

# Paul Krause, PhD

Partner



Dr. Krause is a partner with ERM, and has over 20 years of experience in the fields of marine and aquatic ecology, toxicology, environmental impact analysis, environmental risk assessment, modeling, and regulatory permitting and negotiation as an academic researcher and professional environmental consultant.

Dr. Krause is an internationally recognized expert in marine ecology. He specializes in issues relating to the effects of oil and gas developments worldwide. His particular expertise revolves around marine toxicology and ecology related to the discharge of oil-related effluents and the effects of development and abandonment activities on marine populations and communities. Dr. Krause has managed large ecological assessments of benthic and intertidal receptors throughout the western United States, Gulf of Mexico, the Pacific Islands, Australia, and West Africa. Through his support of the oil and gas industry his ecological projects have involved oil effluents and drilling issues, permitting issues, mine tailing sites, large river benthic community studies, coral and rocky reef studies, wetlands and intertidal mudflat studies. In addition, Dr. Krause has lead field efforts for oil spill response for a variety of oil and gas clients, particularly in relation to spills of significant nature in the marine environment.

Dr. Krause is an accomplished ecologist and toxicologist and has served as the director of a large biological laboratory. He has designed and managed large ecological investigations involving both field (*in situ*) and laboratory tests. His experience includes designing ecological risk assessments and ecological habitat assessments in aquatic and marine habitats. He has

managed the development of large projects through the CEQA and NEPA process, developed EIR/EIS reports, project applications, and project permitting throughout the US. Dr. Krause has also supported international impact studies through the ESHIA process.

Additionally, Dr. Krause has managed projects for all major ports in California (Long Beach, Los Angeles, Oakland, San Francisco, and San Diego, US Navy) as well as the Ports of Portland, Tacoma, and Seattle. His projects have included sediment risk assessments, dredge studies, new construction projects, and beneficial reuse issues.

Dr. Krause has a strong background in basic research as well as consulting. Much of his academic research has been dedicated to studying the ecological effects of municipal and industrial effluents on both benthic and water column organisms. His research efforts have spanned from long-term effects of oil production to the spatial and temporal distribution of toxicity around municipal effluent sources. Dr. Krause has authored several peer-reviewed papers and given many talks at professional meetings. He is the recipient of a National Academy of Science post-doctoral fellowship with the National Biological Survey, and a University of California Toxic Substances Research and Teaching Fellowship while at UC Santa Barbara. He has experience in such diverse areas as analytical chemistry, technical writing, and computer programming, and is a skilled bio-statistician familiar with all major statistical computing packages such as SAS, SYSTAT, and SPSS.

### **Professional Affiliations & Registrations**

- International Association of Impact Analysis
- Society of Environmental Toxicology and Chemistry, Past editorial board member for *Environmental Toxicology and Chemistry*
- Southern California Chapter, Society of Environmental Toxicology and Chemistry, Member of Elected Board of Directors 2002-2004, 2009-2011; Current Chapter Vice President
- Ecological Society of America
- Society of Petroleum Engineers
- *Journal of Experimental Ecology and Marine Biology* – Editorial Board
- *Archives of Environmental Contamination and Toxicology* – Editorial Board

### **Fields of Competence**

- Marine Ecology
  - Temperate
  - Tropical
  - Wetlands
- Ecotoxicology
- Sediment Toxicology
- Natural Resource Damage Assessment
- Ecological Risk Assessment
- Environmental Impact Studies
  - NEPA
  - CEQA
  - ESHIA
- Contaminated Site Investigations
- Oil Spill Response and Cleanup

### **Education**

- Ph.D., Ecology/ University of California, Santa Barbara, CA, 1993
- M.S., Biological Sciences, California State University, Long Beach, CA, 1987
- B.S., Marine Biology, California State University, Long Beach, CA, 1984

