Environmental Forensics: an Authentic Blend of Science, Engineering, and Liberal Arts Ingredients

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ABSTRACT
Environmental forensics is a rich topic that encompasses many technical as well as non-technical fields. These include science, engineering, ethics, law, insurance, society, litigation, policy, economics, pollution/contamination, cleanup, testing, standards, and sustainability. This interesting mixture of subjects provides a fertile ground for an interdisciplinary course. Sources of environmental problems are usually related to emissions, pollution, contamination, and/or waste disposal. Whether the cause is intentional or non-intentional, natural factors or a man-made disaster, or due to normal operation or accident, a crisis ensues and cleanup becomes necessary. This inevitably leads to legal actions and litigations that rely on experts in conducting scientific investigations to establish the facts surrounding potential controversies. Some of the pivotal questions related to environmental forensics investigations include: who caused the contamination, when did the contamination occur, how did the contamination occur, was it accidental or a series of routine operating releases, how extensive is the contamination, is there evidence of neglect or fraud, what levels of contamination have people been exposed to, can environmental forensics assist in allocating remediation costs, and most importantly, who will pay for the cleanup effort. To answer these questions one needs to discuss topics such as liability, site history, environmental site assessment, insurance litigation, toxic tort, science tools, sampling, statistical analysis, chemical fingerprinting, contaminant transport models, evidence evaluation, risk assessment, and expert testimony. This interdisciplinary course made extensive use of case studies to illustrate the goal of studying the above subjects. Students were asked to write two position papers on cases that have already been settled in court to express their opinion regarding the outcomes of the cases. In addition, students were also required to write and present a paper on an actual legal case of their choice that involved litigation founded in forensics. This course served educational and investigative goals and provided students with thorough insight into the inseparable relationship between science, engineering, and the liberal arts which added to students’ appreciation of the contribution each area of knowledge makes toward building well-rounded individuals capable of facing the challenges of today’s complex world.

Tags: Environment, Forensics, Pollution, Investigation, Cleanup

1. Introduction
Forensics is the art of discovery and the application of scientific methods and techniques to the investigation of an incident. Environmental forensics is the study, analysis, and
evaluation of environmental issues in a legal dispute [4]. Environmental forensics is not just chemical analyses or modeling, it is a much more complex process. The objective of the forensic scientist/engineer is to establish the “truth for each and every technical and often-competing element at issue in litigation. Most environmental issues are multifaceted where even factual “truth” is complex [5].

In any environmental forensics investigation, pivotal questions are asked. These questions are:

- Who caused the contamination?
- When did the contamination occur?
- How did the contamination occur?
- Was it accidental or a series of routine operating releases?
- How extensive is the contamination?
- Is there evidence of neglect or fraud?
- What levels of contamination have people been exposed to?
- Can environmental forensics assist in allocating remediation costs?

To answer the above questions, information is needed. The sources of the information include the documentary record, including statements of witnesses or other knowledgeable individuals, aerial photographs, insurance maps, stored electronic information, and measurement or sampling data from the field.

Chemical wastes placed on a property by several different owners/operators over decades of occupancy may necessitate a cleanup of both polluted soil and underlying groundwater. The ability to determine which disposal practice(s) by each owner/operator resulted in the need for cleanup activities usually involves historical information and often requires detailed evaluations of industry specific knowledge and practice employing a number of scientific and engineering disciplines: organic and inorganic chemistry, toxicology, biology, solid waste and wastewater treatment practices and methods, soil science, geology, hydrology, groundwater contaminate modeling, and air emissions and particulate modeling. The forensic investigation includes not only science and engineering aspects, but also the time frame.

