ENSR
Consulting • Engineering • Remediation

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February 15, 1996

ENSR Ref. No: 1410-015
ENSR Doc. No: LPW/495

VIA FEDERAL EXPRESS

Hasmukh C. Shah, Ph.D.
Manager
Vinyl Chloride Panel
Chemical Manufacturers Association
2501 M Street, NW
Washington, DC 20037

Re: Vinyl Chloride Study

Dear Dr. Shah:

Thank you for your time today discussing the ENSR - CMA contractual issues. As we discussed, I'm optimistic we can settle our mutual concerns. I am enclosing for you, further information on ENSR and in particular, information on our Risk Assessment capabilities. I do hope you will be able to accept a partial credit for further services as part of our settlement.

Additionally in speaking with Peter Rasco today, he is working with Mr. Genovese in New York who has expressed a willingness to work with us. We will be sending a letter next week and are optimistic that with Nancy Gordon's assistance we may be able to resolve the issue with the data tapes and release them to you within the next several weeks.

Please call me when you've had a chance to review the enclosed information and speak with your staff. I look forward to hearing from you. I may be reached at (508) 635-9500 x3238.

Sincerely,

Linnea P. Westberg
Senior Contracts Administrator

Enclosures

CMA 115196

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Statement of Qualifications for Risk Assessment

May 1995
Document #: 9421A04

CMA 115197

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Statement of Qualifications for Risk Assessment

May 1995
Document #: 9421A04

CMA 115198

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Why ENSR?

CMA 115199

Why ENSR?

- **Are your site remediation costs soaring because you must meet overly stringent cleanup requirements?**
- **Are you spending too much on sampling and other technical tasks?**
- **Do you expect your environmental permits to sail through the approval process? Could public opposition stall your project and drive up costs?**
- **Are environmental liabilities straining your budget and threatening your company's good name?**
- **How do you know that you have done enough remediation, and that your site can now be closed?**

Reality and public perception of risk can be two entirely different matters. Today, people tend to accept a perception of risk as reality unless industry can prove the difference. Whether you are seeking an environmental permit, siting a new facility, modifying an existing one, or remediating a hazardous waste site, a realistic assessment of human health and ecological risks from your operations will pay dividends.

Industry is finding that risk assessments have numerous practical applications, including responding to health related queries. An effective assessment serves you — and regulatory agencies — as a reality check in permitting air emissions and waste discharges, siting new facilities and modifying existing ones, preparing environmental impact documents (EISs and EAs), and negotiating reasonable cleanup levels for soil and sediment remediation at state-regulated, CERCLA, and RCRA corrective action sites.

Many state and federal regulatory programs require risk assessments as part of the site assessment process. A risk assessment can focus your facility's environmental program even when not required by regulation. The risk assessment helps to provide answers to questions such as which chemicals need to be remediated and how much they need to be remediated. Risk assessments also help you meet the growing number of state and federal initiatives that set site-specific limits for chemicals in air, water, waste, and food. Finally, a realistic assessment helps you clearly communicate risks to your customers, employees, the news media, local residents, and other stakeholders. The result? Your company will earn a level of trust that will serve you well in all economic climates.

ENSR's risk assessment professionals develop and implement practical risk assessment strategies to help you meet your business objectives. Our risk assessment group has a national reputation for top quality service. We know that regulatory agencies have been very aggressive in developing a "cookbook" approach to risk assessment. Sometimes that "cookbook" is all you need. More often than not, however, a

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Why ENSR?

properly conducted risk assessment cannot follow a standard "cookbook" approach. Rather, it must be based on site-specific issues and state-of-the-art methodology, supported by the most recent scientific research, and peer reviewed by experienced risk assessment scientists.

ENSR can provide high quality, low cost assessments and can apply the cutting edge science needed to resolve your challenging environmental problems.

How can effective risk assessment benefit you?

An effective risk assessment enables you to:

- Negotiate more realistic permit, compliance, and cleanup requirements
- Explain risks and allay fears about potentially toxic materials
- Improve chemical management practices
- Earn recognition for responsible environmental management
- Avoid project delays caused by opposition
- Help achieve site closure
- Save money

ENSR has the skills and experience to help you:

- **Comply with evolving risk assessment regulations**

  In response to expanding state initiatives on toxic air contaminants and enhanced federal programs covering waterborne toxic materials, industry must manage its product and by-product waste materials more aggressively and effectively than ever before. Regulations such as New Jersey's Toxic Catastrophe Prevention Act (TCPA), the Illinois and Massachusetts Contingency Plans, and California's Risk Management and Prevention Program (RMPP) and Proposition 65 are especially demanding. Experts agree that similar measures will be implemented in other states. In addition, ENSR has submitted one

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Why ENSR?

of the first incinerator multipathway risk assessments following EPA's November 1993 guidance. Using ENSR's experience with these and other rapidly developing requirements, our risk assessment experts can help you meet both your current needs and anticipated future obligations.

- **Achieve results that are both cost-effective and reliable**

  Few risk assessment consulting companies have in-house design, mitigation, engineering, and laboratory resources. ENSR does. Our full-service capability will help you find answers to your most complex environmental problems.

  For instance, ENSR's environmental laboratory in Fort Collins, Colorado, provides a full range of bench-scale testing capabilities for measuring effluent and sediment toxicity. The laboratory is certified to perform measurements for EPA's effluent toxicity program and will support your efforts in NPDES permitting, Superfund NRDA, and RCRA compliance. Because it is dedicated solely to ENSR projects, the laboratory provides you with accessible, cost-effective, and timely services.

- **Negotiate more realistic, less costly cleanup levels and permit requirements**

  Having successfully completed more than 1,000 risk assessments, ENSR knows how to save you time and money. We have saved our clients millions of dollars at federal Superfund sites by critically evaluating remedial action levels proposed by EPA — and by demonstrating that alternative, less stringent cleanup levels protect public health just as effectively and are more cost-effective. Recently, a pulp and paper company shaved a year from its permitting schedule and saved more than one million dollars based on ENSR's assessment of risks related to facility expansion.

- **Reduce your environmental risks through an integrated approach**

  Nearly every environmental project today calls for risk assessment expertise in human health, the environment, and/or process safety. In fact, nearly half of ENSR's risk assessments are performed not as isolated projects, but in support of other ENSR services such as environmental permitting, hazardous waste site remediation, and air toxics consulting. By taking an integrated approach, we address the full range of risks associated with your company's environmental concerns to develop the most cost-effective and health protective course of action. We quickly identify, evaluate, and often eliminate trivial risk factors from further consideration thereby reducing expense.

- **Earn credibility by performing scientifically defensible risk assessm nts**

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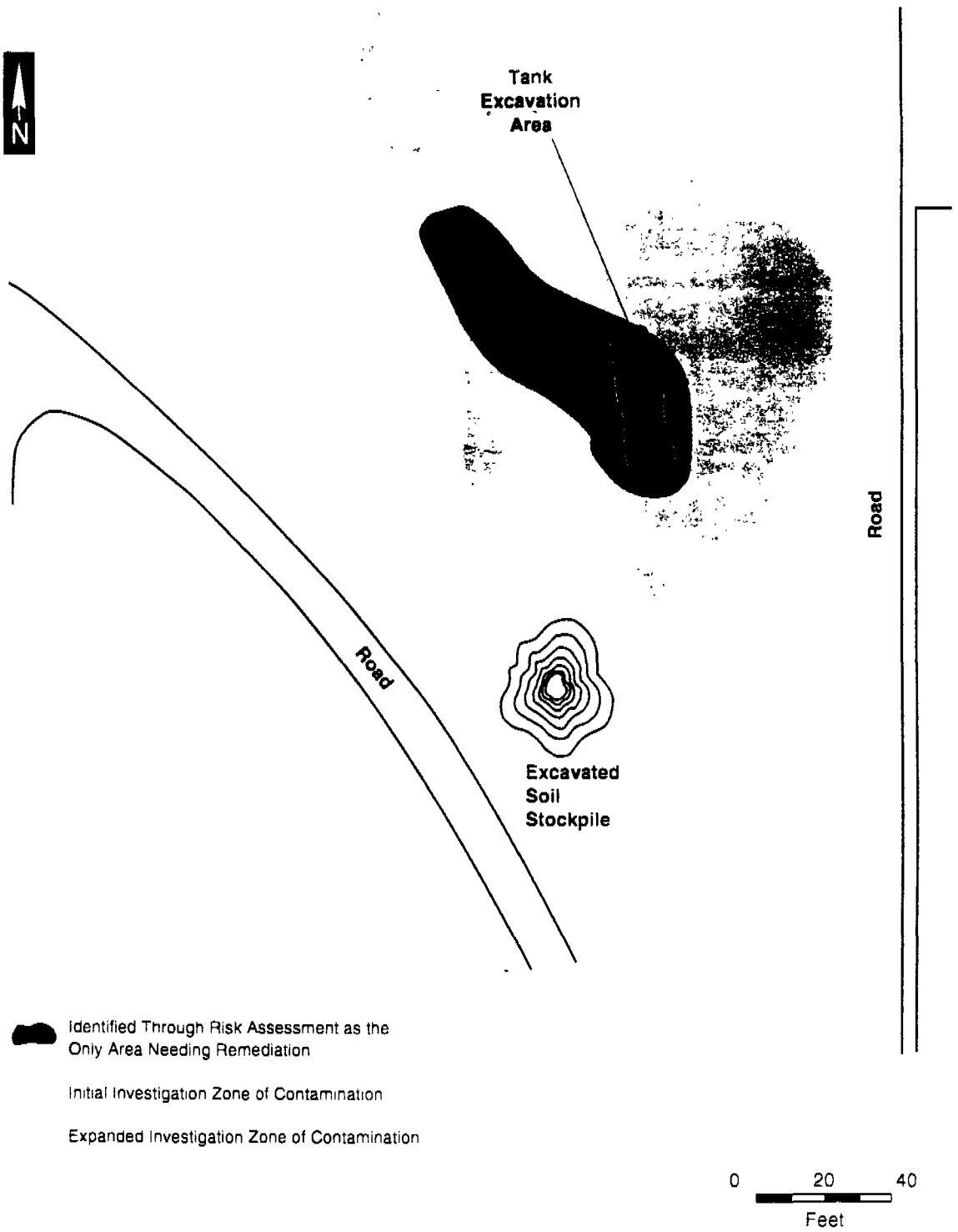
UST Site



