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STATEMENT OF QUALIFICATIONS

FOR

BARRY A. VITTOR & ASSOCIATES, INC.  
8060 COTTAGE HILL ROAD  
MOBILE, ALABAMA 36695

FOR

BIOASSAYS AND BIOLOGICAL ASSESSMENTS  
FOR HAZARDOUS WASTE SITES

SUBMITTED TO

WOODWARD CLYDE CONSULTANTS  
201 WILLOWBROOK BLVD.  
WAYNE, NEW JERSEY 07470

August 7, 1989

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CORPORATE INFORMATION

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Barry A. Vittor & Associates, Inc. is an independent, small business, environmental research and consulting firm specializing in applied biological and environmental sciences. The company, founded in 1977 by Dr. Barry A. Vittor, provides a wide spectrum of environmental services including coastal, marine, and aquatic ecosystem analysis, terrestrial surveys, cultural resources surveys, wetland impact analyses and mitigation, and permit coordination.

Company interests have focused on such problems as monitoring of energy resource developments, environmental impact assessments for industry and government, coastal zone management, commercial fisheries development, benthic ecology, invertebrate and fish taxonomy, hydrographic processes, toxicology, and environmental data synthesis.

The company is staffed by 14 permanent employees, including six professional and eight support personnel. A full-time Director, Business Manager, and Office Manager complete the company structure. Staff personnel provide all business and project management, technical coordination, collection and analysis of all biological and most physical-chemical samples required in an environmental study. Environmental data management and synthesis for graphic and report presentation are all available within the company.

The philosophy at Vittor & Associates, however, is project rather than division oriented. For a given project or task, key personnel are selected from throughout the company to make the most effective use of talent and resources for maximum responsiveness to a particular client's needs.

Staff members at Vittor & Associates have worked together as a team on multidisciplinary programs that have dealt with the collection, synthesis, and interpretation of environmental data from a variety of geographic areas. Much of this experience has been gained from aquatic ecosystem studies in

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the eastern United States, from offshore studies of the Outer Continental Shelf to coastal and inland regions of the Gulf of Mexico, including Florida, Alabama, Mississippi, Louisiana, and Texas.

Vittor & Associates has a proud history of producing technical work of the highest quality. Our professional staff of scientists and technicians are very quality-control conscious and dedicated to timely completion of contractual commitments. We have performed numerous projects for both public and private interests. Table 1 provides a list of selected companies and governmental agencies for whom Vittor & Associates has worked. Appendix A contains summaries of selected projects performed since 1977.

#### FACILITIES AND EQUIPMENT IN MOBILE, ALABAMA

The main office of Vittor & Associates is located in Mobile, Alabama. Our close proximity to a major airport, interstate highway systems, and the Port of Mobile makes it ideal for rapid mobilization via a variety of transportation modes for projects throughout the Gulf of Mexico and southeastern United States.

The Mobile facility consists of 3800 square feet of office and laboratory space. Additional storage space is maintained for field equipment, expendable supplies, and archived samples. Our processing and taxonomic laboratories are organized and equipped to provide efficient and cost-effective analysis of samples while maintaining quality control of sample products and data for the client. An additional 1200 square feet of office space are dedicated to computer-assisted drafting and graphics services provided by Vittor & Associates, through its affiliate, Advanced CompuGraphics, Inc.

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Table 1. List of representative clients of Vittor & Associates, Inc.

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Akzo Chemicals, Inc.  
Alabama Coastal Area Board  
Alabama Department of Mental Health  
Alabama Dry Dock & Shipbuilding Company  
Alabama Highway Department  
Alabama Power Company  
Alabama Seafood Protective Association  
Alabama State Docks-McDuffie Island Coal Terminal  
Ameriport, Inc.  
Aware, Inc.  
Battelle New England Marine Research Laboratory  
BCM-Converse  
Bionetics, Inc.  
CH2M-Hill  
Chicago Bridge & Iron  
Ciba-Geigy Corporation  
Coastal Ecosystems Management, Inc.  
Conoco Chemicals Company  
Continental Shelf Associates  
Dames & Moore  
Degussa Corporation  
Environmental Protection Agency  
Espey-Huston & Associates, Inc.  
Exxon Company, U.S.A.  
Greiner Engineering Sciences, Inc.  
Gulf Area Associated General Contractors  
HDO Farms, Inc.  
Harbor Branch Foundation, Inc.  
Institute of Marine Affairs, Trinidad & Tobago, W.I.  
International Paper Corporation  
Interstate Electronics Corporation  
Jacintoport Corporation  
Kerr-McGee Chemical Corporation  
LPM, Inc.  
Lagman Realty & Mortgage Company  
Louisiana Department of Transportation & Public Works  
Louisiana Department of Natural Resources  
Louisiana Land & Exploration Company  
Louisiana Offshore Oil Port, Inc. (LOOP)  
Marine Environmental Sciences Consortium  
Marine Life of Gulfport  
Masland Carpets  
Mississippi-Alabama Sea Grant Consortium  
Mobil Oil Exploration & Producing Southeast, Inc.  
Mobile Area Chamber of Commerce  
Mobile Bulk Terminals  
Mobile Housing Board  
Mobile Paperboard Corporation  
Mote Marine Laboratory

