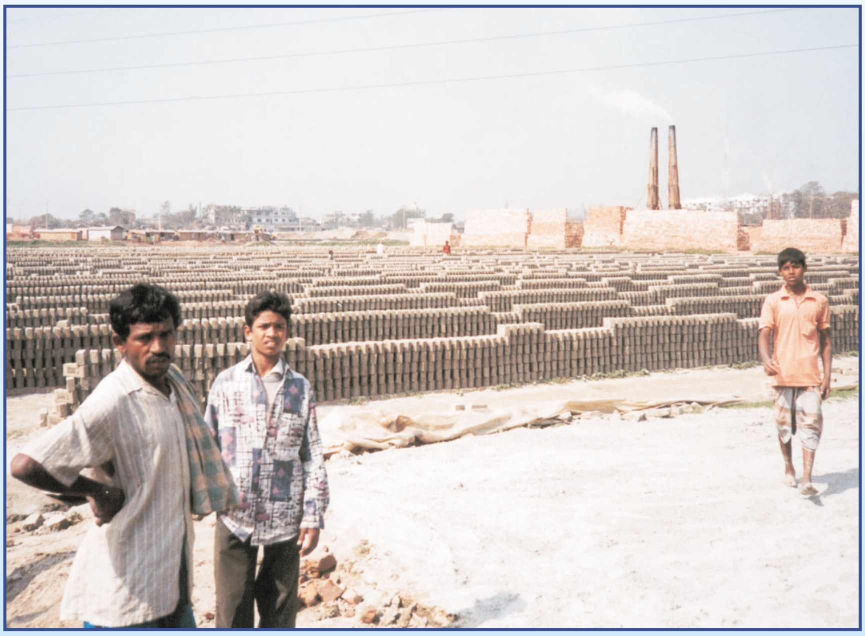
Characterising and Prioritising Groundwater Pollution Threats –

DECISION-SUPPORT TOOL



Lessons learnt from Bishkek and Narayanganj

- The DSS tool was very quick and easy to use, taking just a few minutes to select the options, run the routine and obtain results using information obtained from the Urban Questionnaire and the Groundwater Profile. In Narayanganj for example, Data Entry Table 1 could be used to assess the likelihood of troublesome contaminant concentrations reaching the saturated aquifer by comparing that city's particular range of urban activities with current liquid waste disposal practices. The results informed the assessor that municipal waste disposal, textile processing (dyeing, bleaching, proofing) metal processing (galvanizing) and machinery repair had a **High** likelihood of contaminating the underlying aquifer. This reflects the indexing system underlying the DSS' 'expert logic' that the waste handling system of these industries would dispose rapidly to ground and that this general industry class typically generates significant volumes of noxious effluent/leachate. Other important industries in the city such as garment assembly or retail and commercial have a lower rating because liquid waste disposal is mainly worker sanitation facilities to septic tank rather than the disposal of process chemicals.
- This information helped the team in Narayanganj decide priorities when they planned the contaminant load assessment described later in these guidelines. For example, locating textile and metal processing plants was given a high priority; garment assembly workshops were low priority.
- One problem that users might encounter is that the reconnaissance nature of the system does not allow for gradations, and so some thoughtful interpretation of the options is needed to obtain a representative result. For instance, when assessing 'Other manufacturing industry' in Table 1, Option 2 ('On-site disposal via septic tank systems, or dispersed though surface application') was chosen because 'other industry types' in Narayanganj consisted of numerous but very small-scale activities like metal and wood furniture-making workshops, unlikely to generate large liquid effluent volumes. Where the options are not obvious, it would be an advantage to document how such choices are made when running the DSS.
- The second part of the system was used to answer the question; how widespread and severe is contamination likely to be? Again the system is quick and easy to use, and the mix of industries in Narayanganj together with its sanitation pattern meant that all of the main contaminant classes were classed as **Very Likely** to be widespread.
- Again, the broad nature of the hydrogeological settings does not allow for gradations and this makes interpretation necessary. For instance, most major alluvial/coastal plain sediments have soils derived from the underlying strata. While the presence of a clayey soil would not on its own be enough to confine an underlying aquifer layer, what thickness and proportion of clay horizons in the unconsolidated superficial deposits overlying a productive aquifer would be required to effectively convert an unconfined aquifer into a semi-confined aquifer? Such apparently arcane considerations are important factors in assessing that aquifer's vulnerability to contamination and demonstrate the desirability of including consultation with local hydrogeological expertise during the assessment. In Narayanganj, the thickness, clayey nature and properties of superficial alluvial soils overlying the shallow aquifer were unknown other than anecdotally at the time of running the DSS, so it was not straightforward to complete Data Entry Table 2.
- In the event, the system is so quick to run that it was quite easy to view the two scenarios of confined and unconfined to test the sensitivity of the aquifer system to the two different hydraulic conditions (see example of results for Narayanganj using Ecxel DSS). The results showed the team that in those areas where a protective surface clay horizon was thin, absent or had been removed for brick-making, most of the main contaminant classes would probably or very likely reach the water table. Only microbial pathogens would be

attenuated sufficiently to be unlikely to cause a problem. On the positive side however, the potential to cause severe and widespread contamination is limited to the persistent and mobile contaminant classes, with a long indicated response time of a decade or more. The DSS is not sophisticated enough to distinguish threats from secondary water quality changes, such as those arising from a general organic loading, making the aquifer a more reducing environment.

- The experience of using the DSS in Narayanganj and Bishkek indicated that for cities unable to afford more comprehensive pollution risk assessment procedures before formulating a groundwater management action plan, the system would provide an economical reconnaissance-level tool to help the non-specialist characterise and prioritise groundwater pollution threats according to their type, source, severity, scale, and possible impact on different end uses and users. For the most poorly-resourced cities, this may be the first step in formulating an aquifer protection plan.

Points added to Decision Support System Tool from applying it to case-study cities

- Thoughtful interpretation of the options is needed to account for gradations for example in methods of waste disposal or geological protection of the aquifer. The reasons for any decision should be documented.