ENVIRONMENTAL EVALUATION NOTIFICATION FORM

Grantee/Contractor Laboratory: Golder Associates Inc.; South Oyster Field Site, Northampton County, VA

Project/Activity Title: Flow-Cell Installations and Tracer Experiments, South Oyster Field Site, VA

CH NEPA Tracking No.:
B&R Code:

Type of Funding: Energy Research
Total Estimated Cost: $150,000 (field work alone)

DOE Cognizant Secretarial Officer (CSO):

Contractor Project Manager: W. Timothy Griffin Signature: W. Timothy Griffin

Date: 9/16/98

Contractor NEPA Reviewer: W. Timothy Griffin Signature: W. Timothy Griffin

Date: 9/16/98

I. Description of Proposed Action:

Introduction

This Environmental Evaluation Notification Form (EENF) is being submitted in support of a bioremediation field research project funded by the U.S. Dept. of Energy, Office of Biological and Environmental Research. The purpose of the proposed research project is to study bacterial transport in a subsurface aquifer under both aerobic and hypoxic conditions. A site with these conditions has been identified and characterized on the Delmarva Peninsula near the small fishing village of Oyster, Virginia (Figures 1 and 2). The work to date that has been performed to select and characterize this site was described in EENF's Gold-0020, Gold-0020-Modification 1, and Gold-0020-Modification 2. The property on which the site is located is owned by The Nature Conservancy (TNC), and is part of the Virginia Coast Reserve. The site is herein referred to as South Oyster.

The proposed research is funded by DOE's Natural and Accelerated Bioremediation Research (NABIR) Program. The factors controlling transport of bacteria are important for the field scale application of bioremediation technologies, however, research on microbial transport in the presence of complex subsurface heterogeneity is limited. The purpose of this research program is to focus on the physical and chemical factors which control microbial transport in the subsurface.

An interdisciplinary research team has been assembled to conduct this research. Principal Investigators (PIs) on this team include:

Dr. T.C. Onstott, Princeton University
Dr. Mary F. DeFlaun, Envirogen, Inc
Dr. Donald Swift, Old Dominion University
Dr. William Holben, University of Montana
Dr. Timothy Scheibe, Pacific Northwest National Laboratory
Mr. Timothy Griffin, Golder Associates
Dr. Timothy Ginn, University of California, Davis
Dr. David Balkwill, University of Florida
Dr. Jim Fredrickson, Pacific Northwest National Laboratory
Dr. Tommy Phelps, Oak Ridge National Laboratory
Dr. Chris Murray, Pacific Northwest National Laboratory
Dr. Phil Long, Pacific Northwest National Laboratory
Dr. Ernie Majer, Lawrence Berkeley Laboratory
Dr. Susan Hubbard, University of California - Berkeley

Princeton University, under a grant to Dr. T.C. Onstott, is serving as the lead institution for the research program, and represents the multi-disciplinary team in all issues requiring regulatory input or approval.

In addition to the list of collaborators provided above, there are other PIs in the NABIR program that are interested in obtaining samples from the South Oyster site, and additional PIs may be added to the team as research proposals to the NABIR Program are submitted and approved. The activities of all of these researchers will be coordinated by Dr. T.C. Onstott of Princeton University and Dr. Mary F. DeFlaun of Envirogen, Inc. This research is currently funded through FY 2001.

Generally, the environmental issues to be addressed in this EENF for the work proposed at South Oyster have been addressed previously in EENF's Gold-0020, Gold-0020-Modification 1, and Gold-0020-Modification 2. The proposed activities that require additional documentation include the installation of flow-cells, the extraction and re-injection of unconfined groundwater in flow-cells, the re-injection of indigenous microorganisms into the unconfined aquifer, and the injection of chemical (bromide) tracers into the same aquifer. These activities required a Research Permit from The Nature Conservancy, and a Variance to Virginia Groundwater Quality Standards from the Virginia Department of Environmental Quality (VaDEQ). These documents are included as Attachments 18 and 21 respectively, with additional explanatory text.