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Table 1 (Continued)

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National Aeronautical and Space Administration  
National Oceanographic and Atmospheric Administration (NOAA)  
National Oceanographic and Atmospheric Administration,  
Marine Sanctuaries Division  
North American Gulf Terminals, Inc.  
Offshore Trawlers  
Olin Corporation  
Racal-Decca Survey, Inc.  
Science Applications, Inc. (JRB Associates)  
Scott Paper Company  
Shell Offshore, Inc.  
South Alabama Regional Planning Commission  
Southeastern Louisiana University  
Southern Company Services  
Standard Oil of Ohio  
Superior Oil Company  
Texaco, Inc.  
Texas Instruments, Inc.  
Theodore Deep-Water Industrial Park  
Thompson Engineering & Testing, Inc.  
Union Carbide, Linde Division  
Union Oil Company  
U.S. Army Corps of Engineers/Jacksonville District  
U.S. Army Corps of Engineers/Memphis District  
U.S. Army Corps of Engineers/Mobile District  
U.S. Dept. of the Interior/Bureau of Land Management  
U.S. Dept. of the Interior/Minerals Management Service  
U.S. Marine, Inc.  
United Gas Pipeline Company  
Walk, Haydel & Associates  
Warrior & Gulf Navigation Company

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Field Equipment

Vittor & Associates is well-equipped for major aquatic sampling efforts, including inland, coastal, and offshore investigations. Our equipment inventory includes the following:

Vehicles and Boats

- 2 4-WD vehicles
- 2 20-ft. Monark jon boats w/55-hp outboards and trailers
- 1 19-ft. Monark workboat w/140-hp outboard, enclosed cabin, depth recorder, winch, and trailer
- 1 16-ft. Monark jon boat w/25-hp outboard and trailer

Sampling Gear

- 2 Stainless Steel Grey O'Hara box corers (0.09m<sup>2</sup>)
- 1 Ponar grab (0.05m<sup>2</sup>)
- 1 Shipek grab (0.04M<sup>2</sup>)
- 1 Endeco 110 current meter
- 6 GO flow meters
- 1 Portable pH meter
- 1 Beckman RS5-5 salinometer with 100- and 150-ft. cables
- 3 Niskin bottles (10-liter)
- 1 ISCO portable non-contaminating water sampler
- 1 VanDorn bottle (2-liter)
- 4 Lietz optical distance scopes

Assorted gill nets, hoop nets, block nets, seines, plankton nets, sieves, hand corers, radios, scales, etc. are also available for field sampling.

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Laboratory Equipment

The laboratories at Vittor & Associates' Mobile facility are equipped with state-of-the-art equipment in order to provide accurate and efficient analysis of samples. This includes complete fixed and mobile bioassay laboratories, bioassay test organism culture facilities, 20 research-quality microscopes, fiber-optic light sources, and a variety of analytical balances and measuring devices for biological analysis. A complete sedimentological laboratory for routine sediment analysis is also available. A partial list of laboratory equipment follows:

- 2 Minicomputer/word processor systems (w/Modem tie-in to IBM 4241)
- 1 Mettler digital micro-balance
- 1 Sartorius semi-micro analytical balance
- 11 Wild M-5A stereo dissecting microscopes
- 1 Zeiss stereo dissecting microscope
- 1 A/O phase-contrast microscope
- 1 Nikon phase-contrast microscope
- 1 A/O compound microscope
- 3 A/O stereo-zoom dissecting microscopes
- 2 Nikon Labophot compound microscopes
- 1 Dialux illuminator
- 7 Volpi illuminators
- 1 A/O refractometer
- 4 Scanning magnifier lights
- 1 Sediment analysis system (Ro-Tap, sieves, etc.)
- 1 Drying oven
- 2 YSI dissolved oxygen systems

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2 Flow-through dilutor systems for aquatic bioassays

Various aquaria, culture equipment, and other materials for bioassays

Museum

A curated zoological museum of over 1500 species of fish and invertebrates is maintained at our Mobile laboratory. These represent collections from previous faunal surveys conducted by Vittor & Associates throughout the southeast in marine, estuarine, and aquatic environments.

Staff taxonomists at Vittor & Associates maintain liaison with many of the major museums and repositories of biological materials throughout the United States and abroad. Through exchange of biological specimens and corroboration of identifications, our taxonomists have developed a strong working relationship with many internationally recognized experts in invertebrate and vertebrate taxonomy. Through our professional work we have gained a reputation for providing consistent, accurate identifications of many problematic faunal groups encountered in benthic surveys (e.g., polychaetes, aquatic insect larvae, many marine crustaceans). This reputation is passed on to the Client in the form of reliable, credible data for reporting and future analysis.

Library

The library at Vittor & Associates contains over 1200 volumes and approximately 1500 reprints of scientific literature on a variety of environmental topics. Separate publication holdings are maintained with individual staff scientists in the taxonomic laboratories for current referencing. Computer library databases search capabilities are also available through local libraries. Numerous environmental reports are also on file for reference.



