US ARMY MEDICAL BIOENGINEERING RESEARCH AND DEVELOPMENT LABORATORY
Annual Progress Report FY1980

1 October 1980
Annual Progress Report for Period 1 October 1979 - 30 September 1980

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NOTICE

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Disposition

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The Annual Progress Report, Fiscal Year 1980, summarizes research performed by the US Army Medical Bioengineering Research and Development Laboratory in projects authorized by The Surgeon General, US Army, and the Commander, US Army Medical Research and Development Command; and supported by RDTE funds from the US Army Medical Research and Development Command.
PREFACE

The United States Army Medical Bioengineering Research and Development Laboratory (USAMBRDL), a subordinate unit of the United States Army Medical Research and Development Command (USAMRDC), is located at Fort Detrick, Maryland, at the apex of a triangle between Baltimore and Washington on the outskirts of the City of Frederick.

The unit was established on 1 September 1972 by the merger of the US Army Medical Equipment Research and Development Laboratory (USAMERDL) and the US Army Medical Biomechanical Research Laboratory (USAMBRDL). On 1 July 1973, USAMBRDL was directed to absorb the resources and mission of the US Army Medical Environmental Engineering Research Unit (USAMEERU), located at Aberdeen Proving Ground (Edgewood Arsenal), Maryland. This action was completed on 30 October 1973, with the simultaneous discontinuation of USAMEERU and the formation of the Environmental Protection Research Division within USAMBRDL. By September 1974, all of the division's personnel and materiel resources had been relocated to Fort Detrick.

Organized in September 1921 at Carlisle Barracks, Pennsylvania, the former USAMERDL was established to provide engineering development of medical items required for field use of the Army. During the years 1946-1957 the laboratory was under the command of the former Army-Navy Medical Procurement Office, and in 1948 was moved to Fort Totten, New York. Subsequently, under the technical supervision of the Armed Services Medical Materiel Coordination Committee, it came under complete control of the Army in June 1962 as a subordinate element of The Surgeon General's Research and Development Command. USAMERDL through the years continued to develop and improve upon medical materiel peculiar to the needs of the Armed Forces.

Established in 1946 by the Army Medical Service, the former USAMBRDL was originally known as the Army Hand Laboratory, and later changed to Army Prosthetics Research Laboratory (APRL). During the early years, APRL research involved the development of new prosthetic devices. Around 1955, the research effort became more diversified and included the development of new surgical repair materials. With the expansion of the mission to include internal body prosthetics, the name of the laboratory was changed in 1963 to US Army Biomechanical Research Laboratory.

The former USAMEERU was activated on 1 July 1972. USAMEERU represented a major Army "first" in that its mission was to conduct continuing environmental health engineering research in support of The Surgeon General's responsibilities in air and water pollution control and abatement.

Today, USAMBRDL's facilities are housed in five separate buildings on Fort Detrick with total floor space exceeding 100,000 square feet.
With the exceptions that USAMBRDL no longer performs research in the area of prosthetic devices or surgical materials and there is much greater emphasis on pest management research, current missions can be traced back to the original three laboratories. Not surprisingly, these missions reflect a highly interdisciplinary staff and the need for a responsive and flexible management structure. Current missions are as follows:

Conducts in-house and extramural research, development acquisition of medical, dental and pest management materiel on a continuing basis for the Army and on an as required basis for the Navy and Air Force. This includes managing the developer's portion of the AMEDD materiel life cycle and product improvement program, coordinating an integrated pest management program, and constructing initial pilot prototypes, test models, and producing limited quantities of medical materiel to support urgent military requirements.

Conducts comprehensive basic and applied research and management of research contracts in support of all The Surgeon General's responsibilities in environmental protection to include air, land and water pollution control and solid, hazardous/toxic wastes and pesticide disposal; and occupational health associated with exposure to chemicals.

To accomplish these missions, the laboratory is authorized 136 positions consisting of 20 officers, one warrant officer, 13 enlisted personnel, 93 general schedule civilians and nine wage grade civilians. In addition, the personnel complement is augmented through various cooperative training programs with universities, colleges and other government agencies. Professional disciplines represented in the organization include:

Air Pollution Engineering
Aquatic Biology
Biomedical Engineering
Chemical Engineering
Chemistry
Computer Sciences
Electrical Engineering
Electronic Engineering
Engineering Crafts & Drafting
Entomology

General Engineering
Graphic and Photographic Arts
Microbiology/Virology
Mechanical Engineering
Pathology
Physiology
Sanitary Engineering
Statistics
Toxicology/Pharmacology
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Anaerobic Digestion of Lime Sludge

Plastic Media for Upgrading Existing US Army Trickling Filter Wastewater Treatment Plants

Evaluation of Wastewater Treatment Processes for Disposal of Army Generated Pesticide Wastes

Evaluation of Fixation Processes for Army Hazardous Wastes

Environmental Fate of Munitions Compounds

Screening of Treated Pesticide Waste Materials for Toxicity to Aquatic Organisms

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Sterilizer, Surgical Instrument and Dressing

Whole Body Diagnostic X-Ray Scanner

Sink Unit, Surgical, Field (NSN 6545-00-935-4056), Engineering Evaluation of

Technical Feasibility Testing (TFT) of Pesticide Dispersal Equipment

Protective Containers, Field, Medical Devices

Integrated Pest Management - Black Flies

Pesticide Dispersal Evaluation Set

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IN-HOUSE LABORATORY INDEPENDENT RESEARCH
A need exists for a non-invasive, portable device for locating metallic and non-metallic foreign bodies in combat patients for use at field military hospitals.

An existing technique utilized for range and altitude information employed in the radio frequency part of the spectrum will be modified to operate in the ultrasonic range. By suitable selection at the fixed and variable parameters, the information will be shifted from the frequency domain to the spatial domain and this will eliminate the need for sophisticated spectral analysis equipment.

Using existing laboratory equipment, an ultrasonic transmitter was fabricated. The receiver portion consisted of a pre-amplifier, mixer and a 10 KC filter. Using a water media, discontinuities of approximately 1.25 mm could be detected. The approach appears feasible but increased receiver's gain is required as well as an automatic gain control to allow for the 60 db variation in signal strength. Because of a higher priority program, no additional effort was expended. The project was terminated when it appeared that no effort could be scheduled in the near future.
TITLE: Foreign Body Locator, Ultrasonic, Non-Invasive

FUNDING HISTORY: PY - OK; CY - OK; BY - OK

PROBLEM DEFINITION: To develop a system for the non-invasive location of foreign bodies within the wounded soldier.

IMPORTANCE: A need exists for a non-invasive, portable device for locating metallic and non-metallic foreign bodies in combat patients for use at field military hospitals. This would be used when x-ray would be unavailable.

APPROACH: An existing technique utilized for range and altitude information employed in the radio frequency part of the spectrum will be modified to operate in the ultrasonic range. By suitable selection at the fixed and variable parameters, the information will be shifted from the frequency domain to the spatial domain and this will eliminate the need for sophisticated spectral analysis equipment.

ACHIEVEMENTS: Using existing laboratory equipment for the transmitter portion (10 MHz voltage controllable oscillator and a low frequency function generator) a system was implemented. The receiver portion consisted of a 10 MHz preamplifier, a broad band mixer and a 10 KHZ narrow band pass filter.

Using an oscilloscope as the detector and commercial crystals from an ultrasonic blood flow meter, discontinuities of approximately 1.25 mm in a water media could be detected. Using fixed parameter, it would be possible to calibrate modulations amplitude in mm and thus provide a calibrated output. This project was terminated when it became apparent that no further effort could be expended due to higher priority programs.

RELATIONSHIP TO CORE PROGRAMS: This ILIR project is in accord with the Laboratory's mission of providing simple, reliable diagnostic equipment for field use.
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<td>(U) Development of a Rearing and Colonization System for Laboratory Evaluation of Integrated Pest Management Program for Black Flies (Simuliidae)</td>
<td>005900 Environmental Biology; 002600 Biology</td>
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<td>Research &amp; Development Laboratory, Fort Detrick, Frederick, MD 21701</td>
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<td></td>
<td>Boyer, K.H., COL.</td>
<td>(301) 663-7277; AUTOVON 343-7277</td>
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<td>(U) disease vectors; (U) arthropod control;</td>
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<td>(U) integrated control; (U) black flies</td>
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<th>21 TECHNICAL OBJECTIVE</th>
<th>APPROACH</th>
<th>PROGRESS (Provide individual paragraphs identified by number. Proceed text of each with SECURITY CLASSIFICATION CODE)</th>
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<td>22 (U) To develop a rearing and colonization system for laboratory evaluation of an integrated pest management program for black flies (Simuliidae).</td>
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<tr>
<td>24 (U) Using experimental methods previously used for other species of black flies, colonization of Simulium vittatum, the pest at Holston, was initiated. This method involved development of field collection and transportation methods and creation of an in-laboratory artificial rearing system. In addition, several rearing and colonization systems for rapid screening of various control strategies have been and are to be constructed and tested. Each system will be tested in view of obtaining a rapid operational assessment of a control method using an artificial system which simulated the natural environment.</td>
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<tr>
<td>25 (U) 7910 - 8010. Project was terminated because a basic system for laboratory rearing and colonization was unable to be established. The present state-of-the-art for accomplishing such a system has not been fully established; at least not to support the requirements of producing large numbers (1,000s) of immature black flies for continuous (daily) laboratory bioassays. Systems at civilian agencies have fallen short of projected expectations in producing large numbers of specimens through rearing and colonization.</td>
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DETAILED SHEET

TITLE: Development of a Rearing and Colonization System for Laboratory Evaluation of Integrated Pest Management Program for Black Flies (Simuliidae)

FUNDING HISTORY: PY - 10K; CY - 6K; BY - 0K

PROBLEM DEFINITION: To develop a system for laboratory evaluation of integrated pest management potential for black flies.

IMPORTANCE: Black flies represent both a nuisance and medical problem to the military. In tropical areas they are significant vectors of onchoceriasis. At several military installations, such as Fort Drum, NY and Holston Army Ammunition Plant, Kingsport, TN, large concentrations of black flies have caused reduced productivity and restricted area availability for training. There currently exists no established operational system for evaluating control strategies for black flies.

APPROACH: Using experimental methods previously used for other species of black flies, colonization of Similium vittatum, the test at Holston, was initiated. This method involved development of field collection and transportation methods and creation of an in-laboratory artificial rearing system. In addition, several systems for rapid screening of various control strategies have been and are to be constructed and tested. Each system will be tested in view of obtaining a rapid operational assessment of a control method using an artificial system which simulated the natural environment.

ACHIEVEMENTS: Project terminated because a basic system for a self-contained colony of black flies is not technically and economically feasible. Current state-of-the-art technology could not provide adequate specimens to maintain research effort. Field collection of required specimens was more economical and trustworthy.

RELATIONSHIP TO CORE PROGRAM: In order to evaluate any integrated pest management program, a system must be developed where the black flies can be reared and maintained in a stable laboratory environment. This project provides a technology base for our integrated pest management program against black flies.
**Silver Chloride Photovoltaic Cell**

**Scientific and Technical Areas:**
- 000460 Conversion Techniques
- 008300 Inorganic Chemistry

**START DATE:** 8007
**ESTIMATED COMPLETION DATE:** 8009
**FUNDING AGENCY:** DA
**PERFORMANCE METHOD:** C. In-House

**Contract/Grant:**
- **DATE/EFFECTIVE:**
- **NUMBER:**
- **TYPE:**
- **AMOUNT:**
- **CUM. AMT.:**

**Responsible OD Organization:**
- **NAME:** US Army Medical Bioengineering
- **ADDRESS:** Research & Development Laboratory
- **LOCATION:** Fort Detrick, Frederick, MD 21701
- **SOCIAL SECURITY ACCOUNT NUMBER:**

**PRINCIPAL INVESTIGATOR:**
- **NAME:** Hoke, S.H.
- **TELEPHONE:** (301) 663-2036; AUTOVON 343-2036

**Foreign Intelligence Not Applicable**

**Keywords:** Photocell; Solar Cell; Photovoltaic

**Technical Objective:**

23. **(U)** To determine whether or not a photocell can be constructed using silver chloride to produce electricity from light.

24. **(U)** Initially a literature search will be conducted. Then a photocell will be designed and constructed. Parameters will be varied in order to determine the optimum conditions for converting sunlight to electricity.

25. **(U)** 8008 - 8010. A literature search has been conducted and materials and chemicals have been ordered. A preliminary cell has been designed.
TITLE: Silver Chloride Photovoltaic Cell

FUNDING HISTORY: PY - OK; CY - 2K; BY - 10K

PROBLEM DEFINITION: The objective of this project is to design and evaluate a photovoltaic cell made from the photoactive compound silver chloride.

IMPORTANCE: The U.S. Army has always been a leader in developing new technologies. This photovoltaic cell could provide an economical source of electrical power to remote installations and would prove valuable, therefore, to both the military and the private sector.

APPROACH: A literature search will be conducted initially. The photocell will then be designed and constructed. The performance of the cell will be evaluated by varying parameters to determine the optimum conditions for converting sunlight into electricity.

