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- 1.0 Title: Biofouling and Biocorrosion
- 2.0 Type Effort: Advanced Concepts Technology Development
- 3.0 Proposed by: National Security Programs Office,  
Idaho National Engineering Laboratory
- 4.0 Capability sought and uses to which it could be put:

Development of offensive nonlethal technology for "harassment" of targets, as well as development of detection and countermeasures should similar strategies be employed against the U.S.

#### 5.0 Technical Description:

##### Background

Biologically-mediated fouling and corrosion are processes which have been observed to occur naturally and which are the subject of concern to various commercial interests, including nuclear power plants, oil distribution companies and petrochemical manufacturers. Defense-related agencies are also plagued by these processes. For example, the U.S. Navy invests in research to inhibit hull fouling. Beyond the scope of targets for this proposal, are problems encountered in the medical community with prosthetics and therapeutic fluid delivery systems which are subject to fouling by the same mechanisms.

A critical first step in these processes is microbial attachment and biofilm formation. Once a biofilm has been assembled, the microbial community frequently becomes extremely resistant to inhibition by chemical or biological agents (such as antibiotics), making control of the deleterious effects, including corrosion and fouling, difficult. Considerable research in academia and industry is focused on preventing the initial attachment of microbes to critical surfaces.

##### Strategy:

Research to exploit the naturally-occurring phenomena of biofouling and biocorrosion would be directed towards screening for organisms with high potential to mediate these processes in a directed fashion, and employment of various selection and manipulation avenues to optimize and control the process. Key milestones would include:

Other  
Biofouling and Biocorrosion

Investigation of probable scenarios for employment of biological agents  
 Screening of environmental organisms for corrosive and fouling properties (acid secretion, metal oxidation/utilization, surfactant production, corrosive agent production), polysaccharide formation from petroleum  
 Selection for particularly active strains from initial screening  
 Consideration of genetic techniques for further optimization and control

6.0 Risks and Limitations:

Previous work--Our laboratory and many others in academia and industry have investigated the use of microorganisms to degrade environmental pollution by hydrocarbons, as well as the mechanisms by which microbes foul and corrode industrial and biomedical devices and distribution systems. The INEL has an active program in microbial enhanced oil recovery (MEOR) which researches the use of microbes to reduce the viscosity of secondary oil deposits to permit recovery of heavy crude oil from oil fields.

New discoveries needed--many organisms are already identified with significant capability in this arena. What is needed are organisms with faster rates of degradation and production of fouling agents, as well as novel methods for introducing the organisms to their targets.

Operational limitations include reluctance of end users to employ the technology and the probable need to employ first-generation agents under mild ambient temperatures (operationally between 50-100 'F).

7.0 Project Plan:

FY-1995

1. Identification of targets and deployment scenarios in consultation with user community
2. Selection of candidate microorganisms
3. Evaluate biodegradation rates under ideal conditions
4. Formulate and evaluate potential inoculum mixtures

## FY-1996

1. Initiate adaptation experiments to improve rates of degradation and tolerance to hydrocarbons
2. Prepare first generation inocula and deployment guide

## 8.0 Project Cost by Fiscal Year:

FY-1995	FY-1996
250	300

## 9.0 Organization Point of Contact:

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