Work To Be Performed

The field work that is to be conducted at the South Oyster site over the course of the field research program can be grouped into five categories. Descriptions of these five categories of activities are provided below.

Category 1: Flow Cell Installations

Two flow-cell installations are currently planned for the South Oyster site over the duration of the project (Figure 2). The first will be installed in the northeastern-most corner of the field near Narrow Channel where groundwater is aerobic. The second will be in the northeastern region of South Oyster Focus Area, within 100 meters of the street that runs along the southern perimeter of the village of Oyster. Groundwater in this region is hypoxic. Flow cell installations will take place on separate occasions, each with a duration of approximately 1 to 2 weeks. The first is planned for September of 1998, and the second is projected for some time in early 1999.

The principal framework of each flow-cell is a 20 m x 30 m grid of nine injection/extraction wells arranged in a 3 well x 3 well pattern (Figure 3). These wells will be installed in the uppermost unconfined aquifer at a depth of approximately 10 m below ground surface (bgs). Downgradient from the central injection wells is an array of multi-level samplers (MLSs), as illustrated in Figure 4. Each MLS will have ten to fifteen downhole sampling ports set at even spacing between approximately 6 to 9 m bgs. Precise depth settings for the MLSs will be determined based on field data collected during the installation of the nine injection/extraction wells. Additional details on the MLS installation are provided in the description of the Category 5 activities. In addition to the injection/extraction wells and the MLSs, 4 monitoring wells will be installed within the boundaries of the flow-cells (Figure 3), and at least 4 boreholes will be installed for borehole tomography (Figure 4).

None of these installations will be any deeper than 10 m bgs. Each well-head will extend approximately 2.5 ft above ground surface and will be encased in protective, locking casing (probably PVC tubing) approximately 8 to 10 inches in diameter.

Each hole that is drilled for wells and borehole geophysics will be continuously cored. Core samples will contained in lexan liners, from which subsamples will be selected and distributed to the various laboratories and PIs identified previously. In addition, groundwater samples will be collected periodically from the wells and the MLSs for chemical and microbial analyses, and for monitoring the groundwater quality as required by TNC and VaDEQ.

Equipment that will be required on site during installation will include one (1) roto-sonic drilling/coring rig and a support truck, a personnel truck, and 2 to 3 vehicles for participating program investigators. There will also be a small temporary "lay-down area"

of no more than 10 meters x 10 meters on the perimeter of the site for storage of drilling and sampling equipment and well construction materials during the field program.

Activities will only be conducted during daylight hours. Noise levels, while requiring hearing protection adjacent to the drilling rig, should not create any concern for the nearby residences.

Access to each flow cell will be from the Village of Oyster. The Narrow Channel Focus Area will be accessed by a path that extends through the field from the old homestead property in the center of the field just south of Oyster. This will avoid traffic across private property at the western margin of the field along Seaside Road. Access to the South Oyster Focus Area will be from the road on the south side of town.

Category 2: Excavation at the Narrow Channel Focus Area

Additional excavations along the bank of Narrow Channel Branch are currently anticipated over the course of the project. The first of these excavations was addressed in Modification 2 to EENF Gold-0020, and was conducted in August of 1998. This same excavation site may be reopened from time to time during the course of the project, depending on the research needs of the program. The purpose of these excavations is to provide a 3-dimensional exposure of the sedimentary facies that comprise the nearby flow-cells, and to provide an opportunity for detailed sampling of these facies.

The excavation site is approximately 20 meters by 15 meters, and reaches a depth of approximately 3 meters. The excavated face was tiered such that no vertical face exceeded 1.5 m in height. All slopes met or exceeded OSHA requirements of 1.5:1 (horizontal:vertical) for the soil type in this area.

Samples collected from the vertical face will include a variety of grab samples, including 70 cm long x 7.6 cm diameter cores, grab samples, and syringe samples.

