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UKRAINE

Evaluation of Chemical Analytical Testing Capabilities in Ukraine

Prepared by Dr. Steven M. Fry
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For the New Independent States of the former Soviet Union

A USAID Project Consortium Led by CH2M HILL

PREFACE

Under the 1992 Freedom Support Act, the United States Congress initiated a program to provide various forms of assistance to new independent states (NIS) of the former Soviet Union. Cooperative Agreements were signed between representatives of the U.S. government and each country in which assistance was to be undertaken. The U.S. Agency for International Development (USAID) was given the responsibility to coordinate all U.S. government assistance to the NIS under the Act.

Through competitive bidding, USAID awarded a multi-year contract to a team managed by CH2M HILL International Services, Inc. (CH2M HILL) to support implementation of an environmental assistance program to republics of the former Soviet Union. Under this contract, termed the Environmental Policy & Technology (EPT) Project, CH2M HILL is to assist USAID's missions in Moscow, Kyiv, and Almaty undertake a program to promote environmental improvements in the NIS. The USAID mission in Kyiv supports environmental, and other, assistance programs to Ukraine, Belarus, and Moldova. CH2M HILL established an office in Kyiv from which to perform services in these countries under the EPT Project.

This report was prepared as a contractually required deliverable under a contract between USAID and CH2M HILL. Although work on this report was conducted in cooperation with the assisted governments and USAID, the findings and recommendations are those of the CH2M HILL team. They do not necessarily represent official positions of the governments of the assisted countries nor of the United States of America.

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Consortium for International Development
Ecojuris
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BACKGROUND

As part of a United States government bilateral assistance program, the U.S. Agency for International Development (USAID) is supporting environmental management in Ukraine. Under direction from USAID, a consortium led by CH2M HILL International Services, Inc. (CH2M HILL), is implementing part of USAID's Environmental Policy & Technology (EPT) Project by undertaking various tasks that have been agreed to by representatives of the governments of both countries.

USAID authorized CH2M HILL to perform a series of tasks in Ukraine under Delivery Order No. 5. Activity Implementation Plan #11 required that CH2M HILL prepare an evaluation of analytical chemical capabilities in Ukraine.

In October 1994, CH2M HILL retained a subcontractor, Dr. Steven M. Fry to undertake the evaluation. A copy of Dr. Fry's report follows. This report was initially submitted as a draft to USAID in December 1994, for review and comment. No comments have been received by CH2M HILL from USAID concerning the document. It is hereby re-submitted as a final report.

CONSULTANT REPORT

Evaluation of Ukrainian Analytical Testing Capabilities

Environmental Policy and Technology Project

United States Agency for International Development

Dr. Steven M. Fry

October 4 - November 15, 1994

4

Executive Summary

As a part of USAID's assistance program, the Environmental Policy and Technology Project (***EPT***) has focused on helping Ukraine evaluate its environmental problems. Part of the evaluation has included work that has relied on existing environmental testing results. The quality of environmental policy decisions is directly related to the quality of the analytical test results. Ukrainian analytical testing capabilities were developed under the former Soviet Union (***FSU***). Since the break-up of the ***FSU***, there has been diminishing governmental support for Ukrainian analytical laboratories. In light of this situation, questions have been raised about the reliability of Ukrainian food and environmental testing laboratory results.

In 1993 a team of experts from the World Bank evaluated the status of Ukrainian environmental protection and resource management, and reported observations of problems with Ukrainian analytical testing capabilities. In light of the World Banks expert findings questioning Ukrainian testing capabilities, ***EPT*** chose to not only evaluate analytical testing results, but to also evaluate how the data is produced. The goal was to develop an assistance program to help the Ukrainians produce good analytical results, in order to make good environmental policy decisions. As such, USAID agreed to fund a program to study analytical testing capabilities in Ukraine.

A team of three experienced analytical laboratory specialists, including two Ukrainians, evaluated twelve Ukrainian analytical testing laboratories to determine the nature and scope of the problems. They found that the lack of confidence was justified in the case of testing of environmental media: water, soil, hazardous waste, and air. The evaluation team found food testing capabilities were much better developed and organized. The food laboratories are much better equipped, including instruments that are equivalent to or better than those generally used in the United States.

Overall, the evaluation team found laboratory personnel qualifications and training were quite good, except for a lack of experience in use of modern instruments. Currently, most environmental laboratories are working with out-dated equipment. The lack of modern equipment limits what they can test for, and also limits their ability to test at levels low enough to meet current world standards. This situation has been further aggravated by the laboratories' lack of: uniform ***test methodologies***, ***Quality Assurance programs***, and ***Quality Control measurements***.

The Ukrainian government has standards (equivalent to Maximum Contamination Limits or Maximum Allowed Concentrations in US terminology) on the books for at least 1240 contaminants. Presently, they routinely monitor only 30 - 50 parameters in environmental media, mostly metals and ***inorganics*** species. The evaluation team determined that current ***routine testing capabilities*** for metals and inorganics are mainly up to world standards. There are serious deficiencies in the ability to test for

Note: Analytical chemistry terms listed in the Glossary are identified using ***bold italicized type*** when they are used the first few times in the report.

6

organic contaminants, due to a lack of modern equipment. Based on past and current Ukrainian activities in agriculture and industry, they should be routinely testing for same types of organic contaminants that have been observed in the United States and Western Europe. These organic pollutants include: pesticides, herbicides, ***chlorinated hydrocarbons***, ***aromatic hydrocarbons***, ***polynuclear aromatic hydrocarbons***, petroleum products, and industrial solvents.

The lack of adequate ***organics*** testing capabilities is two-fold. First, they currently perform routine testing for only a small number of organic contaminants: a few pesticides, total petroleum hydrocarbons, and several chlorinated solvents. Second, they are often unable to test for these organic contaminants at low enough levels to meet current world standards.

The evaluation team further noted deficiencies in non-routine analyses of environmental media, and also the routine analyses of air. Non-routine tests include the analysis of: (1) rush samples in emergency situations; (2) exotic matrices like industrial sludges, or river sediments that contain high levels of living creatures; (3) unusual project specific ***analytes*** (contaminants of interest) that are not routinely tested for as national standards; or (4) highly contaminated samples that require special handling and expertise. As such, the situation is complex enough that there is no simple solution to all of the problems.

For these reasons, several solutions are proposed to fit different aspects of the problems:

- Creating a new private or non-governmental central laboratory that could handle most routine and non-routine air, water, soil, and waste samples from the entire country. This option would cost at least $7 - $8 million dollars and take several years to complete. But due to the absence of overnight delivery services, this lab would also not be able to serve remote areas; perform rapid ***turn around time*** (***TAT***) analyses (sample delivery and analysis time in less than 1 - 3 days); or perform tests on samples that have short ***sample holding times*** (similar to limited shelf life). The typical long start-up times of 2 - 3 years for new labs in the USA may also be extended to 3 - 4 years in Ukraine, due to supply issues. There were no qualified parties found that could undertake this type of venture.

- Constructing portable (mobile) laboratories to do sophisticated testing at any site in Ukraine, as long as a laboratory could be towed to there. A mobile laboratory could be outfitted to do almost any combination of tests required. Mobile laboratories provide rapid ***TATs*** on sample results, (30 min. - 2 hr.). They eliminate sample transportation issues, since as self-contained labs, they can be towed to the site of interest. Mobile labs are more cost effective on field projects than fixed base central labs, because the rapid sample result TATs allow field crews to make fast decisions and real-time process adjustments, rather than waiting for several days to weeks for sample shipping and analysis by a less flexible fixed base central laboratory. Depending on equipment, mobile labs

can be outfitted for approximately $600,000 to $800,000 in the United States. Unfortunately, the number of samples that a single mobile lab can handle is limited. Hence, a single mobile laboratory would not have the capacity to handle samples from the entire country. Nation-wide analytical service would require at least 4 - 8 mobile laboratories, strategically placed in a variety of regions. Construction in the US would take 6 months to a year for the first laboratory

- Upgrading an existing laboratory that currently has limited capabilities and significant deficiencies, like the Ministry of Environmental Protection's (MEP) central laboratory, (the Department of Rapid Analysis of Environmental Instrumental and Metrology), to do all environmental ***matrices***. A lab like the MEP's would require significant improvements in: equipment, staffing levels, personnel qualifications, facilities, and management to be upgraded to handle routine and non-routine air, water, soil, and waste samples from the entire country. This would cost between $5 - $6 million dollars, and it would have the same problems described in the first scenario. This type of project would also take approximately 3 years to complete in Ukraine.

- Upgrading an existing central laboratory that currently has relatively significant capabilities, with significant deficiencies, (for example, the State Committee for Geology's central laboratory), to do all environmental matrices. A lab like this, (with many capabilities, but very out of date equipment), would cost $3.5 - $4.5 million to upgrade to world standards. Upgrading a laboratory like this to only do sophisticated soil and water testing, without upgrading or adding air testing could result in a savings of $2 million. The net cost would be $2 - $3 million, and could be done in 6 months to a year. Further, this agency would be expected to cooperate fully with the MEP's regulatory functions, acting as their analytical partner. As such, the upgraded laboratory would function as the expert laboratory supporting the MEP's actions.

- Finally, upgrading a single existing central laboratory that currently has significant capabilities in water and waste water analyses, with very few deficiencies, for example, the Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry central laboratory. The Institute of Colloid and Water Chemistry could be upgraded to do a full suite of world standard water and waste water analyses for approximately $600,000 - $800,000. Their existing capabilities are quite good, including: a wide range of testing capabilities, mostly modern equipment, highly qualified staff, good sample capacity, reasonable facilities, and an excellent reputation. Their water testing capabilities could be completed by adding a few key pieces of missing equipment, and providing training on that equipment. This upgrade could be accomplished in 3 - 6 months. Adding soils capabilities to a highly qualified water laboratory would only require additional sample storage and preparation equipment at a cost of approximately $200,000. Further, this agency would be expected to cooperate fully with the MEP's regulatory functions, acting as their analytical partner. As such, the upgraded laboratory would function as the expert laboratory supporting the MEP's actions.

The consultant also noted that food analysis capabilities would require additional sample preparation equipment and dedicated instrumentation to avoid contamination from some soils and exotic matrices like industrial sludges and oily wastes. As such, food capabilities could be added to a good central laboratory for approximately another $1 - $1.5 million.

Based on historical evidence, the consultant determined that improving water and waste water testing capabilities would yield greater benefits and have a higher probability of success than improving air and soil testing. Some Ukrainian government agencies have estimated that 70% of the environmental problems are related to water quality. Air and soil testing could also be done, but at much higher costs with less public benefit.

There is an additional problem that this study could not find feasible ways to address on a nation-wide basis. There is a serious lack of quality reagents and calibration standards at all laboratories. This deficiency is caused by: a lack of access to old sources of supply, (due to the break-up of the former Soviet Union); and a lack of hard currency to purchase supplies from outside Ukraine. This program could however provide adequate supplies at reasonable costs to a single central lab. Within three years, the laboratory should become self sufficient and not need further international support.

Lastly, the Directors and Heads of all of the central laboratories complained about the lack of uniformity between test results from different labs. The on-going production of inconsistent results raises questions about the reliability of most Ukrainian environmental test results. This observation has also been made by Canadian and American experts. The evaluation team found a consistent lack of awareness of the importance of Quality Assurance (QA) programs and Quality Control (QC) measurements.

As such, most laboratories had inadequate QA/QC programs, that consisted of sporadic monthly evaluations of data quality, rather than the daily performance measurements required by world standards. The QA/QC deficiency is a nation-wide problem that affects the quality and reliability of most Ukrainian environmental testing data. As such, there was broad consensus among laboratory Directors and Heads that the country needs a national quality program to improve the consistency and reliability of environmental test results. They were all eager to start and operate such a program.

The national quality program would potentially consist of: (1) selecting and writing uniform test methodologies; (2) developing laboratory level Quality Assurance programs that include daily Quality Control measurements; (3) providing QA/QC training to laboratory personnel from all of Ukraine; and (4) implementing a national program that certifies laboratories and regularly monitors laboratory performance. A critical portion of the program would be public reporting of individual laboratory performance on world class Performance Evaluation standards, (like the United States EPA's WP and

8

WS standards). This would spur healthy competition between labs to demonstrate to the public and their peers which labs have the best capabilities.

The program would be best operated by an organization that is independent of the current governmental inter-agency struggle over control of the environment. The organization should be highly respected for technical competence. The organization also needs to be a recognized leader in building cooperation and consensus, since there are currently ten national government organizations that have been assigned responsibility for regulating the environment. Such a program could be developed and implemented fairly quickly, at a reasonable cost, with help from western analytical laboratory QA experts.

The evaluation team determined that there is one central laboratory that could be easily upgraded to provide the necessary sophisticated analytical testing for the entire country, the Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry Central Laboratory. This laboratory already has significant analytical capabilities, that could be upgraded to world standards by the addition of several key pieces of organics analysis equipment. With the addition of key organics instruments, they would have the capabilities to test routinely for almost all types of water pollutants at current world standards. This laboratory also is fairly independent of the inter-agency struggle to control the environment. Finally, it has a superb reputation among its peers in the analytical community, and currently receives samples from or works with almost all water testing organizations.

The evaluation team also determined that the same laboratory and its parent agency, the Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry, could successfully operate a national quality program. This organization has the facilities, technical reputation, independence, and recognized leadership ability to develop and operate a program that would improve the reliability of analytical data and build public confidence in Ukrainian analytical laboratories.

Table of Contents:

		Page(s)
Executive Summary		ES 1 - 5
1	**Introduction**	1
1.1	**EPT Project Background**	1
1.2	**Report Purpose and Organization**	1
1.2.1	Main Purposes of the Report	1
1.2.2	Purposes of Other Activities not Included in the Original Scope of Work	2
1.2.3	Organizational Structure of the Report	2
1.2.3.1	Organization and Description of Appendices	2
1.3	**Report Preparation**	3
1.3.1	Preparation Team	3
1.3.2	Methodology	4
2	**Scope of Work, Rationale, and Methodologies**	4
2.1.1	Problems Facing Analytical Laboratories	4
2.1.2	Determination of the Process to Find Solutions	5
2.1.2.1	Determination of Technical Capabilities	5
2.1.2.3	Determination of Position in the Market	5
2.1.2.3	Determination of Effectiveness of Laboratory Management	6
2.1.3	Determination of the Scope of the Project	6
2.1.3.1	Food Testing Capabilities Compared to Environmental Testing Capabilities	7
2.1.3.2	Determination of Project Options for Improving Environmental Testing Capabilities	8
2.1.3.2.1	Creation of a New Central Laboratory for All Environmental Matrices	8
2.1.3.2.2	Creation of a Portable Laboratories for Nation-Wide Environmental Testing	8
2.1.3.2.3	Upgrading a Low Level Existing Central Laboratory for all Environmental Matrices	9
2.1.3.2.4	Upgrading a Medium Level Existing Central Laboratory for all Environmental Matrices	9
2.1.3.2.5	Upgrading an High Level Existing Central Laboratory for Water and Waste Water Analyses	9
2.1.3.3	Intercomparison of the Relative Benefits of Water, Soil, and Air Testing	10
2.1.3.4	Overall Conclusions on the Scope of the Project	10

10

2.2 Methodologies 11
2.2.1 Methodology and Criteria for Interviews and Laboratory Inspection Tours 11
2.2.2 Method of Evaluation of Results from Interviews and Laboratory Inspections 12

3 Other Activities: Data Quality, Laboratory Certification, and a Limited Evaluation of Drinking Water Laboratory Capabilities 12

3.1 Current Status of Reliability and Credibility of Ukrainian Analytical Data 12
3.1.1 Methodology of Developing a Basic Bench-Level Laboratory Quality Control Program 14
3.1.2 Benefits of a Daily Basic Laboratory Level Quality Control Program 14
3.1.3 Potential Future Actions Leading to World Class Standards of Data Quality 14

3.2 Evaluation of the Committee for Standards National Laboratory Certification Program 15
3.2.1 Laboratory Certification Process 15
3.2.2 Laboratory Certification Requirements and Standards 15

3.3 Evaluations of Two Vodocanal Laboratories 16
3.3. Brovary Vodocanal 17
3.3.1.1 Function and Scope of Mandate of the Laboratory and Agency 17
3.3.1.2 Competence of Management 17
3.3.1.3 Level of Equipment 17
3.3.1.4 Levels and Competence of Staff 17
3.3.1.5 Level of Facilities 18
3.3.1.6 Level of Quality Assurance Plan and Quality Control Measurements 18
3.3.1.7 Major Problems Facing the Laboratory and Critical Factors for Success 18
3.3.1.8 Ability to Continue to Receive Samples and Remain Solvent 18
3.3.1.9 Ability to Cooperate with Other Agencies and Share Results 18
3.3.1.10 Overall Conclusions 18

3.3.2 Evaluation of the Kiev Vodocanal Laboratory 19
3.3.2.1 Function and Scope of Mandate of the Laboratory and Agency 19
3.3.2.2 Competence of Management 19
3.3.2.3 Level of Equipment 22
3.3.2.4 Levels and Competence of Staff 22
3.3.2.5 Level of Facilities 22
3.3.2.6 Level of Quality Assurance Plan and Quality Control Measurements 22
3.3.2.7 Major Problems Facing the Laboratory and Critical Factors for Success 22
3.3.2.8 Ability to Continue to Receive Samples and Remain Solvent 23

3.3.2.9 Ability to Cooperate with Other Agencies and Share Results 23
3.3.2.10 Overall Conclusions 23

4 Conclusions 23

4.1 Purpose of the Project 23

4.2 Conclusions Regarding Analytical Laboratory Capabilities and the Associated Problems 23
4.2.1 Problems Affecting Ukrainian Environmental Laboratory Capabilities 24
4.2.1.1 Deficiencies in Testing Capabilities 24
4.2.1.1.1 Potential Solutions for Deficiencies in Testing Capabilities 25
4.2.1.2 Deficiencies in Data Quality, Laboratory Quality Assurance Programs, and Quality Control Practices 27
4.2.1.2.1 Development of a National Laboratory Quality Program to Improve Test Result Reliability 27
4.2.1.3 Problems with Laboratories' Ability to Obtain Pure Chemical Reagents and Calibration Standards 27
4.2.1.3.1 Solutions to the Lack of Pure Chemical Reagents and Calibration Standards 28
4.2.1.4 Problems with a Lack of Public Access to Analytical Test Results 28
4.2.1.4.1 Solutions to the Lack of Public Access to Analytical Test Results 28

4.3 General Conclusions 28

5 Required Actions, Costs , and Schedules for Upgrading Laboratory Capabilities 29

5.1 USAID Purchase and Supply of Key Pieces of Organics Analysis Equipment 30
5.1.1 Current Equipment Needs and Costs 30
5.1.2 Costs for Supplies, Training, and Procurement 32

5.2 Follow-Up Actions Needed in Order to Implement the Project 35
5.2.1 USAID Washington Approval 35
5.2.2 Memorandum of Understanding 35
5.2.3 USAID Provides Funding 36
5.2.4 Procure Equipment 36
5.2.5 USAID On-site Follow-up to Confirm Ukrainian Readiness to Accept Equipment 36
5.2.6 Vendors Provide Equipment and Training 36
5.2.7 USAID On-site Follow-up Visits to Evaluate Progress and Offer Necessary Assistance 36
5.2.8 USAID Assistance in Developing a Program for the Ukrainian Laboratory to Become Self-Supporting 36

12

Tables:

Table 1. Costs of Instruments . 31

Table 2. Annual Cost for Supplies. 32-33

Table 3. Procurement and Training Costs 33

Table 4. Estimated Total Project Costs for Upgrading the Institute for Colloid and Water Chemistry 34

Glossary of Terms and Acronyms Glossary 1-3

Appendices A -H Presented Immediately Following the Glossary.

Appendix A: Environmental Standards from USA, World Health Organization, and Ukraine

Appendix B: Basic Laboratory Level Quality Control Plan and Ukrainian Committee for Standards - Laboratory Certification Plan

Appendix C: Laboratory Evaluation Findings and Evaluation Forms

Appendix D: Business Plan for the Proposed National Analytical Center

Appendix E: Test Results for Two Types of Kiev Drinking Water

Appendix F: Ukrainian Committee for Hydrometeorology Promotional Brochure

Appendix G: Ukrainian State Committee for Water Resources Equipment Request List

Appendix H: Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry: Analytical Capability List and Equipment Lists

Appendix I: Representative Instrument and Mobile Laboratory Costs as Quoted Prices from Hewlett Packard - Kiev and Analytical Technologies Inc. - USA

Appendix J: Professional Resume for Dr. Steven M. Fry

1 Introduction

1.1 EPT Project Background

Under the 1992 Freedom Support Act, the United States Congress initiated a program of assistance to the Newly Independent States (NIS) of the former Soviet Union. The U.S. Agency for International Development (USAID) was given responsibility to coordinate all U.S. government assistance to the NIS under the Act.

The U.S. Agency for International Development (USAID) established the Environmental Policy & Technology (EPT) Project to provide environmental assistance to Newly Independent States (NIS) of the former Soviet Union. USAID awarded a contract, to a consortium managed by CH2M HILL, to assist in implementing the environmental assistance program to republics of the former Soviet Union. Under this contract, CH2M HILL will support USAID's regional mission in Kiev for Ukraine, Belarus, and Moldova (USAID/WESTNIS) in designing and implementing the environmental program.

Specific concerns were raised regarding the ability of current ability of Ukrainian analytical laboratories to test adequately for food and environmental contamination. USAID/Kiev offered to arrange an initial review of analytical laboratory capabilities in Ukraine. Assistance from the EPT Project Kiev regional office was requested from USAID/Kiev. In response, services were arranged by CH2M-Hill (the prime contractor) in conjunction with Ogden Environmental Energy Services to supply a laboratory specialist to review the current analytical laboratory capabilities in Ukraine.

1.2 Report Purpose and Organization

1.2.1 Main Purposes of the Report

This report describes the existing analytical laboratory capabilities in Ukraine, focusing primarily on testing of environmental media, water, soil and air. The ultimate goal of the project is to determine how Ukrainian analytical laboratories can effectively address the analytical testing needs of the country, and then to determine what solutions USAID can offer. Specifically, twelve laboratories and one private venture were evaluated, and their laboratory Directors and Heads were interviewed to determine the nature and scope of the analytical testing problems in Ukraine. An additional goal was to determine if a single laboratory could be improved to meet current world testing standards. One very good laboratory was found that fit the goals and objectives of this project, the Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry central laboratory. The State Committee for Geology's central laboratory was identified as an alternate or back-up option. The conclusions about these laboratories can be found in Section 4 of this report.

14

1.2.2 Purposes of Other Activities not Included in the Original Scope of Work

The evaluation team found that there is a significant nation-wide need for improving the quality and reliability of current analytical analyses. There is a serious lack of: (1) uniform ***analysis methodologies***, (2) ***Quality Assurance*** programs, and (3) routine ***Quality Control*** measurements. The lack of these three things has resulted in inconsistent data quality and diminished confidence in existing data. Hence, this report also includes: (1) an evaluation of their current QA/QC practices; (2) an evaluation of the current national laboratory certification program; (3) suggestions and conclusions on how the quality of analytical testing could be improved through development and implementation of a world standard national quality program. Finally, two vodocanal laboratories were also evaluated in support of the EPT Water Sector Program.

1.2.3 Organizational Structure of the Report

The report is organized into five sections, plus Appendices. Section 1 includes the introduction and report preparation information. Section 2 describes the scope of the work, the rational of the approach taken, and the methodologies used. Section 3 describes other activities that were not directly related to evaluating central laboratory capabilities including: (1) the need for development and implementation of a national laboratory quality program to improve data reliability; (2) an evaluation of the current Committee for Standards laboratory certification program; and (3) evaluations of two vodocanal laboratories, in support the EPT's Water Sector Program. Section 4 contains the conclusions from the laboratory inspection tours, and describes actions that should be taken to improve analytical laboratory capabilities in Ukraine. Section 5 describes the specific costs and timetables for implementing the actions.

1.2.3.1 Organization and Description of Appendices

Appendix A contains lists of environmental testing standards from: the ***former Soviet Union (FSU)***, the ***USEPA***, the World Health Organization, and "proposed" and existing Ukrainian Standards. These are included to allow comparison of world standards with current Ukrainian practices. As such, the lists of Ukrainian currently measured standards were provided by the Kiev Vodocanal Laboratory (for drinking water) and the Ministry of Environmental Protection (for assorted surface waters and effluents).

Appendix B includes copies of a proposed ***Quality Control*** program (in both English and Russian) and an annotated copy of the Ukrainian Committee for Standards National Laboratory Certification Program.

Appendix C includes: the Laboratory Evaluation Form, the Laboratory Interview Form, the list of standard interview questions, and specific detailed evaluation results and conclusions for 11 central laboratories.

15

Appendix C contains findings for the following central laboratories:

- Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry Central Laboratory
- Committee for Geology Central Laboratory of Northern Ukrainian Geology
- Ukrainian Academy of Sciences Institute for Hydrobiology Central Laboratory
- Ukrainian State Committee for Water Resources and Supply Central Laboratory of the Dnipro Basin Management Department
- Ukrainian State Department for Hydrometeorology Republican Center for Control and Supervision of the Environment
- Ministry of Environmental Protection Department of Rapid Analysis of Environmental Instrumental and Metrology Water Laboratory, Air Laboratory, and Soil and Waste Laboratory
- Ministry of Health Sanitary and Epidemiological Service Ukrainian Scientific Hygiene Center
- Ukrainian Academy of Sciences Institute for General and Inorganic Chemistry Physical and Analytical Chemistry Laboratory
- Proposed Laboratory for the National Analytical Center
- Ukrainian State Committee in Food Industry Kiev Laboratory for Alcohol and Biotechnology

The laboratories are listed in order of the most qualified first down to the least qualified last, except for the food laboratory. The two best candidates for upgrading to world class standards were the **Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry** (Appendix C, Section C.2.1), and **the State Committee on Geology Central Laboratory** (Appendix C, Section C.2.2).

Appendix D includes the Business Plan and other documents for the National Analytical Center, a proposed private laboratory. Appendix E includes analysis results from 2 Kiev drinking water samples as reported by the Institute for Colloid and Water Chemistry. Appendices F, G, and H contain documents specific to 3 different laboratories. Appendix I includes Quotations for a mobile (towable - portable) laboratory and analytical instrumentation. Appendix J is a copy of Dr. Fry's professional resume.

1.3 Report Preparation

1.3.1 Preparation Team

This report has been written by Dr. Steven M. Fry, serving as an Ogden Environmental and Energy Services employee in conjunction with CH2M-Hill. He was assisted in evaluating laboratories by Dr.

Note: Analytical chemistry terms listed in the Glossary are identified using ***bold italicized type*** when they are used the first few times in the report.

16

Nicolai Kalibabchuk, Head of the Physical and Analytical Chemistry Laboratory of the Ukrainian Academy of Sciences, and Ms. Natasha Lesoviets, Deputy Head of the Central Laboratory for the Dnipro Basin, State Committee of Water Resources and Supply. Assistance regarding the organizational structure and capabilities of analytical laboratories in Ukraine was provided by Mr. Ulian Bilotkach, Head of Department for Radiological and Hydrochemical Monitoring. Mr. Alan Shultz and Mr. William Maggs provided additional insights into organizational and institutional issues. Mr. Ties van Kempen supplied background information about EPT Project.

1.3.2 Methodology

Data and information for this report were gathered during a three week period in October, 1994. Dr. Kalibabchuk and Ms. Lesoviets arranged a series of on-site meetings with Directors, Deputy Directors, Department Heads, and other key personnel at laboratories, Ministries, and Committees in Kiev. Each of these meetings lasted between 1 - 2 hours, followed by laboratory inspection tours that also lasted 1 - 2 hours. The number of meetings and shortness of time prevented travel to other cities in Ukraine, but careful attention was made during interviews to determine the capabilities of other significant Ukrainian laboratories. There are important laboratories in Kharkiv and Sviersky-Donets, but as regional laboratories, they do not currently have formal mechanisms for receiving samples from the entire country as a central laboratory.

2 Scope of Work, Rationale, and Methodologies

2.1.1 Problems Facing Analytical Laboratories

It is widely accepted that there are several serious problems that currently face Ukrainian analytical laboratories: (1) inadequate funding, (2) a tangled web of government laws and agencies, and (3) a serious lack of Quality Assurance (QA) awareness, Quality Control (QC) measurements, and uniform analysis methodologies. This has resulted in mediocre to poor quality results, with no almost no results for several classes of hazardous pollutants, see Appendix A for lists of compulsory standards. (Appendix A includes a summary table of assorted drinking water and surface water standards for inter-comparison.) The limited ability of Ukrainian analytical laboratories has seriously hampered efforts at evaluating the actual level of environmental problems in the country.

Inadequate funding has led to a lack of up to date testing equipment, a lack of calibration standards and pure reagents, and very marginal salaries for laboratory personnel, (resulting in serious difficulties retaining experienced staff). These deficiencies have caused Ukrainian laboratories to limit the number, type, and quality of tests on water, soil, and air.

There are a large number of government agencies doing environmental testing, with 10 national governmental organizations that have been assigned responsibility for regulating the natural

17

environment, as specified in the Sept. 23, 1993 Resolution No 785 by the Cabinet Ministers of Ukraine. This has led to the propagation of laboratories with overlapping functions, which has seriously diluted the existing funds.

The evaluation team found that public access to laboratory test results is potentially non-existent. None of the 12 laboratories inspected published their data for public review. They all basically send annual reports to their respective administrative agencies, and a few share results with other agencies, (see Appendix C). One laboratory, the Kiev Vodocanal, insisted that their data was "private" and "secret", and could only be given to their superiors and the city administration. This is particularly troubling in light of their potentially deceptive practices in handling drinking water test results, (see Section 3.3.2). We also found only one laboratory that accepted samples from the public, although the investigations into this issue were somewhat limited. This problem is addressed further in Section 5, Conclusions.

Finally, the low level of laboratory Quality Assurance (QA) plans and Quality Control (QC) measurements has led to a crisis of confidence in laboratory results. Current public and industry perception is that laboratory results cannot be trusted. The current absence of routine Quality Control (QC) measurements justifies this lack of confidence. The need for training in QA/QC procedures should be addressed on a nation-wide basis. An upgraded central laboratory that holds the respect of its peers, as a leader, is the best candidate to conduct a training program.

2.1.2 Determination of the Process to Find Solutions

The process of determining solutions to these problems began with evaluating current analytical testing capabilities. Evaluating analytical laboratory capabilities is a complex task. Laboratory capabilities should be evaluated in the context of the overall success of the lab in fulfilling its mission. Ultimately, the success of a laboratory lies in several areas: technical capabilities, position in the market, and the laboratory management's effectiveness.

2.1.2.1 Determination of Technical Capabilities

Technical capabilities are determined by the following factors: type and amount of equipment, personnel qualifications, levels of staffing, quality of reagents and standards, level of the laboratory's Quality Assurance (QA) plan and Quality Control (QC) measurements, quality and variety of analytical methodologies, and level of facilities.

2.1.2.3 Determination of Position in the Market

A laboratory's position in the market determines its ability to get samples. It also controls the lab's current and future sources of funding or revenue. Market position is strongly affected by: (1) reputation, (2) organizational connections, (3) the degree of need for the analyses performed, (4) what is ultimately done with the results, and (5) the laboratory's willingness to improve by making changes

in response to market forces. An additional market position problem that Ukrainian labs face is the poorly organized and poorly managed environmental monitoring and testing system that developed after the break-up of the former Soviet Union (FSU).

Currently, there are at least ten state governmental agencies responsible for testing environmental matrices, (water, soil and air). There are also a large number of regional, oblast, and local level agencies performing analytical environmental testing. The result is two-fold: (1) not enough samples (and hence revenue) to support all of the laboratories; and (2) a very inefficient system for making effective use of these labs. Long term survival of an upgraded central lab will depend on its ability to manage this situation. Some managers, (like the ***MEP***, see Appendix C, Section C.2.6), are depending on change to come from the ministerial level ("command and control"), while others are taking actions now to maintain viability. The organizations that wait until change is forced upon them will become weaker and eventually lose most of their analytical capabilities through loss of staff and inability to maintain operating equipment.

2.1.2.3 Determination of Effectiveness of Laboratory Management

Finally, a laboratory's success is also controlled by the vitality and effectiveness of their management. Vital management is crucial to the development and maintenance of both technical capabilities and market position. Good laboratory management continually evaluates its organization and makes changes, responding to changing circumstances. Management's ability to recognize the need for change and to take action is especially important in Ukraine now. The situation here is very fluid, with changes occurring in many areas: (1) environmental standards, (2) necessary levels of QA and QC, (3) levels of funding, (4) sources of funding, (5) facilities problems, (6) lack of hard currency for consumables, (7) lack of sources of consumables, and (8) severe difficulties retaining staff due to low salaries. The long term success of central laboratories in Ukraine will depend in large part on how their management handles these problems.

Hence, this report's conclusions are based on on-site inspections of laboratories and detailed interviews of laboratory management using the criteria described in the previous paragraphs: (1) technical capabilities; (2) position in the market; and (3) the laboratory management's effectiveness.

2.1.3 Determination of the Scope of the Project

The scope of USAID's response to analytical testing needs in Ukraine could include address testing of both food and environmental ***matrices***. A very broad scope would include upgrading both ***routine*** and ***non-routine*** testing of food, water, soil, air, and hazardous wastes. A more limited scope would address only routine testing of one or two ***matrices***.

19

Routine testing includes long term monitoring of ordinary samples (low difficulty) taken at regular intervals to monitor the "typical" levels of non-exotic contamination. ***Non-routine testing*** includes the analysis of: (1) rush samples in emergency situations; (2) exotic matrices like industrial sludges or river sediments that contain high levels of living creatures; (3) unusual project specific ***analytes*** (contaminants of interest) that are not routinely tested for as national standards; or (4) highly contaminated samples that require special handling and expertise.

One of the additional purposes of this project was to make recommendations on the best alternatives available to USAID. The decision criteria used for this were: (1) the amount of need; (2) the potential benefits per dollars spent; and (3) the probability of success. Based on the amount of need, improved testing of environmental media clearly has higher priority than food. Current food testing laboratories are much better developed and better organized than environmental analytical testing labs.

2.1.3.1 Food Testing Capabilities Compared to Environmental Testing Capabilities

Food testing laboratories are much better funded and developed, as demonstrated by their clearly superior levels of equipment, reagents, and calibration standards. For example, the Ukrainian State Committee in Food Industry Kiev Laboratory for Alcohol and Food Biotechnology was not only the best equipped laboratory of the 12 labs we inspected, but almost all of its equipment was equivalent or superior to that commonly used in the United States, (see Appendix C., Section C.2.10).

This has occurred because the food agencies were powerful in the former Soviet Union (FSU), and hence well funded and well organized. The other major national food testing organization, the central laboratory of the Committee on Standards has slightly older equipment, but is similarly well developed and funded. The levels of QA and QC practices in food testing are much better than in environmental testing, with food testing standards approaching the Good Laboratory Practices (GLP) standards used in the United States.

The organizational structure of food testing is also better developed. There are only four national governmental organizations testing foods, (the Ukrainian State Committee in Food Industry, the Ministry of Health, the Committee on Standards, and the Ministry of Agriculture), as compared to at least ten testing environmental media. These agencies also have food testing laboratories all the way down to the Raion and city levels of government. Finally, there is also an active group of private food testing laboratories, driven by government requirements for certification of food products in some areas.

Conclusions on supporting food and environmental testing are: (1) Due to political and organizational considerations, it is not feasible to combine food and environmental testing under one governmental agency. (2) The current project budget will not allow the separate development and improvement of

both food and environmental laboratories. (3) Since environmental testing has greater, yet manageable, needs, this report is focused mainly on environmental testing.

2.1.3.2 Determination of Project Options for Improving Environmental Testing Capabilities

The evaluation team noted significant deficiencies in non-routine analyses of environmental media, and also the routine analyses of air. As such, the current laboratory situation in Ukraine is so complex, that there is no simple solution to all of the problems. For these reasons, several solutions are proposed to fit different aspects of the problems:

2.1.3.2.1 Creation of a New Central Laboratory for All Environmental Matrices

The program could fund creation of a new private or non-governmental central laboratory that could handle most routine and non-routine air, water, soil, and waste samples from the entire country. Based on historical US laboratory start-up costs, creating a new laboratory would cost at least $7 - $8 million dollars and take several years to complete. But due to the absence of over-night delivery services, this lab would also not be able to perform the following functions: (1) serve remote areas; (2) perform rapid ***turn around time*** (TAT) analyses (sample delivery and analysis time in less than 2 days); or (3) perform tests on samples that have short ***sample holding times*** (similar to limited shelf life). An additional complication is the construction and start-up time. Creating a full-service central laboratory like this would take at least 2 years to plan and construct in the United States, and would take an additional 1 - 2 years to fully staff and train all personnel. Due to supply problems in Ukraine, it would potentially take 3 - 4 years to complete the entire project. The evaluation team also did not find any qualified parties to undertake this type of venture.

2.1.3.2.2 Creation of a Portable Laboratories for Nation-Wide Environmental Testing

The project could construct a portable (mobile) laboratory to do sophisticated testing at any site in Ukraine, as long as the laboratory could be towed to there. A mobile laboratory could be outfitted to do almost any combination of tests required. Mobile laboratories provide rapid TATs on sample results, (30 min. - 2 hr.). They eliminate sample transportation issues, since as self-contained labs, they can be towed to the site of interest. Mobile labs are more cost effective on field projects than fixed base central labs, because the rapid sample result TATs allow field crews to make fast decisions and real-time process adjustments, rather than waiting for several days to weeks for sample shipping and analysis at a less flexible fixed base central laboratory. Depending on equipment, mobile labs can be outfitted for approximately $600,000 to $800,000 in the United States. Unfortunately, the number of samples that a single mobile lab can handle is limited. Hence, a single mobile laboratory would not have the capacity to handle samples from the entire country. Nation-wide analytical service would require at least 4 - 8 mobile laboratories, strategically placed in various regions. Based on historical evidence, laboratories could be built in the US in six months to a year.

21

2.1.3.2.3 Upgrading a Low Level Existing Central Laboratory for all Environmental Matrices

The program could consider upgrading an existing laboratory that currently has limited capabilities and significant deficiencies, like the Ministry of Environmental Protection's (MEP) central laboratory, (the Department of Rapid Analysis of Environmental Instrumental and Metrology), to do all environmental ***matrices***. The MEP central laboratory's evaluation is in Appendix C, Section C.2.6. A lab like the MEP's would require significant improvements in (1) equipment, (2) personnel qualifications, (3) staffing levels, (4) facilities, and (5) management and administration, to be upgraded to handle routine and non-routine air, water, soil, and waste samples from the entire country. Based on actual costs from similar US upgrading projects (in the last 3 years), this would cost between $5 - $6 million dollars, and take approximately 2 years in the US. Due to supply problems, it would probably take 3 years to complete in the Ukraine. The resulting lab would still have the same slow ***TAT*** problems described in the first scenario, Section 2.1.3.2.1.

2.1.3.2.4 Upgrading a Medium Level Existing Central Laboratory for all Environmental Matrices

The program could consider upgrading an existing central laboratory that currently has relatively significant capabilities with some deficiencies, (like the State Committee for Geology's central laboratory), to do all environmental matrices. A lab like this, (with many capabilities, but very out of date equipment, see Appendix C Section C.2.2), would cost $3.5 - $4.5 million to upgrade to world standards. Upgrading a laboratory like this to only do sophisticated soil and water testing, without upgrading or adding air testing could result in a savings of about $2 million, for net cost of $2.0 - $3.0 million. This upgrade would only require addition of equipment and some personnel training, and could be done in 6 months to a year.

2.1.3.2.5 Upgrading an High Level Existing Central Laboratory for Water and Waste Water Analyses

Finally, the program could consider upgrading a single existing central laboratory that currently has significant capabilities in water and waste water analyses, with very few deficiencies, for example, the Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry central laboratory, (see Appendix C, Section C.2.1). The Institute for Colloid and Water Chemistry central laboratory is close to having world standard metals capabilities. Its only significant deficiency is in ***organic contaminants*** testing capabilities.

The Institute of Colloid and Water Chemistry could be upgraded to do a full suite of world standard water and waste analyses for approximately $600,000 - $800,000. Their existing capabilities are quite good, including: a wide range of testing capabilities, mostly modern equipment, highly qualified staff, good sample analysis capacity, reasonable facilities, and an excellent reputation. Their water testing capabilities could be completed by adding a few key pieces of missing organics analysis equipment. This upgrade could be accomplished in 3 - 6 months. Adding soils capabilities to a highly qualified

22

water laboratory like the Institute's would only require additional sample storage and preparation equipment at a cost of approximately $200,000.

Note: Adding food analysis capabilities would require additional sample preparation equipment and dedicated instrumentation to avoid contamination from some soils and exotic matrices like industrial sludges and oily wastes. As such, food capabilities could be added to any of the good central laboratories for approximately another $1 - $1.5 million.

2.1.3.3 Intercomparison of the Relative Benefits of Water, Soil, and Air Testing

One of the main goals of the project was to improve analytical testing capabilities to meet existing world standards. An additional purpose was to make recommendations on the best alternatives available to USAID to meet the first goal. This requires that the choice of analyzing air versus soil and water be considered. The decision criteria used for this were: the amount of need; the potential benefits per dollars spent; and the probability of success. Most air tests require specialized equipment that is not amenable for use on soil and water samples. Air and water quality affect most of the population in Ukraine. Soil contamination generally affects much smaller numbers of people because is usually isolated to specific points and soil can be contained to limit the population's exposure. Hence, the scope of the project was further narrowed to consider primarily air or water testing.

Based on the degree of need, it is difficult to determine whether improving air or water testing is more important. Based on the potential benefits per dollars spent, historical evidence from the United States clearly indicates that surface water testing and remediation has been significantly more effective than air testing and remediation. According to Ukrainian government statistics, it is accepted that 85% of the Ukrainian population and industry get their water from surface water. This means that most of the Ukrainian population would benefit from improved surface water testing, with subsequent remediation based on the results.

The probability for success in improving water quality testing is good, since there are several strong candidates that have everything needed to be successful, except some additional modern equipment and consumables. These agencies also have the resources, respect, and prestige to implement a national laboratory quality improvement program that would improve testing capabilities on a nation-wide scale.

2.1.3.4 Overall Conclusions on the Scope of the Project

The overall conclusions about scope of the project are as follows:

1. Due to political and organizational considerations, it is not feasible to combine food and environmental testing under one agency.

23

2. Environmental testing capabilities in Ukraine have serious deficiencies that threaten the public's health and the future of the environment.

3. Improving environmental testing has greater needs and benefits than food testing.

4. Upgrading a single fixed base central lab fits the current project goals of analysing routine samples from the entire nation. Addition of a mobile laboratory would better fit the future requirements for non-routine analyses.

5. Improving water testing capabilities would have greater benefits and a higher probability of success than improving air or soil testing.

6. Improved water testing capabilities would result in benefits for most of the Ukrainian populace.

7. There are two existing laboratories that could be successfully upgraded to test samples on a nation wide basis: the Institute for Colloid and Water Chemistry and the Committee for Geology's central laboratories.

8. These two laboratories agencies could also effectively manage a national laboratory quality program that would benefit analytical testing on a nationwide scale.

2.2 Methodologies

The interviews and inspections were conducted using a specific list of questions and a "Laboratory Evaluation Form" created and customized by Dr. Fry to address the specific needs of Ukrainian laboratories. Copies of the list of questions and the "Laboratory Evaluation Form" are included in Appendix C, along with a list of the personnel and organizations contacted, from Dr. Fry's Trip Report.

2.2.1 Methodology and Criteria for Interviews and Laboratory Inspection Tours

The laboratory interviews and evaluations focused on:

1. Identifying the current levels of analytical instrumentation;

2. Identifying the current levels of analytical expertise of laboratory personnel;

3. Identifying current and planned major analytical laboratory improvement projects;

4. Identifying if any gaps exist in the variety of currently used analytical methodologies, particularly gaps that represent a lack of testing for significant groups of toxic pollutants;

5. Determining the current and future abilities of inspected laboratories to provide facilities, consumables, and sample preparatory support for upgraded instrumentation;

6. Eliciting the views on analytical testing problems from laboratory heads and personnel.

2.2.2 Method of Evaluation of Results from Interviews and Laboratory Inspections

Dr. Fry, Dr. Kalibabchuk and Ms. Lesoviets held lengthy discussions to draw conclusions about the results of the interviews and laboratory inspections. The differences between laboratories were significant and obvious, (see Appendix C). Hence, the evaluation team agreed on almost all observations and conclusions. The conclusions from these meetings are presented in Section 4.

3 Other Activities: Data Quality, Laboratory Certification, and a Limited Evaluation of Drinking Water Laboratory Capabilities

Section 3 describes other activities that were not directly related to evaluating central laboratory capabilities including: (1) how the quality of analytical testing could be improved through development and implementation of a national quality program; (2) an evaluation of the current Committee for Standards laboratory certification program; and (3) evaluations of two vodocanal laboratories, in support the EPT's Water Sector Program.

3.1 Current Status of Reliability and Credibility of Ukrainian Analytical Data

There are serious problems with the current reliability and credibility of Ukrainian environmental analytical test results. Every laboratory manager and department head interviewed commented on the problems of poor data reliability from Ukrainian laboratories. This problem is most obvious when comparing results from different laboratories on samples from the same rivers, and at times even for results for the same sample. We were consistently told that variations between results from different labs are often as large as 20 fold to 100 fold. Variations this large make data virtually unreliable and unusable for evaluating environmental problems.

An apparent lack of public and governmental awareness is the second problem that arises out of the issue of poor quality data. According to some sources, the public does not currently trust government reporting of environmental problems. Based on our observations of typical QA / QC practices in almost all laboratories inspected, we believe this distrust is justified. In particular, see the evaluation for the

Kiev Vodocanal laboratory, Section 3.3.2., regarding their potentially deceptive handling of drinking water results.

We were told by several laboratory Directors that suspected polluters (especially heads of industrial plants) generally refuse to accept or believe test results from Ukrainian environmental regulatory laboratories, because the quality is so poor. One Director claimed that if he had portable field testing equipment, he could give the polluters first-hand on-site proof of results, which would supposedly increase the data credibility. In subsequent discussions, he agreed that analyzing Quality Control samples with every ***analysis batch*** would prove the associated data's quality and reliability to doubting polluters. We also agreed that improving data reliability through a laboratory quality assurance programs would be more effective than supplying all labs with portable test equipment.

Scepticism about data reliability by the public and industry could be dismissed as a perception problem, but the laboratory evaluation results (see Appendix C) and the wide variations in data from different labs point to a different problem. The current state of laboratory Quality Assurance and Quality Control is approximately where US laboratories were in the 1960's. As an example, only one of the environmental laboratories inspected performed any regular Quality Control checks. This compares poorly with the current world standard of daily checks on all test performed on that day.

The general consensus of the laboratory directors was that these problems are due to differing methodologies, and sometimes due to "poor work" by the "other labs". The current status of poor documentation and potential un-reliability of Ukrainian analytical test results undermines all decisions that are based on those results.

The issue of the need for a national laboratory ***Quality Assurance*** (***QA***) and ***Quality Control*** (***QC***) program arose during every interview with Ukrainian laboratory Directors and Heads, (see Appendix C). The evaluation team concurred with the consistent comments from interviews with laboratory management about the need for uniform nation-wide analytical methodologies and laboratory practices. The evaluation team concluded that awareness of the need of good laboratory QA and QC is very low, as demonstrated by the absence of regular Quality Control measurements at all but one laboratory. As such, there was broad consensus among laboratory Directors and Heads that the country needs a national quality program to improve the consistency and reliability of environmental test results. They were all eager to start and operate such a program.

Developing a nation-wide laboratory Quality Assurance program would take significantly more time than the team had available. So, a basic daily QC measurement program was written to improve laboratory data reliability. Currently, the Ukrainians' levels of awareness of the importance and benefits of laboratory QA and QC is so low that they do not even have terminology to describe typical world

26

standard QA / QC practices. Hence, the basic laboratory operations level, daily QC program was developed as a first step for Ukrainian laboratories to achieve world standard levels of data reliability. The evaluation team translated the basic QC program into Russian for distribution to all of the laboratories inspected.

3.1.1 Methodology of Developing a Basic Bench-Level Laboratory Quality Control Program

Dr. Fry wrote the key elements for a basic bench-level (laboratory operations level) daily Quality Control (QC) measurement program. Ms. Lesoviets spent significant efforts (part-time for 2 weeks) translating this QC program into Russian, with additional input from Dr. Kalibabchuk. This was a fairly complex task, because there was no equivalent Russian or Ukrainian laboratory terminology for most of the elements of the QC program. Ms. Lesoviets was particularly well suited to this task, because her position as Deputy Head, (an "operations manager" in US terminology), of a routine analysis lab allowed her to assist in development of a program that fits the intricacies of Ukrainian laboratory operations and terminology. This QC program is in Appendix B, including the Russian translation.

3.1.2 Benefits of a Daily Basic Laboratory Level Quality Control Program

Implementation of this QC program would significantly increase the reliability and credibility of Ukrainian analytical results, by proving that the ***analysis batch*** was prepared and analyzed properly. This QC program could be implemented for minimal costs. It effectively adds only three daily QC check samples, (a Method Blank, a Matrix Spike Sample, and a Blank Spike Sample), to every 20 sample analysis batch. (See Appendix B for full details and definitions of QC terminology.)