### **Languages**

- English, native speaker
- German, reading

### **Key Industry Sectors**

- Oil and Gas
- Ports & Harbors
- Metals & Mining
- Power

### **Honors & Awards**

- ARCADIS Chairman's Health and Safety Team Award, 2010 – Offshore Sampling Team Lead
- ARCADIS – Health and Safety Innovation Award, 2007 – Diving Control Board
- British Petroleum/ Atlantic Richfield – Diamond Award Finalist for Outstanding Health and Safety Performance, 2006 SCUBA Survey Team
- Certified Professional Ecologist – Ecological Society of America, 2006- present
- Service Award – Southern California SETAC Chapter, Board of Directors 2002 – 2004
- Customer Service Award – MEC Analytical Systems, Inc., 1997
- National Research Council-National Academy of Science Research Associateship Award, 1993
- University of California Regents Fellowship, 1993
- University of California Toxic Substances Research and Teaching Fellowship, 1989 – 1993
- International Women's Fishing Association Scholarship Award, 1989
- Outstanding Thesis Award, CSU, Long Beach, School of Natural Sciences, 1987

## **Key Projects**

### ***Impact Assessment and Planning***

#### **BP/ARCO, Project Principal/Senior Scientist**

Developed and managed scientific services for the decommissioning of a relic oil pier in Southern California. This included development of permits and monitoring plans for the threatened and endangered species, de-construction activities monitoring, and development of a long-term ecological study of the newly created artificial reef. This project involves CEQA reporting, subtidal monitoring activities and reporting.

#### **Confidential Client, Project Manager/Senior Marine**

**Ecologist.** Developed a decommissioning plan and environmental impact assessment for marine fish populations related to the closure and dismantlement of offshore oil production and transportation facilities in the Islamic Republic of Mauritania.

#### **Clearwater Port, LLC, Principal Scientist**

Developed complex project application package under CEQA for the citing and permitting of an offshore Liquefied Natural Gas (LNG) terminal in the Santa Barbara Channel. Project tasks included detailed plume modeling, terminal NPDES permit applications, and the permitting of a 45 mile LNG pipeline through the southern California Mountains.

#### **Chevron, Project Principal/Senior Marine Ecologist**

Managed the marine sciences and ecological risks associated with the disposition of residual shell mounds from the decommissioning of the 4H oil production platforms located in the Santa Barbara Channel. Led marine science investigations on the mounds, developed political strategy, technical frameworks, and project designs for innovative studies to support the CEQA/NEPA process and develop the environmentally superior project alternative.

#### **BP/ARCO, Project Principal/Senior Ecologist**

Served as the principal investigator and program manager for the development of the permits necessary under CEQA for the removal of over six miles of

abandoned pipelines. Pipelines run across sensitive habitats along the Santa Barbara bluffs. Additionally, supported engineering estimates for the development of innovative approaches to the removal of the pipeline with minimal impacts. Developed HSSE, Fire Control, permit monitoring, and demolition teams.

The Termo Company, Project Principal/Senior Scientist Managed a team to develop drilling permits and application packages for the first on-shore drilling project within Los Angeles County in over 25 years. This project involved development of permit packages and evaluation of impacts to local ecology, resident communities, and the public.

### ***Ecological Studies***

#### **Exxon Mobil, Project Principal/Senior Marine Ecologist**

Managed the marine resources investigations for ExxonMobil at the Valloy Norway remediation. This project involved complex diver surveys and operations to investigate the presence and extent of acid tar encroachment into the Oslo Fjord. Ecological receptors were also investigated within the region in anticipation of risk determinations.

#### **Chevron, Project Principal/Senior Marine Ecologist**

Assisted in scoping and project development for deep water fisheries studies in the deep offshore waters of the Nigerian coastline. Developed a sampling scope of work to determine fishery resources that includes demersal/benthic, pelagic, and marine mammals. Data will be used by the client and the local government agencies to develop long-term fishery management strategies.

#### **Southern California Edison, Senior Marine Ecologist**

Developed a population model for the white sea bass in southern California. Included interpretation of planktonic record data, collection of fish growth data and computer modeling.