### Office Equipment

Office equipment at Vittor & Associates includes two IBM Selectric II correcting typewriters, one Xerox 6010 Memorywriter, a Canon NP155 copy machine, and word processing and graphic capabilities. Word and data processing are performed on our in-house Morrow MD-11 microcomputer with multiple terminals and two printers. This computer system may be linked via phone lines to any computer data processing system for safe and efficient transfer of data products generated during this program. The in-house system is presently linked to the University of South Alabama's (USA) IBM 4241 computer, allowing access to nearly unlimited storage and computing space and a wide variety of canned programs (e.g., SPSS, SASS, STAT PAC, DECORANA, etc.) as well as proprietary programs developed by Vittor & Associates. The system provides a wide range of data analysis and report writing capabilities available for use during the proposed study. A Zeta 3653SX digital plotter and GP6-SO digitizer are also available through USA for highly accurate interpretation and sophisticated graphic presentation of environmental data. A computer-assisted drafting and design (CADD) system has been placed in operation and is presently used for mapping and for preparation of graphics of environmental data products. An E-size plotter was added to this system in July, 1986 in order to expand our capabilities to include blueprint production.

### EXPERIENCE

The Vittor & Associates team has an exceptionally strong background in coastal and inland wetland, terrestrial, and aquatic studies, from Texas to the east coast. Our staff are certified in field surveys for hazardous waste site investigations, and are experienced in a wide range of bioassays, bioaccumulation, and ecosystem studies associated with hazardous waste and

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other sites. We have performed numerous wetland-upland vegetation boundary determinations pursuant to Sec. 404 permit acquisition, and have designed several wetland loss mitigation plans where unavoidable habitat losses would occur. Vittor & Associates has also conducted several terrestrial surveys for vegetation, wildlife, endangered or threatened species, and cultural resources. We have performed numerous major aquatic investigations in a wide variety of habitats including lakes and large and small rivers. Our experience enables us to mobilize field and laboratory efforts on time and in budget.

Vittor & Associates has conducted hundreds of aquatic toxicity analyses (acute and chronic), including static and dynamic test methods. These have been performed for a variety of discharges, including power plant cooling water (chlorine minimization), domestic waste treatment facilities, paper mills, petrochemical and other chemical plants, oil refineries, and offshore drilling fluids.

In addition, we have performed biological assessments for several Superfund hazardous waste sites, including three sites in flood plains or swamp environments. We sampled aquatic invertebrates seasonally in several flood plain habitats near the Ciba-Geigy Superfund sites in Alabama. We also collected soil samples and conducted soil toxicity tests using the EPA's new earthworm protocol. We have established a large in-house culture of this test animal, and represent the primary source of this species for soil toxicity testing.

Another hazardous waste site project involved collection of several species of aquatic species (fish and invertebrates) for assessment of the bioaccumulation potential of mercury released from the Akzo Chemicals plant in Alabama. Our field personnel employed requisite precautions **AR304667** to avoid contamination during this intensive sampling project.

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Similar precautions were involved during contingency field sampling after a very large oil spill in the Mississippi River. The heavy waste oil released from the ship contained several potential toxins, including benzene and toluene. Vittor & Associates provided field staff and equipment for this emergency effort, and assisted in technical planning and coordination.

Vittor & Associates has also conducted numerous bioassays for dredging and offshore disposal activities. We recently completed extensive studies of sediment trace metals and toxicity along a proposed gas pipeline route intended to serve the Mobile Bay gas field. We were responsible for designing this study, taking all samples, performing bioassays and data analyses, and writing the final report. We are presently completing two series of dredged material bioassays for the Jacksonville District Corps of Engineers, for harbors in Puerto Rico and Miami. Our responsibilities have included sample collection, bioassay testing, data analysis, and report preparation.

We have performed several major surveys of terrestrial, wetland, and aquatic ecosystems. For example, we mapped wetland habitats throughout a 6,000-acre industrial development area for Alabama Power Company. This project also addressed wildlife, endangered or threatened species, and cultural resources.

A similar project was performed for Jacintoport, Inc. north of Mobile, Alabama. Jurisdictional (Corps of Engineers) wetlands were mapped and cultural resources evaluated in a 900-acre oil refinery expansion area.

Vittor & Associates recently coordinated construction permits for a major coal and grain transloading facility on Mobile Bay, Alabama and a barge repair facility on Chickasaw Creek. Both involved development of extensive wetlands mitigation plans, based on interagency HEP analyses and analysis and interpretation of both the scientific literature and Federal

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and State environmental regulations and policies regarding construction in wetlands and mitigative measures.

We designed and constructed one of the largest tidal marsh creation projects in excavated woodlands. This 45-acre marsh involved excavation of over 150,000 cubic yards of soil, which was stockpiled in vegetated upland islands. Over 100,000 Spartina alterniflora and Juncus roemerianus sprigs were planted in the site, with outstanding success. An adjacent 0.5-acre marsh creation site was planted with S. alterniflora at 3-foot intervals, and had complete coverage after 20 months.