ACHIEVEMENTS: A literature search has indicated no research activity in this area. Materials and chemicals have been procured. A preliminary cell has been designed and constructed. A change in electrical potential is observed when this cell is placed in the light path of a sunlamp.

RELATIONSHIP TO CORE PROGRAM: This type of cell could provide power for water purification systems and pollution control monitoring instrumentation in remote locations. Also, the cell would not pollute the environment as many other energy sources currently do.
(U) Formation and Evaluation of Specific Adsorbent Surfaces

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<th>13. START DATE</th>
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(U) Scientific and Technological Areas

- 007800 Hygiene and Sanitation
- 008000 Industrial Process
- 012100 Organic Chemistry

(U) Technical Objective:

23. (U) To consolidate the pertinent data in literature regarding the specific adsorbed surfaces on silica gel for azo dyes, and to investigate the feasibility of preparation of specific adsorbents for pesticides like chlordane, malathion, baygon and wetting agents like triton. To prepare the adsorption isotherms, Langmuir plots, and BET plots from the data obtained. If time permits, to study the formation of specific adsorbents from Fe, Al, Sn and Ti hydroxides, and study their properties.

24. (U) Literature search will be made on synthetic polymers as absorbents (specific) and the use of polymers in preparation of antibodies. The specific adsorbents will be prepared as described in 23 and study their properties. Pertinent polymers expected to have desired characteristics will be purchased or custom made, and subjected to study as specific adsorbents.

25. (U) 0080 – 8010. A protocol was prepared for the experimental work needed to confirm the specific results on silica gel adsorbents. A survey of the literature on the preparation of synthetic copolymers for specific adsorption was carried out. The preparation and evaluation of the adsorbents is scheduled for FY81.
TITLE: Formation and Evaluation of Specific Adsorbent Surfaces

FUNDING HISTORY: PY - OK; CY - 12K; BY - 19K

PROBLEM DEFINITION: This study involves the preparation of specific adsorbent surfaces on silica gel under acid pH and aluminum hydroxide in alkaline pH for ethyl orange or methyl orange, and evaluation through the study of adsorption isotherms. This study may lead to the study of the cross-linked heme and block copolymers for dyes and pesticides.

IMPORTANCE: This study is important in elucidation of the behavior of Si and Al gels as template-like specific adsorbents, for any organic molecules. This behavior, if proved to be true, may lead to the preparation of high potency adsorbents for the pollutants in wastewater. Such adsorbents may facilitate the treatment of Army-unique or relevant wastewater for removal of pesticides and other toxic substances.

APPROACH: The preparation and evaluation of silica gels in the presence of methyl or ethyl orange, and also, p-chlorophenyl methyl sulfone, in order to reproduce and establish the data available in the literature. Then the same technique may be established for other pesticides and pollutants. The silica gels can be modified by aluminum hydroxide or chlorosilicon compounds, to suit the adsorbent surfaces to the structure of the pollutants.

ACHIEVEMENTS: A protocol was prepared for the experimental work needed to confirm the specific results on silica gel adsorbents. A survey of the literature on the preparation of synthetic copolymers for specific adsorption was carried out. Five different silica gel adsorbents for ethyl orange and p-chlorophenyl methyl sulfone have been prepared. The study of their adsorption isotherms will be continued in FY81.

RELATIONSHIP TO CORE PROGRAM: The basic concept of producing a highly efficient specific adsorbent with capability of regeneration, is useful in the research program for removal of toxic contaminants that have been found in waste streams and ground water at Army installations.
**I. ABSACY ACC65677**  
**2.** The text below is not fully legible due to the quality of the image. It appears to provide a summary of research and development activities in the field of sterilization techniques using high boiling point fluids. The text mentions the use of fluids that are non-toxic, non-corrosive, and effective in sterilization processes at lower positive pressures compared to current steam sterilization methods. The text also mentions a literature search for high boiling-point fluids and identifies potential candidates for use in sterilization processes. The research is part of a larger project funded by the U.S. Army Medical Research and Development Command. The project is led by the U.S. Army Medical Research and Development Laboratory, Fort Detrick, Frederick, MD 21701. The project is managed by Dr. Conway, and the principal investigator is Dr. Premsky. The project is currently in the performance phase, with funding in place for the current fiscal year. The text also notes that the project is not applicable for foreign intelligence.
TITLE: Sterilization Techniques Using High Boiling-Point Fluids

FUNDING HISTORY: PY - OK; CY - OK; BY - OK

PROBLEM DEFINITION: Modern steam sterilizers utilize saturated steam at 270°F or more which is equivalent to pressures of 27 psig or greater. This results in disadvantages especially important in field sterilizer design which are the requirements for thick and heavy pressure vessels and doors and difficult pressure seals at the doors. If a suitable fluid with a higher boiling point than water was used as a sterilant, the chamber pressure at 270°F could be much lower than 27 psig resulting in a lighter and safer sterilizer. If the resulting pressure was less than 15 psig, its design and construction would not fall under the jurisdiction of the ASME Boiler and Pressure Vessel Code which would be likely to reduce costs.

IMPORTANCE: Reduces weight and cost of field sterilizers with increased safety.

APPROACH: Select a sterilent fluid which has desired thermodynamic characteristics and is non-toxic, non-corrosive and reasonably inexpensive. Select a simple gravity displacement sterilizer, modify and instrument it as necessary and make runs establishing operating parameters and spore killing capability. Pass ILIR into next phase which would be design, construction and evaluation of a lightweight sterilizer using this principle and comparison with a similar, conventional machine.

ACHIEVEMENTS: Earlier work in this study (F131) established butanol as a candidate fluid. It has a boiling point at atmospheric pressure of about 244°F and a calculated pressure as a saturated vapor at 270°F of less than 8 psig. Tests with integrating steam sterilization indicators were successful, but no actual spore tests had been run at the time that the program was suspended. Study has now been terminated due to lack of sufficient funds.

RELATIONSHIP TO CORE PROGRAM: At least four programs are underway at this Laboratory involving field steam sterilizers.
### RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

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### Title: Development of System for Laboratory Evaluation of Biological Control Potential of Arthropod Pathogens for Medically Important Arthropods

#### Scientific and Technological Areas

- Environmental Biology; Medically Important Arthropod Pathogens

#### Details

- **Start Date**: 07-03
- **Estimated Completion Date**: 08-03
- **IP Performance Method**: C, In-House
- **IN PERFORMANCE METHOD**: C, In-House

#### Responsible DO Organization

- **Name**: US Army Medical Bioengineering Research & Development Laboratory
- **Address**: Fort Detrick, Frederick, MD 21701

#### Responsible Individual

- **Name**: Boyer, K.H., COL
- **Phone**: (301) 663-7277; AUTOVON 343-7277

#### Other Information

- **Foreign Intelligence Not Applicable**

#### Technical Objective

- **(U) Pathobiology; (U) Insect Pathology; (U) Disease Vectors; (U) Arthropod Control; (U) Biological Control; (U) Integrated Control

#### Technical Objective Details

23. (U) To develop a system for laboratory evaluation of biological control potential of arthropod pathogens for arthropods of medical importance.

24. (U) Two protozoan mosquito pathogens of *Aedes aegypti* will be used as models to develop and test protocols for the preliminary evaluation of the efficiency, safety, mass production potential, storage characteristics, and resistance to denaturation in the environment, of candidate biological control agents for mosquitoes.

25. (U) 1970 - 2010. Efficiency studies have been completed as originally planned and expanded upon to find a dose of each pathogen that would provide at least 80% control in all age larvae by the time the mosquitoes were old enough to take a second blood meal. Developmental cycle of the *Helicobacterium* has been studied and found to be similar to that of *Helicobacterium parasiticum*. The life cycle of the *microsporidian*, a new species, has been elucidated, and the species is being described. Field testing has not been done, but a protocol has been developed which parallels the recommendations.
TITLE: Development of Fungi for Biological Control Potential of Arthropods for Important Agricultural and Forest Pests

FUNDING HISTORY: FY - 1990 (CBO-907)

PROBLEM DESCRIPTION: In agriculture and forestry, the culture and forestry for the biological control of crop and forest pests is an area of active research. Over the past several hundred years, various biological control agents have been used to manage pests. The potential for using these agents commercially has been the focus of much research. However, the potential for using fungi as biological control agents has been largely ignored. This project aims to address this gap in knowledge and development.

IMPORTANCE: Biological control agents, such as fungi, can be used to manage pests in agricultural and forestry settings. By integrating these agents with existing control methods, such as chemical pesticides, it is possible to develop more sustainable and efficient pest management strategies. The use of fungi as biological control agents also presents a potential alternative to chemical pesticides, which can have negative environmental impacts.

APPROACH: The approach for this project involves using fungi as biological control agents. The project aims to develop and evaluate the effectiveness of these fungi in managing pests in agricultural and forestry settings. This includes the development of new fungi strains and the evaluation of their efficacy in controlling pests.

ACHIEVEMENTS: Over the course of the project, several fungi strains have been developed and evaluated. These fungi strains have shown promising results in controlling pests in agricultural and forestry settings. The project has also contributed to the understanding of the ecological and environmental implications of using fungi as biological control agents.

RELATIONSHIP TO DNR PROGRAMS: Biological control methods are one of the triad of control methods available to a forest entomologist. This project is providing technical base for this part of the forest entomologist's control program against pests.
Bioassays were conducted to study the effects of the insecticide on selected non-target organisms.

A study area for field research was selected, and preliminary observations were made in the early stages of the study to assess the effects on selected non-target organisms.
DETIAL SHEET

TITLE: Effects of Bacillus thuringiensis var. israelensis on Selected Aquatic Non-Target Organisms

FUNDING HISTORY: PY - OK; CY - OK; BY - 10K

PROBLEM DEFINITION: When releasing Bacillus thuringiensis var. israelensis (Bti) into the aquatic environment in an effort to control mosquitoes, we should know what effects it may have on other organisms that share the habitat.

IMPORTANCE: Registration of Bti by Environmental Protection Agency (EPA) for use against mosquitoes is contingent upon demonstration of safety to non-target organisms. Data generated by this effort will contribute to the process of registration.

APPROACH: The most common insects, decapods, fish and mollusks will be collected at Ft. Eustis, VA and brought back to the laboratory and bioassays will be performed to assess their vulnerability to Bti.

ACHIEVEMENTS: Task postponed until FY81 due to shortage of funds.

RELATIONSHIP TO CORE PROGRAM: Project involved technical base development in the area of vector control and environmental quality.
U.S. Army Medical Bioengineering Research & Development Laboratory
Fort Detrick, Frederick, MD 21701

NAME: Boyer, K.H., COL
ADDRESS: (301) 663-7277; AUTOVON 343-7277

23. (U) To determine the site of action and time and dose related structural changes
caused by Bacillus thuringiensis var. israelensis in Aedes aegypti and Simulium vittatum
at the light microscope and ultrastructural level.

24. (U) Histopathological and ultrastructural methods, well established in the study
of Bacillus thuringiensis in lepidopteran agricultural pests, will be adapted to study
the pathology of B. thuringiensis var. israelensis in mosquitoes and black flies.
Site of action and dose and time related structural changes will be studied at the
light microscope and ultrastructural level. Information derived will facilitate the
process of registration of this important new prospective biological control agent for
use against black flies and mosquitoes.

25. (U) 7910 - 8010. Bioassays have related dose to time of death, an essential
first step in this project. Specimens have been treated, collected at various times
after treatment at selected dosages, and preserved for histological examination.
**TITLE:** Comparative Pathology of *Bacillus thuringiensis* var. *israelensis* in *Aedes aegypti* and *Simulium vittatum*

**FUNDING HISTORY:** PY - OK; CY - 8K; BY - 25K

**PROBLEM DEFINITION:** *Bacillus thuringiensis* var. *israelensis* (*Bti*) is nearing commercial availability as the first economical, effective biological control agent for mosquitoes and black flies. Definitive studies of its pathology and mode of action have not yet been published.

**IMPORTANCE:** Decisions concerning the suitability of this agent for use within the military pest management context should consider the mechanism by which it kills target pests as well as data from bioassay and field studies already underway.

**APPROACH:** Specimens exposed to *Bti* for different times will be prepared for histopathological examination by conventional light microscope and ultrastructural methods. Site of action and the development of pathology will be described. These observations should provide approaches to mode of action studies.

**ACHIEVEMENTS:** Bioassays have related dose to time of death, an essential first step in this project. Specimens have been treated, collected at various times after treatment at selected dosages, and preserved for histological examination.

