

ABSTRACT 2  
EFFECTS OF HIGH INTENSITY  
60 Hz ELECTRIC FIELDS  
ON  
PRIMATE BEHAVIOR  
INDIVIDUAL PERFORMANCE



A preliminary study, sponsored by the Department of Energy (Contract No. ET-78-C-01-2875), is underway to develop and thoroughly test the experimental protocols and apparatus which are planned for a major study of the behavioral and biological effects of high intensity 60 Hz electric fields. The African baboon (Papio anubis and Papio cynocephalus) has been chosen as an animal model for the examination both of the individual performance (operant conditioning) and natural (social) behavior. The behavior of baboons is being observed before, during, and after exposure to 60 Hz electric fields at a maximum intensity of 60 kV/m.

This paper is concerned with the individual performance tasks. There are three different tasks in this present study: a vigilance task, a matching-to-sample task, and a multiple operant schedule (fixed-ratio schedule and differential-reinforcement-for-low-response-rate schedule).

The increasing need for ultrahigh voltage power lines raises the serious question of what effects exposure to high intensity electric fields will have on both human beings and infra-human species. A preliminary study is underway to develop and thoroughly test the experimental protocols and apparatus which are planned for a major study of the behavioral and biological effects of high intensity 60 Hz electric fields.

The African baboon (Papio anubis and Papio cynocephalus) has been chosen as an animal model for the examination of both individual performance (operant conditioning) and natural (social) behavior. We are especially interested in possible effects on higher integrative functions of the central nervous system. The behavior of baboons is being observed before, during, and after exposure to 60 Hz electric fields at a maximum intensity of 60 kV/m.

The preliminary study, which is currently underway, differs from the planned major study as follows:

- Subjects are being used as their own controls. Independent control subjects (never exposed to intense 60 Hz fields) are not being run nor is there a duplicate exposure facility for the housing and observation of control subjects.
- In the preliminary studies, a total of 20 subjects are being run. The major study calls for 100 subjects.
- In the preliminary study, field intensities are not being varied. Dose-response data will be obtained in the major study.
- The electric field is expected to be more uniform in the major study facility than in the preliminary study facility.
- The preliminary study facility is basically an outdoor facility, although adequate weather protection is provided for the subjects' health. The major study

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facility will have completely environmentally controlled enclosures for the subjects.

- In order to avoid deterioration of plastic materials, the high intensity fields are not turned on during or just after rainfall in the preliminary facility.
- In the preliminary study, the biological work is restricted to the clinical determination of the health of subjects before and after exposure.

The basic assumption which underlies this series of experiments is that any stimulus which affects the nervous system of the organism will of necessity affect the organism's behavior. Furthermore, virtually any biological system that has been perturbed will have some interaction with the nervous system in a complex organism. In order to be sure that no changes in behavior are overlooked, it is necessary to examine as wide a range of behavior as possible. The techniques now being used to record the natural behavior of a group of baboons essentially tap all of the possible behaviors of these subjects. The observers make use of the focal animal observation technique in which only one animal at a time is observed in detail. The observers are trained to record objectively defined unit behaviors as they observe their focal subjects. Recording is made directly into a portable micro-computer and all further data reduction and analysis steps are automated.

The studies of individual performance were modeled after studies which have proven useful in the detection of drug-effects and in the general area of behavioral toxicology. There are three different tasks in the present study: a vigilance task, a matching-to-sample task, and a multiple operant schedule (fixed-ratio schedule and differential-reinforcement-for-low-response-rate schedule). Performance on vigilance tasks are known to be adversely affected by physical stress, fatigue, arousal level, alertness, motivation, and other psycho-physiological variables. Performance on the fixed-ratio component of a multiple schedule is sensitive to any stimuli which change activity levels. The differential-reinforcement-for-low-rate-of-response component of a multiple schedule requires that a subject be able to time his responses. The matching-to-sample task is concerned primarily with short-term memory. Thus, the three operant conditioning tasks are sensitive to a wide range of variables known to effect performance.

For both the natural behavior studies and the individual performance studies, all dependent variables are analyzed within the framework of two experimental designs. First, comparisons are made between the behavior before electric fields are turned on, during the application of the electric fields, and after the electric fields are turned off. Second, during the period of the experiment in which

electric fields are turned on, comparisons are made between behavior during the application of electric fields and while the electric fields are off (the fields are not kept on for a 24 hour period but rather for six hours each day).