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| 1      | 1/18   | I. Introduction and Procedures for Performing a Human Health Risk Assessment (HHRA)  
A. Introduction to the instructors, the course, the project, and the syllabus; student introductions and objectives feedback.  
B. A short history of risk assessment (regulatory basis), HHRA in everyday life, and types of risk assessments; relationship between human health and ecological risk assessments; hot topics (e.g. Precautionary Principle). | Bonczek, Clauberg, Swanson |
| 2      | 1/25   | II. Exposure Assessment  
A. Characterizing the exposure setting (goal is a conceptual site model)  
1. Physical Environment.  
2. Exposed or potentially exposed populations.  
B. Identifying exposure pathways / pathway analysis  
1. Sources of contamination and mechanisms of release.  
2. Transport mechanisms, exposure point development, and exposure routes.  
C. Building conceptual site models - use of SCEM Builder software | Bonczek, Clauberg |
| 3      | 2/1    | II. Exposure Assessment  
C. Contaminant migration (fate & transport), exposure times and concentration  
D. Introduction to modeling  
1. Model selection and description of useful models.  
2. F&T model demo (RESRAD)  
3. risk modeling | Bonczek, Clauberg |
| 4      | 2/8    | II. Exposure Assessment  
E. Calculation of the Chronic Daily Intake  
F. Preliminary Remediation Goals (PRGs)  
G. Associated uncertainties | Bonczek, Clauberg |
| 5      | 2/15   | II. Exposure Assessment (online tools for CDI calculations)  
III. Toxicity Assessment  
A. Exposure Routes  
B. Sources of Toxicity  
C. Types of Toxicity | Bonczek, Clauberg |
| 6      | 2/22   | III. Toxicity Assessment  
D. Toxicity values  
1. Where do they come from?  
2. How were they developed?  
3. Site-specific values.  
E. Radiation assessment (chemical toxicity versus ionizing radiation)  
F. Presentation of Toxicity Assessment  
G. Associated uncertainties | Clauberg |
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| 7      | 2/29  | IV. Data requirements for risk assessments  
A. Data Quality Objectives (DQOs). How rigorous does the data have to be?  
   What decisions are going to be made? Baseline HHRA versus a Screening Risk Assessment. What data are necessary to meet DQOs? Nature and Extent versus Risk Characterization. Politics. Develop list of analytes to be sampled.  
   1. Historical data and process-knowledge information.  
   2. Review of historical data and the quality of these data.  
   3. Data quality steps.  
   4. Reproducibility and validation.  
   5. Environmental sampling / planning.  
      Site-related contaminant concentrations. Background levels/concentrations.  
   6. Meeting EPA sampling requirements.  
B. Media-specific sampling.  
C. Sample analyses: analytical analyses, requirements, and detection limits  
D. Data evaluation.  
   Precision, accuracy, reproducibility, comparability, and completeness (PARCC).  | Bonczek  
Swanson |
| 8      | 3/7   | V. Data Assessment, Evaluation, and Reduction  
A. Screening of data points. Assessment of the data to answer:  
B. Analyte screening and data evaluation  
   1. Evaluation of lab and validation qualifiers.  
   2. Compare sample concentrations with field blank & lab blank (5X and 10X rule).  
   3. Duplicate-sample concentration comparisons.  
   5. Evaluation of Tentatively Identified Compounds (TICs).  
   6. Development of site-related contaminants. Screening against detection limits and background concentration. Site history (e.g., weight-of-evidence).  
   7. Development of Contaminants of Potential Concern (COPCs).  
C. Calculation of representative exposure concentrations (UCL95%).  
D. Analytical techniques (RAIS models).  | Clauberg  
Swanson |
| 9      | 3/14  | V. Data Evaluation and Data Reduction  
E. Statistical comparisons / screening  
   Screening against risk-based PRGs, and comparisons with MCLs and other chemical-specific ARARs. Essential nutrients.  
   Presentation of data evaluation(s), screenings, and summary statistic information  
F. Associated uncertainties  
VI. Risk Characterization  
A. Calculating human health risks and hazard quotients.  
   1. Characterization of human health risks and hazards / Pulling it all together  | Bonczek  
Clauberg  
Swanson |
| 10     | 3/21  | SPRING BREAK  |  
| 10     | 3/28  | VI. Risk Characterization  
A. Calculating human health risks and hazard quotients.  
B. Presentation of risk/hazard information (tables and graphics).  
C. Identifying contaminants of concern (COCs), pathways of concern (POCs), and uses of concern.  
D. Uncertainties / Qualitative & quantitative effects on risk and hazard calculations  
E. Development of Remedial Goal Options (RGOs)  
   1. What are appropriate RGOs and when/why/how are they determined?  
   2. How do RGOs differ from PRGs?  
   3. Calculating RGOs.  | Clauberg |
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| 11     | 4/4    | VI. Risk Characterization  
F. Other sources and types of risk indicators. Other applications of risk concepts.  
Toxic release relative values. EMS risk tools. ASTM Tier I, II. USACoE models                                                                | Swanson       |
| 12     | 4/11   | VII. Introduction to Uncertainty Analysis  
A. Qualitative Uncertainty Analysis  
B. Sensitivity Analysis  
C. Quantitative Uncertainty Analysis and Probabilistic Risk Assessment  
D. Presentation of the Uncertainty Analysis  
E. Guide to further investigations / meeting the DQOs  
F. demo of CrystalBall                                                                 | Clauberg, Robinson, Swanson |
| 13     | 4/18   | VII. Introduction to Uncertainty Analysis  
G. Management of Uncertainty  
VIII. Risk Management of Exposure (interface to Feasibility Studies)  
A. Modifying the conceptual site model  
B. Remedial Action Objectives (RAOs) and risk reduction  
C. Risk assessment in corrective actions                                                                                               | Bonczek       |
| 14     | 4/25   | VIII. Risk Management of Exposure  
IX. Introduction to Risk Communication (if time permits)  
A. Public perception and influence / risk communication  
X. Introduction to Ecological Risk Assessment (if time permits)                                                                           | Bonczek, Clauberg, Swanson |
|        | 5/2    | Study Period - OPTIONAL review session                                                                                                                                                                   |               |
| TBA    |        | Final Exam                                                                                                                                                                                              |               |