Almost all involved in a forensic investigation agree that pollution and contamination of soil, water, or air are harmful. The source of disagreement reveals itself when they try to answer the question “who pays for cleanup?” The easy answer to this question is that the entity that caused the pollution should be responsible for the cleanup. Reflecting on the presumption that more than one party could be identified as a “contributor” of pollution, a percentage allocation must also be determined. Once an allocation has been made, it then must be determined if the identified “contributor” has the ability to pay the proportionate share. Which of the identified parties possesses the financial resources and/or insurance coverage to pay for a cleanup? Pollution cases may require a determination of whether employees or other individuals may have been impacted by environmental pollution and suffered either acute or chronic health effects.
In pursuit of identifying responsible parties and implementing remedies for pollution or contamination, this paper will illustrate how the field of environmental forensics is used to establish the facts concerning a given case. As the area of environmental forensics encompasses many technical as well as non-technical fields, it will be shown how seemingly different disciplines, such as science, engineering, ethics, law, insurance, society, litigation, policy, economics, pollution/contamination, cleanup, testing, standards, and sustainability blend seamlessly together to produce an interesting interdisciplinary course.

2. Making the case
In an environmental forensics investigation, the ultimate goal is the persuasive presentation of the many elements that make up the whole puzzle. This can only happen by uncovering the “truth” about the causes of pollution. Establishing the truth could be evasive due to various viewpoints of those involved in the case. The question that begs for an answer is: If “truth” is “truth,” why do we usually end up with at least two versions of the “truth”? The data used to establish the truth plays an important role in the outcome of a case. The very nature of having an incomplete data set describing pollution is the basis of environmental forensics. An absence, or even incomplete, set of data permits different scientists and engineers to have conflicting views of the truth. During the environmental litigation process, prior to settlement or trial, experts may provide their “truth” as opinions in the form of affidavits, expert reports, rebuttal opinions, and deposition testimony. When all of the testimony has been completed and reviewed, there are occasions when divergent expert opinions are clearly valid.

The first phase of the forensic process is the development of opinions. This process requires the expert to review documents provided by counsel and to review documents collected by the expert. In some cases, it may also require the expert to undertake additional chemical evaluations or simulate environmental conditions for a site (e.g., model the transport of a chemical in soil and/or groundwater). Based on the site-specific information and the expert’s background and experience, the expert will form opinions. Scientists and engineers who conduct research and address environmental problems tend to have a broad academic background and work experience. This diversity can result in expertise based on a unique experience and understanding of the “truth” relative to specific issues. The one area of environmental forensics in which expert opinions are the most diverse is modeling of polluted air or contaminated water and/or soil. Because models of the environment by their very nature are complex, their use requires expert analysis.

3. Pertinent information
The information required to support a strong case in an environmental forensics investigation can be collected from many sources. A vast amount of pertinent information can be publicly found and could prove to be quite relevant. The sources include: site/file information from city, county, state, and federal agencies relating to the operational activities at the site; relevant literature (i.e., state of the art, geology, hydrology, soils, chemicals, etc.) from libraries, universities, institutes, trade associations, and government archives; map data from the U.S. Geological Survey (USGS), Sanborn maps (i.e., historic
fire insurance maps), and aerial and satellite photos; climatic data from the U.S. National Weather Service; and newspapers.

In addition to being a multifaceted academic discipline, environmental forensics involves processes resulting from the complex nature of the interactive relationship of both litigation and environmental science and engineering. In defining the “truth,” virtually all successful environmental forensics investigations depend on an experienced environmental attorney as well as a multidisciplinary team of professionals (e.g., civil, chemical, environmental, and petroleum engineers; chemists; process mineralogists; geologists; soil scientists; hydrologists; biologists; economists; toxicologists; physicists; etc.). The dynamics of the forensic investigation and the strategies that evolve on the basis of legal objectives are unique to each and every case.

