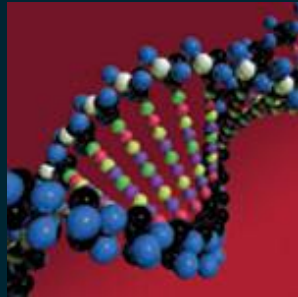




EPS Alumni Student Forum



Environmental Consulting
Perspectives, Opportunities & Information
By: Mauricio Escobar and Nick Walchuk

February 27, 2008

Introduction



- Who are these guys?
- Why do we care?
- What is ENVIRON?
- What does someone with an EPS degree do at a place like ENVIRON?
- What lessons can we learn from M & N?
- In hindsight, M & N would have...
- Questions, lots of questions...?



The Presenters



- **Nick Walchuk**

- Geology, 1996
- California Professional Geologist (P.G.) 2005
- ENVIRON Emeryville office
- Expertise:
Environmental Due Diligence, Site Characterization

- **Mauricio Escobar**

- Earth Science, 1995
- California P.G. 2003
- ENVIRON Los Angeles office
- Expertise:
Site Assessment and Remediation of Hazardous Substances



Why Are We Here?



- Provide students with examples of real world application for EPS degrees
- Provide insight and information regarding environmental consulting
- Share our professional experiences
- Make ourselves available as a professional resource



What is ENVIRON?



- ENVIRON is a global consultancy
- Offices in North America, Europe, Asia, and Australia
- Some of ENVIRON's Practice Areas:
 - Air Quality Management, Carbon Management
 - Ecology and Sediment Management
 - Environmental Due Diligence
 - Site Solutions
 - Risk Assessment / Risk Management
 - Water Quality and Industrial Wastewater Management
 - Litigation Support
 - Health Sciences



Who Works at ENVIRON?



- Geologists
- Engineers (Chemical, Civil, Environmental, etc.)
- Toxicologists
- Risk Assessors
- Atmospheric Scientists
- Biologists
- Chemists
- Epidemiologists
- Regulatory Specialists



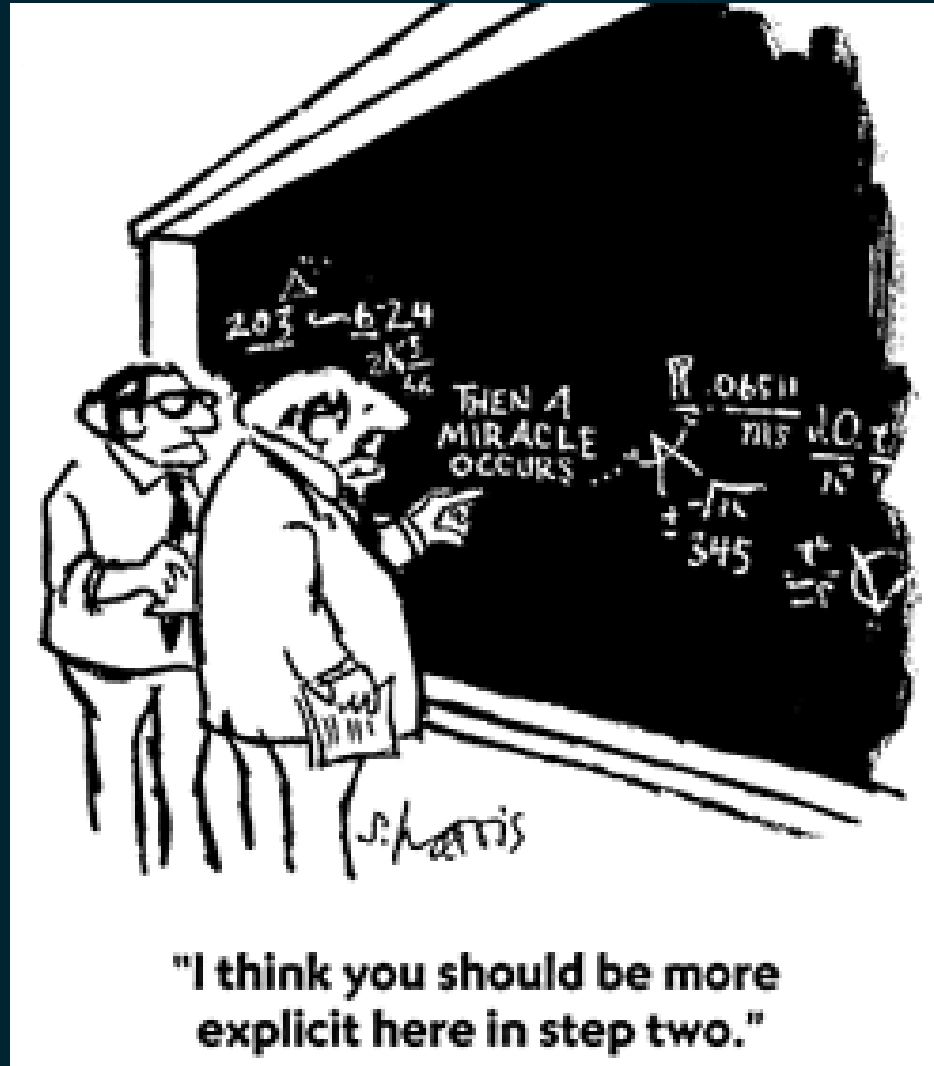
Geoscience, Engineering & Site Solutions Group



