DEVELOPMENT AND IMPLEMENTATION OF WATER AND SOIL SAMPLING, ASSAYING AND ASSESSMENT PROCEDURES MEANT TO DETERMINE THE HUMAN IMPACT ON THE ENVIRONMENT

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ABSTRACT: *The human impact is significant and results from multiple and unprecedented development of human society. Almost all human activities have a negative impact on the environment by noxae emissions, loading surface waters with contaminating elements because of untreated wastewater discharge into the environment, changing hydrogeological regime and groundwater pollution.*

Within the Core Program "Development of national capacity to assess, prevent and limit the risks generated by industrial applications deployed in hazardous and/or toxic risk environments, in the fields of occupational health and safety and environment, mineral resources and materials protection " / HIGH RISK - PN 07:45, two operational procedures for sampling water and soil were developed, as well as two operational procedures for evaluation of the found results, in order to correctly asses the impact upon the environment.

To meet the requirements of legislation on water and soil sampling to further determinations of physical and chemical parameters, within INCD INSEMEX - Petrosani were purchased a series of sampling, preservation and transportation equipments.

KEYWORDS*: procedures, sampling water, soil, environment*

1 INTRODUCTION

The environment is made up of a number of natural components, such as air, water, vegetation and fauna, topography, lithology and soil that through their attributes create the terrestrial ecosystem.

These components are in dynamic balance, achieved over time. Natural components are added to those created by human activity.

1.1. The importance of water as environmental factor

Considered a general phenomenon, pollution can be differentiated into several types:
-biological pollution - bacteriological, virological, parasitological, is the oldest type of pollution - linked directly to human presence,
-physical pollution, which refers specifically to radioactive pollution,
- chemical pollution is the water penetration by chemicals ranging from the organic easily degradable up to toxic highly persistent.

Additionally, there is thermal pollution and pollution caused by floating or sediment insoluble elements, considered as the latest type of pollution, specific to heavily developed areas.

In our country, almost all major companies or industrial plants, that are located in the vicinity of cities, separately purify their wastewater, which is then evacuated into neighboring water streams. [6]

1.2. The importance of soil as environmental factor

Soil is one of the environment components, being particularly important in the existence of terrestrial life. It was formed on the surface of the lithosphere in the area of its contact with the atmosphere, hydrosphere and biosphere, representing an important natural resource for human society. Upon the soil is developed most of the growing season, the basis for human food source.

Soil is the product of mineral and organic substances transformation on the surface of the earth's crust, under the influence of environmental factors, in long time. Characterized by a certain organization and morphology of its own, it is the environment for higher plants development and the living basis for animals and people.

The soil consists of mineral components and organic organisms, which interact with the physical properties, chemical, biological and morphological characteristics different from those of the parent material from which they are formed.

They have evolved over time through specific pedogenetic processes under the action of climate and creatures in different conditions of relief.

The soil is also a reservoir of energy; it accumulates chemical energy in the form of humus, humus resulting from the processing of organic matter formed by plants by converting solar energy during photosynthesis.

This chemical energy can be released by mineralization process being used by the creatures.

2. METHODS OF WATER AND SOIL SAMPLING, UNDER CURRENT LEGISLATION

This paper aims to align sampling procedures to European practice, by making precise measurements of the concentrations of pollutants in soil and water by developing procedures to be consistent with international principles and practice, developing improved research laboratory facilities for providing data necessary for complete analysis.

Achieving the project's goals will have a positive technological impact by increasing the accuracy of qualitative and quantitative measurements of the components of environmental water and soil. These results are the basis for a correct assessment of environmental impact.

Methods developed for soil and water sampling observe the recommendations and provisions mentioned by the General Order 184/1997 and the existing standards [4].

2.1. Sampling of water

The general conditions for efficient sampling require staff to know from where samples are harvested and to reasonably establish collecting points.

The water sampling will consider the following conditions:

- Water sample is representative (harvested water composition is identical to the composition of the water from which the harvesting took place or has the same composition at the time and place when it was harvested) [7];
- The volume of water sample is determined on a case by case basis [5];
- Container should be made of inert materials. Glass vials influence the content of Na and Si. To determine these elements, harvesting will be done in polyethylene bottles or other plastic.