3.1.3 Potential Future Actions Leading to World Class Standards of Data Quality

The intent of the basic QC program was to help Ukrainian laboratories take the first steps in a process that would result in eventually achieving a goal of performing analytical testing up to world class standards. This goal could be attained through the following steps:

1. Selecting and writing uniform test methodologies ;
2. Developing laboratory level Quality Assurance plans and Quality Control measurement programs;
3. Training laboratory personnel from all of Ukraine;
4. Developing an effective national program that certifies laboratories and regularly monitors laboratory performance.

Item 4 is particularly important, because consistent laboratory performance is not guaranteed over time. The past program under the FSU gave indefinite certification. The current national laboratory certification program operated by the Committee for Standards (see Section 3.2) gives 3 year certification, with no scheduled checks after the initial inspection.

21

The current laboratory certification programs operated by various Ministries and Committees are not functioning effectively, as discussed above. Also, the Committee for Standards national certification program has only certified one environmental laboratory in the whole country, the Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry.

3.2 Evaluation of the Committee for Standards National Laboratory Certification Program

The Committee for Standards Division of Laboratory Certification certifies and accredits analytical laboratories for food, water, soil, and air testing. The current program, the Ukrainian System of Certification, is based on the internationally recognized ***ISO 9000*** program, and as such is a fairly rigorous certification. There is currently only one environmental analytical laboratory certified by the Committee for Standards, the Ukrainian Academy of Sciences Institute of Colloid and Water Chemistry.

In the area of laboratory certification, the purpose of this certification is to protect human health, and to protect consumers through legal certification of laboratory independence, technical competence, and performance. This evaluation of the laboratory certification process was based on an interview with the Committee for Standards Laboratory Certification Director and on a copy of their official Certification and Accreditation of Laboratories document. An annotated copy of this document is in Appendix C.

3.2.1 Laboratory Certification Process

The laboratory certification process has four parts: (1) submission of application forms by the laboratory; (2) review of the forms by the Standards Committee; (3) pending a successful review, on-site inspection of the laboratory to confirm the information provided in the forms; (4) further review of all information gathered in the first three steps before granting final accreditation and certification to perform tests. After a laboratory is approved, they may perform tests using the accredited methodologies for the certification period of three years.

No other laboratory or Standards Committee actions are required during that three year period, unless problems occur or unless there is turnover of laboratory management. Subsequent "planned and unplanned" (un-announced?) inspections by the Standards Committee are allowed, but in reality they are seldom done. The Standards Committee has also planned to send out Performance Evaluation (PE) samples, see Appendix B for a definition of PE samples. Currently, the committee has not begun doing this and has no schedule for initiation of such a program.

3.2.2 Laboratory Certification Requirements and Standards

Successful completion of the application forms and subsequent approval is a substantive task with stringent requirements.

28

It involves documentation of:

1. Independence of the laboratory from outside pressure or influences, through independent administrative and financial status.

2. Technical competency for testing specific products with specified tests.

3. Competent qualified management.

4. Independence of employees from pressure by management to influence test results.

5. Systems that check and document personnel qualifications and data quality.

6. Appropriate equipment to perform the accredited test methods.

7. Documentation of test methods, as stepwise protocols.

8. Yearly documentation that proves that equipment functions properly and that tests are performed properly.

9. A system of quality determination.

10. Head of the laboratory periodically checking the test efficiencies to ensure quality results.

It is interesting to note the emphasis on independence of laboratory personnel, to limit outside and inside interference and influence. The Standards Committee also claims to have the power of hiring and firing of laboratory heads, but this does not actually occur. As mentioned above, these requirements substantively come from the ISO 9000 program. It should also be noted that the ISO 9000 program is currently undergoing significant revision for future use as a common standard in the European Community. The problems associated with the National Committee for Standards laboratory certification and with general laboratory quality programs were thoroughly discussed in Section 3.1

3.3 Evaluations of Two Vodocanal Laboratories

Two vodocanal laboratories were evaluated in support of the EPT Water Sector Program. A model vodocanal laboratory, Brovary Vodocanal, was evaluated as a representative of smaller municipal systems. The Kiev Vodocanal laboratory was evaluated as a representative of larger municipal systems.

The descriptions of each agency's mandates and laboratory's responsibilities are based on the claims made by Directors, Deputy Directors, and Laboratory Heads. There was not enough time to do the background work to verify most of these claims. The laboratory evaluation reports were based each laboratory's current capabilities, excluding non-functioning equipment. This is significant, because many laboratories contained test equipment that was poor quality when first purchased, and is now completely non-functional.

3.3.1 Brovary Vodocanal

3.3.1.1 Function and Scope of Mandate of the Laboratory and Agency

This laboratory was evaluated in conjunction with Alan Schultz, as a part of the EPT effort to select a model vodocanal for the EPT Water Sector Program. Further information can be found in the "EPT Water Resources Sector Report", (November, 1994, A. Schulz). According to Mr. Schultz, this is a well run vodocanal, and is representative of other analytical testing capabilities at drinking water laboratories that serve small municipalities. This laboratory tests intake river and reservoir water, and drinking water from three stages in the treatment process, (after filtration, after treatment, and after chlorination/coagulation).

Their primary and most frequent test is for free chlorine. They also test for: alkalinity, pH, turbidity, color, odor, taste, chloride, fluoride, ammonia, nitrate, nitrite, sulfate, Dissolved Oxygen (DO), 5 day Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), residual solids, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), and wet chemistry metals (Copper, Manganese, and Zinc). This list of tests is also presented in a summary table in Appendix A. Heavy metals analyses are sent to the State Committee for Geology's central lab.

3.3.1.2 Competence of Management

The vodocanal and water testing laboratory appear to be well run as demonstrated by: well defined testing schedules, good documentation of results, a rudimentary QA program , and excellent knowledge of their processes.

3.3.1.3 Level of Equipment

They have an adequate supply of somewhat dated equipment. The equipment is appropriate for the general chemistry tests they perform: spectrophtometers, balances and pH meters. All of their stock of culture media for micro-biological testing was outdated (expired). They cannot currently get fresh culture media, since the previous supplier is in Russia.

3.3.1.4 Levels and Competence of Staff

They have a qualified staff, appropriately trained for general chemistry testing. The staff are knowledgable and eager to demonstrate the work they are doing. Staffing levels appear to be adequate for their work load.

3.3.1.5 Level of Facilities

The level of facilities is good, but somewhat dated. They have adequate sample testing and preparation areas, with good exhaust hood availability for sample preparation.

3.3.1.6 Level of Quality Assurance Plan and Quality Control Measurements

Their QA program is under-developed by world standards, but typical of other Ukrainian laboratories. Analysts test single blind QC check samples once or twice a month, based on the opinion of the laboratory operations manager. There are no daily QC process control checks. They only test one Matrix Spike sample per test per week, (see Appendix A for a definition of Matrix Spike sample). All of these checks should be made on a daily basis, or with every preparation or analysis batch. There was no documentation of personnel training. They proudly describe their 20 year old certification from the FSU. They are using test methodologies documented by a standard FSU water testing manual, published in the 1940's. Their awareness of the need for a QA plan and QC measurement is very low.

3.3.1.7 Major Problems Facing the Laboratory and Critical Factors for Success

In their view, their most important problem is the inability to get high quality standards and reagents. Their second most important problem is a lack of modern test equipment. They would like an in-line automatic free chlorine measurement system, or a portable "Hach" brand free chlorine test instrument, to replace their existing manual titrametric method.

3.3.1.8 Ability to Continue to Receive Samples and Remain Solvent

As a part of an active, well managed vodocanal, they should have a steady flow of samples and revenue in the future.

3.3.1.9 Ability to Cooperate with Other Agencies and Share Results

They currently send samples to the Committee of Geology's central lab for more sophisticated test methods.

3.3.1.10 Overall Conclusions

This is a very small laboratory that does only general chemistry testing of local drinking water samples. It has good staff and management, but needs to improve its QA/QC program. Improving the QA/QC program would primarily require training, with minimal additional expenditures to increase documentation and add daily QC check samples. As a small local lab, we recommend that USAID

not fund any significant upgrades of this laboratory as a part of a project to upgrade nation-wide laboratory capabilities. We do however believe this laboratory would be a good candidate for upgrading, as an example of a good municipal laboratory.

3.3.2 Evaluation of the Kiev Vodocanal Laboratory

3.3.2.1 Function and Scope of Mandate of the Laboratory and Agency

This laboratory was evaluated to help develop perspective on analytical testing capabilities at large municipal laboratories. This laboratory tests: (1) intake water from: the Dnipro river, the Dnester river, two reservoirs, and assorted wells, (2) treated drinking water from various points around the city, and (3) industrial supply water. This is also the central laboratory for Kiev vodocanal, and as such, it does the sophisticated testing for their three other smaller laboratories. They currently test for the old former Soviet Union (FSU) compulsory standard list of 30 drinking water tests (indices), but they are upgrading to the new proposed compulsory list of 40 indices. Both of these lists of tests are given in Appendix A.

3.3.2.2 Competence of Management

This laboratory appears to be well run as demonstrated by: well defined testing schedules, good documentation of results, and excellent knowledge of their processes. But there are several troubling aspects about their operational and management practices:

1. They refuse to make their individual tests results available for public scrutiny. Individual results are passed on to upper management, where they are potentially pooled (aggregated) with other results for the same test method. Pooling of test results yields averaged values that are lower than any high individual results. So, individual results may be out of specifications, while the pooled values pass standards.

2. Their laboratory manager made claims that may not be true. He claimed that Kiev drinking water never exceeds the compulsory standard values. As described above, this may be true for pooled results, but it is not necessarily true for individual test values. We observed one significant example of this problem with some actual chloroform results, (one of the compulsory standards). They showed us one set of raw data for volatile chlorinated hydrocarbons, (including chloroform), to demonstrate the efficiency of their relatively new Japanese gas chromatograph with electron capture detection (GC/ECD). This data consisted of results from a calibration standard and three treated water samples, Dnipro, Dnester, and water well(s). Using the peak areas from the calibration standard, (14,700 area counts per 74 ug/L chloroform), and the three samples, (Dnipro = 18,000 area counts, Dnester = 16,000 area counts, and well water = 48,800 area counts), the corresponding

individual chloroform values are: Dnipro River @ 90 ug/L (ppb) chloroform, Dnester River @ 80 ug/L chloroform, and well water @ 250 ug/L chloroform. Pooling the 3 values yields an aggregated value of 140 ug/L chloroform. The well water value (250 ug/L) clearly exceeds the Ukrainian chloroform standard of 200 ug/L, while the aggregated value (140 ug/L) passes the Ukrainian standard. The presence of chloroform in all three samples is additionally significant because chloroform is a volatile chlorinated organic solvent with serious health risks. The Merck Index (eleventh edition, 1989, p 330) lists some of chloroform's health hazards:

i. Chloroform was banned by the US Food and Drug Agency from use in drug, cosmetic, and food packaging products in 1976.

ii. Chloroform "may reasonably be anticipated to be a carcinogen" per the *Fourth Annual Report on Carcinogens:* (NTP 85-002, 1985) p 56.

iii. High concentrations of inhaled chloroform may cause human toxicity reactions as: "hypotension, respiratory and myocardial depression and death."

3. Also troubling was the laboratory manager's response about some potentially carcinogenic, additional unidentified compounds that we observed in these samples. The well water raw data (with the 250 ug/L chloroform) also contained 4 - 6 other measurable peaks. The peaks were well resolved from each other and significantly larger than baseline noise by approximately 20 - 100 fold, each with peak areas of about 3000 - 8000 area counts. These compounds eluted within 10 minutes after the chloroform peak. As such, it is very likely that the sample also contained other potentially carcinogenic volatile chlorinated hydrocarbons, like: dichloroethane species (DCA), trichloroethane species (TCA), dichloroethylene species (DCE), trichloroethylene species (TCE), and/or tetrachloroethylene (PCE). Based on the chloroform calibration response factor, one could estimate concentrations of 15 ug/L to 40 ug/L. When we inquired about these peaks, the laboratory manager responded that "we know what they are" but that this information was "secret" or "private". He went on to say that they weren't a problem because these "unknown" compounds were "not included in their list of standards". (It should be noted that all of the laboratory managers comments were translated from Russian, plus my Ukrainian counterparts later confirmed that the information presented here accurately reflects the lab manager's comments.)

4. On a subsequent day, we asked to see some examples of raw and processed data, to allow us to evaluate their data preparation and QA data review processes. The lab manager

33

refused to let us examine any raw data or processed (reported) data. He responded that these data were "private" and "secret", only for viewing by his superiors. Our request would be considered a routine, reasonable request in the United States.

5. There is similar anecdotal evidence for un-reported heavy metals contamination in Kiev drinking water. Personal testing by a respected Ukrainian Academy of Sciences metals specialist revealed 3 - 5 mg/L (ppm) each of total chromium and total nickel in Kiev drinking water from some wells. The contamination appeared to be related to industrial activity (like tanning) in the vicinity of the wells. These were informal personal tests, and as such, the results were not publicly reported. The current Ukrainian 40 standard indices for drinking water list the chromium standard as 0.05 mg/l, and the nickel standard as 0.02 mg/L. Current USEPA standards for both metals are 0.1 mg/l.

   According to the Merck Index (eleventh edition, 1989, p 347): Chromium (VI) compounds "have been listed as known carcinogens: *Fourth Annual Report on Carcinogens*: (NPT 85-002, 1985) p 58", and "oral ingestion may lead to severe irritation of the gastrointestinal tract, circulatory shock, and renal damage", while "Chromium (III) compounds show little or no toxicity." The 3 - 5 mg/L chromium analysis reported above does not differentiate between chromium (III) and chromium (VI).

   According to the Merck Index (eleventh edition, 1989, p 1027): "...nickel compounds may reasonably be anticipated to be carcinogens: *Fourth Annual Report on Carcinogens*: (NPT 85-002, 1985) p 138."

Based on these incidences, one could reasonably conclude:

1. Individual test results for drinking water are potentially being manipulated by the Kiev Vodocanal management to hide instances when the standards are exceeded.

2. Laboratory management is not interested in using their current capabilities to determine and report all of the potentially hazardous chemical pollutants in Kiev drinking water.

3. Publicly reported values for Kiev drinking water don't accurately reflect actual levels of contamination at specific sites around the city.

These issues were not discussed with the Kiev Vodocanal management. It should also be noted that test results, (Appendix E) from the National Academy of Sciences Institute of Colloid and Water Chemistry showed no significant levels of hazardous pollutants. These results were for single samples

taken in 11/93 and 2/94, and as such may not be representative of all sites at all times around Kiev, particularly if the pollution is associated with specific ground water wells.

3.3.2.3 Level of Equipment

They have an adequate supply of very good equipment for the tests they currently perform. The equipment is appropriate for the general chemistry tests and the metals and chlorinated organics tests they perform. They also have equipment for testing many chemical pollutants that they currently do not publicly report. This equipment includes gas chromatographs that are capable of determining organo-nitrogen and organo-phosphorus compounds (including pesticides) and a high performance liquid chromatograph (HPLC) for determining polynuclear aromatic hydrocarbons (carcinogenic compounds called PAH's or PNA's). They do not currently publicly report values for these three classes of compounds.

3.3.2.4 Levels and Competence of Staff

They appear to have qualified staff, but we had only limited amounts of communication with their staff. Staffing levels are adequate for their work load.

3.3.2.5 Level of Facilities

The level of facilities is good. They have adequate sample testing and preparation areas, with good exhaust hood availability for sample preparation.

3.3.2.6 Level of Quality Assurance Plan and Quality Control Measurements

Their QA program is under-developed by world standards, but typical of other Ukrainian laboratories. Analysts test single blind QC check samples once or twice a month, based on the opinion of the laboratory operations manager. They perform daily calibration, but no daily QC process control checks. QC checks should be made on a daily basis, or with every preparation or analysis batch. There is no documentation of personnel training. They have the old certification from the FSU for 30 compulsory standards, and plan to begin testing for the newer 40 standard indices, see Appendix A. Their awareness of the need for a QA plan and QC measurement is very low.

3.3.2.7 Major Problems Facing the Laboratory and Critical Factors for Success

In their view, their most important problem is the lack of enough modern organic analysis instruments. Their second most important problem is the difficulty in getting high quality standards, reagents, and glassware. They would like the ability to determine halomethanes, and semivolatile and volatile organics by GCMS.

35

3.3.2.8 Ability to Continue to Receive Samples and Remain Solvent

As a part of an active large vodocanal drinking water system, they should have a steady flow of samples and revenue in the future.

3.3.2.9 Ability to Cooperate with Other Agencies and Share Results

Their data goes to their superiors, and is subsequently reported to city officials and the Ministry of Health. Unfortunately, as noted above, their results are not complete and may not be representative of actual conditions due to data manipulation.

3.3.2.10 Overall Conclusions

This is a fairly well equipped drinking water laboratory that may have management problems. They only report results for the list of 30 compulsory indices for drinking water. They do not report values for many other chemical pollutants, for which they currently have testing capabilities. There is also evidence that the results that are reported to the public are not representative of actual levels of contamination. The lab appears to have good staff, but it needs to improve its QA/QC program. Improving the QA/QC program would primarily require training, with minimal additional expenditures to increase documentation and add daily QC check samples. Due to the potential irregularities in management of data, the lack of full utilization of existing equipment, and their position as a municipal lab, I recommend that USAID not fund any upgrades of this laboratory, unless significant management changes are made.

4 Conclusions

4.1 Purpose of the Project

The main purpose of this study was to determine the current capabilities of Ukrainian analytical testing laboratories. Additional purposes were to determine the problems that analytical laboratories face, and to make recommendations on solutions to these problems. These tasks were completed in five weeks in October and November, 1994.

A team of three experienced analytical laboratory specialists, including two Ukrainians, evaluated twelve Ukrainian analytical testing laboratories to determine the nature and scope of the problems. They also met with the leaders of a proposed private laboratory, and with the head of the Committee for Standards Laboratory Certification Section.

4.2 Conclusions Regarding Analytical Laboratory Capabilities and the Associated Problems

The consultant found that Ukrainian environmental laboratory testing capabilities were not up to world standards. Overall, laboratory personnel qualifications and training were found to be quite good, except for a lack of experience in use of modern instruments. The evaluation team determined that food

36

testing capabilities were much better developed and organized than environmental labs. The food laboratories were much better equipped than environmental labs, including instruments that are equivalent to or better than those typically used in the United States. The Ukrainian food testing laboratories also have better QA/QC programs than environmental labs. Environmental laboratory QA/QC programs are typically 20 to 30 years out of date, and as such, raise serious doubts about the reliability of environmental test results. For these reasons, environmental testing laboratories were chosen for detailed study.

4.2.1 Problems Affecting Ukrainian Environmental Laboratory Capabilities

The major problems currently facing environmental laboratories are: (1) the lack of modern testing equipment; (2) poor data reliability due to the lack of uniform analysis methodologies and deficient Quality Assurance and Quality Control practices; (3) the inability to get pure reagents and calibration standards; and (4) the absence of public access to analytical test results, and the resulting lack of laboratory and governmental accountability.

4.2.1.1 Deficiencies in Testing Capabilities

The Ukrainian government currently has standards on the books for at least 1240 contaminants, but they routinely monitor only 30 - 50 parameters in environmental media, mostly metals and ***inorganics*** species. Current ***routine testing capabilities*** for metals and inorganics were found to be mainly up to world standards. There are serious deficiencies in the ability to test for ***organic contaminants***, due to a lack of modern equipment. Based on past and current Ukrainian activities in agriculture and industry, they should be routinely testing for same types of organic contaminants that have been observed in the United States and Western Europe. These organic pollutants include: pesticides, herbicides, ***chlorinated hydrocarbons***, ***aromatic hydrocarbons***, ***polynuclear aromatic hydrocarbons***, petroleum products, and industrial solvents.

The lack of adequate ***organics*** testing equipment causes two types of problems. First, they currently perform routine testing for only a small number of organic contaminants: a few pesticides, total petroleum hydrocarbons, and several chlorinated solvents. Second, they are often unable to test for these organic contaminants at low enough levels to meet current world standards.

The evaluation team further noted deficiencies in non-routine analyses of environmental media, and also the routine analyses of air. Non-routine tests include the analysis of: (1) rush samples in emergency situations; (2) exotic matrices like industrial sludges, or river sediments that contain high levels of living creatures; (3) unusual project specific ***analytes*** (contaminants of interest) that are not routinely tested for as national standards; or (4) highly contaminated samples that require special handling and expertise. As such, the situation is complex enough that there is no single solution to all of the problems.

4.2.1.1.1 Potential Solutions for Deficiencies in Testing Capabilities

Since the problems are complex, several solutions are proposed to fit the different aspects. Specifically, improving organics testing capabilities potentially requires a different solution than improving non-routine testing capabilities. The following solutions are presented in order of cost:

- Creating a new private or non-governmental central laboratory that could handle most routine and non-routine air, water, soil, and waste samples from the entire country. This option would cost at least $7 - $8 million dollars and take several years to complete. But due to the absence of overnight delivery services, this lab would also not be able to serve remote areas; perform rapid ***turn around time*** (***TAT***) analyses (sample delivery and analysis time in less than 1 - 3 days); or perform tests on samples that have short ***sample holding times*** (similar to limited shelf life). The typical long start-up times of 2 - 3 years for new labs in the USA may also be extended to 3 - 4 years in Ukraine, due to supply issues. There were no qualified parties found that could undertake this type of venture.

- Constructing portable (mobile) laboratories to do sophisticated testing at any site in Ukraine, as long as a laboratory could be towed to there. A mobile laboratory could be outfitted to do almost any combination of tests required. Mobile laboratories provide rapid ***TATs*** on sample results, (30 min. - 2 hr.). They eliminate sample transportation issues, since as self-contained labs, they can be towed to the site of interest. Mobile labs are more cost effective on field projects than fixed base central labs, because the rapid sample result TATs allow field crews to make fast decisions and real-time process adjustments, rather than waiting for several days to weeks for sample shipping and analysis by a less flexible fixed base central laboratory. Depending on equipment, mobile labs can be outfitted for approximately $600,000 to $800,000 in the United States. Unfortunately, the number of samples that a single mobile lab can handle is limited. Hence, a single mobile laboratory would not have the capacity to handle samples from the entire country. Nation-wide analytical service would require at least 4 - 8 mobile laboratories, strategically placed in a variety of regions. Construction in the US would take 6 months to a year for the first laboratory

- Upgrading an existing laboratory that currently has limited capabilities and significant deficiencies, like the Ministry of Environmental Protection's (MEP) central laboratory, (the Department of Rapid Analysis of Environmental Instrumental and Metrology), to do all environmental ***matrices***. A lab like the MEP's would require significant improvements in: equipment, staffing levels, personnel qualifications, facilities, and management to be upgraded to handle routine and non-routine air, water, soil, and waste samples from the entire country. This would cost between $5 - $6 million dollars, and it would have the same

problems described in the first scenario. The type of project would also take approximately 3 years to complete in Ukraine.

- Upgrading an existing central laboratory that currently has relatively significant capabilities, with significant deficiencies, (for example, the State Committee for Geology's central laboratory), to do all environmental matrices. A lab like this, (with many capabilities, but very out of date equipment), would cost $3.5 - $4.5 million to upgrade to world standards. Upgrading a laboratory like this to only do sophisticated soil and water testing, without upgrading or adding air testing could result in a savings of $2 million. The net cost would be $2 - $3 million, and could be done in 6 months to a year.

- Finally, upgrading a single existing central laboratory that currently has significant capabilities in water and waste water analyses, with very few deficiencies, for example, the Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry central laboratory. The Institute of Colloid and Water Chemistry could be upgraded to do a full suite of world standard water and waste water analyses for approximately $600,000 - $800,000. Their existing capabilities are quite good, including: a wide range of testing capabilities, mostly modern equipment, highly qualified staff, good sample capacity, reasonable facilities, and an excellent reputation. Their water testing capabilities could be completed by adding a few key pieces of missing equipment, and providing training on that equipment. This upgrade could be accomplished in 3 - 6 months. Adding soils capabilities to a highly qualified water laboratory would only require additional sample storage and preparation equipment at a cost of approximately $200,000.

Food analysis capabilities would require additional sample preparation equipment and dedicated instrumentation to avoid contamination from some soils and exotic matrices like industrial sludges and oily wastes. As such, food capabilities could be added to a good central laboratory for approximately another $1 - $1.5 million.

Based on historical evidence, the consultant also determined that improving water and waste water testing capabilities would yield greater benefits and have a higher probability of success than improving air and soil testing. It has been estimated by the Ukrainian government that 70% of the environmental problems are related to water quality. Air and soil testing could also be done, but at much higher costs with less public benefit.

4.2.1.2 Deficiencies in Data Quality, Laboratory Quality Assurance Programs, and Quality Control Practices

The evaluation team found that there are serious problems with the reliability of Ukrainian environmental test results, and with the level of QA/QC laboratory practices. The Directors and Heads of all of the central laboratories complained about the lack of uniformity between test results from different labs. These observations have been confirmed by other Canadian and American experts.

The evaluation team concluded that most laboratories had inadequate QA/QC programs, that consisted of sporadic monthly evaluations of data quality, rather than the daily performance measurements required by world standards. The QA/QC deficiency is a nation-wide problem that affects the quality and reliability of most Ukrainian environmental testing data. As such, there was broad consensus among laboratory Directors and Heads that the country needs a national quality program to improve the consistency and reliability of environmental test results. They were all eager to start and operate such a program.

4.2.1.2.1 Development of a National Laboratory Quality Program to Improve Test Result Reliability

The national laboratory quality program would potentially consist of: (1) selecting and writing uniform test methodologies; (2) developing laboratory level Quality Assurance programs that include daily Quality Control measurements; (3) providing QA/QC training to laboratory personnel from all of Ukraine; and (4) implementing a national program that certifies laboratories and regularly monitors laboratory performance. A critical portion of the program would be public reporting of individual laboratory performance on world class Performance Evaluation standards, (like the United States EPA's WP and WS standards). This would spur healthy competition between labs to demonstrate to the public and their peers which labs have the best capabilities.

The program would be best operated by an organization that is independent of the current governmental inter-agency struggle over control of the environment. The organization should be highly respected for technical competence. The organization also needs to be a recognized leader in building cooperation and consensus, since there are currently ten national government organizations that have been assigned responsibility for regulating the environment. Such a program could be developed and implemented fairly quickly, at a reasonable cost, with help from western analytical laboratory QA experts.

4.2.1.3 Problems with Laboratories' Ability to Obtain Pure Chemical Reagents and Calibration Standards

There is an additional problem that this study could not find feasible ways to address on a nation-wide basis. There is a serious lack of quality reagents and calibration standards at all laboratories. This

deficiency is caused by: a lack of access to old sources of supply, (due to the break-up of the former Soviet Union); and a lack of hard currency to purchase supplies from outside Ukraine.

4.2.1.3.1 Solutions to the Lack of Pure Chemical Reagents and Calibration Standards

It is not practical for USAID to supply funding to all laboratories to solve this problem. This program could however provide adequate supplies at reasonable costs to a single central lab. Within three years, the laboratory should become self sufficient and not need further international support. Nation-wide solutions may best come from economic restructuring of laboratory funding to market driven systems. Long term market based solutions may also include development of Ukrainian producers of chemical supplies. As such, it was beyond the scope of this project to address the problem on a nation-wide basis.

4.2.1.4 Problems with a Lack of Public Access to Analytical Test Results

The evaluation team observed that public access to laboratory test results is potentially non-existent. None of the 12 laboratories inspected published their data for public review. They all basically send annual reports to their respective administrative agencies, and a few share results with other agencies, (see Appendix C). One laboratory, the Kiev Vodocanal, insisted that their data was "private" and "secret", and could only be given to their superiors and the city administration. This is particularly troubling in light of their potentially deceptive practices in handling drinking water test results, (see Section 3.3.2). We also found only one laboratory that accepted samples from the public, although the investigations into this issue were somewhat limited.

4.2.1.4.1 Solutions to the Lack of Public Access to Analytical Test Results

This best long term solution would potentially be for the USAID to help the Ukrainian Government to develop policies that require public accountability. In the short term, laboratory funding for this project could be made contingent upon the recipient laboratory agreeing to publicly publish all of its results. It could also work with the laboratory to develop a mechanism for analysis of samples from private citizens. This mechanism could also include development of fee structures for analytical structures.

4.3 General Conclusions

The consultant determined that there are two areas of analytical testing capabilities that need to be addressed. The first is the lack of organics testing equipment that severely limits analytical testing capabilities. The second issue is the poor quality of analytical results due to the absence of: uniform testing methodologies, Quality Assurance Plans, and Quality Control measurement programs.

The evaluation team determined that there is one central laboratory that could be easily upgraded to provide the sophisticated analytical testing on water and waste water for the entire country. This laboratory is the Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry Central

41

Laboratory, (see Appendix C, Section C.2.1). This laboratory already has significant analytical capabilities, that could be upgraded to world standards by the addition of several key pieces of organics analysis equipment.

With the addition of key organics instruments, they would have the capabilities to test routinely for almost all types of water pollutants at current world standards. This laboratory also is fairly independent of the inter-agency struggle to control the environment. Finally, it has a superb reputation among its peers in the analytical community, and currently receives samples from or works with almost all water testing organizations.

We also determined that the same laboratory and its parent agency, the Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry, could successfully operate a national quality program. This organization has the facilities, technical reputation, independence, and recognized leadership ability to develop and operate a program that would improve the reliability of analytical data and build public confidence in Ukrainian analytical laboratories.

The Institute for Colloid and Water Chemistry has the best management team of all of the laboratories inspected. This is crucial, because becoming the leading national laboratory will be a challenging task, particularly in light of the current inter-agency struggle for control of the environment and the associated funding. This big task requires proven leadership to build the consensus and cooperation that are needed to improve analytical testing capabilities on a nation-wide basis.

Finally, the Institute for Colloid and Water Chemistry is widely recognized as a leader in theoretical and technical excellence. They have also demonstrated leadership in successfully leading cooperative ventures with other agencies. Their dynamic management has a clear vision of the Ukraine's current analytical laboratory problems. They have also proposed viable solutions that fit well with the EPT's goals of influencing national policy changes to provide long term benefits to the entire country.

For these reasons, we heartily recommend that USAID fund the Ukrainian Academy of Sciences Institute of Colloid and Water Chemistry Central Laboratory for upgrading to world standards by the addition of analytical instrumentation. We further recommend that the Ukrainian Academy of Sciences Institute of Colloid and Water Chemistry be chosen for developing and implementing a national Quality Assurance Plan.

5 Required Actions, Costs , and Schedules for Upgrading Laboratory Capabilities

There are five areas where USAID should take actions to improve environmental analytical laboratory capabilities. The first area is the supply of key pieces of organics analysis equipment to the Institute

of Colloid and Water Chemistry Central Laboratory, (hereafter called "the Institute" in this document). The second area of USAID actions involves supporting that equipment for a long enough period of time to allow the Institute to develop their own support systems. The third area is providing aid in development of a national quality program. Inititiation of the first two actions should be contingent on the Institute taking actions on beginning a national quality program, and on publicly publishing their test results. This issue will be discussed further in the last section on an approximate schedule that integrates the first three types the actions.

The fourth area for USAID action is the development of a national QA/QC program. The scope of such a program is large enough that it is not appropriate for discussion in this report, but this is a vital activity that would improve laboratory data quality on a nation-wide scale. (See Section 4.2.1.2.1 p. 27 for further discussion). The fifth area is the need for future development of non-routine testing capabilities. Potential solutions for non-routine testing could be the addition of soils and air testing capabilities, and the addition of mobile laboratory capabilities to handle rush samples and field projects.

5.1 USAID Purchase and Supply of Key Pieces of Organics Analysis Equipment

5.1.1 Current Equipment Needs and Costs

The equipment requirements are presented in the order of importance, with the most important equipment listed first. This order is based on its relative need and resulting rewards. The manufacturers are all based in the United States, except for COSA/Mitsubishi. COSA is the US representative for the Japan based Mitsubishi company.

The Mitsubishi total organic halogen (TOX) instrument allows rapid screening (30 minute sample preparation and analysis time) for halogenated (chlorinated) hydrocarbons at ***detection limits*** equivalent or better than ***GCMS*** results. It can be used for EPA Methods 1649, 1650, and 9020. It also allows the analysis of very nasty complex matrices, like waste oils and sludge extracts. This instrument would be used to screen (check) samples for chlorinated, iodinated, and brominated organics. This would allow their GCMS capacity to be used for confirmation, (with identification of specific compounds), of hits (detections of analytes) determined by the TOX instrument. It would also allow screening of complex matrices that often cause GCMS instruments to break down. The operating costs for this instrument are also much lower than for a GCMS. The Mitsubishi instrument is far superior to anything made in the United States or Ukraine. The Mitsubishi instrument has at least three generations of technology improvements ahead of their competition. It has far better reliability, with approximately 95% more up-time than their competition's equipment. Dr. Fry has personally used three different TOX instruments, and found the Mitsubishi far and away the best.

Finally, the Institute has committed to prepare and maintain adequate space for the equipment. They have already done this for a high quality semi-volatile organics ***GCMS***, so we feel confident that they will be able to provide it for this equipment. We further recommend that final delivery of the instruments and supplies be contingent on the Institute completing preparation of the necessary space.

Table 1. Costs of Instruments.

Instrument	Manufacturer*	Purpose	Cost **
Purge & Trap GCMS	Hewlett Packard	Volatile Organic Compounds including Chlorinated Organics.	$166,000
2 - GCs with ECD, FID, TCD, & FPD with autosamplers	Hewlett Packard	Pesticides, Herbicides, & Petroleum Products	$100,000
High Performance Liquid Chromatograph with UV-Vis/Fluor. Det	Hewlett Packard	Substituted Phenols, Organo-Nitrogen Compounds, & Carbamates.	$110,000
Total Organic Halogen Analyzer	COSA / Mitsubishi	Screen Samples for Chlorinated Hydrocarbons.	$30,000
Total Organic Carbon Analyzer	Beckman	Total Organic Carbon to Estimate Speciation Effects	$27,000
High Purity Water Deionizer	Millipore	Reagent Grade (18 M-Ohm) Water with Act. Carbon & Extra Cartridges	$21,000
Uninterruptible Power Supplies (UPS) for all Equipment (6)	None Specified	Provide Clean Electrical Power to Protect all New Equipment	$7,000
		Total Instrument Cost:	**$461,000**
		Total Cost Without VAT:	***$360,000***

*Example manufacturer, used only for price quotation purposes, not necessarily as a recommended vendor.

**Cost is in US dollars (including 28% Value Added Tax VAT)) for equipment delivered and installed in Ukraine with full computer/data handling systems. The VAT may be eliminated in 1995. President Kuchma has said he is considering dropping the VAT. If this happens, lower all equipment prices by 22%.

44

It should be noted that all of these instruments, except the Total Organic Carbon Analyzer, could also be used to test soil, sludge, and industrial waste samples. Soils, sludge, and industrial waste samples must be extracted for all of these analyses. The Institute for Colloid and Water Chemistry doesn't currently have soils extraction equipment, but the capabilities could be added for an equipment cost of approximately $25,000 dollars for soxhlet extractors, sonication baths, and associated glassware and hardware.

5.1.2 Costs for Supplies, Training, and Procurement

These support costs include estimates for: procuring instruments, procuring supplies, transportation of supplies, training personnel, and cost of supplies for three years. The three year supply period was based on conservative estimates of the length of time required for the Institute to develop their own support systems. Cost estimates for supplies for other key analyses are included, to ensure that the laboratory maintains world standard levels during the three year start-up period as a national laboratory. As stated above, the equipment and support items could be used as incentives for starting and operating a national quality program.

It should be noted that the Institute has an adequate supply of refrigerators to handle samples and extracts in the laboratory areas, but construction of at least one walk-in refrigerator would be necessary to handle the anticipated sample load. (approximately $4,000 as an on-site remodelled insulated room with a generic refrigeration unit). An additional 15 cubic foot refrigerator/freezer is required to protect the integrity of volatile organics samples and standards ($800).

Table 2. Annual Cost for Supplies.

Item	Purpose	Annual Cost*	Total Cost*
GC/HPLC/GCMS Start-up Supplies	Syringes, ferrules, injection liners, vials, crimping tools, columns, etc.	$43,000	$43,000
Extraction Solvent (as 5500 L $MeCl_2$ per year)	Sample Preparation for Organics Analyses (50 samples per week per test: SV-GCMS, 4-GC, 2-HPLC)	$52,500	$157,500
High Purity HPLC Eluent Solvent	Solvent for HPLC operation (100 L per year)	$2,800	$8,400

45

Table 2. (cont.)

Calibration Standards	Calibrate Organics and Metals Instruments	$6,400	$19,200
Metals Samples Prep. Reagents	Nitric Acid and Peroxide (250 samples per week)	$15,400	$46,200
Gases for Operating 6 GCs	High Purity Gases for 4 GCs and 2 GCMSs	$2,600	$7,700
Chromatography Columns	Columns for 4 GCs, 2 HPLCs, and 2 GCMSs (14 columns per year)	$15,400	$46,200
TOX Operating Supplies & N_2	Mitsubishi Granular Activated Carbon (6 vials/year) & Acetic Acid	$1,300	$3,900
TOC Operating Supplies	Reagents and Gas	$700	$2,100
Incidentals	Miscellaneous Supplies	$3,900	$11,700
2 Refrigeration Units	1 Walk-in and 1 Upright	$6,100	$6,100
		1 Year	**3 Year**
	Total Cost of Supplies:	**$150,100**	**$352,000**
	Total Cost Without VAT:	***$117,000***	***$197,000***

*Cost is in US dollars (including 28% Value Added Tax VAT)) for equipment delivered and installed in Ukraine. The VAT will most likely be eliminated in 1995. President Kuchma has said he is considering dropping the VAT. If this happens, lower all equipment prices by 22%.

46

Table 3. Procurement and Training Costs

Item	Cost
Procurement Costs for 1 person for 15 days in the United States at $663.84 per day (at fully burdened rates)	$10,000
Miscellaneous Procurement Costs	$600
Training Costs for an bringing an instrumental expert into Ukraine to conduct on-site GCMS, GC, and HPLC training: (based on Hewlett Packard's 11/94 Quote)	$8,400
Per Diem Expenses For Hewlett Packard Training Personnel (14 d)	$4,200
Total Training and Procurement Costs	**$24,000**

Table 4. Estimated Total Project Costs for Upgrading the Institute for Colloid and Water Chemistry

Item	No VAT Cost	VAT added Cost
Instrument Costs	$360,000	$461,000
3 Years of Supplies (1 year only = $150 K)	$197,000	$352,000
Procurement Costs and Training	$24,000	$24,000
Estimated Total Project Costs:	**$581,000**	**$837,000**

The agency that is getting the instruments and supplies may be able to get the value Added Tax waived. This option should be investigated if the VAT is not eliminated in 1995.

Final Procurement Notes: As a part of the bid solicitation, request that the supplier include: (1) instrument set-up, (2) warrantee specifications, (3) necessary supplies and associated costs, (4) training costs, (5) any applicable shipping costs and taxes (like the VAT), and (6) computers and data processing systems. Ideally, the training could be supplied at the same time, by the same person, that the instruments are installed and set-up. The costs listed above for Hewlett Packard equipment include all of these 6 items. Instrument set-up and training should not be necessary for the TOX and TOC instruments. They are fairly straightforward to set-up and operate.

5.2 Follow-Up Actions Needed in Order to Implement the Project

5.2.1 USAID Washington Approval

Janelle Daane presents short version of laboratory upgrade report, and gets agreement to proceed with the project.

5.2.2 Memorandum of Understanding

Prepare a Memorandum of Understanding that identifies what actions the Ukrainian Laboratory will take before the equipment is delivered. The Memorandum would also describe Ukrainian and USAID's longer term commitments. As such, the Memorandum should include:

1. Ukrainian and USAID agreement on actual equipment and supplies needed.
2. Ukrainian agreement to prepare suitable space and facilities to house the equipment.
3. Ukrainian agreement to provide on-going support (personnel and repairs) for at least 3 years after the USAID supports ends.
4. Ukrainian agreement to use the equipment for routinely analysing water and waste water samples from all environmental agencies in Ukraine. The results would be made freely available for all government agencies.
5. Ukrainian agreement to use the equipment primarily for routine analyses, not just for method development and research.
6. Ukrainian agreement to initially make test results accessible for public review, and eventually to publicly publish test results.
7. Possibly, Ukrainian agreement to begin work on a national quality assurance program.
8. USAID agreement to supply laboratory equipment.
9. USAID agreement to provide start-up supplies, and computers and software for data processing.
10. USAID agreement to provide support and training for the complex instrumentation.
11. USAID agreement to supply consumables to allow the laboratory to operate at world standard levels. This support would potentially last for 3 years, after which the Ukrainians would take responsibility.
12. USAID agreement to provide assistance in developing mechanisms/systems for the Ukrainian laboratory to become self supporting after three years of USAID support. This program development assistance would begin in the second year, with partial implementation of a program in the third year as a transition from USAID support to self-support.
13. USAID and Ukrainians agree to try to get a waiver of the Value Added Tax.

5.2.3 USAID Provides Funding

USAID approves WESTNIS Delivery Orders for equipment purchase, procurement costs, supplies, and training. Attempt to get a waiver of the VAT, since the project would benefit the entire country.

5.2.4 Procure Equipment

Laboratory expert makes arrangements in the United States for equipment purchase and delivery to Ukraine.

5.2.5 USAID On-site Follow-up Visit to Confirm Ukrainian Readiness to Accept Equipment

USAID should have a representative conduct an on-site visit and interview(s) with Ukrainian laboratory personnel to confirm whether systems have been put in place to fulfil the terms of the Memorandum of Understanding, (see Section 5.2.2).

5.2.6 Vendors Provide Equipment and Training

Vendors deliver equipment and provide training.

5.2.7 USAID On-site Follow-up Visits to Evaluate Progress and Offer Necessary Assistance

USAID should have a representative conduct on-site visits to evaluate the progress of the program, and suggest modifications to accommodate any changes that occur in the meantime. The first visit should occur after the equipment is installed and training is completed. There should be additional visits after approximately 1 month and 6 months and 1 year, to help with any problems that arise. The visit at the end of 6 months could also be used to update the list of supplies that would be needed for the second year. These visits could also be coordinated with activities on the proposed national Quality Assurance plan. They could also be used to confirm that the terms of the Memorandum of Understanding are being followed.

5.2.8 USAID Assistance in Developing a Program for the Ukrainian Laboratory to Become Self-Supporting

Per Item 12 in the proposed Memorandum of Understanding, it would be beneficial for USAID to provide assistance in development of funding or revenue generating mechanisms to ensure that the laboratory be fully self-supporting at the end of 3 years of USAID support. This program development assistance should occur no later than the second year, to allow a transition period in the third year. The transition period could be used to partially implement the revenue generating program. Using a phased approach, with a "break-in" period in the third year, significantly increases the long-term prospects for successful development of a world standard laboratory. Costs of assistance for development of revenue gnerating mechanisms were not included in this report.

Glossary of Terms and Acronyms

These are items that are identified using ***bold italicized type*** when they are used the first few times in the report.

Analysis Batch	A group of samples that are prepared and analyzed together, usually not to exceed 20 samples.
Analysis Methodologies	The specific set of steps and equipment used to analyze a sample.
Analyte	An element or compound that the laboratory is measuring for.
Aromatic Hydrocarbons	Organic compounds that contain rings with conjugated double bonds. These compounds are generally carcinogenic, like benzene and toluene.
Chlorinated Hydrocarbons	Organic compounds that also contain chlorine. These compounds are generally both carcinogenic and fat (lipid) soluble. This makes them particularly hazardous, because fat soluble compounds tend to concentrate as they move up the food chain (bio-magnification).
FSU	The Former Soviet Union
GC	A Gas Chromatograph is and instrument that separates organic compounds, so they can be detected as separate (unique) species.
GCMS	Gas Chromatograph with Mass Spectrometric detection of organic compounds.
Inorganic Contaminants	Polluting elements or compounds that do not contain carbon.
ISO 9000	An internationally recognized Quality Assurance Program that emphasizes documentation of : Analysis Methodologies, Training Programs, Standard Operating Procedures (SOPs) for all activities, and regular Quality Control measurements.
Matrix	The predominant material of which a sample is composed. For example, a river water sample with a little bit of sediment would be called a water matrix.

Non-Routine Tests These are tests on samples with special or difficult problems. Some examples of Non-routine tests are: (1) highly contaminated samples; (2) exotic matrices like industrial sludges, or river sediments that contain high levels of living creatures; (3) unusual project specific analytes (contaminants of interest) that are not routinely tested for as national standards; or (4) highly contaminated samples that require special handling and expertise.

NQA1 This is a set of 18 guidelines for operation of US nuclear facilities. These guidelines dictate that all laboratory activities must be controlled and monitored. This is the accepted Quality Assurance plan for US Dept. of Energy work.

Organic Contaminants These are contaminants that contain carbon. Organic contaminants (also called pollutants) include: pesticides, herbicides, chlorinated hydrocarbons, aromatic hydrocarbons, polynuclear aromatic hydrocarbons, petroleum products, substituted phenols, and industrial solvents.

Polynuclear Aromatic Hydrocarbons

These are carcinogenic organic compounds that typically come from diesel fuel, or from combustion of organic compounds. They look like benzene rings joined together to make "chicken wire" like substances. Examples: anthracene, and pyrenes.

Quality Assurance Plan A plan that attempts to guarantee that every analysis is done correctly, (with high quality), by controlling and documenting all facets of a laboratory's operations. The ultimate purpose is to produce data of known precision and bias for every sample. QA plans often include descriptions of: (1) how samples are received, recorded, and tracked; (2) step by step standard operating procedures (SOPs) for sample preparation and analysis; (3) personnel training plans, including documentation and measurement of the training program's effectiveness; (4) regular mandated Quality Control (QC) measurements to prove that the analysis process is in control (within specifications) for all sample analyses; and (5) tracking of QC measurements to identify problems and implement prescribed corrective actions. Further descriptions of these quality terms are in Appendix B.

Quality Control A set of measurements made with every batch (group) of samples, that proves that the analysis process is in control, (within a prescribed set of specifications). Typically, QC measurements are made by adding special test samples that contain a known amount of the compound of interest. The results for these test samples are compared to the known (expected) value, and a percent recovery is calculated. A process is considered to be in control if the QC samples pass their prescribed criterion (control limits). One further assumes that if the process is in control, then the associated samples analysis results are in control, (results have good quality), and are valid for use in evaluating environmental situations. If the QC fails, then process was not in control, and the sample results are not valid for use in environmental evaluations. Further descriptions of these quality terms can are in Appendix B.

Routine Tests Routine tests are tests on ordinary soil, water, or air samples that are performed in a regular way and in a non-rapid / non-rush turn around time. Routine samples do also not require any special handling or special analysis methodologies.

Sample Holding Time This is the maximum time a sample can be stored (held) after is has been collected, without loss of "potency". It can be compared to a shelf life. Samples should always be analyzed before their holding times have expired.

Sample Turn Around Time This is the time it takes to get results after the sample has been collected. This includes shipping to the laboratory, preparation of the sample, analysis of the sample, and preparation of the analysis results.

USEPA United States Environmental Protection Agency

Appendix A

Environmental Standards from

USA, World Health Organization, and Ukraine

Table A.1: Summary Table of Regulated Compounds (Standards)

Compound	USEPA Drinking Water (mg/L)	WHO Drinking Water (mg/L)	FSU "30 Cmpd." Drinking Water** (mg/L)	Ukraine "40 Cmpd." Drinking Water** (mg/L)	"I. W. D." into Kiev Reservoirs*** (mg/L)	"I. W. D." into Kiev Collection Systems*** (mg/L)	"I. W. D." into Settlement Collection Systems*** (mg/L)	Water Reservoirs for Drinking Water*** (mg/L)	Water Reservoirs for Fish Breeding*** (mg/L)
(Organics)									
Acrylamide	treatment	-	2	2	-	-	-	-	-
Alachlor	0.002*	-	-	-	-	-	-	-	-
Aldicarb	0.003@	-	-	-	-	-	-	-	-
Aldicarb sulfone	0.003@	-	-	-	-	-	-	-	-
Aldicarb sulfoxide	0.004@	-	-	-	-	-	-	-	-
Aldrin	-	3E-05	-	-	-	-	-	-	-
Atrazine	0.003*	-	-	0.002	-	-	-	-	-
Benzene	0.005	0.01a	-	0.01	-	-	-	-	-
Bromoform	-	-	-	0.1	-	-	-	-	-
Caprolactam	-	-	-	-	-	44.4	1	1	-
Carbofuran	0.04*	-	-	-	-	-	-	-	-
Carbon Disulfide	-	-	-	-	-	-	-	1	1
Carbon Tetrachloride	0.005	0.003a	-	0.002	-	-	-	-	-
Chlordane	0.002*	0.0003	-	-	-	-	-	-	-
Chlorobenzene	0.1*	-	-	-	-	-	-	-	-
Chloroform	-	0.03	-	0.2	-	-	-	-	-
2,4-D	0.07*	0.1	-	0.03	-	-	-	-	-
Dalapon	0.2+	-	-	-	-	-	-	-	-
DDT	-	0.001	-	0.002	-	-	-	-	-
Dibromochloromethane	-	-	-	0.1	-	-	-	-	-
Dibromochloropropane	0.0002*	-	-	-	-	-	-	-	-
o-Dichlorobenzene	0.6*	-	-	-	-	-	-	-	-
p-Dichlorobenzene	0.075	-	-	-	-	-	-	-	-
Dichlorobromomethane	-	-	-	0.06	-	-	-	-	-
1,2-Dichloroethane	0.005	0.01	-	0.03	-	-	-	-	-
1,1-Dichloroethylene	0.007	0.0003	-	0.03	-	-	-	-	-
c-1,2-Dichloroethylene	0.07*	-	-	-	-	-	-	-	-
t-1,2-Dichloroethylene	0.1*	-	-	-	-	-	-	-	-
Dichloromethane	0.5+	-	-	-	-	-	-	-	-
2,4-Dichlorophenol	-	-	-	0.002	-	-	-	-	-
1,2-Dichloropropane	0.005*	-	-	-	-	-	-	-	-
Dieldrin	-	3E-05	-	-	-	-	-	-	-
Di(ethylhexyl)adipate	0.5+	-	-	-	-	-	-	-	-
Di(ethylhexyl)phthalate	0.1+	-	-	-	-	-	-	-	-
Diquat	0.02+	-	-	-	-	-	-	-	-
Endothall	0.1+	-	-	-	-	-	-	-	-
Endrin	0.002+	-	-	-	-	-	-	-	-
Epichlorohydrin	treatment	-	-	-	-	-	-	-	-
Ethyl Benzene	0.7*	-	-	-	-	-	-	-	-
Ethylene Dibromide	0.00005*	-	-	-	-	-	-	-	-

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"+" = Proposed FR 55 (143) Wednesday July 25, 1990, p. 30370
"#" = Six individual PAHs are regulated
"&" = Proposed FR 53 (160) Thursday Aug 18, 1988, p. 31516. ICP-MS method proposed FR 55 (203) Friday Act. 19, 1990, p.42409, Finalized FR 56 (110), Friday June 7, 1991, p.26460.
"@" = Revised FR 56 (126) Monday July 1, 1991, p. 30266
"a" = Guideline computed form a conservative hypothetical mathematical model
"-" = No guidelines set.
"**" = Values supplied as species reported by the Kiev Vodocanal
"***" = Values supplied by Ministry of Environmental Protection, where "I. W. D." = Industrial Water Discharge

See following pages in Appendix A for references.