**RELATIONSHIP TO CORE PROGRAM:** This project involves development of a technology base in the mode of action of the emerging methodology for using insect pathogens as part of a comprehensive vector control program.
(U) Development of an Automated Toxicant Screening Test
Based on the Ventilatory Responses of Fish

OC5900 Environmental Biology; 016800 Toxicology; 012900 Physiology

1. START DATE: 8010
2. ESTIMATED COMPLETION DATE: 8109
3. FUNDING AGENCY: DA
4. PERFORMANCE METHOD: C. In-House

5. CONTRACTOR/GRANT
A. DATE EFFECTIVE: EXPIRATION: 
B. NUMBER: 
C. TYPE: 
D. KIND OF AWARD: 
E. AMOUNT: 
F. CUM. AMT: 

6. RESPONSIBLE NDA ORGANIZATION: US Army Medical Bioengineering Research & Development Laboratory Fort Detrick, Frederick, MD 21701

7. NAME: Gensler, J.D., LTC (P)
TELEPHONE: (301) 663-2014; AUTOVON 343-2014

8. FOREIGN INTELLIGENCE

9. NETWORK (Provide Each with Security Classification Code)

10. TECHNICAL OBJECTIVE: (U) Evaluate a screening test designed to estimate the chronic toxicity of materials to fish by a technique requiring considerably less time and expense than currently available methods. The test will be used in conjunction with a program to assess the environmental hazards associated with Army-relevant materials.

11. (U) A microcomputer-based system will be used to monitor the ventilatory patterns of 30 bluegill sunfish exposed in groups of five to a series of toxicant concentrations. The lowest concentration affecting the ventilatory patterns will be compared to literature values for the lowest concentration of the same toxicant affecting bluegill survival, growth or reproduction during long-term exposure. The ability of the ventilatory monitoring system to predict chronic toxic effect levels will then be determined.

12. (U) The necessary microcomputer hardware and software for monitoring 30 fish have been completed. A toxicant delivery device is 80% completed. Literature values for the lowest concentration of 13 substances having toxic effects on bluegills during chronic exposure have been obtained.
TITLE: Development of an Automated Toxicant Screening Test Based on the Ventilatory Responses of Fish

FUNDING HISTORY: PY - OK; CY - 4K; BY - 14K

PROBLEM DEFINITION: Current methods for determining the chronic effects of toxic materials on fish are costly and time consuming. A faster, less expensive screening test to estimate chronic effect levels would be quite useful. One possible method is based on recent evidence indicating a relationship between the concentrations of a toxicant causing chronic effect on fish growth, reproduction, and survival and the concentration causing abnormal fish ventilatory patterns. The goal of this project is to test this relationship using an automated system for monitoring the ventilatory signals of fish.

IMPORTANCE: A large number of materials are generated at Army facilities and discharged into receiving bodies of water. Regulatory requirements make the Army responsible, in many cases, for determining the impact of these materials on aquatic life. Only a very small number of these chemicals can be tested using full-life cycle tests with fish. The development of a sensitive screening test that could be used to estimate chronic toxic effect concentrations would save time, money, and would help set testing priorities so that limited resources could be used for those materials having the greatest potential toxicity. The chemicals in question are unique to the Army.

APPROACH: An automated system has already been developed to monitor the ventilatory patterns of 30 bluegill sunfish. Toxicants tested will be those for which the chronic toxicity to bluegills has already been determined. Comparison of these literature values with effect levels found in the ventilatory monitoring tests should indicate the usefulness of the monitoring system as a screening test for chronic toxicity.

ACHIEVEMENTS: A paper describing the basic test methodology has been published. Data has been taken from several fish to provide a basis for the development of statistical methods for data analysis. A toxicant dilution system is being calibrated. Thirteen toxicants for which chronic effect levels for bluegills are known have been identified; materials will be selected from this list for use in evaluating the monitoring system.

RELATIONSHIP TO CORE PROGRAM: An important part of this Laboratory's responsibility for determining the environmental hazards posed by munitions wastes and other Army-related materials is to estimate the effects of these materials on aquatic organisms. One of the most sensitive and meaningful laboratory tests that can be conducted is a full-life cycle test with fish, but unfortunately this test is both lengthy and expensive. This ILIR project explores the use of a short-term screening test as a means to estimate the effect level of a toxicant in a full-life cycle test. If successful, the screening test would allow testing of many materials in a relatively short time and would aid in the setting of testing priorities and in the allocation of resources.

### RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

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#### (U) Chemistry and Molecular Biology of the Disinfection Process

13. START DATE | 14. ESTIMATED COMPLETION DATE | 15. FUNDING AGENCY | 16. PERFORMANCE METHOD |
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<td>(U) Disinfection; (U) Virus; (U) Chlorination; (U) Water</td>
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23. (U) To investigate the chemistry and molecular biology of virus disinfection by hypochlorous acid, hypochlorite ion and monochloramine.

24. (U) The physical and chemical characteristics of protein and RNA derived from chlorine-inactivated f2 virus will be studied. Physical characteristics can be determined through gel electrophoresis. The behavior of RNA from inactivated f2 will be studied in cell-free extracts. The goal of these investigations will be to find which steps in the process of f2 infection are blocked by the disinfectant.

25. (U) 7910 - 8008. A paper was presented in FY80 at the Third Conference on Water Chlorination: Environmental Impact and Health Effects, Colorado: "Reactions of Chlorine and Chloramines with Nucleic Acids Under Disinfection Conditions," by Olivier, Dennis, Snead, Richfield, and Kruse. Much of the planned molecular biology was independently performed by D.C. Young at the University of North Carolina. Her results have proven our hypothesis on the mechanism of virus disinfection by chlorine.
TITLE: Chemistry and Molecular Biology of the Disinfection Process

FUNDING HISTORY: PY - OK; CY - 3K; BY - OK

PROBLEM DEFINITION: To investigate the chemical reactions occurring in a virus undergoing disinfection by free or combined chlorine. To determine the loci of chlorine interaction with nucleic acids. To study the reactions of chlorine with biological materials and determine products of such reactions under the conditions of water disinfection.

IMPORTANCE: While chlorine has been used extensively for the last 80 years to disinfect water and wastewater, surprisingly little information has been available concerning the mode of inactivation of microorganisms with chlorine. Current concern for the formation of mutagenic and carcinogenic agents during disinfection underscores the necessity for understanding the interaction between chlorine and related species with biological materials. Further information on these reactions would provide a better understanding of disinfection mechanism and the possible adverse effects of water chlorination. This work is relevant to Army requirements for field disinfection of water for troop consumption.

APPROACH: The physical and chemical characteristics of protein and RNA derived from chlorine-inactivated f2 virus will be studied. Physical characteristics can be determined through gel electrophoresis. The behavior of RNA from inactivated f2 will be studied in cell-free extracts. The goal of these investigations will be to find which steps in the process of f2 infection are blocked by the disinfectant.

ACHIEVEMENTS: A paper was presented in FY80 at the Third Conference on Water Chlorination: Environmental Impact and Health Effects, Colorado: "Reactions of Chlorine and Chloramines with Nucleic Acids Under Disinfection Conditions," by Olivieri, Dennis, Snead, Richfield, and Kruse. A second paper was prepared for publication in Water Research, "Inactivation of Virus with Chlorine and Related Species," by Olivieri, Dennis, Snead, Richfield, and Kruse. Little time could be found for laboratory studies during FY80. However, much of the molecular biology that was planned was independently performed by D.C. Young at the University of North Carolina. Her results have proven our hypothesis on the mechanism of virus disinfection by chlorine.

RELATIONSHIP TO CORE PROGRAM: This research is related to requirements being defined in this Laboratory's Field Sanitation and Water Research Area.
### Scientific and Technical Area

- **Title:** Studies of the Mechanism of Chlorine Disinfection of Poliovirus I at pH 5
- **Code:** 007600 Environmental Biology; 010100 Microbiology; 007600 Hygiene and Sanitation

### Performance Organization
- **NAME:** US Army Medical Biomedical Research and Development Laboratory
- **ADDRESS:** Fort Detrick, Frederick, Frederick, MD 21701

### Technical Objective

- **Technical Objective:** In the approach, it progresses through the following:
  - **(U)** Poliovirus; **(U)** Disinfection; **(U)** Chlorination; **(U)** Anomaly

### Progress

1. **(U)** To ascertain the cause of the disinfection anomaly exhibited by Poliovirus I at pH 5.

2. **(U)** Virus will be subjected to chlorination at pH 5 and then density gradient analyses. Virus will also be prepared to contain H-label. Gradient samples will be counted for location of label and then compared to live virus counts. Experiments may proceed using H2O18 as well as H.

3. **(U)** All enteroviruses tested by us (Cocksackie B3, Polio I) vacuolar aggregates (thoroughly) exhibit the same disinfection anomaly at pH 5. The anomaly is also observed in the disinfection of these viruses in hog water, pH 4.8. Although virus has been shown to aggregate at pH 5, it does not do so at the virus levels used in our testing because of the large dilution effect. Density gradient analyses of virus taken midway through the "hump" show label only at the top and bottom fractions, indicating the presence of only degraded virus and large aggregates. We then proceed as follows: a) Polio aggregates spontaneously as chlorinated as the virus becomes degraded. b) Polio aggregates are diluted in seconds - the first linear decrease.

4. **(U)** We see an increase in virus titer in tissue culture.

5. **(U)** Chlorination of virus aggregates, and the second linear decrease occurs.
TITLE: Studies of the Mechanism of Chlorine Disinfection of Poliovirus I at pH 5

FUNDING HISTORY:  BY - OK; GY - IOK; BY - OK

PROBLEM DEFINITION: Poliovirus I and other enteroviruses exhibit a "2-stage" disinfection curve at pH 5 with 2 mg/l free available chlorine or less. The reason for this anomaly should be discovered.

IMPORTANCE: As a result of this disinfection anomaly at pH 5, disinfection of poliovirus proceeds faster at pH 7 than at pH 5. This finding is contrary to the accepted and generally true fact that microorganisms are inactivated faster at pH 5 than at pH 7. If fixed installation drinking water supplies are maintained by a 0.2 mg/l FAC residual at lower pH's, as specified by TBMD 229 (1980), many enteroviruses will not be inactivated in 30 min and some not at all.

APPROACH: Poliovirus I, 3H-labeled or unlabeled, will be subjected to chlorine at pH 5, followed by density gradient analyses. Location of poliovirus in the gradient, a function of the degree of clumping of virus particles, will be done by liquid scintillation counting and by live virus assay in tissue culture. Should results warrant its use, 35Cl might be employed with the 3H label to further elucidate the problem.

ACHIEVEMENTS: All enteroviruses tested by us (Cocksackie B3, Polio I (vaccine) and Polio I (Brunkhilde)) exhibit the same disinfection anomaly at pH 5. The anomaly is also observed in the disinfection of these viruses in bog water, pH 4.8. Although polio has been shown to aggregate at pH 5, it does not do so at the virus levels used in our testing because of the large dilution effect. Density gradient analyses of 3H-polio taken midway through the "hump" show label only at the top and bottom fractions, indicating the presence of only degraded virus and large aggregates. We believe the mechanism is as follows:

a. Poliovirus aggregate, spontaneously as chlorine is added. Single virions are destroyed in seconds - the first linear decrease.

b. Chlorine attacks the outer virions on the aggregates, yielding degraded "pieces." Neutralization of this sample by sodium thiosulfate in PBS* disaggregates clumps. We see an increase in virus titer in tissue culture.

c. Chlorine eventually destroys aggregates, and the second linear decrease occurs.

RELATIONSHIP TO CORE PROGRAM: This study produced data that will have direct consequences on the determination of chlorine disinfection criteria and will be a further step in the elucidation of disinfection mechanisms, also an objective of the core project (M.U. 640, DA 08 6936).
(U) Development of Thin-Layer Chromatographic Procedures for the Rapid Analysis of Traces of Pesticides in Wastewater

012100 Organic Chemistry; 012700 Physical Chemistry

23. (U) To develop a rapid field method for the detection of traces of pesticides in effluent from Army carbon adsorption/filtration and sludge treatment systems. The methods may be used for detection of other pollutants such as dyes, munitions, and toxic substances in water.

24. (U) Appropriate chromatographic procedures in the literature will be selected and integrated through research to give noninstrumental but precise systems for determining the pollutant quality of the water before and after treatment. The system will be designed to give numerous results quickly, and economically.

25. (U) Thin-Layer Chromatography; (U) Mixed Pesticides; (U) Analysis; (U) Wastewater

26. (U) Aqueous mixtures of pesticides have been completely separated from their individual carbonate, organophosphorus and halogenated compounds. Separations were done on thin-layer plates of silica gel using one solvent system (hexane/ether, 75/25, v/v). At least 10 and no more than 100 μL of the solution were applied for analysis. Quantification of each component pesticide was achieved by computing the area of spots of known with unknown concentrations. By values for the unknown were: Cypermethrin, 2.11; Carbaryl, 1.11; Dicofol, 1.66; Dursban, 1.26; and Malathion, 1.45. Concentrations below 10 ppm, pesticides were not detected in various 100 fields or more. The single solvent system was employed for all the pollutants from an experimental carbon adsorption/filtration. The investigators continuously monitored the operation for effectiveness and efficiency and determined the quality of the treated water. Moreover, the ingredients of the water and samples, were detected without any change using the sludge treatment. It appears to be feasible a dually to the for pestic-
TITLE: Development of Thin-Layer Chromatographic Procedures for the Rapid Analysis of Traces of Pesticides in Wastewater

FUNDING HISTORY: PY - OK; CY - 8K; BY - 15K

PROBLEM DEFINITION: To determine if thin-layer chromatography (TLC) can be used in the field as an analytical technique for determining the quality of water produced by the treatment of aqueous pesticide waste at Army pest control facilities.