During collection and until analysis, samples will be stored and transported properly.

Sampling program takes into account a number of important factors such as:

- Location of sampling sections;
- Frequency of the sampling;
- Sampling procedures.

Particular attention should be given to details referring to pollutant loads, maximum concentration, minimum, arithmetic mean, and outliers.

Of great importance is to make a list of parameters considered to be of interest, so that the designated sampling techniques, types of glass used and the methods of preservation and handling would be pointed out.

2.2. Soil sampling

Soil analyzes must follow the requirements of Government Decision 1403 and 1408 from 2007 for investigation and restoration of contaminated land [1, 2].

In order to investigate land contamination, samples for soil analysis may be collected from the surface layer, from 5-30 cm and for evidencing in depth pollution, from 1, 5 m and even reaching the groundwater layer.

Sampling is the most important step for an analytical process. The collection may involve very complex processes, often requiring several stages of subdivision before giving the final analytical result. For the development of effective sampling procedures, one should take into consideration the following aspects:

- Sample taken must be representative for the entire volume of material;
- The amount of sample to be taken has to be determined;
- Subsequent sample handling and storage must be correct.

Soil sampling for analysis is a very important operation, results largely depending on its accuracy. Soil samples are taken from each horizon and sub-horizon in part; from thicker horizons are taken 2-3 samples and from thinner horizons a single central one. Samples are harvested at a depth of 1 m or more, depending on the type of soil pollutant, and the characteristics analyzed. Soil surface to be studied is determined by limiting a parcel between 25-50m^2 upon which are positioned sampling points.

Soil sampling is performed with different types of probes, depending on the depth at which we want to perform harvesting and on soil nature.

Soil sampling at depths of up to 0.5-0.7 m probe is done by hand; greater depths require mechanical equipment and machinery (drill).

Soil sampling will be performed, usually, in clean and dry plastic containers (approx. 0.5 kg). Number of soil samples collected varies depending on terrain, the character of uniformity or nonuniformity of the field.

Soil samples once collected, are packaged in paper bags paraffin, plastic bags, cans or cartons waxing. Afterwards, these are labeled, marking the sample number, collection location, depth, time of harvest, name of person who took the sample. It also draws an outline of the land falling figures indicating the sample number and location of harvest.

3 DEVELOPMENT AND EVALUATION PROCEDURES FOR SAMPLING AND GROUND WATER SAMPLES

Taking into account that the provisions of existing legislation on the collection, preservation, transport and storage of water and soil samples and purchase of advanced equipment must be observed, the need to

develop new operational procedures came into prominence.

We specify that within LAFC (Laboratory of Physico-Chemical) there exist the OP-04 "water sampling" procedure, which will change by detailing aspects of sampling surface water, groundwater, and water samples municipal waste and / or industrial / technology.

An operational procedure was also developed for procurement, preservation, transport and storage of soil samples. In this respect have developed two new operational procedures, namely:

- Water sampling - OP 01 reports for sampling of surface water, groundwater wells, and wastewater and industrial / technological
- Soil sampling - OP 02 soil sampling report.

For each operational procedure was defined the same chapters as for the testing procedures.

Based on current standards and national legislation, two new assessment operational procedures were completed, namely:

- Assessment of water samples - PO 03, the assessment report on the physical and chemical parameters of water and
- Evaluation of soil samples - PO 04 evaluation report on soil parameters.

In order to asses the results of water samples, Government Decision no. 188/2002 for approval of discharge conditions of wastewater into aquatic environments, supplemented and amended, was taken into account. For performing the evaluation of the soil samples results we have taken into consideration the provisions specified in the Order no. 756/1997 on approving regulations on environmental pollution assessment, issued by the Ministry of Waters, Forests and Environmental Protection, which establishes [3]:

a. Normal values of chemicals and some metals traces, aromatic hydrocarbons and polyaromatic hydrocarbons from oil, organic compounds organochlorine (PCBs), organochlorine pesticides and pollutants to be reported if the threshold is exceeded.

b. alert thresholds on the types of sensitive and less sensitive uses the same trace chemical elements mentioned in pt.

c. intervention thresholds kinds of sensitive and less sensitive uses the same trace chemical elements mentioned in pt. a.