Table A.1: Summary Table of Regulated Compounds (Standards)

Continued

Compound	USEPA Drinking Water (mg/L)	WHO Drinking Water (mg/L)	FSU "30 Cmpd." Drinking Water** (mg/L)	Ukraine "40 Cmpd." Drinking Water** (mg/L)	"I. W. D." into Kiev Reservoirs*** (mg/L)	"I. W. D." into Kiev Collection Systems*** (mg/L)	"I. W. D." into Settlement Collection Systems*** (mg/L)	Water Reservoirs for Drinking Water*** (mg/L)	Water Reservoirs for Fish Breeding*** (mg/L)
Organics (cont)									
"Fats and Oils"	-	-	-	-	50	1	-	-	-
Formaldehyde	-	-	-	-	0.6	0.05	0.05	-	-
Glyphosate	0.7+	-	-	-	-	-	-	-	-
Heptachlor	0.0004+	0.0001	-	-	-	-	-	-	-
Heptachlor Epoxide	0.0002*	-	-	3E-05	-	-	-	-	-
Hexachlorobenzene	0.001+	1E-05	-	0.001	-	-	-	-	-
Hexachloropentadiene	0.05	-	-	-	-	-	-	-	-
Lindane	0.0002*	0.003	-	0.002	-	-	-	-	-
Methoxychlor	0.4*	0.03	-	-	-	-	-	-	-
Oxamyl (vydate)	0.2+	-	-	-	-	-	-	-	-
"Oil Products"	-	-	-	-	-	4.4	0.3	0.3	0.05
PAHs(Benzo(a)pyrene)	0.0002+#	0.01a	-	0.0007	-	-	-	-	-
PCBs as DCBP	0.0005*	-	-	-	-	-	-	-	-
Pentachlorophenol	0.001@	0.01	-	0.01	-	-	-	-	-
Phenols - Total	-	-	-	0.001	-	0.05	0.001	0.001	0.001
Picloram	0.5+	-	-	-	-	-	-	-	-
Simazine	0.001+	-	-	0.002	-	-	-	-	-
Styrene	0.01*	-	-	-	-	-	-	-	-
2,3,7,8-TCDD (Dioxin)	5E-08*	-	-	-	-	-	-	-	-
Tetrachloroethylene	0.005*	0.01	-	0.04	-	-	-	-	-
THM (Trihalomethanes)	0.1	-	-	-	-	-	-	-	-
Toluene	0.001*	-	-	-	-	-	-	-	-
Toxaphene	0.003	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons	-	-	-	0.1	-	20	-	-	-
2,4,5-TP (Silvex)	0.05*	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	0.009+	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	0.005+	-	-	-	-	-	-	-	-
Trichloroethylene	0.005	0.03	-	0.07	-	-	-	-	-
2,4,6-Trichlorophenol	-	0.01	-	0.004	-	-	-	-	-
Vinyl Chloride	0.002	-	-	-	-	-	-	-	-
Xylenes (total)	0.01	-	-	-	-	-	-	-	-

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5

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Inorganics									
Ammonium	-	-	-	-	-	-	0.5	2	-
Antimony	0.01/0.005+	-	-	0.005	-	-	-	-	-
Arsenic	0.05	0.05	0.05	0.01	-	-	-	-	-
Barium	2.0@	-	-	0.7	-	-	-	-	-
Beryllium	0.001+	-	0.002	0.0002	-	-	-	-	-
Biological Oxygen Demand	-	-	-	-	500	-	-	3 - 6	3
Cadmium	0.005+	0.005	-	0.003	-	0.1	0.005	0.001	0.005
Chemical Oxygen Demand	-	-	-	-	800	-	-	15 - 30	-
Chlorine - Residual	-	0.2 - 0.5	0.3 - 0.5	0.3 - 0.5	-	-	-	-	-
Chlorine - Bound	-	-	0.8 - 1.2	0.8 - 1.2	-	-	-	-	-
Chromium VI	-	-	-	-	-	0.1	-	0.05	0.001
Chromium III	-	-	-	-	-	2.5	0.5	0.5	-
Chromium (Total)	0.1+	0.05	-	0.05	-	-	-	-	-
Copper	1.3&	-	-	-	-	-	-	-	-
Cyanide	-	0.1	-	0.07	-	0.37	0.05	0.1	0.5
Dissolved Oxygen	-	-	-	-	-	-	-	< 4	< 4
Fluoride	-	1.5	1.5	-	-	1.94	0.75	0.75	-
Gross Alpha Activity	-	0.1Bq/L	-	0.1Bq/L	-	-	-	-	-
Gross Beta Activity	-	1 Bq/L	-	1 Bq/L	-	-	-	-	-
Lead	0.015&	0.05	0.03	0.01	-	0.1	0.08	0.03	-
Mercury	0.002	0.001	-	0.001	-	0.002	0.0005	0.0005	-
Nickel	0.1+	-	-	0.02	-	0.5	0.1	0.1	0.01
Nitrate	-	10	45	45	-	-	-	45	9.1
Nitrite	-	-	-	3	-	-	-	3.3	0.08
Ozone	-	-	-	0.1 - 0.3	-	-	-	-	-
Selenium	0.05+	0.01	0.01	0.01	-	-	-	-	-
Silver	-	-	-	-	-	-	-	-	-
Thallium	0.002/0.001+	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	0.1	-

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Aesthetic Qualities									
Aluminum	-	0.2	0.5	0.5	-	0.75	-	0.5	-
Boron	-	-	-	0.3	-	-	-	-	-
Chloride	-	250	350	350	350	-	-	350	300
Color - Total Color Units	-	15	20	20	1 - 16	-	-	-	-
Copper	-	1	1	2	-	0.5	0.001	1	0.001
Hardness	-	500	7 mEq/L	1.5 - 70 mEq/L	-	-	-	-	-
Hydrogen Sulfide	-	No Odor	-	-	-	-	-	-	-
Iron	-	0.3	0.3	0.3	-	2.5	0.5	0.3	-
Manganese	-	0.1	0.1	0.5	-	-	-	-	-
Molybdenum	-	-	0.25	0.07	-	-	-	-	-
pH	-	6.5 - 8.5	6.0 - 9.0	6.0 - 9.0	6.8 - 8.5	-	-	6.8 - 8.5	-
Phosphate	-	-	3.5	3.5	-	-	-	0.25	-
Sodium	-	200	-	-	-	-	-	-	-
Solids - Total Dissolved	-	1000	1000	1000	500	-	-	1000	-
Strontium	-	-	7	7	-	-	-	-	-
Sulfate	-	400	500	500	500	-	-	500	100
Surfactants - Anionic	-	-	-	0.5	-	20	-	0.5	-
Taste & Odor	-	Not Offensive	2 / 5	2 / 5	-	-	-	-	-
Turbidity - Turbidity Units	-	5	1.5	4	-	-	-	-	-
Zinc	-	5	5	5	-	1	0.01	1	0.01
Microbial Quality (per 100 mL)									
Coliform Organisms	-	0	3	3	-	-	-	-	-
Fecal Coliforms	-	0	0	0	-	-	-	-	-
Free-Living Organisms	-	-	< 100	< 100	-	-	-	-	-
"Balantede"	-	-	-	0 / 1000 mL	-	-	-	-	-
Pathogenic Helminths	-	-	-	0 / 1000 mL	-	-	-	-	-
Pathogenic Protozoa	-	-	-	0 / 1000 mL	-	-	-	-	-
'Stomach Microbes"	-	-	-	0 / 1000 mL	-	-	-	-	-

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USEPA

Table 1 — Drinking Water Regulations

Regulated Parameter	MCL (mg/L)	Methods
Organics		
Benzene	0.005	a
Carbon tetrachloride	0.005	c
Chlorobenzene	0.1*	b
p-Dichlorobenzene	0.075	b
o-Dichlorobenzene	0.6*	b
1,2-Dichloroethane	0.005	c
1,1-Dichloroethylene	0.007	c
c-1,2-Dichloroethylene	0.07*	c
t-1,2-Dichloroethylene	0.1*	c
Dichloromethane	0.5+	c
1,2-Dichloropropane	0.005*	c
Di(ethylhexyl)adipate	0.5+	506, 525
Di(ethylhexyl)phthalate	0.1+	506, 525
Ethyl benzene	0.7*	a
Hexachlorobenzene	0.001+	505, 508, 525
Hexachlorocyclopentadiene	0.05+	505, 508, 525
PAHs[Benzo(a)pyrene]	0.0002+#	525, 550, 550.1
Styrene	0.1*	a
2,3,7,8-TCDD (Dioxin)	5×10^{-8}	513
Tetrachloroethylene	0.005*	b
Toluene	1*	a
1,2,4-Trichlorobenzene	0.009+	a
1,1,1-Trichloroethane	0.005+	c
Trichloroethylene	0.005	b
Vinyl Chloride	0.002	c
Xylenes (total)	10*	a
THMs (Trihalomethanes)	0.1	d
Alachlor	0.002*	505, 507
Aldicarb	0.003@	531.1
Aldicarb sulfoxide	0.004@	531.1
Aldicarb sulfone	0.003@	531.1
Atrazine	0.003*	505, 507
Carbofuran	0.04*	531.1
Chlordane	0.002*	505, 508
Dalapon	0.2+	515.1
Organics		
Dibromochloropropane (DBCP)	0.0002*	504
2,4-D	0.07*	515.1
Dinoseb	0.007+	515.1
Diquat	0.02+	549
2,4,5-TP (Silvex)	0.05*	515.1
Endothall	0.1+	548
Endrin	0.002+	505, 508
Ethylene dibromide (EDB)	0.00005*	504
Glyphosate	0.7+	547
Heptachlor	0.0004*	505, 508
Heptachlor epoxide	0.0002*	505, 508
Lindane	0.0002*	505
Methoxychlor	0.4*	505, 508
Oxamyl (Vydate)	0.2+	531.1
Picloram	0.5+	515.1
PCBs (as Decachlorobiphenyl)	0.0005*	e
Pentachlorophenol	0.001@	515.5
Simazine	0.001+	505, 507, 525
Toxaphene	0.003	505, 508
Acrylamide	treatment	-
Epichlorohydrin	treatment	-
Inorganics		
Antimony	0.01/0.005+	204.2, 200.8, D-3697
Arsenic	0.05	206.2
Barium	2.0@	208.1, 200.7
Beryllium	0.001+	210.2, 200.7, 200.8
Cadmium	0.005+	213.2, 200.7
Chromium	0.1+	218.2, 200.7
Copper	1.3&	220.1, 200.8
Lead	0.015&	239.2, 200.8
Mercury	0.002	245.1, 245.2
Nickel	0.1+	249.2, 200.7, 200.8
Selenium	0.05+	270.2, 270.3
Thallium	0.002/0.001+	279.2, 200.8

* Proposed FR 54 (97) Monday May 22, 1989, p. 22062.
\+ Proposed FR 55 (143) Wednesday July 25, 1990, p. 30370.
\# Six individual PAHs are regulated
& Proposed FR 53 (160) Thursday Aug. 18, 1988, p. 31516. ICP-MS method proposed FR 55 (203) Friday Oct. 19, 1990, p. 42409. Finalized FR 56 (110) Fnday June 7, 1991, p. 26460.
@ Revised FR 56 (126) Monday July 1, 1991, p. 30266.

a 502.2, 503.1, 524.2; b 502.1, 502.2, 503.1, 524.2; c 502.1, 502.2, 524.2; d 501.1, 501.2, 502.1, 502.2, 524.2; e 505, 508, 508A

Bibliography for methods:

1. Federal Register 44 (231) Nov. 29, 1979, 68672.
2. Methods for the Determination of Organic Compounds in Drinking Water, NTIS PB 89-220461, December 1988.
3. Methods for the Determination of Organic Compounds in Drinking Water, Supplement 1, NTIS PB 91-108266, July 1990.
4. Methods for Chemical Analysis of Water and Wastes, NTIS PB 84-128677, March 1983.

drinking water below which no adverse health effect has been observed.

In addition, more than 50 separate industries have been regulated for wastewater discharges. EPA oversees these efforts through the National Pollution Discharge Elimination System (NPDES) permitting process. NPDES permit levels are chemical and industry specific.

How The Methods Maze Started

Analytical methods originate in the particular federal EPA office that determines a need to monitor for certain contaminants. As a different EPA office recognizes the need to monitor, new methods are developed. In many cases, the methods require different analytical equipment or different matrices for the same analyte, depending on the EPA program, even though the different methods are identifying and quantifying the same chemical contaminant.

For example, there are 12 EPA methods that can be used to determine thallium. The methods specify either flame

continued on page 14

58

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GUIDELINES FOR DRINKING-WATER QUALITY

Volume 1

Recommendations

World Health Organization
Geneva 1984

A3

58A

Table 1. Microbiological and biological quality

Organism	Unit	Guideline value	Remarks
I. Microbiological quality			
A. Piped water supplies			
A.1 Treated water entering the distribution system			
faecal coliforms	number/100 ml	0	turbidity < 1 NTU; for disinfection with chlorine, pH preferably < 8.0; free chlorine residual 0.2–0.5 mg/litre following 30 minutes (minimum) contact
coliform organisms	number/100 ml	0	
A.2 Untreated water entering the distribution system			
faecal coliforms	number/100 ml	0	
coliform organisms	number/100 ml	0	in 98% of samples examined throughout the year—in the case of large supplies when sufficient samples are examined
coliform organisms	number 100 ml	3	in an occasional sample, but not in consecutive samples
A.3 Water in the distribution system			
faecal coliforms	number/100 ml	0	
coliform organisms	number/100 ml	0	in 95% of samples examined throughout the year—in the case of large supplies when sufficient samples are examined
coliform organisms	number/100 ml	3	in an occasional sample, but not in consecutive samples
B. Unpiped water supplies			
faecal coliforms	number/100 ml	0	
coliform organisms	number/100 ml	10	should not occur repeatedly; if occurrence is frequent and if sanitary protection cannot be improved, an alternative source must be found if possible
C. Bottled drinking-water			
faecal coliforms	number/100 ml	0	source should be free from faecal contamination
coliform organisms	number/100 ml	0	
D. Emergency water supplies			
faecal coliforms	number/100 ml	0	advise public to boil water in case of failure to meet guideline values
coliform organisms	number/100 ml	0	
Enteroviruses	—	no guideline value set	
II. Biological quality			
protozoa (pathogenic)	—	no guideline value set	
helminths (pathogenic)	—	no guideline value set	
free-living organisms (algae, others)	—	no guideline value set	

Table 2. Inorganic constituents of health significance

Constituent	Unit	Guideline value	Remarks
arsenic	mg/l	0.05	
asbestos	—	no guideline value set	
barium	—	no guideline value set	
beryllium	—	no guideline value set	
cadmium	mg/l	0.005	
chromium	mg/l	0.05	
cyanide	mg/l	0.1	
fluoride	mg/l	1.5	natural or deliberately added; local or climatic conditions may necessitate adaptation
hardness	—	no health-related guideline value set	
lead	mg/l	0.05	
mercury	mg/l	0.001	
nickel	—	no guideline value set	
nitrate	mg/l (N)	10	
nitrite	—	no guideline value set	
selenium	mg/l	0.01	
silver	—	no guideline value set	
sodium	—	no guideline value set	

Table 3. Organic constituents of health significance

Constituent	Unit	Guideline value	Remarks
aldrin and dieldrin	µg/l	0.03	
benzene	µg/l	10[a]	
benzo[*a*]pyrene	µg/l	0.01[a]	
carbon tetrachloride	µg/l	3[a]	tentative guideline value[b]
chlordane	µg/l	0.3	
chlorobenzenes	µg/l	no health-related guideline value set	odour threshold concentration between 0.1 and 3 µg/l
chloroform	µg/l	30[a]	disinfection efficiency must not be compromised when controlling chloroform content
chlorophenols	µg/l	no health-related guideline value set	odour threshold concentration 0.1 µg/l
2,4-D	µg/l	100[c]	
DDT	µg/l	1	
1,2-dichloroethane	µg/l	10[a]	
1,1-dichloroethene[d]	µg/l	0.3[a]	
heptachlor and heptachlor epoxide	µg/l	0.1	
hexachlorobenzene	µg/l	0.01[a]	
gamma-HCH (lindane)	µg/l	3	
methoxychlor	µg/l	30	
pentachlorophenol	µg/l	10	
tetrachloroethene[d]	µg/l	10[a]	tentative guideline value[b]

A5

60

Table 3 (*continued*)

Constituent	Unit	Guideline value	Remarks
trichloroethene[d]	μg/l	30[a]	tentative guideline value[b]
2,4,6-trichlorophenol	μg/l	10[a,c]	odour threshold concentration, 0.1 μg/l
trihalomethanes		no guideline value set	see chloroform

[a] These guideline values were computed from a conservative hypothetical mathematical model which cannot be experimentally verified and values should therefore be interpreted differently. Uncertainties involved may amount to two orders of magnitude (i.e., from 0.1 to 10 times the number).

[b] When the available carcinogenicity data did not support a guideline value, but the compounds were judged to be of importance in drinking-water and guidance was considered essential, a tentative guideline value was set on the basis of the available health-related data.

[c] May be detectable by taste and odour at lower concentrations.

[d] These compounds were previously known as 1,1-dichloroethylene, tetrachloroethylene, and trichloroethylene, respectively.

Table 4. Aesthetic quality

Constituent or characteristic	Unit	Guideline value	Remarks
aluminium	mg/l	0.2	
chloride	mg/l	250	
chlorobenzenes and chlorophenols	—	no guideline value set	these compounds may affect taste and odour
colour	true colour units (TCU)	15	
copper	mg/l	1.0	
detergents	—	no guideline value set	there should not be any foaming or taste and odour problems
hardness	mg/l (as $CaCO_3$)	500	
hydrogen sulfide	—	not detectable by consumers	
iron	mg/l	0.3	
manganese	mg/l	0.1	
oxygen—dissolved	—	no guideline value set	
pH	—	6.5–8.5	
sodium	mg/l	200	
solids—total dissolved	mg/l	1000	
sulfate	mg/l	400	
taste and odour	—	inoffensive to most consumers	
temperature	—	no guideline value set	
turbidity	nephelometric turbidity units (NTU)	5	preferably <1 for disinfection efficiency
zinc	mg/l	5.0	

Table 5. Radioactive constituents

Constituent	Unit	Guideline value	Remarks
gross alpha activity	Bq/l	0.1	(*a*) If the levels are exceeded more detailed radionuclide analysis may be necessary. (*b*) Higher levels do not necessarily imply that the water is unsuitable for human consumption
gross beta activity	Bq/l	1	

1.7 Application of the guidelines

1.7.1 Laws, regulations, and standards

Effective programmes to control drinking-water quality depend ideally upon the existence of adequate legislation, supported by regulatory standards and codes that specify the quality of the water to be supplied to the consumer, practices to be followed in selecting water sources, in treatment, and in distribution. The precise nature of the legislation will, of course, be dictated by national, constitutional, and other considerations, but some features commonly incorporated in such legislation include:

(*a*) specification of the scope of authority;
(*b*) delegation of powers to administer the law to a specified agency or agencies;
(*c*) provision for the establishment and amendment of regulations for the development, production, maintenance, and distribution of safe drinking-water; and
(*d*) provision for enforcement.

Many countries lack such basic legislation and in others the existing legislation is seriously out of date. However, much can be done under general welfare or health legislation, or on the basis of voluntary cooperation. Implementation of programmes to provide safe drinking-water should not be delayed because of the lack of appropriate legislation.

1.7.2 Compliance and surveillance

The organizational arrangements to ensure compliance with drinking-water quality standards are fully discussed in *Surveillance of drinking-water quality* (*4*). In general, it is the responsibility of the local water authority to ensure that the water it produces meets the quality defined in drinking-water standards. However, the surveillance function (i.e., a policing function on behalf of the public, to oversee operations and

A7 62

Table 6. Guideline values for bacteriological quality

Organism	Unit	Guideline value	Remarks
A. Piped water supplies			
A.1 Treated water entering the distribution system			
faecal coliforms	number/100 ml	0	turbidity < 1 NTU; for disinfection with chlorine, pH preferably <8.0, free chlorine residual 02–0.5 mg/litre following 30 minutes (minimum) contact
coliform organisms	number/100 ml	0	
A.2 Untreated water entering the distribution system			
faecal coliforms	number/100 ml	0	
coliform organisms	number/100 ml	0	in 98% of samples examined throughout the year—in the case of large supplies when sufficient samples are examined
coliform organisms	number/100 ml	3	in an occasional sample, but not in consecutive samples
A.3 Water in the distribution system			
faecal coliforms	number/100 ml	0	
coliform organisms	number/100 ml	0	in 95% of samples examined throughout the year—in the case of large supplies when sufficient samples are examined
coliform organisms	number/100 ml	3	in an occasional sample but not in consecutive samples
B. Unpiped water supplies			
faecal coliforms	number/100 ml	0	
coliform organisms	number/100 ml	10	should not occur repeatedly; if occurrence is frequent and if sanitary protection cannot be improved an alternative source must be found if possible
C. Bottled drinking-water			
faecal coliforms	number/100 ml	0	source should be free from faecal contamination
coliform organisms	number/100 ml	0	
D. Emergency water supplies			
faecal coliforms	number/100 ml	0	advise public to boil water in case of failure to meet guideline values
coliform organisms	number/100 ml	0	

protected sources which are distributed without disinfection should be similar in quality to that of disinfected drinking-water. No water entering a distribution system should be considered satisfactory if coliform organisms are detected in any sample of 100 ml. The presence of not more than 3 coliform organisms per 100 ml may be tolerated in

Table 7. Inorganic constituents of potential health significance

Constituent	Guideline values set	Background document drafted	Referred for consideration of aesthetic and organoleptic aspects	No action required
aluminium			X	
antimony				X
arsenic	X	X		
asbestos		X		
barium		X		
beryllium		X		
boron				X
cadmium	X	X		
chromium	X	X		
cobalt				X
copper			X	
cyanide	X	X		
ferrocyanide				X
fluoride	X	X		
hardness (calcium and magnesium)		X	X	
iron			X	
lead	X	X		
lithium				X
magnesium			X	
manganese			X	
mercury	X	X		
molybdenum				X
nickel		X		
nitrate	X	X		
nitrite				X
selenium	X	X		
silver		X		
sodium		X	X	
tellurium				X
thallium				X
thiocyanate				X
tin				X
titanium				X
tungsten				X
uranium				X
vanadium				X
zinc			X	

reasons why guideline values could not be recommended are also provided in section 4.2.2 for 7 other constituents.

Eight of the constituents listed in Table 7, although not of direct health concern, could have an indirect effect upon health because of their effect on the aesthetic quality of drinking-water. These substances are dealt with later under "Aesthetic and organoleptic aspects" (page 77).

A9

64

Table 8. Guideline values for health-related inorganic constituents

Constituent	Guideline value (mg/litre)
arsenic	0.05
cadmium	0.005
chromium	0.05
cyanide	0.1
fluoride	1.5[a]
lead	0.05
mercury	0.001
nitrate (as N)	10.00
selenium	0.01

[a] Guideline value may vary depending upon climatic conditions and water consumption.

4.2.2 Summaries of the evidence used in setting guideline values

4.2.2.1 *Arsenic*

Based on human health data, a concentration of 50 μg of arsenic per litre is not associated with any adverse health effects. Estimates have been made of the risk of cancer from low intakes of arsenic, but these are very uncertain. At an arsenic concentration of 50 μg/litre, the contribution made by water to the total intake will normally be about one-half to two-thirds; for very low dietary intakes of arsenic, the proportion provided by water may be somewhat higher. Arsenic in drinking-water will normally be the main source of inorganic arsenic. An arsenic concentration of 0.05 mg/litre is recommended as a guideline value.

4.2.2.2 *Asbestos*

The health hazards associated with occupational exposure to airborne asbestos have been well documented. Epidemiological studies suggest that prolonged inhalation of asbestos also leads to an increased incidence of cancer of the gastrointestinal tract: however, it is not known whether such an effect is systemic or results from swallowing inhaled fibres.

The harmful effects of swallowed asbestos on human health have not been determined. Studies in progress should permit a more complete evaluation of any hazard resulting from the swallowing of asbestos, but available data are, at present, insufficient to determine whether a guideline value is needed.

4.2.2.3 *Barium*

There is no firm evidence of any health effects associated with the normally low levels of barium in water. Even at a barium concentration

A10

Table 9. Groups of organic compounds of potential health significance

Contaminant	Detailed examination required	No further action required[a]
1. Source contaminants		
humic substances		X
chlorinated alkanes and alkenes	X	
nitrosamines		X
polynuclear aromatic hydrocarbons (PAH)[b]	X	
nitrilotriacetic acid (NTA)		X
phenols	X	
synthetic detergents		X
pesticides[b]	X	
polychlorinated biphenyls (PCB)		X
phthalate esters		
petroleum oils, including gasoline		X
chlorobenzenes	X	
chlorinated phenols	X	
benzene and alkylaromatics	X	
carbon tetrachloride	X	
2. Introduced during treatment		
carbon tetrachloride	X	
acrylamide		X
trihalomethanes	X	
3. Introduced during distribution		
vinyl chloride monomer	X	
polynuclear aromatic hydrocarbons (PAH)[b]	X	

[a] Substances did not comply with criteria enumerated on the previous page.
[b] Mentioned in *International standards for drinking-water* (9).

aesthetic and organoleptic aspects rather than their health effects. Such substances can often make water completely undrinkable when present at concentrations well below those that cause concern for health reasons.

4.3.2 Other factors to be considered when assessing the level of organic contamination

Drinking-water quality can affect the health and wellbeing of a community in a variety of ways. The importance of chemical contamination involving trace amounts of substances (especially organic substances) must be assessed in relation to the other health risks associated with drinking-water (e.g., transmission of waterborne diseases of bacterial and viral origin, and of parasites), and the relative importance attached to these risks must be decided by taking into account the local or regional situation. For instance, pesticides may be used to control disease vectors, and chlorine may be used for disinfection. In such situations, the risks associated with the low levels of organic compounds (e.g., pesticides, trihalomethanes) may be smaller

Table 10. Organic compounds for which no guideline value is recommended

Chlorinated alkanes and alkenes	*Chlorinated phenols*
dichloromethane	2-chlorophenol
1,1,1-trichloroethane	4-chlorophenol
1,2-dichloroethene	2,4-dichlorophenol
vinyl chloride	2,6-dichlorophenol
	2,4,5-trichlorophenol
Pesticides	*Others*
alpha-HCH	toluene
beta-HCH	trihalomethanes other than chloroform
triazine herbicides	
Chlorobenzenes	
chlorobenzene	
1,2-dichlorobenzene	
1,4-dichlorobenzene	
trichlorobenzenes	

than the risk they are eliminating, and so the authority responsible for public health should set values higher than those given in this document in order to benefit the health of its consumers.

4.3.3 Guideline values set on evidence of toxicity

It was assumed that the average consumption of water is 2 litres per person per day and that the average weight of a person is 70 kg, although these factors may vary. For toxic agents whose effect only becomes apparent after a dose threshold has been exceeded, an acceptable daily intake (ADI) previously established by the Joint FAO/WHO Expert Committee on Food Additives was used. When such an ADI was not available, a value was calculated from the published scientific literature by applying a "safety factor" to the no-adverse-effect dose (i.e., maximum ineffective dose). It must then be decided what proportion of the ADI should be allocated to drinking-water and what proportion to other sources of exposure (i.e., food, air, etc.). For these guidelines, the percentage of the ADI allocated to drinking-water was determined as an inverse function of the tendency for the chemical to accumulate in food chains. For chemicals such as chlorinated pesticides which accumulate readily as little as 1% of the ADI was allocated to drinking-water, whereas for chemicals that accumulate to a lesser extent a greater proportion was allocated. Consideration has also been given to the proportion of the normal intake of these chemicals that is derived from alternative sources. However, for most chemicals, there are few data on potential sources of human exposure.

4.3.4 Guideline values set on evidence of carcinogenicity

In view of the problems associated with the extrapolation of data from animals given high doses it was decided that a guideline value

H12

67

Table 11. Guideline values for health-related organic contaminants

Contaminant	Guideline value (μg/litre)
aldrin and dieldrin	0.03
benzene	10
benzo[*a*]pyrene[a]	0.01
chlordane (total isomers)	0.3
chloroform[a, d]	30
2,4-D	100
DDT (total isomers)	1
1,2-dichloroethane[a]	10
1,1-dichloroethene[a, e]	0.3
heptachlor and heptachlor epoxide	0.1
hexachlorobenzene[a]	0.01[c]
gamma-HCH (lindane)	3
methoxychlor	30
pentachlorophenol	10
2,4,6-trichlorophenol[a, b]	10

[a] The guideline values for these substances were computed from a conservative, hypothetical, mathematical model that cannot be experimentally verified and therefore should be interpreted differently. Uncertainties involved are considerable and a variation of about two orders of magnitude (i.e., from 0.1 to 10 times the number) could exist.

[b] The threshold taste and odour value for this compound is 0.1 g/litre.

[c] Since the FAO/WHO conditional ADI of 0.0006 mg/kg body weight has been withdrawn, this value was derived from the linear multi-stage extrapolation model for a cancer risk of less than 1 in 100 000 for a lifetime of exposure.

[d] The microbiological quality of drinking-water should not be compromised by efforts to control the concentration of chloroform.

[e] Previously known as 1,1-dichloroethylene.

5 Tentative guideline values

tentative guideline value was recommended in some cases (Table 12) ı, although the carcinogenicity data did not justify a full guideline e, the compounds were considered to have important health ications when present in drinking-water. The tentative values were, rtheless, based on the available health-related data; if additional ence cannot be obtained, the tentative level may in the future be

Table 12. Organic substances for which tentative guideline values are recommended

Contaminant	Tentative guideline value (μg/litre)
carbon tetrachloride	3
tetrachloroethene[a]	10
trichloroethene[a]	30

[a] Previously known as tetrachloroethylene and trichloroethylene, respectively.

Table 13. Guideline values and ADIs for certain pesticides

Compound or group of isomers	Guideline value (μg/litre)	ADI (mg/kg body weight)
DDT (total isomers)	1	0.005
aldrin and dieldrin	0.03	0.0001
chlordane (total isomers)	0.3	0.001
hexachlorobenzene	0.01[a]	—
heptachlor and heptachlor epoxide	0.1	0.0005
gamma-HCH (lindane)	3	0.01
methoxychlor	30	0.1
2,4-D	100	0.3

[a] Since the FAO/WHO conditional ADI of 0.0006 mg/kg body weight has been withdrawn, this value was derived from the linear multi-stage extrapolation model for a cancer risk of less than 1 in 100 000 for a lifetime of exposure.

(*a*) *DDT (total isomers)*

The structure of DDT allows several different isomeric forms and the commercial products consist predominantly of *p,p'*-DDT. The use of DDT in some countries has been restricted or even prohibited, but it is still extensively used in some tropical countries, both in agriculture and for vector control. It is a persistent insecticide, stable under most environmental conditions; both it and some of its metabolites are resistant to complete breakdown by soil microorganisms. Daily intake from food may be as high as 0.286 mg/person, most of which is derived from foods of animal origin. In small doses, DDT is almost totally absorbed following ingestion or inhalation and is stored in adipose tissue. Concentrations of total DDT in the blood of the general population of different countries range between 0.01 and 0.07 mg/litre and levels in human milk have been reported in the range 0.01–0.10 mg/litre.

A typical median lethal dose for the rat is 250 mg/kg body weight (administered in oil). The main effect of DDT is on both the central and peripheral nervous systems. The liver is the only other organ significantly affected. In long-term feeding tests in mice and rats, liver changes progressed from hypertrophy, margination, and lipospheres to the formation of nodules of affected cells. No teratogenic effects have been observed in several animal species and it has not been found to be mutagenic in bacterial test systems. Long-term occupational exposure provides no evidence of DDT-induced cancer in man (*14*). The conditional ADI for DDT (total isomers) for man was established in 1969 as 0.005 mg/kg body weight.[a]

(*b*) *Aldrin and dieldrin*

Aldrin and dieldrin are persistent insecticides that accumulate in the food chain. Dieldrin is formed from aldrin by metabolic oxidation in

[a] FAO/WHO. *1969 Evaluations of some pesticide residues in food.* Unpublished documents: FAO/PL: 1969/M/17/1: WHO/Food Add./70.38.

A 14

69

contamination. However, it is most important that attempts to provide aesthetically pleasing and acceptable water, for example by reducing the chlorine dosage, should not compromise the microbiological safety of drinking-water.

In addition to taste and odour, the appearance of water can also cause consumer complaints. Discoloration, with or without particulate matter, may have many causes. Apart from reflecting deficiencies in water treatment it may, in untreated water, indicate unsatisfactory source water. Therefore, colour and turbidity measurements are important and may reflect abnormal concentrations of aluminium, iron, or manganese or perhaps a deficiency in the dissolved oxygen or excessive microbial growth.

4.4.1 Guideline values recommended

A total of 23 constituents and characteristics of drinking-water have been carefully examined to ascertain their influence on the aesthetic quality of water. Guideline values have been recommended for 15 of these (Table 14) and five additional monographs are included for constituents or characteristics which, under certain conditions, may cause problems.

4.4.2 Synthetic detergents

The *International standards for drinking-water* (*8*) included a "highest desirable level" for anionic detergents of 0.2 mg/litre. In many countries,

Table 14. Guideline values for chemical constituents and physical characteristics that may affect the aesthetic quality of drinking-water

Constituent or characteristic	Guideline value
aluminium	0.2 mg/litre
chloride	250 mg Cl^-/litre
colour	15 true colour units
copper	1.0 mg/litre
hardness	500 mg/litre (as $CaCO_3$)
hydrogen sulfide	not detectable by consumer
iron	0.3 mg/litre
manganese	0.1 mg/litre
pH	6.5–8.5
sodium	200 mg/litre
solids—total dissolved	1000 mg/litre
sulfate	400 mg SO_4^{2-}/litre
taste and odour	not offensive for most consumers
turbidity	5 nephelometric turbidity units, preferably < 1 for disinfection efficiency
zinc	5.0 mg/litre

H 15

70

Drinking H_2O
HC Russian Std
"Low List"

See
c 18 1.3 to 3°

BEST AVAILABLE COPY

P1
HC std's

Сан-Пин. Н. РФ

Нормативы, характеризующие сан-эп. безопасность питьевой воды:

Bacteriological Indices

* - общее микр. число, в 1 мл Total Micro Orgs. ≤ 100
* - колл-индекс, в 1000 мл ~~Total~~ coliforms ≤ 3
* - фекальные колиформы (ТКСФЗ) в 100 мл отсутствие
  Fecal coliforms
* - колифаги, в 100 мл отсутствие
  Bacteria

Паразитологические показатели безопасности питьевой воды:

- патогенные кишечные простейшие:

Human Stomach microbes Helminths
* лямблии, в 1000 мл отсутствие
dysentery
* дизентерийные амёбы, в 100 мл отсутствие
? - * балантидии, в 1000 мл отсутствие
Helminths (intestinal worms) - гельминты, в 1000 мл отсутствие

Химико-токсикологические показатели безвредности питьевой воды:

		mg/L
*	- Алюминий, мг/дм³ Al	0,5
*	- Барий, мг/дм³ Ba	0,7
*	- Бериллий, мг/дм³ Be	0,0002
Большие конц.	- Бор, мг/дм³ B	0,3
*	- Кадмий, мг/дм³ Cd	0,003
*	- Молибден, мг/дм³ Mo	0,07
*	- Мышьяк, мг/дм³ As	0,01
*	- Никель, мг/дм³ Ni	0,02

A 16

1

P2
4 c stds

	Санитарные ПДК мг/л
* — Нитраты, мг/дм³ NO_3^-	45,0
* — Нитриты, мг/дм³ Nitrite NO_2^-	3,0
* — Ртуть, мг/дм³ Hg	0,001
* — Свинец, мг/дм³ Pb	0,01
* — Селен, мг/дм³ Se	0,01
* — Сурьма, мг/дм³ Sb	0,005
* — Стронций, мг/дм³ Sr	7,0
* — Фтор, мг/дм³ 1–2 Cl^-	1,5
(для климат. р-нов) 3 (different climatic regions)	1,2
4	0,7
* — хлор. (total)	0,05
— цианиды (CN^-)	0,07
* — четырёххлористый углерод, мкг/дм³ CCl_4	2,0
* — хлороформ, $HCCl_3$ — " —	200,0
— бромоформ, $HCBr_3$ — " —	100,0
— дибром-хлорметан, $ClBr_2CH$ — " —	100,0
— бром-дихлорметан, Cl_2BrCH — " —	60,0
— 1,2 дихлорэтан 1,2 DCA — " —	30,0
— 1,1 дихлорэтилен 1,1 DCA — " —	30,0
— трихлорэтилен TCE — " —	70,0
— тетрахлорэтилен, PCE — " —	40,0
— бензол Benzene — " —	10,0
— бенз(а)пирен — Benzo pyrene — " —	0,7
— пентахлорфенол, Pentachloro phenol — " —	10,0
— полиакриламид, Poly-acylamide — " —	2000,0
— Пестициды: Pesticides	
• линдан, Lindane — " —	2,0
• гептахлор и гептахлорэпоксид, — " —	0,03
Hepta Chlor epoxide	

Цифры нужны для сравнения

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TV 1

ПО 5-й
Р 3

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Санпин Н. РБ

• ДДТ, DDT	мкг/дм³	2,0
• гексахлорбензол, Hexachlorobenzene	— " —	1,0
• атразин, atrazine	— " —	2,0
• 2,4 — Д, 2,4-D	— " —	30,0
• симазин, simazine	— " —	2,0

Органолептические показатели:

* — привкус, баллы (taste)		2
* — запах — " — (odor)		2
* — мутность, баллы мутн. (opacity (turbidity) по формазину)		4 ×
* — цветность, град (colour)		20
* — pH		6,0 ÷ 9,0
* — минерализация общая (с/о) (dissolved solids)	мг/дм³	1000
* — железо Fe	— " —	0,3
* — жесткость общая (Ca+Mg Hardness)	мг-экв/дм³ (mg eq/L)	1,5 ÷ 7
* — марганец, Mn	мг/дм³	0,5
* — медь, Cu	— " —	2,0
— полифосфаты, ortho phosphate	— " —	3,5
* — сульфаты, SO_4^{2-}	— " —	500
* — хлориды, Cl^-	— " —	350
* — цинк Zn	— " —	5,0
— ПАВ - surfactants (anionic)	— " —	0,5
— фенол Total phenols	— " —	0,001 — полн. запах
— 2,4 — дихлорфенол, 2,4 dichloro phenol	— " —	0,002 — полн. привкус
— 2,4,6 — трихлорфенол, 2,4,6 TCP	— " —	0,004 полн. привкус
— нефтепродукты	— " —	0,1

(A18) • Total Petroleum Hydro Carbons, мин-масл — 171.0

410 стр
РЦ

СанПиН РБ

* – хлор свободный, Free Cl. мг/дм³ 0,3÷0,5
* – хлор связанный, Bound Cl. – 11 – 0,8÷1,2
* – озон, O_3 – 11 – 0,1÷0,3 (≥12

Показатели радиоактивного загрязнения питьевой воды:

* – суммарная α-активность (gross α) Бк/дм³ 0,1
* – суммарная β-активность (gross β), Бк/дм³ 1,0

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Standards - potable MEPHLOLOS 10/24

for surface + sewage waters

ПДК вредных веществ, мг/л

СанПиН №4630-87

№ п/п	Наименование показателей	из "Правил приема пр изв дственных сточных вод в системе канализации населенных пункт в: Общие требования	Принемаемых в ГК г.Киева	На сбр с в в д ем/ в р-н г.Киева	В в доемах х з-питьевого и культ-быт в г вод пользования	В водоемах, используемых для рыбохозяйственных целей
I.	pH	6,5-8,5		mg/L	6,5-8,5	
2.	I°C	не выше +4			не более 3°	
3.	Взвешенные в-ва	500				
4.	ХПК	600			I5-30	
5.	БПКполн.	500			3-6	3
6.	П р г цветности	I:I6				
7.	Хлориды	350			350	300
8.	Сульфаты	500			500	I00
9.	Эфир извлекаемые в-ва	20				
I0.	Нефтепродукты		4,4	0,3	0,3	0,05
II.	СПАВ анионактивн.		20,0	-	0,5	
I2.	Цианиды		0,37	0,05	0,I	0,05
I3.	Cr^{+6}		0,I	-	0,05	0,00I
I4.	Cr^{+3}		2,5	0,5	0,5	-
I5.	Медь		0,5	0,00I	I,0	0,00I
I6.	Цинк		I,0	0,0I	I,0	0,0I
I7.	Никель		0,5	0,I	0,I	0,0I
I8.	Железо $^{+3}$/общее/		2,5	0,5	0,3	
I9.	Ртуть		0,002	0,0005	0,0005	
20.	Алюминий		0,75	-	0,5	
2I.	Фториды		I,94	0,75	0,75	
22.	Ванадий				0,I	
23.	Кадмий		0,I	0,005	0,00I	0,005
24.	Свинец		0,I	0,08	0,03	
25.	Капролактам		44,4	I,0	I,0	
26.	Фенолы		0,05	0,00I	0,00I	0,00I
27.	Жиры раст. и животн.		50,0	I,0		
28.	Формальдегид		0,6	0,05	0,05	
29.	Сероуглерод				I,0	I,0
30.	Нитриты по NO_3				3,3	NO_2-0,08 по N-0,02
3I.	Фосфаты/кальция фосфат по PO_4/				0,25	
32.	Аммиак /по азоту/		П NH_4-0,5		2,0	
33.	Нитраты /по NO_3/				45,0	9,I
34.	Растворен. кислород				не менее 4,0	не мен.4
35.	Минерализация не более I000					

H2O

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75

Kiev Vodocanal current Standards

ГОСТ 2874-82 "old" from FSU

Вода питьевая
Гигиенические требования и контроль за качеством.

Число микроорганизмов в 1 мл воды, не более — Nr. microorganisms — 100

Число бактерий группы кишечных палочек в 1 л. воды (кол-индекс), не более — Total coliform bacteria — 3

Алюминий остаточный (Al), мг/л, не более — 0,5

Бериллий (Be), мг/л, не более — 0,0002

Молибден (Mo), мг/л, не более — 0,25

Мышьяк (As), мг/л, не более — 0,05

Нитраты (NO_3), мг/л, не более — 45,0

Полиакриламид остаточный, мг/л, не более — 2,0

Свинец (Pb), мг/л, не более — 0,03

Селен (Se), мг/л, не более — 0,01

Стронций (Sr), мг/л, не более — 7,0

Фтор (F), мг/л, не более для климатических районов:

- I и II — 1,5
- III — 1,2
- IV — 0,7

Водородный показатель, pH — 6,0-9,0

Железо (Fe), мг/л, не более — 0,3

Жесткость общая, мг-экв/л, не более (Ca+Mg) — 7,0

Марганец (Mn), мг/л, не более (A21) — 0,1

Медь (Cu^{2+}), мг/л, не более 1.0

Полифосфаты остаточные (PO_4^{3-}), мг/л, не более 3.5

Сульфаты (SO_4^{2-}), мг/л, не более 500

Сухой остаток, мг/л, не более Total solids dissolved 1000

Хлориды (Cl^-), мг/л, не более 350

Цинк (Zn^{2+}), мг/л, не более 5.0

Запах при 20°с и при нагревании до 60°, баллы, не более (Odor) 2

Вкус и привкус при 20°с, баллы, не более (taste) 2

Цветность, градусы, не более — color 20

Мутность по стандартной шкале, мг/л, не более (Turbidity) 1.5

Остаточный хлор свободный, мг/л — Cl^0 residual 0.3-0.5

Остаточный хлор связанный, мг/л 0.8-1.2

Bound Cl^-

Appendix B

Basic Laboratory Level Quality Control Plan

and

Ukrainian Committee for Standards Laboratory Certification Plan

Analytical Laboratory QA Definitions:

For USAID EPT Project, 1994
S. Fry

Introduction to Laboratory Quality Programs:

The ultimate goal of this portion of the EPT's program is to develop a project to improve laboratory capabilities in the Ukraine. One activity that could improve nation-wide laboratory capabilities would be the improvement of the perceived quality of laboratory results. The types of Quality Control (QC) measures presented here are meant to be the beginning framework of a solid laboratory Quality Assurance (QA) plan. QA plans utilizing these QC measures should improve the defensability of laboratory data, and hence improve the confidence in the associated sample results. These QC measures are not meant to cover all possible types of QA situations. The EPT program could supply analytical equipment and reagents to Ukrainian laboratories, when a laboratory QA plan (potentially including these QC measures) is in place.

Brief Glossary of Terms:

Analyte:

An analyte is the element or compound (contaminant) that we are trying to analyzing for.

Spike:

Spiking is the addition of a very small volume (typically 5 - 100 micro-liters) of a very concentrated standard to a sample, as is done in the Method of Standard Additions. This gives a measurable addition of analyte, without significantly altering the total volume of sample. Spiking is the first step in a mass balance (recovery) determination.

Recovery:

Recovery is the determination of how much of the previously spiked analyte is measured in the analysis. Ideal conditions would give a 100% recovery of the spiked analyte. Recovery is the last step of a mass balance determination.

Native Concentration:

The Native Concentration is the amount of analyte present in the sample before the laboratory handles or alters the sample.

Analytical Batch:

An Analytical Batch is a group of Samples that are prepared and analyzed together.

Quality Control (QC):

Measurements (monitors) that verify that a process worked.

Quality Assurance (QA):

The program that ensures that the results have consistently high quality.

Suggested Quality Control Criteria and Measurements:

The following Quality Control (QC) samples can be prepared by a laboratory every day they analyze samples. The purpose and benefits of analyzing these QC samples are as follows:

1. They prove that the analysis results for that day are correct and have high quality.
2. They measure the efficiency of the analysis process.
3. They identify any problems that occurred during the analysis.
4. They prove that any contaminants found in a sample are native, not caused or introduced by the laboratory.

A. Method Blank: (definition)

One Method Blank is prepared with every analytical batch to monitor potential laboratory contamination. The Method Blank is a clean reference sample of the same matrix as the samples. Ex.: use distilled water for method blanks when analyzing water samples, and clean silica sand when analyzing soil or sediment samples. The Method Blank is prepared and analyzed exactly the same way as the other samples. If the results for the Method Blank are clean (all non-detects - no contamination found), it is assumed that all associated samples in the same analytical batch have not experienced any laboratory contamination.

For comparison purposes, the method blank goes through the entire method (sample preparation and analysis), as compared to a reagent blank where only the method's reagents are tested, or an instrument blank where a clean reagent is placed in the instrument. Method Blank results are reported along with the associated sample results from the same preparation batch.

B. Blank Spike Samples: (definition)

Blank Spikes are QC samples that demonstrate the overall efficiency of the analysis method. Blank Spike compounds are identical to the compounds we're testing for, but they are added to a Method Blank (clean reference matrix). They are chosen to be representative of the general types of compounds we're testing for in your sample. Typically, one or two Blank Spike samples are prepared with every group (batch) of samples.

We define Control Limits for their % Recovery as the range of acceptable values that indicate that the analysis worked properly. Failure of the Blank Spike Recovery often triggers re-analysis and re-extraction or re-preparation of the sample analysis batch. We frequently prepare and analyze a Blank Spike Duplicate to monitor the precision of an analysis method. The Blank Spike results are reported along with the associated sample results from the same preparation batch.

Example Calculation of a Blank Spike Recovery:

[Amount Measured (mg/L) / Amount Added (mg/L)] x 100% = % Recovery

Typically the Amount Measured and the Amount Added are expressed as concentrations, like mg/L or ug/L.