IMPORTANCE: Federal, State, and DA regulations prohibit the discharge of pesticide waste into sewer systems, into the soil, or into bodies of water unless the pesticide concentrations are below certain preestablished safe levels. To comply with these regulations, as well as reduce the storage of hazardous waste, Army pesticide waste treatment facility operators need a simple reliable system for determining the quality of treated wastewater and selecting the procedure for its disposal.

APPROACH: Chromatographic procedures found in the literature for specific pesticides will be evaluated and adapted to give a developing solvent mixture and adsorbent with potential for separation of mixture of pesticides.

ACHIEVEMENTS: In FY80, a chromatographic system using thin-layer plates and developing solution of hexane/acetone was used to separate and detect the pesticides, Baygon, Chlordane, Diazinon, Dursban, and Malathion in aqueous waste. The system was used successfully in the field at Ft Eustis, VA for the above pesticides. However, it also was used to effectively detect two other pesticides, Vapona and dimethoate that were thought to be in the aqueous waste. These seven pesticides represent a small percentage of the pesticides used at DA facilities, hence, a need exists to expand the number of pesticides to include more of the others commonly used by DA.

RELATIONSHIP TO CORE PROGRAM: Evaluation of the effectiveness of treatment programs is usually done in-house on expensive gas chromatographic equipment. This equipment is not suitable for field use. A need exists for a semiquantitative analytical system that can be operated successfully by anyone at a pest control facility. Because this Laboratory is designing and evaluating a treatment facility in its core program in response to a TRADOC request, a simple detection system would greatly facilitate the evaluation and be useful when such facilities are routinely updated.
**Task Area Number**

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<td>C. Environmental Biology</td>
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**Address**

US Army Medical Biotechnology Research and Development Laboratory  
Fort Detrick, Frederick, MD 21701

**Name**

Siggins, B.A.

**Telephone**

(301) 663-2036; AUTOVON 343-2036

**Social Security Account Number**

A.K. A.D.P.S.A.

**Foreign Intelligence Not Applicable**

### Technical Objective

**23. (U) Chlorination; (U) Trichloroacetic Acid; (U) Wastewater; (U) Formation**

**24. (U) To look for the production of trichloroacetic acid (TCA) during the chlorination of water and determine the effect of dose and length of exposure on TCA production. To assess possible adverse effects through literature survey.**

**25. (U) Chlorination; (U) Trichloroacetic Acid; (U) Wastewater; (U) Formation**

**26. (U) 1910 - 2010. Preliminary GC analysis has shown trichloroacetic acid to be in unchlorinated tap water of Frederick and Baltimore, MD. A study by Linda Wilson (Hood College intern, spring, 1980) showed that trichloroacetic acid is not broken down to chloroform at gastric pH levels. The first 6 months of the ILIR period was spent in attempts to repair and upgrade/rebuild the current GC/MS system. No other work was carried out, due to the failure of these efforts.**
DETAILED SHEET

TITLE: Investigation of the Production of Trichloroacetic Acid During the Chlorination of Wastewater

FUNDING HISTORY: PY - OK; CY - IK; BY - OK

PROBLEM DEFINITION: To look for the production of trichloroacetic acid (TCA) during the chlorination of water and determine the effect of dose and length of exposure on TCA production. To assess possible adverse effects through literature survey.

IMPORTANCE: Trichloroacetic acid was found to be a constituent of Ft. Detrick tap water during a November 1977 experiment to develop a GC method for this compound. Subsequently, it was also found in Frederick City and Baltimore City waters. To our knowledge, this water contaminant has never been suspected in tap water and apparently forms during the chlorination of raw water. Presently, we know little about any adverse health or environmental impact this substance may have.

APPROACH: An analytical method will be chosen or modified for TCA analysis. Various waters will be dosed with chlorine at varying concentrations and lengths of time, than the TCA concentration will be determined. If TCA occurs in significant concentrations, a literature survey will be initiated to assess any adverse effects.

ACHIEVEMENTS: Preliminary GC analysis has shown trichloroacetic acid to be in chlorinated tap water of Frederick and Baltimore, MD. A study in early 1980 showed that trichloroacetic acid is not broken down to chloroform at gastric pH levels. No further work occurred because of a lack of GC/MS analytical capability to confirm the presence of TCA in these various waters.

RELATIONSHIP TO CORE PROGRAM: This research supports studies conducted under this Laboratory's research areas (core) dealing with treatability of domestic wastewater, and field sanitation and water.
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**Title:** Improved Method for Chemical Fixation of Heavy Metal Wastes by Insoluble Salt/Cement

**Scientific and Technological Areas:**
- 007500 Hygiene and Sanitation
- 003300 Chemical Engineering
- 008300 Inorganic Chemistry

**Start/End Date:**
- Start Date: 7910
- End Date: 8009

**Funding/Performance:**
- DA
- FRC
- I-House

**Resources/Estimate:**
- Professional Man Yrs: 0
- Funds (in Dollars): 0

**Contract/Grant:**
- DA

**Performance Organization:**
- US Army Medical Bioengineering Research & Development Laboratory
- Fort Detrick, Frederick, MD 21701

**Responsibility/Organization:**
- NAME: Gensler, J.D., LTC (P)
- ADDRESS: Fort Detrick, Frederick, MD 21701
- RESPONSIBLE INVESTIGATOR:
- NAME: Dennis, W.H., Jr.

**Keywords:**
- Heavy Metals; Fixation; Cement; Silicates; Sulfides

23. (U) To make improvements in the chemical fixation process for producing the insoluble silicates or other insoluble compounds (such as sulfides) of heavy metals contained in electroplating wastes. These improvements may provide an environmentally acceptable method for landfill disposal of heavy metal wastes.

24. (U) Alterations in the existing chemical fixation process will be suggested which should result in a solid product having very low toxic metal leaching characteristics.

25. (U) 7910 - 8010. Task terminated due to equipment failure and lack of time and funds.
DETAIL SHEET

TITLE: Improved Method for Chemical Fixation of Heavy Metal Wastes by Insoluble Salts/Cement

FUNDING HISTORY: PY - OK; CY - OK; BY - OK

PROBLEM DEFINITION: To make improvements in the chemical fixation process for producing the insoluble silicates or other insoluble compounds (such as sulfides) of heavy metals contained in electroplating wastes. These improvements may provide an environmentally acceptable method for landfill disposal of heavy metal wastes.

Importance: New technology is needed for disposal of hazardous chemical wastes that are unique or relevant to Army industrial operations.

APPROACH: The present method of using cement and silicate to bind heavy metal wastes is inadequate. Alterations in this method will employ the formation of heavy metal sulfides prior to adding cement. This should result in a solid product having very low toxic metal leaching characteristics.

ACHIEVEMENTS: None. This task was terminated due to unavailability of analytical equipment and the requirement to use technician support elsewhere.

RELATIONSHIP TO CORE PROGRAM: This research supports this Laboratory's core program in the Hazardous Waste Disposal research area.
Evaluation of the Effect of an Antifoam Additive to Beef Extract Eluent on the Recovery of Enteroviruses from Water and Wastewater

005900 Environmental Biology; 010100 Microbiology; 007300 Hygiene and Sanitation

23. (U) To evaluate the effect of an antifoam additive to beef extract eluent on the recovery of enteroviruses from water and wastewater.

24. (U) The previous study indicated that the recovery of an enteric virus from polished water is improved by the addition of an antifoaming agent to the beef extract eluent. Environmental waters and other enteroviruses should also be tested before preparing for publication. A comparison of the bentonite-absorption system with the new positively-charged filters (AMF CUNO) would also benefit the study especially at minimal virus concentration. It might be of interest to determine the compound(s) responsible for "toxicity" to the recovery system.

25. (U) 7910 - 6016. Two blocks of experiments (six samples/block) were completed to test for system variability using poliovirus as a model. This was followed by an optimum antifoam study using a seeded distilled water source, then two randomized studies using a common, seeded, tap water source. By hand cleaning glassware and filter holders, the recovery of poliovirus has increased from 62.5% to 92.2% using bentonite with addition of 0.1% or 0.2% antifom B (spontaneously dried). The recovery of virus is approaching 100% (99.1 ± 5.9)
TITLE: Evaluation of the Effect of an Antifoam Addition to Beef Extract Eluent on the Recovery of Enteroviruses from Water and Wastewater

FUNDING HISTORY: PY - OK; CY - 1K; BY - 5K

PROBLEM DEFINITION: The current standard method for virus assay employs filters to trap and concentrate viruses from water environments. Foaming which occurs during elution of these viruses from the filters interferes with the assay procedure.

IMPORTANCE: Improved ability to detect virus in various waters for R&D purposes; secondarily, to reduce the physical and aerosol hazards during elution of these filters.

APPROACH: To test the effects on the recovery of various enteroviruses of adding small amounts of antifoam to the beef extract eluent.

ACHIEVEMENTS: Two blocks of experiments (six samples/block) were completed to test for system variability using poliovirus as a model. This was followed by an optimal antifoam level study using seeded distilled water source and two randomized studies using a common, seeded, tap water source. Quadratic regression analysis of the results indicated that there was a significant effect on the recovery of virus when Antifoam B was added to the eluent. By hand cleaning glassware and filter holders, the recovery of poliovirus has increased from 62.5% to 82.2% using beef extract alone. With the addition of 0.15 - 0.2% Antifoam B (sonically dispersed) to the beef extract eluent, the recovery of virus approached 100% (99.1% ± 5.3%).

RELATIONSHIP TO CORE PROGRAM: This work will provide improved capability for virus assay in the ongoing evaluation of the Reverse Osmosis Water Processing Unit (ROWPU) that this Laboratory is conducting for USAMERADCOM.
(U) Pesticide - Droplet Based Measurement

008400 Bioengineering; 005900 Environmental Biology; 002600 Biology

23. (U) The investigation of methods to accurately measure the response of insects (ticks, flies, and cockroaches) to precisely determined droplet sizes of various pesticides.

24. (U) Oscillator controlled vibrating reeds will be used to produce precisely controlled droplets of insecticides. Droplet streams of precisely determined concentration will be directed at target insects. Dose response data will be collected and the mechanism of droplet impact will be measured and documented.

25. (U) 7/16 - 8/07. Literature review was initiated and a survey of droplet generator technology was begun. Work unit was terminated because of other tasks having higher priority.
TITLE:  Pesticide Droplet Dose Measurement

FUNDING HISTORY:  PY - OK; CY - OK, BY - OK

PROBLEM DEFINITION: There is a need in an Integrated Pest Management (IPM) system to establish accurately the amounts of insecticide necessary to provide effective control of economically important insect pests. Insecticides are applied in various ways such as the application of materials to surfaces on which the pests may be found, to treated baits on which the insects feed, to the actual spraying of insecticide to effect control by direct contact between the chemical and the insect. Accurate data on the quantitative effect of droplet size (of pesticide) on various insect species is unavailable except in the case of mosquitoes. It is intended that this study will produce this kind of information. For the current investigation it is intended that the work involve the cockroach.

IMPORTANCE: The economical use of commercial pesticides is of extreme importance so that environmental effects are minimized while effective control is attained.

APPROACH: A vibrating reed or similar electrically driven device will be used to produce a precisely defined droplet stream of pesticide. The interaction of the droplets will be measured by monitoring physiological responses in the cockroach. Dose response data will be collected and analyzed and the mechanism(s) of interaction will be studied.

ACHIEVEMENTS: None, project never started and finally terminated due to a lack of funds.

RELATIONSHIP TO CORE PROGRAM: In order to use and evaluate pesticide dispersal equipment accurate means of droplet and dose measurement are required.
HEALTH STANDARDS FOR MILITARY POLLUTANTS
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- **Program Element**: 7610
- **Project Number**: U
- **Task Area Number**: AA
- **Work Unit Number**: 123 APC F691

**Title**: Screening of Munitions-Related Chemicals for Toxicity to Aquatic Organisms

**COS900 Environmental Biology - 016800 Toxicology**

**Start Date**: 7610

**Estimated Completion Date**: CONT

**In House Funds**

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**In-House Grants**

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</table>

**Principal Investigator**

- **NAME**: van der Schalie, W.I.
- **TELEPHONE**: (301) 663-7237; AUTOVON 343-7237

**Foreign Intelligence Not Applicable**

**Keywords**

- (U) Munitions; (U) Aquatic Toxicology; (U) Hazardous Wastes

**Technical Objective**

23. (U) To provide aquatic toxicity data required in conjunction with in-house and extramural research related to munitions production.

24. (U) To conduct aquatic toxicity testing through comparative screening tests and through generation of acute toxicity data; to evaluate state-of-the-art toxicity testing methods to determine applicability to research requirements; to advance the state-of-the-art in toxicity testing methods where research requirements cannot be met with existing methods.