Evaluation report on the physical and chemical parameters water include:

- Name and address of the applicant
- Order no.
- Type of water sample
- Name of the evaluation,
- Point / Place of harvest (GPS coordinates)
- Number of test report the basis for the evaluation,
- Date of sample collection,
- Date of test,
- The legal document on which assessment is carried out,
- Table summarizing the assessment results,
- The sensitivity of the method,
- Conclusions and recommendations.

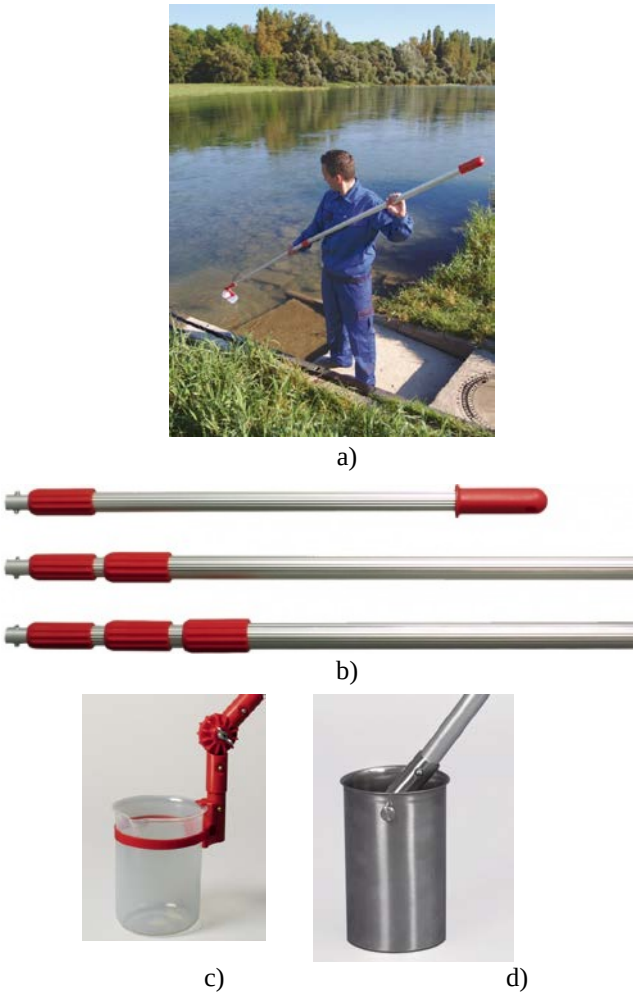
Evaluation report for soil samples, comprising:

- The purpose of the analysis,
- Location,
- The exact location of sampling points,
- Number of test report according to which the evaluation is:
- The number of samples taken,
- Time and date of collection (day, month, year)
- Characteristics local
- Depth of harvest
- The amount of sample collected,
- Name of the person who carried out the collection,
- Observations.

4 SAMPLING EQUIPMENT AND GROUND WATER

In order to respect the requirements of the soil and water sampling procedures, in order to further determinations of physical and chemical parameters according to the legislation in force, a series of equipments were purchased.

4.1. Sampler for surface water – Burcle TeleScoop model



a) b) c) d)

Fig. no. 1 – a) Sampling of surface water - b) adjustable bar, from 115-300 cm

c) Sampler angular glass; d) sampler type stainless steel pendular glass

The telescopic handle is used for sampling surface water from lakes, rivers or sewage systems for domestic wastewater (Fig. no 1).

The telescopic handle is a sampling device, interchangeable for a variety of applications. The tools (angular beaker, glass stainless steel) are attached to the telescopic rod for multiple uses.

4.2. Sampler water samples from wells - EASY-FLOW model, Burca

Features and characteristics of the container (Fig. no. 2 and 3) of the Immersion:

- Fitted with Easy-Flow (valve optimized flow rate);
- Heavy cylinder (favoring rapid descent);
- Capacity: 1000 ml;
- High capacity (with handle), 427 mm;
- Made of anti-sparkle, copper or stainless steel V2A (for areas with potential exhibitors);
- Can be used in hazardous areas: IIA, IIB and IIC.