Vittor & Associates also completed a 1.2-acre fresh marsh construction project on Chickasaw Creek, in conjunction with ship berth development on the Mobile River. This mitigation project was praised by regulatory agencies and has exhibited excellent survival and growth of the target plant species.

Vittor & Associates has performed numerous site designation biological surveys for offshore dredged material disposal sites throughout the Gulf of Mexico and Atlantic coast. Our responsibilities have generally involved laboratory analysis of benthic samples collected by or on behalf of the U.S. Environmental Protection Agency, as well as benthic community data analysis and report preparation. Since 1979, Vittor & Associates has performed taxonomic analysis of several thousand benthic samples for these studies.

We have also analyzed many more benthic samples in freshwater, estuarine and marine ecosystems. These have included materials from several hundred miles of the Mississippi River, the Atchafalaya River Basin, the Mobile River, Puerto Rico, Key West, New York Bight, Chesapeake Bay, all of the Gulf of Mexico, and the Red Sea.

Our extensive benthic community benchmark work in the eastern Gulf of Mexico (for the Bureau of Land Management) culminated in development and

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printing of a 7-volume taxonomic guide to the polychaetes of the northern Gulf of Mexico. This unique guide has received worldwide acclaim as a valuable tool for standardizing laboratory analysis of benthic macroinfauna.

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APPENDIX A

KEY PROJECTS

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BIOLOGICAL ASSESSMENT OF THE SUPERFUND  
SITE AT CIBA-GEIGY, McINTOSH, ALABAMA

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Ciba-Geigy Corporation  
McIntosh, Alabama

Period of Performance:  
1987-1988  
Value: \$21,200

This project consisted of three types of biological assessment: soil toxicity tests; aquatic bioassays; and seasonal flood plain aquatic fauna surveys. Vittor & Associates used newly-formulated EPA soil toxicity test protocols to estimate biological hazard associated with in situ soil in a hazardous waste site. Our work included refinement of the EPA earthworm soil toxicity test and development of a viable test animal culture. Aquatic bioassays included screening and definitive tests with a variety of species. Several locations in the Tombigbee River swamp adjacent to the plant were monitored seasonally for one year, using a variety of collection techniques, including dipnets, seines, shovels, and sieves. All taxa were identified and enumerated, and a vouch collection was prepared for the client.

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BIOACCUMULATION STUDIES AT THE  
SUPERFUND SITE AT AKZO CHEMICALS, INC.,  
AXIS, ALABAMA

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Akzo Chemicals, Inc.  
Axis, Alabama

Period of Performance:  
1988 - Present  
Value: \$14,400 (to date)

Vittor & Associates participated in sampling of aquatic organisms for bioaccumulation analysis, in response to recommendations of the U.S. Fish & Wildlife Service. Species collected included semi-aquatic oligochaetes, bivalves, crawfish, and several species of fish. Sampling methods included use of traps, dipnets, seines, shovels, sieves, and electroshockers. Specimens were handled with maximum care to preclude contamination by extraneous material, and were identified and stored (frozen) at Vittor & Associates' laboratory. Field personnel were equipped with standard protective clothing and were trained in OSHA-sponsored procedures for field technicians working in hazardous waste sites.

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EFFLUENT TOXICITY TESTING AND DISCHARGE INFORMATION ZONE  
MONITORING FOR INTERNATIONAL PAPER COMPANY, MOBILE, ALABAMA

International Paper Co.  
Mobile, Alabama

Period of Performance:  
1987 - Present  
Value: Approx. \$15,000

Vittor & Associates developed the bioassay study plan for this major paper mill and has performed toxicity testing since January, 1987. All tests performed to date have been conducted according to EPA guidelines and completed successfully. Vittor & Associates also developed a study plan for evaluating the biological impact of existing discharge on the fauna and flora of the Mobile River. A preliminary benthic survey was conducted in October, 1988, in order to provide a basis for the design of the study. The preliminary survey included the collection and biological analysis of 25 discrete bottom samples as well as standard hydrographic measurements (temperature, conductivity, dissolved oxygen, and salinity). The Alabama Department of Environmental Management has indicated approval of the study plan and work is expected to commence in the Spring, 1989.

All work performed has been completed on schedule.

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DISCHARGE INFORMATION ZONE MONITORING  
FOR SCOTT PAPER COMPANY, MOBILE, ALABAMA

Scott Paper Company  
Mobile, Alabama

Period of Performance:  
1988 - date  
Value: Approx. \$12,000

Vittor & Associates designed and developed the Discharge Information Zone (DIZ) study plan for this major paper mill. The study has been designed to determine the present size of the possible impact zone and to document any changes in the zone resulting from effluent discharge. The study includes biological monitoring of the benthic macroinfauna as well as wetlands, submersed aquatic vegetation, phytoplankton, and periphyton in the study area. A preliminary faunal survey was conducted in November, 1988, in order to provide a basis for the design of the DIZ study. The preliminary survey involved the collection and biological analysis of 20 discrete bottom samples as well as standard hydrographical measurements. The Alabama Department of Environmental Management has indicated approval of the study plan and work is expected to commence in the Spring, 1989.

All work performed has been completed on schedule.