Our risk assessment saved this client one-quarter of a million dollars in remediation costs at a diesel fuel-contaminated site in Alabama. The initial cleanup goal for soil was 100 ppm TPH, but based on a site- and chemical-specific risk assessment, ENSR derived a cleanup goal of 5000 ppm TPH. This higher cleanup goal, which was accepted by the regulatory agency, meant that one-third less soil from the site needed to be hauled to a landfill. This corresponded to substantial savings for this client.

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Why ENSR?

ENSR toxicologists and environmental scientists understand the complex factors in multipathway risk assessments such as inhalation of chemical vapor or particles, ingestion of contaminated soil, water, or food, and dermal contact with chemicals in water or soils. We have pioneered advances such as developing the most accurate methods to estimate the amount of process-originated cadmium on a fugitive dust particle that might be inhaled by a passerby, or calculating the amount of dioxin that could reach the dinner table in edible fish.

- **Ensure credible expert witness testimony to support litigation**

  ENSR provides litigation support in the form of expert witness testimony, evaluation of cases for toxicological relevance, critique of the scientific credibility of opposing expert testimony, and overview of health- and/or ecological-related issues. We focus on delivering a scientifically-based defense that can be readily understood by non-technical audiences. Our work has been almost exclusively on behalf of defense counsel and the regulated community.

- **Lower costs through money-saving computer modelling, methodology, and technical approaches**

  ENSR delivers timely, economical, and defensible risk assessments with the aid of computer modeling software systems developed by our scientists. ENSR can customize these models for application to the specific conditions and requirements of your site. As a result, we can conduct risk assessments at lower costs and often in less time.

  ENSR has developed an integrated approach to data management for hazardous wastes sites. The ENSR Hazardous Waste Database Management system (HAZWASTE), Automated Data Validation Software (ADV), Risk Assessment and Toxicology Chemical-Specific Database (RATFACTS), the Regulatory Information Database, and risk calculation programs have all been developed through our Corporate Research and Development Program and have been used successfully on scores of projects. These systems are fully compatible and provide an integrated approach to data management that greatly increases the efficiency and quality of our site analysis.

  Health standards and chemical toxicity data from the RATFACTS system and analytical data from the HAZWASTE system are electronically linked to a multifaceted, three-dimensional spreadsheet program that can be used to build customized risk scenarios for your facility or site from our library of exposure scenario templates. The ENSR exposure models include the very complex indirect exposure and bioaccumulation pathways, such as beef, dairy/milk, fish, and vegetable consumption.

  Our software systems automate the steps required to reduce a large dataset for use in human health or ecological risk assessments. Data can be easily parcelled and analyzed for temporal or spatial trends.

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Corporate Profile

To better serve our clients, American NuKEM has brought together three operating divisions to form ENSR. Although each division is structured as an independent unit, this change was made to provide our clients with an optimal blending of environmental consulting, process and design engineering, and remediation and construction services. This structure gives us the flexibility to respond seamlessly to a full range of client needs – from single-phase project services to comprehensive services. We save clients time and money, focusing on the "end point" of every project by using appropriate consulting, engineering, remediation, or construction staff to bring all technical perspectives together to achieve client objectives.

Environmental Consulting Services

ENSR Consulting and Engineering is a national leader in providing problem-solving environmental services to industry. ENSR project managers have helped industrial companies save money and reduce liabilities as they manage new and constantly changing environmental issues. These services include:

- Risk Assessment and Toxicology
- Hazardous Waste Assessment and Remediation
- Toxicological Laboratory/Consulting
- Environmental Management
- Water Quality Management and Wastewater Consulting
- Air Quality Management
- Environmental Permitting
- Property Transfer Assessments
- Environmental Communications
- Pollution Prevention
- Occupational Health Management

Process and Systems Engineering

ENSR Systems Engineering provides process engineering and design services that lead to cost-effective treatment systems. For clients who are developing large-scale capital projects, such as wastewater or nuclear waste treatment facilities, ENSR offers comprehensive services – from design to construction oversight to facility startup and operation.

This division also works closely with our consulting staff to support remedial design efforts and to provide design services for air pollution control projects.

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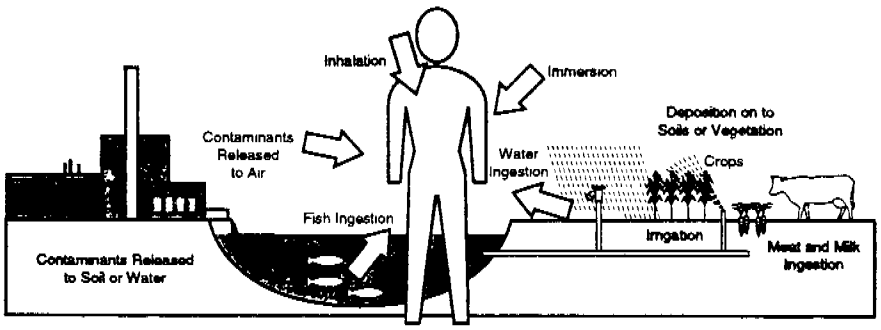
Why ENSR?

An unlimited querying capability allows ENSR's toxicologists, environmental scientists, and risk assessment specialists to conduct a variety of analyses.

ENSR maintains a continually updated and expanded database of chemical-specific information. Regulatory, health-based, and ecological criteria from federal, state and scientific sources are available to compare with the findings at your site, often eliminating chemicals from further consideration early in the assessment process.

AIRTOX®, ENSR's state-of-the-art system of over 20 air toxics models, simulates chemical spills, leaks, and other accidental releases. Using AIRTOX®, you can quickly examine possible impacts from a full range of sources and incidents such as stacks, pipes, valves, fires, and explosions.



Computerized models, regulatory understanding, and technical expertise allow ENSR to consider a variety of chemicals in many pathways customized to your project.

