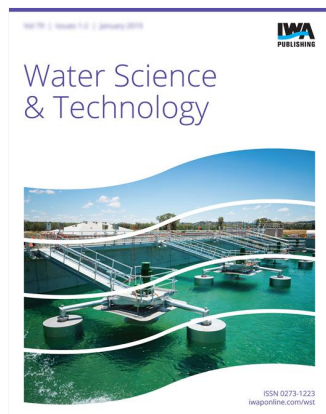




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




Three Types of Approaches to Controlling Non-Point Source Pollution of Agrochemicals from Golf Links in Water Resources Management

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In recent years Japan has had an opportunity to develop a strategy to control diffused pollution of agrochemicals in watersheds upstream of drinking water intakes. Three types of approaches to controlling probable pollution have been examined. These are (1) risk based assessment approach, (2) regulatory approach supported by standard setting and (3) planning based guide to land use. In this paper, based on the results of pilot studies in several golf links, the practical procedures of these approaches are systematically structured.

First, risk-based assessment approach includes typical exposure assessment and quantitative risk assessment (QRA) coupled with fate analysis of runoff into reservoirs. The basic process of QRA of indicative herbicides, insecticides and fungicides, generated the result that additional cancer risk would be around minus 5-6 order of life time risk for citizens to drink water from reservoirs receiving contaminated river water.

Second, appropriate standard setting enhances a reasonable regulatory approach. In 1990, concentration of twenty agrochemicals in effluents from golf links and rivers at receiving outlets from golf links were evaluated in a nation-wide program in terms of the ratios of samples having higher concentrations than the tentative quality standard. Both seasonal change of observed concentration in dry weather and high concentration in rainfall events are evaluated.

Concerning a planning based guide to land use, zoning of forest conservation districts for water resources conservation would be responsible for appropriate land use management and water quality control. The author proposed the skeleton of a water resources conservation plan for safe drinking water supply for a local government as a client, especially emphasizing land use suitability mapping, development guides and mitigation techniques.

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Nonpoint source (NPS) pollution is widely dispersed in the environment and is associated with a variety of human activities. These programs include three basic mechanisms for controlling NPS pollution (NYC DEP, 1998a): (1) strict performance standards applied to activities that produce NPS pollution, (2) a review and approval process for activities that produce NPS pollution, and (3) prohibition of certain activities in a "setback" region between the activity and nearby waterbodies. Monitoring for changes in water quality at this stage is an ideal approach to measuring the impact of farm BMPs. However, in some cases the necessary monitoring techniques do not exist, or the staff or technical equipment is not available to conduct the monitoring.

Non-point source pollution: Non-point source (NPS) pollution refers to diffuse contamination that does not originate from a single discrete source. NPS pollution is often the cumulative effect of small amounts of contaminants gathered from a large area. The leaching out of nitrogen compounds from agricultural land which has been fertilized is a typical example. The following points may help in reducing water pollution from non-point sources. (i) Judicious use of agrochemicals like pesticides and fertilizers which will reduce their surface run-off and leaching. Use of these on sloped lands should be avoided. (ii) Use of nitrogen fixing plants to supplement the use of fertilizers. Nonpoint source water pollution affects a water body from sources such as polluted runoff from agricultural areas draining into a river, or wind-borne debris blowing out to sea. Nonpoint source air pollution affects air quality, from sources such as smokestacks or car tailpipes. Also, unlike other types of point sources, such as industrial discharges, sewage treatment plants and other operations, pollution in urban runoff cannot be attributed to one activity or even group of activities. To control nonpoint source pollution, many different approaches can be undertaken in both urban and suburban areas. Buffer strips provide a barrier of grass in between impervious paving material like parking lots and roads, and the closest body of water. Nonpoint source (NPS) water pollution regulations are environmental regulations that restrict or limit water pollution from diffuse or nonpoint effluent sources such as polluted runoff from agricultural areas in a river catchments or wind-borne debris blowing out to sea. In the United States, governments have taken a number of legal and regulatory approaches to controlling NPS effluent. Nonpoint water pollution sources include, for example, leakage from underground storage tanks, storm water runoff