4. Waste and chemical pollution
Many industries and commercial activities produce hazardous waste or chemical pollution. The quality of the environment in areas where such activities are taking place could be directly impacted. In the early history of the United States, little or no regulations existed for preserving a clean environment. Activities that resulted in the generation of significant waste, such as agriculture, foundries, shipyards, tanneries, and lumber mills, were major contributors to environmental pollution. This problem became more pronounced with the industrial revolution and the adoption of large scale manufacturing activities. The quality of soil and water in a given property today is sometimes dictated by the actions of prior owners. This may necessitate an in-depth search into the historical use of land and water. The past industrial practices and associated chemical use may have degraded the quality of a land’s present and future use. Furthermore, the use of natural resources such as coal, natural gas, petroleum, and nuclear energy results in air pollution, ground and water contamination, and a serious hazardous waste disposal problem for spent radioactive materials. With further development and manufacturing of an ever-expanding pool of synthetic products and chemicals, the list of waste materials referred to as “residuals” gets longer.

Over decades of use, a given property may have had one or more owners that manufactured or used chemicals or disposed of chemical wastes. The land and water impacted by these practices often retains the layered and commingled environmental legacy of each owner or neighbor. Because all property owners share the land use, a property owner may be an involuntary recipient of potential environmental hazard. Litigation often is the selected remedy to settle disputes regarding chemical pollution. As a result, the focus of environmental forensics often is the unraveling of historical storage and handling practices associated with raw materials and products and disposal practices that may have contaminated soil and groundwater, as well as surface waters and air. Chemical fingerprinting of complex organic chemical assemblages, inorganic chemical properties and ratios, chemical age dating methods, determination of chemical isotopes, statistical analysis of chemical data, and process mineralogy is used to define and separate sources of pollution.
The central questions compelling an environmental forensics investigation involve sorting out who caused a contamination problem, when, how, and, among multiple potentially responsible parties (PRPs), how much of the problem is appropriately assigned to each. Answering these questions may in the end involve the expertise of multiple professionals: soil scientists, hydro-geologists, forensic chemists, and process engineers. The beginning of the answer, however, lies in the work of the site historian. Not only will the site history answer many of the questions compellingly through a trail of documentary evidence, but it will both narrow and structure the remaining questions. For example, a site history of a property with several industrial uses over the years may uncover the whereabouts of a former, now graded-over, liquid waste disposal sump. Through historic maps, the sump may be found on the current property, and, through historic annual reports submitted to a now-defunct water agency, some of the types of process wastes deposited there may be identified. With this information, scientists can develop a sampling and analytical plan to locate and identify residual chemicals from the historic operation and to compare them to the contamination problem at hand.

5. History of environmental regulations
In 1899 Congress passed the Rivers and Harbors Act (RHA). The RHA prohibits the discharge of refuse matter “of any kind or description whatever” into the navigable waters of the United States without a permit from the U.S. Army Corps of Engineers. However, the RHA was difficult to police and, therefore, rarely used for enforcement. The following lists the major environmental regulations enacted in the United States:

- 1914, the U.S. Public Health Service (PHS) published its first drinking water standards addressing only bacterial contamination.
- 1948, passage of the Federal Water Pollution Control Act.
- 1970, the U.S. Environmental Protection Agency (EPA) was formed along with passage of the Water Quality Improvement Act, which firmly established standards commonly referred to as effluent limitations.
- 1972, passage of the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act). This law was deemed necessary to reduce the introduction of pollutants, such as organic wastes, toxic chemicals, and hazardous substances, into the water bodies of the United States.
- 1973, the Clean Air Act was originally passed and amended in 1990. It is a United States federal law designed to protect human health and the environment from the effects of air pollution.
- 1976, a new federal era of waste management began with passage of the Resource Conservation and Recovery Act (RCRA), which defined “hazardous waste” and established the often-expressed concept of “cradle to grave” responsibility for hazardous waste.
- 1980, regulations pertaining to the prevention, containment, and remediation of pollution from abandoned hazardous waste areas or chemical spills came into place with the passage of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), commonly referred to as Superfund.

The pollution of surface waters, such as streams, rivers, and lakes, was the first to be addressed through environmental regulations. This was because the waste that the public
saw was an eye sore and the foul order of rotting waste or smoke was an irritant that the public had to smell. Although garbage dumps and early landfills were recognized as problem areas, health issues such as dust, odor, and fly and rodent infestation were the impetus for control measures. Soil and groundwater were not addressed more aggressively because they did not appear as imminently on the radar screen of concern.

