5-19-2015

Practitioner Interview

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Proposed Questions for Interviews with Water Resources Engineers on Use of Water Resources Systems Analysis in the Engineering Workplace

Prepared by:
Technical Committee on
Excellence in Systems Analysis Teaching and Innovative Communication (ECSTATIC)
American Society of Civil Engineers (ASCE)

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Submitted to the Utah State University Institutional Review Board for Request for Determination of Non-Human Subject Research - #6063

August 22, 2014
December 10, 2014

Interview of Abhishek Singh, Interra, Austin, TX, May 19, 2015

JOB BACKGROUND

dwatkins 5/21/15 8:14 PM
Comment [1]: Abhishek said he would send this info separately.

1. What is your current job title?
2. For how many years have you worked in your job?
3. What formal training have you had in systems analysis?
4. If your professional activities have included systems analysis, for how many years have you performed these activities?

QUESTIONS ABOUT USE OF SYSTEMS ANALYSIS ON THE JOB

5. Describe your job. What is/are your roles/activities in your job?

   Project manager – meet with clients, carry out technical studies involving groundwater modeling and analyses of groundwater-surface water interactions

6. What work projects have used systems analysis techniques to identify/evaluate/select a design or decision alternative?

   Water supply planning for municipalities, including water resources assessments, sustainability of groundwater withdrawals

   Impacts of climate change on water resources and ecological indicators

   Performance assessment of radioactive waste disposal sites

7. What systems analysis techniques, software, and/or tools were used?
   GoalSim, Stella, Ecolego for dynamic simulations

   Stochastic modeling with MIKE-SHE and in-house Monte Carlo/Latin hypercube sampling code

   Range of uncertainty analysis procedures, including sensitivity analysis, PCA, mutual entropy

   Statistical modeling

   (Don't do a lot of optimization, except for automatic calibration, e.g., PEST)

8. Have any projects coupled optimization algorithms with external simulation models, simulated system equations within the optimization framework, or used an optimization algorithm available within a simulation model? If yes, what kinds of simplifications were required in the solution approach?

   Typically conceptualize problems as optimization problems (objectives, constraints, decision variables) – the biggest challenge is often formulating a problem in mathematical terms.

   Calibration of models with PEST.

   Random search (e.g., Monte Carlo simulation of reservoir operating parameters and then selection of the "best")

9. What uncertainty analyses have been used to evaluate designs or decision alternatives? If yes, what assumptions were required? What difficulties (if any) were there in communicating results of the uncertainty analysis to decision-makers?

   Often evaluate the sensitivity of systems to perturbations in inputs.

   In a project to help regional planning groups incorporate uncertainty in supply and demand, found it very challenging to convey the idea of probability distributions; stakeholders preferred a scenario-based approach.

   In climate change studies, there is a tendency for clients or stakeholder groups to focus on the worst-case scenario.

10. Have projects applied multi-objective decision methods to select a final design or decision alternative? If yes, how was a preferred alternative selected from a set of tradeoffs?

In developing portfolios of management strategies with several objectives, along with multiple scenarios (e.g., climate), used satisficing thresholds to filter out some portfolios; then use a decision matrix (scoring) approach.

USE OF SYSTEMS ANALYSIS IN THE PROFESSION

11. What role should systems analysis play in professional practice? How can the profession more effectively use systems analysis in the future?

    Systems perspective is integral to any water resources planning problem.

    Dynamic simulation modeling captures interactions at a high level, and can highlight parts of the system needing closer inspection, or assessment of uncertainty.

    Ability to integrated detailed numerical models at a higher level is also important.

    Need statistical methods/Monte Carlo to deal with uncertainty.

    Systems approach is becoming more accepted in dealing with climate change.

    a. What encourages or limits the use of systems analysis in the water resources engineering profession?

    Decision makers tend to ignore/misunderstand uncertainty – just want a model that will give them "the answer." (Even then, uncertainty analysis is still critical to building "the model".)

12. What systems analysis skills and techniques should universities teach to prepare new practitioners to successfully join the profession?

    Use of a tool like GoalSim (dynamic simulation), statistical modeling, data analysis – not just running a GUI.

    Ability to code and link models, experience with data processing.