C. Matrix Spike Samples: (definition)

Matrix Spike samples are quality control (QC) samples that determine if the sample matrix interferes with the overall efficiency of the analysis method. Matrix Spike compounds are a shorter list of exactly the same compounds that the method tests for. Matrix Spike compounds are added to an aliquot of one sample per analysis batch. They are chosen to be representative of the general types of compounds we're testing for in the samples. **Matrix Spike Recoveries *do not* necessarily represent or describe the quality or efficiency of the analysis! Matrix Spike Recoveries also do not necessarily reflect the accuracy of the analysis!**

For these reasons, we strongly resist defining Acceptance or Control Limits for Matrix Spike Recoveries. The Matrix Spike recovery should only be used to characterize the ability of the analysis method to recover analytes from your specific type of soil or water. Hence, low Matrix Spike Recoveries are caused by matrix interferences, and usually only trigger further evaluation of the sample, surrogate, and Blank Spike results. High Matrix Spike Recoveries (> 100%) can be caused by sample inhomogeneity, particularly when the native analyte concentration is close to the amount of the spike. The Matrix Spike Recoveries are reported with the group of sample results from the same preparation batch. Finally, Matrix Spikes can be analyzed in duplicate to give estimates of the precision of the

sample results. If both the Matrix Spike and it's duplicate values are very high or very low, the matrix interference has been confirmed. If a matrix interference is confirmed, it simply shows that the analysis method does not work well for this matrix, and possibly a different analysis method is required.

Example of Matrix Spike Calculation:

$$[(C_{ms} - C_{native}) / C_s] \times 100\% = \%\ \text{Matrix Spike Recovery}$$

Where:

C_{ms} = the concentration (amount) measured of the matrix spiked sample

C_{native} = the native concentration (amount) measured in the un-spiked sample

C_s = the concentration (amount) added as the spike.

D. Calibration: (definition)

Calibration is the determination of the relationship between the amount (standard concentration) of the target analyte and the instrument's response (magnitude of signal) for that standard. The laboratory can analyze 1, 3, or 5 standards, depending on the analysis method requirements. (Typically, USEPA SW846 8000 series methods use 5 standards, and USEPA CWA 600 series methods use 3 standards.) The frequency of re-calibration depends on instrument stability. Re-calibration may also be necessary if any instrumental problems occur that require significant changes or adjustments in the instrument.

E. Calibration Verification Standards: (definition)

Calibration Verification Standards are used at the beginning of an analysis batch to prove (verify) that the instrument is still in calibration. The Calibration Verification Standard is only used for instruments or methods that historically maintain calibration well between analysis batches. We typically analyze a mid-range standard, and compare the result to the expected value. If the result is within the acceptance range for the method (typically ±10% or ±20%), then we can proceed with the analysis without any further calibration. When analyzing very contaminated samples, Calibration Verification Standards can also be analyzed after a group of samples (typically after every 10 samples) to prove that the instrument maintained calibration during the sample analyses.

86

F. Detection Limits and Practical Quantitation Limits: (definitions)

A Detection Limit (DL) is often defined as the smallest amount (concentration) of target analyte that can be observed above background. The Practical Quantitation Limit (PQL) is the smallest amount that can be reliably measured (quantitated) with good confidence. The PQL is often 3 - 10 times larger than the DL. Measurements of values that fall between the PQL and the DL are reported with increasing uncertainty as they approach the DL. Unfortunately, the terms PQL and DL are often used interchangeably in literature and in discussions. There is a lack of standard terminology in western analytical chemistry, as reflected by these additional terms: Determination Limit (equivalent to PQL), Reporting Limit (RL), Estimated Quantitation Limit (EQL), and Method Detection Limit (MDL). Use of the term MDL can be particularly confusing. Sometimes it is used to mean a specific laboratory's Detection Limit, other times it refers to a required specification as published in a USEPA approved method.

G. Control Limits and Warning Limits: (definition)

Control Limits are the range of acceptable values for a given QC parameter. They can be specified by the analysis method, or they can be statistically determined from historical laboratory results. Statistical determinations are made by calculating the statistical mean (average) and the standard deviation (s) of a group of results. Control Limits are then calculated as the average value ± 3s. Warning Limits are typically calculated as the average value ± 2s. QC results that exceed the Warning Limits should trigger evaluation or scrutiny of the analytical process. QC results that exceed the Control Limits should trigger corrective actions. Some examples of corrective actions are: (1) re-analyze sample; (2) re-extract and re-analyze sample; (3) re-calibrate instrument and re-analyze sample; or (4) repair instrument, re-calibrate instrument, and re-analyze sample.

H. Performance Evaluation Samples: (definition)

Performance Evaluation (PE) samples are check (or test) samples that are sent out to laboratories to test laboratory performance. PE samples contain known (verified or certified) amounts of analytes. Typically, a respected central authority sends out PE samples every 3 - 6 months to monitor laboratories' performance. The subscribing laboratories do not know what is in the sample, (called a single blind test). The results of all of the laboratories are gathered by the central authority, and

published in a public record. The results are typically categorized as "Pass" or "Fail" for each type of test or analyte. Good performance on PE samples can translate into respect and prestige for the subscribing laboratories. Repeated poor performance on PE samples can result in the loss of laboratory certification for the associated tests. As such, a PE sample program can be an effective tool for on-going (long term) evaluations in a laboratory certification program.

I. Surrogate Compounds: (definition)

Surrogates compounds are spiked into organics samples to monitor extraction and analysis efficiencies on each sample (like an internal standard). Surrogate compounds are chemically similar to the compounds we're testing for. They are chemically unique or distinct from any compounds we would expect to find in the real world, so it is highly unlikely that they would appear in a sample. Examples: use deuterated surrogate compounds for Mass Spectrometry analyses, like phenol-d5; or use decachlorobiphenyl (DCBP) as a surrogate for organochlorine pesticide analyses.

Example Calculation of Percent Surrogate Recovery:

(Measured Surrogate Concentration / Added Surrogate Concentration) x 100% = % Surrogate Recovery

We define "Control Limits" for % Surrogate Recovery as the range of acceptable values that indicate that the analysis method was effective for that sample's matrix. Failure of the Surrogate Recovery does not necessarily imply that the data is bad, but that we should evaluate the sample, Blank Spike, and Matrix Spike results to determine if a problem occurred with the extraction or if there is matrix interference. Because they are only chemically similar to the analysis compounds, their recoveries should not be used to correct or adjust the sample results.

The % Surrogate Recovery results are presented with each organics sample's results. Conclusions and comments about surrogate, Blank Spike, and Matrix Spike recoveries are listed in Qualifiers and in the Cover Letter's Narrative.

J. Qualifiers: (definition)

Qualifiers are brief narrative comments that are written to describe anything unusual that was observed during sample preparation and analysis. These comments are best written on the same page as the sample results. Expanded or detailed comments can be made in the Cover Letter that accompanies the report.

K. Assorted Method Specific QC Samples:

There are additional types of QC checks that are specific to individual methods. Generally, these are designed to monitor problems unique to each method. Some examples of these are:

Method / Analyte	QC Sample
Metals	Spectral Interference Check Standards
Organo-Chlorine Pesticides	DDT and DDE Breakdown Standards
Radiological Tests	Tracers (Unusual isotopes added to monitor and correct for preparation and analysis efficiency, like adding Sr-85 to a Sr-90 sample.)
Metals & Radiological Tests	Laboratory Control Samples (Similar to blank spikes, but they are often a certified sample provided by an outside vendor, not made by the lab.)

85

Описание аналитических лабораторных способов гарантии качества.

Стивен Фрай

Введение.

Конечной целью данной части программы ППТ является осуществление проекта по усовершенствованию лабораторных служб в Украине. Повышение качества выполнения лабораторных анализов - это первый шаг, который может привести к усовершенствованию лабораторной службы по всей Украине. Представленные в данном документе виды контроля качества являются началом налаживания общей системы гарантии качества (ГК). Система ГК, используя эти методы контроля, должна повысить надёжность лабораторных данных, уверенность в полученных результатах. Приведённые здесь виды контроля качества не обязательно должны охватывать все возможные типы ситуаций ГК. Программа ППТ могла бы предоставить аналитическое оборудование и необходимые реагенты украинским лабораториям при наличии системы гарантии качества, включающей и данные виды контроля качества.

Краткий перечень терминов и определений:

Аналит (Analyte): элемент или соединение (загрязнитель), которые подлежит анализу.

Спайкинг (Spike): это добавление к образцу очень маленького объёма (обычно 5-10 мкл) концентрированного стандартного раствора, например, как это делается в методе стандартных добавок. Спайкинг позволяет существенно увеличить количество аналита в образце без существенного изменения его общего объёма. Спайкинг является первым этапом определения материального баланса (правильности) определения.

Правильность определения (Recovery): величина (обычно выраженная в %), которая показывает какое количество от ранее добавленного в образец аналита удалось определить в процессе анализа.

Собственная концентрация (Native concentration): количество аналита (выраженное в единицах концентраций), которое присутствует в образце до начала его обработки или подготовки к анализу в лаборатории.

Серия анализируемых образцов (Analytical batch): группа образцов, которые подготавливаются и анализируются вместе.

Контроль качества (Quality control): измерения (наблюдения), которые подтверждают, что анализ выполнен правильно.

Гарантия качества (Quality Assurance): программа, которая гарантирует, что полученные результаты имеют высокую степень достоверности.

Предлагаемые критерии контроля качества и измерения:

Приведённые ниже типы образцов контроля качества (КК) должны готовится каждый день, когда производится анализ проб. Образцы КК применяются с определённой целью и дают следующие преимущества:
1) подтверждают, что полученные в этот день результаты анализов корректны и достоверны;
2) позволяют определить эффективность анализа;
3) позволяют выявить и устранить любые проблемы, которые возникают в процессе анализа;
4) подтверждают, что все контаминанты (загрязнения), которые обнаружены в пробе, являются её собственными контаминантами, а не внесены в пробу в процессе анализа, т.е. проба не испытывала лабораторного загрязнения.

А. Холостой образец (бланк) (Method Blank):

Один холостой образец (бланк) готовится для каждой серии анализируемых проб, чтобы проконтролировать возможность попадания в них контаминантов в процессе выполнения анализа. Холостой образец (бланк) представляет собой чистый эталонный образец той же структуры, как и анализируемые пробы. Например: использование дистилированной воды в качестве холостого образца при анализе проб воды, использование чистого силиката при анализе проб почвы или отложений. Холостой образец подготавливается и анализируется точно тем же образом, что и анализируемые пробы. Если в холостом образце не обнаружено никаких примесей, то считается, что все пробы данной серии не испытали лабораторного загрязнения.

Результат анализа холостого образца характеризует качество выполнения анализа в целом (приготовление образца и его анализ), в отличие от контроля реагента, где проверяются только используемые в методе реагенты, или контроля используемых приборов, где чистый реагент размещается в самом приборе. Результат анализа холостого образца описывается вместе с результатами анализа проб данной серии.

Б. Стандартные образцы (бланк спайк) (Blank spike samples):

Стандартные образцы (бланк спайк) - это холостые образцы с добавками стандартных растворов. Они демонстрируют предельную эффективность метода анализа. Компоненты стандартных образцов (бланк спайк) идентичны соединениям, которые мы в данный момент анализируем в пробах, однако они добавляются к холостым (чистым) образцам. Стандартные добавки к стандартным образцам выбираются таким образом, чтобы представлять те основные типы соединений, которые мы анализируем в пробах. Обычно, для каждой серии проб готовятся один или два стандартных образца .

Мы устанавливаем контрольные пределы их % определения компонента, добавляемого в стандартный образец, как диапазон допустимых значений, которые показывают, что анализ выполнен корректно. Недостаточная точность в определении стандартного образца является поводом для повторного анализа, повторной экстракции или повторного приготовления серии проб. Для проверки точности выполненного анализа часто готовят два паралельных стандартных образца (бланк спайка). Результаты анализа бланк спайка описываются вместе с результатами анализа всей серии проб.

Пример расчёта правильности определения образца бланк спайка:

$$\frac{\text{Измеренное количество}}{\text{Фактическое (добавленное) количество}} \times 100\% = \text{правильность определения, \%}$$

Обычно, измеренное и фактическое количество стандартной добавки выражается в мч/л или мг/л.

В. Образцы с матричными добавками (матрикс спайк), (Matrix Spike Samples):

Образцы с матричными добавками - это образцы анализируемых проб с добавкой стандартных растворов. Образцы матрикс спайк - это образцы контроля качества, которые позволяют установить не создает ли матрица пробы препятствий для выполнения анализа с требуемой эффективностью. Добавляемые стандартные добавки содержат меньшее количество компонентов, чем анализируемые пробы. Стандартные добавки вносятся аликвотно в одну из проб анализируемой серии. Стандартные добавки подбираются таким образом, чтобы представлять те основные типы соединений, которые мы анализируем. **Правильность определения матричных добавок не обязательно должна представлять или описывать качество или эффективность анализа. Она не обязательно также должна отражать точность анализа.**

По этим причинам, мы воздержимся от чёткого определения понятия контрольных пределов для получения значений матрикс спайк. Полученный результат следует использовать лишь для того, чтобы установить возможность применения данного метода анализа для вашего специфического типа почвы или воды. Следовательно, низкий уровень правильности определения матричных добавок (в результате влияния матрицы пробы) обычно являются лишь поводом для дальнейшей оценки исследуемого пробы, примесей и холостого образца. Причиной завышенного значения величины матричной добавки (>100 %) может являться неоднородность исследуемой

98

пробы, особенно когда собственная концентрация аналита в пробе приближается к величине добавки. Результат анализа образца матрикс спайк описывается вместе с результатами анализов исследуемой серии. В конечном итоге, для достижения более точного результата можно проводить анализ параллельных образцов с матричными добавками. Если результаты определения параллельных образцов матрикс спайк очень высоки или очень низки, то это подтверждает значительное влияние среды (матрицы) исследуемой пробы на результат анализа. В этом случае можно считать, что для проб с такой матрицей данный метод не очень подходит и следует использовать другие методы.

Пример расчёта правильности определения матричной добавки:

[(С изм - С с) / С д] X 100% = % определение матричной добавки,

Где:
С изм - измеренная концентрация матричной добавки
С с - собственная концентрация
С г - концентрация добавки (спайка), введенной в пробу

Г. Калибровка
(Calibration):

Калибровка - это определение взаимосвязи между количеством (стандартной концентрацией)определяемого вещества и величиной ответного сигнала прибора. Лаборатория может анализировать 1, 3 или 5 стандартов, в зависимости от требований метода анализа. (Обычно, USEPA SW846 8000 используют 5 стандартов, и USEPA CWA используют 3 стандарта) Частота повторной калибровки зависит от стабильности прибора. Повторная калибровка может также быть необходимой если возникают какие бы либо проблемы с прибором, которые требуют значительного вмешательства или его перенастройки .

Д. Калибровочные стандарты
(Calibration Verification Standards):

Калибровочные стандарты (стандартные образцы для проверки калибровки) применяются перед началом анализа серии проб с тем, чтобы подтвердить (проверить), что калибровка прибора не нарушена. Калибровочные стандарты используются только для приборов или способов, которые хорошо поддерживают между сериями определений (анализов) Обычно мы проверяем по стандарту средний диапозон калибровкии сравниваем результат с ожидаемым значением. Если результат находится в пределах диапазона погрешностей применяемого для метода (обычно _+ 10% или 20%), мы можем продолжать анализ без дальнейшей калибровки. При анализе грязных проб, калибровочные стандарты проверки применяются также после анализа группы проб (обычно 10 образцов), чтобы подтвердить, что прибор сохраняет калибровку на протяжение всего времени измерений.

Е. Пределы обнаружения и рабочие пределы измерения
(Detection Limits and Practical Quantitation Limits):

Пределу Обнаружения (ПО) часто дают определение наименьшего количество (концентрации) анализируемого вещества, которое может измерено данным методом. Рабочий Предел Измерения (РПИ) характеризуется наименьшим количеством вещества (концентрацией), которое может быть измерено (подсчитано) достаточно надёжно. РПИ часто в три-десять раз больше чем ПО. К сожалению, термины, которые попадают между РПИ и ПО часто используются в литературе и дисскуссиях взаимозаменяемо. Недостаток стандартной терминологии западной аналитической химии отражён в существовании следующих дополнительных терминов: Предел Определения (эквивалент РПИ), Предел Достоверного Измерения (ПДИ), Установленный Количественный Предел (УКП) и Предел Чувствительности Метода (ПОМ). Использование термина Предел Чувствительности Метода может особенно вводить в заблуждение. Иногда он используется для обозначения специфического лабораторного предела обнаружения, в иных случаях он относится к необходимым техническим требованиям, как опубликовано в методе, одобренном USEPA.

Ж. Контрольные пределы и предупреждающие пределы (Control Limits and Warning Limits):

Контрольные пределы представляют диапозон приемлемых величин для данного параметра КК. Они могут быть определены при помощи метода анализа, или статистически по полученным раннее лабораторным данным (результатам анализов). Статистические определения производятся путём расчёта статистической средней величины (среднее арифметическое) и стандартного отклонения (S) серии результатов. Затем контрольные пределы подсчитываются как среднее значение с погрешностью плюс-минус 3S. Предупреждающие пределы обычно подсчитываются как среднее значение плюс-минус 2S. Результаты КК, которые превышают предупреждающие пределы должны служить поводом для корректировки метода анализа, например:
1) повторить измерение;
2) повторить экстракцию и повторить измерение;
3) перекалибровать прибор и повторно измерить образцы;
4) исправить прибор, перекалибровать его и провести повторное измерение образцов.

З.Контрольные образцы (слепые пробы) (Perfomance Evaluation samples):

Контрольные образцы (КО) образцы, которые отправляются в лаоратории с тем, чтобы проверить качество лабораторных результатов. КО содержат известное (проверенное или снабжённое сертификатом) количество аналитов. Обычно, авторитетная организация каждые 3-6 месяцев рассылает КО для того, чтобы получить данные о качестве выполнения анализов в лабораториях. Абонентские лаборатории не знают,что находится в образце, называемом единичный слепой тест. Результаты всех лабораторий собираются и публикуются в печати. Результаты обычно оценивают как "Зачтено" или "Не зачтено" для каждого типа проверки или аналита. Хорошие эксплуатационные показатели по КО образцам являются престижными для абонентских лабораторий. Повторяющиеся низкие показатели выполнения анализа по КО могут привести к потере лабораторного сертификата на данный тип анализа. Таким образом, КО могут быть эффективным средством для долговременной оценки работы лаборатории в программе сертификации лабораторий.

И. Реперные добавки
(Surrogate Compounds):

Реперные добавки (РД) вносятся в органические образцы с тем, чтобы контролировать экстракцию и эффективность анализа каждой пробы по типу внутренего стандарта. РД химически подобны соединениям, которые мы проверяем. Они же химически уникальны, т.е. отличаются от любых соединений, котрые можно было бы ожидать в реальной среде, поэтому их не может быть в исследуемой пробе.
Например: использование таких дейтерированных соединений в качестве реперной добавки, как фенол - d5 в масс-спектрометрическом анализе, или использование декахлордиоренила в качестве репера при анализе хлорорганических пестицидов.

Пример расчёта правильности определения реперной добавки:

$$\frac{\text{Измеренная концентрация РД}}{\text{Фактическая (добавленная) концентрация РД}} \times 100\% = \text{\% определение РД (правильность определения)}$$

Мы принимаем Контрольные Пределы для правильности определения РД как диапозон приемлемых величин, которые могут означать, что методика анализа эффективна для анализируемых проб. Погрешности в правильности определения данного реагента не обязательно означают, что полученные результаты анализов неудовлетворителены, но нам следует оценить пробу, результаты анализов стандартного образца (Бланк спайк) и матричной добавки для того, чтобы определить что является причиной неудовлетворительного результата: проблемы с экстракцией или мешающее влияние матрицы пробы. Так как РД только химически подобны анализируемым соединениям, то правильность их определения не должна использоваться для корректировки результата анализа пробы. Результаты определения (%) РД представляются вместе с результатами анализируемых проб. Выводы о правильности определения РД, стандартного образца (Бланк Спайк), образца с матричной добавкой (Матрикс Спайк) перечисляются в форме краткого комментария.

К: Краткий комментарий
(Qualifier):

Краткий комментарий - это краткое последовательное изложение фактов, которые описывают что либо необычное, имевшее место во время подготовки или анализа образца. Лучше, если этот комментарий написан на той же странице, что и результаты анализа образца. Более подробный или детальный комментарий может быть оформлен в виде приложения к отчёту.

Л.Смешанные типы образцов КК, специфические для определённых методов анализа.
(Assorted method Specific QC Samples):

Имеются дополнительные типы проверок КК, которые являются специфическими по отношению к индивидуальным методам. Они созданы для того, чтобы контролировать

уникальные ситуации данных методов. Вот некоторые примеры таких типов КК:

Метод / Аналит	Образцы КК
Металлы	Стандарты проверки спектральной интерференции.
Хлорорганические пестициды	Стандарты продуктов деструкции ДДТ ДДЕ.
Радиологические определения (тесты)	Трейсы (обычно изотопы, добавляемые для наблюдения и корректировки эффективности подготовки и анализа проб, как например, добавление Sr-85 в пробы со Sr-90.)
Металлы и радиологические измерения	Контрольные образцы (подобные стандартным образцам) - (Бланк Спайк). Однако это чаще всего сертифицированные образцы, предоставляемые внешним поставщиком, а не приготовленные в лабораториию

Certification / Accreditation of Labs by State Committee

РУКОВОДЯЩИЙ НОРМАТИВНЫЙ ДОКУМЕНТ

СИСТЕМА СЕРТИФИКАЦИИ УкрСЕПРО

Требования к испытательным лабораториям и порядок их аккредитации

ИЗДАНИЕ ОФИЦИАЛЬНОЕ

Based on ISO-9000

(But they don't always do this)

Accreditation certification based on competence and independence

independence from outside interference even from client

ГОССТАНДАРТ УКРАИНЫ
КИЕВ

РУКОВОДЯЩИЙ НОРМАТИВНЫЙ ДОКУМЕНТ

СИСТЕМА СЕРТИФИКАЦИИ УкрСЕПРО

Требования к испытательным лабораториям и порядок их аккредитации

Действителен с 1993-07-01

I. ОБЛАСТЬ ПРИМЕНЕНИЯ

I.I. Настоящий руководящий нормативный документ устанавливает общие требования к испытательным лабораториям, аккредитуемым в Системе сертификации Украины /Системе УкрСЕПРО или Системе/, правила и порядок проведения их аккредитации.

I.2. Руководящий документ является обязательным для испытательных лабораторий и органов, проводящих их аккредитацию.

I.3. Руководящий документ разработан с учетом требований руководств ИСО/МЭК и Европейских стандартов в области сертификации.

Based on ISO-9000 Stds

2. ТЕРМИНЫ

2.I. Используемые в настоящем документе термины и их определения соответствуют Руководству ИСО/МЭК 2, стандарту ИСО 8402 и КНД 50- "Система сертификации УкрСЕПРО. Основные термины и определения".

3. ОБЩИЕ ПОЛОЖЕНИЯ

3.I. Аккредитация испытательной лаборатории в Системе является официальным признанием технической компетентности и независимости лаборатории от разработчиков, изготовителей /поставщиков/ и потребителей /покупателей/ продукции /процессов, услуг/ или только ее технической компетентности в прове-

or if they only include technical competency

дении испытаний конкретной продукции или конкретных видов испытаний в соответствии с требованиями стандартов или иных нормативных документов.

Аккредитована может быть любая лаборатория, из"явившая желание пройти аккредитацию, независимо от ее отраслевой принадлежности и форм собственности.

3.2. Испытания для целей сертификации проводятся испытательными лабораториями, аккредитованными на техническую компетентность и независимость в Системе.

Допускается проводить испытания для целей сертификации в испытательных лабораториях, аккредитованных только на техническую компетентность, под контролем представителей органа по сертификации продукции. Ответственность за об"ективность таких испытаний несет орган по сертификации или организация, выполняющая его функции, поручившие испытательной лаборатории их проведение.

3.3. Основной функцией испытательной лаборатории является проведение испытаний в закрепленной области аккредитации.

3.4. Требования аккредитации, установленные настоящим документом, могут быть дополнены при аккредитации конкретных испытательных лабораторий другими требованиями, исходя из специфики деятельности этих лабораторий.

3.5. Испытательная лаборатория должна осуществлять свою деятельность в соответствии с "Положением об испытательной лаборатории", разработанным на основе настоящего документа и утвержденным Национальным органом по сертификации.

3.6. Испытательная лаборатория должна располагать комплектом юридических, организационно-методических, нормативных и других документов, необходимых для осуществления своих функций. Перечень документов приведен в приложении А.

4. ОБЩИЕ ТРЕБОВАНИЯ К ИСПЫТАТЕЛЬНЫМ ЛАБОРАТОРИЯМ, ПРАВА И ОБЯЗАННОСТИ

4.1. Независимая испытательная лаборатория должна иметь юридический статус, организационную структуру, административную подчиненность, финансовое положение и систему оплаты труда сотрудников, обеспечивающие необходимую уверенность в

том, что она признается об"ективной и независимой от разработчиков, изготовителей и потребителей по всем вопросам оценки показателей, подтверждаемых при сертификации конкретной продукции.

4.2. Техническая компетентность

4.2.1. Организация и управление

4.2.1.1. Испытательная лаборатория должна обеспечивать техническую компетентность при проведении испытаний в признанной области аккредитации.

4.2.1.2. Испытательная лаборатория должна иметь руководителя, несущего ответственность за деятельность лаборатории и результаты ее работы. Назначение и освобождение руководителя аккредитованной на техническую компетентность и независимость лаборатории должны производиться по согласованию с Национальным органом по сертификации.

4.2.1.3. Если аккредитуемая испытательная лаборатория сама не является юридическим лицом, а входит в состав органа по сертификации или другой организации, являющихся юридическими лицами, то она должна быть структурным подразделением этих организаций.

4.2.1.4. Каждый сотрудник лаборатории должен быть компетентным в закрепленной сфере деятельности, знать свои права и обязанности.

4.2.1.5. Организационная структура должна исключать возможность оказания на сотрудников лаборатории давления, способного повлиять на их выводы или результаты работы по испытаниям продукции.

4.2.1.6. В лаборатории должна быть система проверки компетентными лицами хода и результатов испытаний, а также квалификации персонала лаборатории.

4.2.2. Персонал лаборатории

4.2.2.1. Персонал аккредитованной лаборатории должен иметь профессиональную подготовку, квалификацию и опыт в проведении испытаний в признанной области аккредитации. Каждый специалист должен иметь должностную инструкцию, устанавливающую функции, обязанности, права и ответственность, требования к образованию, техническим знаниям и опыту работы.

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4.2.2.2. Сотрудники, непосредственно участвующие в проведении испытаний, должны быть аттестованы на право проведения конкретных испытаний в соответствии с установленным порядком аттестации.

4.2.2.3. Лаборатория должна располагать документально подтвержденными сведениями и документами по вопросам повышения квалификации персонала.

4.2.3. Помещения и окружающая среда

4.2.3.1. Окружающая среда, в условиях которой проводятся испытания, должна обеспечивать необходимую точность измерений при испытаниях.

4.2.3.2. Помещения для проведения испытаний должны соответствовать по производственной площади, состоянию и обеспечиваемым в них условиям /температура, влажность, чистота воздуха, освещенность, звуко- и виброизоляция, защита от излучений магнитного, электрического и других физических полей, параметры всех питающих сетей/ требованиям применяемых методик испытаний, санитарным нормам и правилам, требованиям безопасности труда и охраны окружающей среды.

4.2.3.3. Доступ к месту проведения испытаний, а также условия допуска в помещения лиц, не относящихся к персоналу данной лаборатории, должны контролироваться.

4.2.4. Испытательное оборудование и средства измерений

4.2.4.1. Испытательная лаборатория должна иметь оборудование, необходимое для проведения испытаний и средства измерений всех параметров, определенных областью аккредитации. Испытательное оборудование и средства измерений должны отвечать требованиям нормативных документов на методы испытаний, на соответствие которым аккредитуется лаборатория. При необходимости должна быть предусмотрена, подтверждаемая документально, возможность использования аттестованного испытательного оборудования и поверенных средств измерений других организаций на основе заключенных договоров.

4.2.4.2. Все оборудование и средства измерений должны содержаться в условиях, обеспечивающих их сохранность и защиту от повреждений и преждевременного износа. Для оборудования,

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требующего периодического технического обслуживания, должны быть разработаны и утверждены инструкции и графики по техническому обслуживанию, а также графики поверок.

4.2.4.3. Неисправное испытательное оборудование и средства измерений должны сниматься с эксплуатации и маркироваться соответствующим образом, указывающим на их непригодность для выполнения своих функций.

4.2.4.4. Каждая единица испытательного оборудования и средства измерений должна быть зарегистрирована. Регистрационный документ /лист, карта и др./ на каждую единицу должен включать следующие сведения:

- наименование и вид;
- предприятие-изготовитель /фирма/, тип /марка/, заводской и инвентарный номера;
- дату изготовления, дату получения и ввода в эксплуатацию;
- состояние при покупке /новый, бывший в употреблении, после ремонта и т.п./;
- место расположения /при необходимости/;
- данные о неисправностях, ремонтах и техобслуживании;
- данные о поверках.

4.2.4.5. Все испытательное оборудование и средства измерений должны быть аттестованы и поверены. Порядок аттестации и поверки в испытательной лаборатории должен быть документально оформлен. Порядок поверки прибора должен соответствовать требованиям, установленным действующими нормативными документами.

4.2.5. Методы испытаний и процедуры.

4.2.5.1. Аккредитованная испытательная лаборатория должна располагать актуализированной документацией, включающей:

- документы, устанавливающие технические требования к испытываемой продукции и методы ее испытаний - стандарты и технические условия, в том числе международные стандарты /правила, технические рекомендации и т.п./;

- документы, устанавливающие программы и методы проведения испытаний закрепленной продукции в данной аккредитованной лаборатории. Нестандартизованные методики испытаний должны быть аттестованы в установленном порядке;

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- документы, касающиеся обеспечения поддержания в надлежащем состоянии испытательного оборудования и средств измерений: графики поверки применяемых средств измерений и аттестации испытательного оборудования, паспорта на них, методики аттестации испытательного оборудования и методики поверки нестандартизованных средств измерений, эксплуатационную документацию на применяемые средства измерений;

- документы, определяющие систему хранения информации и результатов испытаний /протоколов, рабочих журналов, отчетов и т.п./.

4.2.5.2. В лаборатории должны быть установлены и документально оформлены процедуры, обеспечивающие актуальность и наличие на рабочих местах инструкций, нормативных документов, руководств и других документов, связанных с обеспечением качества испытаний, охраны труда и ведения документации.

4.2.5.3. Все расчеты и передача результатов испытаний должны подвергаться соответствующей проверке.

4.2.5.4. Если результаты испытаний получены с помощью системы электронной обработки данных, то надежность системы должна исключать возможность их искажения. Система должна иметь возможность обнаруживать неисправности вычислительной техники во время выполнения вычислений для принятия соответствующих мер.

4.2.6. Система обеспечения качества

4.2.6.1. Испытательная лаборатория должна иметь систему обеспечения качества, соответствующую ее деятельности и об"ему выполняемых работ.

4.2.6.2. Лицо или лица, отвечающие за обеспечение качества работ, должны назначаться руководителем лаборатории.

4.2.6.3. Документация на элементы системы обеспечения качества должна быть включена в "Руководство по качеству испытательной лаборатории", которым должны пользоваться сотрудники лаборатории. Руководство по качеству должно содержать комплексное описание лаборатории и организации работ по испытаниям. Если какая-либо информация непосредственно не включена в руководство по качеству, а отражена в других документах, то в этом

случае в руководстве по качеству должна быть помещена ссылка на эти документы. Ведение руководства по качеству возлагается на ответственного сотрудника лаборатории.

Руководство по качеству должно разрабатываться с учетом рекомендаций Руководства ИСО/МЭК 49.

4.2.6.4. Руководство лаборатории должно периодически проводить внутренние проверки системы обеспечения качества с целью обеспечения эффективности ее функционирования. Такие проверки должны регистрироваться с подробной записью корректирующего действия.

4.2.7. Испытываемые изделия и продукция

4.2.7.1. Обозначение образцов изделий и продукции, предназначенных для испытаний, должно осуществляться путем документального оформления или маркировки.

4.2.7.2. Образцы изделий и продукции должны быть идентифицированными на соответствие технической документации и должны сопровождаться соответствующим протоколом отбора, подписанным уполномоченным лицом органа по сертификации конкретной продукции.

4.2.7.3. При наличии требований к особым условиям хранения образцов должен быть установлен порядок и процедуры контроля условий хранения, которые должны документироваться в установленном порядке.

4.2.7.4. В лаборатории должны быть установлены правила, определяющие порядок приемки, хранения, возвращения заявителю образцов испытываемых изделий и продукции.

4.2.8. Регистрация результатов испытаний и хранения документов

4.2.8.1. Испытательная лаборатория должна иметь систему регистрации данных об испытаниях, обеспечивающую:

- регистрацию результатов первоначальных измерений и их прослеживаемость;

- регистрацию расчетов и других данных;

- указание лиц, получивших образец, готовивших его к испытанию и проводивших испытания и измерения;

- хранение документации на методы испытаний, отчетов о проверках и техническом обслуживании оборудования, а также документов, содержащих зарегистрированную информацию об испытаниях

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/в том числе протоколы и отчеты об испытаниях/ с указанием сроков их хранения.

4.2.8.2. Срок хранения документов с результатами испытаний на безопасность не ограничивается.

4.2.8.3. Об"ем и содержание зарегистрированной информации об испытаниях, предназначенной для хранения, должны обеспечивать возможность сопоставления результатов испытаний при повторном их проведении.

4.2.8.4. Условия хранения всей документации должны обеспечивать ее сохранность в течение установленного срока и, при необходимости, конфиденциальность.

4.2.8.5. Должна быть обеспечена юридическая правомерность документального оформления на всех стадиях регистрации и выдачи результатов испытаний / исключение исправлений, идентификация подписей, печати, даты и др./.

4.2.9. Права и обязанности

4.2.9.1. Аккредитованная испытательная лаборатория имеет право:

- указывать в рекламных материалах, в различных документах /в том числе содержащих результаты испытаний/, что она аккредитована в Системе;
- совместно с органом по сертификации определять конкретные сроки проведения испытаний сертифицируемой продукции;
- устанавливать форму протокола испытаний;
- заключать с другими лабораториями субподрядные договоры на проведение конкретных испытаний /в области аккредитации/ при условии, что эти лаборатории аккредитованы в Системе на проведение этих же испытаний.

Примечания. 1. Об"ем работ по субподряду должен составлять не более 25% от общего об"ема работ по испытаниям, выполняемых аккредитованной лабораторией-заказчиком /в области аккредитации/.
2. При аккредитации испытательной лаборатории могут быть установлены лимиты на об"емы выполняемых ею работ по субподряду /в области аккредитации/.
3. В документах, содержащих результаты испытаний, должны быть четко выделены результаты, которые получены субподрядчиком.
4. Лаборатория-заказчик несет полную юридическую ответственность за все работы, выполненные по субподряду в области аккредитации.

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4.2.9.2. Аккредитованная лаборатория в соответствии с статусом аккредитации обязана:

- поддерживать соответствие требованиям аккредитации, установленным настоящим документом;
- обеспечивать достоверность, об"ективность и требуемую точность результатов испытаний;
- принимать на испытания для целей сертификации только образцы, идентифицированные на соответствие технической документации на них;
- заявлять об аккредитации только по тем испытаниям, которые входят в область аккредитации;
- вести учет всех пред"являемых претензий по результатам испытаний;
- информировать органы, поручившие лаборатории проведение испытаний продукции, о результатах испытаний;
- не использовать права аккредитованной лаборатории по истечении срока действия аттестата аккредитации;
- своевременно оплачивать расходы, связанные с проведением инспекционного контроля.

4.2.9.3. Аккредитованная лаборатория по отношению к Национальному органу по сертификации обязана:

- обеспечить доступ в соответствующие помещения для проверки соответствия лаборатории требованиям аккредитации и/или/ наблюдения за проведением работ по испытаниям, предоставлять возможность ознакомления с результатами внутрилабораторных проверок системы обеспечения качества испытаний или проверок на качество проведения испытаний;
- участвовать в проведении работ по зарубежному и/или/ международному признанию аккредитованных лабораторий и/или/ Системы в целом;
- проводить испытания для проверки технической компетентности при инспекционном контроле;*
- предоставлять, при необходимости, по согласованию с заказчиком образцы испытываемой продукции для проведения их сличительных испытаний в других лабораториях*;
- принимать участие, при необходимости, в сличительных испытаниях*;

* Оплата производится по договоренности сторон

- согласовывать с Национальным органом по сертификации изменения в статусе, а также уведомлять его об изменениях в структуре, технической оснащенности, в стандартах и иных нормативных документах, которые могут повлиять на погрешность, об"ективность и достоверность результатов испытаний или на область деятельности лаборатории, признанной при аккредитации;

- предоставлять отчеты о своей деятельности.

4.2.9.4. Аккредитованная лаборатория по отношению к заявителю обязана:

- предоставлять заявителю возможность наблюдения за проводимыми для него испытаниями;

- соблюдать установленные и/или/ согласованные сроки проведения испытаний;

-уведомлять заявителя о намерениях поручить проведение части испытаний другой аккредитованной лаборатории и проводить их только с его согласия;

- обеспечивать конфиденциальность информации о результатах испытаний продукции.

4.2.10. Испытательная лаборатория обязана регистрировать и хранить информацию о компетентности других лабораторий, проводивших для нее работы по субподряду, а также вести регистрацию всех этих работ.

4.2.11. Руководитель аккредитованной испытательной лаборатории утверждает протоколы испытаний и несет ответственность за необ"ективность и недостоверность результатов испытаний. При проведении испытаний для целей сертификации лабораторией, аккредитованной только на техническую компетентность, протоколы испытаний утверждаются также представителем органа по сертификации, поручившим лаборатории эти испытания.

Утверждающая подпись должна быть заверена печатью.

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5. ПОРЯДОК АККРЕДИТАЦИИ ИСПЫТАТЕЛЬНЫХ ЛАБОРАТОРИЙ

Order of Accreditation of Labs

5.1. Аккредитация предусматривает следующие этапы:

Stages:
1) Application
2) Reviewing documents
3) Lab inspection
4) Approval of Lab documents + tests

- заявление на аккредитацию;
- экспертиза поданных документов;
- проверка испытательной лаборатории /центра/;
- принятие решения об аккредитации по результатам проверки

лаборатории /центра/;

- оформление, регистрация и выдача аттестата аккредитации.

Каждый последующий этап выполняется при положительных результатах предыдущего.

5.2. Заявка на аккредитацию испытательной лаборатории подается в Национальный орган по сертификации по форме указанной в приложении Б.

Одновременно с заявкой направляются следующие документы:

- Проект Положения об аккредитованной испытательной лаборатории /центра/. Форма титульного листа приведена в приложении В;

- Руководство по качеству испытательной лаборатории /центра/, форма титульного листа приведена в приложении Д;

- Паспорт испытательной лаборатории /центра/, в соответствии с приложением Е;

- заполненная анкета-вопросник в соответствии с приложением Ж;

- Проект области аккредитации испытательной лаборатории в соответствии с приложением И.

Национальный орган по сертификации может делегировать право проведения аккредитации испытательных лабораторий /центров/ органу по сертификации продукции.

5.3. Национальный орган по сертификации регистрирует заявку и организует проведение экспертизы документов.

5.4. После проведения экспертизы представленных документов и принятия решения о продолжении работ по аккредитации формируется комиссия по проверке лаборатории -далее - комиссия/. В состав комиссии включаются представители изготовителей, обществ потребителей, научно-исследовательских организаций и территориальных органов Госстандарта Украины с привлечением экспертов-аудиторов Системы.

Комиссия назначается приказом Председателя Госстандарта Украины.

5.5. Проверка испытательной лаборатории /центра/ осуществляется по программе, утверждаемой в Национальном органе по сертификации.

В процессе проведения проверки могут быть проведены испытания по определению одного или более показателей испытываемой продукции.

5.6. По результатам проверки комиссия составляет акт по форме приложения К.

5.7. Решение об аккредитации лаборатории принимается после рассмотрения в Национальном органе по сертификации всей полученной информации о состоянии лаборатории и результатов ее проверки. Аккредитованная лаборатория вносится в Реестр Системы и ей выдается аттестат аккредитации по форме приложения Л /если она аккредитована на техническую компетентность и независимость/ и по форме приложения М /если она аккредитована только на техническую компетентность/ с приложением области аккредитации по форме приложения И.

Аттестат выдается не более, чем на три года.

5.8. За 6 месяцев до окончания срока действия аттестата аккредитации лаборатория, имеющая намерение продлить действие аккредитации, направляет заявку в соответствии с требованиями, установленными в п.5.2.

Порядок повторной аккредитации устанавливается в зависимости от результатов инспекционного контроля и она может проводиться по полной или сокращенной процедуре.

5.9. Расширение области аккредитации

5.9.1. Аккредитованная лаборатория, претендующая на расширение своей области аккредитации, направляет заявку по форме приложения Б.

К заявке прилагаются:

- сведения о дополнительной области аккредитации /по форме приложения И/;
- дополнения к Паспорту /по формам приложения Е/.

5.9.2. Аккредитация может проводиться либо по полной, либо по сокращенной процедуре. Степень сокращения устанавливается в каждом конкретном случае.

6. ИНСПЕКЦИОННЫЙ КОНТРОЛЬ ЗА ДЕЯТЕЛЬНОСТЬЮ АККРЕДИТОВАННЫХ ЛАБОРАТОРИЙ

6.1. Инспекционный контроль за деятельностью аккредитованных испытательных лабораторий осуществляет Национальный орган по сертификации или по его поручению - территориальные органы по стандартизации и метрологии Госстандарта Украины и проводится путем:

- периодических проверок деятельности лаборатории;
- присутствия в аккредитованной лаборатории представителей, назначенных Госстандартом Украины;
- предоставления лабораторией регулярной информации о качестве проводимых ею испытаний: данных о сличительных испытаниях /если таковые осуществляются/, о результатах периодических собственных внутренних проверок системы обеспечения качества испытаний, о претензиях клиентов лаборатории и т.д.;
- сбора и анализа информации от организаций, осуществляющих общественный и государственный контроль за качеством продукции;
- любых других действий контрольного характера, которые могут обеспечить уверенность в том, что лаборатория в течение срока действия аттестата аккредитации постоянно обеспечивает соответствие требованиям, пред"являемым к ней при аккредитации.

6.2. Условия инспекционного контроля для каждой конкретной лаборатории определяются при принятии решения по аккредитации лаборатории и его проведение оформляется дополнительным соглашением к договору по аккредитации или отдельным договорам.

7. ПРИОСТАНОВЛЕНИЕ И АННУЛИРОВАНИЕ АККРЕДИТАЦИИ ЛАБОРАТОРИИ

7.1. Аккредитация лаборатории может быть досрочно приостановлена или отменена в следующих случаях:

- несоответствия лаборатории требованиям, пред"являемым к аккредитованной лаборатории;
- самостоятельного решения аккредитованной лаборатории о досрочном прекращении действия аккредитации.

7.2. Лаборатория может в течение 15 дней опротестовать решение по любым вопросам аккредитации в Комиссии по апелляциям Госстандарта Украины.

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Приложение А
/справочное/

ПРИМЕРНЫЙ ПЕРЕЧЕНЬ ДОКУМЕНТОВ, КОТОРЫМИ ДОЛЖНА РАСПОЛАГАТЬ АККРЕДИТОВАННАЯ ЛАБОРАТОРИЯ /ВКЛЮЧАЯ ДОКУМЕНТЫ ОРГАНИЗАЦИИ, В КОТОРУЮ ВХОДИТ ЛАБОРАТОРИЯ В КАЧЕСТВЕ СТРУКТУРНОГО ПОДРАЗДЕЛЕНИЯ/

I. ПРАВОВАЯ ДОКУМЕНТАЦИЯ

Положение об испытательной лаборатории.

Паспорт испытательной лаборатории.

Аттестат аккредитации.

2. ОРГАНИЗАЦИОННО-МЕТОДИЧЕСКАЯ ДОКУМЕНТАЦИЯ

Комплект организационно-методических документов Системы сертификации УкрСЕПРО.

Документы ИСО, ИСО/МЭК, стандарты серии EN 45000, регламентирующие организационные и методические вопросы аккредитации и деятельности аккредитованных лабораторий.

3. НОРМАТИВНО-ТЕХНИЧЕСКАЯ ДОКУМЕНТАЦИЯ НА ИСПЫТЫВАЕМУЮ ПРОДУКЦИЮ

Документация, регламентирующая технические требования к испытываемой продукции и методы ее испытаний и измерений в области аккредитации лаборатории, стандарты и другая нормативная документация, стандарты и Руководства ИСО, МЭК и др.

4. ДОКУМЕНТАЦИЯ НА СИСТЕМУ ОБЕСПЕЧЕНИЯ КАЧЕСТВА

"Руководство по качеству испытательной лаборатории"

5. ДОКУМЕНТАЦИЯ НА СРЕДСТВА ИСПЫТАНИЙ

Регистрационные документы на оборудование /журнал, карты, листы и пр./, включающие следующие сведения:

наименование и вид оборудования;

предприятие-изготовитель /фирма/, тип /марка/, заводской и инвентарный номера;

дата изготовления, получения и ввода в эксплуатацию оборудования;

состояние при покупке /новое, бывшее в употреблении, после ремонта и т.п./;

данные об имеющихся неисправностях, ремонтах, техобслуживании;

данные об аттестации и поверках;

документы по эксплуатации и техническому обслуживанию испытательного оборудования и средств измерений;

паспорт на каждую единицу испытательного оборудования и средств измерений;

методики проведения поверок средств измерений, а также "Программы и методики аттестации испытательного оборудования";

порядок аттестации и утверждения нестандартизованных методик испытаний и измерений;

документы по учету поверок средств измерений и аттестации испытательного оборудования;

графики аттестации испытательного оборудования и поверок средств измерений.

6. ДОКУМЕНТАЦИЯ ПО ПЕРСОНАЛУ ЛАБОРАТОРИИ

Личные дела сотрудников лаборатории.

Должностные инструкции.

Материалы по аттестации сотрудников лаборатории.

7. ДОКУМЕНТАЦИЯ НА ИСПЫТЫВАЕМЫЕ ОБРАЗЦЫ ИЗДЕЛИЙ

Технические условия, стандарты, ссылки на которые имеются в технических условиях.

Паспорт, технические описания и руководства по эксплуатации на испытываемые изделия.

Инструкции, содержание;

порядок идентификации образцов изделий;

порядок проверки комплектности и работоспособности образцов при их приемке;

требования к комплектности документов на образцы изделий;

порядок хранения образцов;

порядок возврата образцов изделий заказчику.

8. ДОКУМЕНТАЦИЯ НА ПОРЯДОК ПРОВЕДЕНИЯ ИСПЫТАНИЙ И РЕГИСТРАЦИИ ДАННЫХ

Программы и методики проведения испытаний.

Документы, содержащие порядок расчетов и расчетные данные.

Рабочие журналы, содержащие результаты испытаний и измерений.

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Продолжение приложения А

Протоколы испытаний.
Отчеты о проведенных испытаниях.
Инструкция по охране труда и технике безопасности.

9. ДОКУМЕНТАЦИЯ ПО ПОДДЕРЖАНИЮ УСЛОВИЙ В ПОМЕЩЕНИЯХ

Инструкция по обеспечению должного порядка в производственных помещениях.
Журнал контроля состояния окружающей среды в помещениях.
Эксплуатационная документация на оборудование, контролирующее и/или/ поддерживающее необходимые условия окружающей среды в помещениях.

10. ДОКУМЕНТАЦИЯ ПО АРХИВУ

Инструкция по порядку ведения архива данных измерений и испытаний, рабочих журналов, расчетных данных, протоколов, отчетов, сопроводительных документов к образцам и т.д.

Приложение Б
/обязательное/

Председателю
Госстандарта Украины

З А Я В К А

Прошу аккредитовать _____
/наименование лаборатории/
в Системе сертификации УкрСЕПРО на _____
/указывается аккредитация
_____
на техническую компетентность и независимость или только на
_____.
техническую компетентность/

_____ обязуется:
/наименование лаборатории/

отвечать требованиям аккредитованной испытательной лаборатории;
оплачивать все расходы, связанные с проведением оценки и решением административных вопросов на этапе, предшествующем аккредитации, независимо от положительного решения по аккредитации или отказа в ней.

Приложения: Проект "Положения об аккредитованной испытательной лаборатории;
Паспорт испытательной лаборатории;
Руководство по качеству испытательной лаборатории;
Заполненная анкета-вопросник;
Проект области аккредитации.

М.П.

_____
/подпись, инициалы, фамилия руководителя/

_____
/подпись, инициалы, фамилия гл.бухгалтера/

" " _____ 199__г.

ОЗНАКОМЛЕН
Руководитель территориального
органа Госстандарта Украины

_____
/подпись/

Приложение В
/обязательное/

СИСТЕМА СЕРТИФИКАЦИИ УкрСЕПРО

УТВЕРЖДАЮ*
Руководитель _____
_____
" " _____ 199__ г.
М.П.

УТВЕРЖДАЮ
Председатель Госстандарта Украины
_____
" " _____ 199__ г.
М.П.

П О Л О Ж Е Н И Е

об испытательной лаборатории /центре/

_____
/наименование лаборатории /центра/

аккредитованной Госстандартом Украины _____
_____
/указывается на техническую компетентность и независимость или
_____
только на техническую компетентность/

Начальник Управления сертификации Госстандарта Украины
_____
/подпись, инициалы и фамилия/
" " _____ 199__ г.