25. (U) 7910 - 8009. A new toxicity testing facility has been completed. Tests have been initiated to measure the acute toxicity of three munitions-related materials (1,3-dinitrobenzene, 3,5-dinitroaniline, and 1,3,5-trinitrobenzene) to four species of fish and an invertebrate.
DETAIL SHEET

TITLE: Screening of Munitions-Related Chemicals for Acute Toxicity to Aquatic Organisms

FUNDING HISTORY: PY - 71K; CY - 63K; BY - 95K

PROBLEM DEFINITION: This project is designed to provide data on the toxicity of munitions-related materials to aquatic organisms. Short- and longer-term tests with several species of fish and an invertebrate will be conducted under static and dynamic water flow conditions. Effects on mortality and, in certain tests, growth and reproduction will be recorded.

IMPORTANCE: Pollution control facilities at Army ammunition plants are currently being upgraded. The type and extent of treatment required for aqueous effluents will depend greatly on the toxicity of the effluent components to aquatic life. Generation of this toxicity information will aid in assessing the environmental hazard posed by the munitions-related materials found in these effluents.

APPROACH: Preliminary screening tests include static, acute tests with fish and an invertebrate. These are followed by dynamic (flow-through) acute tests. Effects on the sensitive life stages of fish will be evaluated using a 35 day embryo-larval test. Survival, growth, and reproduction of an invertebrate will be determined in a full life cycle test.

ACHIEVEMENTS: Static, acute screening tests have been completed with four species of fish and an invertebrate. Materials tested included 1,3-dinitrobenzene, 1,3,5-trinitrobenzene, and 3,5-dinitroaniline. Of these, 1,3,5-trinitrobenzene was by far the most toxic, with 96-hour LC50's of 1 mg/L or less. Longer term flow-through tests with selected fish species have also been completed and have provided useful information on the level and kinds of effects of these compounds.

RELATIONSHIP TO CORE PROGRAM: This work is based on a request by the US Army Materiel Command for information relating to the design of waste treatment facilities. Measurements of the toxicity to aquatic organisms of various components of a waste effluent are an important part of the database required for the design of proper waste treatment techniques.
To evaluate the use of filtration/adsorption techniques for treatment of operational wastes from Army Pest Management Programs.

2. (U) The filtration/adsorption system will be taken to Fort Eustis, VA and set up within the new Fort Eustis Pest Control Facility for on-site testing. Wastewater from the Fort Eustis Facility will be collected, stored and treated by the carbon adsorption system. Effluent samples from each carbon column will be collected, analyzed at Fort Detrick's Environmental Protection Research Division Laboratory. From this data we will evaluate the performance of the absorption system.

2. (U) Laboratory tests of the carbon filtration system are complete. A recipe wastewater containing diazinon, dursban, malathion, baygon, and chlordane at a level of 1200 mg/L total pesticide has been tested. Five-hundred gallons of such wastewater may be treated and the effluent will show no diazinon, dursban, malathion, or baygon (below 1 ppm). Chlordane was found in the effluent at concentration near that of the input concentration. Aeration of the wastewater to remove volatile chlorinated solvents from wastewater did not improve performance of the adsorption system. Performance testing tests of spent carbon indicate a very low rate of pesticide removal at pH 6.2. The wastewater being generated at Ft. Eustis shows pesticide concentrations no lower than expected. The first test at Ft. Eustis showed removal of many materials except chlordane. The input water contained 16 ppm chlordane; the effluent showed 0.2 ppm. Other pesticides present in the input water were baygon (1 ppm) and dursban (1 ppm); these were absent in the effluent.
DETAIL SHEET

TITLE: Evaluation of Filtration Techniques for Disposal of Operational Wastes from Army Pest Management Programs

FUNDING HISTORY: FY - 29K; CY - 34K; BY - 67K

PROBLEM DEFINITION: To evaluate the use of carbon adsorption techniques for treatment of wastes generated by Army installation pest control facilities.

IMPORTANCE: The US Army operates pest control facilities at its installations throughout the country. Federal law places responsibility for safe disposal of pesticides and pesticide wastes on the user - DA. As a result, the Army is responsible for the safe disposal of the pesticide waste it generates.

APPROACH: The filtration/adsorption system was taken to Ft. Eustis, VA and set up within the new Ft. Eustis Pest Control Facility for on-site testing. Wastewater from the Ft. Eustis Facility was collected, stored and treated by the carbon adsorption system. Effluent samples from each carbon column were collected on-site and analyzed at Ft. Detrick’s Environmental Protection Branch Division Laboratory. From these data we will evaluate the performance of the adsorption system.

ACHIEVEMENT: Laboratory tests of the carbon filtration system are complete. A recipe wastewater containing diazinon, dursban, malathion, baygon and chlordane at a level of 1200 mg/L total pesticide has been tested. Five-hundred gallons of such a wastewater may be treated and the effluent will show no diazinon, dursban, malathion, or baygon (below 1 ppm). Chlorodane was found in the effluent at concentration near that of the input concentration. Extraction of the wastewater to remove volatile chlorinated solvents from wastewater did not improve performance of the adsorption system. Preliminary leaching tests of spent carbon indicate a very slow rate of pesticide leaching at pH 4.0. The wastewater being generated at Ft. Eustis shows pesticide concentrations much lower than expected. The first test at Ft. Eustis showed removal of all materials except chlordane. The input water contained 16 ppm chlordane while effluent showed 0.2 ppm. Other pesticides present in the input water were kethane (42 ppm) and dursban (1 ppm), those were absent in the effluent. During the second field test, the Ft. Eustis input wastewater contained less than 0.5 ppm of any of the expected pesticides.

RELATIONSHIP TO CORE PROGRAM: This research is a part of the Army’s evaluation of environmental consequence of the disposal of hazardous wastes and pesticides generated by military activities.
(U) Development and Evaluation of Criteria for Advanced Wastewater Treatment Processes at Military Installations

**Research and Technology Work Unit Summary**

- **Program Element**: 225339 Chemical Engineering; 004400 Civil Engineering; 010100 Microbiology
- **Task Area Number**: 137 APC 6044
- **Work Unit Number**: STOC 82-814

**Description**

- **Scientific and Technological Areas**: 225339 Chemical Engineering; 004400 Civil Engineering; 010100 Microbiology

**Objectives**

1. **Criteria for Advanced Wastewater Treatment Processes**
   - Provide criteria for advanced wastewater treatment processes suitable for US Army wastewater treatment plants.
   - Ensure compliance with NPDES permit limitations under PL 92-500.
   - Establish design criteria for processes with initial emphasis on organic loading rates and nitrogen removal procedures.
   - Evaluate phosphorus removal techniques and processing of resultant chemically treated effluent in relation to upgrading existing waste treatment facilities.
   - Consider the applicability of combining carbon and nitrogen oxidation processes to determine impact on upgrading US Army wastewater facilities.

2. **Pilot-scale Studies**
   - Conduct studies on selected advanced wastewater treatment processes and problems.
   - Emphasis will be placed on upgrading existing facilities, rather than attempting to develop new processes and procedures for totally new treatment plants.
   - The goal will be to satisfy NPDES permit limitations for designated pollutants, as opposed to attempting to obtain design criteria for extremely low pollutant levels.
   - Laboratory and bench-scale studies will be conducted to support pilot static operations.

**Reports**

- **Final Report**: April 1980
- **Two Final Reports Have Been Completed**: 1979
- **APC Process for Secondary Treatment and Nitrification Following a Trickling Filter**: Completed in April 1979.
- **APC Process for Secondary Treatment and Recarbonation Following Low-Level Lime Addition for Phosphorus Removal**: Completed in April 1980.

**POC**

- **DA**
TITLE: Development and Evaluation of Criteria for Advanced Wastewater Treatment Processes at Military Installations

FUNDING HISTORY: PY - 186K; CY - 117K; BY - 67K

PROBLEM DEFINITION: To evaluate phosphorus removal techniques and processing of the resultant chemically treated effluent and chemical sludges produced. The applicability of combining carbon and nitrogen oxidation processes will be evaluated to determine its impact on upgrading US Army wastewater facilities.

IMPORTANCE: The importance of this work lies in optimizing wastewater treatment processes through combining chemical/physical treatment technologies with biological processes. The goal is to improve the overall plant efficiency with minimal construction. Combining low-level lime treatment processes for phosphorus removal followed by biological recarbonation not only allows for phosphorus concentrations to meet effluent limitations, but also enhances nitrification. This research is highly-relevant to current Army problems of compliance with discharge limitations at installations. It may permit compliance by upgrading existing facilities.

APPROACH: Pilot-scale studies will be conducted on selected advanced wastewater treatment processes and problems. Emphasis will be placed on upgrading existing facilities, rather than attempting to develop processes and procedures for totally new treatment plants. The goal will be to satisfy NPDES permit limitations for designated pollutants, as opposed to attempting to obtain design criteria for extremely low pollutant levels. Laboratory and bench-scale studies will be conducted in support of pilot-scale operations.


RELATIONSHIP TO CORE PROGRAM: An agreement between USAMBRDL and USACERL has been established such that existing equipment and expertise can be used effectively in solving Army waste treatment problems.
22. (U) RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

23. (U) Three fermentors will be run in parallel. One fermentor will be a control unit being fed normal primary sludge. One fermentor will be fed a sludge resulting from commercial lime addition (magnesium impurities) while the third fermentor will be fed a sludge resulting from reagent grade lime (no magnesium). Process parameters, pH, qps, solids destruction, COD destruction, C/N and NH, will be monitored. After the acclimation occurs, sodium and/or potassium will be used as an antagonist.

24. (U) 7910 - 8009. The fermentors are currently in an acclimation period. The last year's work shows that the digesters are being inhibited most probably by light metal cations because a heavy metals scan proved negative.

(U) Anaerobic Digestion of Lime Sludge

(U) Hygiene and Sanitation; 003300 Chemical Engineering

(U) Anaerobic; (U) Digestion; (U) Lime; (U) Sludge
TITLE: Anaerobic Digestion of Lime Sludge

FUNDING HISTORY: PY - OK; CY - OK; BY - 67K

PROBLEM DEFINITION: The purpose of this project is to verify the cause of inhibition experienced in the lime sludge digestors as light metal cation toxicity and to determine the concentration of calcium and/or magnesium required to cause the inhibition. The second half of the study will investigate the possible use of sodium and/or potassium as an antagonist to reduce or eliminate the inhibitory effects of calcium and/or magnesium on the anaerobic digestion process.

IMPORTANCE: The importance of this work lies in the optimization of the anaerobic digestion of lime sludges. If the inhibition process occurring in lime digestors can be decreased, any Army wastewater treatment plant using a lime coagulation and sedimentation process can use existing anaerobic digestors, eliminating the need to construct new facilities for sludge digestion.

APPROACH: The fermentors will be run in parallel. One fermentor will be a control unit being fed normal primary sludge. One fermentor will be fed sludge resulting from commercial lime addition (magnesium impurities) while the third fermentor will be fed sludge resulting from reagent grade lime (no magnesium). Process parameters, pH, gas, solids destruction, COD destruction, CH₄ and NH₃ will be monitored. After the inhibition occurs, sodium and/or potassium will be used as an antagonist.

ACHIEVEMENTS: A technical report is being prepared on the first year's work.

RELATIONSHIP TO CORE PROGRAM: This research is part of the Army's efforts in water pollution source reduction, control, and treatment technology.
**TVEC; Task 3 Objective**

23. (U) To compare rock plastic trickling filter media demonstrating the possibility of using the plastic media for trickling filter upgrade. Plastic media could be used to replace the existing rock media to upgrade existing trickling filter plants and thereby eliminate the need to build or add on to existing Army treatment facilities.

24. (U) Three filters will be run in parallel. One filter filled with plastic media will be run at the same loading rate during the whole study as a control unit. One filter will be filled with rock media and the last filter will contain plastic media. Several loading rates will be compared. Two experiments will be run to compare filter depth effects and surface loading effects on filters of comparable media surface area.

25. (U) 7910 - 8009. Problems were encountered with trickling filter flies. The flies could not be controlled with pyrethrin aerosol sprays. The study was terminated and the trickling filter system is being redesigned.
TITLE: Plastic Media for Upgrading Existing US Army Trickling Filter Wastewater Treatment Plants

FUNDING HISTORY: PY - OK; CY - 38K; BY - OK

PROBLEM DEFINITION: The purpose of this study is to determine the possibility of using plastic media to upgrade existing trickling filters.

IMPORTANCE: Plastic media may be able to be used in place of regular rock media for trickling filter. Since plastic media has a higher surface area to volume ratio than rock media, it is possible to increase the efficiency of a trickling filter plant simply by changing the media. The Army has trickling filter plants that need upgrading. Replacing the trickling filter media is economically more attractive than building additional trickling filters or alternative treatment processes.

APPROACH: Three filters will be run in parallel. One filter filled with plastic media will be run at the same loading rate during the whole study as a control unit. One filter will be filled with rock media and the last filter will contain plastic media. Several loading rates will be compared. Two experiments will be run to compare filter depth effects and surface loading effects on filters of comparable media surface area.

ACHIEVEMENTS: A technical report is being written on the results of this work.

RELATIONSHIP TO CORE PROGRAM: This research is part of the Army's efforts in water pollution source reduction, control, and treatment technology.
23. (U) To evaluate the applicability of wastewater treatment processes for degradation of waste pesticides and rinsates generated by Army pest control facilities. Federal legislation has established that the disposal of pesticide wastes be the responsibility of the user. As a result, many Army pest control facilities do not have the capability to meet the present storage or disposal requirements. The variety of pesticides and pesticide wastes generated by the Army make this a unique effort in waste disposal.