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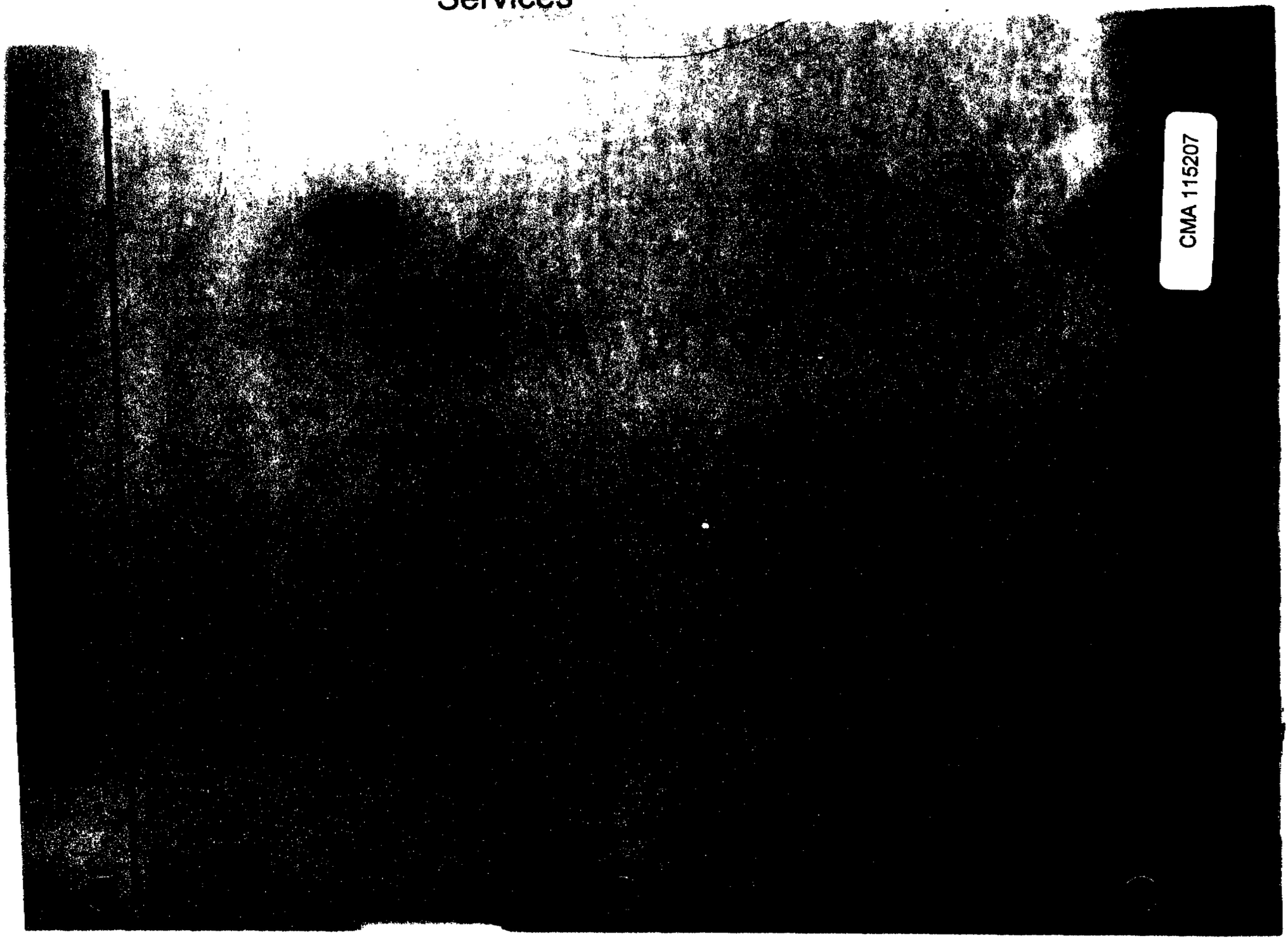

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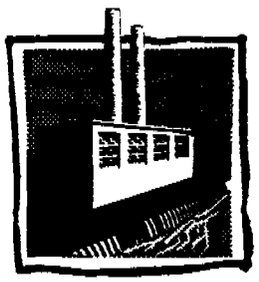

ENSR has extensive resources to plan, conduct, analyze and communicate your human health and/or ecological risk assessment. Descriptions of our risk assessment services and how ENSR can help you achieve your environmental goals are detailed below.

RISK MANAGEMENT PLANNING

Effective risk management will help you ensure regulatory compliance and minimize human health and ecological risks associated with your facilities and operations. ENSR's experts use proven risk assessment methods to help you:

- Satisfy compliance requirements and streamline environmental permitting
- Identify potentially unacceptable human health or ecological risks and reduce or eliminate them
- Save money on cleanup costs and reduce potential liabilities
- Effectively communicate risk information to government agencies, your employees, and the public
- Calculate acceptable risk-based concentrations of chemicals in air, soil, groundwater, surface water, biota, and sediment
- Develop acceptable environmental media-specific concentration limits for previously unregulated chemicals
- Negotiate the most appropriate remedial alternative for simple or complex sites, focusing on both health and cost issues
- Design risk-based field sampling programs for hazardous waste sites to maximize information and statistical power while minimizing sampling and analytical costs
- Model or predict the likely outcome of hypothetical sudden release, explosion, or combustion scenarios associated with hazardous chemical storage or transport
- Establish procedures to protect human health and the environment
- Solve problems associated with the manufacture, use, and disposal of hazardous substances

No matter why you need to perform a risk assessment, ENSR's goal remains constant. Without disrupting your operations, we will help you identify and resolve your chemical and waste management challenges before they become major liabilities.

REGULATORY COMPLIANCE

Most environmental regulations contain some provision for human health and/or ecological risk assessment, and new requirements are evolving rapidly. Achieving compliance pays off in many ways, including avoided fines, reduced cleanup costs, and better public, media, and regulatory agency relations.

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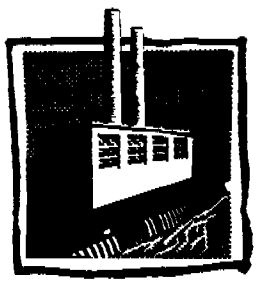

ENSR risk assessment experts will help you:

- **Comply with CERCLA (Superfund)**

If you are designated a potentially responsible party (PRP) at a hazardous waste site, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA/Superfund) requires you to conduct human health and ecological risk assessments. You may also be compelled to investigate potential inquiries to natural resources as part of a Natural Resource Damage Assessment (NRDA). EPA may conduct its own studies which are usually based on very conservative assumptions, requiring immediate, extensive, and costly remedial action. ENSR can often perform more realistic analyses by incorporating factors which account for decreased bioavailability of chemicals in soil and water, decreased toxicity of chemicals when ingested as opposed to inhaled, and other similar issues. We have successfully demonstrated that in some cases there is no real threat to public health or that the risk is overestimated. The result is a significant savings on remediation for our clients. Our staff includes former EPA personnel, regulatory experts, and remediation specialists who are skilled Superfund negotiators.

EPA's risk assessment of a former hazardous waste lagoon on the Quinnebaug River in Connecticut called for excavation and incineration of the contents of the lagoon. ENSR demonstrated that EPA substantially overestimated risks - which would actually be much greater with excavation and incineration than if the lagoon's contents were left in place. We then proposed development of ACLs and successfully negotiated with EPA to simply modify the lagoon's existing cap. The client saved over 90 million dollars in cleanup costs.

- **Comply with RCRA**

Under RCRA, you may need to measure and predict the health effects of your emissions. If these risks are considered substantial, the government may conduct its own public health risk assessment and impose strict emissions limits. By providing scientifically defensible human health and ecological risk data for your facility, ENSR can help you avoid government intervention and save substantial corrective action costs. From identifying the most cost-effective strategy for developing groundwater protection standards in your Part B permit, to determining if a hazardous waste release requires further action, to initiating corrective action or negotiating site closure, ENSR can help you save time, money, and peace of mind.

ENSR conducted a risk assessment as part of a RCRA closure of a stormwater basin at a petroleum refinery. Using realistic exposure scenarios, the risk assessment developed less stringent cleanup objectives for surface water and sludges in the stormwater basin. The result was a significant reduction in the time and cost of the remediation effort that was still protective of human health and the environment.

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- **C mply with State R gulati ns**

Several states have recently enacted stringent laws governing accident prevention and risk communication. Those enacted by California, Massachusetts, New Jersey, and Illinois are among the most demanding, but other states may soon adopt similar initiatives. The objective of these new laws is to protect communities against acute risks associated with potential catastrophic releases of certain hazardous chemicals from industrial processes. These laws commonly require industry to undertake diverse and costly risk assessment activities. ENSR regulatory experts can help you meet these requirements or take action to prepare for tightening regulations in your state.

For a large synthetic rubber manufacturer, ENSR conducted a design review of all equipment associated with hazardous materials, performed a Hazard and Operability Study, developed a fault tree-based hazard analysis, and performed consequence analyses using our AIRTOX accidental release models to develop mitigation measures. ENSR's work enabled the client to receive California RMPP state certification.