Руководитель испытательной лаборатории /центра/
_____
/подпись, инициалы и фамилия/
" " _____ 199__ г.

* Если испытательная лаборатория /центр/ не является юридическим лицом, а входит в состав организации как структурное подразделение, то документ утверждается также руководителем этой организации.

Приложение Д
/рекомендуемое/

УТВЕРЖДАЮ
Руководитель испытательной лаборатории /центра/
_____
/подпись/

РУКОВОДСТВО ПО КАЧЕСТВУ

_____
/наименование испытательной лаборатории /центра/

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102

Приложение Е
/рекомендуемое/

_____
/наименование предприятия, организации/

УТВЕРЖДАЮ[x]
Руководитель _____
_____
"___"_____199__ г.
М.П.

П А С П О Р Т
испытательной лаборатории /центра/

_____
/наименование испытательной лаборатории /центра/

Руководитель
испытательной лаборатории
/центра/
_____
/подпись, инициалы и фамилия/
"___"_____199__ г.
М.П.

[x] Если испытательная лаборатория не является юридическим лицом, а входит в состав организации как структурное подразделение, то документ утверждается руководителем этой организации

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Продолжение приложения Е

Форма I

Наименование и почтовый адрес аккредитованной испытательной лаборатории.

Наименование и почтовый адрес организации, код ОКПО, в составе которой функционирует аккредитованная испытательная лаборатория.

Фамилия, имя, отчество, должность, телефон руководителя организации.

Фамилия, имя, отчество, должность, телефон руководителя аккредитованной испытательной лаборатории.

Расчетный счет: _____
_____

Продолжение приложения Е

Форма 2

1. НОМЕНКЛАТУРА ПРОДУКЦИИ, ИСПЫТЫВАЕМОЙ ЛАБОРАТОРИЕЙ

Наименование испытываемой продукции	Код ОКП /шифр/	Обозначение нормативных документов на продукцию x/

2. ВИДЫ ИСПЫТАНИЙ, ПРОВОДИМЫХ ЛАБОРАТОРИЕЙ

Наименование видов испытаний	Обозначение нормативных документов на методы испытаний x/

x/ Наименования нормативных документов приводятся в форме 7.

Форма 3

ОСНАЩЕННОСТЬ ИСПЫТАТЕЛЬНЫМ ОБОРУДОВАНИЕМ /ИО/

Наименование испытательного оборудования /ИО/, тип /марка/, заводской, инвентарный номер	Наименование испытаний и /или/ определяемых характеристик /параметров/ продукции	Изготовитель /страна, предприятие, фирма/	Основные технические характеристики	Год ввода в эксплуатацию	Степень амортизации %	Аттестованность аттестация	Примечание
1	2	3	4	5	6	7	8

Примечание: Форма заполняется по разделам:

Раздел 1. Серийно выпускаемое ИО общепромышленного применения;

Раздел 2. Серийно выпускаемое ИО отраслевого применения;

Раздел 3. Нестандартизованное ИО;

Раздел 4. Передвижные /транспортируемые/ средства измерений;

Раздел 5. Уникальное ИО;

Раздел 6. Сооружения испытательные

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104

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Форма 4

СВЕДЕНИЯ О СРЕДСТВАХ ИЗМЕРЕНИЙ /СИ/ ДЛЯ ИСПЫТАНИЙ ПРОДУКЦИИ

Наименование СИ, тип /марка/ заводской, инвентарный номер	Наименование определяемых /измеряемых/ характеристик /параметров/ продукции x	Изготовитель /страна, предприятие, фирма/	Основные технические характеристики /диапазон измерений, погрешность/	Год ввода в эксплуатацию	Периодичность поверки	Степень амортизации %	Примечание
I	2	3	4	5	6	7	8

Примечание. Сведения представляются по следующим группам:

- серийно выпускаемые СИ общепромышленного применения;
- серийно выпускаемые СИ отраслевого применения;
- СИ нестандартизованные и специального применения /средства измерений, предназначенные для измерений в данной испытательной лаборатории и /или/ изготовленные в единичных экземплярах/

x В соответствии с областью аккредитации.

Форма 5

СВЕДЕНИЯ О СРЕДСТВАХ ИЗМЕРЕНИЙ /СИ/ ДЛЯ АТТЕСТАЦИИ ИСПЫТАТЕЛЬНОГО ОБОРУДОВАНИЯ

Наименование испытательного оборудования	Наименование документа на методы аттестации оборудования	Диапазон и точность измерений	Наименование СИ, тип /марка/	Изготовитель, страна, заводской, инвентарный номер	Технические характеристики	Год изготовления	Периодичность поверки	Примечание
I	2	3	4	5	6	7	8	9

Примечание. Сведения представляются по следующим группам:

- серийно выпускаемые СИ общепромышленного применения;
- серийно выпускаемые СИ отраслевого применения;
- СИ нестандартизованные и специального применения.

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Форма 6

ОСНАЩЕННОСТЬ СТАНДАРТНЫМИ ОБРАЗЦАМИ /КОНТРОЛЬНЫМИ ЭТАЛОНАМИ/ ПРИ АНАЛИТИЧЕСКОМ КОНТРОЛЕ

Назначение применяемых стандартных образцов /градуировка приборов, контроль правильности результатов измерений, аттестация образцов других категорий/	Обозначение и наименование нормативного документа, в котором установлено применение стандартных образцов	Наименование и номер образца	Кем утвержден, когда	Аттестованные характеристики	Погрешность установления аттестованных характеристик	Срок годности	Степень обеспеченности	Наличие свидетельств	Примечание
1	2	3	4	5	6	7	8	9	10

Примечание: 1. В графе 4 указывается уровень утверждения стандартного образца /государственный, отраслевой, предприятия/ и для двух последних категорий - кем утвержден и когда.

Графу заполняют на основании свидетельства.

2. В графе 8 указывают сроки, в течение которых обеспечиваются потребности предприятия в стандартных образцах, при условии применения их в полном соответствии с требованиями нормативного документа.

Форма 7

ПЕРЕЧЕНЬ

нормативной документации, устанавливающей требования к испытываемой продукции и методы ее испытаний

Обозначение нормативного документа	Наименование нормативного документа	Кем и когда утвержден документ, дата введения в действие
1	2	3

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Форма 8

КАДРОВЫЙ СОСТАВ СОТРУДНИКОВ, ПРОВОДЯЩИХ ИСПЫТАНИЯ

Ф.И.О.	Должность	Образование	Проводимые виды испытаний	Периодичность аттестации	Примечание
I	2	3	4	5	6

Примечание. В форме, кроме сотрудников аккредитованной лаборатории, следует указать сотрудников других подразделений, привлекаемых для участия в испытаниях /об этом делается отметка в графе 6/.

Форма 9

СОСТОЯНИЕ ПРОИЗВОДСТВЕННЫХ ПОМЕЩЕНИЙ

Назначение помещения /в т.ч. виды проводимых испытаний/	Специальное или приспособленное	Площадь	Температура и влажность, °С, %	Освещенность на рабочих местах	Уровень загазованности	Уровень шума	Уровень помех	Наличие спец. оборуд. /вентил. защиты от помех и т.д./	Удобство доставки об"ектов испытаний	Условия приемки и хранения образцов	Примечание
I	2	3	4	5	6	7	8	9	10	II	I2

Приложение Ж
/рекомендуемое/

АНКЕТА-ВОПРОСНИК
с данными о состоянии испытательной лаборатории

I. Испытательная лаборатория, претендующая на аккредитацию:
Наименование:
Адрес:
Телефон: Телекс: Факс:

2. Организация или предприятие, которому подчинена испытательная лаборатория:
Наименование:
Адрес:
Телефон: Телекс: Факс:

3. Лицо, ответственное за данную анкету:
Фамилия, имя, отчество:
Должность:
Телефон: Телекс: Факс:

4. Лицо, ответственное за связь с Госстандартом Украины:
Фамилия, имя, отчество:
Должность:
Телефон: Телекс: Факс:

5. Министерство /ведомство/:

6. Руководящий состав и структура

6.I. Фамилия и должности ответственных руководителей испытательной лаборатории и организации, которой она подчиняется:

6.2. Фамилия и должность лица, ответственного за систему обеспечения качества испытательной лаборатории:

6.3. Фамилия и должность лица, ответственного за связь с другими организациями и его помощники:

6.4. Подразделения испытательной лаборатории, представляемые на аккредитацию /указываются на отдельном листе, прилагаемом в форме перечня или организационной структуры испытательной лаборатории/.

7. Сотрудники

7.I. Общее количество сотрудников испытательной лаборатории, представившей заявку на аккредитацию.

7.2. Количество квалифицированных сотрудников в предлагаемой области аккредитации.

8. Оборудование.

8.I. На отдельном листе составляется перечень основного испытательного оборудования, используемого в заявляемой области аккредитации. Допускается ссылка на паспорт лаборатории.

Указать виды испытаний, производимые субподрядчиком в заявляемой области аккредитации.

9. Прочая информация

9.I. Указать, при необходимости, методы обеспечения связи испытательной лаборатории с другими организациями или органами.

I0. Политика в области управления качеством

	Да/Нет	Представление подробной информации/при необходимости/
I0.I. Является ли политика и процедуры функционирования испытательной лаборатории составной частью "Руководства по качеству"?		
I0.2. Назначен ли сотрудник, ответственный за управление качеством, правами, позволяющими ему определять проблемы в области качества и находить эффективные средства их решения?		
I0.3. Включает ли "Руководство по качеству" процедуры, предусматривающие надзор за кадрами с недостаточным уровнем квалификации?		
I0.4. Разработана ли процедура контроля функций управления качеством?		

II. Инструкция

II. I. Имеются ли в распоряжении сотрудников руководства, инструкции и правила, регламентирующие проведение работы?

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	Да/Нет	Представление подробной информации /при необходимости/
11.2. Разработана ли система актуализации, применения документации и регистрации изменений?		
11.3. Имеется ли в наличии документация на каждую операцию по испытаниям?		
12. Кадры		
12.1. Проводится ли подготовка кадров для совершенствования и поддержки профессионального уровня?		
13. Оборудование для испытаний и поверка средств измерений		
13.1. Устанавливает ли система управления качеством совместимость степени точности средств испытаний с требованиями нормативных документов на испытания.		
13.2. Регистрируется ли все испытательное оборудование и средства измерений, включая результаты аттестации и поверки?		
13.3. Имеются ли помещения и соответствующие условия для аттестации, поверки, транспортировки, контроля, хранения и обслуживания всего испытательного оборудования и средств измерений?		
13.4. Имеются ли документы на процедуры, обеспечивающие аттестацию и поверку средств испытаний?		
13.5. Могут ли быть соотнесены используемые для поверки контрольные эталоны /стандартные образцы/ с национальными или международными эталонами /образцами/ измерений?		

	Да/Нет	Представление подробной информации /при необходимости/
14. Методы испытаний		
14.1. Аттестованы ли методы испытаний и процедуры, не указанные в технических условиях, стандартах и т.п.?		
14.2. Обеспечивают ли условия проведения испытаний точность их проведения и регистрации результатов?		
14.3. Контролируется ли доступ к месту проведения испытаний?		
14.4. Имеется ли система, обеспечивающая выявление ошибок и их причин при проведении испытаний и устранение получения ошибочных результатов?		
15. Транспортировка и хранение		
15.1. Разработаны ли инструкции по транспортировке, хранению и возврату материалов, изделий заказчику?		
15.2. Предусмотрены ли специальные складские помещения, предупреждающие порчу продукции?		
15.3. Разработаны ли процедуры контроля хранящихся образцов?		
15.4. Организован ли доступ к складским помещениям только лицам, имеющим специальное разрешение?		
15.5. Разработаны ли меры, предусматривающие соответствующую идентификацию и этикетирование всех образцов, подлежащих испытаниям, хранению или возврату заказчику?		
16. Архивы.		

109

	Да/Нет	Представление подробной информации /при необходимости
16.1. Существует ли система, устанавливающая сдачу в архив документации о результатах проведенных испытаний?		
16.2. Хранятся ли в архиве результаты анализов и расчетов, входящие в протокол испытаний?		
16.3. Разработаны ли меры, обеспечивающие актуализацию документов и их секретное хранение, если это требуется?		

17. Протоколы испытаний

17.1 Содержат ли протоколы испытаний всю необходимую информацию в соответствии с требованиями нормативных документов на испытания?

17.2. Может ли испытательная лаборатория при необходимости рассылать копии протоколов испытаний на строго конфиденциальной основе?

18. Готовность к проведению аккредитации

18.1. Когда испытательная лаборатория будет готова к проведению проверки?

18.2. Есть ли необходимость в срочном проведении проверки?

Если да, то укажите причины.

Фамилия заявителя_____

Подпись лица, имеющего право подписи от имени заявителя

_____ /должность/

Дата _____

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Приложение Н
/обязательное/

Приложение к аттестату аккредитации
№ _____
от _____

ОБЛАСТЬ АККРЕДИТАЦИИ ИСПЫТАТЕЛЬНОЙ ЛАБОРАТОРИИ

_____
/наименование испытательной лаборатории/

Наименование продукции	Код ОКП	Обозначение НТД, регламентирующего требования к продукции	Обозначение НТД на методы испытаний	Ограничения по показателям испытаний продукции
1	2	3	4	5

Примечания: 1. В графе 5 ограничения выражаются одним из трех определений:
без ограничений;
кроме показателей /перечисляются показатели/;
только по показателям /перечисляются показатели/.

2. Данный лист приложения заверяется печатью Госстандарта Украины.

ГОССТАНДАРТ УКРАИНЫ

Место Гербовой печати

_____ /_____/

Приложение К
/обязательное/

АКТ ПРОВЕРКИ ИСПЫТАТЕЛЬНОЙ ЛАБОРАТОРИИ /ЦЕНТРА/

_____
/наименование испытательной лаборатории /центра/

г._____ "___"_____199__г.

В период с "___"_____199__ г. по "___"_____199__ г.
на основании _____
/название, номер и дата документа о проведении
_____ комиссия в составе:
проверки/

Председатель комиссии _____
/место работы, должность, инициалы,фамилия/

Заместитель председателя комиссии _____
/место работы, должность, инициалы, фамилия/

Члены комиссии _____
/место работы, должность, инициалы, фамилия/

провела проверку с целью аккредитации _____
/наименование испытательной
_____
лаборатории, наименование организации, в составе которой
_____
функционирует испытательная лаборатория/

При проверке установлено /приводятся результаты проверки по разделам/:

1. Статус, организационная структура, административная подчиненность, финансовое положение, система оплаты труда сотрудников.

2. Оснащенность средствами испытаний и их состояние.

3. Обеспеченность нормативной и методической документацией, их учет и хранение.

4. Квалификация и опыт работы персонала, состояние проводимой работы по повышению квалификации.

5. Состояние производственных помещений.

6. Наличие и эффективность функционирования системы обеспечения качества испытаний.

7. _____.
/дополнительные характеристики лаборатории/

8. Замечания и рекомендации

Заключение: _____
/рекомендации комиссии в отношении аккредитации
_____
лаборатории и уточнения, при необходимости, области аккредитации/

Приложения: Проект "Положения об аккредитованной лаборатории";
Паспорт испытательной лаборатории;
Руководство по качеству;
Проект области аккредитации испытательной лаборатории, согласно приложения И;
Протоколы заседаний комиссии;
Протоколы испытаний,проведенных при проверке.

Председатель комиссии /подпись, инициалы,фамилия/

Заместитель председателя комиссии /подпись,инициалы,фамилия/

Члены комиссии /подпись,инициалы,фамилия/

С актом ознакомлен:

/подпись руководителя/ /инициалы, фамилия/

ГОСУДАРСТВЕННЫЙ КОМИТЕТ УКРАИНЫ ПО СТАНДАРТИЗАЦИИ, МЕТРОЛОГИИ И СЕРТИФИКАЦИИ /ГОССТАНДАРТ УКРАИНЫ/

СИСТЕМА СЕРТИФИКАЦИИ УкрСЕПРО

АТТЕСТАТ АККРЕДИТАЦИИ ИСПЫТАТЕЛЬНОЙ ЛАБОРАТОРИИ

Зарегистрирован в Реестре Системы сертификации УкрСЕПРО
"___"_____199__ г.
№ _____
Действителен до "___"
_____199__ г.

ГОССТАНДАРТ УКРАИНЫ УДОСТОВЕРЯЕТ, ЧТО _____
/наименование испытательной лаборатории,

_____ /адрес/ [| | | | | | |] код ОКПО

СООТВЕТСТВУЕТ ТРЕБОВАНИЯМ СИСТЕМЫ СЕРТИФИКАЦИИ УкрСЕПРО И АККРЕДИТОВАНА НА ТЕХНИЧЕСКУЮ КОМПЕТЕНТНОСТЬ И НЕЗАВИСИМОСТЬ.

Область аккредитации приведена в приложении к аттестату.

Место гербовой печати

ГОССТАНДАРТ УКРАИНЫ

_____ /адрес Госстандарта Украины/ _____ /должность, подпись, инициалы, фамилия/

КНД 50-004-93

Приложение Л /обязательное/

ГОСУДАРСТВЕННЫЙ КОМИТЕТ УКРАИНЫ ПО СТАНДАРТИЗАЦИИ, МЕТРОЛОГИИ И СЕРТИФИКАЦИИ /ГОССТАНДАРТ УКРАИНЫ/

СИСТЕМА СЕРТИФИКАЦИИ УкрСЕПРО

АТТЕСТАТ АККРЕДИТАЦИИ ИСПЫТАТЕЛЬНОЙ ЛАБОРАТОРИИ

Зарегистрирован в Реестре Системы сертификации УкрСЕПРО
"___"_____199__ г. № _____
Действителен до "___"_____199__ г.

ГОССТАНДАРТ УКРАИНЫ УДОСТОВЕРЯЕТ, ЧТО _____ [| | | | | | |]
/наименование испытательной лаборатории, код ОКПО

_____ адрес/

СООТВЕТСТВУЕТ ТРЕБОВАНИЯМ СИСТЕМЫ СЕРТИФИКАЦИИ УкрСЕПРО И АККРЕДИТОВАНА НА ТЕХНИЧЕСКУЮ КОМПЕТЕНТНОСТЬ.

Область аккредитации приведена в приложении к аттестату.

Место гербовой печати

ГОССТАНДАРТ УКРАИНЫ

_____ /адрес Госстандарта Украины/ _____ /должность, подпись, инициалы, фамилия/

КНД 50-004-93

Приложение И /обязательное/

Укрполиграфпрод 150 экз. 1658 13.07.93

Appendix C

Laboratory Evaluation Findings

and

Evaluation Forms

Appendix C

Findings of Laboratory Evaluations and Miscellaneous Meeting Notes

Organization of Findings and Associated Notes

This Appendix contains the evaluations for 11 environmental central governmental labs, a proposed private venture, and a food testing laboratory. Except for the food testing lab, the results of the other laboratory evaluations and associated meeting notes are presented with the best laboratory organizations presented first, followed by successively less capable labs. The food testing lab was evaluated to check whether food testing capabilities are better developed than environmental testing capabilities. The food laboratory was found to be one of the best laboratories, but it is presented last because we decided to focus on environmental capabilities.

The descriptions of each agency's mandates and laboratory's responsibilities are based on the claims made by Directors, Deputy Directors, and Laboratory Heads. There was not enough time to do the background work to verify most of these claims. The laboratory evaluation reports were based each laboratory's current capabilities, excluding non-functioning equipment. This is significant, because many laboratories contained test equipment that was poor quality when first purchased, and is now completely non-functional.

It should also be noted that none of the laboratories had programs for making test results available to the public. The evaluation team also found only one lab for the public to submit samples for testing, (the Committee for Geology's central lab). All of the laboratories send their test results to their superiors. A few of the laboratories share their results freely with other governmental environmental agencies. A few treat results as a commodity (property), only to be sold to other agencies. These characteristics are in Section C.2.-.9 for each lab.

The two best candidates for upgrading to world class standards were the **State Committee on Geology Central Laboratory** (Section C.2.2) and the **Ukrainian Academy of Sciences Institute for Colloid and Water Chemistry** (Section C.2.1).

Evaluation of the Ukrainian Academy of Sciences Institute of Colloid and Water Chemistry

Function and Scope of Mandate of the Laboratory and Agency
This agency is the head of the "state program for potable water" and the "Clean Water Program". It is charged by the Cabinet of Ministers to develop analytical laboratory testing for potable and waste water. They are currently working with 50 other agencies and 6 ministries on testing potable water, sewer water, and ground water. They are the official leader of the "Clean Water Program". As the head of the "Clean Water Program" and the "Potable Water Program", they coordinate the work of as many as 50 agencies. They are a recognized leader in the network of water testing laboratories, according to consistent comments made by the other laboratories we inspected. They are the only environmental analytical laboratory certified by the Committee for Standards.

Competence of Management
The laboratory has very vital, experienced, and effective management. They have had the foresight to change the scope of their operations in the last few years. Under the FSU, they had previously been a world leader in membrane chemistry, and also focused heavily on treatment of waste water. With the break-up of the FSU, they realized that environmental analytical work would be better funded, and shifted the focus of their efforts.

We observed that they are currently the most active group in coordinating analytical testing efforts between Ukrainian agencies. They also have had the foresight to have a training center "for the exchange of knowledge". The management has developed and maintained the best staff we observed.

They have a slightly dated knowledge of QA/QC practices, but they are committed to producing quality results. They raised the issues of nationwide lab quality problems, and are eager to "coordinate" a national quality program. Their two leaders (Nina Falendisch and Vladislav Goncharuk) had the broadest and best developed vision of a system for improving analytical testing nation-wide. Their analytical testing capabilities are fairly modern, better developed, and have broader variety than all of the other labs, excepting the State Committee of Geology's central lab.

Level of Equipment
They have an excellent variety of equipment, with the far and away the best water testing capabilities of the labs inspected. Most of the equipment is 5 to 10 years old, with a some newer equipment. They currently perform over 70 tests, (see Appendix H for a list of major tests). They also have adequate redundancy in most areas. The equipment included: (1) 3 HPLC's for: PAH's, substituted phenols, and aliphatic and aromatic amines; (2) GC's for a wide assortment of volatile, aromatic, chlorinated organics, and semivolatile organics; (3) a good GCMS for semivolatile mass spectral analyses; (4) excellent metals capabilities (world class) with: flame AA's, electrothermal atomization AA's, cold vapor AA's, and electro-chemical polarographic instruments for ultra low level determinations of labile metals; (5) excellent inorganic anion capabilities by Ion Chromatography and Ion Selective Electrodes; (6) infrared spectrophotometers for petroleum and special organic compound analyses; and (7) a "Bruker" fourier transform Nuclear Magnetic Resonance spectrometer (NMR). The equipment is well maintained and supported. They are also actively using their equipment.

Levels and Competence of Staff
They have the most highly qualified staff of all of the laboratories inspected, many with advanced degrees. The staff are very knowledgeable and eager to demonstrate the work they are doing. Staffing levels are good. Their scientists appeared busy with real work.

Level of Facilities
The level of facilities is good, but somewhat dated. They have lots of sample testing areas, but somewhat limited preparation areas. They also have very good exhaust hood availability, and the best level of refrigerators for storing samples and sample extracts.

Level of Quality Assurance Plan and Quality Control Measurements
Their QA program is good, but focused more on research and method development. Their

awareness of the need for QC measurements is the second best of all labs inspected. They are also the only environmental analytical laboratory certified by the Committee for Standards. This is significant because as noted in Section 2.1, this certification process is fairly rigorous, and is comparable to the world standard ISO 9000 program.

Major Problems Facing the Laboratory and Critical Factors for Success
In their view, improving the nation's analysis capabilities for environmental protection is their biggest problem. They are concerned about "spring and summer levels of pollution in the Dnipro River that exceed admissible levels by 10 to 100 fold". They are particularly concerned about "the outbreaks of cholera and diphtheria that result from the polluted water". Only after discussing these nationally important, broad issues, did they raise issues about their laboratories condition. They have the same difficulty in obtaining pure reagents and standards, but they have found a creative (but inefficient) solution. They purchase low quality stocks and purify them. They also have very specific instrumental needs of several lower priced screening instruments, and a few sophisticated pieces of equipment. Their choices for equipment were excellent, matching our estimates of the current gaps in their capabilities. They have no radiochemistry instruments, and did not raise the issue of trying to develop such capabilities.

Ability to Continue to Receive Samples and Remain Solvent
As an Institute within the Ukrainian Academy of Sciences, they have only 60% of their budget guaranteed. They have been successful at maintaining their current levels of capabilities, but do not have the ability on their own to raise funds to add the last few pieces of equipment required to meet world standards. Their strong management should continue to be able to get adequate funding to continue on their present course as a leader in Ukrainian analytical testing.

Ability to Cooperate with Other Agencies and Share Results
Their level of cooperation has been excellent, as described in Section C.2.1.2. As noted above, they not only participate in many cooperative ventures, but are a recognized leader in these ventures. They are often called upon to make recommendations to the cabinet level ministry Committee for Technology, Ecology, and Science.

Overall Conclusions
This laboratory is clearly the best fit with the stated goals of this project:

This is a large central laboratory that had the best qualities of all of the water laboratories inspected, see sections C.2.1.1-C.2.1.10.

It has the strongest, most vital management of all of the laboratories inspected.

With the addition of a few key pieces of equipment, it would meet world standards in environmental water testing capabilities.

It has consistently supported its existing equipment and personnel, and has demonstrated its ability and commitment to provide similar support for any future upgrades.

Their equipment needs can be adequately met by the current project budget ($580,000).

This cannot be said of any of the other labs inspected.

It has a proven reputation of successfully leading cooperative ventures with other agencies, yielding nationwide benefits.

It has a clear vision of the current environmental analytical laboratory problems, and has proposed viable solutions to these problems.

As an Institute in the Ukrainian Academy of Sciences, it could serve as an independent analytical testing expert, providing results to the regulatory agencies like the Ministry of Environmental Protection.

It is a recognized leader in producing high quality analytical results. Combined with its acknowledged theoretical and technical excellence, it would be accepted as a nation-wide leader in improving analytical capabilities.

All of these qualities, plus its training experience, also make it the best choice for developing and implementing a nation-wide Quality Assurance program to improve data quality at all analytical laboratories.

In light of these points, we heartily recommend that USAID fund the Ukrainian Academy of Sciences Institute of Colloid and Water Chemistry for upgrading of analytical instrumentation, and for developing and implementing a national quality assurance program.

Evaluation of the Committee for Geology Central Laboratory of Northern Ukrainian Geology

Function and Scope of Mandate of the Laboratory and Agency
This laboratory has no mandate that requires samples be sent to them, nor do they have any other guaranteed funding. This is an unusual laboratory, in that it supposedly has no other source of funding other than voluntarily samples sent by other agencies or private individuals. As such, this laboratory was the only one inspected that operates on a pure profit and loss basis. The Committee for Geology has responsibility for ground water, but this has not translated into guaranteed samples for their central laboratory. The laboratory's current functions are: (1) analyzing samples for small water districts, that do not have sophisticated test methods; (2) analyzing difficult or exotic samples that the other labs can't handle; (3) acting as an independent referee when the results from other labs don't agree; and (4) developing methods for unusual tests or unusual sample matrices.

Competence of Management
The laboratory has very vital and experienced management. This is a good laboratory with broader capabilities, (using obsolete equipment), than any other we inspected:

It has the broadest range of types equipment.
It does the largest variety of tests: metals, pesticides, radionuclides, polynuclear aromatic hydrocarbons, specialty organics by IR, and general chemistry. For example, they analyze

for 24 different pesticides, while most of the other labs only did 4-6 different pesticides.
It tests the largest variety of samples: surface water, ground water, sewer water, sediments, potable water, liquid and solid industrial wastes, industrial sludges, sediments, plant and animal tissue, and minerals and ores.
It has highly qualified staff and an excellent reputation among its peers in the analytical testing community.
It has more equipment and hence the largest capacity, as demonstrated by it's past sample through-put of 700,000 samples per year.

Unfortunately, due to its lack of guaranteed funding, it has not been able to improve its equipment for at least 15 years, and it has steadily lost market share and personnel, (down to 26 scientists from a previous high of 60 scientists). Even at 26 scientists it has more good personnel than all of the other labs inspected, except for the Institutes of Hydrobiology and Colloid and Water Chemistry.

Level of Equipment
This lab has an excellent variety of seriously outdated equipment. The equipment included: alpha and beta counters, 12 packed column GC's, 3 X-ray fluorescence spectrometers, two x-ray diffractometers, 7 flame AA's, 2 electro-thermal atomization AA's, 3 DC arc spectrometers, 2 flame photometers, a flame emission spectrometer, several multi-channel high resolution emission spectrometers, an automated aluminum analyzer, and a large number of balances. Most of the equipment was first-rate when purchased 20-40 years ago. The equipment has been well maintained by their staff of electronics experts.

Levels and Competence of Staff
They have a highly qualified staff, many with advanced degrees. The staff are very knowledgeable and eager to demonstrate the work they are doing. Staffing levels are declining due to a lack of revenue. Even with limited amounts of work, their staff industriously continues to work on special projects and methods development. This is in stark contrast to the Ministry of Environmental Protection staff, who have too much work, and very little desire to do it.

Level of Facilities
The level of facilities is adequate, but very old. They have lots of sample testing and preparation areas, with very good exhaust hood availability for sample preparation.

Level of Quality Assurance Plan and Quality Control Measurements
Their QA program is the best of all the labs inspected. They claimed to do QC check samples with every analytical batch. Analysts test single blind QC check samples once or twice a month. Their awareness of the need for QC measurements is the best of all labs inspected.

Major Problems Facing the Laboratory and Critical Factors for Success
In their view, a serious lack of funding is their most important problem. The lack of revenue has left them with obsolete equipment and limited ability to purchase high quality standards and reagents. Unless the funding situation changes, this laboratory will most likely go under.

Ability to Continue to Receive Samples and Remain Solvent
As discussed in sections C.2.2.1 and C.2.2.7, this laboratory has no guaranteed sources of funding. Activity in most of the analysis groups appeared to be fairly low, due to not enough work. There are very limited prospects for revenue generation in the current economy. For example, the market will only bear a charge of 140,000 coupons for the same analyses that cost the equivalent of 5 billion coupons in Germany.

Ability to Cooperate with Other Agencies and Share Results
Their level of cooperation has been very high due to their excellent reputation. They receive samples from 26 other labs, including the Ministries of: Environmental Protection, Chernobyl, Agricultural Chemistry, Internal Affairs, Health, and the State Committee of Water Resources.

Overall Conclusions
This is a large laboratory that has many of the best qualities of all of the laboratories inspected, see sections C.2.2.2-C.2.2.6. It has excellent staff and management. It's major flaws are its future survivability and its obsolete equipment. As the laboratory with the widest range of analytical testing capabilities and strong management, paired with obsolete equipment and a dim future, we recommend that USAID use this laboratory as a second choice to the Ukrainian Academy of Sciences Institute for Colloid and water chemistry. Please note that combining the analytical capabilities, strong management, and excellent reputation of this laboratory with Ministry of Environmental Protection's overload of responsibilities and weak management, could result in a single analytical organization that would be the best choice for USAID to support. This combination might also be a good candidate for implementing a national quality plan. It is this reviewer's opinion that it is not politically or mechanically feasible to combine the two operations.

Evaluation of the Ukrainian Academy of Sciences Institute of Hydrobiology Central Laboratory

Function and Scope of Mandate of the Laboratory and Agency
This laboratory is responsible national surface water quality and the role of aquatic flora and fauna. They are responsible for the Dnipro River, with six reservoirs, part of the Danube River, the Southern Bug River, and 23,000 smaller Ukrainian rivers. The lab is organized into 12 departments that focus on: hydrochemistry, hydrology, toxicology, radiology, microbiology, plant physiology, aquatic fauna physiology, and sanitation hydrobiology. Their primary analytical analysis emphasis is on the effects of water quality on aquatic flora and fauna. They have a moderate level of analytical capabilities, geared for research work, to support their extensive biological facilities.

Competence of Management
The laboratory is well organized and well run. They offer a good variety of analyses, appropriate for the testing of the effects of heavy metals, some pesticides, and some radionuclides. The quality of management is demonstrated by: good documentation of results; a low level, but effective, QA program; and excellent employee knowledge of their analytical processes.

Level of Equipment

They have an adequate supply of somewhat dated equipment. The equipment is appropriate for the tests they perform: 4 good Zeiss flame AA spectrophotometers, 3 FSU AA's for total metals, several old packed column GC's, several polarographs for labile metal determinations, a chemiluminescence analyzer, and balances and pH meters.

Levels and Competence of Staff
They have a highly qualified staff, many with advanced degrees, working on modern research projects. The staff are very knowledgeable and eager to demonstrate the work they are doing. Staffing levels appear to be adequate for their work load.

Level of Facilities
The level of facilities is good, but somewhat dated. They have adequate sample testing and preparation areas, with good exhaust hood availability for sample preparation.

Level of Quality Assurance Plan and Quality Control Measurements
Their QA program is under-developed by world standards, but typical of other Ukrainian laboratories. Analysts test single blind QC check samples once or twice a month, based on the opinion of the laboratory operations manager. There are no daily QC process control checks. The checks should be made on a daily basis, or with every preparation or analysis batch. There is no documentation of personnel training. Their awareness of the need for QC measurements is very low, but they are very interested in uniform methodologies and QA plans.

Major Problems Facing the Laboratory and Critical Factors for Success
In their view, their most important problem is the inability to get high quality standards and reagents. Their second most important problem is a lack of standardized test methodologies between Ukrainian analytical laboratories. The deficiency of uniform methodologies and QC measurements has lead to frequent and large (10-20 fold) variations in results for the same water samples analyzed by different agencies, (Hydrobiology vs. Hydrometeorology vs. Ministry of Environmental Protection). They believe many of the problems occur because there is more than one organization testing water. They strongly support cooperation between labs, to integrate the data from ground water, surface water, and influents. There should be one lab of professional experts to oversee all of the data. They also believe that all of these results should be made public.

Ability to Continue to Receive Samples and Remain Solvent
As an Ukrainian National Academy of Sciences Institute, sixty percent of their funding is guaranteed by the government, so they must continue to find outside projects to raise additional revenue. Activity in most of the analysis groups appeared to be fairly low, potentially due to not enough work. Their analytical analysis reputation is better than Ministry of Environmental Protection's or Hydrometeorology's, so they should potentially be able continue to get some work.

Ability to Cooperate with Other Agencies and Share Results
Their level of cooperation is very high, as demonstrated by participation in numerous joint ventures. Most recently they participated in a joint Dnipro river project with: Ministry of Environmental Protection, Hydrometeorology, Hewlett Packard's Danube River Basin group, and the Canadian IDRC. They also currently work with 114 other institutions to

implement their overall water quality program. Their report on an international Danube river project was highly assessed, and included soil, water, and air results from 50 different agencies, including the Ministry of Health. They also are a key participator in the Slavutich association. Slavutich "unites all cities and towns on the banks of the Dnipro River into a conglomerate."

Overall Conclusions

This is a moderately sized laboratory that focuses on research on the effects of water quality on aquatic flora and fauna. It had excellent staff and management, but needs to improve its QA/QC program. Improving the QA/QC program would primarily require training, with minimal additional expenditures to increase documentation and add daily QC check samples. As a research lab that focuses on biology, we recommend that USAID not fund any significant upgrades of this laboratory as a part of a project to upgrade nation-wide laboratory capabilities. They could however be a key participant in the development of a national quality program.

Evaluation of the State Committee for Water Resources and Supply Central Laboratory of the Dnipro Basin Management Department

Function and Scope of Mandate of the Laboratory and Agency

The State Committee for Water Resources and Supply is responsible for supplying water for drinking, agricultural, and industrial purposes. Their laboratories monitor water quality at the intakes for drinking water, agricultural water, and industrial water. They claim that there is a cabinet level directive to shift effluent monitoring from Ministry of Environmental Protection to the State Committee of Water Resources by the end of the year. This laboratory is the central laboratory for the Dnipro River Basin. It has oversight over all of the State Committee's Dnipro basin laboratories, and manages and reports all of the State Committee's Dnipro Basin water quality results. This laboratory is three years old. It was created to be the best laboratory in the Dnipro basin system. They have a moderate level of analytical capabilities, geared for quality analysis of routine water samples.

Competence of Management

The laboratory is well organized and well run. They offer a good variety of analyses, appropriate for the testing of the effects of heavy metals, some pesticides, petroleum products, and significant radionuclides. The quality of management is demonstrated by: (1) good documentation of results; (2) a good data review process; (3) a low level, but effective, QA program; (4) excellent employee knowledge of their analytical processes; and (5) excellent personnel attitudes, with a strong desire to do things even better.

Level of Equipment

They have an adequate supply of good equipment, but slightly out of date by world standards. The equipment is appropriate for the tests they perform and all good quality: a flame AA spectrophotometer for total metals; a GC-ECD for organo-chlorine pesticides; a fairly new polarograph for labile and ultra low level metals determinations; a single wavelength IR spectrophotometer for petroleum hydrocarbons; a good Gamma Spectrometer for Cs-137; a beta counter for Sr-90; a scintillation counter for C-14 and tritium; and a UV-Vis spectrophotometer for general chemistry tests.

Levels and Competence of Staff
They have a very qualified staff, as evidenced by their good questions and good responses to our questions. The staff are very knowledgeable and eager to demonstrate the work they are doing. Staffing levels appear to be adequate for their work load.

Level of Facilities
The level of facilities is very good, but somewhat dated. They have good sample testing and preparation areas, with good exhaust hood availability for sample preparation.

Level of Quality Assurance Plan and Quality Control Measurements
Their QA program is under-developed by world standards, but better than most of the other laboratories we inspected. Analysts test single blind QC check samples once or twice a month, based on the opinion of the laboratory operations manager. There are no daily QC process control checks. The checks should be made on a daily basis, or with every preparation or analysis batch. There was no documentation of personnel training. In their role as central lab for the Dnipro basin, they do a good job of monitoring data quality. When problems arise in their lab or other labs, they pursue it until the source of the problem is found. This is the opposite behavior of the Hydromet central water lab. Their awareness of the need for QC measurements is good, and they are very interested in uniform methodologies and a nation-wide QA plan. They even volunteered staff and facilities to administer a nation-wide QA plan.

Major Problems Facing the Laboratory and Critical Factors for Success
In their view, their most important problem is the difficulty in getting high quality standards and reagents. Their second most important problem is the lack of ability to do on-site field testing. They believe that on-site testing would allow them to monitor effluents better, because they currently need a fleet of vehicles to collect samples and get them back to the laboratory within sample holding times. (See Appendix G for their suggested list of field equipment.) They would also like a rapid method for Strontium-90, so they could better monitor trans-boundary releases of Sr-90 from nuclear reactors that are upstream from Ukraine. The current Sr-90 method takes at least 2 weeks, which severely limits their ability to take any actions to protect the public health. I provided a brief written summary of a 1 day procedure that is currently used in the United States. They also have no redundancy of equipment, so if a key instrument goes down, they temporarily lose capabilities. Finally, they would like an HPLC to do substituted phenols and PAH's (two types of carcinogenic organic compounds).

Ability to Continue to Receive Samples and Remain Solvent
The State Committee of Water Resources and Supply has a stable budget as a line item from the Ministry of Finance for. The State Committee of Water Resources and Supply was very powerful in the FSU, and some of that power carries forward to today. As the State Committee's Dnipro Basin central lab, they are assured of continued samples and adequate budget in the future. Activity in the analysis groups appeared to be fairly good, indicating a good current supply of work.

Ability to Cooperate with Other Agencies and Share Results
Their official level of cooperation is limited to yearly reports to Ministry of Environmental Protection. They unofficially share data with other agencies. Since they are controlled by the State Committee for Water Resources, they have to give priority to the Committee's

samples. As such they cannot effectively analyze samples from other agencies.

Overall Conclusions
This is a medium sized laboratory with a fairly broad range of capabilities. It has excellent staff and management, but needs to make minor improvement to its QA/QC program. Their analytical analysis reputation is better than Ministry of Environmental Protection's or Hydrometeorology's, but the problem of sharing data and analyzing samples from other agencies would limit their role as a nationwide central laboratory. Due to this limitation, we recommend that USAID not fund any significant upgrades of this laboratory as a part of a project to upgrade nation-wide laboratory capabilities. They could however be a key participant in the development of a national quality program.

Evaluation of the State Department for Hydrometeorology Republican Center for Control and Supervision of the Environment

Function and Scope of Mandate of the Laboratory and Agency
The scope of the State Department of Hydrometeorology (Hydromet) responsibilities are control of the environment through control of: (1) surface water, (2) atmospheric precipitation, (3) soil, (4) radioactive materials, (5) air, and (6) stratospheric ozone. (See Appendix E for their public relations package.) The purpose of this laboratory is to measure surface water quality. Specifically, they measure "background" water quality that is not associated with any specific influent, effluent, or water intakes. They apparently process more routine samples than any other agency in the government. They estimate that they (along with their regional labs) generate 70% of all Ukrainian water testing results. This laboratory serves as the central laboratory for performing sophisticated tests that can't be done in regional labs, like pesticides and metals. They do not have control or oversight over Hydromet's regional labs. Hydromet was a powerful agency in the FSU.

Competence of Management
The management has developed a laboratory that is good at turning out lots of results (5000 samples for 60 tests per year). Unfortunately, they do not evaluate what they produce. So they tend to produce reports with lots of data, but not many conclusions. They also do not perform much QC, nor do they do any comparative analyses. The result of these actions is that their results often disagree with other reputable laboratory agencies like: the Institute for Colloid and Water Chemistry, the Institute for Hydrobiology, the State Committee for Geology, the State Committee for Water Resources, and many times even with their own regional labs.

Their organizational structure and management style is very rigid. This rigidity is demonstrated by their attitudes that "this is the way we've always done it", or "we followed the method, so there was nothing more to be done". When differences arise between results from other labs, they either: (1) ignore the problem; (2) attribute it to "changing water conditions"; or (3) attribute it just to "differences between labs". They resist making changes to improve things. They also reminisced extensively about the good old days of central command by their FSU central laboratory in Rostov on Don. They believe there should be a national central laboratory as part of a single agency that "deals with water", and that they should be that laboratory. They also added that three years of USAID financial support was not enough to implement a plan.

Many of these same operational attitudes regarding change were found in United States analytical laboratories ten years ago, but US laboratories were forced to change by market forces or go out of business. In this case, Hydromet is still a powerful organization, and is unlikely that its laboratory culture will change.

Level of Equipment
They have a moderate assortment of reasonable but somewhat out of date equipment. The amount of equipment is adequate for the large number of tests they claim to perform per year. The equipment includes: five packed column GC for organo-chlorine, organo-phosphorus, and phenoxy acid pesticides, two flame AA spectrophotometers for metals, 4 Zeiss UV-Vis spectrophotometers for general chemistry, two single wavelength Infra-Red spectrophotometers (IR) for petroleum products in water, 5 older Gamma Spectrometers (25% efficiency Germanium crystals) for radionuclides like Cs-137, and a good assortment of support equipment.

Levels and Competence of Staff
They appear to have qualified staff, but we had only limited amounts of communication with their staff. Staffing levels are adequate for their work load.

Level of Facilities
The level of facilities is good. They have good amounts of sample testing and preparation areas, and excellent levels of hood space for preparation of hazardous samples.

Level of Quality Assurance Plan and Quality Control Measurements
They have a very limited QA/QC program, consisting only of instrument calibration with every analysis shift.

Major Problems Facing the Laboratory and Critical Factors for Success
In their view, their most important problem is the difficulty in getting high quality standards and reagents. They believe their second most important problem is the lack of uniformity in results, caused by having more than one agency doing water testing.

Ability to Continue to Receive Samples and Remain Solvent
They claim to be the only state organization with control over all surface water. They also claim that they can get samples from all other water organizations. As a part of the very powerful and well organized Hydrometeorological Department, they should have adequate funding in the future.

Ability to Cooperate with Other Agencies and Share Results
In addition to the information presented in Section C.2.5.8, they claim responsibility for acute problems, and control the data base for surface water quality. They send some of this data to Ministry of Environmental Protection, but "data is not officially shared with the State Committee for Water Resources because they have different tasks". Sometimes they sell their data to other agencies. Their reputation for low quality is echoed by the other laboratories we inspected.

Overall Conclusions

This is a very efficient laboratory that gets a lot of work done in a moderate amount of space. They turn out large amounts of data, but it is often poor quality. They need to implement a QA/QC program, and work at evaluating what their data means. Their management culture is very rigid, and would be difficult to change. As such, they do not fit the goals of this project, and we recommend that USAID not fund any significant upgrades of this laboratory as a part of a project to upgrade nation-wide laboratory capabilities.

Evaluation of the Ministry of Environmental Protection Department of Rapid Analysis of Environmental Instrumental and Metrology (Science of Measurement)

Function and Scope of Mandate of the Laboratory and Agency
This organization was founded in 1993 as part of the Ecological Inspectors Section as two laboratories, an air analysis laboratory, and a soil, water, and waste analysis laboratory. The water analysis section was supposedly first created in 1986, as a part of the State Committee of Water Resources and Supply. We evaluated all three parts of both laboratories. This organization's main responsibility is the control of all analytical services of the Ministry of Environmental Protection (MEP). As such, the evaluation of the two laboratories, with their four sections, will be presented as a single evaluation, and the organization will be referred to as a single laboratory in this report. As the Ministry of Environmental Protection's central lab, this organization has many responsibilities. Quoting the head of this group of laboratories, Mr. Belokyn, this group is mandated to:

coordinate all environmental analytical data from all agencies
collect and publish environmental results from all regions and all agencies in Ukraine
monitor environmental contaminants in air, soil, water, and wastes for all of Ukraine (envisioned as sampling 2-4 times per year)
analyze the monitoring samples from step 3
work out standard analysis methodologies
make rapid analyses of the environment
make rapid recommendations based on analysis results
verify results of other Ministry of Environmental Protection labs, including administering a Performance Evaluation (PE) samples program (see Appendix B for a definition of PE sample) to monitor performance of other the Ministry of Environmental Protection labs
inspect the other 29 Ministry of Environmental Protection labs
certify Ministry of Environmental Protection labs in conjunction with the Committee on Standards
inspect all industrial wastes
control all industrial wastes
conduct training on and distribution of environmental analytical methods for all of Ukraine.

In actuality, this laboratory appears to fulfill very little of its mission, as it has a small staff, very limited facilities, very limited equipment, and is poorly organized. It seems strange that such a small organization is expected to do so many things. In the United States, one could easily expect to spend at least $5 million dollars in start-up capital just to meet the analytical testing requirements in items 4, 5, 6, & 11.

The other responsibilities could be reasonably separated into at least three or four

additional organizations: a data management group for items 1 & 2; a Quality Assurance and oversight group for items 8, 9, & 10; a sample collection agency for items 3 & 11; and a decision-making and enforcement group for items 7 & 12. Alternately, items 3, 7, 11, & 12 could also be combined into the same group. We couldn't identify any division of responsibilities within the current organizational structure, other than the previously described breakdown of air, soil, water, and waste analytical testing responsibilities.

Competence of Management

The management has many responsibilities and very limited resources. There was very little evidence that it is actually addressing any of the responsibilities listed above. The management appears to be broken down or paralyzed by the magnitude of the problems. Given its existing staff and equipment, it could be addressing some small parts of its responsibilities, but it appears to have given up. They have been in their current cramped laboratories for a year, but they have done little more than unpack instruments and set glass-ware on shelves. They claim to do a good job of water testing, but there was almost no physical evidence of any significant activity. They say they are just beginning waste testing, but could show no supporting evidence.

It was slightly difficult to assess the situation, because the laboratory director and staff were only nominally communicative. They seemed to only be interested in what money and equipment we (and other western agencies like the EPA) could give them. They were not interested in talking about what they actually do. They would typically only talk in vague general terms about their activities, but they would get very specific in discussions about what they want others to do for them.

It should be noted that the management of this group was very reluctant to allow us to meet with them and tour their facilities. Out of 13 organizations, this was the only one that refused to see us. After persistent efforts by my Ukrainian counterparts for a week and a half, they granted us permission to interview them and tour their facilities. My counterparts commented before the visit that this lab's personnel were possibly ashamed for us to see how little they have accomplished.

In their own words, the laboratory management described their program as "we have no set programs, only some methods development", and with regards to regional laboratory data verification and certification they said "all labs pass". When pressed on the reasonableness of the laboratory certification comment, they acknowledged that they had inspected one regional laboratory in southern Ukraine, and found the quality of work so poor that it did not initially pass, but was subsequently certified after making changes in analysis methodologies.

Level of Equipment

They have a reasonable assortment of older equipment. The equipment includes: two packed column GC's with electron capture detectors (GC-ECDs) and Flame Ionization detectors (GC-FIDs), two flame AA spectrophotometers, and a high performance liquid chromatograph (HPLC) with UV-Vis and fluorescence detectors, an X-ray fluorescence spectrometer (XRF) for metals determination, an Ion Chromatograph (IC) for anions, and a "phosphorescent organics analyzer" (fluorimeter?). They have limited sample storage and preparation areas. They have very limited refrigeration space for storing samples, and

very few hoods for handling hazardous samples. The water laboratory has adequate levels of equipment for performing bacteriological and general chemistry tests, including two good UV-Vis spectrophotometers.

Levels and Competence of Staff
They appear to have qualified staff, but we had only limited amounts of communication with their staff. They clearly do no have anywhere near enough staff to accomplish their responsibilities.

Level of Facilities
The level of facilities for air, soil and waste testing are poor, but still usable. They anticipate moving these operations to new quarters this year. They said the new laboratory is currently under construction. The water testing facilities were good, compared to most of the other laboratories we toured.