Future excavations will require either one (1) excavator or backhoe, which will be delivered to the site on a flatbed truck/trailer. Support equipment at the site will include vehicles for field personnel. Proper erosion control procedures (silt fencing, hay bales, re-seeding) were employed previously at the site, and will again be implemented during future excavations.

Excavation sampling programs will last an average of 1 week. Immediately upon completion of the excavation sampling activities, the site will be backfilled, compacted, and re-seeded. Silt fencing and hay bales will remain in place for erosion control until native and seeded grasses are re-established.

Category 3: Additional Selective Sampling and Characterization

Some additional sampling and characterization may be required at the site for detailed correlation between the two flow-cell areas. This work will likely be performed in a similar manner to previous work done at the site by cone penetrometer testing (CPT), which requires a CPT truck, as well as a support truck and trailer. Additional support vehicles include two to three automobiles for participating investigators. Some limited roto-sonic drilling and coring may also be employed. In both cases, boreholes will either be backfilled or shallow monitoring wells will be installed, both in accordance with Virginia Department of Health guidelines.

One or two campaigns are anticipated over the course of the project of approximately 1 week duration; however, no additional CPT or roto-sonic field work has been specifically scheduled at this time.

Category 4: Tracer/Microbial Injections and Sampling

Three to four injection/sampling events are currently anticipated over the course of the project, the first anticipated some time before the end of 1998 at the Narrow Channel Focus Area. Equipment required on site for these activities include a diesel or gas powered generator (provided power is not made available), two pumps to simultaneously inject and extract groundwater, and two large volume (300-500 gallon) carboy tanks for water storage and injection preparation. This equipment will likely be stationed on two small flatbed trailers of 15 to 20 ft in length. During microbial and tracer injection experiments, up to 10 peristaltic pumps will be used to extract groundwater from the MLSs. Extracted volumes will be relatively small - approximately 1 liter per sampling port.

Additional support equipment will include vehicles for participating investigators.

The injection/sampling experiments will be conducted around the clock for a period of 1 to 2 weeks. Personnel will be required on site during the night, so some minimal lighting will be required (lanterns, etc.). Every effort will be made to minimize traffic, noise, and light pollution during these experiments.

> **Note:** Due to the considerable number of samples that must be collected during these experiments (estimated 21 MLSs x 10 samples per MLS), an automated sample collection system is being considered for each flow cell. In the event the automated system is employed, the equipment will be housed in a small (est. 8 ft x 8 ft) temporary building constructed near the center of each flow cell. This building would be constructed in accordance with environmentally sensitive guidelines provided by TNC.

Category 5: Multi-level Sampler Installations

An array of approximately 21 multi-level samplers (MLS's) will be installed just downgradient of the central injection well inside each flow-cell (Figure 4). The surface expression of each MLS will be a bundle of 10 to 15, 3/8-inch diameter poly tubes with swage-lock fittings and caps on each end. Each bundle will be attached to a central, ½-inch diameter PVC pipe, which will all be encased inside locking protective casing (PVC), approximately 8 to 10 inches in diameter, that extends no more than 3 ft above ground surface.

Installation of the MLSs will require either a standard rotary drill rig or CPT rig, with one support truck and vehicles for participating investigators. Installation will take no more than 4 days to 1 week.

> **Note:** The MLS installations may actually occur during Category 3 sampling and characterization activities, provided CPT technology can be utilized.

Once each flow-cell is installed, fencing will be constructed around the perimeter of each site in accordance with TNC guidelines. Informational descriptions of the research program and the site will be placed at the entrance of each flow cell for purposes of educating the local citizens and visitors on the objectives of the research program.

All site activities require laboratory space. In the past TNC has provided us the use of a house within the town of Oyster. This house provided adequate accommodations for our field laboratory, however, the future use of this house by TNC is uncertain. Therefore, it may be necessary to provide a laboratory trailer for use during field campaigns. The location of this trailer would be at the discretion of TNC.