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EFFLUENT TOXICITY TESTING AND DETERMINATION  
OF ISOPLETHS OF WASTE CONCENTRATIONS  
IN THE TOMBIGBEE RIVER, ALABAMA

Olin Chemicals  
McIntosh, Alabama

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Period of Performance:  
1987 - date  
Value: Approx. \$8,000

Vittor & Associates developed the bioassay study plan for this major chemical plant and has performed toxicity testing since February, 1988. Permit discharge limitations were established on the basis of an isopleth study performed by Vittor & Associates in October, 1987. This study involved the determination of the boundaries of the effluent mixing zone and the contouring of the effluent concentrations within the mixing zone based on plume dispersion. Standard hydrographic measurements were also performed during the survey.

All work performed to date has been completed on schedule.

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USE OF WATER HYACINTHS FOR REMOVAL OF  
NITROGEN FROM FACILITY EFFLUENTS

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U.O.P. (formerly Union Carbide)  
Chickasaw, Alabama

Period of Performance:  
1985 - 1986  
Value: \$21,000

Vittor & Associates designed and conducted a series of bioassays and on-site studies using water hyacinths, in order to determine the survivability, growth rate, and nitrogen uptake rates of plants cultured in varied concentrations of effluents. Various concentrations of ammonium nitrate effluent were tested in order to determine the optimum concentration for maximum uptake by the hyacinth treatment system. By correlation of the observed nitrogen removal (via chemical analysis 2 times weekly) with the hyacinth growth rate, it was possible to estimate the amount of nitrogen removed as a result of direct plant uptake. Following the pilot study program, a cost analysis of a full-scale hyacinth treatment system was prepared. Overall, the effort demonstrated a cost-effective means of removing nitrogen from the facility's effluent. Vittor & Associates has also conducted all NPDES toxicity testing for this facility since June, 1983.

All work performed has been completed within budget and on schedule.

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DREDGED MATERIAL BIOASSAYS AND CHEMICAL ANALYSIS  
FOR PUERTO NUEVO CHANNEL, PUERTO RICO AND MIAMI RIVER, FLORIDA

U.S. Army Corps of Engineers  
Jacksonville District  
Jacksonville, Florida

Period of Performance:  
1988-89  
Value: \$109,000

Vittor & Associates was Prime Contractor for these projects, which involved sample collection at five locations near San Juan Harbor and six sites in the Miami River. Dredged material suspended particulate and solid phase bioassays were conducted at Vittor & Associates' Mobile, Alabama laboratory. Chemical analyses were conducted by a subcontractor. Data analysis and report preparation tasks were performed by Vittor & Associates. Sample collection and bioassay tasks were completed on schedule, while chemical analyses were delayed by unusually high concentrations of hydrocarbons in some sediments from both project sites. Study reports were completed in accordance with guidelines prepared by the U.S. Environmental Protection Agency and Army Corps of Engineers Waterways Experiment Station. All work was completed in budget.

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BIOASSAY TESTING AND TRACE METAL ANALYSIS OF  
PIPELINE CORRIDOR SEDIMENTS, MOBILE BAY, ALABAMA

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Exxon Company, USA  
New Orleans, Louisiana

Period of Performance: 1987  
Value: \$38,000

Vittor & Associates was contracted to design and implement a detailed analysis of sediments that would be excavated during gas pipeline construction in lower Mobile Bay and offshore State waters. Emphasis was placed on areas that had been shown previously to contain relatively high levels of several trace metals. The study plan was devised and coordinated with EPA's Region IV office, which had expressed concern over possible impacts of sediment resuspension. Parameters measured in this study were sediment texture, sediment trace metals, acute toxicity of dredged material, and bioaccumulation of trace metals by organisms exposed to area sediments. The EPA-Corps guidelines for sediment bioassays were employed by Vittor & Associates. Because of the unusual levels of certain trace metals at some sites, Vittor & Associates included interlaboratory calibration of sediment and tissue chemical analyses. No acute toxicity was demonstrated, nor was trace metal bioaccumulation observed among the test organisms.

The project was completed within budget and on time, and the study results were approved by the EPA.

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DRILLING FLUID TOXICITY TESTING

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Standard Oil of Ohio  
Houston, Texas  
and  
Environmental Enterprises, Inc.  
Slidell, Louisiana

Period of Performance:  
1987-Present  
Value: \$20,000 to date

Vittor & Associates has conducted routine bioassay analysis of drilling fluids, in conformance with U.S. EPA's testing protocol. Tests have been performed primarily for the above two clients. Test animals are generally cultured by Vittor & Associates but may be obtained from commercial vendors as needed. Testing is performed under controlled temperature and lighting conditions, as required by the EPA protocol. Data and reports are furnished to the client within 10 days of sample receipt.

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FATE AND EFFECTS OF DRILLING FLUID DISCHARGES  
IN SHALLOW, NEARSHORE WATERS

American Petroleum Institute  
Washington, D.C.