Since much of the domestic pollution still came from septic tanks and leach fields, and since industrial wastes were being disposed of behind fences on private property (i.e., lagoons and landfills)—each having its path to the groundwater through the soil—and each being relatively “invisible,” the extent and magnitude of the problems were not universally recognized by governmental agencies until many of the underground aquifers had been polluted by wastes, which then began to manifest themselves in drinking-water wells.

6. Remedial investigation and feasibility study
Any Environmental Protection Agency (EPA) cleanup of a contaminated site must be completed in a manner not inconsistent with the National Contingency Plan (NCP). NCP requires scoping, which is an early review of data to determine future steps to be taken. Scoping includes developing health and safety plans, evaluating existing data, identifying potential cleanup methods, notifying natural resource trustees, and identifying potential Applicable or Relevant and Appropriate Requirements (ARARs). Once scoping has been completed, a remedial investigation (RI) must be performed. A remedial investigation helps in forming a remedy selection by assessing the site and evaluating alternative forms of remediation, often leading to the question: How clean is clean? [1] [2] [3] The remedial investigation involves a baseline risk assessment that is intended to determine the current and potential threats to human health and the environment, and to determine acceptable exposure levels.

The feasibility study’s (FS) purpose is to develop and analyze alternatives for an appropriate response. This involves a consideration of a wide variety of remedies, followed by deleting those options that may be too expensive or ineffective. An expensive remedy may be eliminated when a cheaper, equally effective remedy exists. Upon completion of the RI/FS, the remaining cleanup options are evaluated in detail, applying the following criteria:

- Overall protection of the public and environment;
- Compliance with ARARs; long-term effectiveness;
- Reduction of toxicity and mobility;
- Short-term effectiveness;
- Implementability;
- Cost;
- Acceptability to the affected state or Indian tribe; and
- Acceptability to the public.

CERCLA identifies four groups that may encounter liability:

- Current owners and operators;
- Owners and operators at the time of disposal;
• Generators who arranged for the disposal or arranged with the transporter for the disposal; and
• Transporters.

The liability scheme under CERCLA is extremely broad and could include any or all of the following:
• A current owner or operator who never touched a hazardous material or an owner or operator at the time of disposal can and has included, within the long arm of CERCLA,
• A plant supervisor who had authority over the disposal of wastes;
• One who had the authority to prevent the disposal, even though that person never engaged in the disposal activities;
• A lending institution with a security interest in the facility;
• A landlord that had no involvement in a tenant’s waste disposal; and
• Countless other individuals and entities.

Some of the more common tort claims brought in the environmental arena are:
• Trespass. Actions alleging a physical invasion of property through groundwater contamination, air contamination, and surface water contamination. Generally, one can bring a suit under trespass for an invasion of invisible substances.
• Negligence. To use negligence in an environmental context, a toxic tort plaintiff must show that the defendant breached a standard of care that has been established in the environmental scheme.
• Nuisance. Many toxic tort plaintiffs utilize a private nuisance claim, the interference with one’s use and enjoyment of property, or a public nuisance claim, the interference with a right common to the public, to abate environmental harms. For example, a plaintiff may bring a cause of action under a private nuisance theory because contaminated groundwater is interfering with his or her enjoyment of property.
• Some novel claims include battery and emotional distress.

The American Society for Testing and Materials (ASTM) developed standard practices for environmental site assessments. The stated objectives of these standards were closely followed in introducing the students to the elements of environmental site assessment (ESA). ASTM has compiled a significant body of knowledge related to ESA and formalized it in the form of standard that made it easy for professionals to conduct an elaborate assessment of sites subjected to, or suspected to have been subjected to pollution or contamination. In Phase I [1] the objectives guiding the development of this standard practice are (1) to synthesize and put in writing good commercial and customary practice for environmental site assessments for commercial real estate; (2) to facilitate high quality, standardized environmental site assessments; (3) to ensure that the standard of all appropriate inquiry is practical and reasonable; and (4) to clarify an industry standard for all appropriate inquiry in an effort to guide legal interpretation of the Limited Liability Partnerships (LLPs).