Level of Quality Assurance Plan and Quality Control Measurements
As a methods development lab that does not routinely analyze samples, they have a very limited QA program, consisting of instrument calibration with every analysis shift. It is difficult to imagine how they could effectively operate a national laboratory certification and inspection program, given their lack of enthusiasm and deficient knowledge of common QA/QC practices.

Major Problems Facing the Laboratory and Critical Factors for Success
In their view, they have so many problems they couldn't prioritize them. They want us to help provide: better facilities, uniform sophisticated equipment for all of their 30 labs, reagents and calibration standards, standard analysis methods, computers and software to support their data gathering program, more personnel to do monitoring and inspections, better salaries for policy experts and laboratory personnel, and training seminars on analytical methods. They also want to: (1) have changes come down from the ministerial level ("command and control"); (2) improve sharing of information from all regions of Ukraine; (3) develop a group that does both analysis and ecological control; and (4) develop systems "that actually do what they say they are doing".

Ability to Continue to Receive Samples and Remain Solvent
Unless changes are made in funding, scope of responsibilities, management, and organizational structure, this laboratory will continue to flounder.

Ability to Cooperate with Other Agencies and Share Results
They have strong desire to share data with other agencies, but by their own admission, their results are "not trusted because of poor quality" and "low salaries". They are not held in high regard by their peers in the analytical testing community.

Overall Conclusions
The current weak management doesn't seem to have the vision to see what changes can be made, and also isn't decisive enough to make the changes happen. They have a potentially overwhelming number of responsibilities, and only limited resources. They are willingly waiting for changes to come from above. By waiting, they are squandering their meager resources. They have some reasonable equipment and personnel, but are not using either one effectively. This is a medium to small laboratory that only acts as a low level method

development lab and low level inspectorate. For these reasons, we recommend that USAID not fund any significant upgrades of this laboratory, unless significant management and organizational changes are made first.

Evaluation of the Ministry of Health Sanitary and Epidemiological Service Ukrainian Scientific Hygiene Center

Function and Scope of Mandate of the Laboratory and Agency
This laboratory was founded in 1993 to create a central analytical control laboratory for developing analytical methods (research) and pooling national data SES data for presentations. This laboratory does not certify regional labs. This laboratory does not routinely receive air or water samples, and has very limited capacity. The routine analysis responsibilities are handled by their regional labs. As such, the SES does not have a single central laboratory with oversight over Ministry of Health's analytical testing. The laboratory's head, now first Deputy Minister of Health, Andrey M. Serdyuk would like to develop this laboratory into a National Laboratory of Ecological Safety, but this plan has not been funded or implemented.

Competence of Management
The management has developed a small core group of good staff and excellent equipment laboratory equipment. This laboratory is part of the very powerful and well organized SES, originally developed as the Institute of Hygiene in the FSU. Their management characterized this lab as the SES's most sophisticated group in their system. Their management is intent on developing national laboratory programs. They strongly support a national central laboratory to control laboratory practices and QA programs for the entire country. They would like to sponsor a meeting of the ministers and heads of "all key organizations", to develop a national QA laboratory that has "command and control" over all analytical laboratories. They strongly believe that they are the organization to operate the program.

Level of Equipment
They a small assortment of excellent equipment. The amount of equipment is appropriate for methods development. The equipment includes: several GC's, a flame AA spectrophotometer, and an HPLC.

Levels and Competence of Staff
They appear to have qualified staff, but we had only limited amounts of communication with their staff. Staffing levels are adequate for their work load.

Level of Facilities
The level of facilities was excellent. But they have very limited amounts of sample testing and preparation areas.

Level of Quality Assurance Plan and Quality Control Measurements
As a methods development lab that does not routinely analyze samples, the have a very limited QA program, consisting of instrument calibration with every analysis shift.

Major Problems Facing the Laboratory and Critical Factors for Success

In their view, their most important problem is their small size, the lack of a variety of test equipment, and small facility. Their second most important problem is the difficulty in getting high quality standards and reagents.

Ability to Continue to Receive Samples and Remain Solvent
As a part of the very powerful and well organized SES, they should have adequate funding in the future.

Ability to Cooperate with Other Agencies and Share Results
They currently send their results to the Ministry of Health. Their regional labs sometimes function as "ecological police", and "share" their results with offending agencies in this capacity.

Overall Conclusions
This is a very small laboratory only does methods development and research. It has good staff and management, but is very small and needs to improve its QA/QC program. As a small lab, we recommend that USAID not fund any significant upgrades of this laboratory as a part of a project to upgrade nation-wide laboratory capabilities.

Evaluation of the Ukrainian Academy of Sciences Institute of General and Inorganic Chemistry Physical and Analytical Chemistry Laboratory

Function and Scope of Mandate of the Laboratory and Agency
This laboratory tests primarily solid metals samples, ore samples, and industrial by-products (slag) for metals and impurities content. Their work is related to industrial processes. They do not currently perform water testing. The laboratory head is Dr. Nikolai Kalibabchuk, one of my counterparts.

Competence of Management
The head of the laboratory is highly qualified. The laboratory is well run as demonstrated by: good documentation of results, a low level QA program, and excellent knowledge of their analytical processes.

Level of Equipment
They have an adequate supply of very old equipment. The variety of equipment is appropriate for the qualitative and quantitative metals tests they perform, but it is seriously out of date. The equipment includes: a DC arc spectrometer with photographic plate detection, flame Atomic Absorption spectrophotometer (FAAS), Ultra Violet-Visible (UV-Vis) spectrophtometers for wet chemistry, balances and pH meters.

Levels and Competence of Staff
They have a highly qualified staff, appropriately trained for metals testing. The staff are knowledgeable and eager to demonstrate the work they are doing. Staffing levels appear to be adequate for their work load.

Level of Facilities
The level of facilities is adequate, but fairly old. They have adequate sample testing and preparation areas, with adequate exhaust hood availability for sample preparation.

Level of Quality Assurance Plan and Quality Control Measurements
Their QA program is under-developed by world standards, but typical of other Ukrainian laboratories. Analysts test single blind QC check samples once or twice a month, based on the opinion of the laboratory head. There are no daily QC process control checks. These QC checks should be made on a daily basis, or with every preparation or analysis batch. There was no documentation of personnel training. They were using test methodologies developed as part of their basic mission. Their awareness of the need for a QA plan and QC measurement was very low.

Major Problems Facing the Laboratory and Critical Factors for Success
In their view, their most important problem is the low level of salaries for laboratory personnel. Their second most important problem is a lack of modern test equipment. Lastly, the inability to get high quality standards and reagents, and a lack of revenue are also significant problems.

Ability to Continue to Receive Samples and Remain Solvent
As a part of the Ukrainian Academy of Sciences, this laboratory depends on winning outside projects for 40% its revenue, so it primarily does method development for industry. There appears to be limited need or demand for their capabilities.

Ability to Cooperate with Other Agencies and Share Results
As part of the Academy of Sciences, they readily share their data with other agencies.

Overall Conclusions
This is a very small laboratory that does only metals testing of ore, solid metals, and industrial by-products. It has good staff and management, but needs to improve its instrumentation. As a small metals lab that does no water testing, we recommend that USAID not fund any significant upgrades of this laboratory as a part of a project to upgrade nation-wide laboratory capabilities.

Evaluation of the Proposed National Analytical Center

Function and Scope of Mandate of the Laboratory and Agency
The National Analytical Center is being proposed by the Ukrainian Consumers Association to be either a private or Non-Governmental Organization venture. They have prepared a business plan describing the start-up of an analytical laboratory, see Appendix D - Business Plan. They are also considering an attempt at privatizing the Ukrainian State Committee in Food Industry Central Laboratory, described above in Section C.2.10. They plan to offer analytical testing of foods and environmental samples.

Competence of Management
The principals in this venture are Mr. Gennadiy Kuznetsov, Director of the proposed National Analytical Center and Vice President of the Ukrainian Consumers' Association, and Evgen Pisarev, Ph.D., Head of the Ukrainian State Committee in Food Industry Central Laboratory. As head of an existing laboratory, Evgen Pisarev has developed the best laboratory we inspected. Mr. Kuznetsov is an unknown quantity.

Mr. Kuznetsov talked about many different proposals that he "is working" with western

agencies. At times they proposed trying to privatize the existing food and alcohol lab, where they currently work. They would then shift the discussion to development of a new facility. It appears that they have not thoroughly investigated either option. This is further demonstrated by the deficiencies in the Business Plan in the key areas of: sample preparation, equipment requirements, supply levels, marketing projections, marketing strategies, and contingency planning.

The Business Plan does not currently include appropriate costs for sample preparation areas and equipment, which leaves the proposal short by approximately 20%-25%. They have only included enough equipment to do either environmental testing or food testing, leaving the proposal at least an additional 40%-50% short. Food and environmental sample analyses require much of the same equipment, but that equipment cannot effectively be shared for both purposes. Environmental samples are often very contaminated. Analyzing contaminated environmental samples leaves behind residues in the instrument that interfere with subsequent food analyses. For example, it is widely known that soil samples can easily contaminate a metals instrument for weeks to months with sodium. The residual sodium levels are not large enough to interfere with subsequent environmental analyses, but they can greatly exceed tolerance levels for food analyses.

The Business Plan includes only cost estimates for amounts of solvents will not support their projected sample requirements. Current world standard analytical methods require a minimum of at least $***** per year of solvents to handle their projected sample load. The solvent costs error is typical of other potentially under-estimated costs in their proposal.

They have also left out key marketing estimates of: (1) actual numbers of samples from specified sources, (2) the likelihood or probability of receiving those samples, (3) a schedule for start-up time requirements, (4) a schedule for growth of the sample load, and (5) a schedule for projected revenues and costs as a function of sample load. This last schedule also predicts when the business is likely to show a profit. The Business Plan also does not present contingency plans or actions that would be taken if the market does not develop as they expect. The marketing deficiencies in their Business Plan could be due to a lack of experience that could be remedied by training, but the inadequate levels of analysis and sample preparation equipment, and inadequate amounts of supplies raise serious doubts about the quality of the planning of this venture. These deficiencies in their Business Plan also raise questions about the competency of the principal owner and operators.

Level of Equipment

They have proposed purchasing an excellent assortment of modern instruments for performing chemical testing on foods, see Appendix D. They have not proposed any redundancy in equipment or service contracts for equipment maintenance. This leaves them susceptible to instrument break-down, which leads to: missed deadlines, frustrated clients, missed sample holding time (sample shelf life), and lost revenues. Additionally, as described above, they also neglected to include enough equipment to perform both food and environmental analyses.

They have also not proposed adequate sample preparatory equipment. The cost of necessary sample preparatory equipment is significant. Performance of the analyses they

have proposed requires the following equipment: muffle furnaces, grinding mills, ball mills, drying ovens, hot plates, analytical balances, sample extraction equipment, sample concentration equipment, and sample clean-up equipment (ex. Gel Permeation Chromatography).

Levels and Competence of Staff
The Business Plan proposes adequate levels of qualified staff, at salaries that are potentially adequate based on local standards.

Level of Facilities
There is no laboratory building to evaluate at this time. The square footage they have proposed is adequate, except for sample preparation. Based on their proposed sample loads, sample preparation areas should be equal to or larger than the instrumental analysis areas.

Level of Quality Assurance Plan and Quality Control Measurements
There is no QA plan or analysis methodologies presented in their Business Plan. They have included a salaried position for a Quality Manager. The laboratory that they currently work at has a strong, QA program with good daily QC support, so QA/QC should not really be a problem.

Major Problems Facing the Laboratory and Critical Factors for Success
They see the lack of outside funding as their major problem. They provided a fax from the European Community TACIS program's intent to make them the Ukrainian recipient of the 1993 TACIS "Food Quality Technical Support and Training" Project, see Appendix D. Mr Kuznetsov claims this entitles them to $400,000 ECU (approximately $480,000 USD). They also claim they were supposed to receive this funding this fall, but it has not been finalized, (see the October 28 1994 TACIS fax in Appendix D).

Ability to Continue to Receive Samples and Remain Solvent
As noted in the Sections 2.3.2 and C.2.9.3, they have seriously underestimated the key factors of: (1) the amount of equipment required; (2) the amount of supplies required; (3) how many samples they expect to receive from specified sources; (4) an approximate schedule of sample receipt; and (5) the probability of receiving samples. Based on anecdotal evidence, they have the potential for receiving adequate numbers of samples, as long as the economic situation improves. The need for food testing is supposed to grow as local and national government agencies expand compulsory food testing and certification.

Ability to Cooperate with Other Agencies and Share Results
As a private venture, their data would go to their clients. This makes the ability to cooperate with other agencies and share results is not a significant issue.

Overall Conclusions
As discussed above, the Business Plan was deficient in several key areas: marketing projections, marketing strategies, contingency planning, amount of analysis equipment required, amount of necessary supplies, and sample preparation. The first three deficiencies, relating to marketing and business development issues, could be remedied by training. The last three deficiencies are far more serious. In their proposed roles as

experienced chemists and laboratory managers, they should have realized how crucial sample preparation and the adequate instrumentation are to the success of a laboratory. If there were no other suitable laboratories for upgrading, then this proposed venture could be considered, with significant qualifications, but there are two other good laboratories that are better suited for funding by this project. As a new venture with no reputation, it would also be difficult for this laboratory to promote and administer a nation-wide quality program. As such, I recommend that USAID not fund this proposed laboratory venture.

Evaluation of the Ukrainian State Committee in Food Industry Kiev Laboratory for Alcohol and Biotechnology

Function and Scope of Mandate of the Laboratory and Agency
This laboratory tests foods and beverages on a nationwide basis to certify products for public consumption. As the State Committee in Food Industry's central lab, it also develops methods for their 10 regional laboratories. It is only one of three Committee on Standards certified food laboratories in Kiev. The other two certified food laboratories in Kiev are the Committee on Standards' lab and a private lab (Podolsky laboratory).

Competence of Management
The head of the laboratory, Evgen Pisarev, Ph.D., is a very talented chemist and manager. He has developed the best laboratory we inspected. He has: (1) maintained excellent staff; (2) added sophisticated equipment to stay current with world standards; (3) recently gotten his lab certified by the Committee on Standards to not only analyze alcoholic beverages, (their traditional business), but to also test and certify food products. The laboratory appeared to have a fair amount of work to do, with almost all personnel busy at analyzing samples or preparing data.

Level of Equipment
They have an excellent supply of modern equipment for performing chemical testing on foods, with redundancy in several areas. The significant test capabilities and appropriate equipment includes: (1) heavy and toxic metals by Flame Atomic Absorption Spectrophotometry (FAAS), (2) Anions by Ion Chromatography (IC), (3) semivolatile organic compounds by Gas Chromatography with Mass Spectrometric detection (GCMS) including over 20 different types of capillary columns, (4) organo-chlorine pesticides and chlorinated hydrocarbons by Gas Chromatography with Electron Capture Detection (GC-ECD), (5) hydrocarbons by Gas Chromatography with Flame Ionization Detection (GC-FID), (6) general wet chemistry species with high resolution Ultra-Violet and Visible Spectrophotometers (UV-Vis), and (7) sample preparation equipment including: muffle furnaces, solid and liquid phase extractors, grinding mills, high speed centrifuges, and a microwave oven.

Levels and Competence of Staff
They have a highly qualified staff, all with university degrees, and many with advanced degrees. The staff are knowledgeable and eager to demonstrate the work they are doing. The staffing levels appear to be adequate for their moderate work load, but they may be short on sample preparation staff.

Level of Facilities
The level of facilities was good, better than most of the labs we inspected. They had

good exhaust hood availability for sample preparation, and plenty of glassware and lab bench space for sample preparation.

Level of Quality Assurance Plan and Quality Control Measurements
Their QA program was strong with good daily QC support. The level of their quality program was second only to the Committee on Geology's central lab. There was no formally documented QA plan, but only one of the 12 laboratories we visited had one. There is no documentation of personnel training or tracking of laboratory performance. It would take minor revisions to bring their quality up to world standards.

Major Problems Facing the Laboratory and Critical Factors for Success
In their view, their most important problem is employee retention, due to low salaries. Their second major problem is the limited ability to get high quality standards and reagents.

Ability to Continue to Receive Samples and Remain Solvent
As a part of the alcohol production industry, their future funding should be stable. They have the additional potential for good revenues by continuing food testing. The need for food testing is supposed to grow as local and national government agencies expand compulsory food testing and certification.

Ability to Cooperate with Other Agencies and Share Results
They currently cooperate with the Committee on Standards on a formal basis in the certification of food and beverage products. Their need to cooperate and share data with other food testing agencies is not as necessary as in the environmental field.

Overall Conclusions
This was the best equipped laboratory we inspected. It has a combination of: good management, good facilities, excellent equipment, qualified staff, and good funding. Without examining extensive amounts of raw data, they appear to be doing a good job of chemical testing of foods and beverages. This evaluation confirms the previously stated conclusion that food testing capabilities are much better developed than their environmental counterparts. As such, I do not recommend that USAID fund any upgrades of this laboratory or any other food laboratories as a part of this project.

Appendix D

Business Plan for the Proposed National Analytical Center

Appendix C

NATIONAL ANALYTICAL CENTER

BUSINESS PLAN

CREATION OF THE LABORATORY FOR TESTING OF FOOD, AGRICULTURAL PRODUCTS AND ENVIRONMENT MONITORING

National Analytical Center
Prospect Peremogy 37, korpus 1
252056, Kiev
UKRAINE
tel. (044) 224-3511
fax (044) 446-7484

Kiev 1994

136

THE MAIN AIM

This plan is aimed for creation of independent laboratory for testing of food, agricultural products and environment monitoring. It is fulfilled by National Analytical Center (further mentioned as the Center).

COMPANY SUMMARY

The Center is a private company. It was founded at the beginning of 1993 by Ukrainian Consumers' Association and five physical persons who work for the Center.

The Center provides the services in testing of food, agricultural products and environment monitoring. Its activity is supported by highly qualify personnel. All operators and members of the Board have a higher education. They have experience in working with modern analytical equipment like GC/MS HP5890/HP5970B, GC/FTIR HP5890/HP5965B, HPLC HP1090 Win and in analytical test methods development. Amongst ten operators five men have a doctorate degree in chemistry. Amongst three members of the Board two have a doctorate degree.

The Center masters AOAC, FDA, EPA methods, follows recommendations of GLP (Good Laboratory Practice) and ISO 9000.

The customers of the Center are state organizations and private companies.

For the time being, the Center has not its own laboratory equipment and uses this one of different owners. The Center can not meet the market needs of this kind of services because of low equipment complement of these organizations and modern analytical equipment shortage. At the same time, the adoption of the new laws described further involves increasing of potential Centers' customers quantity. In case of foreign investment, the Center is supposed to be provided with modern laboratory equipment (see scheme 1).

The program of technical support to the Center on the side of the European Community is being realized in 1994. This program includes the training of the Centers' personnel, consultations concerning quality testing of food, agricultural products, allocation of money for office equipment purchase.

MARKET ANALYSIS SUMMARY

The market of the Centers' services began developing since 1993 only after the adoption of the following basic legislative acts.

- law "On protection of consumers' rights" (1993)
- law "On protection of atmospheric air"(1992)
- Government decree "On standardization and certification" (1993)
- Government decree "On State control on standards, Norms and Rules conformity and responsibility for its violation" (1993)
- Government decree "On radiological, chemical-toxicological, physic-chemical control of food in trade organizations and in the system of public nutrition (1993)

137

The development of organizations which provide services for quality investigation of food, agricultural products and environment has actually stopped by now. Due to the situation described these organizations are not able to carry out the mentioned legislative acts enforcement neither in reliability of the tests nor in their quantity.

Creation and activities of new organizations working in the sphere of quality investigation of food, agricultural products and environment is closely connected with changes for the worse going on in political and economical life in the Ukraine. The State is not capable to provide complement of these organizations with reliable equipment. The private ukrainian firms are making only first steps in this direction. The foreign investments in base creation for food quality tests are hindered by unstable economical and political situation.

Since January 1994 Russia and some other N.I.S. countries restricted import of uncertified food products. These countries are the main importers of food and agriculture products produced in the Ukraine.

The difficult ecological situation which is caused by frequent ecological catastrophes and low culture of natural resources usage needs deep investigation of the environment situation.

Taking into account the above mentioned, the following conclusions could be made:
- there exists acute need in creation of laboratories which could provide quality investigation of food, agricultural products and environment;
- the market provision of services concerning quality investigation of food, agricultural products and environment will be developing very slowly in the nearest 3 - 5 years;
- international aid to the Ukraine only could speed up the creation of mentioned laboratories in the nearest future.

MARKETING STRATEGY

1. The Center will provide the following services.

- food and agricultural products testing in the framework of State Obligatory Certification System.
- food testing paid by national and foreign sponsors.
- food and agricultural products testing for exporters.
- scientific researches aimed to improve food, agricultural products and environment quality.
- environment monitoring in the framework of State and International Programs.
- provision of consultant services on creation and development of analogous laboratories in the Ukraine.

2. Expected customers of the Center:

- state organizations
  (ministries responsible for State food and environment safety control system)

138

Ministry of Environment Protection
Ministry of Health
Ministry of Population Protection against the Consequences of Chernobyl Catastrophe
State Committee on Protection of Consumers' Rights
State Committee on Standardization, Metrology and Certification

(state scientific research institutes)

Institute of Forensic Expertise
Institute of Feeding Hygiene
Institute of Calloids Chemistry and Chemistry of Water
etc.

- producers, food and agriculture products trade companies

- foreign state and organization-donors
  USA Government (USAID, EPA, etc.)
  European Community
  Canadian Government
  Netherlands Government
  GB Government

  World Bank
  European Bank of Reconstruction and Development
  etc.

3. The Center has established contacts and hopes for future fruitful cooperation with the following foreign companies.

- INTERNATIONAL RESOURCES GROUP LTD (USA)
- NTO (NETHERLANDS)
- BUREAU VERITAS (FRANCE)
- WS ATKINS ENVIRONMENT (GB)

4. The ways of customers' network extension

- free publicity of the Centers' activity by means of mass media with assistance of the Center's founder - Ukrainian Consumers' Association

- workshops and seminars holding in cooperation with interested Ministries, companies and organizations

- participation in Exhibitions of food and agriculture products producers, producers of laboratory equipment, Exhibition related to environment protection

FINANCIAL PLAN

Tax exemptions

In case of foreign investment for equipment purchase the Center will receive tax exemptions (VAT, tax on profits) on the period of five years according to the Government decree "On regime of foreign investments". Further calculations will be made taking into account this note.

139

ITEMS OF EXPENSES

	Annual US $	
1. SALARY	88,600	
2. RENT OF SPACE	57,000	
3. UTILITY SERVICES	15,400	
4. OFFICE	13,200	
5. TRANSPORT	5,200	
6. SPARE PARTS AND ACCESSORIES	26,000	
7. TECHNICAL SERVICE	5,000	
8. BUSINESS TRIPS	5,000	
10. SAFEGUARDING	3,000	
BASIC ANNUAL EXPENSES	218,400	US $
11. EMERGENCY FUND (3% of revenues)	12,000	
12. LONG-TERM CAPITALS	40,000	
13. DEPRECIATION (besides cars)	100,000	
14. ENTERTAINMENT	5,000	
15. RESEARCH	20,000	
ADDITIONAL ANNUAL EXPENSES	177,000	US $
TOTAL ANNUAL EXPENSES	395,400	US $

140

1. SALARY

Position	Number of man per position	Monthly salary US $	Total salary fund monthly/annual US $
director general	1	300	300/3600
technical director	1	250	250/3000
executive director	1	250	250/3000
bookkeeper	1	100	100/1200
standardization and quality manager	1	100	100/1200
secretary	1	100	100/1200
ASS operator	2	150	300/3600
GC operator	2	150	300/3600
GC/MS operator	2	150	300/3600
LC operator	4	150	600/7200
CE operator	1	150	150/1800
service engineer	1	100	100/1200
supply manager	1	80	80/960
sampling engineer	1	70	70/840
sample preparation laboratory assistant	5	50	250/3000
office-cleaner	1	30	30/360
	--- 26		

Annual salary fund:
39,360.00 US $ + reward fund(50% of salary fund, 19,680.00 US $) + tax(50%, 29,520.00) = 88,560.00 US $

TOTAL ANNUAL SALARY FUND	**88,600**	**US $**

2. RENT OF SPACE

	Quantity of rooms	Space of one room sq. m.	Total space sq.m.
Administration	3	15.00	45.00
Personnel	5	15.00	75.00
ASS-laboratory	1	20.00	20.00
GC-laboratory	2	20.00	40.00
LC-laboratory	2	20.00	40.00
CE-laboratory	1	15.00	15.00
Sampling preparation	4	15.00	60.00
Subsidiary premises	9	20.00	180.00

Total space 475.00 sq. m.
Total annual space rent 475*120 US $(annual space rent of one sq.m.) = 57,000.00 US $

TOTAL ANNUAL SPACE RENT	**57,000**	**US $**

141

3. UTILITY SERVICES

1. Electricity

Consumer of electr.	Power kW/hour	Work condit. hours/ day/month/year	Total consumption of electr. kW/hour/year	Number of units	Total annual consump. MW/hour
Basic equipment					
-	5	24/720/7200	36000	6	216
-	0.5	24/720/7200	3600	10	36
-	2	8/160/1600	3200	10	32
-	1	8/160/1600	1600	20	32
-	0.2	8/160/1600	320	40	13
Subsidiary equipment (illumination, air conditioning etc)					
-	0.2	2/40/400	80	100	8

Total annual electricity consumption 347 MW (15 US $ per MW)

Total annual electricity cost	5,300	US $

2. Thermal energy for heating room space

0.5 US $ per sq.m. per month
475*12*0.5 US.$ = 2,850.00 US $

Total annual thermal energy cost	2,900	US $

3. Water

Cool water expenditures per month	-	200 cube meters
Hot water expenditures per month	-	50 cube meters
Cool water expenditures per year	-	2400 cube meters
Hot water expenditures per year	-	600 cube meters
Cost of one cube meter of cool water	-	0.4 US $
Cost of one cube meter of hot water	-	0.5 US $
Annual cost of cool water	-	960 US $
Annual cost of cool water	-	300 US $

Total annual water cost	1,200	US $

4. Current repairing

Total annual current repairing cost	6,000	US $

TOTAL ANNUAL UTILITY SERVICES COST	**15,400**	**US $**

142

4. OFFICE

	per month US $	per year US $
1. Communications	500	3600
2. Stationery	200	2400
3. Fax, Xeroks	300	6000
4. Paper	100	1200
TOTAL ANNUAL OFFICE EXPENSES		13,200 US $

5. TRANSPORT

2 cars
daily 200 km per car
8 liters of fuel per 100 km
20 work days per month
Total annual cost of fuel 32*24*12*0.3 US $=2,765 US $
Depreciation 200 US $ per month
Total annual depreciation 2,400.00 US $

TOTAL ANNUAL TRANSPORT EXPENSES	5,200 US $

6. SPARE PARTS AND ACCESSORIES

	per year US $
Solvents	1,500
Gases	1,100
Chemical reagents	900
Standards for Chromatography and Atomic Adsorption Spectrometry	2,000
Paper for printers	400
Cartridges for printers	1,000
Chemical Glassware	2,300
Columns	12,000
Sample Concentration Cartridges for LC	800
Lamps for detectors and ASS	4,000
TOTAL ANNUAL SPARE PARTS AND ACCESSORIES COST	26,000 US $

7. TECHNICAL SERVICE

200 hours per year x 20.00 US $ per hour=4,000 US $
travelling allowance and etc. 1,000 US $

TOTAL ANNUAL TECHNICAL SERVICE	5,000 US $

13. DEPRECIATION (besides cars)

Total equipment cost 600,000.00 US $
Term of depreciation - 6 years

TOTAL ANNUAL DEPRECIATION	100,000 US $

143

ITEMS OF REVENUES

AMOUNT OF ANNUAL TESTS
(proceeding from the middle equipment productivity)

	Tests per day	Tests* per month	Tests per year
1. Atomic Absorption spectrometry (AAS-2 devices)	150	3000	36000
2. Gas Chromatography (GC-4 devices)	20	400	4800
3. Liquid Chromatography (LC-4 devices)	20	400	4800
4. Capillary Electrophoresis (1 device)	8	160	1920

TOTAL ANNUAL AMOUNT OF TESTS 47,520- Approx. 5,000 SAMPLES

Tests	Quantity of tests per year	Cost of one test US $	Total amount US $
ASS	36000	5.00	180,000.00
GC	4800	30.00	144.000.00
LC	4800	30.00	144,000.00
CE	1920	30.00	57,600.00
TOTAL ~~ANNUAL COST OF~~ TESTS			525,600.00 US $

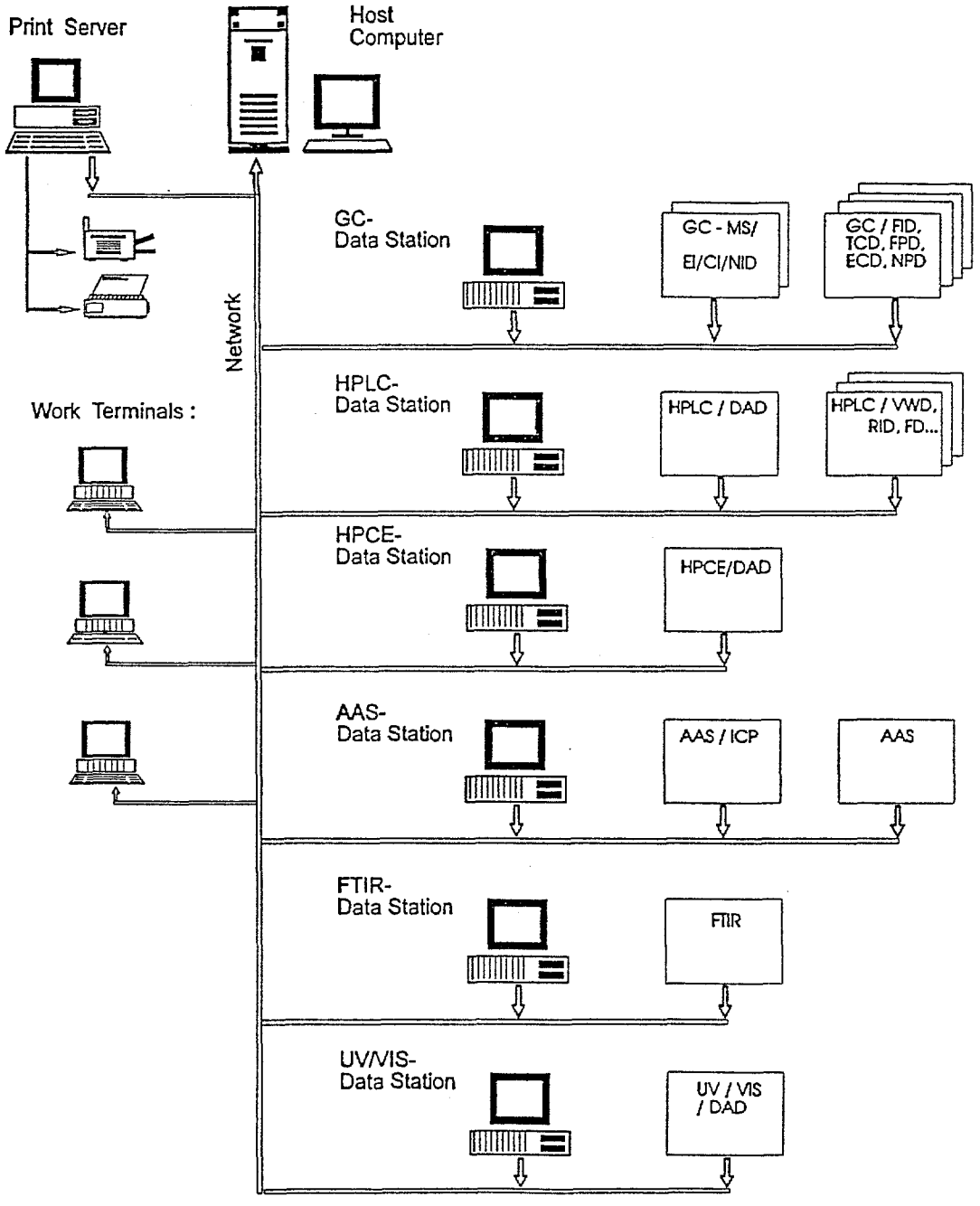
"Revenue From" S.Z. 10/24/94

* it is assumed 20 work days per month + two days for current service

144

Laboratory of environment and food testing

Set of analytical equipment



Abbreviations:

ICPS	inductive coupled plasma spectrometer
AAS	atomic absorption spectrometer
GS	gas chromatograph
HPLC	high perfomance liquid chromatograph
HPCEI	high perfomance capillary electrophoresis instrument
FTIR	fourier-transformed infra-red spectophotometer
UV/VIS	ultra-violet and visible spectophotometer
MSD	mass selective detector
FID	flame ionization detector
ECD	electron capture detector
DAD	diode array detector
VWD	variable wavelength (ultra-violet and visible) detector
FD	fluorescence detector
RID	refractive index detector

E C SUPPORT TEAM TACIS PROGRAMME

tel 212 8327/8312
fax 230 2513
1 Mikhailivska Sq.
KIEV 252018
UKRAINE

Mr. Gennadiy Kuznetsov
Director
National Analytical Center
37, Prospect Peremogy
Kiev, Ukraine

OBJECT. TACIS Project "Food Quality Technical Support and Training"

Dear Mr. Kuznetsov,

I hereby confirm to you that the National Analytical Center of Kiev is the Ukrainian recipient for the above-mentioned project of the 1993 Regional Programme.

Best Regards,

Ecu $1 = $1.2 USD

Michel Leblanc
Programme Director Agriculture and Environment
TACIS Programme Coordinating Unit

Program - Total fund 1.2 million Ecu
3 — 400,000 ~~Ecu~~ Ecu — only the Firm
$400K Moldova
$400K Belarus

147

ENVIRONMENTAL POLICY AND TECHNOLOGY PROJECT
20 Esplanadna Street, Kiev 252023, Ukraine

Fax Cover Sheet

DATE:	November 4, 1994	TIME:	8:04 AM
TO:	Mr. Steven M. Fox Analytical Technologies, Inc.	PHONE: FAX:	(044) 220-1187 (044) 220-0242
FROM:	Gennadiy Kuznetsov NAC	PHONE: FAX:	(044) 224-3511 (044) 446-7484
RE:	Fax from COMMISSION OF THE EUROPEAN UNION		

Number of pages including cover sheet: 2

Dear Sir,

I am sending for you the copy of fax from COMMISSION OF THE EUROPEAN UNION. I think that this fax will be interesting for you.

Hoping that you are interested in fruitful cooperation with us and thanking you in advance for your kind endeavors, I remain,

Gennadiy Kuznetsov

Director

148

TECHNICAL ASSISTANCE COORDINATION UNIT
COMMISSION OF THE EUROPEAN UNION

TACIS
PROGRAMME

tel 212 8327/8312
fax 230 2513
1 Mikhailivska Sq.
KIEV 252018
UKRAINE

N 1000

FAX MESSAGE

Date: 28 October 1994
Number of pages (including this one): 1
To: Mr Gennadi Kuznetsov, Director National Analytical Centre
(fax 446 74 84)
From: Mr Michel LEBLANC, TACIS Programme Coordinating Unit Kiev
(fax 230 25 13)

OBJECT: TACIS project - Food Quality Technical Support and Training

Dear Mr Kuznetsov,

According a fax message received from Mr Le Breton (Commission) on 26 October 1994, the project has not yet been tendered. The Terms of Reference are 99% complete and the shortlist agreed. In November. the proposed shortlist will enter the circuit for approval and launch.

You could expect the arrival of tenderers during December - January hunting for information for the preparation of their proposals. It is reasonable not to expect the project to start before April 1995.

Michel Leblanc

149

Appendix E

Test Results for Two Types of Kiev Drinking Water

Reported by

The Ukrainian Academy of Sciences

Institute for Colloid and Water Chemistry

- Kiev Drinking
- Rise Source
= Dn.pro

УТВЕРЖДАЮ
Руководитель Научно-технического центра исследования качества вод
_____ Сушко В.А.

_____

ПРОТОКОЛ №1

испытания качества водопроводной воды г.Киева
Дата отбора проб для испытаний - 2.11.93 г.
Дата доставки пробы воды в лабораторию - 2.11.93 г.
Дата проведения испытаний: 2.11.93 г. - 4.11.93 г.
Способ консервирования воды: без консервирования.

Адрес водопровода: ул. Народного Ополчения, 5-а

Результаты анализа:

Показатели химического состава воды:		Концентрация
Алюминий, мг/дм3	Al	0,57
Бор , мг/дм3	B	0,05
Бромиды, мг/дм3	Br^-	< 0,01
Иодиды, мг/дм3	I^-	0,003
Железо, мг/дм3	Fe	0,17
Кадмий, мг/дм3	Cd	< 0,001
Калий, мг/дм3	K	3.98
Кальций, мг/дм3	Ca	72,0
Магний, мг/дм3	Mg	10,1
Марганец, мг/дм3	Mn	0,020
Медь, мг/дм3	Cu	0,030
Молибден, мг/дм3	Mo	< 0,0001
Мышьяк, мг/дм3	As	0,003
Натрий, мг/дм3	Na	11,3
Никель, мг/дм3	Ni	0,002
Нитраты, мг/дм3	NO_3	0,9
Ртуть, мг/дм3	Hg	0,00005
Свинец, мг/дм3	Pb	< 0.001
Силикаты, мгSiO_2/дм3		8,3
Сумма растворимых силикатов, мгΣSiO_2/дм3		8,3
Стронций, мг/дм3	Sr	0,13

157

Kiev Aquaduct H_2O
Dnepr River Source
p 2

Сульфаты, мг/дм3 SO_4^{2-}		46,0
Углекислота (HCO_3^-), мг/дм3		232,0
Фториды, мг/дм3 F^-		0,3
Ортофосфаты, мг/дм3 PO_4^{3-}		0,09
Полифосфаты, мг/дм3 polyphosphate	<	0,005
Хлориды, мг/дм3 Cl^-		18,4
Хром, мг/дм3 ΣCr	<	0,0005
Общая жесткость, мг-экв/дм3 (Ca^{2+}+Mg^{2+})		4,5
Бериллий, мг/дм3 Be	<	0.00002
Аммоний, мг NH_3/дм3 NH_4^+	<	0,05
Цинк, мг/дм3 Zn		0,032
ХПК, мг O_2/дм3 COD		17
Фенол, мг/дм3 Phenol	<	0,0002
Амины алифатические первичные, мг/дм3 Aliphatic amines		10,0
Амины ароматические, мг/дм3 Aromatic amines	<	0,0002
Гептахлор, мг/дм3 Heptachlor	<	0,00001
Альдрин, мг/дм3 Aldrin	<	0,00001
Дильдрин, мг/дм3 Dieldrin	<	0,00002
ДДЕ, мг/дм3	<	0,00008
ДДТ, мг/дм3	<	0,00002
ДДД, мг/дм3	<	0,00008
Линдан, мг/дм3 Lindane	<	0,000005
Нефтепродукты, сумма, мг/дм3 Oil prod		0,14
Неполярные НП, мг/дм3 Non polar		0,08
Слабо полярные НП, мг/дм3 semi polar		0,06
Бензол, мг/дм3 Benzene	<	0.002
НПАВ, мг/дм3 nonionic surfactant		0,020
АПАВ, мг/дм3 anion surfactant		0,001
Активный хлор, мг/дм3 $Cl^{\oplus}$		0,3
Сухой остаток, мг/дм3 Mineralization		330,3
pH		7,55
Цветность Colour		15 градусов
Мутность (по каолину), мг/дм3		1,3
Запах, балл smell		1
Вкус, балл smack		0
Коли-индекс	<	3
Микроорганизмы, число/см3	<	100
Общая бета-активность, Ки/дм3 $\Sigma\beta$	<	1,35*10-11
Цезий-137, Ки/дм3 Cs-137	<	1,35*10-11
Стронций-90, Ки/дм3 Sr-90	<	1,35*10-11

Руководитель испытаний **Н.Ф.Фалендыш**

152

Kiev Ground H_2O Source

Drinking

УТВЕРЖДАЮ

Руководитель НТЦИКВ ИКХХВ
АН Украины

_____ Сушко В.А.

Протокол № 3

испытания качества воды, представленной фирмой ARGE Walter-Tekser

Адрес источника: ул.Народного ополчения, столовая /скважина/

Дата отбора пробы - 9.02.94 г.
Дата доставки в лабораторию - 9.02.94 г.
Дата проведения испытаний: 9.02.94 - 11.02.94 г.
Способ консервирования: без консервирования

Underground water

Показатели химического состава воды			Концентрация
pH			7,3
Алюминий, мг/дм^3	Al		0,040
Аммоний, мг N /дм^3	NH_4^+		0,34
Бериллий, мг/дм^3	Be	менее	0,00005
Бор, мг/дм^3	B		0,05
Бромиды, мг/дм^3	Br^-		0,008
Иодиды, мг/дм^3	I^-		0,005
Железо, мг/дм^3	Fe		0,3
Кадмий, мг/дм^3	Cd	менее	0,0001
Калий, мг/дм^3	K		6,6
Кальций, мг/дм^3	Ca^{2+}		85,7
Магний, мг/дм^3	Mg^{2+}		14,9
Марганец, мг/дм^3	Mn		0,12
Медь, мг/дм^3	Cu		0,014
Молибден, мг/дм^3	Mo		0,002
Мышьяк, мг/дм^3	As		0,004
Натрий, мг/дм^3	Na		15
Никель, мг/дм^3	Ni		0,005
Нитраты, мг NO_3^-/дм^3	NO_3		4,7
Нитриты, мг NO_2^-/дм^3	NO_2	менее	0,01
Ртуть, мг/дм^3	Hg		0,00005
Свинец, мг/дм^3	Pb		0,002
Селен, мг/дм^3	Se		0,00024
Стронций, мг/дм^3	Sr		0,55
Ортосиликаты, мг Si /дм^3			13,1

153

Kiev Brewery – Ground H_2O source H_2O (2)

Сумма растворимых силикатов, мг ΣSi /дм^3		13,3
Сульфаты, мг SO_4^{2-}/дм^3		2,8
Углекислота, мг HCO_3^-/дм^3		372
Фториды, мг/дм^3 F^-		0,43
Ортофосфаты, мг PO_4^{3-}/дм^3		0,075
Полифосфаты, мг PO_4^{3-}/дм^3	менее	0,005
Хлориды, мг/дм^3 Cl^-		2,5
Хром, мг/дм^3 ΣCr		0,0009
Цинк, мг/дм^3 Zn		1,2
Жесткость общая, мг-экв./дм^3 (Ca^{2+} + Mg^{2+})		5,5
ХПК, мг O /дм^3 COD		9
АПАВ, мг/дм^3 Anion surfactant		0,023
НПАВ, мг/дм^3 Nonionic surfactant	менее	0,02
КПАВ, мг/дм^3 Cation surfactant	менее	0,05
Фенол, мг/дм^3 Phenol	менее	0,0002
Амины ароматические, мг/дм^3 aromatic amines	менее	0,001
Амины алифатические, мг/дм^3 aliphatic amines		0,25
Нефтепродукты: Oil products		
сумма, мг/дм^3 Σ		0,10
неполярные, мг/дм^3 nonpolar		0,04
слабо полярные, мг/дм^3 semipolar		0,06
Бензол, мг/дм^3 Benzene	менее	0,002
Линдан, мг/дм^3 Lindane	менее	0,000005
ДДЕ, мг/дм^3 DDE	менее	0,00008
ДДД, мг/дм^3 DDD	менее	0,00008
ДДТ, мг/дм^3 DDT	менее	0,0002
Гептахлор, мг/дм^3 Heptachlor	менее	0,00001
Альдрин, мг/дм^3 Aldrin	менее	0,00001
Дильдрин, мг/дм^3 Dieldrin	менее	0,00001
Сухой остаток, мг/дм^3 Mineralization		335
Микробиологические показатели:		
Сапрофитные бактерии, число/дм^3 Saprophytic bacteria		20
Бактерии группы кишечной палочки, индекс Coliforms	менее	3

Руководитель испытаний Н.Ф.Фалендыш

Appendix F

Ukrainian Committee for Hydrometeorology Promotional Brochure

Appendix F

Ukraine (a Newly Independent State)
Republic since 1991
Area: 603,7 sq.km
Population: 53 million
Average population density about 85 inhabitants/sq.km.
Official language: Ukrainian
Capital: Kiev (more than 3 mln inhabitants)

THE STATE HYDROMETEOROLOGICAL COMMITTEE OF UKRAINE

Our target is to excel in providing hydrometeorological services that satisfy our customers current and future requirements

To fulfil this purpose,we commit ourselves to:

* Serving our customers - the Ukrainian Government,the public,the defence forces,aviation,industrial,agricultural,maritime and commercial customers - by meeting their agreed current and future requirements for meteorological, hydrological, agrometeorological,climatological and environmental services, forecasts, information and advice in an effective manner,

* Helping our customers to get maximum benefit from our information, advice and services,

* Maintaining an integrated National Hydrometeorological observational network,

* Continually striving to improve our forecasts and warnings, particularly their accuracy,

* Trying to use modern,well-proven technologies in our operations,

* Playing a role in the development of hydrometeorological science and operations through national and international collaboration,

* Making collection,processing,distribution and storage of meteorological,hydrological,climatological,air-quality, water quality, aerological data,

* Maintaining of scientific and technical research and development in all these fields.

ORGANIZATION

The State Hydrometeorological Committee of Ukraine is an Executive Agency under the auspice of the Cabinet of Ministry.The Committee is vote-financed within the Government and receives funds directly through the Ministry's of Finance budget allocation process.

HUMAN RESOURCES

At present time there are more than 5 thousand staff employed by the Hydrometeorological Service of Ukraine.Of these, 2500 have higher (university level) education and 1000 have had secondary level technical training. Highly-trained people are dedicated and energetic and represent a remarkable resources for provision of benefical services in the support of weather-sensitive sectors of the economy. From an operational viewpoint, staffing is available for most, if not all, hydrometeorological areas of interest while at the same time, women are well represented two-thirds of the total staff with many in professional positions.

The State Hydrometeorological Committee is managed by the Chairman, Mr. Viatcheslav Lipinskii, was appointed Chairman of the HMC in February, 1993 and assisted by two Vice-Chairmans, Mrs.Natali Tokar and Mr.Vladimir Dudarenko.

SURFACE - BASED OBSERVING NETWORK

Good observations are the foundation of good forecasts. In order to provide observational data for purely national purposes, as well as for international exchange for the World Weather Watch,the State Hydrometeorological Committee (HMC) of Ukraine maintains an extensive network of observational stations over the country and along the coastal zone areas of the Black and Azov Seas.

The land - based observing network consist of 203 surface meteorological observing stations (32 of which are exchanged internationally), 36 aeronautical weather stations, 651 secondary

stations (manual,automated and combaned), 9 upper-air stations release ballon-borne instruments every 6 hours.There are 375 hydrological observing sites located in the 6 major river basins and 60 sites on lakes. The agrometeorological network includes 180 sites plus a large number of sites providing data from farms.

A network of stations make regular observations and measurements of pressure, wind, temperature, visability, humidity, precipitation, sunshine duration, evaporation, phenological data and so on. Aerological stations provide temperature, humidity and wind data from the surface up to several tens kilometres.

All observing stations report in real - time to the 24 regional data - based centres and Central data - base centre.

WEATHER SERVICE

The county - wide service provide by the Hydrometeorological Centre in Kiev, 13 regional centres and specialized 35 aeronautical weather stations.

Forecasting is highly skilled scientific and technological process.Meteorological forecasts based upon the computer output products and upon guidance products mainly in graphical facsimile form received from Moscow as well as from such NMC's as Offenbach and Bracknell and from the ECMWF in Reading are prepared and issued for periods of up to 5 days for the country while short-term forecasts out to 36-hours are prepared by the regional centres respective areas of responsibility.

Severe weather warnings are issued as required. Early weather warnings often issued several days in advance, within a few hours of the event emergency "Flash" messages, giving greater details.

The forecast and warning products are disseminated on radio, T V , recorded telephone , newspapers and in the form of a widely distributed daily bulletin .

SPECIAL WEATHER SERVICE

* Aeronautical weather service is supplied by the aeronautical centre Borispol and regional aeronautical stations. Provide and advice meteorological information is carried out under agreement meteorological service to the Civil Aviation Authority .

158

* Largest specialized service is the Agriculture weather service. It's supplied by the Hydrometeorological Centre in Kiev and regional centres, specialized agrometeorological stations .

Specific service for agrometeorology is define ,as : making regular assessments of the impact of current and recent weather on agricultural production, the timely transmission of agriculturally significant weather information ; the interpretation of agricultural usage ; the application of agrometeorological data for the assessment of crops and early warnings of yield failure, preparation of agrometeorological forecasts.

* Hydrological service supplies forecasts river basins and cascade of water storages on Dnieper - river . Flood warnings are issued as required .

* Marine weather service provide forecasts and warnings for the coastal zones, areas Black and Azov Seas, Atlantic and Indian Oceans within the requirements of the International Convention for Safety of Life at Sea . Marine Weather Centres located at the seaports of Odessa, Mariupol, Sevastopol, Il'ichevsk .

Specialized forecasts and related products are provided as needed for various users such as economic interests, environmental control,water management, transport, construction,etc.

DATA PROCESSING SYSTEM

Observational data within Ukraine are transmitted from the sites by teletype, telegraph, telephone and, where appropriate for the type of data , by mail .Real - time data are collected at regional hydrometeorological centres from where it is relayed to the Kiev Centre which collects data from its region in real - time .There are 32 telegraph and 12 telephone circuits operating and providing input into an automated dual computer - based telecommunications collection and transmission system .