Period of Performance:  
1987-Present  
Value: \$25,000

Vittor & Associates has worked as a key Subcontractor to Continental Shelf Associates, Inc., with responsibility for benthic community analysis. The purpose of this study is to measure the impacts of open-water disposal of drilling wastes in an area characterized by poor mixing (low wave energy) and minimum previous exposure to drilling wastes. Prospective study locations were screened by the API in order to meet these considerations. The selected site was sampled during a preliminary cruise, to establish sample replication needs and possible patterns of drilling waste dispersion from the rig. Benthic sampling design was then based on these results and samples were collected at 25 stations during two seasonal cruises.

Vittor & Associates has been responsible for benthic sample analysis, data interpretation, and preparation of portions of the final report. All tasks have been completed ahead of schedule and in budget.

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APPENDIX B

KEY PERSONNEL

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BARRY A. VITTOR, Ecologist

B.A. Zoology, University of California, Riverside - 1966  
M.A. Biology, San Diego State College - 1968  
Ph.D. Ecology, University of Oregon - 1971

Qualifications

Dr. Vittor is a coastal/marine ecologist with particular expertise in benthic ecosystems. He has considerable experience in invertebrate taxonomy, with emphasis on the polychaetous annelids. As President of Vittor & Associates, he has responsibility for planning, coordination, and performance of a wide range of coastal and marine investigations, including aquatic toxicity studies, water quality monitoring, fisheries, resource management and values, invertebrate communities, and pollutant impacts.

Dr. Vittor has extensive experience in both technical and management aspects of major field investigations in the estuaries and the continental shelf waters of the Gulf of Mexico. While a professor at the Dauphin Island Sea Lab in Alabama, he participated as an oceanographer in the ESCAROSA project conducted in northwest Florida for the Coast Coordinating Council for the State of Florida. He also participated in NASA's remote-sensing fly-over survey in 1971-72 of the Mississippi Sound and Chandeleur Island and Sound area. He was principal investigator for several projects funded through the Mobile District Corps of Engineers, for preparation of eleven EIS's for maintenance dredging in coastal Alabama and northwest Florida.

Dr. Vittor was Program Manager for a major fisheries habitat investigation in dike fields along a 550-mile stretch of the Mississippi River. This project involved use of several types of fish sampling gear and methods, as well as water quality, sediment, and benthic sampling and analysis. He was also Program Manager for data analysis and report preparation for a four-year dredge disposal monitoring study of the Apalachicola River, on behalf of the Mobile District

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Corps of Engineers. Data were obtained for fish populations, sediments, benthos, and water quality.

Dr. Vittor has also been principal investigator for several estuarine and marine benthic programs for the U.S. EPA Office of Marine and Estuarine Protection. These have included benthic studies of ODMDSS at Jacksonville, Charlotte Harbor, Port St. Joe, Panama City, Tampa, Pensacola, and Pascagoula. Other project experience includes the collection and identification of benthic polychaetes for the BLM's MAFLA programs; studies of coral reef crypto- and infauna communities in the Bahama Islands; the benthic community study of the Gulf Intra-Coastal Waterways from St. Marks River, Florida to Lake Borgne, Louisiana for the Mobile District Corps of Engineers; macroinfauna communities from the Theodore Ship Channel, Alabama; benthic monitoring of brine disposal and pipeline impacts in coastal and offshore Louisiana for the Louisiana Offshore Oil Port; benthic community analysis of open-ocean disposal sites in the Gulf of Mexico and Puerto Rico for Interstate Electronics Corporation; and several benthic surveys conducted in upper Mobile Bay for the Alabama State Docks and Alabama Dry Dock and Shipbuilding Company. He was program manager of Tech Con, Inc's multidisciplinary environmental baseline and monitoring program performed for a pre-, during, and postoperative evaluation of exploratory drilling by Mobil Oil in Mobile Bay, Alabama. As program manager, he provided liaison with Mobil Oil for the execution of the project and internal review of the final data and report products. Dr. Vittor was program manager of a recently completed state-of-art benthic community characterization study in Mississippi Sound and adjacent waters for the Mobile District Corps of Engineers.

Dr. Vittor recently completed an information collection, ~~summary and~~ annotation project for the Corps of Engineers which included Mobile Bay, Missis-

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issippi Sound, and the offshore waters of Alabama and Mississippi. He was also principal investigator for a 1978-80 environmental information cataloging project performed for NOAA. This program covered all of Alabama, Mississippi, Louisiana, and Texas. He has been program manager for an exhaustive information analysis effort for the Tuscaloosa Trend study area, which includes coastal Alabama, Mississippi, and eastern Louisiana. Dr. Vittor has recently completed a review and analysis of benthic community ecology in the north central Gulf of Mexico. This paper deals with several major data bases generated by MMS (BLM), the Department of Energy, EPA, the Mobile District Corps of Engineers, the Gulf Universities Research Consortium, and Louisiana Offshore Oil Port.

Relevant Experience

Program Manager for dike field fishery habitat investigations in the Lower Mississippi River, for Memphis District Corps of Engineers.

Program Manager for data analysis and report preparation for a four-year dredge disposal study of the Apalachicola River, for Mobile District Corps of Engineers.

Program Manager for benthic community analyses conducted in conjunction with evaluations of ocean disposal sites by the U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection.

