This diploma work represents a part of the project “Reactive Chemical Barrier for Decontamination of Highly Polluted Groundwaters” (RECHEBA) that is focused on the complex research and practical realization of *in-situ* reactive barriers. Search and choise of suitable localities as well as applying of the novel photochemical method, developed originally for disinfection and cleaning of bath water, to toxic underground waters for the environmental remediation.

Based on hydrogeological conditions and chemical contaminations, four suitable localities have been proposed for application of the permeable reactive barriers. As the most appropriate place, an industrial area in the North Moravia near Ostrava was chosen located on terraces of the river Odra. From the hydrogeological point of view, it represents a highly permeable collector. This area in mainly contaminated by aromatic hydrocarbons and other organic compounds as well as inorganic waste substances, mostly sulfate and ammonium ions.

Applicability of the novel photochemical method for remediation of contaminated groundwaters was tested. It is based on the direct photolysis of hydrogen peroxide upon intensive ultraviolet irradiation yielding hydroxyl radicals. They subsequently attack present organic molecules, including microbial structures, inducing thus their consecutive oxidative degradation. In the end, total mineralization occurs, i.e., transformation of all organic compounds into final inorganic products such as carbon dioxide, water and corresponding mineral acids.

Two different versions of the special flow-through photoreactor were used for laboratory experiments and field tests, respectively. The photoreactor consisted of a quartz tube surrounded by low pressure mercury lamps, which dominantly emit at the wavelength of 254 nm. A continuous dosing of hydrogen peroxide into the purified water was applied in front of its entering the photoreactor. Reaction conditions of the photoreactor were optimized for the particular composition and concentration of organic pollutants.

For laboratory experiments, 4-chlorophenol and 2-butoxyethanol were chosen as model organic compounds. The course of their photoinduced degradation and oxidative mineralization was followed employing analytical methods of UV/VIS absorption spectrophotometry, liquid chromatography with absorption as well as fluorescence detection and by determination of the content of total organic carbon. Finally, purification of real contaminated groundwaters was tested under analogous conditions. The rate of the photoinduced mineralization of organic pollutants was sufficient to apply the novel photochemical method within the concept of reactive barriers.