- **Environmental Due Diligence (Nick)**
 - Real estate transactions and property redevelopment
 - Corporate Mergers & Acquisitions (M&A)
 - Site characterization
- **Site Solutions (Mauricio)**
 - **Site characterization (Remedial Investigation)**
 - Soil and ground water investigations
 - Ground water monitoring
 - Delineating contaminant plumes in soil, soil gas and ground water
 - **Evaluating best alternative for site cleanup (Feasibility Study)**
 - Soil excavation
 - In-situ remediation
 - Bioremediation
 - Remedial Implementation
- We often work on behalf of Clients negotiating with private parties or regulatory agencies such as USEPA, California DTSC, California Water Control Board, local health agencies, and fire departments.



So What Do We Do?



Due Diligence: “Phase I” ESA



- Typical scenario
 - Client property acquisition with intention of redevelopment for commercial/R&D use
 - ENVIRON retained for environmental assessment prior to purchase
- Phase I Environmental Site Assessment
 - Research site history, setting, geology
 - Historic maps, aerial photographs, local agency files, known contaminated sites in the area, interviews with knowledgeable facility personnel and owner
 - Identified potential for contamination and specific release points due to historical site use.
 - Site used industrially for nearly a century, in an area long used for heavy industry.
 - Based on research, numerous areas of possible contamination identified
 - Additional investigation recommended prior to completing the transaction



Due Diligence: Follow-up “Phase II”



■ Phase II Subsurface Investigation

- Soil and ground water sampling identified contamination resulting from historical site operations
- Client purchased the property, but upon condition that responsibility for addressing contamination issues would be retained by the seller.
- Cleanup activities conducted by seller, overseen by ENVIRON



Site Characterization and Remediation



- Site with identified contamination resulting from historical use of solvents at the property during historical site operations
- Chemical of Concern (COC) is Trichloroethene (TCE) in ground water.
- Objectives of Study:
 - Fully characterize the extent of impact
 - Develop cost-effective strategy for full-scale implementation.
 - Evaluate efficacy of permanganate (MnO_4^-) for TCE oxidation
 - Evaluate MnO_4^- subsurface longevity and rebound of TCE
 - Evaluate whether increased ORP promotes metals mobilization (i.e., Cr^{3+} to Cr^{6+})
 - Evaluate the effect of MnO_4^- on microbial population and natural attenuation
 - Evaluate effect of reduced ground water concentrations on TCE in soil gas



Terminology You Need to Know



- ISCO: In Situ Chemical Oxidation – Addition of strong chemical oxidant to ground water for COC destruction.
 - Permanganate (MnO_4^-) – Sodium or Potassium
 - Persulfate ($\text{S}_2\text{O}_8^{2-}$) – Sodium or Potassium
 - Ozone (O_3) – Gas
 - Peroxide (H_2O_2) – Combined with Ferrous Iron (Fe^{2+})
- Example: $\text{C}_2\text{HCl}_3 + 2\text{MnO}_4^- \longrightarrow 3\text{Cl}^- + 2\text{CO}_2 + \text{H}^+ + 2\text{MnO}_2$
- TCE: Industrial chlorinated solvent used primarily as industrial degreasing and cleaning agent
 - TCE is most prevalent ground water contaminant in the US.
 - TCE production in the United States began in the 1920s.
 - TCE production increased steadily from the 1940s; peaked in 1970.
 - TCE problem not recognized until 1970s.



What Do We Know About the Site?



- Facility operations used TCE for more than 30 years.
- Geology consists of fractured bedrock.
- Hydrogeologic studies showed little storage, low porosities; low transmissivity; slow average ground water velocities.
- A conceptual model was developed with a firm understanding of the geologic setting, the fate and transport mechanisms controlling plume distribution, the chemistry of degradation reactions, the geochemical characteristics of our host matrix/rock/system; and the attenuation potential of the plume (biological and otherwise).



ISCO Implementation



- MnO_4^- chosen as most effective for a pilot study
- Injection of 10% MnO_4^- at nearly 50 multi-depth injection points
- Max Treatment Depth ~50 feet
- Some Important Considerations
 - Minimize displacement (low % of pore volume, low pressure and rate)
 - Consider contaminant mass and natural oxidant demand (soil/gw)
 - Extent of Influence



ISCO Performance



- MnO_4^- delivery successful
- TCE GW concentrations significantly reduced – continue to monitor
- No evidence of plume mobilization
- Generation of Cr^{6+} noted in wells with abundant MnO_4^-
- Oxygen Reduction Potential (ORP) elevated in wells with MnO_4^- and Cr^{6+} - Effect considered transient



Open Issues



- Questions
 - What predictions can be made about Cr^{6+} reverting back to Cr^{3+} ?
 - How will elevated soil gas concentrations react to lower ground water concentrations?
 - How will the natural microbial community react to the addition of MnO_4^- to the subsurface environment?
- Present studies will give us the answers to these questions.
- Full scale implementation will proceed once the issues above have been adequately laid to rest.