Task Manager for benthic community impact monitoring of open-water disposal of drilling wastes, for Shell Offshore, Inc.

Task Manager for benthic community analysis of drilling waste discharge impacts off Texas, for American Petroleum Institute.

Program Manager for a long-term study of the effects of brine discharge from the Louisiana Oil Port facility.

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Program Manager for the Tuscaloosa Trend Regional Data Search and Synthesis Study sponsored by the U.S. Department of the Interior, Minerals Management Service.

Program Manager for environmental monitoring of Mobil Oil's first exploratory well in Mobile Bay, Alabama.

Program Manager for benthic community characterization of Mississippi Sound and adjacent areas, for the Mobile District Corps of Engineers.

Pertinent Publications

Over 50 publications and reports dealing with marine and estuarine invertebrate taxonomy and ecology, coral reefs, artificial reefs, ocean disposal site evaluations, impacts of brine discharges on benthic communities, impacts of channel dredging in estuaries, water quality implications of estuarine disposal of industrial effluents, values of estuarine and marine resources such as fisheries and hydrocarbons, environmental characterizations of OCS areas in the Gulf of Mexico, and toxicity of power plant and other effluents to aquatic organisms.

Vittor, B.A. and P.G. Johnson. 1977. Polychaete abundance, diversity, and trophic role in coral reef communities at Grand Bahama Island and the Florida Middle Ground. Proc., Third International Coral Reef Symposium, Miami, Florida. pp. 163-168.

Vittor, B.A. 1982. Characterization and development of valuation methodology for Mobile Bay and adjacent offshore areas. Contract report to Mobile District Corps of Engineers. 119 pp.

Vittor, B.A., D. Boesch, P. Johnson, K. Shaw, G. Gaston, and D. Weston. In Press. Ecological characteristics of the macrobenthos of the continental shelf of the north central Gulf of Mexico.

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Vittor, B. A. and P. S. Wolf. 1986. Data analysis for the Apalachicola River dredged material disposal site evaluation program. Contract report to Mobile District Corps of Engineers. 166 pp.

Vittor, B. A. and J. R. Stewart. 1986. Report on disposal site designation for the interim approved Port St. Joe and Panama City, Florida, offshore dredged material disposal sites. Contract report to U.S. EPA, Office of Marine and Estuarine Protection. 105 pp.

Vittor, B. A., P. Wolf, B. Barnett, and G. Gaston. 1987. Benthic communities of coastal Louisiana. Technical Report to Louisiana Department of Natural Resources. 136 pp.

Vittor, B. A., J. R. Stewart, and A. L. Middleton. 1987. Creation of a brackish tidal marsh at West Fowl River, Alabama. Pp. 120-129, In: Symposium on the natural resources of the Mobile Bay Estuary. Mississippi-Alabama Sea Grant Program.

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JULIAN R. STEWART, Biologist

Education:

B.S. Biology and Mathematics, Mobile College, 1974  
M.S. Aquatic Biology, University of South Alabama, 1980

Qualifications

Mr. Stewart is a marine biologist and has worked for Vittor & Associates as assistant to the Laboratory Manager and as Research Scientist responsible for benthic sample analysis, bioassays, and water hyacinth studies. He has coordinated several projects performed by Vittor & Associates for the U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, as managed by Battelle New England Marine Research Laboratory.

Mr. Stewart has a broad background in environmental studies. He has worked as an analytical chemist (Vester J. Thompson, Jr., Inc.) and as a research assistant at the Dauphin Island Sea Lab, in regard to coastal marsh productivity studies. He has participated in numerous field surveys, in both aquatic and marine ecosystems and is familiar with most standard biological sampling and water quality sampling/measurement techniques.

Since joining Vittor & Associates, Mr. Stewart has been involved in analysis of benthic macroinvertebrate samples from freshwater habitats such as the Mississippi River and inland canals of coastal Louisiana. He has performed bioassays of chlorinated effluents and has performed field work associated with a water hyacinth study designed to determine nitrogen uptake rates from enriched effluents.

Mr. Stewart has conducted several river surveys, including extensive fishery sampling in the Lower Mississippi River, using gill nets, rotenone, hoop nets, and other devices. He was involved in fish and invertebrate

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sampling in the Mobile River, in conjunction with investigations of bioaccumulation of industrial wastes (mercury) among aquatic biota. Mr. Stewart was Technical Coordinator for salinity isopleth studies of the Tombigbee River, in regard to establishment of industrial effluent toxicity limits for a major pesticide manufacturer. He is presently Technical Coordinator for Discharge Information Zone monitoring studies in the Mobile River, for two paper mills.

Relevant Experience

Received certification for Hazardous Waste Worker Training (OSHA), for field sampling and biological assessment of hazardous waste sites, 1988-1989.

Technical Coordinator for soil toxicity tests for the Ciba-Geigy Superfund site (Alabama), including refinement of the earthworm test protocol with U.S. EPA.

Technical Coordinator for field sampling for bioaccumulation potential studies at Akzo Chemicals, Inc., Alabama.