Internationally , the Hydrometeorological Centre in Kiev is connected to the NMC in Minsk , World Meteorological Centre in Moscow , NMC in Kishinev .Alpha - numeric and graphical products are exchanged via circuits while the Kiev Centre transmits selected data and graphical products via radio teletype and radio facsimile and also receives such information from Moscow and from NMCs in Offenbach and Bracknell as well as being relayed from the

159

European Centre for Medium Range Weather Forecasts in Reading .

The international exchange of data and products is carried out within the framework of WMO 's World Weather Watch Global Telecommunications System.

HMC's Computer Centre includes an EC - 1062 main frame computer system (comparable to IBM 379 series) with disk and tape drives , plotters , PC - type terminals , etc .The system handles a lot amount of the hydrometeorological and environmental data and serves as a data bank providing access on the part of the various forecast departments , for the automated plotting of weather charts and graphs and for output from numerical weather prediction models .

OBSERVATIONS FROM SATELLITES

Geostationary satellites provide visible images of the Earth and its clouds , measure cloud - top or surface temperature and detect regions of high or low water - vapour concentration .

Today the Hydrometeorological Centre in Kiev and 2 regional centres in Odessa and Lutsk utilize data from polar orbiting satellites are provided by NOAA - 11 . Aeronautical centres Borispol and Simpferopol have the receiving system data from satellites " MADAR " .

ENVIRONMENTAL MONITORING

HMC provides monitoring of pollution atmosphere ,surface water , sea water , fallouts , snow cover and soil .

About 173 observing sites in 53 cities provide air quality samples for laboratory analysis while surface water and sea water quality observations are made at 136 river, 15 reservoir and 7 lake sites plus 126 observing sites on the Black and Azov Seas.

Similarly, soil samples, precipitation and fallouts samples are regularly analyzed for the various chemical and metal elements.

In particular, soil pollution has numerous sources in Ukraine. Soils commonly are polluted by pesticides, in some places are by toxic heavy metals. Data of soil pollution are collected to define a trend of multi year pollution level.

Radio-aktive monitoring is carried out at 182 observing stations,the most demanding and crucial radiation assessments are being made in 30-km area around the Chernobyl Nuclear Power Plant.

Annualy, maps of Cs-137 and Sr-90 are prepared for

160

consideration by the appropriate authorities. The analytical aspects of the environmental monitoring programme for air, water and soil quality and for radiation are carried out amongst 45 laboratories in the country and National Centre of Observation Environment.

HMC provides the information regarding pollution emergencies caused by the release of toxic chemicals into the atmosphere, water and soil, seas, and relayed to nuclear accidents to a Government and Authority.

R E S E A R C H A C T I V I T Y

The Scientific Research Institute's task is to improve the various forecasting system used by Hydrometeorological Centre and regional Centres.

The main research fields are:

- numerical weather prediction models;
- theoretical studies of the dynamics and microphysics of clouds and precipitation on the mesoscale proccess in atmospheric fronts;
- mesoscale numerical models of stratiform clouds and precipitation in frontal systems;
- regional climate modelling;
- development and verification on crop - weather models;
- study chemical and radioactive pollutants;
- study of distribution of ozone concentration;
- water quality monitoring.

The research results are published in national magazines and in Publications of the Ukrainian Hydrometeorological Scientific Research Institute.

INTERNATIONAL COOPERATION

The State Hydrometeorological Committee of Ukraine is a member of the International Council of Hydrometeorology, which was established after break - up of the Soviet Union and 10 member - states are involved in its activity. The work is being coordinated by 14 working groups and the Executive Committee.

The State H M C has bilateral agreements with the

Hydrometeorological Service of Moldova and Azerbaijan.

Bilateral Agreements have been prepared between Russian Federation and Belorus about the interaction and collaboration in hydrometeorology.

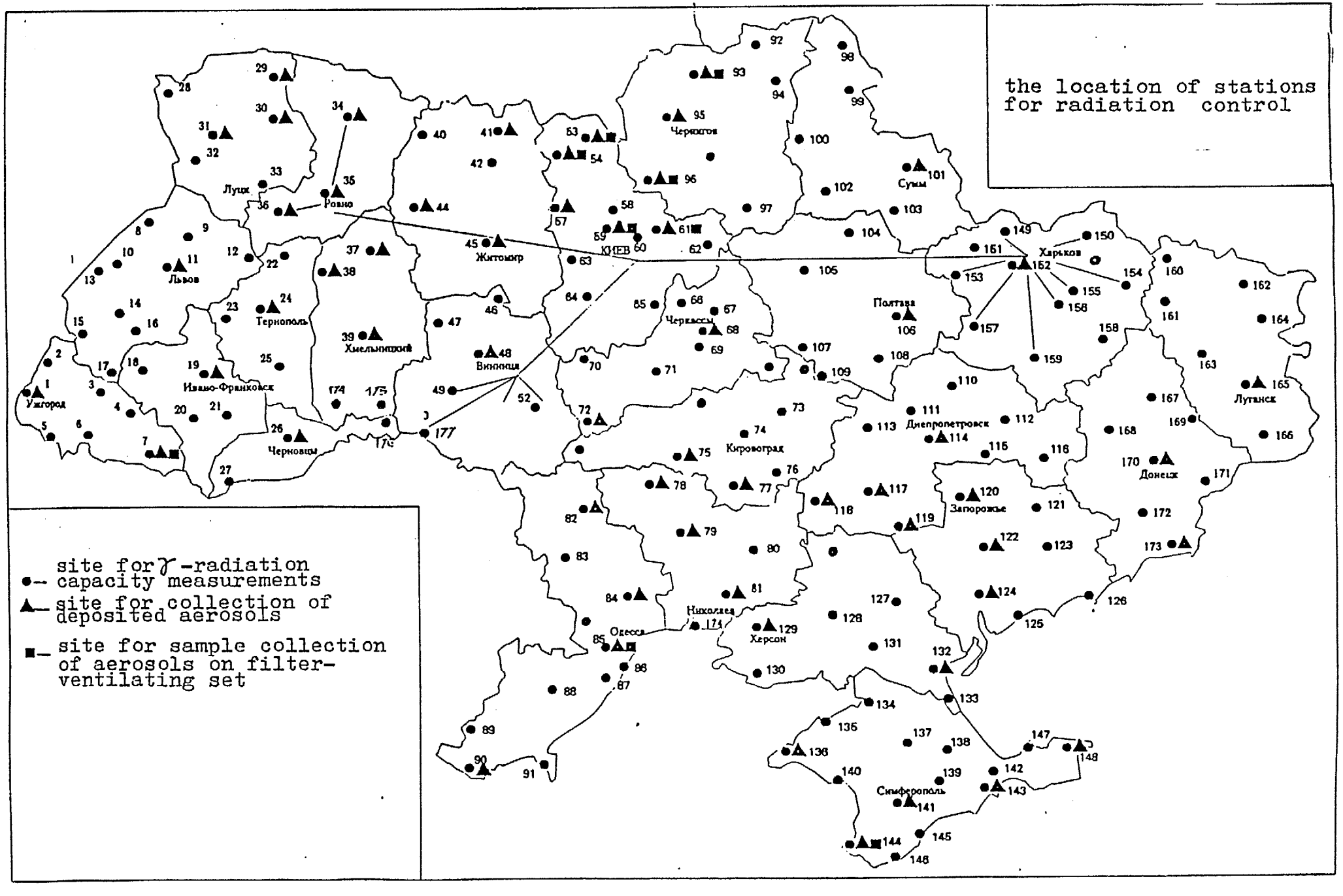
Ukraine takes part in regional cooperation of hydrological institutions of Danube countries in the framework of the International Hydrological Programme (IHP of UNESCO).

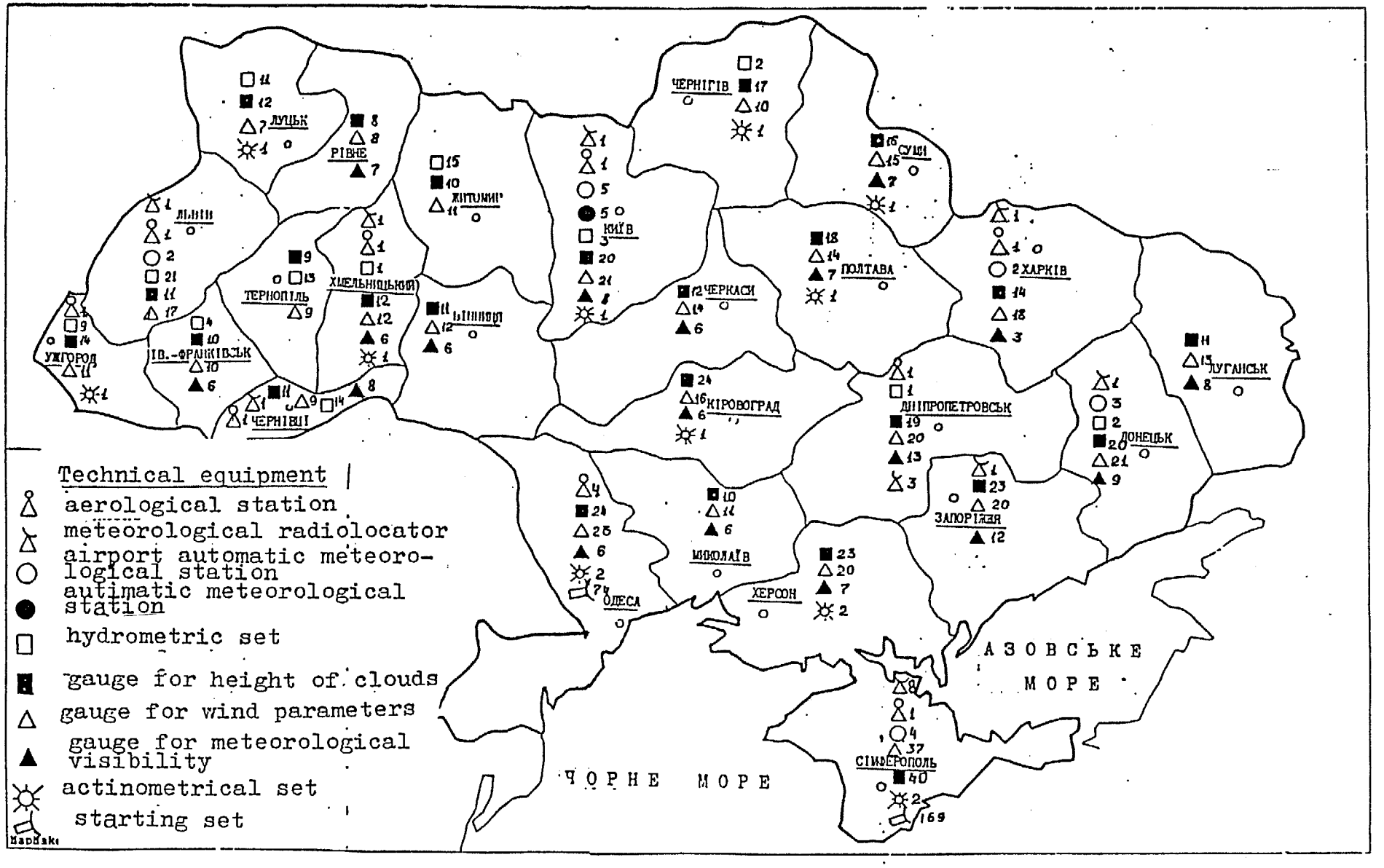
The State Hydrometeorological Committee of Ukraine is a member of the World Meteorological Organization and included in 6-th regional association.

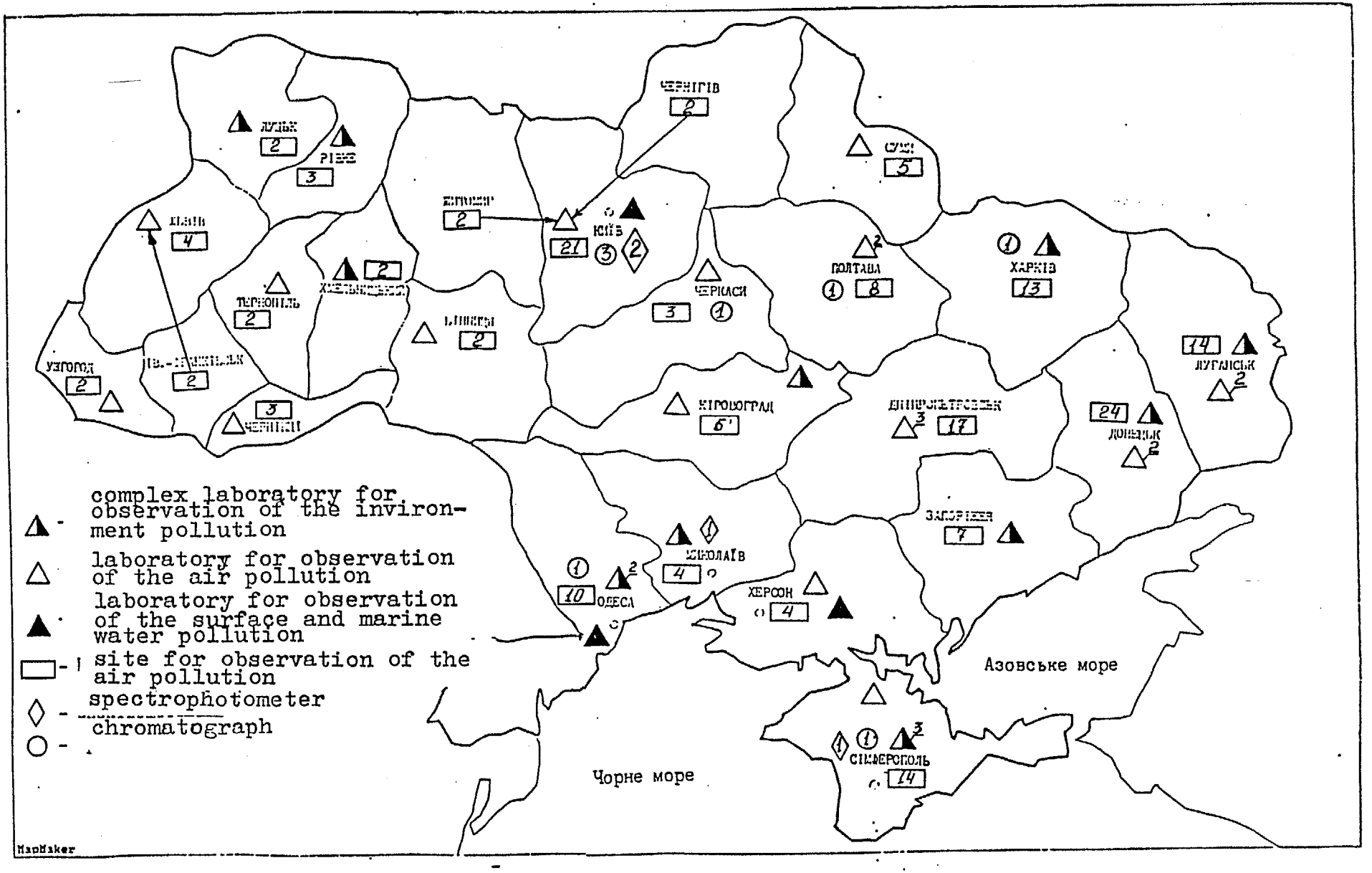
Publications are available from:
State Hydrometeorological Committee of Ukraine
Department for International Cooperation
6, Zolotovorotskaya street,
34, Kiev, 252601, Ukraine
Phone: 044 221 93 92, Fax: 044 229 18 88

39/2, Nauki prospect
28, Kiev, 252028, Ukraine
Phone: 044 265 20 04
Head of chemical laboratory
Semenova Irina

162


the location of stations for radiation control
site for γ-radiation capacity measurements
site for collection of deposited aerosols
site for sample collection of aerosols on filter-ventilating set
Ужгород
Львов
Луцк
Ровно
Тернополь
Ивано-Франковск
Хмельницкий
Черновцы
Житомир
Винница
КИЕВ
Черкассы
Черногов
Сумы
Полтава
Харьков
Днепропетровск
Кировоград
Луганск
Донецк
Запорожье
Одесса
Николаев
Херсон
Симферополь


Technical equipment
aerological station
meteorological radiolocator
airport automatic meteorological station
autimatic meteorological station
hydrometric set
gauge for height of clouds
gauge for wind parameters
gauge for meteorological visibility
actinometrical set
starting set
ЛУЦЬК
РІВНЕ
ЛЬВІВ
ЖИТОМИР
КИЇВ
ЧЕРНІГІВ
СУМИ
ТЕРНОПІЛЬ
ХМЕЛЬНИЦЬКИЙ
ЛЬВІВ
ЧЕРКАСИ
ПОЛТАВА
ХАРКІВ
УЖГОРОД
ІВ.-ФРАНКІВСЬК
ЧЕРНІВЦІ
КІРОВОГРАД
ДНІПРОПЕТРОВСЬК
ЛУГАНСЬК
ДОНЕЦЬК
ЗАПОРІЖЖЯ
МИКОЛАЇВ
ХЕРСОН
ОДЕСА
СІМФЕРОПОЛЬ
АЗОВСЬКЕ МОРЕ
ЧОРНЕ МОРЕ


complex laboratory for observation of the invironment pollution
laboratory for observation of the air pollution
laboratory for observation of the surface and marine water pollution
site for observation of the air pollution
spectrophotometer
chromatograph
ЧЕРНІГІВ
2
СУМИ
5
ЛУЦЬК
2
РІВНЕ
3
ЛЬВІВ
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ЖИТОМИР
2
КИЇВ
21
ПОЛТАВА
8
ХАРКІВ
13
ЧЕРКАСИ
3
ТЕРНОПІЛЬ
2
ХМЕЛЬНИЦЬКИЙ
2
ВІННИЦЯ
2
УЖГОРОД
2
ІВ.-ФРАНКІВСЬК
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ЧЕРНІВЦІ
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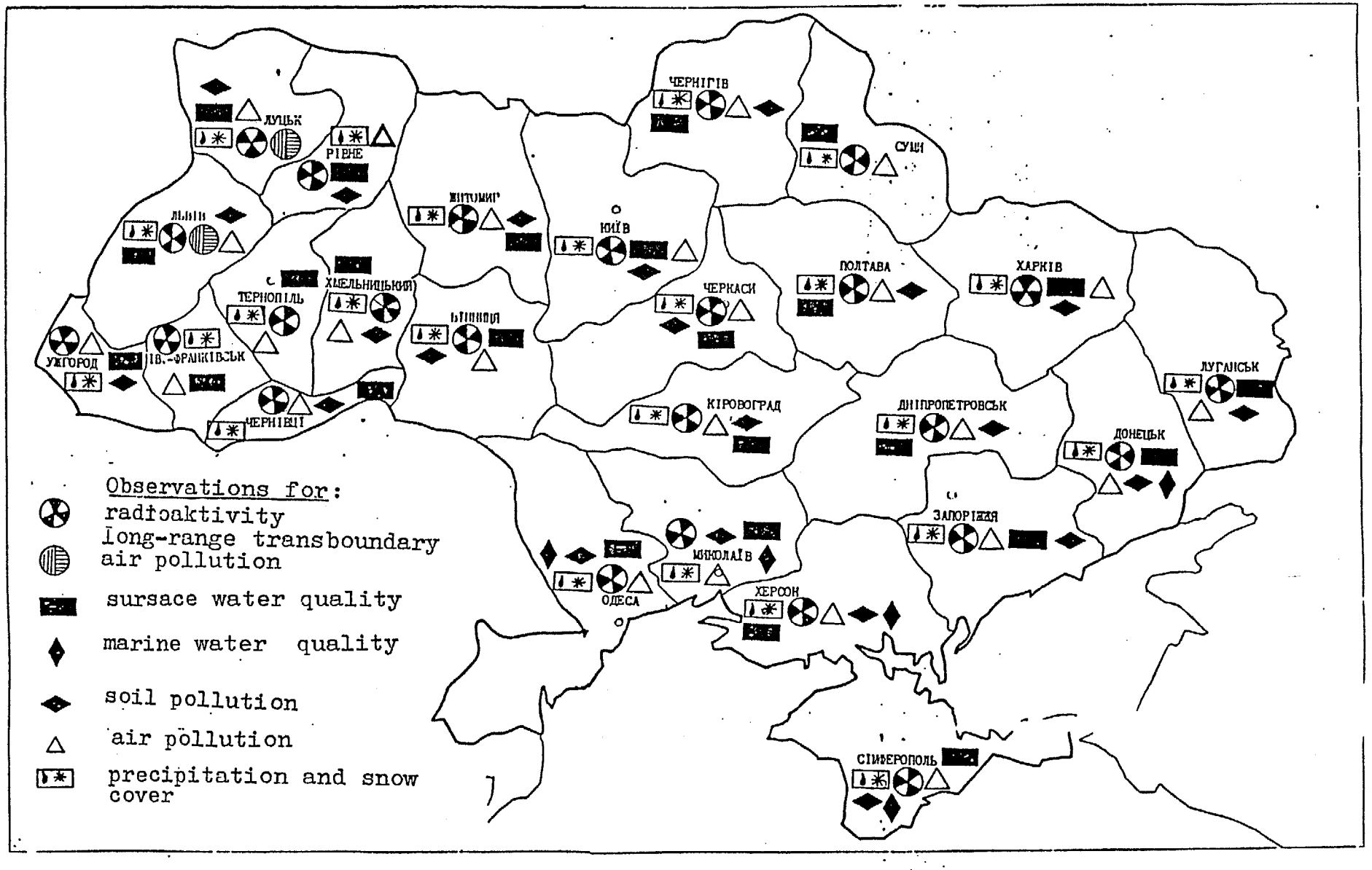
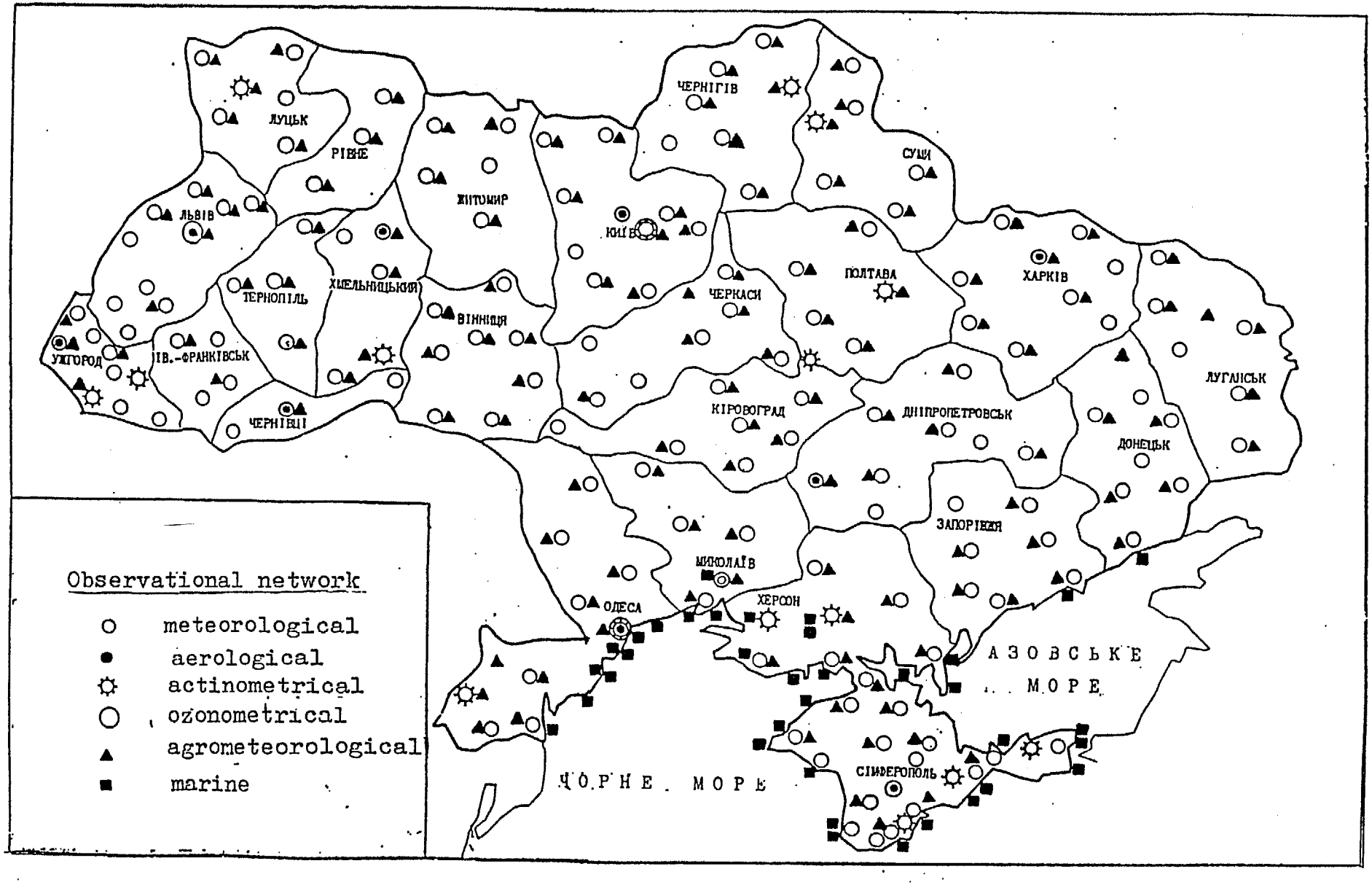
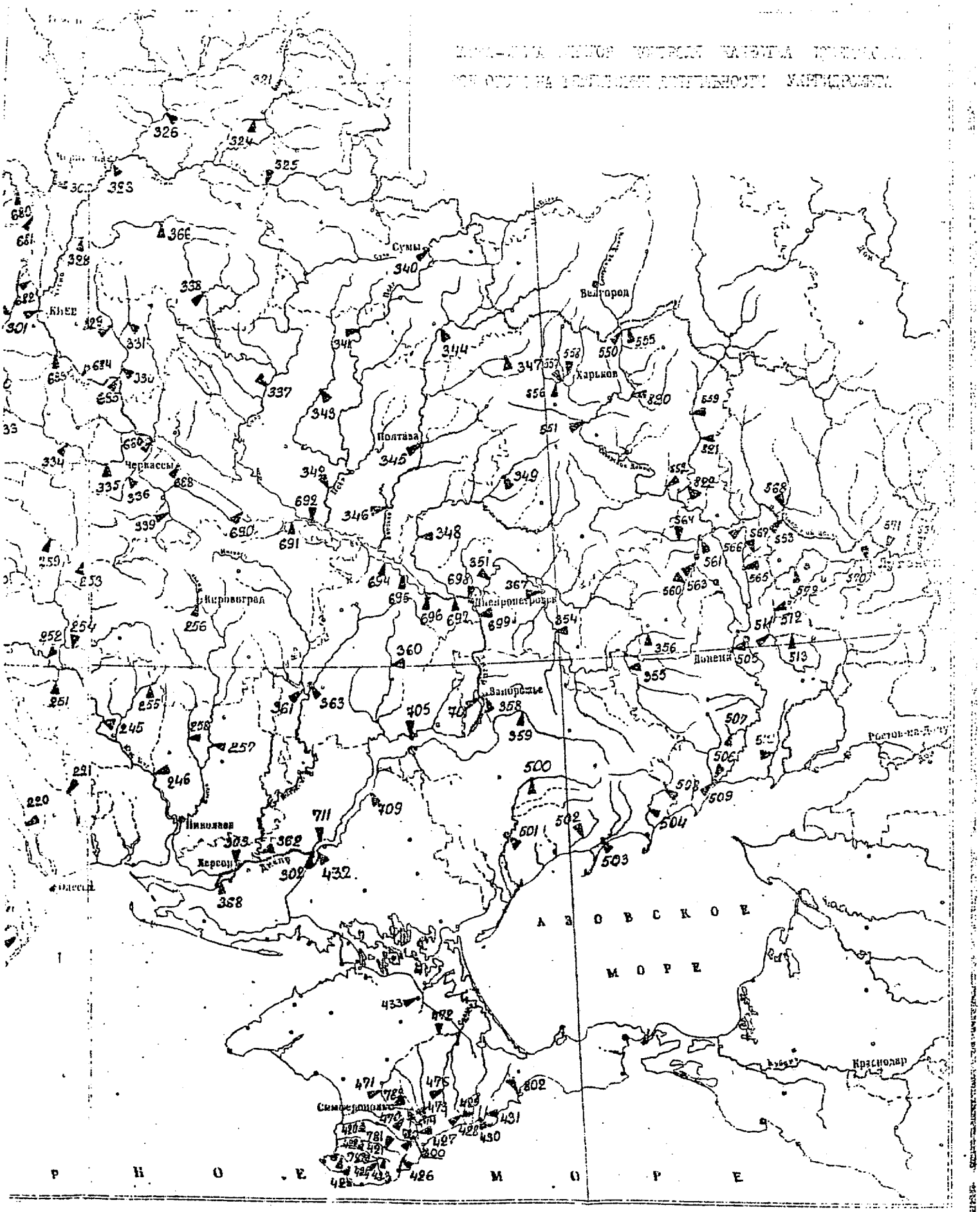
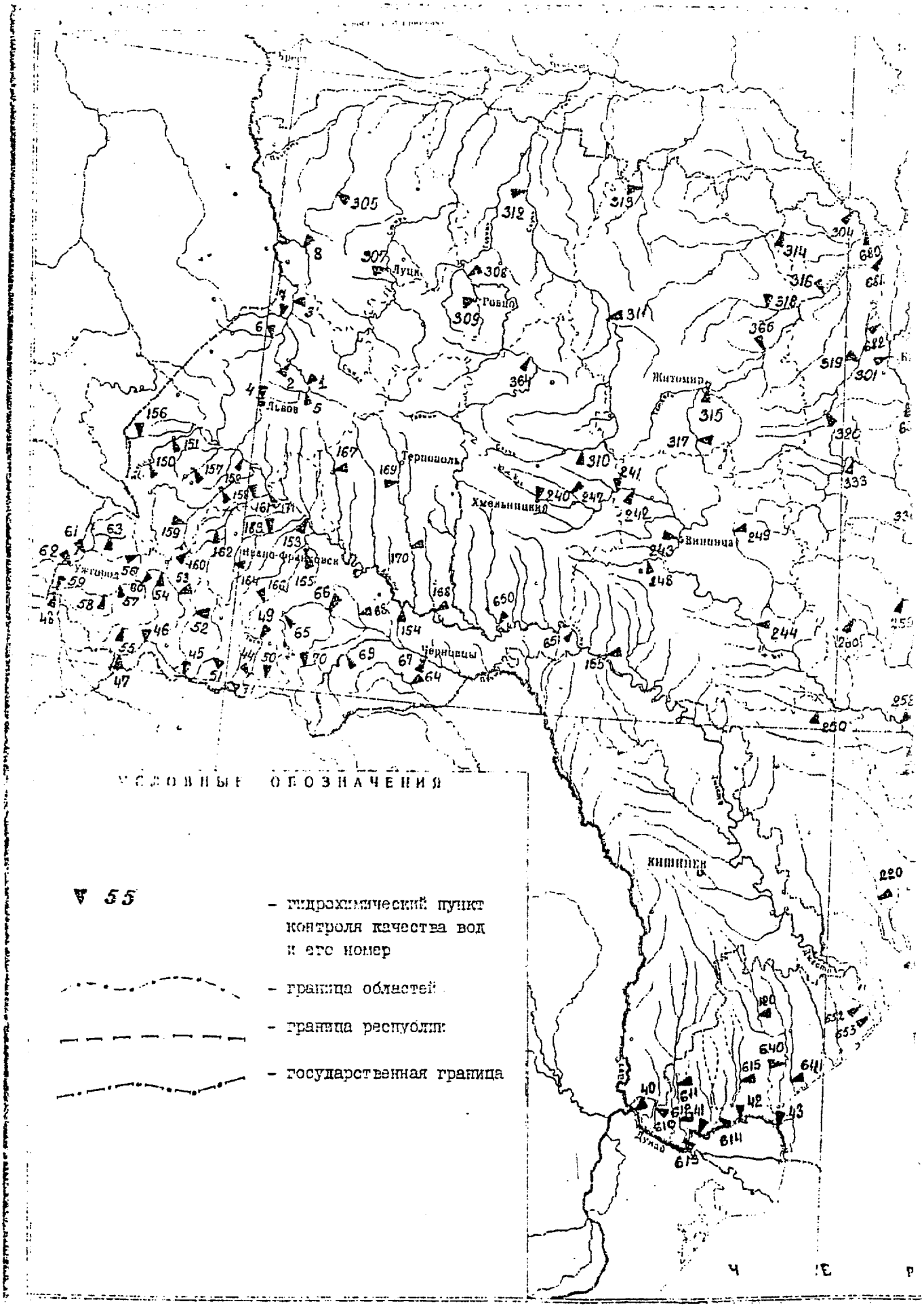
КІРОВОГРАД
6
ДНІПРОПЕТРОВСЬК
17
ЛУГАНСЬК
14
ДОНЕЦЬК
24
ЗАПОРІЖЖЯ
7
МИКОЛАЇВ
4
ОДЕСА
10
ХЕРСОН
4
СІМФЕРОПОЛЬ
14
Чорне море
Азовське море
MapMaker


ЛУЦЬК
РІВНЕ
ЛЬВІВ
ЖИТОМИР
ЧЕРНІГІВ
СУМИ
КИЇВ
ТЕРНОПІЛЬ
ХМЕЛЬНИЦЬКИЙ
ВІННИЦЯ
ЧЕРКАСИ
ПОЛТАВА
ХАРКІВ
УЖГОРОД
ІВ.-ФРАНКІВСЬК
ЧЕРНІВЦІ
КІРОВОГРАД
ДНІПРОПЕТРОВСЬК
ЛУГАНСЬК
ДОНЕЦЬК
ЗАПОРІЖЖЯ
МИКОЛАЇВ
ОДЕСА
ХЕРСОН
СІМФЕРОПОЛЬ
Observations for:
radioaktivity
long-range transboundary air pollution
sursace water quality
marine water quality
soil pollution
air pollution
precipitation and snow cover


Observational network
meteorological
aerological
actinometrical
ozonometrical
agrometeorological
marine
ЛУЦЬК
РІВНЕ
ЛЬВІВ
ЖИТОМИР
ЧЕРНІГІВ
СУМИ
КИЇВ
ТЕРНОПІЛЬ
ХМЕЛЬНИЦЬКИЙ
ВІННИЦЯ
ЧЕРКАСИ
ПОЛТАВА
ХАРКІВ
УЖГОРОД
ІВ.-ФРАНКІВСЬК
ЧЕРНІВЦІ
КІРОВОГРАД
ДНІПРОПЕТРОВСЬК
ЛУГАНСЬК
ДОНЕЦЬК
ЗАПОРІЖЖЯ
МИКОЛАЇВ
ОДЕСА
ХЕРСОН
СІМФЕРОПОЛЬ
АЗОВСЬКЕ МОРЕ
ЧОРНЕ МОРЕ


Сумы
Белгород
Харьков
Полтава
Черкассы
Кировоград
Днепропетровск
Запорожье
Донецк
Николаев
Херсон
Ростов-на-Дону
Краснодар
Симферополь
А З О В С К О Е
М О Р Е
Р Н О Е М О Р Е



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Appendix G

Ukrainian State Committee for Water Resources Equipment Request List

10/13 Ukrian B's; Suggested equipment for improving current capabilities

Appendix G

EQUIPMENT PROPOSAL
for Ukrainian Instituions (Laboratories)

NOTE: All equipment of Hach Company (USA), 1995 Catalog

State Committee for Water Resources

*Water Quality Laboratories:

Cat.No 46210-00 CEL/700, Price $2695.00, Quantity: 3
Cat.No 45250-05 DREL/2000, Price $3195.00, Quantity: 2

*COD Apparatus:

Cat.No 45600-00 COD Reactor, Price $495.00, Quantity 6
Cat.No 45717-01 Accessory Block, Price $110.00, Quantity 6
Cat.No 21258-15 Low Range COD Reagent Vials, Price $167.00, Quantity 12

*BOD Trak Apparatus:

Cat.No 26197-00 BOD Trak Apparatus, Price $1385.00, Quantity 10
Cat.No 14160-66 BOD Dillution Water Pillows 300 mL, Price $5.00, Quantity 100
Cat.No 621-00 BOD Bottle and Glass Stopper 300 mL, Price $9.00, Quantity 100
Cat.No 2597-02 IncuTrol/2 Regulator, 230 Vac, Price $550.00, Quantity 10

*Toxicity Test Kits:

Cat.No 25977-00 Toxi Trak, 25 tests, Price $250, Quantity 10

Ministry of Environmental Protection -- State Ecologic Inspectorate

*Water Quality Laboratories:

Cat.No 46210-00 CEL/700, Price $2695.00, Quantity: 3
Cat.No 45250-05 DREL/2000, Price $3195.00, Quantity: 2

*BOD Trak Apparatus:

Cat.No 26197-00 BOD Trak Apparatus, Price $1385.00, Quantity 10
Cat.No 14160-66 BOD Dillution Water Pillows 300 mL, Price $5.00, Quantity 100
Cat.No 621-00 BOD Bottle and Glass Stopper 300 mL, Price $9.00, Quantity 100
Cat.No 2597-02 IncuTrol/2 Regulator, 230 Vac, Price $550.00, Quantity 10

Kiev Vodokanal

*Portable Water Quality Laboratory:
Cat.No 45218-00 MEL/700, Price $3395.00, Quantity 2

*Pocket Colorimeter:
Cat.No 46700-00 Chlorine 0-2 mg/l, Price$295.00, Quantity 20

State Committee for Hydrometeorology

*Spectrophotometer:
Cat.No 44800-00 DR/2000, Price $1495.00, Quantity 2

Total $94,264-

Appendix H

Ukrainian Academy of Sciences

Institute for Colloid and Water Chemistry

Analytical Capability List

and

Equipment Lists

Appendix H

The List of Water Quality Parameters
Which are Monitored
by Institute of Colloid and Water Chemistry

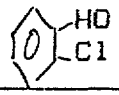
N N	Difined compound		Method of analysis	The low level of determination, mg/dm3
1	Silver	Ag	Photometry AAS (elektro-termal)	0,005 0,0003
2	Aluminium	Al	Photometry	0,01
3	Arsenic	As	Photometry IVAM	0,005 0,001
4	Berryllium	Be	AAS (elektro-termal)	0,0001
5	Barium	Ba	AAS (flame)	0,3
6	Boron	B	Photometry	0,05
7	Calcium	C	Titrimetric AAS (flame)	0,6 0,4
8	Cadmium	Cd	AAS (elektro-termal) IVAM	0,0002 0,0005
9	Cobalt	Co	AAS (flame) AAS (elektro-termal)	0,05 0,005
10	Copper	Cu	AAS (flame) AAS (elektro-termal) Photometry	0,05 0,001 0,005
11	Chromium	Cr Cr(III) Cr(VI)	Photometry AAS (elektro-termal) Photometry Photometry	0,01 0,0005 0,01 0,01
12	Iron	Fe Fe(II) Fe(III)	Photometry AAS (elektro-termal) Photometry Photometry	0,05 0,0006 0,05 0,05
13	Mercury	Hg	AAS (cold vapour)	0,00002
14	Potassium	K	AAS (flame)	0,2
15	Magnesium	Mg	AAS (flame) Titrimetric	0,1 1,5
16	Manganese	Mn	Photometry AAS (elektro-termal)	0,02 0,005

1	2		3	4
17	Molybdenum	Mo	Photometry AAS (elektro-termal)	0,002 0,004
18	Sodium	Na	AAS (flame)	0,2
19	Nickel	Ni	Photometry AAS	0,01 0,001
20	Lead	Pb	IVAM AAS (elektro-termal)	0,002 0,001
21	Strontium	Sr	AAS (flame)	0,01
22	Thallium	Tl	Photometry	0,0001
23	Uranus	U	Photometry	0,0005
24	Zinc	Zn	AAS (elektro-termal) IVAM	0,0001 0,0001
25	Selenium	Se	Fluorescent	0,0001
26	Cu, Pb, Cd, Zn		IVAM	0,0001
27	Fe, Co, Cu, U, Zn, Ca, Ag, Ni		X-ray fluorescent	0,003
28	Bromid	Br^-	Chemiluminescent IC	0,003 0,2
29	Chlorine	Cl^-	Potentiometric IC Titrimetric	0,5 0,05 0,5
30	Hydrocarbonate	HCO_3^-	Titrimetric	1,0
31	Iodide	J^-	Kinetic	0,002
32	Nitrate	NO_3^-	IC Potentiometric	0,2 0,4
33	Nitrite	NO_2^-	Photometry IC	0,01 0,1
34	Phosphate	PO_4^{3-}	Photometry IC	0,01 1,0
35	Polyphosphate		Photometry	0,01
36	Silicate	SiO_3^{2-}	Photometry	0,05

175

1	2	3	4
37	The same of soluble silicates	Photometry	0,05
38	Sulfate SO_4^{2-}	Titrimetric IC	2,0 0,3
39	Chlorine $Cl^{\bullet}$	Titrimetric	0,1
40	Chlorine Cl^{-}	Titrimetric	0,05
41	Hydrogen sulfide H_2S	Photometry	0,01
42	Ammonium NH_4^+	Photometry	0,05
43	Soluble oxigen O_2	Titrimetric	0,1
44	Rigidity (Ca+Mg) mg-ekv/dm3	Titrimetric	0,5
45	COD мг-O/дм3	Photometry	1,0
46	Acetat, Formate $CH-C{=}O{-}O^-$ $H-C{=}O{-}H$	IC	0,5
47	Aliphatic ammines $CH_3-CH_2-NH_2$	Photometry	0,03
48	Formaldegide $H-C{=}O{-}H$	HELC	0,002
49	Acetaldegide $CH_3-C{=}O{-}H$	HELC	0,02
50	Aceton $H_3C-C(=O)-CH_3$	HELC	0,003
51	Aromatic Ammines (Toluidines) C_6H_5-NH	HELC	0,0008-0,0015
52	Methylethylketone $CH_3-C(=O)-CH_2-CH_3$	HELC	0,005
53	Phenols C_6H_5-OH	HELC	0,2-0,5

176

1	2	3	4
54	Chlorphenols 	HELC	0,5-1,0
55	Anion surfactant	Photometry Fluorescent	0,05 0,005
56	Nonionic surfactant	Photometry	0,5
57	Cation surfactant	Photometry	0,05
58	Chloro Organic Pesticides Lindane, Heptachlor, Aldrin, Dieldren, DDT, DDD, DDE	Gass cromatography	$(1-5)*10^{-6}$
59	Polyaromatic hydrocarbons, Organic compound, Carboxilic acids, Pesticides, Phenol compounds	Cromato-mass- spectroscopy	10^{-5} -:- 10^{-8}

Note:

Method of analysis

AAS (f) - AAS with the fleame atomization;
AAS (e-t) - AAS with the electrothermal atomization;
IVAM - inversion voltammetry;
IC - ionic cromatography;
HELC - highlyeffective liquid cromatography;

177

The List of Water Quality Parameters which are Monitored by Institute of Colloid and Water Chemi

Нормируемые показатели качества вод, контролируемые Научно-техническим центром испытания качества вод при ИКХХВ НАН Украины

N	Определяемый компонент Defined compound	Метод анализа Method of analysis	Нижняя граница определяемых концентраций, мг/дм3 Low lim of determinat
1.	Silver серебро Ag	photometry фотометрический	0,005
		ААС-эт AAS (electro-thermal)	0,0003
2.	Aluminium алюминий Al	фотометический	0,01
3.	Arsenic мышьяк As	фотометрический	0,005
		ИВА IVAM	0,001
4.	Beryllium бериллий Be	ААС-эт AAS (e-t)	0,00001
5.	Barium барий Ba	ААС-п AAS (flame)	0,3
6.	Boron бор B	фотометрический	0,05
7.	Calcium кальций Ca	титриметрический	0,6
		ААС-п AAS (f)	0,4
8.	Cadmium кадмий Cd	ААС-эт AAS (e-t)	0,0002
		ИВА	0,0005
9.	Cobalt кобальт Co	ААС-п AAS (f)	0,05
		ААС-эт AAS (e-t)	0,005
10.	Copper медь Cu	ААС-п AAS (f)	0,05
		ААС-эт AAS (e-t)	0,001
	Chromium Cr	фотометрический	0,005
11.	хром	фотометрический	0,01
	Chromium	ААС-эт AAS (e-t)	0,0005
	хром (III) Cr(III)	фотометрический	0,01
	хром (VI) Cr(VI)	фотометрический	0,01
	Iron		
12.	железо Fe	фотометрический	0,05
	Iron	ААС-эт AAS (e-t)	0,0006
	железо (II) Fe(II)	фотометрический	0,05
	железо (III) Fe(III)	фотометрический	0,05
13.	Mercury ртуть Hg	ААС-хп AAS (cold vapour)	0,00002
14.	Potassium калий K	ААС-п AAS (f)	0,2
15.	Magnesium магний Mg	ААС-п AAS (f)	0,1
		титриметрический	1,5
16.	Manganese марганец Mn	фотометрический	0,02
		ААС-эт AAS (e-t)	0,005
17.	Molybdenum молибден Mo	фотометрический	0,002
	Sodium	ААС-эт AAS (e-t)	0,004
18.	натрий Na	ААС-п AAS (f)	0,2
19.	Nickel никель Ni	фотометрический	0,01
		ААС AAS	0,001
20.	Lead свинец Pb	ИВА IVAM	0,002
		ААС-эт AAS (e-t)	0,001

21.	стронций Sr	ААС-п AAS(f)	0,01
22.	таллий Tl	фотометрический	0,0001
23.	уран U	фотометрический	0,0005
24.	цинк Zn	ААС-эт AAS(e-t)	0,0001
		ИВА IVAM	0,0001
25.	селен Se	флуоресцентный fluorescent	0,0001
26.	медь, свинец, кадмий, цинк	ИВА IVAM	0,0001-
		X-ray fluorescent	0,002
27.	железо, кобальт, медь, уран, цинк, свинец, кадмий, ртуть, никель	рентген-флуоресцентный	
		флуоресцентный	0,003
		chemiluminescent	
28.	бромид Br^-	хемилюминесцентный	0,003
		(IC) ИХ ionic chromatography	0,2
29.	хлорид Cl^-	потенциометрический potentiometric	0,5
		ИХ IC	0,05
		титриметрический titrimetric	0,5
30.	гидрокарбонат HCO_3^-	титриметрический	1,0
31.	иодид I^-	кинетический Kinetic	0,002
32.	нитрат NO_3^-	ИХ IC	0,2
		потенциометрический potentiometric	0,4
33.	нитрит NO_2^-	фотометрический	0,01
		ИХ IC	0,1
34.	фосфат PO_4^{3-}	фотометрический	0,01
		ИХ IC	1,0
35.	полифосфат	фотометрический	0,01
36.	силикат SiO_3^{2-}	фотометрический	0,05
37.	сумма растворимых силикатов	фотометрический	0,05
38.	сульфат SO_4^{2-}	титриметрический	20
		ИХ IC	0,3
39.	хлор, активный Cl^0	титриметрический	0,1
40.	хлор, связанный Cl^-	титриметрический	0,05
41.	сероводород H_2S	фотометрический	0,01
42.	аммоний NH_4^+	фотометрический	0,05
43.	растворимый кислород O_2	титриметрический	0,1
44.	жесткость, общая, мг-экв/дм3	титриметрический	0,5
45.	ХПК, мг O /дм3 COD	фотометрический	1,0
46.	ацетат, формиат	ИХ IC	0,5
47.	алифатические амины	фотометрический	0,03
48.	формальдегид	ВЭЖХ HELC	0,002
49.	ацетальдегид	ВЭЖХ HELC	0,02
50.	ацетон	ВЭЖХ HELC	0,003
51.	ароматические амины (толуидины)	ВЭЖХ HELC	0,0008-0,0015
52.	метилэтилкетон	ВЭЖХ HELC	0,005
53.	фенолы	ВЭЖХ HELC	0,2-0,5
54.	хлорфенолы	ВЭЖХ HELC	0,5-1,0

anion surfactant

55.	АПАВ	фотометрический	0,05
	nonionic surfactant	флуоресцентный	0,005
56.	НПАВ	фотометрический	0,5
57.	КПАВ cation surfactant	фотометрический	0,05
58.	ХОП: Chloro Organic Pesticides		
	линдан, гептахлор, альдрин, диальдрин, ДДТ, ДДД, ДДЕ — DDT, DDD, DDE	газовохромато-графический (Gas chromatography)	(1-5).10-6
59.	полиароматические углеводороды, полихлорированные бифенилы, хлорорганические соединения, карбоновые кислоты, пестициды, фенольные соединения (Polyaromatic Hydrocarbons)	хромато-масс-спектрометрический (chromato-mass spectroscopy) organic compounds carboxilic acids pesticides phenol compounds	10-5 - 10-8

Note : AAS(f) AAS with the flame atomization

Примечание: ААС-п - атомно-абсорбционный с пламенной атомиза-
AAS(e-t) цией; AAS with the electrothermal atomization
ААС-эт - атомно-абсорбционный с электротермической атомизацией;
IVAM
ИВА - инверсионная вольтамперометрия; inversion voltammetry
ИХ IC - ионная хроматография; ionic chromatography
ВЭЖХ - высокоэффективная жидкостная хроматография
HELC higheffective liquid chromatography

Institute of Colloid and Water Chemistry

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Instruments and Equipment.

