed development of a National Ambient Air Monitoring network is the level of priority and commitment given to the network by central government. This commitment includes an initial investment of both capital and human resource upon which the network could be founded. There is a risk of the national monitoring network failing due to under resourcing, should the programme not receive sufficient political and financial support.

There are significant challenges in establishing a National Ambient Air Monitoring network, such as large capital and annual running costs, development of suitable infrastructure and progression of skills amongst technical staff. These could all be progressively phased if a step-wise approach is used, where activities such as identifying suppliers, procuring equipment and services, commissioning the network and staff training could all be spread over several years, e.g. from 2015 through to 2018.

Once sufficient skills and technical understanding have been established within Georgia, then an upgrading of the national air quality monitoring network would allow additional fourth daughter directive pollutant species, where necessary, to be routinely monitored, as part of an expanded air quality monitoring network.

6. CONCLUSION

6.1 SUMMARY PILOT PROJECT ACTIVITIES

The following activities were completed as part of the National Pilot Project feasibility study:

- An outline of the existing ambient air monitoring network and air quality in Georgia and national legislation and statutory instruments relating to air quality existing Georgian was completed.
- A preliminary assessment of the existing air quality against EU air quality directives was undertaken, using data from the existing air quality monitoring network, national emissions inventories, air quality modelling outputs and short-term passive sampling. It was identified that there was a clear risk that levels of air pollution in parts of Georgia were above EU concentrations thresholds for which fixed measurements were deemed necessary. Road transport was concluded to be the main source of pollution affecting the majority of the Georgian population. There were potential impacts upon residential populations as a result of pollutants from the emissions of point sources to the south east of Tbilisi, the area surrounding Kutaisi as well as Gori and Batumi;
- An air quality monitoring network design for Tbilisi was developed based upon the population distribution, a detail emissions inventory for the city, existing ambient monitoring data and on the output from the ADMS-Urban model for Tbilisi.
- A draft programme for the development of a National Ambient Air Monitoring System in Georgia was outlined. This explored the minimum number of measuring stations required for both minimum and maximum exposure scenarios.

6.2 CONCLUSION

As a consequence of the National Pilot Project feasibility study the following recommendations were made:

- Use of a diverse body of legislative instruments to organise the air quality monitoring and assessment at a national level, with the intention that these form complementary strands within an overall framework;
- Development of a national air quality strategy for Georgia;
- Further development of the air quality evidence base, including source identification and emission inventories, allowing further improvements to the assessment of Georgia air quality;
- Georgia to be sub-divided into 9specific zones and 1 agglomeration (Tbilisi), for air quality management purposes;
- A rationalised passive sampler survey needs to be operated alongside the national monitoring network;
- Continued development of an emissions inventory from both domestic and dispersed sources;
- An ideal urban air quality monitoring network for Tbilisi would involve 5 fixed locations, with stations monitoring NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, lead, O_3, benzene. This would include a background location in Tbilisi, a roadside location, an industrial/ traffic sampling point of road transport emissions in Agmashenebeli Street, Tbilisi and a suburban location and a maximum point of ground concentrations in the city;

- A CAFE directive compliant national network would require a minimum of 9 additional fixed continuous monitoring stations (including existing EU compliant station in Tbilisi);
- Modelling of air quality in Georgia should continue at the national level, to supplement monitoring data;
- All network procedures should be subject to an rigorous QA/QC process in order that the Georgia National Air Quality Monitoring Network can meet EU data quality objectives;
- A secure and realistic funding stream needs to be identified, in order to assist in overcome the NEAs resource and skills shortages and meet annual running costs;
- Non-governmental finances and resources should be sought, possibly from external donors and/ or industry.