MODELING AND EVALUATION CRITERIA	APPRAISAL		
	Yes	No	Comments
OBJECTIVES AND DATA REQUIREMENTS			
Are the purpose and scope outlined?	√		
Are the objectives consistent with decision-making needs?	√		
Are the objectives satisfactory?	√		
Are a site description and waste disposal history provided?	√		
Are the data requirements for the proposed modeling outlined?	√		
Are the sources of data adequately presented?	√		
Are data uncertainties discussed?	√		
Is the probable sensitivity of the future modeling results presented for the data?	√		Sensitivity to regional gradients.
Are the potential data limitations and weaknesses provided?	√		
Are the plans to resolve data limitations discussed?	√		Checked as sensitivities.
Is the physical framework discussed in detail? Both regional and local?	√		
Is the hydrogeologic framework described in detail? Both regional and local?	√		
Are the hydraulic boundaries described in detail?	√		
Is the conceptual model consistent with the field data?	√		
Are the uncertainties inherent in the conceptual model discussed?	√		
Are the simplifying assumptions outlined?	√		
Are the assumptions justified?	√		
Are the following figures and/or tables[1] included:			In background files/reviewed during modeling process.
· Map showing location of study area.	√		
· Geologic map and cross sections indicating the areal and vertical extent of the system.	√		
· Topographic map with the surface water bodies.	√		
· Contour maps showing the tops and/or bottoms of the	√		

In some instances tabular representation of the data may be appropriate.

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aquifers and confining units.			
· Isopach maps of hydrostratigraphic units.	√		
· Maps showing extent and thicknesses of stream and lake sediments.		√	N/A
· Maps indicating discrete features (e.g., faults), if present.	√		
· Maps and cross sections showing the unsaturated zone properties (e.g., thickness, K_{sat}).	√		Unsaturated zone not modeled.
· Potentiometric surface maps of aquifer(s) and hydraulic boundaries.	√		
· Maps and cross sections showing storage properties of the aquifers and confining units.[1]	√		
· Maps and cross sections showing hydraulic conductivity of the aquifers, confining units, and stream and lake sediments (if applicable).	√		
· Maps and hydrographs of water-budget information.	√		Regional studies.
SCOPING ANALYSIS			
Are scoping analyses performed?	√		
Do scoping results lead to proposed modeling approach?	√		
SITE CHARACTERIZATION MODELING			
Code Selection			
Is the rationale for the selection clearly presented for proposed code(s)?	√		
Are the general features of the code(s) presented?	√		
Are the assumptions and limitations of the code(s) presented and compared to the conceptual model?	√		Modflow/MT3D etc. widely used.
Is the basis for regulatory acceptance presented?	√		Well documented
Does the code have a history of use?	√		
Is the code well documented?	√		
Is the code adequately tested?	√		
Are the hardware requirements compatible with those available?	√		
Model Construction			
Layering and Gridding:			
	√		

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Is the domain of the grid large enough so that the boundaries will not interfere with the results?			
Do the nodes fall near pumping centers on existing and potential future wells and along the boundaries?			N/A
Is the grid oriented along the principal axes of hydraulic conductivity?			Principal axes uncertain.
Is the grid discretized at the scale appropriate for the problem?	√		
Are areas of sharp contrasts (e.g., hydraulic conductivity, concentration, gradient) more finely discretized?			No property zones.
Do adjacent elements vary in size by a distance less than a factor of 1.5?	√		Adequate variation/no problems identified.
Are strong vertical gradients within a single aquifer accommodated by multiple planes or layers of nodes?			N/A
If matrix diffusion is important, are the confining units adequately discretized in the relevant regions of the model?	√		
Is the grid more finely spaced along the longitudinal direction of simulated contaminant plumes?	√		
Is the aspect ratio less than 100:1?			
Are the following figures included:			
· Grid presented as an overlay of a map of the area to be modeled.	√		
· A vertical cross section(s) which displays the vertical layering of the model grid.			
Boundary and Initial Conditions			
Is justification provided for the selection of all boundary and initial conditions?	√		
Are model boundaries consistent with natural hydrologic features?	√		
Are the boundary and initial conditions consistent with the conceptual model?	√		
Are the uncertainties associated with the boundaries and initial conditions addressed?	√		
Are the boundaries far enough away from any pumping/injection centered to prevent "boundary effects"?	√		
Are transient boundaries discussed?			Steady-state boundaries
Is the rationale given for simplifying the boundaries from the conceptual model discussed?	√		
Are the values for the assigned boundaries presented?	√		

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	Yes	No	Comments
Model Parameterization			
Are data input requirements fully described?	√		
Is the discussion of the data well founded with respect to Objectives and Data Review Section?	√		
Are the interpretation and extrapolation methods (e.g., Kriging) adequately presented?	√		
Do the figures and tables completely describe the data input with respect to discrete components of the model?	√		
Are the model parameters within the range of reported or measured values?	√		
MODEL CALIBRATION			
Has calibration been attempted?	√		
Is the rationale for model calibration approach presented?	√		
Are the calibration procedures described in detail?	√		
Are the calibration criteria presented?	√		
Does the calibration satisfactorily meet specified criteria?	√		
Is the rationale presented for selecting convergence criteria?	√		
Are code convergences and numerical instabilities discussed?			Integrated into modeling program.
Do the calibrated parameters fall within their expected ranges?	√		
Are discrepancies explained?	√		
Has the calibration been tested against actual field data?	√		Head calibration, boundary calibration, and initial contaminant concentrations
Are the differences between steady-state and transient calibrations presented?			N/A
Could other sets or parameters have calibrated the code just as well? Is this discussed?	√		Discussed in sensitivity analysis.
Are areal and cross-sectional representations of the final calibrated results included for hydraulic heads ?	√		
Does calibration of the model take into account the inconsistency between point measurements at wells and areal averages of model output?	√		Widely spaced calibration wells would be helpful.
Is the match between the calibration targets and final parameters shown diagrammatically?	√		
Were calibrating errors presented quantitatively through the use of descriptive statistics?	√		

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If particle-tracking was performed, are these results shown?	√		
Is the calibrated model consistent with the conceptual model?	√		
Are any changes to the conceptual model discussed and justified?		√	
Is non-uniform areal recharge applied? Is this approach justified?			N/A
Does the calibration properly account for vertical gradients?	√		Upper to lower aquifer.
Is the calibrated hydraulic conductivity field consistent with the geologic logs and aquifer stress tests?	√		USGS data.
Are the convergence criteria appropriate?	√		
Was a mass balance performed?	√		
Is the water-balance error less than 1%?	√		
Are the mass balance results for the calibrated model discussed?	√		Water volumes between facilities.
Is the model's water balance consistent with known flows of rivers and levels of lakes?			N/A
SENSITIVITY ANALYSES			
Was a sensitivity analysis performed?	√		
Is the approach to the sensitivity analysis detailed?	√		ASTM methods
Were all input parameters selected for investigation? If not, was rationale presented for excluding parameters?		√	Only the ones that are unpredictable.
Was a sensitivity analysis performed on the boundary conditions?	√		Regional boundaries.
Are the ranges of parameters appropriate?	√		
Were sufficient simulations performed? Was justification provided?	√		
Was the relevance of the sensitivity analysis results to the overall project objectives discussed?	√		
Are the results presented so that they are easy to interpret?	√		
Were sensitivity analyses performed for both the calibration and the predictive simulations?	√		