1. Atomic-absorption photometers:
   1.1. C-115M1 (Ukraine) with the flame atomiz
   1.2. C-115M1 with the el.-thermal atomizer
   1.3 „Saturn-3" (Ukraine) with the el.-therm. atomiz
2. Chromato-mass spectrometer (France „Vermeg R-10-100
3. IR-spectrometer „Specord M-80 (Germany)
4. Spectrophotometers (visible and ultraviolet spe
   4.1 СФ-26 (Russia)
   4.2 СФ-16 (Russia)
   4.3 „Spectron" (Uzbekistan)
   4.4 Specord UV-VIS (Germany „Karl Zeiss
5. Spectrophotometers (visible spectrum)
   5.1 Specol-10 (Germany)
   5.2 Specol-11 (Germany)
   5.3 КФК-2 (Russia)
   5.4 КФК-3 (Russia)
6. Fluorimeter РПУ-2 (Russia)
4. Ionic chromatograph „Цветность" (Russia)
8. Gas chromatograph (Russia)
   detectors: thermo-ionic
   flame-photometric
   Electron Capture ECD

18

9. Liquid chromatograph ampero-metric detector (Russia)

10. Liquid chromatograph photo-metric detector (Czech)

11. Liquid chromatograph „Milichrom-4" (Russia)

12. Polarograph „ПУ-1" (Russia)

13. Polarographic analyzer „PA-3" (Czech)

14. Ionometers with ion-selective electrodes (Russia)

15. Fourier-spectrometer NMR „CXP-200" (nuclear magnetic resonance) (Germany „Bruker")

16. Spectrometer EPR (electronic paramagnetic resonance) SE/X-2544 (Poland)

17. Spectrometer NMR ЯСМ 1-13 (Russia)

18. Relaxometer „PEKAP" (Russia)

19. Refrigerators, stereotaxes, analytical oven muffles.

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Приборы и оборудование

Научно-технического центра испытания материалов вст,
Институт коллоидной химии и химии воды НАН Украины

Атомно-абсорбционные спектрофотометры:

С-115-М1	Украина, Сумское ПО "Электрон"
С-115-М1 с приставкой "Графит-2"	-"-
"Сатурн-3" с приставкой "Графит-2"	Украина, НПО "Химавтоматика", г. Северодонецк
Хромато-масс-спектрометр R-10-100	Франция, фирма "Wermet"
ИК-спектрометр: Specord M-80	Германия, фирма "Карл Цейсс", Йена
Спектрофотометры (видимой и ультрафиолетовой области спектра):	
СФ-26	Россия, Ленинградское оптико-механическое объединение
СФ-16	
"Спектротрон"	Узбекистан, СКБА НПО "Химавтоматика", г. Гирчик
Specord UV-VIS	Германия, фирма "Карл Цейсс", Йена
Спектральные фотометры (видимая область спектра):	
Specol-10	Германия, фирма "Карл Цейсс", Йена
Specol-11	
КФК-2	Россия, Загорский оптико-механический завод, ПО "ЗОМЗ"
КФК-3	
Флуориметр ФМЦ-2	Россия, ЗНИКИ МПТ, г. Ленинград
Хроматограф ионный Цвет 2006	Россия, ОКБ приборов и автоматики, г. Йошкар-Ола
Хроматограф газовый ХПМ-5 с электронно-захватным, термионным, пламенно-ионизационным, пламенно-фотометрическим детекторами	Россия, ДОКБА, г. Дзержинск Нижегородской обл.
Хроматограф жидкостный с амперометрическим детектором ХПЖ-1	-"-
Хроматограф жидкостный с фотометрическим детектором ГПЦ	Чехия, фирма "Лабораторные приборы", г. Прага
Хроматограф жидкостный "Милихром-4"	Россия, ПО "Научприбор",

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Полярограф универсальный ПУ-1	г. Орел Беларусь, "Измеритель", г. Гомель
Полярографический анализатор РА-3	Чехия, фирма "Лабораторные приборы", г. Прага
Иономеры с комплектом ион-селективных электродов	Россия, Беларусь, Польша
Фурье-спектрометр ЯМР ФХР-200	Германия, фирма "Брукер"
Спектрометр ЭПР SE/X-2544	Польша, фирма "Радиопан"
Спектрометр ЯМР ИСШ 1-13	Россия, Фрязино
Релаксометр "РЕКАР"	Россия, г. Казань
Холодильники, секундомеры, весы аналитические, шкафы муфельные и сушильные	

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H2O + Colloid Chem
Desired Equipment List

Перечень крайне необходимых приборов для проведения аналитических работ в Научно-техническом центре испытания качества вод Института коллоидной химии и химии воды НАН Украины

Номер	Тип прибора	Область применения
1.	Анализатор общего органического углерода (Total organic carbon analyzer) Фирмы: "Beckman" (США), "Shimodzu" (Япония) TOC Furnace	В серийных анализах вод определение показателя общего содержания органического углерода, поскольку он характеризует уровень загрязнения вод органическими веществами
2.	Анализатор общего органического хлора Фирма: ИАС (Германия) Total Organic Halogen analyzer	В серийных анализах для определения суммы хлорсодержащих органических соединений. Актуально для оценки качества питьевой воды, так как водоподготовка включает стадию хлорирования, в результате чего образуются десятки хлорорганических соединений
3.	Хромато-масс-спектрометр GC/MS Фирма: "Hewlett-Packard" Volatile w/purge + Trap	Идентификация и определение летучих и ограниченнолетучих органических загрязнителей вод (хлор-, фосфор-, азот-, серосодержащие пестициды, полиядерные ароматические соединения, карбоновые кислоты и их производные и др.)
4.	Хромато-масс-спектрометр LC/MS Фирма: "Hewlett-Packard" amines, nitrosamines, acrylonitrile, Carbamates	Идентификация и определение нелетучих и термолабильных соединений в водах, таких как: амины, нитрозоамины, арил-, алкилмочевины, карбоматы и др.

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5.	Газовый хроматограф с набором детекторов: ECD, FID, TCD, AED Фирма: "Hewlett-Packard" (Flame photometric)?	В серийных анализах вод для определения летучих ограниченолетучих соединений
6.	Жидкостный хроматограф с набором детекторов – HP 1040 M HP 1046 A HP 1047 A HP 1049 A Liq Chrom Organic N_2, phenols (substituted) Фирма: "Hewlett-Packard"	В серийных анализах вод для определения азотсодержащих органических соединений, фенолов и фенольных соединений

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Appendix I

Representative Instrument and Mobile Laboratory Costs

as Quoted Prices

from

Hewlett Packard - Kiev

and

Analytical Technologies Inc. - Fort Collins, CO, USA

COMPUTERCENTER / КОМП'ЮТЕРЦЕНТР

Commercial suggestion #086/94

Division ShowRoom#1 Відділення	Currency Валюта	Total amount агальна сума	$160,486.40

Sales Manager
Код продавця

Date issued
Дата
04.Nov.94

Sold to / US Agency of International Development
Environmental Policy and Tecnology Programm (EPT-Program)
ATTN / До уваги: Dr. Steven Fry
Senior Laboratory Specialist
Address / Адреса: 252023 Esplanadnaya st. 20, Kiev, Ukraine
Phone / Телефон: (044) 220-13-67 (220-14-69) FAX / Факс: (044) 220-02-42

#	Configuration Конфігурація	Item # Код	Q-ty К-ть	Unit Price Вартість	Amount Сума
	GC5890/MSD5972A System				
1	**Chromatographic Mainframe** **Series II Plus Gas Chromatograph** **including Electonic Pressure Control**	5890E	1	$11,562.00	$11,562.00
2	**Capillary Inlet System with EPC** for split/splitless operation. Provides digital display of column head pressures of 0 - 100 psi (6.9bar).	5890E #110	1	$3,599.00	$3,599.00
3	**Split/Splitless capillary inlet with EPC and MSD** Configuration. Also includes HPIB digital communications interface, HP-5MS column, traps, liner, Merlin Microseal septum, and misc. hardware.	5890E #605	1	$5,255.00	$5,255.00
4	**Standard HP MSD System.** Includes HP 5972A MSD with ion gauge tube, Vectra 486/66XM instrument controller with 16 MB RAM, 450 MB disk, coprocessor, 3S" floppy, UltraVGA, 17" UltraVGA monitor, mouse, mouse pad, operating software, MS-DOS, MS-Excel, MS-Windows, Laserjet 4 printer (2MB RAM), installation and documentation.	G1020B	1	$67,970.00	$67,970.00
5	**NIST Chem. Structure MS library.** PBM format, includes 62.000 MS spectra, uses 13 - 29 MB disc space.	G1036A	1	$1,122.00	$1,122.00
6	**Purge & Trap Concentrator**	G1901A	1	$12,622.00	$12,622.00
7	**Pocket Heater for the P&T**	G1901A #002	1	$419.00	$419.00
8	**Interface cable for the P&T**	G1901A #011	1	$131.00	$131.00
9	**Automatic sampler with single injector** HPIB-interface and Bar Code Reader. Consists of Injector module HP18593B, Controller module HP 18596B, Tray module HP18596B; Bar Code Reader Module HP18587A and mounting bracket kit for HP5890 gas- chromatograph (HP18597-60655 and HP18597-60665). Includes shipping kit with 10µl syringe, 4ml- solvent and waste bottles with diffusion screw caps; 2ml-glass vials with polyethylene snap caps; 100 2-ml glass vials, caps and 11-mm crimper.	7673A #276	1	$14,288.00	$14,288.00
	Subtotal Mainfraime				$116,968.00
	Consumables:				
10	**Vespel-Ferrule for capillary direct or** open split interface 10/pk (0,4-mm id.) For use with 0,2mm capillary columns.	5062-3508	2	$61.00	$122.00
11	**Vespel-Ferrule for capping off. (10/pk).**	5181-3308	2	$47.00	$94.00
12	**Column nut for MSD-interface.**	05988-20066	5	$13.00	$65.00
13	**Filament assembly.**	05971-60140	2	$203.00	$406.00
14	**K&M Electron multiplier assembly.**	05971-80102	1	$1,137.00	$1,137.00
15	**Diffusion pump oil (18ml).**	6040-0809	1	$79.00	$79.00

188

COMPUTERCENTER / КОМП'ЮТЕРЦЕНТР

Commercial suggestion #086/94

Division ShowRoom#1 Відділення	Currency Валюта	Total amount загальна сума	$160,486.40

Sales Manager Код продавця

Date issued Дата 04.Nov.94

Sold to / US Agency of International Development
Environmental Policy and Tecnology Programm (EPT-Program)
ATTN / До уваги: Dr. Steven Fry
Senior Laboratory Specialist
Address / Адреса: 252023 Esplanadnaya st. 20, Kiev, Ukraine
Phone / Телефон: (044) 220-13-67 (220-14-69) FAX / Факс: (044) 220-02-42

#	Configuration Конфігурація	Item # Код	Q-ty К-ть	Unit Price Вартість	Amount Сума
16	Nylon gloves (large 1 pr).	8650-0030	5	$16.00	$80.00
17	Lint-free industrial wipes. 100% cotton, 9 x 9 inch (box of 300)	9310-4828	2	$174.00	$348.00
18	Aluminium powder.	8660-0791	2	$28.00	$56.00
19	Startup Kit	19199M	1	$448.00	$448.00
20	Column nut for capillary columns (2/pk).	5181-8830	5	$25.00	$125.00
21	Microseal kit	5181-8816	1	$242.00	$242.00
22	Vial rack for 11-mm vials (5/pk)	9301-0987	5	$31.00	$155.00
23	2-ml cripm/snap vial, (in plastic pack)	5182-0547	5	$178.00	$890.00
24	Crimping tool for 2 ml vials, 11mm caps	8710-0979	1	$169.00	$169.00
25	Graph. ferr. 0.5 mm id for all col (10/pk)	5080-8853	5	$48.00	$240.00
26	Septa gray 11 mm (144 /pk)	5080-8894	2	$73.00	$146.00
27	Split liner for capillary inlet	18740-80190	2	$48.00	$96.00
28	Splitless liner for capillary inlet	18740-80220	2	$30.00	$60.00
	Capillary Columns:				
29	HP-1(Closslinked Methyl Silikone) 25 m x 0.2 mm x 0.33 um	19091A-102	2	$615.00	$1,230.00
30	HP-5(Closslinked 5%Ph-Me Silikone) 25 m x 0.2 mm x 0.33 um	19091J-102	2	$408.00	$816.00
31	HP-FFAP (Cr/Link. Polyeth. Glycol-TPA Phase) 25 m x 0.2 mm x 0.3 um	19091F-102	2	$408.00	$816.00
	Syringes:				
32	Hamilton 701N 10 ul	9301-0021	2	$25.00	$50.00
33	Hamilton 7105NWG w/Guide 5 ul	9301-0089	2	$86.00	$172.00
34	Hamilton 1001N 1,0 ml	9301-0038	2	$40.00	$80.00
35	Hamilton 7101N Single needle 1,0 ul	9301-0057	5	$58.00	$290.00
	Training Courses:				
36	Mass Selective Detector Op.Trg (DOS)	H4043A	2	$2,100	$4,200
	Subtotal for consumables:				$8,412.00
	Cost of analytical equipment / Вартість аналіт. обладнання:				$125,380.00
	VAT/Податок на Додадкову Вартість	28.00%			$35,106.40
	Total/Загалом				$160,486.40

Payment terms / Умови оплати:

Wire transfer / Безготівковий переказ

Bank account & Address / Реквізити банку
CREDITANSTALT-BANKVEREIN
HEAD OFFICE: A-1010 VIENNA
ACCOUNT NAME: HEWLETT-PACKARD Ges.m.b.H.
ACCOUNT #: 23-38-861

DELIVERY TERMS 10 *weeks after receiving payment*
ТЕРМІН ПОСТАВКИ 10 *тижднів після отримання оплати*

If you will get any questions concerning equipment Hewlett-Packard please, don't hesitate to contact HP rep in Ukraine FE Dr. Andrey Esaulenko (SE Igor Tanasov): tel.:(044) 245-32-24 (224-04-71; 225-22-82), fax: (044) 224-00-22 or to HP Demo-Center Ms. Natalia Ostanina (Ms.Tatjana Pankratjeva) tel. (044) 559-34-64. Validity of this quotation: 90 days.

Customer Замовник _____ DD.MM.YY

Seller Продавець _____ 04.11.94 DD.MM.YY

VAT - is additional tax which have to be paid after equipment delivery in local currency.
Seems to be VAT is temporary measure. May be since 1995 it will be canceled.

189

COMPUTERCENTER / КОМП'ЮТЕРЦЕНТР

Commercial suggestion #084/94

Division ShowRoom#1 Відділення	*Currency* *Валюта*	Total amount Загальна сума	$59,640.32

Sales Manager
Код продавця

Date issued
Дата
04.Nov.94

Sold to / US Agency of International Development
Environmental Policy and Tecnology Programm (EPT-Program)
ATTN / До уваги: Dr. Steven Fry
Senior Laboratory Specialist
Address / Адреса: 252023 Esplanadnaya st. 20, Kiev, Ukraine

Phone / Телефон: (044) 220-13-67 (220-14-69) FAX / Факс: (044) 220-02-42

#	*Configuration* *Конфігурація*	Item # Код	Q-ty К-ть	Unit Price Вартість	Amount Сума
	Gas Chromatograph FID & ECD				
1	**Chromatographic Mainframe**	5890E	1	$11,562.00	$11,562.00
	Series II Plus Gas Chromatograph				
	including Electonic Pressure				
	Control				
2	**Capillary Inlet System with EPC**	5890E #110	1	$3,599.00	$3,599.00
	for split/splitless operation.				
3	**Temperature-programmed on-column**	5890E #116	1	$3,599.00	$3,599.00
	capillary inlet with EPC				
4	**Single FID with make up gas adapter**	5890E #211	1	$2,201.00	$2,201.00
5	**Single Electron Capture Detector**	5890E #231	1	$4,696.00	$4,696.00
7	**Install a set of three pressure regulators**	5890E #L43	1	$1,329.00	$1,329.00
8	**Single instrument advanced datastation**	G1271A	1	$11,370.00	$11,370.00
	Includes an Vectra 486/50VL2 computer;				
	80486DX2 processor, 12MB RAM, 210MB harddisc,				
	coprocessor, 3S"-Diskdrive, UltraVGA card				
	and an 15"-UltraVGA-monitor, tilt- and swievel,				
	mouse, mousepad, keyboard and HPIB-interface;				
	an HP Laserjet 4 printer with 2MB RAM and an				
	single instrument dual-channel software(G1201A).				
	An the MS-Excel-Report generator software G1280C.				
	Price on mainfraime:				$38,356.00
	Capillary Columns:				
9	**Ultra 1: 25 mx0.2mm x 0.33 um**	19091A-102	2	$615.00	$1,230.00
10	**Ultra 1: 50 mx0.2mm x 0.33um**	19091Z-105	2	$692.00	$1,384.00
11	**HP-1: 30 mx0.53mm x 1.5um**	19095Z-323	2	$562.00	$1,124.00
	Cross-linked 5% phenyl methyl silicone gum phase				
12	**Ultra 2: 25mx0.2mm x 0.33um**	19091B-102	2	$615.00	$1,230.00
13	**Ultra 2: 50mx0.2mm x 0.33um**	19091B-105	2	$935.00	$1,870.00
14	**FFAP: 25 mx0.32mm x 0.5um**	19091F-112	2	$450.00	$900.00
15	**HP-1701:30mx0.25mmx0.25um**	19091L-433	2	$528.00	$1,056.00

190

COMPUTERCENTER / КОМП'ЮТЕРЦЕНТР

Commercial suggestion #084/94

Division ShowRoom#1 Відділення	*Currency* *Валюта*	Total amount агальна сума	$59,640.32

Sales Manager
Код продавця

Date issued
Дата
04.Nov.94

Sold to / US Agency of International Development
Environmental Policy and Tecnology Programm (EPT-Program)
ATTN / До уваги: Dr. Steven Fry
Senior Laboratory Specialist
Address / Адреса: 252023 Esplanadnaya st. 20, Kiev, Ukraine
Phone / Телефон: (044) 220-13-67 (220-14-69) FAX / Факс: (044) 220-02-42

#	*Configuration* *Конфігурація*	Item # Код	Q-ty К-ть	Unit Price Вартість	Amount Сума
	Syringes:				
16	GC-on column (metal removable needle syringe 10	9301-0562	2	$126.00	$252.00
17	Replacement needles (3p/k)	9301-0561	1	$126.00	$126.00
18	Hamilton 701N 10 ul	9301-0021	4	$25.00	$100.00
19	Hamilton 7101N Single needle 1.0 ul	9301-0057	2	$58.00	$116.00
20	Hamilton 1001N fixed SS needle 1.0 ml	9301-0038	2	$40.00	$80.00
	Subtotal for consumables:				$8,238.00
	Cost of equipment / Вартість обладнання:				$46,594.00
	VAT/Податок на Додадкову Вартість	28.00%			$13,046.32
	Total/Загалом				$59,640.32

Payment terms / Умови оплати: Wire transfer / Безготівковий переказ	Bank account & Address / Реквізити банку CREDITANSTALT-BANKVEREIN HEAD OFFICE: A-1010 VIENNA ACCOUNT NAME: HEWLETT-PACKARD Ges.m.b.H. ACCOUNT #: 23-38-861

DELIVERY TERMS	9	*weeks after receiving payment*
ТЕРМІН ПОСТАВКИ	9	*тижднів після отримання оплати*

If you will get any questions concerning equipment Hewlett-Packard please, don't hesitate to contact HP rep in Ukraine FE Dr. Andrey Esaulenko (SE Igor Tanasov): tel.:(044) 245-32-24 (224-04-71; 225-22-82), fax: (044) 224-00-22 or to HP Demo-Center Ms. Natalia Ostanina (Ms.Tatjana Pankratjeva) tel. (044) 559-34-64. Validity of this quotation: 90 days.

Customer Замовник _____ DD.MM.YY	*Seller* *Продавець* _____ 04.11.94 DD.MM.YY

VAT - is additional tax which have to be paid after equipment delivery in local currency.
Seems to be VAT is temporary measure. May be since 1995 it will be canceled

191

COMPUTERCENTER / КОМП'ЮТЕРЦЕНТР

Commercial suggestion #083/94

Division ShowRoom#1 Відділення	*Currency* *Валюта*	Total amount агальна сума	$62,782.72

Sales Manager Код продавця	***Sold to / US Agency of International Development*** Environmental Policy and Tecnology Programm (EPT-Program) ***ATTN / До уваги: Dr. Steven Fry*** Senior Laboratory Specialist
Date issued Дата 04.Nov.94	***Address / Адреса: 252023 Esplanadnaya st. 20, Kiev, Ukraine***
	Phone / Телефон: (044) 220-13-67 (220-14-69) FAX / Факс: (044) 220-02-42

#	*Configuration* *Конфігурація*	Item # Код	Q-ty К-ть	Unit Price Вартість	Amount Сума
	Gas Chromatograph with TCD & FPD				
1	**Chromatographic Mainframe**	5890E	1	$11,562.00	$11,562.00
	Series II Plus Gas Chromatograph				
	including Electonic Pressure				
	Control				
2	**Capillary Inlet System with EPC**	5890E #110	1	$3,599.00	$3,599.00
	for split/splitless operation.				
3	**Temperature-programmed on-column**	5890E #116	1	$3,599.00	$3,599.00
	capillary inlet with EPC				
4	**Single Thermal Conductivity Detector**	5890E #221	1	$2,922.00	$2,922.00
5	**Single Flame Photometric Detector**	5890E #240	1	$7,660.00	$7,660.00
7	**Install a set of three pressure regulators**	5890E #L43	1	$1,329.00	$1,329.00
8	**Single instrument advanced datastation**	G1271A	1	$11,370.00	$11,370.00
	Includes an Vectra 486/50VL2 computer;				
	80486DX2 processor, 12MB RAM, 210MB harddisc,				
	coprocessor, 3S"-Diskdrive, UltraVGA card				
	and an 15"-UltraVGA-monitor, tilt- and swievel,				
	mouse, mousepad, keyboard and HPIB-interface;				
	an HP Laserjet 4 printer with 2MB RAM and an				
	single instrument dual-channel software(G1201A).				
	An the MS-Excel-Report generator software G1280C.				
	Price on mainfraime:				$42,041.00
	Consumables/Supplies:				
	Capillary Columns:				
9	**Ultra 1: 25 mx0.2mm x 0.33 um**	19091A-102	2	$615.00	$1,230.00
10	**Ultra 1: 50 mx0.2mm x 0.33um**	19091Z-105	2	$692.00	$1,384.00
11	**HP-1: 30 mx0.53mm x 1.5um**	19095Z-323	2	$562.00	$1,124.00
	Cross-linked 5% phenyl methyl silicone gum phase				
12	**Ultra 2: 25mx0.2mm x 0.33um**	19091B-102	2	$615.00	$0.00
13	**Ultra 2: 50mx0.2mm x 0.33um**	19091B-105	2	$935.00	$1,870.00
14	**FFAP: 25 mx0.32mm x 0.5um**	19091F-112	2	$450.00	$900.00
15	**HP-1701:30mx0.25mmx0.25um**	19091L-433	2	$528.00	$1,056.00

192

Commercial suggestion #083/94

Division ShowRoom#1 Відділення	*Currency* *Валюта*	Total amount агальна сума	$62,782.72

Sales Manager
Код продавця

Date issued
Дата
04.Nov.94

Sold to / US Agency of International Development
Environmental Policy and Tecnology Programm (EPT-Program)
ATTN / До уваги: Dr. Steven Fry
Senior Laboratory Specialist
Address / Адреса: 252023 Esplanadnaya st. 20, Kiev, Ukraine
Phone / Телефон: (044) 220-13-67 (220-14-69) FAX / Факс: (044) 220-02-42

#	*Configuration* *Конфігурація*	Item # Код	Q-ty К-ть	Unit Price Вартість	Amount Сума
	Syringes:				
16	GC-on column (metal removable needle syringe 10	9301-0562	2	$126.00	$252.00
17	Replacement needles (3p/k)	9301-0561	1	$126.00	$126.00
18	Hamilton 701N 10 ul	9301-0021	4	$25.00	$100.00
19	Hamilton 7101N Single needle 1.0 ul	9301-0057	2	$58.00	$116.00
20	Hamilton 1001N fixed SS needle 1.0 ml	9301-0038	2	$40.00	$80.00
	Supplies:				
21	Startup Kit	19199M	1	$448.00	$448.00
22	Microseal kit	5181-8816	1	$242.00	$242.00
23	Vial rack for 11-mm vials (5/pk)	9301-0987	5	$31.00	$155.00
24	2-ml cripm/snap vial, (in plastic pack)	5182-0547	5	$178.00	$890.00
25	Crimping tool for 2 ml vials, 11mm caps	8710-0979	1	$169.00	$169
26	Graph. ferr. 0.5 mm id for all col (10/pk)	5080-8853	5	$48.00	$240.00
27	Septa gray 11 mm (144 /pk)	5080-8894	3	$73.00	$219.00
28	Split liner for capillary inlet	18740-80190	2	$48.00	$96.00
29	Splitless liner for capillary inlet	18740-80220	2	$30.00	$60.00
	Subtotal for consumables:				$7,008.00

Cost of equipment / Вартість обладнання:		$49,049.00
VAT/Податок на Додадкову Вартість	28.00%	$13,733.72
Total/Загалом		$62,782.72

Payment terms / Умови оплати: Wire transfer / Безготівковий переказ	Bank account & Address / Реквізити банку CREDITANSTALT-BANKVEREIN HEAD OFFICE: A-1010 VIENNA ACCOUNT NAME: HEWLETT-PACKARD Ges.m.b.H. ACCOUNT #: 23-38-861

DELIVERY TERMS	9	*weeks after receiving payment*
ТЕРМІН ПОСТАВКИ	9	*тижднів після отримання оплати*

If you will get any questions concerning equipment Hewlett-Packard please, don't hesitate to contact HP rep in Ukraine FE Dr. Andrey Esaulenko (SE Igor Tanasov): tel.:(044) 245-32-24 (224-04-71; 225-22-82), fax: (044) 224-00-22 or to HP Demo-Center Ms. Natalia Ostanina (Ms.Tatjana Pankratjeva) tel. (044) 559-34-64. Validity of this quotation: 90 days.

Customer Замовник _____ DD.MM.YY	*Seller* *Продавець* _____ 04.11.94 DD.MM.YY

VAT - is additional tax which have to be paid after equipment delivery in local currency.
Seems to be VAT is temporary measure. May be since 1995 it will be canceled.

193

COMPUTERCENTER / КОМП'ЮТЕРЦЕНТР

Commercial suggestion #085/94

Division ShowRoom#1 Відділення	Currency Валюта	Total amount загальна сума	$63,768.32

Sales Manager Код продавця	Sold to / US Agency of International Development Environmental Policy and Tecnology Programm (EPT-Program) ATTN / До уваги: Dr. Steven Fry Senior Laboratory Specialist
Date issued Дата 04.Nov.94	Address / Адреса: 252023 Esplanadnaya st. 20, Kiev, Ukraine
	Phone / Телефон: (044) 220-13-67 (220-14-69) FAX / Факс: (044) 220-02-42

#	Configuration Конфігурація	Item # Код	Q-ty К-ть	Unit Price Вартість	Amount Сума
	Gas Chromatograph with FID & NPD				
1	**Chromatographic Mainframe**	5890E	1	$11,562.00	$11,562.00
	Series II Plus Gas Chromatograph				
	including Electonic Pressure				
	Control				
2	**Capillary Inlet System with EPC**	5890E #110	1	$3,599.00	$3,599.00
	for split/splitless operation.				
3	**Temperature-programmed on-column**	5890E #116	1	$3,599.00	$3,599.00
	capillary inlet with EPC				
4	**Single FID with make up gas adapter**	5890E #211	1	$2,201.00	$2,201.00
5	**Single Nitrogen-Phosphorus Detector**	5890E #231	1	$2,817.00	$2,817.00
7	**Install a set of three pressure regulators**	5890E #L43	1	$1,329.00	$1,329.00
8	**Single instrument advanced datastation**	G1271A	1	$11,370.00	$11,370.00
	Includes an Vectra 486/50VL2 computer;				
	80486DX2 processor, 12MB RAM, 210MB harddisc,				
	coprocessor, 3S"-Diskdrive, UltraVGA card				
	and an 15"-UltraVGA-monitor, tilt- and swievel,				
	mouse, mousepad, keyboard and HPIB-interface;				
	an HP Laserjet 4 printer with 2MB RAM and an				
	single instrument dual-channel software(G1201A).				
	An the MS-Excel-Report generator software G1280C.				
	Price on mainfraime:				$36,477.00
	Consumables/Supplies:				
	Capillary Columns:				
9	**Ultra 1: 25 mx0.2mm x 0.33 um**	19091A-102	2	$615.00	$1,230.00
10	**Ultra 1: 50 mx0.2mm x 0.33um**	19091Z-105	2	$692.00	$1,384.00
11	**HP-1: 30 mx0.53mm x 1.5um**	19095Z-323	2	$562.00	$1,124.00
	Cross-linked 5% phenyl methyl silicone gum phase				
12	**Ultra 2: 25mx0.2mm x 0.33um**	19091B-102	2	$615.00	$0.00
13	**Ultra 2: 50mx0.2mm x 0.33um**	19091B-105	2	$935.00	$1,870.00
14	**FFAP: 25 mx0.32mm x 0.5um**	19091F-112	2	$450.00	$900.00
15	**HP-1701:30mx0.25mmx0.25um**	19091L-433	2	$528.00	$1,056.00

194

COMPUTERCENTER / КОМП'ЮТЕРЦЕНТР

Commercial suggestion #085/94

Division ShowRoom#1 Відділення	Currency Валюта	Total amount загальна сума	$63,768.32

Sales Manager Код продавця

Date issued Дата 04.Nov.94

Sold to / US Agency of International Development
Environmental Policy and Tecnology Programm (EPT-Program)
ATTN / До уваги: Dr. Steven Fry
Senior Laboratory Specialist
Address / Адреса: 252023 Esplanadnaya st. 20, Kiev, Ukraine
Phone / Телефон: (044) 220-13-67 (220-14-69) FAX / Факс: (044) 220-02-42

#	Configuration Конфігурація	Item # Код	Q-ty К-ть	Unit Price Вартість	Amount Сума
11	HP-1: 30 mx0.53mm x 1.5um	19095Z-323	2	$562.00	$1,124.00
	Cross-linked 5% phenyl methyl silicone gum phase				
12	Ultra 2: 25mx0.2mm x 0.33um	19091B-102	2	$615.00	$1,384.00
13	Ultra 2: 50mx0.2mm x 0.33um	19091B-105	2	$935.00	$1,870.00
14	FFAP: 25 mx0.32mm x 0.5um	19091F-112	2	$450.00	$900.00
15	HP-1701:30mx0.25mmx0.25um	19091L-433	2	$528.00	$1,056.00
	Syringes:				
16	GC-on column (metal removable needle syringe 10	9301-0562	2	$126.00	$252.00
17	Replacement needles (3p/k)	9301-0561	1	$126.00	$126.00
18	Hamilton 701N 10 ul	9301-0021	4	$25.00	$100.00
19	Hamilton 7101N Single needle 1.0 ul	9301-0057	2	$58.00	$116.00
20	Hamilton 1001N fixed SS needle 1.0 ml	9301-0038	2	$40.00	$80.00
	Supplies:				
21	Startup Kit	19199M	1	$448.00	$448.00
22	Microseal kit	5181-8816	1	$242.00	$242.00
23	Vial rack for 11-mm vials (5/pk)	9301-0987	5	$31.00	$155.00
24	2-ml cripm/snap vial, (in plastic pack)	5182-0547	5	$178.00	$890.00
25	Crimping tool for 2 ml vials, 11mm caps	8710-0979	1	$169.00	$169
26	Graph. ferr. 0.5 mm id for all col (10/pk)	5080-8853	5	$48.00	$240.00
27	Septa gray 11 mm (144 /pk)	5080-8894	5	$73.00	$365.00
28	Split liner for capillary inlet	18740-80190	4	$48.00	$192.00
29	Splitless liner for capillary inlet	18740-80220	4	$30.00	$120.00
	Subtotal for consumables:				$13,342.00

Cost of equipment / Вартість обладнання:		$49,819.00
VAT/Податок на Додадкову Вартість	28.00%	$13,949.32
Total/Загалом		$63,768.32

Payment terms / Умови оплати:	Bank account & Address / Реквізити банку
Wire transfer / Безготівковий переказ	CREDITANSTALT-BANKVEREIN HEAD OFFICE: A-1010 VIENNA ACCOUNT NAME: HEWLETT-PACKARD Ges.m.b.H. ACCOUNT #: 23-38-861

DELIVERY TERMS	9	*weeks after receiving payment*
ТЕРМІН ПОСТАВКИ	9	*тижднів після отримання оплати*

If you will get any questions concerning equipment Hewlett-Packard please, don't hesitate to contact HP rep in Ukraine FE Dr. Andrey Esaulenko (SE Igor Tanasov): tel.:(044) 245-32-24 (224-04-71; 225-22-82), fax: (044) 224-00-22 or to HP Demo-Center Ms. Natalia Ostanina (Ms.Tatjana Pankratjeva) tel. (044) 559-34-64. Validity of this quotation: 90 days.

Customer Замовник _____ DD.MM.YY	Seller Продавець _____ 04.11.94 DD.MM.YY

VAT - is additional tax which have to be paid after equipment delivery in local currency.
Seems to be VAT is temporary measure. May be since 1995 it will be canceled

COMPUTERCENTER / КОМП'ЮТЕРЦЕНТР

Commercial suggestion #088/94

Division ShowRoom#1 Відділення	*Currency* *Валюта*	Total amount Загальна сума	$122,549.76

Sales Manager
Код продавц

Date issued
Дата
04.Nov.94

Sold to / US Agency of International Development
Environmental Policy and Tecnology Programm (EPT-Program)
ATTN / До уваги: Dr. Steven Fry
Senior Laboratory Specialist
Address / Адреса: 252023 Esplanadnaya st. 20, Kiev, Ukraine
Phone / Телефон: (044) 220-13-67 (220-14-69) FAX / Факс: (044) 220-02-42

#	*Configuration* *Конфігурація*	Item # Код	Q-t К-т	Unit Price Вартість	Amount Сума
	HPLC 1050/DAD/FD/ECD				
1	**HP-1050 Series Quarternary Pump** Includes solvent conditioning module with four 1-liter solvent bottles, each with sparger, filter, cap and four individual helium regulators; start-up -kit and documentation; one HP1050 remote control cable.	79852A	1	$16,557.00	$16,557.00
2	**Maintenance Kit** Includes spare parts required for one year of normal operation of the pump.	79852A #010	1	$506.00	$506.00
3	**Manual Injection Valve.** Factory installed into solvent conditioning module. Includes Rheodyne 7125 valve with 20 µl loop, position-sensing switch, remote start cable, 250 µl Hamilton syringe and needle, leak drain.	79852A #021	1	$1,232.00	$1,232.00
4	**Diode-Array HPLC-Detection System.** Includes HP G1306A Diode-Array Detector with start-up kit and communication interface for control by HPLC3D Chemstation (DOS-Series); HPIB-cable, 1m; SST Flow Cell, 10 mm pathlength, 13 µl; and an Vectra 486/66XM computer; 80486DX processor, 16MB RAM, 450MB harddisc, coprocessor, 3S"-Diskdrive, UltraVGA card and an 15"-UltraVGA-monitor, tilt- and swievel, mouse, mousepad, keyboard and HPIB-interface; an HP Laserjet 4 printer and an single instrument chemstationsoftware (G1307A).	G1324A	1	$34,236.00	$34,236.00
5	**HP 1046A Programmable Fluorescence Detector** Includes 280 nm cut-off filter; one 2 x 2 mm slit on excitation side; two 4 x 4 mm slits on emmision side; 1/16-inch swagelok female connections for solvent inlet and outlet; documentation.	1046A	1	$15,428.00	$15,428.00
6	**Communication Interface.** For control by HP 3396B integrator or HP-Chemstation (3D-DOS-Series). Includes HPIB interface, HPIB-cable 0.5 m long.	1046A #305	1	$1,284.00	$1,284.00
7	**Maintenance Kit.**	1046A #502	1	$782.00	$782.00
8	**Cut-off filter kit I.** Including special low fluorescent filters for 389, 408, 450, 500, 550 nm.	1046A #810	1	$439.00	$439.00
9	**HP 1049A Programmable Electrochemical Detec** Includes inlet capillary, outlet tubing, glassy carbon working electrode, solid state electrode and documentation.	1049A	1	$10,636.00	$10,636.00
10	**Solvent thermostat.**	1049A #025	1	$1,373.00	$1,373.00
11	**Gold working electrode.** includes P/N 01049-28802.	1049A #030	2	$405.00	$810.00
12	**Reference electrode with internal electrolyte** KCl solution, includes reference electrode (P/N 01049-62902) and KCl solution (P/N 01049-92101).	1049A #035	2	$514.00	$1,028.00

196

COMPUTERCENTER / КОМП'ЮТЕРЦЕНТР

Commercial suggestion #088/94

Division ShowRoom#1 Відділення	Currency Валюта	Total amount Загальна сума	$122,549.76

Sales Manager
Код продавц

Date issued
Дата
04.Nov.94

Sold to / US Agency of International Development
Environmental Policy and Tecnology Programm (EPT-Program)
ATTN / До уваги: Dr. Steven Fry
Senior Laboratory Specialist
Address / Адреса: 252023 Esplanadnaya st. 20, Kiev, Ukraine

Phone / Телефон: (044) 220-13-67 (220-14-69) FAX / Факс: (044) 220-02-42

#	Configuration Конфігурація	Item # Код	Q-t К-т	Unit Price Вартість	Amount Сума
13	Signal/remote cables to Universal includes signal cable (P/N 01046-60105) and remote control cable (P/N 01049-60201).	1049A #105	1	$159.00	$159.00
14	Polishing kit.	01049-67001	1	$90.00	$90.00
15	Glassy carbon working electrode.	01049-64105	1	$102.00	$102.00
	Subtotal mainfraime				$84,662.00
	Consumables:				
16	Deuterium Lamp	79883-60002	1	$557.00	$557.00
17	Xenon-arc flash lamp.	2140-0549	1	$575.00	$575.00
	HPLC columns:				
18	Hypersyl ODS 5 um, 200x4.6mm	79916OD-574	2	$340.00	$680.00
19	Hypersyl Silica 5 um, 200x4.6mm	79916SI-574	2	$340.00	$680.00
20	Spare frits for 4.6 mm columns (6/pk)	01090-27603	3	$24.00	$72.00
21	Hypersyl ODS 5 um, 200x2.1mm	79916OD-572	2	$340.00	$680.00
22	TSK Column 3000SW (XL 5um 7.8x300mm)	79912S3-597	2	$1,019.00	$2,038.00
	Supplies:				
23	Connecting calillary 35x0.12mm id	79841-87609	1	$64.00	$64.00
24	Flexible capillaries (without fittings) 105 mm	5021-1820	1	$36.00	$36.00
25	Fittings (10/pk)	5062-2418	1	$127.00	$127.00
26	HPLC-50 ul syringe	9301-0875	2	$30.00	$60.00
27	HPLC-100 ul syringe	9301-0401	2	$33.00	$66.00
28	Capillary kit	5061-3315	1	$315.00	$315.00
29	Solvent filter kit	3150-0577	2	$381.00	$762.00
30	Memb. teflon filter (10/pk)	3150-0509	2	$25.00	$50.00
31	Sample loop 10ul	0101-0376	1	$57.00	$57.00
32	Vespel rotor seal for manual injector	0101-0623	1	$61.00	$61.00
	Training courses:				
33	HPLC 3D-ChemStation Op.Trg. (DOS)	H4033A	2	$2,100.00	$4,200.00
	Subtotal for consumables:				$11,080.00
	Cost of equipment/Вартість обладнання				$95,742.00
	VAT/Податок на Додадкову Вартість	28.00%			$26,807.76
	Total/Загалом				$122,549.76

Payment terms / Умови оплати:	Bank account & Address / Реквізити банку
Wire transfer / Безготівковий переказ	CREDITANSTALT-BANKVEREIN HEAD OFFICE: A-1010 VIENNA ACCOUNT NAME: HEWLETT-PACKARD Ges.m.b.H. ACCOUNT #: 23-38-861

DELIVERY TERMS	10	*weeks after receiving payment*
ТЕРМІН ПОСТАВКИ	10	*тижднів після отримання оплати*

If you will get any questions concerning equipment Hewlett-Packard please, don't hesitate to contact HP rep in Ukraine FE Dr. Andrey Esaulenko (SE Igor Tanasov): tel.:(044) 245-32-24 (224-04-71; 225-22-82), fax: (044) 224-00-22 or to HP Demo-Center Ms. Natalia Ostanina (Ms.Tatjana Pankratjeva) tel. (044) 559-34-64. Validity of this quotation: 90 days.

Customer Замовник _____ DD.MM.YY	Seller Продавець _____ 04.11.94 DD.MM.YY

VAT - is additional tax which have to be paid after equipment delivery in local currency.
Seems to be VAT is temporary measure. May be since 1995 it will be canceled

197

COMPUTERCENTER / КОМП'ЮТЕРЦЕНТР

Commercial suggestion #087/94

Division ShowRoom#1 Відділення	*Currency* *Валюта*	Total amount агальна сума	$33,729.28

ales Manager

Код продавця

Date issued
Дата
04.Nov.94

Sold to / US Agency of International Development
Environmental Policy and Tecnology Programm (EPT-Program)
ATTN / До уваги: Dr. Steven Fry
Senior Laboratory Specialist
Address / Адреса: 252023 Esplanadnaya st. 20, Kiev, Ukraine

Phone / Телефон: (044) 220-13-67 (220-14-69) FAX / Факс: (044) 220-02-42

#	*Configuration* *Конфігурація*	Item # Код	Q-ty К-ть	Unit Price Вартість	Amount Сума
1	Win-UV-Visible Spectroscopy System. Includes HP8452A with 190-820 nm wavelegth range; 2 nm optical bandwidth. HP Vectra 486/50VL2 with 3S" diskdrive, 210 MB harddisc, 12MB RAM, Mouse, Mousepad, Ultra VGA-card, 15"UltraVGA monitor, Deskjet 500 printer, MS-DOS, MS-Windows G1100A General Scanning and G1101A Quantification UV-Vis-Software and documentation.	G1110A	1	$22,770.00	$22,770.00
	Subtotal Mainfraime				$22,770.00
	Consumables:				
2	Thermostatable Cell Holder. A jacketed cell holder for standard 1cm cuvettes with provisions for attaching to a water bath with temperature-regulated, circulating water.	89054A	1	$791.00	$791.00
3	Standard Cuvette. Quartz, 10 mm path length, matched pair.	89063A	4	$398.00	$1,592.00
4	Deuterium Lamp Assembly.	08452-60104	2	$599.00	$1,198.00
	Subtotal for consumables:				$3,581.00
	Cost of analytical equipment / Вартість аналіт. обладнання:				$26,351.00
	VAT/Податок на Додадкову Вартість	28.00%			$7,378.28
	Total/Загалом				$33,729.28

Payment terms / Умови оплати: Wire transfer / Безготівковий переказ	Bank account & Address / Реквізити банку CREDITANSTALT-BANKVEREIN HEAD OFFICE: A-1010 VIENNA ACCOUNT NAME: HEWLETT-PACKARD Ges.m.b.H. ACCOUNT #: 23-38-861

DELIVERY TERMS	9	*weeks after receiving payment*
ТЕРМІН ПОСТАВКИ	9	*тижднів після отримання оплати*

If you will get any questions concerning equipment Hewlett-Packard please, don't hesitate to contact HP rep in Ukraine FE Dr. Andrey Esaulenko (SE Igor Tanasov): tel.:(044) 245-32-24 (224-04-71; 225-22-82), fax: (044) 224-00-22 or to HP Demo-Center Ms. Natalia Ostanina (Ms.Tatjana Pankratjeva) tel. (044) 559-34-64. Validity of this quotation: 90 days.

Customer Замовник _____	DD.MM.YY	*Seller* *Продавець*	04.11.94 DD.MM.YY

VAT - is additional tax which have to be paid after equipment delivery in local currency.
Seems to be VAT is temporary measure. May be since 1995 it will be canceled

198

Appendix I

Analytical Technologies, Inc. Corporate Offices: 9660 Mercedes Drive San Diego, CA 92121

QUOTATION FOR FIELD ANALYTICAL SERVICES

DATE OF QUOTE	10/27/94	QUOTE NUMBER	10279402.MEB
CONTACT	JODI BARR/ STEVE FRY		
CLIENT	ATI-FORT COLLINS		
PROJECT NAME/ NUMBER	UKRAINE TRAILER QUOTE		
NOTES	EQUIPMENT COSTS:		
	28' TRAILER, WINTERIZED, WITH TOPENDLE HITCH		$65000.00
	DIONEX ION CHROMATOGRAPH		$50000.00
	SPECTRACE 6000 XRAY FLUORESCENCE DETECTOR		$75000.00
	HP 5971 GCMS W/ 7673 AUTOSAMPLER		$65000.00
	RUSKA THERMAL DESORPTION MODULE		$20000.00
	BRANSON SONIC BATH		$ 500.00
	CONSUMMABLES FOR ONE YEAR		$90000.00
	LABOR FOR TWO CHEMISTS		$130000.00
	OFFICE SUPPLIES		$ 10000.00
	TOTAL ESTIMATED COSTS		$505500.00
	DOES NOT INCLUDE TRANSPORTATION		
	DOES NOT INCLUDE HOUSING OF CHEMISTS		
	TRAILER REQUIRES BUTANE FOR HEATERS, DIESEL FOR GENERATORS, WATER SUPPLY, AND HAZARDOUS WASTE STORAGE/DISPOSAL.		

Appendix J

Professional Resume

for

Dr. Steven M. Fry

About the Author

PROFILE: Dr Steven Fry over seventeen years of diverse analytical and management experience. His primarily area of interest has been in the development of analytical methodologies for metals, organic, radiochemical nuclides, and inorganics in environmental waters and soils. He has twelve years of experience analyzing environmental samples. He has developed methods for: Atomic Spectroscopy, Molecular Spectroscopy, Chromatography, Radiochemistry, Organic Halide Analyses, and Electrochemistry. Dr. Fry has three years of production management experience. As a Project Manager, Dr. Fry specialized in identifying unique solutions to meet each client's special requirements. He also advises clients on regulatory compliance issues for RCRA, CERCLA, CWA, UST, TCLP, TTO and SSW846 requirements.

SUMMARY OF PROFESSIONAL EXPERIENCE:

- Dr. Fry is currently a Technical Representative and a Senior Project Manager. His is primarily responsible for developing and managing ATL's largest DOE account, providing $3 million in analytical services for the Environmental Restoration Project at Los Alamos National Laboratory. He is also involved in writing and evaluating Quality Assurance Project Plans (QAPP's), Sampling and Analysis Plans (SAP's), and contracts.

- Dr. Fry was previously Client Services Manager for three years at Analytical Technologies. He was responsible for managing Project Management, Report Management, Waste Disposal, and Sample Control. As the head of Project Management, he was in charge of all phases of business development.

- As Client Services Manager, he was responsible for all aspects of supervision for four departments. These duties included: Quality Control, pricing of analytical services, business development, waste collection and minimization, and procurement and hiring; all four growth from $1.5 million (1991) to $4.0 million (1994). This growth was successfully completed with on-time and quality ratings of 99% effectiveness.

- As a manger, Dr. Fry has consistently facilitated major improvements in productivity in every management solution. While serving as Client Services Manager at Analytical Technologies, his departments improved report quality rom 60% up to 99.7%. As a production supervisor at Gidden Coatings and Resins, his department improved from thirteenth to second place in productivity and safety.

- Dr. Fry has participated in major environmental studies for the United States EPA (USEPA), the United States Geological Survey (USGS), and Illinois Geological Survey. This work included trace metal analyses using all of the current atomic spectroscopic methods (ICAP, GFAAS, FAAS, FAES, and CVAA). This work was performed using or developing approved methodologies for the USEPA, the USGS, and the Illinois Geological Survey.

- Dr. Fry has been involved in all phases of methods development and methods writing for environmental samples. At Analytical Technologies, Dr. Fry developed

and co-authored USEPA Methods 1649a and 1650 for the analyses of Organic Halides. This work included full method validation studies for both methods.

- At Colorado State University, Dr. Fry determined the fate of lead, mercury, and other heavy metals in aquatic systems for the USGS. He developed a preconcentration system that improved detection limits for heavy metals in water by 500 fold, with simultaneous real-time detection of 20 different metals species.

- While at University of Illinois, Dr. Fry developed methods for radiochemical determinations of : Radium, Radon, Gross Alpha and Gross Beta for the Illinois Geological Survey. Dr. Fry also developed a Proton Induced X-Ray Emission system for the non-destructive determination of trace elements in environmental samples and semiconductors. He also contributed to the USEPA's landmark study of lead contamination of plant and animal species around interstate highways. The results of this study lead to the eventual elimination of lead additives in fuels.

- Dr. Fry served on the faculty at Alfred University and Colorado State University. He taught courses in Instrumental Analysis for three years, and graduate level Atomic Spectroscopy. These courses consisted of detailed coverage of all modern analytical instrumental techniques. He also taught Analytical Chemistry and Introductory Chemistry for four years. While at Alfred University, Dr. Fry also served as Research Director for senior research projects.

- At Alfred University, Dr. Fry developed chromatographic analysis methods for the separation, identification, and measurement of constituents in beverages, gasoline, and non-steroidal anti-inflammatory drugs in biological fluids. He also has taught short courses in practical statistics and personal computing.