



Project Soil Quality
Environmental Sciences
 Avans University of Applied science



1 INTRODUCTION

1.1 GENERAL BACKGROUND

Soil pollution is a major environmental problem worldwide. Soil has many functions: it is the basis for construction of buildings and roads, it is the bedding for plants (nature), it is the source for agricultural products and the bio based economy, it is our “playground”. If soil is polluted, some or all of these functions can be impaired.

In order to be able to solve a soil pollution problem you first have to know how serious the problem is, you have to identify the pollutants, their concentrations and their spatial distribution. “Finding” pollutants in the soil is difficult because of the heterogeneity of the soil and because of the fact that half of the time you’re conducting your work “in the dark”.

Nowadays in more and more countries, soil investigation and soil management is standardised and regulated. The protocols and policies used in different countries are not the same but they do resemble each other in many respects. The Netherlands was and is on the forefront in developing soil management tools and policies. In this project we will use Dutch soil investigation protocols and tools. When interpreting the results from the investigation we will also be using Dutch standard values for soil pollutants.

Although you are not trained to become a lab technician or a field technician, it IS useful if you have knowledge and understanding of the techniques used in soil analysis and soil sampling, so this will also be a part of the project.

Soil investigations are mostly executed by environmental consultants; this means you also have to be able to write a proposal for a prospective client and present your results in a client oriented report. Learning how to work and communicate as a consultant is also part of this project. To this end we will work together with Antea Group, a large international consultancy. They will provide a project case, information sources and guidance, they will also be involved in the assessment of the project.

1.2 PROJECT CASE

The municipality of Tilburg has plans to sell a plot of land in the Hendrik van Tulderstraat. According to law, the soil quality of the plot has to be investigated prior to the sale, and to determine the possible usage of the plot in the future. More information is available on Blackboard.

1.3 REQUIRED KNOWLEDGE

To conduct this project successfully, the following pre-existing knowledge is required:

- Composition of the soil, characteristics of different soil components
- Definition of soil texture

- Behaviour of organic and inorganic components in the soil: adsorption, exchange, precipitation and dissolution, evaporation, transport, partitioning over liquid-gas-solid phase
- Geohydrology: hydraulic pressure and gradients, permeability, Darcy velocity, linear velocity, aquifers
- Behaviour of chemical equilibria in a changing environment (Le Chatelier rules)
- Intermolecular forces
- Names and structures of organic compounds, molecular compounds and ionic compounds

Some of these subjects were part of the chemistry courses in year 1, some of the subjects are the course soil science that is offered parallel to this project.

1.4 READING GUIDE

In chapter 2 the learning goals and competency development are explained, in chapter **Error! Reference source not found.** the project assignments are explained, in chapter 3.5 the project organisation is explained, in chapter **Error! Reference source not found.** the project assessment is explained.

2 LEARNING GOALS

In this project you will learn the following about soil investigation:

- Define the activities involved in a standard soil investigation
- Summarise the problem, activities, goal and costs of a standard soil investigation in a quotation for a client
- Understand and apply the different steps involved in a standard Dutch soil investigation
- Identify possible pollution sources and pollutants resulting from them, from historical information about the use of the soil
- Predict the behaviour of soil pollutants (dissolution, evaporation, transport, adsorption) based on the characteristics of the soil and the pollutants
- Design a soil sampling strategy according to Dutch soil investigation standards
- Knowing and understanding the techniques and equipment involved in soil and groundwater sampling and sample conservation
- Interpret the information from soil sampling and previous investigation steps in order to request the correct chemical analysis of the samples
- Compare the results of the chemical analysis of the soil samples to Dutch soil standards and draw a conclusion about the pollution situation on the site
- Advise the client about further steps (if any), based on the results of the soil investigation
- Present the investigation and results in a clear and concise way in a client oriented report
- Have a basic understanding and being able to apply the laboratory techniques involved in destruction, extraction and analysis of pollutants in soil samples

3 PROJECT ASSIGNMENTS

Below you can find a description of the different assignments and products involved in this project.

3.1 QUOTATION

When you work for a consultancy you have to write a quotation for the client. In this quotation you specify the background and goal of the soil investigation, which activities are involved in the investigation, how much working hours and costs are involved, which products will be delivered and also a time plan. The quotation will be made after the preliminary investigation, when it is clear what the activities in the exploratory investigation are going to be.

3.2 PLANNING DOCUMENT

Next to the soil investigation itself you will also have some assignments that are relevant to soil consultancy in general but do not contribute to the result of the specific project assignment (e.g. lab work, fieldwork excursion). Also you will specify activities in the quotation that you will not perform yourself (e.g. taking actual samples from the site or analysing all the samples yourself). To make sure you keep an overview of what you actually have to do, you have to make a planning document where you specify all the activities and deadlines that you as students have to work with, like you normally do in the activities and planning chapter of a plan of approach.

3.3 PRELIMINARY INVESTIGATION

In the preliminary investigation you need to gather and interpret the information provided, to determine which possible pollution sources are present on the project site, where they might be located and which pollutants might be present. You have to present the results, this presentation has to meet the following requirements:

- Introduction with background of the soil investigation and the goal
- Information sources used in the investigation
- Summary of the information (activities on the site, pollution sources, pollutants, expected spatial distribution of the pollutants)
- Hypothesis for the pollution situation

The preliminary investigation will be done at the offices of Antea Group in Oosterhout.

3.4 EXPLORATORY INVESTIGATION

In the exploratory investigation you need to determine whether pollutants are present or not by conducting an intrusive investigation: determine where to take samples (soil and groundwater), evaluate the results of the fieldwork (borehole descriptions, observation from the field technicians) and send a request for chemical analyses of the samples to the lab. In this case you will not conduct the sampling and chemical analysis yourself, for this the Antea Group employs field technicians and an external certified laboratory. After you receive the analysis results from the lab you have to compare them to the Dutch standard values (this includes recalculation of the concentrations based on clay and

organic matter content), draw a conclusion about the pollution situation of the site and give advice to the client about further steps with regards to the site. All of this has been written in a report for the client.

It is important to realise that the report structure is different from the standard project report you have been using in the first year! So for this project you have to let go of that standard set up.

All maps in the report have to be created using ArcGIS, you will get an assignment about this in the training GIS which runs parallel to this project.

The results from the exploratory investigation also have to be summarised in a poster, to be presented in week 10.

3.5 LAB WORK AND FIELD WORK

You are not trained to become field technicians or lab technicians in our environmental sciences programme. But a soil consultant needs to have basic knowledge on these subjects to be able to do his/her job well.

As part of this project you will perform two chemical analysis experiments on soil samples. One experiment involves the use of atomic absorption spectrometry (heavy metals in soil), the second experiment involves chromatographic techniques (Gas Chromatography). Before using these techniques you have to extract the pollutant from the soil matrix, this will also be part of the practical. The lab work results in a short report, the practicals have to be prepared in the labjournal as usual.

You will also be involved in a field work demonstration. For this demonstration you need to be present and actively participate.