In Phase II [2] ASTM’s stated objectives are (1) assess whether there has been a release
of hazardous substances within the meaning of CERCLA, for purposes including landowner liability protections (i.e., innocent landowner, bona fide prospective purchaser, and contiguous property owner); (2) provide information relevant to identifying, defining and implementing landowner “continuing obligations,” or the criteria established under CERCLA (e.g., taking reasonable steps to prevent or limit exposures to previously released hazardous substances) for maintaining the CERCLA landowner liability protections; (3) develop threshold knowledge of the presence of substances on properties within the scope of the CERCLA definition of a “brownfield site” and as required for qualifying for brownfields remediation grants from the EPA Brownfields Program; (4) provide information relevant to identifying, defining and evaluating property conditions associated with target analyses that may pose risk to human health or the environment, or risk of bodily injury to persons on the property and thereby give rise to potential liability in tort; (5) provide information relevant to evaluating and allocating business environmental risk in transactional and contractual contexts, including transferring, financing and insuring properties, and due diligence relating thereto; (6) provide information to support disclosure of liabilities and contingent liabilities in financial statements and securities reporting.

ASTM has also developed a standard practice intended for ESA for forestland and rural property [3]. The objectives guiding the development of this standard are (1) to synthesize and put in writing good commercial and customary practice for environmental site assessments for forestland or rural property; (2) to facilitate high quality, standardized environmental site assessments; (3) to ensure that the standard of all appropriate inquiry is practical and reasonable; and (4) to clarify an industry standard for all appropriate inquiry in an effort to guide legal interpretation of the LLPs.

7. Insurance coverage of environmental losses
There are two types of environmental insurance coverage:
- Commercial General Liability (CGL)
- Environmental Impairment Liability (EIL)

An incident that may constitute an “occurrence” under occurrence-based policies often is not a discrete event such as a slip-and-fall accident, a punch in the nose, or a theft, which generally have an identifiable beginning and end as well as a recognizable cause and effect. Occurrences affecting the environment, such as a fuel leak or a chemical spill, often, although not always, begin slowly, continue for months or even years, and experience a gradual decline in effect that may not be detectable by the unaided senses.

The standard CGL coverage provision states that the insurer “will pay those sums that the insured becomes obligated to pay as damages because of bodily injury or property damage . . . to which this insurance applies.” Most, although not all, CGL policies provide coverage for bodily injury or property damage caused by an “occurrence” that takes place during the policy period. Breach of contract claims are generally not covered under CGL policies. The justification for this is that only a fortuitous event falls within the parameters of the definition of “occurrence”; tort claims satisfy the fortuity requirement, while breach of contract claims do not.
An EIL policy provides coverage only for personal injury or property damage caused by an “environmental impairment” that arises out of or in the course of the insured’s “operations, installations, or premises.” The term “environmental impairment” encompasses most conceivable forms of pollution and contamination, but also includes odors, noises, vibrations, and other phenomena that affect the environment. Another difference between EIL and CGL policies is that the former provides coverage on a claims-made basis, which means that the insurer agrees to pay all amounts that the insured is obligated to pay as damages as a result of all claims first made against the insured during the policy period.