24. (U) Initial work will involve laboratory studies to determine pesticide concentrations which can be recovered from sewage effluents and sludges. Development and modification of extraction procedures are necessary to recover the seeded pesticide and possible degradation products. Pure bacterial cultures and organisms from waste treatment processes will be used in batch degradation studies, followed by the operation of pilot-scale processes. The goal will be to demonstrate the biodegradability, inertness, or accumulation of pesticides in the wastewater treatment processes.

25. (U) 7010 - 8009. Literature review by A.D. Little will be completed by 1 Dec 80.
TITLE: Evaluation of Wastewater Treatment Processes for Disposal of Army Generated Pesticide Wastes

FUNDING HISTORY: PY - OK; CY - 12K; BY - 88K

PROBLEM DEFINITION: One objective is to determine the fate of pesticide compounds in sewage treatment processes in common use at military installations. Also, the effect of these compounds on the performance of an experimental trickling filter unit will be assessed.

IMPORTANCE: The Federal Insecticide, Fungicide and Rodenticide Act and the Resource Conservation and Recovery Act apply, respectively, to the use and later discharge of pesticidal substances by the Army. Such substances may reach sewage treatment plants through either intentional discharge or surface runoff. Thus, it is to the advantage of the Army to investigate the fate of these compounds in treatment processes and their possible toxic effect upon these processes.

APPROACH: Seven pesticide compounds, chosen for their widespread use at military installations, will be studied. These are baygon, cygon, chlordane, diazinon, dursban, malathion, and ronnel. Bench-scale settling experiments with and without flocculant will be performed using untreated wastewater and trickling filter effluent from local sources. The persistence of each compound during settling and its partition into aqueous and sediment phases will be determined. Pesticide persistence in bench-scale anaerobic sludge digestion and trickling filter processes will be studied. Pesticide effect on trickling filter performance will be assessed by measuring reductions in important wastewater parameters, in the presence and absence of the pesticides.

ACHIEVEMENTS: A research plan and research protocol for this work are in preparation.

RELATIONSHIP TO CORE PROGRAM: This research is part of the Army's evaluation of the environmental consequences of the use and discharge of pesticidal substances at military installations. Studies in this area have been requested by TRADOC and have included the development of an activated carbon system for adsorption of pesticides from contaminated wash waters.
### RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

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**A. PREMISE**

**B. CONTRACTING**

**C. DESCRIPTION**

**D. SECTOR**

**E. PROGRAM ELEMENT**

**F. PROJECT NUMBER**

**G. TASK AREA NUMBER**

**H. WORK UNIT NUMBER**

**I. AGENCY**

**J. DATE OF SUMMARY**

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**O. LEVEL OF SUMMARY**

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**S. CONTRACTOR**

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**X. CONTRACTOR**

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**TT. REPORTING**

**UU. USE IN INDEX**

**VV. SPECIFIC DATA**

**WW. CONTRACTOR**

**XX. REPORTING**

**YY. USE IN INDEX**

**ZZ. SPECIFIC DATA**

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**17. ** Evaluation of Fixation Processes for Army Hazardous Wastes

**17A. ** Scientific and Technical Areas:

- Environment and Sanitation;
- 012700 Physical Chemistry

**17B. ** Start Date:

- 2000

**17C. ** Estimated Completion Date:

- 2009

**17D. ** Funding Agency:

- DA

**17E. ** Performance Method:

- C. In-House

**17F. ** Responsible DoD Organization:

- US Army Medical Bioengineering Research & Development Laboratory
- Fort Detrick, Frederick, MD 21701

**17G. ** Performing Organization:

- US Army Medical Bioengineering Research & Development Laboratory
- Fort Detrick, Frederick, MD 21701

**17H. ** Principal Investigator:

- Kulkarni, R.K.
- (301) 663-2036; AUTOVON 345-2036

**17I. ** Associate Investigators:

- Rosencrance, A.B.

**17J. ** Keywords (Use each with security classification code)

(U) Waste Disposal; (U) Hazardous Wastes; (U) Electroplating Wastes; (U) Heavy Metals

**17K. ** Technical Objective:

- 24. To evaluate the fixation methods for the treatment and disposal of Army hazardous wastes. Sludges from Army electroplating and paint removal operations, excess laboratory chemicals and excess inorganic pesticides are examples of wastes requiring treatment to fix pollutants prior to disposal. The processes of solidification of sludges by cementation, or by microencapsulation by organic binders such as asphalt, are under consideration for detailed study.

- 25. The Tobyhanna Army Depot electroplating wastes are to be tested to eliminate hexavalent chromium and cyanides, and then fixed by using two processes: Solidification by portland cement and sodium silicate and; microencapsulation by asphalt, by Werner Pflüger volume-reduction and solidification process. The samples fixed by the two processes are to be evaluated by the toxicant extraction process developed and proposed by Environmental Protection Agency and by analysis of the heavy metals hexavalent chromium and cyanides in the leachate generated using Atomic Absorption Spectroscopy and Autoanalyzer. The results are to be compared with maximum levels indicated by Environmental Protection Agency for safe disposal in the sanitary landfill sites.

- 26. Preliminary work on asphalt-fixation was carried out under the project. The data indicates that the fixation method failed to bind the materials sufficiently to meet regulatory requirements.
TITLE: Evaluation of Fixation Processes for Army Hazardous Wastes

FUNDING HISTORY: PY - OK; CY - 53K; BY - OK

PROBLEM DEFINITION: This study involves the comparison of the relative merits of the two general fixation processes for electroplating wastes prior to disposal in sanitary landfill sites. One process is the solidification of waste sludged by cementation, and the other is the microencapsulation by an asphalt process. The prior work in this area is the microencapsulation of electroplating sludges with asphalt without any pretreatment to remove cyanides or hexavalent chromium as reported in Technical Report 7997.

IMPORTANCE: This study is of importance in determining whether the heavy metal hydroxides form insoluble silicates in the cementation process; and in the elucidation of the mechanism of the asphalt process in prevention of leachate production. Both processes are relevant to solving problems the Army presently has in disposing of hazardous wastes from industrial operations (e.g., electroplating, paint removal).

APPROACH: The experimental work consists in the pretreatment of two or more randomly selected electroplating waste sludges from Tobyhanna Army Depot, to remove cyanides and chromium, and then fix them by "Chem Fix" process and asphalt process separately. The fixed samples are then subjected to EPA leaching tests to find the conformity with the regulations to qualify as nonhazardous waste for disposal in sanitary landfill sites.

ACHIEVEMENTS: Preliminary work on asphalt-fixation was carried out under the project. The data indicates that the fixation method failed to bind the materials sufficiently to meet regulatory requirements. No comparison of the asphalt and cement methods, which was the objective of the investigation, could therefore be made. Therefore, the project was terminated and the interim report of partial results was prepared.

RELATIONSHIP TO CORE PROGRAM: Research on the fixation of hazardous wastes supports this Laboratory's Hazard Assessment Research Area in studying ways to render toxic heavy metal wastes nonhazardous according to new EPA hazardous waste regulations.
(U) Environmental Fate of Munitions Compounds

23. (U) The objective is to determine the chemical degradation and biodegradation rate constants for use in a mathematical model for prediction of the environmental fate of chemical pollutants of importance to Army munitions production.

24. (U) The rate of chemical degradation of selected compounds via photolytic, hydrolytic and oxidative pathways will be determined. The rate of microbial degradation will be determined. The rate of microbial degradation will be determined by using microbial communities indigenous to the soil of pollution. Identification of transformation products will be attempted. Adsorption of pollutants and bioaccumulation to selected microorganisms will be measured.

(U) Munitions; (U) Environmental Fate; (U) Biodegradation; (U) Hydrolysis; (U) Protolysis.
TITLE: Environmental Fate of Munitions Compounds

FUNDING HISTORY: PY - OK; CY - 102K; BY - 211K

PROBLEM DEFINITION: The objective is to determine the chemical degradation and biodegradation rate constants for use in a mathematical model for prediction of the environmental fate of chemical pollutants of importance to Army munitions production.

IMPORTANCE: Like other chemicals, the wastes resulting from the munitions manufacturing and loading processes could be subjected to federal discharge regulations. TNT (2,4,6-trinitrotoluene) and RDX (1,2,5-trinitrohexyldro 1,3,5-triazine) are manufactured at Army munitions facilities and are discharged with associated waste chemicals without significant treatment. Since wastewaters from munitions manufacturing facilities are released to the environment and since the chemical compounds contained in the wastes have the potential to affect health, it is important to define the overall environmental fate of these chemicals.

APPROACH: The rate of chemical degradation of selected compounds via photo- lytic, hydrolytic and oxidative pathways will be determined. The rate of microbial degradation will be determined by using microorganisms endogenous to the site of pollution. Identification of transformation products will be attempted. Adsorption to sediments and biosorption to selected microorganisms will be measured.

ACHIEVEMENTS: 1,3-Dinitrobenzene; 1,3,5-trinitrobenzene and 3,5-dinitroaniline were synthesized, purified and methods developed for their analysis. The two former compounds are very slow to photodegrade in water and all three are stable to hydrolysis. A new method to measure the volatility of these substances was developed and volatility of 1,3-dinitrobenzene was determined. A culture was developed which would use 1,3-dinitrobenzene as a sole carbon source, and the second order rate constant for its biodegradation was determined. 1,3,5-trinitrobenzene and 3,5-dinitroaniline would not act as sole carbon sources and appeared to be cometabolized in the presence of exogenous metabolizable nutrients. One product was recovered after the microbiological transformation of 1,3,5-trinitrobenzene and at least resulted from the transformation of the aniline compound.

RELATIONSHIP TO CORE PROGRAM: This research is a part of the Army's evaluation of the health and environmental consequences of munitions manufacture carried out by military activities.
(U) Screening of Treated Pesticide Waste Materials for Toxicity to Aquatic Organisms

23. (U) To provide data on the toxicity to aquatic organisms of treated pesticide waste materials from an Army pest control facility.

24. (U) The acute toxicity of the pesticide wastes to the water flea (Daphnia magna) before and after treatment will be determined. The efficiency of the treatment process in reducing the toxicity of the waste to this sensitive aquatic invertebrate will be evaluated.

25. (U) 7910 - 8009. Tests on pesticide wastewater were conducted before, during, and after passage through a series of six carbon columns. Overall, acute toxicity to the water flea was reduced eighteenfold by the columns, but the final effluent was slightly toxic, with a 1.34% solution killing 50% of the water fleas after 48 hours of exposure.
DETAIL SHEET

TITLE: Screening of Treated Pesticide Waste Materials for Toxicity to Aquatic Organisms

FUNDING HISTORY: PY - OK; CY - 7K; BY - OK

PROBLEM DEFINITION: Pesticide wastes are generated at Army pest control facilities. Full evaluation of an experimental carbon adsorption treatment method developed for these wastes requires both chemical analysis toxicity information on the treated wastes. Aquatic organisms receive the primary impact from the discharge of these waste materials and are protected by federal and state laws.

IMPORTANCE: Army pest control facilities around the country generate complex pesticide wastes which, under current regulatory requirements, must be treated prior to their discharge. Protection of aquatic life in bodies of water receiving such discharges is frequently a goal of both federal and state regulatory agencies. Assessment of the toxicity to aquatic organisms of these wastes is an important addition to the chemical analysis, since organisms may be affected by interactions between multiple toxicants or by the presence of a pesticide material not detected analytically.

APPROACH: The acute toxicity of the pesticide wastes to the water flea (Daphnia magna) before and after carbon adsorption will be determined. The efficiency of the treatment process in reducing the toxicity of the waste to this sensitive aquatic invertebrate will be evaluated.

ACHIEVEMENTS: Tests on pesticide wastewater were conducted before, during, and after passage through a series of six carbon columns. Overall, acute toxicity to the water flea was reduced eighteenfold by the columns. The final effluent was still highly toxic; 50% of the animals were killed by a 1.34% dilution after 48 hours of exposure.

RELATIONSHIP TO THE CORE PROGRAM: The Army is responsible for determining the health and environmental effects associated with the disposal of hazardous wastes associated with its activities. This project is related to the potential environmental effects of pesticide wastes generated at Army facilities.
CARE OF COMBAT CASUALTY
23. (U) To identify a replacement item for the biological refrigerator currently in the inventory (NSN 4110-00-707-2550) which is no longer supportable.

24. (U) An effort will be made to locate a suitable commercially produced item that will satisfy requirements or that can be made to do so with minor modification. Should that effort fail, which is unlikely, a new development effort will be undertaken - probably on contract.

25. (U) 7910 - 8009. A market survey has been conducted in depth. One commercial candidate has been selected for evaluation and a specimen procured. Manufacturer's specifications indicate that the performance of this item meets the essential characteristics of the LR. Some modification will probably be required, however, to ruggedize the item for field use.
DETAIL SHEET

TITLE: Refrigerator, Medical, Field

FUNDING HISTORY: PY - OK; CY - 11K; BY - 57K

PROBLEM DEFINITION: The biological refrigerator currently in the inventory (NSN 4110-00-707-2550) is said to be no longer supportable, primarily due to high acquisition cost.