- **Comply with EPA's Combustion Initiatives**

In May 1993, Administrator Carol Browner announced EPA's National Combustion Strategy which outlined guidance for assessing risks to indirect exposure of combustion emissions. The new guidance required an evaluation of indirect exposure pathways (such as exposure through beef and dairy milk ingestion) as well as the traditional direct (inhalation) route be conducted. In addition, the strategy imposed more stringent limits on metals, dioxin and furan emissions, tighter controls for particulates, and increased public involvement throughout the permitting process. ENSR's risk assessment experts have conducted numerous multipathway assessments for combustion units that are consistent with the requirements outlined by Administrator Browner.

ENSR prepared a multipathway risk assessment for the proposed upgrade of an industrial furnace accepting hazardous waste. Our toxicologists negotiated innovative approaches with the state agency and conducted the risk assessment evaluating direct and indirect exposure routes. The client received all permits and is meeting all the requirements as outlined in National Combustion Strategy guidance.

- **Comply with SARA Title III**

SARA Title III requires manufacturers to provide their communities with statistics on extremely hazardous chemical emissions. It is expected that the SARA chemical list will be expanded to include many more substances at lower threshold concentrations. Because SARA Title III statistics have been widely publicized, people are intensely concerned about potential health risks and are more aware than ever of chemical use in their community. Using exposure modeling, risk assessment, and

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risk communication services, ENSR will help you comply with SARA Title III and alleviate community concern.

For a pharmaceutical company, ENSR developed a comprehensive hazard assessment/emergency planning and management risk mitigation program that addressed the requirements of SARA Title III Community Right-to-Know. ENSR assessed the potential impacts of accidental releases of chemicals used in the manufacturing process, reviewed the effectiveness of selected mitigation measures and engineering controls, revised the existing risk management plans to incorporate the new findings, and communicated the new program in workshops to the department managers.

- **Comply with NEPA**

If you plan to build or modify a facility, National Environmental Policy Act (NEPA) requires you to conduct an Environmental Impact Assessment (EIA). Credible risk assessment is often crucial to the EIA process. ENSR has an outstanding track record working with many facilities including cogeneration plants, hazardous and hospital waste incinerators and waste-to-energy facilities, wastewater treatment plants, steel mills, pulp and paper mills, refineries, and fossil fuel utilities. We use hazard analyses and quantitative risk assessment techniques to predict the possible locations, probabilities, and magnitudes of human health and environmental risks intrinsic to facility siting and expansion. A well planned effort facilitates permitting and may lessen your future compliance requirements and costs. And, since public opposition has stalled, and even prevented new facility plans, a proactive risk communication program can be essential to your permitting success.

For Enron Corporation's proposed gas-fired power plant, ENSR secured all environmental permits and approvals. We also saved Enron hundreds of thousands of dollars by demonstrating to agencies and highly vocal public and special interest groups that the plant's proposed wet cooling system would not harm human health or the aquatic environment.

- **Comply with CWA/NPDES**

The Clean Water Act (CWA) and National Pollution Discharge Elimination System (NPDES) require you to determine how your wastes, wastewaters, and products affect water quality. ENSR has been at the forefront of water toxics issues. We have been especially active with the pulp and paper and petroleum industries regarding the setting of effluent limits for dioxins and benzene. No matter what you manufacture, your activities may affect water quality. If so, you may need to take immediate action. ENSR's scientists, engineers, and environmental toxicity laboratories can help you reduce your environmental liability while achieving compliance.

To expand a facility, an electric company had to prove that thermal discharges would not adversely affect aquatic biota or water quality.

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ENSR demonstrated that the existing system would adequately protect the aquatic ecosystem after the plant expansion, and showed that it was superior to proposed alternatives because it optimized dissolved oxygen levels in the receiving water. The client saved millions of dollars that might otherwise have been spent on a new system.

ASSESSMENT OF ECOLOGICAL RISKS

Protection of natural resources is a driving force behind environmental regulation and is required for compliance with RCRA, CERCLA, NPDES, and many state regulations. These regulations are placing increasing emphasis on evaluating ecological risks.

ENSR's staff of environmental scientists have extensive experience conducting ecological risk assessments that are based on the most current scientific methods. They will assist you to:

- **Develop Cleanup Levels Based on Actual Risk**

Often regulatory-mandated cleanup standards require you to remediate beyond what is necessary to protect the environment. Using an ecological risk assessment to base your cleanup plan on the actual risk level may substantially reduce the amount of soil to be remediated, lessen the equipment necessary for pollution control or suggest alternate, less costly treatment methods.

For a Superfund Site in the northeast, ENSR used an ecological risk assessment to demonstrate that a costly excavation and incineration remedial action posed a potentially high risk to ecological receptors. Instead, the site was capped and ENSR performed an Alternative Concentration Limit Demonstration to derive cleanup levels that were based on human-health and ecological risks.

- **Estimate Realistic Impacts to Natural Resources**

A Natural Resource Damage Assessment (NRDA) estimates the extent of damage to the natural environment caused by an accident, poor disposal practices, or past operations, then NRDA calculates the cost required to restore the environment to its original condition. The restoration cost is recouped through a penalty levied against the source or sources of the damage - potentially resulting in millions of dollars in fines. Using ecological risk assessment principles and site-specific information can result in a more accurate determination of environmental impact. This can be used in negotiation with trustees.

For a company required to conduct an NRDA after a spill in Lake Superior, ENSR was able to assess the damage was significantly less than what the regulatory agency determined. ENSR risk assessors convinced the agency that the affects of the spill were short-term and reversible, thus substantially reducing the fine originally levied against the company.

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- **Negotiate Alternatives with Regulatory Agencies**

Regulatory agencies often assess risk using conservative, overly-protective numbers. ENSR's risk assessment experts assess risk using realistic information to depict scenarios that better represent the actual conditions. Our staff of recognized experts conduct technically-defensible arguments that agencies respect. We've successfully negotiated with agencies on many projects to reduce fines, modify cleanup plans, and grant more flexible operating permits.

When a regulated government organization had to remediate leaking underground storage tanks at two locations, ENSR conducted a detailed, site-specific risk assessment in preparation of the cleanup plan. Based on the results of ENSR's health risk assessment, the state agency took the unprecedented step of approving a much less stringent cleanup level, thereby reducing overall cleanup requirements and completely eliminating one site from remediation. This reduction in cleanup level saved our client substantial costs and time in their remediation efforts.

- **Conduct Technically-Defensible, Cost-Effective Risk Assessments**

Agencies recognize that risk determination allows room for varying opinions. Many of ENSR's risk assessors have advanced degrees and are board-certified. This expertise provides technical credibility when defending alternative solutions to an agency while using our own aquatic toxicology laboratory, proprietary modelling tools, and staff with backgrounds in over 60 disciplines. ENSR has all the resources in-house to conduct a cost-effective and a thorough ecological risk assessment.

For a Superfund client in the western part of the U.S., ENSR performed a two-tiered ecological risk assessment to evaluate risk through criteria exceedances or toxicity test results. Extensive fate and transport analysis, application of recent U.S. EPA guidance on aquatic metals bioavailability, and evaluation of laboratory and in situ toxicity data indicated substantially less toxicity than presumed.

- **Communicate with the Public, Employees, and Activist Groups**

There are many people and groups committed to protecting our natural resources. When mobilized, these forces can stop a project that they consider a threat to a particular species or general environmental health. An ecological risk assessment goes beyond blanket protection of the threatened, rare, and endangered species to identify and consider potential risks posed by a facility or project. Conducting a risk assessment for biological communities and their ecosystems demonstrates your commitment to protecting the environment and provides information that allows you to communicate intelligently and effectively with potential project opponents.

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A Mid-Atlantic medical waste incinerator became the focus of unfavorable media coverage which raised intense community concern. ENSR is helping to defuse the situation by providing risk communication expertise and by assisting with public meetings and gatherings with local citizen groups.

ASSESSMENT AND MINIMIZATION OF WORKPLACE RISKS AND HAZARDS

If you handle industrial chemicals, you face unique risk assessment requirements. Chronic workplace exposure, perceived risk, acute hazards, and chemical effects on product quality are especially challenging. ENSR will help you assess these situations and make necessary changes in current practices.

ENSR risk assessment experts will help you:

- **Protect Your Workers from Chronic Chemical Exposure**

By proactively addressing your employees' daily exposure to workplace emissions, you can satisfy OSHA permitting requirements, limit worker compensation costs, and avoid potential toxic tort cases. ENSR risk assessors in combination with ENSR's Certified Industrial Hygienists will help you evaluate worker exposure, develop and assess corporate industrial hygiene programs, evaluate workplace health hazards, design and implement medical monitoring programs, and statistically analyze employee health data.