When environmental contamination exists over a period of years, or where the injury is such that the toxic conditions were likely present for a time before the pollution manifested itself in the form of injury, the issue of when and if the insurer’s defense and indemnity obligations are activated becomes important for claims under occurrence-based policies. The event that activates these obligations is known as the “trigger” of coverage. Which event is seen as triggering coverage determines which policy years, and thus which insurers, will have to respond to the loss. An insurer whose policy or policies have been triggered is said to be “on the risk” for that loss. Determining which event is the triggering event can be very difficult when the contamination involves, for example, toxic chemicals that were present at a site for an extended period of time and resulted in diseases that a person or persons may have contracted sometime before the visible symptoms developed. The same difficulties can exist in the property damage context, where, for example, the damage to a building or the effects on soil are very gradual and are not detected until months or even years after the destructive processes commenced.

8. Litigation and evidence admissibility
Any environmental practitioner, whether attorney or expert, must address and revisit evidence admissibility issues early and often in the environmental forensic process. This applies both to making sure the expert will be allowed to testify and to taking the necessary actions to enhance the possibility of keeping the opposing expert from testifying. An expert must be expert enough to provide forceful testimony. Equally important, the environmental practitioner must be able to foresee any potential obstacles to the admissibility of expert testimony and evidence, and make every effort to ensure that the court will allow the admission of a proposed expert’s opinion.

The U.S. Supreme Court set the standard for determining the admissibility of expert testimony. This standard requires federal court judges to act as judicial “gatekeepers” by barring expert testimony unless it is both relevant and reliable. There is no way to guarantee that a court will allow the testimony of any particular expert or the admission of a given piece of evidence. Nevertheless, there are certainly steps that can be taken to better the odds.

Another standard that federal and state courts use for evidence admissibility is the general acceptance test. The rule requires that “a scientific principle or discovery … must be
sufficiently established to have gained general acceptance in the particular field in which it belongs.”

In 1975, Congress enacted the Federal Rules of Evidence (FRE) which seemed to create a new standard for courts to evaluate the admissibility of expert testimony. FRE placed the power of determining the qualifications of a witness in the hands of the district court.

9. Alternative Dispute Resolution (ADR) Techniques
ADR has proven to be an effective means of accelerating dispute closure and reducing overall transaction costs in many environmental cases. Different ADR techniques have advantages and disadvantages, depending on the characteristics of the environmental dispute, and one selection is not necessarily the optimum method for all such disputes. Nonetheless, ADR techniques enjoy increasing popularity, and their use is likely to expand in the future as a prominent legal tool for resolving environmental disputes. ADR techniques may be best suited to resolve certain types of environmental disputes where the inherent level of technical uncertainty in the facts of the case makes the outcome of a jury or judge trial highly uncertain. Modern methods on the ADR include:

- Dispute review boards: Panel of experts established to review and provide nonbinding recommendations on disputes during project implementation.
- Facilitation: Third-party neutral assists participants in nonsubstantive issues related to dispute.
- Formal fact finding: Neutral assists parties in developing reliable information.
- Mediation: Mediator or co-mediator facilitates the mutual negotiation of dispute.
- Mini-trials: Parties present case before third party neutral; follows rules of regular trial, but scope limited by agreement.
- Arbitration: Arbitrator or arbitration panel decision provides binding on issues in dispute.
- Judicial reference: Private decision maker adjudicates proceedings between parties.

Critics of using ADR identify a number of limitations:

- Public regulatory agencies become less accountable.
- Public agencies and other vital interests may be left out or deliberately omitted.
- Regulatory standards may be overridden to secure purely local, site-specific deals.
- Non-accountable actors (e.g., the mediator) gain undue influence.
- Powerful interests can impose their will on weaker interests.

Fundamentally, the success of ADR in resolving these disputes rests on the willingness of the parties to reach consensus and settlement and the skill of the third-party neutral or third-party neutral team.

10. Negotiation and settlement
Although the allocation of remedial costs between past and present tenants of a contaminated property is usually driven by technical issues, occasionally a situation arises that calls into question the business acumen of certain parties to a dispute. Even when the technical issues are well defined, once the attempt to settle enters the legal
arena, the monetary stakes can be raised significantly. As each party prepares a position to force a favorable settlement, it usually becomes necessary for the forensic consultant to separate fact from fiction in order to place inflated and unrealistic settlement demands into perspective. The following are some of the factors impacting remedial environmental costs:

- A company that does not know the environmental history of its property has little appreciation for its potential future liabilities.
- Regulatory agents do review work plans and do yield to well-framed and supported arguments.
- Costs are not always what they appear to be.
- Legal fees can, and sometimes do, stand in the way of a reasonable and expeditious settlement.

