The solvents trichloroethene (TCE) and tetrachloroethene (PCE) have been used for decades due to their great versatility of use in food industries. However, improper use and disposal of these compounds has lead to widespread contamination. This is problematic because of their carcinogenic effects. Microorganisms such as those of the genus “Dehalococcoides” are very attractive for bioremediation because of their ability to completely detoxify PCE to ethylene. However, because different Dehalococcoides strains have different catabolic capabilities, it’s necessary to develop tools to differentiate between them. The availability of new methods of quantitative and sensitive detection is of great interest to study these environmentally important microorganisms and will allow the rapid determination of the population dynamics of these species to environmental changes. In this research project, fluorescence in situ hybridization method using peptide nucleic acid probes (PNA-FISH) was developed and tested to determine their efficacy in distinguishing two strains of Dehalococcoides (CBDB1 and 195). As such, two probes that distinguished between the two strains of Dehalococcoides because of a SNP (Single Nucleotide Polymorphism) that exists in the 16S rRNA of these microorganisms were designed. The results indicated that PNA-FISH is a fast, simple and effective method in detecting Dehalococcoides 195 and CBDB1. After optimization of the method, both CBDB1, 195 and mixed cultures were easily observed under the microscope when the PNA-probes were used. Future work the detection of Dehalococcoides can be studied comparatively using the techniques of DNA-FISH and PCR, to obtain the limitations, advantages and disadvantages among the three techniques.