ENSR helped a food manufacturer that used large amounts of ammonia in it's refrigeration systems to comply with OSHA's Process Safety Management Rule. A team of ENSR risk assessors, engineers, and air quality specialists conducted an audit of the facility's existing plans for emergency management and engineering controls and updated Standard Operating Procedures for training, maintenance, inspections, and periodic testing. As follow-up, ENSR provided advice and assistance with employee training and risk communication programs.

- **Prevent Accidents and Minimize Potential Impacts**

Despite your best efforts, you may eventually face an accidental release. Unexpected spills, fires, explosions, and other unplanned chemical emissions demand immediate action to protect human health and the environment. ENSR provides a full spectrum of risk management services to lessen your liability. They include computer simulation of release scenarios, evaluation of both acute and potential long-term health risks related to accidental releases, HAZOP evaluations, design and

implementation of mitigation measures, fast access to toxicological profile information, and employee, community, and media relations support.

For a Gulf Coast company's offshore wells and onshore gas refining plant, ENSR developed the first real-time emergency monitoring and warning system for the oil and gas industry.The interactive system includes air quality modeling and monitoring of meteorological data, SO_2, H_2S, and NO_x. Data is correlated with output from the company's pipeline leak detection system to model potential impacts from accidental releases. The system is used for training and to coordinate emergency response.

- **Communicate Risks Without Raising Alarm**

Issues surrounding industry's chemical and hazardous waste management practices are emotional and complex, and many people may not have the technical background necessary to interpret them. At the same time, people expect immediate answers to questions about perceived health risks. In some cases, they initiate citizen suits or attempt to stop work at a controversial site. Even if you don't currently face a community relations crisis, a proactive risk communication and education program can benefit you. The community good will and trust created by open, clear communication about chemical risk before a problem arises will stand you in good stead should an emergency occur. ENSR risk communication experts will assist you by preparing educational materials, training your staff in proven risk communication techniques, representing you during public meetings, and helping you to think and act proactively rather than reactively to potential environmental issues. For a number of companies, we have prepared and implemented comprehensive employee and community relations programs.

ENSR's environmental communications programs and strategies helped a company branded as a corporate polluter regain its credibility with agencies and the public. Negative press gave way to positive media coverage, and EPA's Regional Administrator went on record saying that the company had made "an enormous turnaround in their corporate thinking and an extraordinary commitment to environmental compliance."

- **Evaluating Potential Product Hazards Through Environmental Toxicology Testing**

Federal and state regulations require various aquatic and terrestrial laboratory toxicity tests to register, or maintain, the registration of pesticides (FIFRA) or drugs (FDA). Sometimes compliance with the Toxic Substances Control Act (TSCA) may require laboratory toxicity tests, as well. Most recently, regulators have been requiring toxicity testing to evaluate the effectiveness of remediation efforts under CERCLA. ENSR's toxicology laboratories in Fort Collins, Colorado and Houston, Texas, are flexible facilities capable of satisfying and testing need. ENSR's toxicologists are nationally and internationally known for their expertise in evaluating the environmental risks associated with

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anthropogenic materials. ENSR is unique in that it combines consulting, technical excellence, and laboratory facilities to provide a complete approach in the evaluation of environmental risks.

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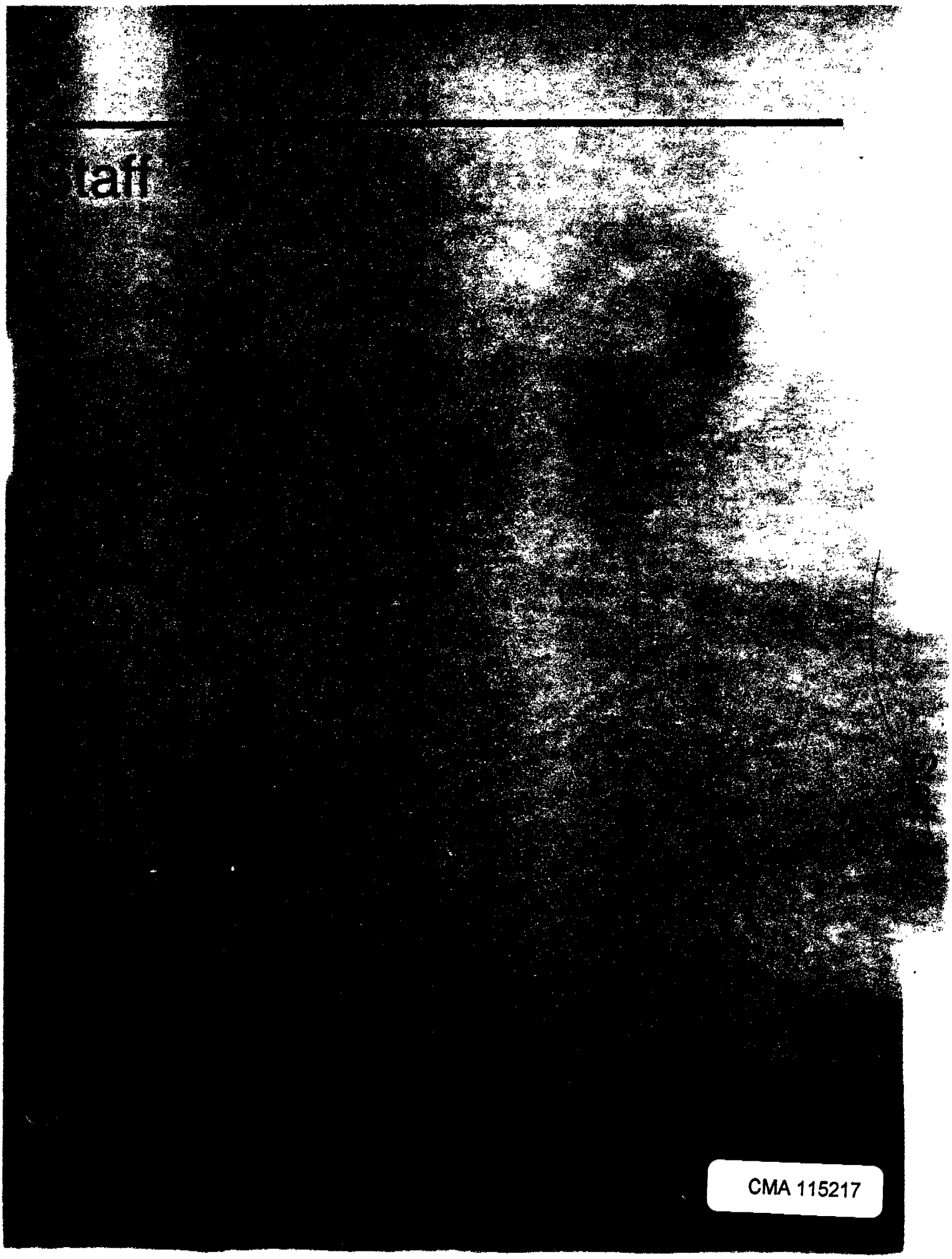

ENSR Risk Assessment
Personnel Experience Profile

Name	Title	Years Experience	Technical Experience							Industry Experience								Regulatory Experience				
			Human Health Risk Assessment	Ecological Risk Assessment	Product Registration / Safety	Fate and Transport / Data Analysis	Risk / Hazard Communication	Litigation Support / Expert Witness	Chemical / Pharmaceutical	Petroleum and Products	Military / Aerospace	Mining and Minerals	Pulp and Paper	Resource Recovery / Waste Incineration	CERCLA / RCRA Sites	Utilities	Clean Air Act	Clean Water Act	CERCLA / RCRA	NPDES	TSCA / FIFRA / FDA
Anita Boehm, M.S.	Risk Assessment Specialist	5	•	•		•	•	•	•	•		•		•	•	•	•		•		
Anita Barth, M.S.	Environmental Chemist	9		•	•	•			•	•		•		•		•					•
Therese Beaudoin, M.S.	Environmental Scientist	8	•	•							•		•		•	•		•	•		
Peter Bell, Ph.D.	Sr Environ Scientist	12	•	•												•	•				
Lisa Bradley, Ph.D.	Sr. Toxicologist	11	•						•	•	•		•	•	•	•	•		•		
Elizabeth Caldwell, Ph.D.	Sr. Risk Scientist	10	•	•		•	•		•	•	•	•			•	•	•		•		
Dave Cameron, B S.	Wetland Scientist	3		•						•		•	•	•	•		•	•	•		
Ishrat Chaudhuri, Ph.D.	Sr. Toxicologist	11	•			•	•	•	•	•	•			•	•	•	•		•		
Gary Chia, B.S.	Environmental Scientist	2	•			•	•		•	•		•			•	•	•				
Steve Cibik, M.S.	Sr. Aquatic Ecologist	14		•		•		•		•			•		•	•		•	•		
Adam Cohen, M.S.	Toxicologist/Risk Specialist	5	•	•	•			•	•	•		•		•	•			•	•	•	•
Elpida Constantinou, M.S.	Environmental Engineer	6	•			•				•						•					
William A. Duvel, Ph.D.	Sr Program Manager	25	•	•		•		•	•	•	•	•	•		•	•		•			•
Patricia A. Fleischauer, M A.	Sr. Program Manager	30	•			•	•	•	•	•		•	•	•		•	•	•			
Marcus Garcia, B.S.	Risk Assessment Specialist	1	•						•	•					•				•		
Mark Gerath, M.Sc., S.M.	Sr Hydrologist	10				•		•	•	•	•	•	•	•	•	•	•	•	•		
Marie Giordano, M.S.	Sr. Project Manager	9	•	•			•		•	•	•		•	•	•	•			•		
Dan Godden, M.S.	Sr. Atmospheric Scientist	17	•			•	•			•	•			•		•	•				