IMPORTANCE: A refrigerator for the storage of perishable medical supplies is a necessity for field military units. The special requirements brought about by the need to store such things as whole blood and the rugged operating environment eliminate a great many commercially available units from consideration.

APPROACH: To canvas the commercial market for a machine that meets the required performance characteristics and which can be ruggedized to meet environmental and handling requirements. At the same time, consideration is to be given to reengineering of the current design to modernize it and make it more easily and cheaply procurable.

ACHIEVEMENTS: Two commercial units have been identified as possibly meeting the performance requirements although both would have to be ruggedized for field service. Specimens of these are being procured. In addition one of the currently stocked military models is being procured for evaluation of its modernization potential.

RELATIONSHIP TO CORE PROGRAM: This task is consistent with the Laboratory's mission to develop equipment specific to field medical requirements.
1. **Title:** Sterilizer, Surgical Instrument and Dressing

2. **Scientific and Technological Areas:**
   - Medical and Hospital Equipment

3. **Start Date:** 7/91
   - **Estimated Completion Date:** 8/10/93
   - **Funding Agency:** DA
   - **Performance Method:** In-House

4. **Contract Grant:**
   - **Grant No.:** DA-19-003-0001
   - **Expiration:** 7/90

5. **Responsible DOD Organization:**
   - **Name:** US Army Medical Bioengineering Research & Development Laboratory
   - **Address:** Fort Detrick, Frederick, MD 21701

6. **Performing Organization:**
   - **Name:** US Army Medical Bioengineering Research & Development Laboratory
   - **Address:** Fort Detrick, Frederick, MD 21701

7. **Principal Investigator:**
   - **Name:** Prensky, W.
   - **Address:** US Army Medical Bioengineering Research & Development Laboratory
   - **Telephone:** (301) 663-7237; AUTOVON 343-7237

8. **Foreign Intelligence:**
   - **Not Applicable**

9. **Key Words:**
   - Sterilizer, Field
   - Sterilizer, Dental
   - Sterilizer, Veterinary
   - Sterilizer, Small

10. **Technical Objective:**
    - **Approach:**
      - **Progress:**
        - 1. To identify a small table-top sterilizer to replace NSN 6530-00-782-6503, NSN 6530-00-926-4857 and NSN 6530-00-926-2022 which are no longer supportable.
      - **Approach:**
        - 2. To canvass the market for a commercial item that is suitable or that can be made so by minor modification. If this approach should fail, a new development is contemplated.
      - 25. (U) 7909 - 8009. One commercial electrically powered sterilizer unit was evaluated and found effective. The task has been placed in a holding status, however, due to a reevaluation of Battalion Aid Station requirements being performed by the Combat Developer.
DETAIL SHEET

TITLE: Sterilizer, Surgical Instrument and Dressing

FUNDING HISTORY: PY - OK; CY - 14K; BY - 51K

PROBLEM DEFINITION: Three small table-top sterilizers for field use (NSN 6530-00-782-6503, 653-00-926-4857 and 6530-00-926-2022) are of aging designs and are no longer supportable. These units serve aid stations, field dental facilities, field laboratories and the like. A need exists for a single small sterilizer, supportable in a field environment, to replace these obsolete units.

IMPORTANCE: A sterilization capability in small field medical elements such as those mentioned above is an evident necessity. The substitution of a single satisfactory item for the three separate units currently in stock will greatly improve the logistical support situation relative to this class of equipment while simultaneously allowing a move up to current technology.

APPROACH: To canvas the commercial market for item that is suitable or can be made so by minor modification. Failing this, a new development would be undertaken.

ACHIEVEMENTS: A preliminary evaluation was conducted on one commercial electrically powered unit and the results were promising. The Combat Developer advises, however, that sterilizer requirements relative to the Battalion Aid Station are undergoing study and probable revision. Since that application is of paramount importance in selection of a design, this task is now being held in abeyance pending the outcome of that review process.

RELATIONSHIP TO CORE PROGRAM: This task falls in the realm of the Laboratory's mission to provide equipment to support the practice of medicine and dentistry in a field environment.
**RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY**

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**STGQ 80-7-2; 6**

**TITLE (Provisional With Security Classification Code):**

**000500 Clinical Medicine; 009800 Medical and Hospital Equipment**

**START DATE: 7602**

**ESTIMATED COMPLETION DATE: 8309**

**FUNDING AGENCY: DA**

**PERFORMANCE METHOD: C. In-house**

**RESOURCES ESTIMATE**

- **FISCAL YEAR:**
  - **CURR:**
    - **81:**
      - **1:**
        - **1:**
          - **1:**
            - **1:**

- **CURR:**
  - **AMT:**
    - **32:**
      - **32:**
        - **32:**

**PERFORMING ORGANIZATION**

- **US Army Medical Bioengineering Research & Development Laboratory**
  - **Fort Detrick, Frederick, MD 21701**

**PRINCIPAL INVESTIGATOR**

- **Boyer, K.H., COL**
  - **(301) 663-7277; AUTOVON 343-7277**

**KIND OF AWARD:**
- **3. CUM. AMT.**

**RESPONSIBLE DOD ORGANIZATION**

- **US Army Medical Bioengineering Research & Development Laboratory**
  - **Fort Detrick, Frederick, MD 21701**

**GENERAL USE**

- **Foreign Intelligence Not Applicable**

**TECHNICAL OBJECTIVE:**

- **(U) Whole Body; (U) Diagnostic; (U) X-Ray; (U) Scanners; (U) Flying Spot; (U) Field Medicine; (U) Field Equipment**

**APPROACH:**

- **15. PROGRESS REPORT:**
  - **23.**  (U) To provide engineering assistance in evaluating new diagnostic X-ray scanners being evolved for military field use.
  - **24.**  (U) Professionally evaluate and assess new equipment as required.
  - **25.**  (U) 7910 - 8309. A contract has been let for the development of an electronic flying spot X-ray source. Several tubes have been fabricated with an electron beam deflection system externally providing vertical and horizontal scanning of the anode. Heat and gas problems have limited the life of these early models.
DETAIL SHEET

TITLE: Whole Body Diagnostic X-Ray Scanner

FUNDING HISTORY: PY - 9K; CY - 32K; BY - 142K

PROBLEM DEFINITION: Currently available radiographic equipment requires high radiation exposure to obtain diagnostic quality radiographs. In addition, these systems require a large amount of support, (chemicals, film, water, processors, etc.) as well as operator and patient shielding.

The technology exists which would permit diagnostic quality radiographs to be made with a reduction of the radiation exposure by a factor of 100.

IMPORTANCE: The importance of reducing patient and operator exposure to ionizing radiation is well documented. The elimination of the requirements for the ancillary support items (water, film, film processors, etc.) have a direct impact on support of field medicine.

APPROACH: Evaluation of a low-dose X-ray unit in a clinical environment to determine the adequacy of the image and its applicability to a mass casualty situation.

ACHIEVEMENTS: A low-dose unit was installed and evaluated at the Maryland Shock/Trauma Unit in Baltimore. The results indicate that the low-dose technique with electronic imaging would have application in a field situation. Other methods have been investigated and one approach, which appears promising, has been funded. This is a technique which uses electron beam deflection and a pin-hole columnator to provide the scanning X-ray beam. A bench model of the scanning source is scheduled for demonstration during the 2nd QTR FY81.

RELATIONSHIP TO CORE PROGRAM: The program is directly related to the Laboratory's mission of developing field medical equipment.
**RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY**

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(U) Sink Unit, Surgical, Field (HSN 6545-00-935-4056), Engineering Evaluation of 002400 Bioengineering; 009000 Medical and Hospital Equipment

**I. START DATE** 7612

**22. APPROACH. 23. PROGRESS:**

23. (U) To conduct an engineering evaluation of the field surgical sink to determine feasibility of conducting a product improvement program or a need for a new product design to eliminate field complaints.

24. (U) Prepare a testing protocol based on accrued field complaints, conduct an in-house evaluation and prepare an engineering evaluation report so that a proper course of future action can be determined.

25. (U) 7909 - 8009. A trial modification of 40 sink units has been undertaken for the purpose of evaluating the effectiveness of the "quick-fix" approach and gathering statistical and cost data on the effort required to modify all units currently in stock. This effort is expected to be completed in CY80.
DETAIL SHEET

TITLE: Sink Unit, Surgical, Field, Engineering Evaluation of

FUNDING HISTORY: PY - 15K; CY - 41K; BY - 24K

PROBLEM DEFINITION: Numerous complaints from field medical units have been received citing problems with the Surgical Field Sink (NSN 6545-00-935-4056). The complaints deal with heater burn-out and other problems. This task was undertaken to conduct an engineering evaluation of the item and determine whether a modification or a new development is necessary to correct the deficiencies.

IMPORTANCE: These sinks are used for surgical scrubbing in forward area medical units. Their high failure rate makes logistical support difficult and jeopardizes the mission of these medical units.

APPROACH: To identify the root causes of the high failure rate through extensive testing and analysis and to determine appropriate corrective action.

ACHIEVEMENTS: The principal cause of heater burn-out has been identified along with a number of other less catastrophic design and manufacturing defects. Due to the large number of these devices still in the inventory, a depot level modification has been developed which will improve the reliability of existing units. Additionally, the performance of these units, in terms of flow rate and water temperature, has been found to be less critical than originally thought. Thus, the modification of the items now in stock seems feasible if the cost can be held to a reasonable level. Forty sink units have been modified to provide statistical data on cost and time to modify those units in stock. A final report of this effort will be forwarded to OTSG for a decision.

RELATIONSHIP TO CORE PROGRAM: This task is consistent with the Laboratory's mission of providing development engineering on field medical equipment.
### RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

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#### Technical Feasibility Testing (TFT) of Pesticide Dispersal Equipment

- **23.** (U) To determine the durability of commercially available Ultra Low Volume (ULV) pesticide dispersal equipment by comparative type engineering tests. Units will be used by military medical and engineer personnel for controlling mosquito and other flying insects. Results will provide the user agencies with comparative durability data for purchase through military channels.

- **24.** (U) To determine the operational capabilities of skid mounted and special purpose ULV pesticide dispersal equipment by quantitative and qualitative methods. Measurable quantitative parameters include: particle size determination and maintenance of desired pressure and flow rate. General engineering design observations will include: corrosive effect of pesticide used during tests, verification of manufacturers' claim of performance specifications, general durability definitions as applied to mean time between breakdown, maintenance time, gas and oil consumption and definition of high mortality repair parts.

TITLE: Technical Feasibility Testing (TFT) of Pesticide Dispersal Equipment

FUNDING HISTORY: PY - 48K; CY - 64K; BY - 32K

PROBLEM DEFINITION: Continuous evaluation of the basic engineering design and durability and operational effectiveness of commercial pest control equipment.

IMPORTANCE: Yearly, new and improved commercial items are presented to DoD as potential standard items. Most of these are suitable for DoD use. Others are unfit and should not be procured. Centralized, uniform testing of these items, on a request basis, is essential to maintain state-of-the-art technology in pest control and to keep from wasting tax dollars on unacceptable equipment.

APPROACH: At the request of other DoD agencies and developing needs of military vector control programs, conduct extensive engineering and operational evaluations of designated items. These evaluations will include items such as specification design, quality assurance testings as required by specification and procurement, and individual item evaluation.

ACHIEVEMENTS: During FY80, evaluation of the following items were completed: Micro-Gen (San Antonio, TX) models CCG-1, M-16, and S-4; the Bolt (Johnson Wax Corp) E-10; and two B&G (Plumsteadville, PA) manual dusters. Initial production testing of the Londonaire, Long Lake, MN) Model XKA continued with several problem areas being uncovered. Input was provided for revision of the military specifications.

RELATIONSHIP TO CORE PROGRAM: Project involves continuous evaluation of commercially available pesticide dispersal equipment. Project provides a technology base for pest control equipment evaluation and development.
(U) Protective Containers, Field, Medical Devices

002400 Bioengineering; 009800 Medical and Hospital Equipment

23. (U) To design a family of strong, lightweight containers for fragile medical equipment that is presently authorized to field medical units.

24. (U) Identify physical characteristics of existing items to be protected. Determine similarities and then design a container or containers with various inserts to protect during handling, shipping and storage.

25. (U) 7910 - 8009. Fourteen items have been identified as needing immediate packaging. These have been procured and packaging for each designed. Drawings have been made for 10 items and container fabrication initiated.

Foreign Intelligence Not Applicable
TITLE: Protective Containers, Field, Medical Devices

FUNDING HISTORY: PY - 13K; CY - 60K; BY - 122K

PROBLEM DEFINITION: A requirement exists for a family of strong, lightweight shipping containers for fragile medical equipment issued to field medical units.

IMPORTANCE: The protection of the sensitive medical equipment is essential during loading, transportation and unloading when being deployed in field locations. This equipment, properly protected, must be available for immediate use in patient care. Unprotected, the equipment may be damaged or misaligned requiring extensive repair or recalibration.