Site Monitoring and Contingency

As stipulated by TNC's Research Permit (Attachment 18), a draft Monitoring and Contingency Plan was prepared that describes the short- and long-term monitoring protocols that will be implemented at the site. The draft Monitoring and Contingency Plan is included as Appendix A of Attachment 17, the draft Research Application submitted to TNC.

The focus of this monitoring program will be the microorganisms and tracers that are injected during the tracer injection experiments. In the event that levels of tracers or injected microorganisms exceed background at any time, VaDEQ and TNC will be contacted immediately and a contingency action will be determined at that time. IT IS IMPORTANT TO NOTE THAT NEITHER THE TRACER OR MICROORGANISMS THAT ARE TO BE INJECTED ARE LISTED CONTAMINANTS EITHER WITH VADEQ OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA).

Monitoring will continue for one year after the final injection experiment. Upon approval of TNC and VaDEQ, site closure will be conducted soon thereafter, which will include pulling and/or abandonment of all wells and restoration of the site to its condition prior to research program.

Benefits to Virginia's Eastern Shore Communities

General Benefits

In a general sense, this project will significantly enhance the understanding of the groundwater hydrogeological system that is a fundamental underpinning of the Eastern Shore ecosystem(s). The results of this multi-disciplinary research, both independently and when combined with that of others at Old Dominion University, the University of Virginia's Long-Term Ecological Research Program, and elsewhere, will form one of the most comprehensive studies of a groundwater system in a region this size anywhere.

Specific Benefits

With respect to specific contributions, TNC has expressed a particular interest in the impact of self-sustaining agricultural practices on groundwater quality and biodiversity in the region. In particular, nitrate and other chemical constituent levels in the Eastern Shore groundwater are of particular concern with respect to their potential impact on flora and fauna in low-lying areas. We believe that we can make a significant contribution to the understanding of this problem, and that the South Oyster site offers a unique opportunity to study the problem in both anoxic and aerobic environments. This is important, since models developed by the U.S. Geological Survey, and corroborated by our field work, indicate that anoxic and low DO groundwater conditions may be widely distributed at least in the southern portion of the Eastern Shore, particularly in the critical fringe areas of lowlands and wetlands that border creeks and marshes.

To begin to understand why nitrate is present in the groundwater it is necessary to understand the overall nitrogen cycle in the system. Microorganisms play a critical role in this cycle, both in anoxic and hypoxic environments. Depending on the environmental conditions (aerobic vs. hypoxic), nitrate is either produced or converted to nitrogen by microorganisms (nitrifiers and denitrifiers). Understanding the presence and interactions of the microbial community that produces these reactions is fundamental to assessing the naturally varying baseline concentrations of nitrate in the system. Comparison of data from both the aerobic and hypoxic environments will determine the limitations that exist on hypoxic nitrate reduction. Coupled with studies of how effective nitrate uptake is in plants such as warm season grasses, a more realistic picture can be developed as to the mechanisms of overall nitrate production/uptake in the groundwater.

Dr. David Balkwill of Florida State University and other program PI's will be determining the presence and relative abundance of nitrifiers and denitrifiers in both the aerobic and

hypoxic groundwater systems, and will assess the degree of nitrate production and/or reduction in these respective environments.

Plots of warm season grasses have already been planted in wide borders around the proposed flow-cell sites. These plots will not only serve as natural "blinds" for the flow-cells, but will also provide an opportunity to assess the potential for nitrate uptake by these grasses. Monitoring wells installed down-gradient from these plots will be monitored regularly for nitrate levels, as well as other chemical and microbial constituents. We will also work with the farmer, Ray Newman, to determine the spatial and temporal patterns of nitrogen data derived from the monitoring wells.

It is anticipated that nitrate transport at South Oyster should be more limited under the hypoxic conditions near the proposed site for South Oyster Focus Area flow-cell relative to the aerobic site adjacent to Narrow Channel. A determination of the effect of hypoxic groundwater on nitrate concentrations in surface water and groundwater could have tremendous implications for large scale ecosystem management in the region.