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Personnel Experience Profile (Continued)

CMA 115219

Name	Title	Years Experience	Technical Experience						Industry Experience								Regulatory Experience				
			Human Health Risk Assessment	Ecological Risk Assessment	Product Registration / Safety	Fate and Transport / Data Analysis	Risk / Hazard Communication	Litigation Support / Expert Witness	Chemical / Pharmaceutical	Petroleum and Products	Military / Aerospace	Mining and Minerals	Pulp and Paper	Resource Recovery / Waste Incineration	CERCLA / RCRA Sites	Utilities	Clean Air Act	Clean Water Act	CERCLA / RCRA	NRDA	TSCA / FIFRA / FDA
Bill Gorham, Ph.D.	Marine Ecologist/Physiologist	14	•	•						•	•					•		•		•	
Dave Hanson, M.S.	Sr. Program Manager	17		•			•	•	•	•	•		•		•	•		•	•	•	
Olga Hassiotis, M S.	Air Quality Engineer	7	•			•			•	•			•	•		•	•				
Russ Hockett, B.S.	Aquatic Toxicologist	9		•		•			•	•		•	•			•		•			
Karen Hopkins, M.E M.	Aquatic Toxicologist	3		•		•			•	•	•		•		•			•			
Nancy Hunter, M.P.H	Risk Communication Specialist	9					•		•		•			•	•				•		
Tarang Khangaonkar, Ph.D.	Sr. Water Quality Engineer	6				•			•	•			•					•			
Nancy Lee, B.A.	Staff Risk Assessor	5	•	•				•													
Richard McGrath, B.A.	Program Director	25		•		•		•		•	•		•		•	•		•	•	•	
Michael Mills, Ph.D.	Technical Director	22	•			•	•	•	•	•	•	•	•	•	•	•	•		•		
Dave Mitchell, Ph.D.	Sr. Aquatic Ecologist	15		•		•		•		•			•		•	•		•	•		
Alan Parsons, Ph.D.	Principal Technical Specialist	20	•	•		•	•	•	•	•			•		•				•	•	
David Pillard, Ph.D.	Aquatic Ecologist/Toxicologist	9		•	•			•	•	•	•	•	•		•			•	•		•
Betsy Ruffle, M.S.	Program Manager	10	•	•		•	•		•	•	•		•	•	•	•	•	•	•		
Robert Sanz, B.S.	Senior Program Manager	20		•			•	•	•	•	•	•	•	•	•	•		•	•	•	
Christian Signeur, Ph.D.	Air Toxics Risk Assessor	15	•			•		•	•	•					•	•	•				
Douglas Smith, Sc.D	Sr Risk Scientist	25	•			•	•	•	•	•	•	•	•	•	•	•	•		•		
William Stubblefield, Ph.D.	Sr Environmental Toxicologist	15		•	•		•	•	•	•		•	•	•	•			•		•	•
Carl Tamml, B.S.	Sr. Wetland Scientist	6						•	•	•	•	•	•	•	•	•		•	•	•	

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Personnel Experience Profile (Continued)

Name	Title	Years Experience	Technical Experience						Industry Experience								Regulatory Experience				
			Human Health Risk Assessment	Ecological Risk Assessment	Product Registration / Safety	Fate and Transport / Data Analysis	Risk / Hazard Communication	Litigation Support / Expert Witness	Chemical / Pharmaceutical	Petroleum and Products	Military / Aerospace	Mining and Minerals	Pulp and Paper	Resource Recovery / Waste Incineration	CERCLA / RCRA Sites	Utilities	Clean Air Act	Clean Water Act	CERCLA / RCRA	NPDA	TSCA / FIFRA / FDA
Joe Tietge, M.S.	Aquatic Toxicologist	11		•						•			•					•	•		•
Bill Van Liew, M.S.	Geohydrologic Engineer	14				•		•	•	•		•			•				•		
Laureen Wojciechowski, B.S.	Sr. Systems Analyst	9	•	•		•			•	•	•		•	•	•			•	•		

Expert

CMA 115221

Exp rienc

ENSR has conducted numerous risk assessments for a wide range of industries across the U.S. Below is a sampling of our project experience.

HAZARDOUS WASTE RISK ASSESSMENTS

ACL Demonstration and Critique of Existing ROD
Yaworski Lagoon
Connecticut

The EPA had completed a risk assessment for a former hazardous waste lagoon located on the bank of the Quinnebaug River. EPA's risk assessment supported the excavation and incineration of the contents of the lagoon. ENSR:

- Reviewed EPA's risk assessment and found that it substantially overestimated potential risks and therefore, there was no need to excavate the lagoon.
- Demonstrated that the potential risks associated with the excavation and incineration remedial option were much higher than if the lagoon and its contents were left in place.
- Completed a focused ecological sampling program that demonstrated the existing lagoon was not impacting the river.
- Proposed development of ACLs to protect human health and the environment.
- Successfully negotiated with EPA to leave the lagoon in place and modify the existing cap, saving the client over 90 million dollars in cleanup costs.

RI/FS Risk Assessment
Confidential Client
Texas

For an NPL site that was a former wood treating facility, ENSR:

- Completed a risk assessment that used the flexibility within CERCLA guidance for risk assessment to develop several innovative approaches to establishing cleanup levels for PAHs.
- Successfully negotiated with EPA leading towards adoption of some of these approaches.
- Developed cleanup levels for PAHs that were nearly 100 times greater that those typically used by the EPA, saving the client several million dollars in cleanup costs.

Sac Tannery Waste Pits Site
The Finance Auth rity f Maine
Saco, Maine

The EPA had completed human and ecological risk assessments that indicated waste pit contents needed to be excavated and solidified at an estimated cost of $33 million. ENSR:

- Reviewed and critiqued all available information supporting the EPA's proposed remedy.
- Demonstrated that the assumptions used by EPA greatly overestimated potential risks to humans.
- Critically reviewed available toxicity data and verified that the chemicals in the pits did not pose extensive risk to aquatic life, benthos, birds, or mammals such as foxes and deer.
- Assisted the PRP in successfully negotiating with the EPA to adopt an alternative remedy costing about $10 million, thus saving the PRP $23 million.

AIR QUALITY RISK ASSESSMENTS

Power Plant Emission Studies and Risk Assessment
Electric Power Research Institute (EPRI)
California

In response to increasingly stringent federal, state, and local air toxics regulations, and public concern over potential air toxics health effects, the electric industry commissioned studies to determine the air toxics emissions from electric power systems, assess the environmental risks associated with these emissions, and reduce toxic emissions effectively. ENSR:

- Simulated the multimedia fate and transport of toxic compounds released by power plants into air, water, and solid waste.
- Estimated potential human exposure to toxic compounds through inhalation, ingestion, and dermal absorption.
- Developed toxicological profiles for the chemicals of interest when no regulatory unit risk values are available.
- Developed a risk assessment model that integrates chemical fate and transport, population exposure, and carcinogenic health effects.
- Estimated potential public health risks associated with the operation of power plants for several scenarios that will be jointly selected with EPRI.

Experi nce

- Prepared the multimedia risk assessment chapter of the Electric Utility Trace Substances Synthesis Report submitted by EPRI to EPA in response of Title III of the Clean Air Act Amendments of 1990.