#### **Confidential Client, Project Manager/Senior Ecologist**

Served as the principal ecologist to determine ecological effects on riverine benthic communities from residual

PCB in sediments. Project involved interpretation of benthic invertebrate community data sets collected over a multi-year study with synoptic toxicological and chemical data.

**Confidential Client, Project Manager/Senior Ecologist**

Served as a litigation expert for stream and bay communities contamination from chromium, PCB and fluoride contamination from groundwater sources. Project involved development of field studies, interpretation of past studies, review and analysis of benthic ecological data, development of litigation support materials and trial demonstrable materials.

**Chevron, Principal Marine Ecologist**

Provided expert evaluation of the feasibility of the development of offshore mariculture facilities for the culture of large marketable species such as California halibut, rockfishes, yellowtail, and striped bass. Culture facilities are designed to be deployed onto existing offshore oil platforms as grow-out facilities in conjunction with Hubbs Sea World.

***Sediment Investigations***

**California Sediment Quality Objectives**

Served as a principal toxicologist in the evaluation and development of the proposed framework for establishing sediment quality objectives for the State of California. This included participating in as a member of the Scientific Advisory Committee and evaluation of proposed methods for the evaluation and implementation of objectives to determine the direct and indirect effects of contaminated sediments on ecological receptors.

**Port of Portland, Project Manager/Toxicologist**

Provided senior level management for the development of the site characterization and risk assessments associated with an Early Action under CERCLA for the Port of Portland. Lead field sampling, laboratory quality assurance, project management and reporting through the Engineering Estimate/Cost Analysis (EE/CA) report.

**Pacific Sound Resources Superfund Site, Chemical Quality Control Officer/Toxicologist**

Provided quality control oversight, reporting, development of Sampling and Analysis Plans and Quality Assurance Project Plans, negotiations with regulators, and water quality modeling for the Pacific Sound Resources Superfund Site located in Puget Sound, WA.

**US Army Corps of Engineers, San Francisco District, Los Angeles District, and Pacific Division, Program Manager**

Served as the primary contact and manager for multi-year service contracts for several USACE districts. Projects included maintenance dredging projects for over 50 sites throughout California, Oregon, and Hawaii. Managed the disposal and daily operation of the largest contained disposal facility in California at the Galbraith Disposal Area in Oakland California. Developed study designs, field sampling plans, and supervised field and laboratory activities related to permitting of ACOE projects.

**Port of Long Beach, CA, Program Manager**

Managed multi-year sediment projects including maintenance dredging, new construction dredging, and Port development projects. Supervised field studies involved in dredging and risk assessment activities related to contaminated sediment issues for the Port. Projects included serving as the program manager for the West Basin, Channel Two, Pier T and Pier S deepening and terminal development projects. Activities included regulatory interactions, sampling plan designs, field studies and laboratory toxicity studies.

**Port of Oakland, CA, Program Manager**

Supervised staff in regulatory interactions, sediment quality guideline development, and permitting for routine maintenance dredging and new construction projects for the Port over multiple years. Projects included sediment studies at all Port terminals, supervision of dredging activities, and disposal operations. Served as manager for field activities for the 50-foot deepening project and Middle Harbor re-

development that included collection and analysis of over 250 sediment samples.

**Port of Los Angeles, CA, Program Manager**

Managed sediment projects for the Port that included sediment sampling, testing, and long-term evaluations. Projects included maintenance dredging, and new construction dredging at various Port properties including municipal marinas, bulk loading terminals, and container terminals. Management tasks included development of detailed management plans for contaminated sediments, regulatory interactions, supervising field and laboratory studies and development of sediment action plans for sites at risk.

**US Navy, Project Toxicologist**

Designed field and laboratory studies to investigate sediment quality for the future home-porting of Navy assets in Pearl Harbor, and San Diego.