Technical Coordinator for toxicity analyses of ammonium-nitrate effluent and feasibility studies of use of intensive hyacinth cultures for wastewater treatment, for Union Carbide.

Technical Coordinator for Discharge Information Zone monitoring in the Mobile River, for two major paper mills. Technical Coordinator for salinity isopleth and toxicity studies in the Tombigbee River.

Technical Coordinator for site designation report preparation for the Port St. Joe and Panama City, Florida ODMDSs, for U.S. **AR304689** Protection Agency, Office of Marine and Estuarine Protection.

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Technical Coordinator for analysis of residual chlorine toxicity to aquatic organisms, for Mississippi Power & Light Company.

Technical Coordinator for aquatic bioassays performed in compliance with NPDES permits for numerous industrial and municipal facilities.

Field logistics coordinator for monitoring of effluent impacts in Mobile Bay and the Theodore Ship Channel, for Kerr-McGee Chemical Corporation.

Field logistics coordinator for a field survey of submersed grassbeds, oyster reefs, and sediment type in Little Lake, Louisiana, for the Mobile District Corps of Engineers.

Staff Biologist involved in identification and enumeration of infaunal polychaetes for ocean disposal site evaluations, monitoring of the LOOP brine discharge operation, monitoring of space shuttle exhaust impacts at Cape Canaveral, and other studies.

#### Pertinent Publications

Three publications and reports dealing with aquatic toxicity of industrial effluents and taxonomy and ecology of an estuarine decapod.

Stewart, J. R., Jr. 1980. A Morphological and Ecological Comparison of Uca minax (LeConte) and Uca longisignalis (Salmon & Atsides) (Crustacea: Decapoda) in Coastal Alabama, M.S. Thesis, University of South Alabama, 85 pp.

Stewart, J. R., Jr. and B. A. Vittor. 1985. Toxicity of residual chlorine to aquatic species at the Gerald Andrus Electric Generating Station, Mississippi Power & Light Company.

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W. TERRY WHITEHURST, Field Technician

Education

Partial Fulfillment of Degree in Landscape Design, Louisiana State University, 1967-69

Qualifications

Mr. Whitehurst has two years of formal university training in soil science and landscape design. He also has six years of practical experience in landscape planning and design. Since joining Vittor & Associates in 1987, he has been responsible for managing wetland mitigation planning and implementation, including freshwater and brackish water marsh creation projects. In addition, Mr. Whitehurst is responsible for aquatic sampling logistics and field work, including surveys in streams, estuaries, and open-Gulf of Mexico waters.

Relevant Experience

Received certification for Hazardous Waste Worker Training (OSHA), for field sampling and biological assessment of hazardous waste sites, 1988-1989.

Participated in hazardous waste site bioaccumulation studies and field surveys for Akzo Chemicals plant at Axis, Alabama.

Field Technician for oil spill emergency assessment and monitoring in the Mississippi River, for Exxon Company, U.S.A.

Field Technician for channel sediment sampling for dredged material bioassays, Miami River, Florida.

Managed the Southeast's largest tidal marsh creation project that involves upland excavation, including coordination of field logistics, supervision of up to eight field workers, collection and analysis of soil

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samples, marsh grass transplanting, and monitoring. The Fowl River site comprises 43 ac of brackish marsh and 14 ac of upland islands.

Managed a 1.2-ac fresh marsh creation project on Chickasaw Creek, Alabama, including elevation surveys, supervision of excavation, and transplanting of 5,000 sawgrass plugs.

Participated in evaluation of wetlands and mitigation requirements for a major private golf course project on Fort Morgan peninsula, Alabama.

Participated in quarterly benthic infauna and sediment sampling for the Shell Offshore open-water disposal monitoring project in Alabama offshore waters.

Participated in sediment and water sampling for bioassay analysis of a gas pipeline corridor in Mobile Bay and offshore Alabama, for Exxon Corporation.

Participated in benthic infauna and sediment quality sampling for a gas gathering pipeline in Mobile Bay, state, and federal waters, for Enron, Inc.

Participated in oyster and sediment quality sampling in Mobile Bay, for areawide monitoring of drilling impacts for the Offshore Operators Committee.

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THOMAS KEITH, Biologist

Education

Enrolled in B.S. degree program in Biology, University of South Alabama, 1986 - Present (graduation in 1990)

Qualifications

Mr. Keith is a biologist with two years experience in environmental analysis, with emphasis on aquatic and soil toxicology. Since joining Vittor & Associates in 1987, he has conducted numerous bioassays of industrial and municipal waste treatment facility effluents. He has also been responsible for performing drilling fluid bioassays for offshore drilling NPDES compliance monitoring, and has participated in dredged material bioassays for gas pipeline construction and marina maintenance dredging projects. The latter study involved performance of the EPA's modified dredge material bioassay procedure, which is a simplified version of the 1977 EPA-Corps of Engineers protocol. Mr. Keith has also conducted numerous earthworm soil toxicity tests, for hazardous waste site investigations. This test has been developed by the EPA as part of a new bioassessment protocol for hazardous waste site clean-up.

Mr. Keith has participated in marsh creation projects, including field work for a major tidal marsh planting program at Fowl River, Alabama.

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