Risk Assessment for Municipal Waste Incinerator
ThermalKEM
South Carolina

Although ThermalKEM's permit was not up for renewal for several years, the company voluntarily decided to conduct an indirect risk assessment. ThermalKEM reasoned that running through an indirect risk assessment now will allow the company to determine what operational changes may be needed to the facility and will give EPA an educated response to the indirect risk assessment methodology. ENSR prepared the multipathway human health risk assessment. ENSR:

- Evaluated exposure to two receptors: the closest nearby resident and a subsistence farmer. Various indirect exposure pathways were modeled, including accumulation in plants, fish, beef and dairy milk.

- Modeled a future scenario that involved operational changes to the facility. A higher stack height was assumed for this scenario. Emissions resulting from the change in stack height were modeled for each of the receptors.

- Provided risk information for communicating with the surrounding community.

Risk Assessment for Permitting a Municipal Waste Incinerator
American Ref-Fuel Company
Niagara Falls, NY

ENSR prepared a human health risk assessment for the proposed upgrade of an existing municipal waste incinerator. ENSR:

- Conducted a multipathway risk assessment in accordance with a previously prepared protocol for a hazardous waste incinerator, as well as with all relevant state and federal regulatory requirements.

- Estimated potential carcinogenic and noncarcinogenic risks associated with direct and indirect pathways including inhalation, soil contact, drinking water, and consumption of fish, dairy products, meats, and produce, as well as infant ingestion of mother's milk. Receptors included a local resident and a subsistence farmer.

- Prepared risk assessments for two separate cases, including a "Maximum" case evaluating high-end exposures to maximum emissions from the facility, and an "Expected" case evaluating average exposures to anticipated or expected emissions from the facility.

- Derived a methodology to estimate dioxin/furan uptake into dairy products and fish tissue that was specific to the dioxin/furan mixture anticipated to be emitted from the facility.

Air Toxics Risk Assessment
University of California
California

The University needed to prepare programmatic Environmental Impact Reports (EIR) for the proposed expansion of several campuses. Because of stringent CA regulations on air toxics, the assessment of the impact of air toxic emissions was an essential component of the EIRs. ENSR's team of toxicologists, air quality scientists, chemical engineers and regulation specialists:

- Performed emission source sampling for several toxic chemicals at the UCAL Santa Barbara campus.
- Reviewed use of chemicals in the research and teaching laboratories, hospitals, and medical centers, and, on the basis of toxicity and volume, selected indicator chemicals for risk analysis.
- Quantified emissions, modeled air dispersion, and estimated exposure to population in proximity to each of the seven campuses for which a risk assessment was performed.
- Compared the calculated exposure to the allowable exposure in order to characterize risk of carcinogenic and non-carcinogenic effects.
- Developed a new methodology for assessing air toxics' cumulative impacts.
- Prepared reports for public review, and on behalf of the university, responded to public comments on EIRs.

WATER QUALITY RISK ASSESSMENTS

Delisting of a Pulp and Paper Mill from a National Hotspots List
Confidential Pulp & Paper Company
Texas

In 1990 the EPA released a national risk assessment for dioxin from pulp and paper mills that estimated very high potential risks for this mill. ENSR:

- Critically reviewed EPA's national risk assessment assumptions and demonstrated that the assumptions did not apply to the mill.

Exp rience

- Developed a dynamic bioconcentration model that incorporated site-specific effluent and river flows. The model predicted significantly lower potential risks (by several orders of magnitude) than the EPA's risk assessment.

- Completed a report, within a month of project start-up and for under $20,000, that was submitted to the EPA and formed the basis for the delisting of the mill.

Milltown Reservoir Superfund Site
Atlantic Richfield Company
Montana

The Milltown Reservoir Superfund Site is located at the confluence of the Clark Fork and Blackfoot Rivers near Missoula, Montana. In 1981, four Milltown drinking water wells were identified with arsenic concentrations in excess of safe drinking water standards. The site was listed in 1983 and has a rank of 321 on the National Priorities List. The suspended and bedload sediment transport of both rivers has contributed approximately 120 million cubic feet of sediment to the reservoir since 1907 (an accumulation of sediment deposits over 29 feet thick on the upstream side of the dam). Leaching of arsenic and heavy metals from reservoir sediments is thought to be the source of contamination in groundwater. ENSR:

- Provided technical support to the client at public review meetings and in anticipation of potential litigation.

- Served as prime contractor for completion of RI/FS activities involving hydrogeologic, water quality, and sediment/soils investigations.

- Provided extensive health and ecological risk assessment technical support.

- Prepared a Site Endangerment Assessment Work Plan.

Development of Linked Models for Determining Acceptable Effluent Dioxin Concentrations
National Council for Air and Stream Improvement (NCASI)

ENSR developed a trio of linked models for use in determining acceptable effluent dioxin concentrations.

- The first model is a continuous simulation dynamic model that predicts daily values of dioxin dissolved in the water column and sorbed to suspended organic material in rivers. Site-specific parameters including river flow, effluent flow, and effluent dioxin concentration are input or missing river flow data is filled in using simulators.

ENSR

- The second model simulates bioaccumulation of dioxins in fish and accounts for uptake by fish from both water and the food chain. Many site-specific parameters are explicitly considered such as fish community structure and species-specific metabolic attributes.

- The third model estimates human exposures and risks based upon recent scientific data and site-specific information. The model allows employment of different dose/response models and exposure assumptions, as well as, site-specific information related to how many and what kind of fish are eaten.

PERMITTING

Human Health and Ecological Risk Assessment
Boise Cascade Corporation
Minnesota

As part of an EIS for expansion of an existing facility to more than double its current capacity, ENSR performed a multimedia risk assessment for the pulp and paper mill's air emissions and water discharges. ENSR:

- Used a multipathway assessment technique to assess chronic and subchronic risks from discharged compounds.

- Determined that compounds, other than dioxins and furans, contributed a substantial portion of the overall risk.

- Used defensible environmental toxicology data to negotiate a higher dioxin and furan discharge limit than that originally specified by state agencies.

- Demonstrated a reduction in overall risk following facility modernization and expansion which allowed the project to proceed on an accelerated schedule.

Risk Assessment for Permitting a Pulp Mill Expansion
Potlatch Corporation
Cloquet, Minnesota

ENSR conducted a multipathway human health and ecological risk assessment for the proposed modernization and expansion of the Potlatch pulp mill in Cloquet, Minnesota. ENSR:

- Performed complex air modeling on 14 chemicals from 11 point emission sources and three fugitive sources to estimate relative long and short-term air concentrations.

- Estimated chronic health risks to the maximally exposed individual located in the point of maximum impact, assuming exposure via direct pathways (air, soil, water) and indirect pathways (crops, beef, daily

milk, and mother's milk), and accounting for realistic, site-specific factors whenever possible.

- Performed an analysis of potential acute risk from exposure to the one-hour maximum concentrations of nine compounds associated with acute health impacts.

- Performed a detailed sensitivity analysis of the chronic exposure pathways including a "base case," which incorporated site-specific assumptions, a case using more stringent MPCA-defined parameters, and cases using best and worst-case assumptions.

- Performed a detailed review of the scientific literature concerning the health effects and mechanism of action of 2,3,7,8-TCDD and related compounds, and derived appropriate dose-response values based on the literature.

ECOLOGICAL RISK ASSESSMENTS

Oil Spill Risk Assessment
Ashland Oil Company
Pennsylvania, West Virginia, Ohio, and Indiana

Anticipating litigation after a highly publicized fuel oil spill in the Ohio River, this client's attorney contracted ENSR to complete field studies and human and ecological risk assessments. ENSR:

- Examined surface water, bottom sediments, bank soils, aquatic biota and sensitive ecological areas and collected water, sediment and fish samples.

- Performed aquatic toxicity tests and chemical analyses of water, sediment and fish samples.

- Evaluated spill impacts on wetlands, water quality, fisheries, recreation and other natural resources.

- Assessed human health risk from ingestion of fish, and demonstrated that the public health effects of the release were negligible.

Natural Resource Damage Investigation for the Valdez Oil Spill
Exxon USA
Alaska

On March 24, 1989, Exxon's oil tanker *Valdez* struck Bligh Reef in Prince William Sound, Alaska, releasing an estimated 11 million gallons of crude oil. ENSR:

- Coordinated marine toxicology studies designed to assist Exxon in determining the effect of the oil spill on natural resources.

Experience

- Conducted extensive bioassay tests on water column and sediment samples taken in Prince William Sound.
- Collected and analyzed water, sediment, and clam and mussel tissue from subtidal and intertidal areas around Kodiak Island to assess the extent of petroleum contamination in the island's marine environment.
- Designed and established a state-of-the-art marine toxicology laboratory for EXXON at the Alyeska Terminal to allow more rapid turnaround of samples.