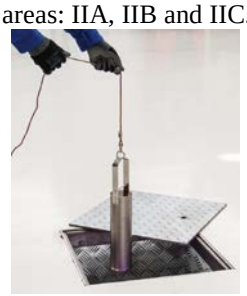



Fig. no.2 ,3- Systems of drilling water sampling

4.3. Thermostat thermoelectric Box - POL-EKO type preservation and transportation of water samples taken.

The box (Fig.no.4) is used for the transport of samples of water, wastewater, in compliance with the requirements of transport (stable at 4 ° C).

Fig.no.4- thermostatic box

Features:

- The volume of the box, 25 l,
- The transfer of samples from the stable temperature of 4 ° C,
- Adjustable temperature from -18 to +10 ° C (stable temperature regardless of the ambient temperature),
- Internal or external batteries, power supply car or standard 230V, 50 HZ.

4.4 Sampler soil samples - Burke, Model MOLE

Equipment used for sampling to determine soil quality, humidity, etc, (is shown in fig. no 5).

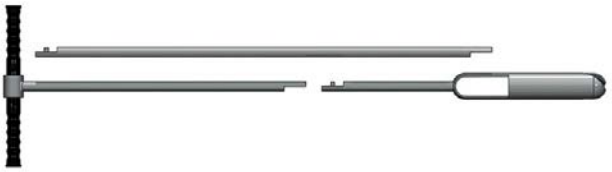


Fig. no. 5- soil samples Burke, model MOLE

Shape sampler to minimize frictional forces which requires minimal physical effort from the user.

Mole sampler parts: handle stem 75 cm, 100 cm Extension rod seven bits available, each designed for a particular type of soil.

Extension bars allow increased sampling depth up to 5 m Mole device.

5 CONCLUSIONS AND SUGGESTIONS

Sampling of water and soil is an important step in the process of their physico-chemical analysis because samples must be representative, should not introduce errors caused by poor technique or improper conditions of preparation of the material, as errors caused by poor harvest can not be subsequently corrected.

Regulations that set physico-chemical parameter limits, for surface water, wastewater and soil are:
- Ord. 161/2006 updated, which prescribes the classification of surface water quality to determine the ecological status of water bodies
- GD 188/2002 amended and supplemented by G.D 352/2005, which sets rules on their discharge into the aquatic environment of waste water
- Order 756/1997 update provides soil quality and soil pollution levels.

Following the purchase of advanced equipment used for collection, preservation, transport and storage of water and soil samples and in order to comply with legal provisions, came into prominence the development of new operational procedures.

Thus, four operational procedures were developed, namely:

- Sampling of water - OP 01,
- Soil sampling - OP 02,
- Evaluation of the results of water samples – OP 03,
- Evaluation results for the soil samples - OP 04.

Procedures OP 01 and OP 02 show how the sampling, preservation, transport and storage of water and soil samples take place, as well as their reporting.

Evaluation procedures OP 03 and OP 04 presents the results of analysis and their classification in legal provisions and their reporting.

For full compliance with the legal provisions in force and the requirements of the sampling procedures, purchase of the following equipment was required:

- For procurement, preservation and transport of water samples,

- Sampler surface water samples - Burkle Telescoop model,
- Sampler water samples from wells - EASY-FLOW model, Burke,
- Box / box-type thermoelectric thermostat POL-EKO preservation and transportation of water samples taken,
- Plastic containers for transporting water samples taken.

- For soil sampling

- Sampler soil samples with Accessories
- Burke, model and MOLE
- Bags conservation and transport of soil samples - ROTILABO model.

Based on these results we propose the comprisal of the procedures developed within the operational procedures of the Quality Manual developed by the Testing Laboratory of INCD INSEMEX - Petrosani Group.

REFERENCES

[1] - Decision no. 1403 of 19/11/2007 on the restoration of the soil, subsoil and terrestrial ecosystems have been affected

[2]- GD. 1408/2007 on how the investigation and assessment of soil and subsoil,

[3]- Ord. No 756/1997 updated, regulations on the assessment of environmental pollution

[4]- Ord. No. 184/1997 updated Procedure for Environmental Audits

[5]- Techniques wastewater Felix Stroe Technical Publishing 2011

[6]- The situation in Romania wastewater and sludge from sewage treatment plants, the Ministry of Environment Brochure public, Bucharest, 2012

[7]- Wastewater treatment unit processes, Technical University of Cluj-Napoca