**US Navy SINKEX program, Program Manager**

Managed the long-term study designed to detect toxicity in sediments from sunken Navy target ships at depths of over 2000 feet. Designed field study programs, developed innovative protocols, engineered field sampling equipment and provided laboratory support. Senior Ecologist/Toxicologist.

**US Minerals Management Service, Principal Investigator.** Managed the data collection, interpretation, statistical analysis of a long-term deep sea study of the effects of offshore discharge of drilling fluids. This study included placement of settling traps, and *in-situ* bioassays at a depth of over 600 feet in the Santa Barbara Channel.

***Ecological Toxicology/Risk Assessment***

**U.S. Army, Risk Assessor, Project Manager**

Managed the ecological risk assessment for closure of offshore resources at the Oakland Army Base for the U.S. Army.

**Union Pacific Railroad, Risk Assessor/Project Manager**

Ecological risk assessment on effects of residual PCBs and metals on the terrestrial and marine communities in Humboldt Bay, CA, in preparation for a property transfer.

**United Nuclear Corp., Risk Assessor/Project Manager**

Ecological risk assessment on effects of mine tailings on a stream community at the Cornucopia mine site in eastern Oregon.

**City and County of San Francisco, Department of Public Works and the Port of San Francisco, Project Toxicologist/Project Manager**

Served the Port to provide regulatory support, sediment study plans, field and laboratory services and risk assessment assistance for routine maintenance dredging and development activities.

**California State Water Resources Control Board, Project Toxicologist**

Toxic Hot Spot review and sediment quality criteria development for the State of California.

***Additional Research Studies***

**Corpus Christi Bay, TX, Principal Investigator**

Analysis of spatial and temporal distributions of toxicity around a municipal-industrial wastewater discharge in Corpus Christi Bay, Texas. Designed and led field and laboratory studies to characterize waste plumes using sediment pore-water toxicity, water chemistry, and benthic diversity data.

**Principal Investigator**

Analysis of the ecological effects of oil-related effluents. Designed and led both field and laboratory studies to investigate effects on reproduction, growth, and development of marine invertebrates from produced water discharges in southern California.

**Principal Investigator**

Studies to quantify the level fish mediated, heavy metal importation onto rocky reefs off Catalina Island, CA.

## Publications (selected last five years)

- Krause, P.R. 2010. A new artificial reef in Santa Barbara, California: An example of environmental enhancement from oil field decommissioning activities. Presented at the Ecological Society of America, 2010 Annual Conference, Pittsburgh, PA.
- Hartley, M.K., P.R. Krause, W.R. Gala, and R.W. Hill. 2010. Decommissioning of offshore platforms: Ecological value to fish resources of leaving shell mounds in-situ as determined through habitat equivalency analysis. Presented at the Ecological Society of America, 2010 Annual Conference, Pittsburgh, PA.
- Krause, P.R., R. W. Hill, W.R. Gala, and S. Larew. 2010. Determining the ecological value of fish resources at platform decommissioning sites using ROV and trapping techniques in the Santa Barbara Channel, USA. Society of Petroleum Engineers, SPE Journal 2010.
- Krause, P.R., M. Chamberlin, and J.R. Starr 2008. Managing storm water in ports: a non-point source and analysis approach. Presented at the 2008 Ports Environment Conference, Rotterdam, NL Krause, P.R. , L.A. Hostetter, and W.R. Gala. 2008. Habitat Equivalency Analysis (HEA) as a tool to rank environmental project alternatives. Presented at the 2008 Conference on Ecosystem Services. Naples, FL.
- Carr, R.S., P.R.,Krause, and P. Montagna. 2008. Spatial and temporal patterns of toxicity around a municipal-industrial wastewater discharge in Corpus Christi, Texas. In: *Marine Pollution: New Research* Hofer, T.N. (ed). Nova Science Publishers.
- Krause, P.R., and A. Brown. 2007. Ecological development of a newly formed artificial sub-tidal reef community. Proceedings of the 2007 meeting of the Society of Toxicology and Chemistry, Europe. Porto, Portugal.