Ecological and Human Health Risk Assessment for NPL Site
Universal Oil Products (UOP)
New Jersey

Located in a coastal wetland management area, UOP's site contained elevated levels of VOC, base/neutrals, PCBs, and heavy metals in the groundwater, soil, and stream-drained sediment. UOP retained ENSR to install monitoring wells, perform hydrogeological investigations, complete ecological and human health risk assessments, complete an RI/FS, and implement remedial actions. ENSR:

- Performed human health and ecological risk assessments for human and animal populations potentially affected by the site.
- Evaluated aquatic, avian and mammalian species using statistical analysis of biological sampling, toxicity quotient method, analysis of extrapolation error method, and foodchain exposure pathway analysis.
- Developed clean-up levels based on the ecological and human health risk assessments.
- Helped UOP successfully negotiate with U.S. EPA and New Jersey Department of Environmental Protection. Participated in the NJDEP-required community relations program, which included communication with local officials and residents.
- Saved UOP money by convincing the state to consider bioremediation rather than the expensive off-site disposal option required in the Administrative Consent Order.

Fate and Effects of Dioxin in Pulp and Paper Mill Sludge
Pulp and Paper Mill
Wisconsin

A Wisconsin paper manufacturer treated land with a pulp and paper mill sludge that contained up to 126 ppt dioxin. ENSR:

Experience

- Prepared a field, histopathologic, and analytical chemistry study plan to determine dioxin levels in soil, vegetation, invertebrates, and mammals which was subsequently approved by the Wisconsin DNR.
- Collected soil, vegetation, earthworm, bird, and mammal samples according to sampling protocols and analyzed them for dioxin and furan.
- Recorded abnormalities of sample organ and tissues, general body condition, and reproductive states.

STATE-MANDATED RISK ASSESSMENTS

Risk Assessments for Manufactured Gas Plant Disposal Sites
Colonial Gas Company
Massachusetts

Some of the waste generated by Colonial Gas Company's former manufactured gas plant was used for fill in urban and suburban areas in Lowell, Massachusetts. ENSR:

- Performed a complete investigation and remediation program, including a complete Phase II risk assessment.
- Investigated the toxicology of cyanide and polynuclear aromatic hydrocarbons (PAH) and developed bioavailability adjustment factors (BAFs) to accurately predict exposure dose.
- Successfully demonstrated that the potential risks posed by the sites were not as severe as those anticipated by the DEP.
- Participated in the MCP-required Public Involvement Plan, which included communication with local officials and residents.

Air Toxics Modeling and Health Risk Assessment
Minnesota Pollution Control Agency
Minnesota

As part of a third-party EIS for a 500-ton per day refuse-derived fuel-fired facility, ENSR:

- Performed comprehensive pollutant emission characterization and dispersion modeling analyses.
- Implemented a health risk assessment for exposure to chlorinated dioxins, furans, benzenes, phenols, PAHs, and metals emitted from the facility. The EPA and Swiss methodologies were comparatively applied to illustrate the differences in risk produced by evolving types of human health assessments.

Experience

- This was one of the first health risk assessments to consider multimedia exposure. ENSR considered inhalation, ingestion, and dermal absorption exposure mechanisms.

Accidental Release and Dispersion Modeling
Chemical Manufacturer
New England

A chemical manufacturer wanted to examine the consequences of potential chemical releases from its facility. ENSR:

- Adapted models for the specific configurations involving spills of acutely toxic gases and volatile liquids.
- Calculated atmospheric dispersion in flat and elevated terrain surrounding the site.
- Analyzed the effectiveness of various control systems for mitigating potential off-site hazards.
- Developed data that were used by the client to develop a risk reduction plan.

Expert Witness Testimony Regarding the Initiation of a Gasoline Storage Tank Fire
Tenneco Refining
Texas

A large petroleum refiner needed to determine the probability of a tank fire due to the accumulation of gasoline on the top of a floating roof tank and the presence of a downwind ignition source. ENSR was contracted to provide expert witness testimony about the likelihood of such an event. ENSR:

- Calculated the hydrocarbon emission rate by species, as a function of time, from the gasoline pool.
- Developed a model of the dispersion of this heavier-than-air vapor toward the ignition source to account for the influence of tank farm structures upon the air flow.
- Calculated the ignition probability from the computed 30-minute average concentration at the ignition source and a model for short-term fluctuations about this mean value.

Exp rience

On-Site Review and Site Analysis for Episodic Illness
Puerto Rico Environmental Quality Board
Puerto Rico

The EQB required an investigation of the potential causes of episodic outbreaks of acute sickness in an industrial park near Mayaguez, Puerto Rico. ENSR was retained to review the problem and recommend detailed investigation procedures. ENSR performed a major multidisciplinary investigative program including:

- Detailed review of chemical inventory and usage in the park.
- A comprehensive program of air quality monitoring in and around the park buildings coupled with trace level laboratory analysis and meteorological data gathering.
- Study of building ventilation characteristics using tracer material.
- Medical evaluation of the symptoms reported by affected personnel.
- A program of psychosocial work environment research.

PAH Health Risk Assessment
Port of Oakland
California

ENSR assessed the risk of possible health impacts to construction workers and post-construction occupants of land developments in bayshore property adjacent to a former gas manufacturing plant. ENSR:

- Focused on polynuclear aromatic hydrocarbons (PAH) and volatile hydrocarbon contaminants in soils underlying a building site.
- Evaluated environmental pathways including diffusion from subsurface deposits to air in the construction workspace, within the completed buildings, and via the food chain (estuarian fauna).
- Evaluated cancer and non-cancer effects of direct exposure and consumption of contaminated organisms, as well as effects to organisms in nearby estuary.

RISK COMMUNICATION

Risk Assessment and Risk Communication Workshop
Boise Cascade Corporation
USA

ENSR staff presented risk assessment and risk communication techniques to mill and corporate environmental staff and discussed how risk

assessments and risk communications can benefit the pulp and paper industry. ENSR:

- Demonstrated that risk assessments are now routinely used to permit air emissions (PSD) and waste discharge (NPDES); site new facilities and modify existing facilities; prepare EIS and EIA documents; and negotiate less conservative cleanup levels for soil and sediment remediation at CERCLA and RCRA corrective action sites.
- Demonstrated effective use of risk assessment techniques and communication skills to benefit the pulp and paper industry.
- Suggested simple ways to improve risk communications and public relations at each mill and corporate-wide.
- Developed and conducted a risk communications training workshop.

Public Safety Assessment/Risk Communication
Everett Energy Corporation
Massachusetts

For a proposed coal-fired generating station, ENSR performed a plant safety and accidental spill potential assessment. The analysis included:

- Identification of potential incidents.
- Evaluation of worse-case impacts.
- Analysis of facility and community emergency response resources.
- Design of response procedures.

ENSR subsequently represented the client in discussions with the local Emergency Planning Committee (LEPC) and in presenting the results of our studies at a meeting of community and regional emergency response officials.

Ecological Risk Assessment Workshop
ALCOA
Pennsylvania

ALCOA contracted ENSR to provide an ecological risk assessment training workshop to its corporate staff. The workshop focused on ecological risk assessment approaches at hazardous waste sites. The workshop covered topics such as:

- A comparison of the human health and ecological risk assessment paradigms.

Experience

- The implications of requirements to evaluate potential risks to numerous receptors at different levels of ecological organization.
- Providing ALCOA with a basis from which to develop a corporate strategy to deal with issues raised by the new regulatory emphasis on ecological risk assessment.

ENSR

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	Costa Mesa	(714) 641-7443
	San Francisco	(510) 748-6700
Colorado	Denver	(303) 446-8420
	Fort Collins	(970) 493-8878
Connecticut	Hartford	(203) 657-8910
Florida	Tallahassee	(904) 385-0808
Hawaii	Honolulu	(808) 833-5540
Illinois	Chicago	(708) 887-1700
Louisiana	Lake Charles	(318) 475-9977
Massachusetts	Boston	(508) 635-9500
	Woods Hole	(508) 457-7900
Minnesota	Minneapolis	(612) 924-0117
New Jersey	Piscataway	(908) 457-0500
North Carolina	Raleigh	(919) 571-0669
Ohio	Cincinnati	(513) 677-8583
Oklahoma	Oklahoma City	(405) 721-3677
Oregon	Portland	(503) 224-7338
Pennsylvania	Philadelphia	(610) 397-0867
	Pittsburgh	(412) 261-2910
South Carolina	Columbia	(803) 731-1588
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	Houston	(713) 520-9900
	San Antonio	(210) 590-9279
Washington	Seattle	(206) 881-7700
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