The groundwater chemistry in areas proximal to tidal marshes can be highly variable, reflecting the impacts of agriculture, marine precipitation events, and saline water encroachment. To better understand this complex "mixing" zone, water samples from monitoring wells on the perimeter of the hypoxic flow cell will be analyzed for inorganic and organic chemical constituents at regular intervals over a three year period. We also propose to collect precipitation samples for compositional analyses. This data set will yield a record of salinity fluctuations at this mixing interface, as well as the nutrients entering the marshes and creeks. Ultimately, these temporal and spatial variations can be correlated with changes in precipitation events, cultivation practices, water circulation during bacterial injections, and natural vegetation. These measurements could ultimately help define the geochemical factors that mitigate the expansion of Phragmites.

Other Initiatives

Program PI's will continue to look for opportunities where their scientific objectives can be integrated with the programmatic objectives of TNC. Dr. Mary DeFlaun of Envirogen, Inc. will continue to work with Ms. Terry Thompson, Director of Research and Education for the Virginia Coast Reserve (VCR), to identify such opportunities. Program PI's are also available for educational seminars and other community outreach programs.

Flow-cells will be constructed with sensitivity to the surrounding environment, and instructive plaques will be placed at the sites for the benefit of students, the community, and other TNC visitors.

Public Information

In cooperation with TNC information about this project has been presented to public officials and citizens in Northampton County. Specifically, the project has received the support of the Northampton County Board of Supervisors and the County Office of

Planning and Zoning, the Water Quality Consortium of Northampton County, and the Joint Industrial Development Authority of Northampton County. In addition to TNC, Mr. John Humphrey, the Director of Planning and Zoning for the County of Northampton will be informed of all activities at the site related to this project.

II. Description of Affected Environment:

The South Oyster Site is located on the Eastern Shore of Virginia, near the southern end of the Delmarva Peninsula (Figure 1). It is identified on the USGS 7.5 minute Cheriton Quadrangle just to the south of the small village of Oyster (Figure 2). The property is owned by TNC, which leases the fields to a local farmer. In order to conduct any investigative or research related work on this site, TNC requires that a Research Permit Applicationbe submitted that describes the project in detail (Attachment 17). If the project meets all the rigorous requirements and constraints of TNC, they issue a research permit to conduct the work (Attachment 18).

The proposed field characterization initiative described herein is fully funded by the U.S. Dept. of Energy, Office of Health and Environmental Research, through Grant # DE-FG06-92ER61507. Golder Associates will subcontract all field support necessary to conduct this project (i.e., roto-sonic drilling and coring), and will supervise the field operations. Laboratory analyses and future research initiatives are funded through other individual research grants.

The first of the flow-cells is scheduled for installation in early October, 1998, and the second in early 1999. Flow-cell installations are expected to take one to two weeks. MLS installations will be scheduled for approximately 1 month following the installation of the flow-cells, and tracer injection experiments will take place in 1 to 2 months following MLS installation. Additional characterization work (i.e., CPTs) and excavations have not been scheduled at this time.

Those categorical exclusions that are applicable to the proposed field program, in accordance with Appendix B to Subpart D to 10 CFR Part 1021, are as follows:

B3 Categorical exclusions applicable to site characterization, monitoring, and general research.

B3.1 Site characterization/environmental monitoring.

B3.6 Siting/construction/operation/decommissioning of facilities for bench-scale research, conventional laboratory operations, small-scale research and development and pilot projects.

B3.8 Outdoor ecological/environmental research in a small area.

III. **Potential Environmental Effects:** (Attach explanation for each "yes" response, and "no" responses if additional information is available and could be significant in the decision making process).

