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A Cascade Comprehensive Framework for Emergency Response to Water Pollution Incidents from Monitoring to Disposal Engineering: Water Security Protection on South-To-North Water Division Project

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Abstract: Complex surrounding conditions along the water routes put threats on the water supply security of South-to-North Water Division Project (SNWDP), the biggest water transfer projects around the world. Comprehensive emergency management and decision support system (DSS) for chemical spill incidents prevention and control are of great necessary. However, many quantitative decision support models for guiding emergency response and disposal are not available nowadays. For example, how to quantitatively design emergency monitoring network? How to select emergency disposal technology and materials? Whether to start the disposal or not? How to analysis the risk of emergency disposal engineering? ... After four years investigation, a three level cascade emergency response framework with a group of numerical models was proposed. The cascade framework links "Emergency monitoring-Risk early warning-Preparedness plan generation-Disposal engineering" four main processes in the first level. The second level is "method" level, which covers key models (model groups) or technologies used at the four processes. The "base" level servers as infrastructures, databases, material and equipment bases, etc. The middle-placed "method" level is of the most important and intensive. It provides a whole-process numerical decision tools for emergency response. A technical route of incidents response and pilot-scale DSSs for middle-route and east-route of SNWDP were established by cooperation with seven institutions. In order to test the proposed framework and tools, this team conducted a full-scale sucrose-based demonstrative tracer experiment at 2014. Results shown that these 3-level cascade framework, model groups and DSSs laid sound scientific foundation for spill risk prevention and emergency disposal at SNWDP. It also provides a generic technical toolbox for quantitative decision making while response to environmental incidents, especially for emergency pollutant control and clean-up.

Keywords: *Emergency response; emergency monitoring; disposal engineering; decision support system; South-to-North Water Division Project.*