There are contaminated sites where the responsible party has been clearly established and has a legitimate insurance claim for the reimbursement of remedial costs. When this condition exists, the consultant to the insurance company should provide its client with an unbiased assessment of the case facts so that the client can attempt to achieve a reasonable and early cost settlement. The worst case scenario occurs when an early settlement is not attained and as such, over time, both legal fees and investigative costs ultimately inflict a greater financial pain. Lessons learned in such situations include:

- All parties do not succumb to the “initial offer” regardless of how large or fair it appears to be.
- Investigative data alone do not necessarily allow all parties to recognize the extent of a problem.
- Regulatory agencies are not always blind to a reasonable technical argument.
- The IRS rules can influence settlement negotiations because if the responsible party accepts the insurance proceeds in advance of actually paying for cleanup expenditures, the proceeds would be considered as taxable income at the time of receipt.

11. Students Take Away
Upon completion of this course and with extensive coverage of the topics detailed above, students will be able to:

1. Develop an understanding that pollution, contamination, and waste disposal problems have very serious consequences on the lives of humans as well as all living creatures.
2. Develop a fresh perspective regarding rules, laws, specifications, and regulations that control and govern the activities that may harm the environment.
3. Appreciate the inherent value in the scientific approach to do analysis and reach conclusions. Recent scientific advances will revolutionize the field of environmental forensics.

12. Assessment of learning
Assessment of student learning in this course involved several tools as detailed below:
1. Class discussion and participation which required every student in class to be prepared to share, if randomly selected, a current event in the news that has an environmental forensics component.

2. Students were asked to write two position papers on cases that have already been settled in court to express their opinion regarding the outcomes of the cases. This probably was the most controversial component in the course because, although some students agreed with the litigation outcome, others did view the events that led to litigation from a different angle.

3. Students were also required to write and present a paper on an actual legal case of their choice that involved litigation founded in forensics. This was students’ venue to explore a case of their choice and where their interest lied. Students were heavily invested in studying their selected cases and this was evident in their class oral presentation.

4. A stakeholder meeting proved to be an exciting component in this course where every student was assigned a role to play and students were asked to represent their role through arguing for their assigned point of view. It was a spirited debate that, at several points, turned to heated exchanges.

5. In addition to all of the above assessment tools, the course included midterm and final exams.

13. Conclusions
Environmental forensics is a rich subject that involves many science, engineering, and liberal arts disciplines. The variety and the interconnectedness of the subjects related to environmental forensics constitute an authentic blend containing many of the elements necessary for an interesting interdisciplinary course. The student population in this course came from many technical and non-technical majors as the course was open for all students from any department. Due to the diversity of student backgrounds, none of the technical subjects covered in this course delved too deep into highly specialized topics. This made it possible for students to get a good understanding of the issues related to environmental contamination and pollution and to appreciate the necessity for cleanup and remediation. The course concluded with a stakeholder meeting where, at least a week prior to the meeting, students were given a real-world case to read and were randomly assigned one of the following roles: company accused of causing contamination, present property owner, forensic expert, geologic expert, hydrology expert, historian, EPA official, insurance company, and ADR mediator. The instructor played the role of moderator and facilitator. The stakeholder meeting gave the students a good idea of how and why various interests collide but more importantly how best efforts should be made to find a common ground for an acceptable resolution. It was important for students to see how out of sharp disputes one should allow the sound of reason to prevail over unproductive stubbornness and rigidity. According to responses compiled from formal course evaluation, the course was very well received and commended for its wide scope of relevant and interdisciplinary topics.

14. Bibliography