A. **Sensitive Resources: Will the proposed action result in changes and/or disturbances to any of the following resources?**

	Yes/No	Attmnt
1. Threatened/Endangered Species and/or Critical Habitats	__x_	1,2,3
2. Other Protected Species (e.g., Burros, Migratory Birds)	__x_	_____
3. Wetlands	__x_	_____
4. Archaeological/Historic Resources	__x_	4,5
5. Prime, Unique, or Important Farmland	x___	6
6. Non-Attainment Areas	__x_	_____
7. Class I Air Quality Control Region	__x_	_____
8. Special Sources of Groundwater (e.g. Sole Source Aquifer)	x___	7,8,9
9. Navigable Air Space	__x_	_____
10. Coastal Zones	__x_	10,11
11. Areas w/Special National Designation (e.g. National Forests, Parks, Trails)	__x_	_____
12. Floodplain	x___	12,13

B. **Regulated Substances/Activities: Will the proposed action involve any of the following regulated substances or activities?**

	Yes/No	Attmnt
13. Clearing or Excavation (indicate if greater than 5 acres)	__x_	_____
14. Dredge or Fill (under Clean Water Act section 404; indicate if greater than 10 acres)	__x_	_____
15. Noise (in excess of regulations)	x___	14
16. Asbestos Removal	__x_	_____
17. PCBs	__x_	_____
18. Import, Manufacture or Processing of Toxic Substances	__x_	_____
19. Chemical Storage/Use	__x_	_____
20. Pesticide Use	__x_	_____
21. Hazardous, Toxic, or Criteria Pollutant Air Emissions	x___	15
22. Liquid Effluent	__x_	_____
23. Underground Injection	__x_	_____
24. Hazardous Waste	__x_	_____
25. Underground Storage Tanks	__x_	_____
26. Radioactive (AEA) Mixed Waste	__x_	_____
27. Radioactive Waste	__x_	_____
28. Radiation Exposures	__x_	_____

C. **Other Relevant Disclosures. Will the proposed action involve the following?**

29. A threatened violation of ES&H regulations/permit requirements	__ x __	16,17,18
30. Siting/Construction/Major Modification of Waste Recovery or TSD Facilities	__ x __	_____
31. Disturbance of Pre-existing Contamination	__ x __	_____
32. New or Modified Federal/State Permits	x __	19,20,21,22,23
33. Public controversy (e.g. Environmental Justice Executive Order 12898 consideration and other related public issues)	__ x __	_____
34. Action/involvement of Another Federal Agency (e.g. license, funding, approval)	__ x __	_____
35. Action of a State Agency in a State with NEPA-type law. (Does the State Environmental Quality Review Act Apply?)	__ x __	_____
36. Public Utilities/Services	__ x __	_____
37. Depletion of a Non-Renewable Resource	__ x __	_____

IV. **Section D Determination**: Is the project/activity appropriate for a determination by the OM under Subpart D of the DOE NEPA Regulations for compliance with NEPA?

Yes No

Indicate the recommendation and specific class of action from Appendix A-D to Subpart D (10 CFR 1021):

A. **DOE-CH NEPA Coordinator Review:**

Proposed Class of Action Recommended
CX EA EIS

Category_____

DOE-CH NEPA Coordinator Reviewer: _____

Signature: _____ Date:_____

B. **DOE CH NCO NEPA Review:**

NCO Concurrence with Proposed Class of Action Recommended
CX EA EIS

Category_____

DOE CH NCO Reviewer: _____

Signature: _____ Date: _____

DOE Recommendation Approvals:

CH PM: _____ Signature: _____

Date: _____

CH NCO: W. S. White _____ Signature: _____

Date: _____

CH GLD: _____ Signature: _____

Date: _____

CH STS: Michael J. Flannigan _____ Signature: _____

Date: _____

CH TAS: John P. Kennedy _____ Signature: _____

Date: _____

Office Manager Subpart D CX Determination and Approval:

The preceding pages are a record of documentation required under DOE Final NEPA Regulation, and 10 CFR Part 1021.400 to establish that an action may be categorically excluded from further NEPA review. I have determined that the proposed action meets the requirements for the Categorical Exclusion referenced above. Therefore, by my signature below, I have determined that the proposed action may be categorically excluded from further NEPA review and documentation.

(Proper Authority): _____ Signature: _____

Date: _____

cc: Appropriate Program Office NCO
TAS
Appropriate Area Office
CH NCO