Lessons Learned in the “Real World”



- We use what we learned at CAL all the time
- “Book Smarts”
 - How to read/interpret/produce maps (topographic, geologic)
 - Thinking in 3-D is a special skill!
 - Particular Classes taken and used in career
 - All field courses, especially summer field camp
 - observation and critical thinking are essential
 - Hydrogeology
 - Geomorphology
 - Geochemistry
 - Environmental Policy, Administration, and Law



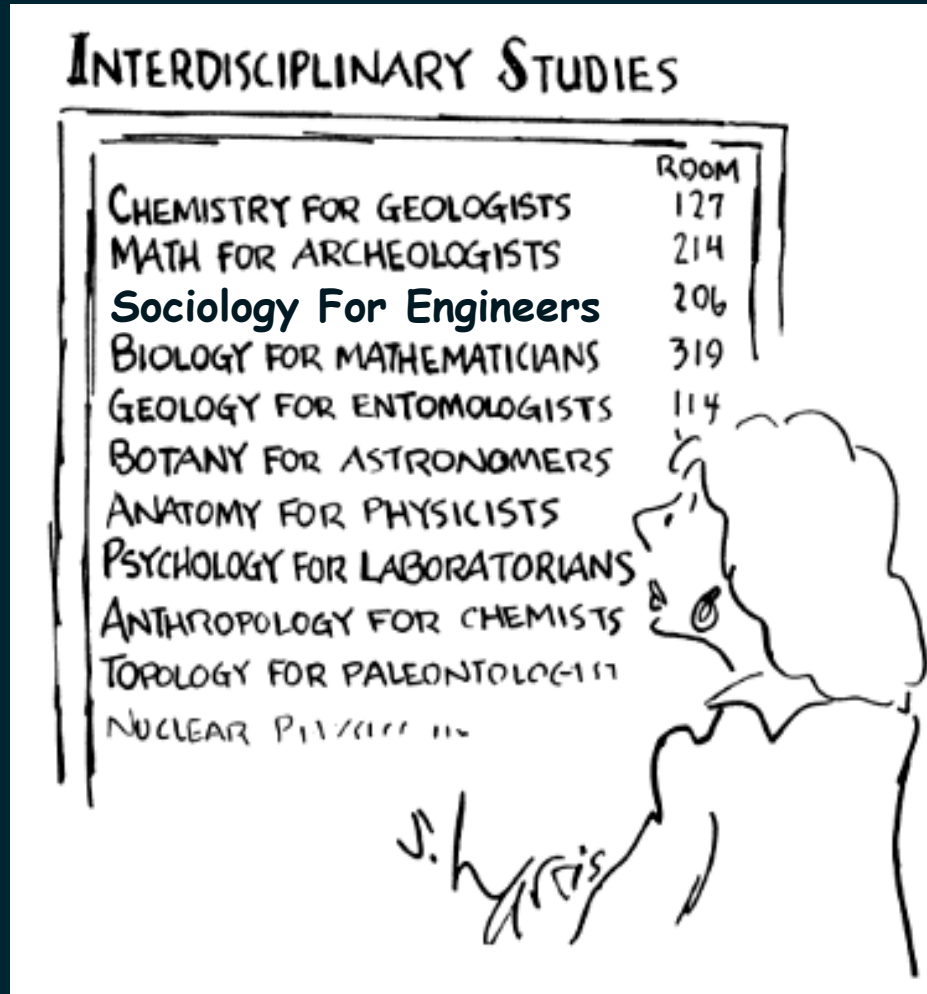
Lessons Learned in the “Real World” (cont)



- “Street Smarts”
 - Written skills; we “sell” reports and our ability to provide contextual analysis
 - People skills; key to learning and advancement
 - The BIG picture; each project is part scientific, part political, part economic.
- Solid educational foundation provides us with a basis for analysis of a field- or site-specific scenario; helps focus our analytical thinking and allows formulation of proper questions.
- Critical thinking is the key to success in the Real World.



In Hindsight...



Hindsight is ALWAYS 20/20



- Particular Classes – Not taken but wish we had (or wish we'd paid more attention!!)
 - Organic Chemistry
 - More Hydrogeology
 - Statistics/Risk Assessment/Environmental Statistics & Analysis
 - Stratigraphy & (more) Structural Geology
 - Atmospheric Science
 - Rhetoric/Public Speaking
 - More Field Courses



Pop Quiz: What Did you Learn...?



- We hope we provided “real world” insight
- We hope to be a professional resource to you
- We hope to receive lots of questions – now and/or later
- If you like, you can reach us:
 - **Nick Walchuk (Emeryville)**
510/420.2559 nwalchuk@environcorp.com
 - **Mauricio Escobar (Los Angeles)**
213/943.6337 mescobar@environcorp.com
 - www.environcorp.com



Questions??



- Thank you.

