TASC Soil Gas Analysis Technique

CASE HISTORY ONE

CALGARY INTERNATIONAL AIRPORT

1992 UNDERGROUND STORAGE TANK STUDY

Conducted by Transport Canada, Kilborn Western Inc. and Thurber Environmental Consultants Ltd.

This case history presents a summary of the results of an environmental investigation at which the TASC technique was used as part of a detailed investigation to assess and delineate unknown organic contamination from a waste oil storage tank at an industrial warehouse site at the Calgary International Airport. The key features of the site included:

- An underground waste oil storage tank with unknown contents
- A paved parking lot
- Relatively low permeability, clay till subgrade materials
- Utility lines and services within the area.

The TASC technique identified the presence of two separate volatile organic hydrocarbon plumes in the subsurface including the presence of chlorinated solvents in the plume resulting from the leaking tank under investigation as well as a separate plume attributed to leakage from a utilities line which passed through the site.

The use of TASC in conjunction with conventional drilling investigation techniques allowed accurate delineation of the volume and nature of the site contamination with minimum cost.

Background

In 1992, Kilborn Western Inc. and Thurber Environmental Consultants Ltd. conducted an investigation to assess underground storage tanks on Transport Canada property at the Calgary International Airport. The project was conducted in three phases. Phase one consisted of an initial assessment by Kilborn of the UST inventory on Transport Canada property. This assessment included a questionnaire and interviews intended to identify the contents, age, monitoring, testing and other relevant information regarding the presence and history of underground storage tanks on site. On completion of this assessment, sites identified as probably being contaminated were subjected to detailed field investigation by Thurber to assess the soil and groundwater conditions and evaluate the physical extent and nature of any releases.

A total of ten individual sites on the property were identified as requiring further assessment. The field investigation was conducted included a screening phase and a detailed drilling and sampling program. Thurber utilized both passive and active soil gas screening, including the TASC technique to optimize the selection of drilling targets and laboratory analyses. In their report the TASC technique is referred to as the Gas Chromatography technique.

Site Description

The site consisted of a slab on grade warehouse structure that had been occupied by industrial clients for several years. The preliminary investigation by Kilborn indicated that an underground storage tank of unknown dimensions had been used to store waste oil, solvents and other hydrocarbon liquids. The tank was accessed through a fill pipe on the inside of the building. However, the tank dimensions, age and other details were not available. The tank could not be precision leak tested due to the access manhole configuration and no inventory records or record of tank servicing was available. Interviews with the building staff could not confirm whether the tank had ever been emptied. Based on this lack of information it was concluded that this tank site had a high probability of leakage.

Previous geotechnical investigations conducted as part of the Environmental Site Assessment conducted in support of the property transfer from Transport Canada to the Calgary Airport Authority (Thurber 1991) identified the regional site subsurface as silty clay or clay till extending to over 30 m in depth below the existing ground surface. The depth of surface disturbance due to construction of the airport facilities was unknown, but was expected to be shallow.

Methodology

Figure 1 attached shows the key features of the site as well as the test hole and soil gas analysis locations used. The area outside the building was paved with

asphalt concrete and used for staff and customer parking. A total of twenty soil gas locations were selected at the site over an area of about 32 X 16 m in plan area. All sample locations were out side the building to minimize disturbance to the on going operations. Due to uncertainty regarding the tank configuration, possible mitigation pathways and the possible influence of the underground utility lines in the area, the sampler locations were selected based on the assumption that the tank was a single source and that any leakage would be attenuated by the low permeability soils. Soil gas samplers were spaced at about 2.5 m in the immediate vicinity of the tank source and progressively spaced further apart as distance away from the tank increased. On the outer boundaries a spacing of about 4.5 m was used.

The asphalt concrete pavement was cored and the base course grave removed. Each test hole location was scanned for total volatiles using an H.Nu model PI 101 photo ionization detector immediately after excavation. The soil gas samplers were installed to a depth of approximately 450 mm below the gravel layer in a single morning with no disturbance to the sites routine operations. All samplers were protected from surface damage by installation of a temporary grout cap and left in place for a total of seven days. At the end of seven days the samplers were recovered and analyzed.

Results

The TASC soil gas analysis results are presented in Figure 2. This data confirms the presence of benzene, toluene and other hydrocarbon compounds and suggests that the highest concentration of chlorinated compounds may be associated with the utility line to the north rather than from the underground storage tank. The data also strongly suggest that benzene and toluene are predominately associated with the utility line to the north.

Based on the TASC results, three test holes were advanced to quantify the contamination in the soil and groundwater. In addition, heated head space scans for total combustibles using a Gastector model 1238 combustible gas meter and H.Nu model PI 101 photo ionization detector were conducted. Detailed test hole logs showing the subsurface conditions and results of the head space scans are shown on the attached bore hole logs. Results of quantitative chemical analyses of the soil and groundwater, along with the Province of Alberta, Management of Underground Storage Tank (MUST) Guideline criteria in effect in 1992 are presented in table 1 and 2.

Soil Chemistry results indicate that the highest concentration of hydrocarbons (2700 ug/g extractables) was found in TH92-D1. This corresponds to the highest concentration of hydrocarbons identified in the TASC soil gas samples. Similarly, TH92-D2 showed an intermediate level of contamination (520 ug/g) and TH92-D3 showed only trace contamination - as was indicated by the TASC soil gas results.

Conclusions

The report concludes that the hydrocarbon contamination, most notably extractable hydrocarbons, in the vicinity of test holes TH92-D1 and TH92-D2 is associated with the underground storage tank. A concentration of benzene, toluene and chlorinated compounds, probably not associated with the tank is evident near the utility line to the north. This distribution, which was identified by TASC soil gas techniques at the scanning stage, was confirmed by detailed quantitative investigation and confirms the effectiveness of the TASC soil gas technique.

In this case, the areal extent and nature of the subsurface contaminants was delineated by 20 TASC soil gas samplers and three test holes. Without the use of TASC, it is unlikely that the secondary plume associated with the utility line would have been discovered since it is impossible to drill directly on utility lines and a greater data density is required for this level of assessment. Using conventional drilling techniques alone it is expected that at least six and probably eight test holes would have been required to reasonably assess the tank plume alone.