APPROACH: Obtain medical equipment which requires packaging. These items will be tested to determine the degree of protection required. Using this information, a family of containers will be designed to protect these and other pieces of equipment. A study will also be made to increase the capacity of the existing medical equipment field chests.

ACHIEVEMENTS: Twelve items of noncontainerized commercial field medical equipment have been obtained for evaluation. Extensions have been designed to increase the capacity of the existing containers and information on packaging materials and containers has been gathered. Seven sizes of containers which will accommodate all 12 items have been designed and fabricated. Protective foam inserts have been designed and fabricated for each item and compatible with the appropriate container. Developmental testing of these containerized items will begin during the 2nd QTR FY81.

RELATIONSHIP TO CORE PROGRAM: In order to provide adequate patient care it is essential to provide equipment in working order to units in the field. This containerization program will also reduce the time spent packaging equipment developed by this Laboratory.
(U) Integrated Pest Management - Black Flies

COB, 000 Environmental Biology; 002600 Biology

(U) TECHNICAL OBJECTIVE.

23. (U) To develop a method of long-term suppression of immature stages of black flies without adverse effect on the environment. Currently, black flies seasonally restrict use of vast military training areas at several CONUS installations. Overseas, they are the primary vector of onchoceriasis or river blindness, a disease of military importance in parts of Africa, Central and South America. Effective vector control strategies will permit increased military training at the affected installations and will reduce the threat of non-combat casualties due to onchoceriasis.

24. (U) Growth regulator hormones or synthetic chemical analogues will be applied in the aquatic habitat in laboratory and field evaluations in such a manner to attach to specific substrates and with slow release action provide long lasting control. Attention will also be directed to the use of biological control agents including pathogenic protozoa, bacteria, and microsporidia. Insect pathogens on hand will be evaluated against black flies. Further, naturally occurring black fly pathogens will be collected and evaluated. Laboratory and field testing is required to develop methods for manipulation, storage, and application of these agents.

25. (U) 1970 - 800W. Successful field trials were completed during 1980 using Bacillus thuringiensis israelensis (Bti) for control of black flies. Results clearly demonstrated Bti can effectively reduce larval populations by 80% over a 1/4 mile length of stream for a week or longer. Distribution and dissipation of Bti in the test stream were maintained at acceptable concentration levels during exposure periods thus enabling Bti to be effective over long distances.
TITLE: Integrated Pest Management - Black Flies

FUNDING HISTORY: PY - 77K; CY - 98K; BY - 88K

PROBLEM DEFINITION: To develop a program of long-term suppression of black fly populations without adverse effects on the environment.

IMPORTANCE: Black flies are major vectors of onchoceriasis and rank high as military nuisance pests. In areas where onchoceriasis occurs, blindness due to this filarial infection is epidemic. In areas where large populations of black flies occur, training and marshalling areas cannot be used in presence of these pests. There currently is no effective means for control of these insects.

APPROACH: Growth regulator hormones or synthetic chemical analogues and chemical pesticides will be applied in the aquatic habitat in laboratory and field evaluations in such a manner to attach to specific substrates and with slow-release action provide long lasting control. Attention will also be directed to the use of biological control agents including pathogenic protozoa, bacteria, and microsporidia. Insect pathogens on hand will be evaluated against black flies. Further, naturally occurring black fly pathogens will be collected and evaluated. Laboratory and field testing is required to develop methods for manipulation, storage, and application of these agents.

ACHIEVEMENTS: Several successful field trials using a new commercial agent, Bacillus thuringiensis israelensis (Bti) were conducted at Holston Army Ammunition Plant, Kingsport, TN. Trials demonstrated that Bti could be effectively used over significant lengths of a stream with duration of control of 1 week or more. Control effectiveness was found not to be disrupted by stream flow characteristics or dense vegetation. Preliminary studies with nontarget organisms indicate this control strategy will not adversely affect stream fauna.

RELATIONSHIP TO CORE PROGRAM: This project is the first systematic approach to providing a vector control program for management of a medically important insect. Project is in keeping with mission for research in applied military vector control.
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2. **ESTIMATED COMPLETION DATE**

**Funding Agency**

3. **PROJECT NUMBER**

4. **PROJECT NUMBER**

**RESOURCES ESTIMATE**

5. **SUPPORT**

6. **IN-HOUSE**

**NAME**

7. **US Army Medical Bioengineering**

**ADDRESS**

8. **Research & Development Laboratory**

**FORT DETRICK, FREDERICK, MD 21701**

**RESPONSIBLE INDIVIDUAL**

9. **BOYER, K.H., COL**

**PHONE**

10. (301) 663-7277; AUTOVON 343-7277

**GENERAL USE**

11. **FOREIGN INTELLIGENCE NOT APPLICABLE**

**TECHNICAL OBJECTIVE**

12. **(U) PESTICIDE DISPERSAL EVALUATION SET**

**APPROACH**

13. **S SCIENTIFIC AND TECHNICAL AREAS**

**PROGRESS**

14. **009000 MEDICAL AND HOSPITAL EQUIPMENT; 002400 BIOENGINEERING**

**IN-HOUSE**

15. **C**

**PERFORMING ORGANIZATION**

16. **C**

**NAME**

17. **US Army Medical Bioengineering**

**ADDRESS**

18. **Research & Development Laboratory**

**FORT DETRICK, FREDERICK, MD 21701**

**PRINCIPAL INVESTIGATOR**

19. **O'CONNOR, R.J.**

**TELEPHONE**

20. (301) 663-7277; AUTOVON 343-7277

**ASSOCIATE INVESTIGATORS**

21. **NELSON, J.H.**

22. **ANDERSON, L.M.**

23. **POC: DA**

**TEXT**

(U) Pesticide Dispersal; (U) Droplet Size; (U) Insect Control; (U) EPA Requirements

23. (U) To develop a pesticide field evaluation set capable of measuring ULV droplet size and total pesticide amounts applied by military dispersal equipment utilized in insect control operations at military installations in CONUS and overseas.

24. (U) Review commercial or military sources and if search is unsuccessful, fabricate new equipment and field-evaluate for efficacy of design.

25. (U) 7910 - 8009. The PMS optical imaging droplet spectrometer (OIDS) was installed in the laboratory area of Building 1054. The ground aspirator was installed and vented to the outside so that the OIDS could be used indoors. A lease of another potential candidate droplet measuring device was negotiated so that comparison between it and the OIDS can be accomplished. The OIDS system was also rated in the field to determine its suitability in that mode. A 2 KW gasoline generator provided electrical power adequate for operation of the OIDS, the ground aspirator, and the air purge of the sampling probe.
TITLE: Pesticide Dispersal Evaluation Set

FUNDING HISTORY: PY - 28K; CY - 18K; BY - 36K

PROBLEM DEFINITION: The development of instrumentation which can accurately measure droplet size distribution in pesticide aerosols thus providing precise calibration for pesticide dispersal units.

IMPORTANCE: Accurate calibration of dispersal equipment is essential for the effective and economical usage of ULV pesticide formulations to provide protection for the soldier from disease vectors and pest arthropods. The dissemination of droplets which are too large for effective control are capable of adverse environmental effects.

APPROACH: An optical imaging aerosol droplet sizing spectrometer has been secured and has been calibrated. A ground aspirator which produces a constant speed air flow past the sampling region of the spectrometer has been secured. The aspirator will provide isokinetic conditions at the sampling region and will also enable the data processing system of the spectrometer to provide aerosol concentration information. Various nonvolatile droplet aerosols will be dispersed and information on their size distribution and propagation will be gathered.

Additional experiments are planned in which the results of the aerosol spectrometer are compared with other droplet sizing techniques (e.g., slide-wave, settling, hot wire sampler).

ACHIEVEMENTS: The PMS optical imaging droplet spectrometer (OIDS) was installed in the Laboratory. A series of tests were conducted to test correlation of OIDS with current slide-wave methodology. After refinement by the manufacturer, an initial correlation coefficient was determined. The OIDS was also successfully operated using field power sources thus demonstrating a potential for field utilization.

RELATIONSHIP TO CORE PROGRAM: An item of medical surveillance equipment which will enable the 10E entomology service units to ensure proper calibration of their ULV dispersal equipment. Program is related to the core program in the areas of medical equipment development and integrated pest management systems.
**Tactical Ambulance Adaptation, Feasibility Study of**

**Scientific and Technological Areas:**
- Bioengineering
- Medical and Hospital Equipment

**Program Elements:**
- 6277A
- 3S162772A874
- 3S162778A838
- STG 80-7,216

**Title:** Tactical Ambulance Adaptation, Feasibility Study of

**Scientific and Technological Areas:**
- Bioengineering
- Medical and Hospital Equipment

**Contract/Grant Information:**
- DA 09 6219
- 80 10 01
- Research and Technology Work Unit Summary

**Resources Estimate:**
- CUM. AMT.
- 81
- 0.8
- 56

**Performing Organization:**
- US Army Medical Bioengineering Research & Development Laboratory
- Fort Detrick, Frederick, MD 21701

**General Use:**
- Foreign Intelligence Not Applicable

**Technical Objective:**
- Conduct a study of the Army's needs in tactical ambulances and their capabilities in preparation for the next major procurement.

**Approach:**
- Initiate a study program to identify the number and type of vehicles needed, the required medical capabilities of each and the logistical implications. The results of this study will be a comprehensive requirements document.

**Progress:**
- 7910 - 8009. A West German hard mounted litter rack for the M113 has been procured and has undergone extensive testing at Fort Benning. Also, a medical equipment list for the M113 ambulance vehicle has been developed and its packaging into the vehicle is being investigated.
DETAIL SHEET

TITLE: Tactical Ambulance Adaptation, Feasibility Study of

FUNDING HISTORY: PY - 19K; CY - 51K; BY - 55K

PROBLEM DEFINITION: To assist the combat developer in determining the level of medical treatment that can practically be provided in tactical ambulances by studying items of equipment and layout of tactical vehicles for compatibility.

IMPORTANCE: The "Division 86" study, currently going on, is leaning toward expansion of the level of medical treatment in the forward area including ambulance vehicles. In view of the decision that tactical ambulances will be adaptations of combat vehicles, it becomes important to know what equipment can logically be placed in those vehicles and how well the medical personnel function with it.

APPROACH: To procure specimen tactical vehicles and equip them as medical treatment/evacuation vehicles based on guidance from the combat developer and medical consultants. These trial configurations will then be evaluated for functional practicability and the results transmitted for use in "Division 86" or other studies.

ACHIEVEMENTS: It has been determined that the M113A1 will be the principal frontline ambulance for the foreseeable future. A specimen M113A1 hull was procured, equipped with stabilized litter racks and provisioned with the medical equipment specified by the Academy of Health Sciences. The information thus generated is being assembled for presentation to the Academy for their concurrence. Plans are being made to perform the same task relative to a mobile Battalion Aid Station.

RELATIONSHIP TO CORE PROGRAM: Development of ambulance internal configuration comes under the mission of this research area to develop field medical treatment and evacuation equipment.
## Integrated Pest Management - Mosquitoes

### 23. General Use
Foreign Intelligence Not Applicable

### 24. Technical Objective
(U) To develop methods for mosquito control which integrate physical, chemical, and biological control methods, as appropriate to the target, so as to maintain effective control economically without undue damage to the environment.

### 25. Approach
(U) The mosquito problems at a US Army installation will be defined using previously accumulated data and on-site observations. Proposed strategies for control of the problems will be developed. These strategies will integrate physical, chemical and biological methods as appropriate to the problems and as appropriate to projected resources for pest control. The proposed strategies will be implemented on-site to test the integrated pest management concept as it applies to mosquitoes. Conventional pest management methods will be used as a back-up, if the proposed strategies prove ineffective.

### 26. Progress
(U) 7910 - 8009. Simulated field trials and a large number of laboratory bioassays have been conducted with four formulations of Bacillus thuringiensis israelensis (Bti) against several species of lab-reared mosquitoes at Ft. Detrick. Field trials with three formulations were conducted at Ft. Eustis, VA against natural mosquito populations. Residual activity and sedimentation rates of the various formulations are being studied. Laboratory experiments on the possibility of resistance to Bti developing in mosquitoes are underway. Data from these studies will substantiate the practicality of Bti as a larvicide for use in integrated mosquito control programs.
TITLE: Integrated Pest Management - Mosquitoes

FUNDING HISTORY: PY - OK; CY - 98K; BY - 143K

PROBLEM DEFINITION: Rapid advances are being made in insect pest management technology in the civilian sector. Among those not yet fully capitalized on by military pest management are ultra-low volume pesticide dispersal technology, controlled release and microencapsulation formulations, use of hormone analogues, and the impending availability of effective, economical biological control agents for mosquitoes and black flies. While evaluation and assimilation of some of this technology by the Army is underway, a context is needed in which to tie together conventional and developing technology into an integrated pest management system for use by the military to control mosquitoes efficiently, economically and with minimal environmental insult.

IMPORTANCE: Vector control is the only way to protect the American fighting man from many vector-borne diseases. Military medical history demonstrates that protection of troops from vector-borne diseases may be vital to the outcome of armed conflict in many parts of the world. Therefore, it is of critical importance that insect pest/vector control technology in the military be developed and maintained at the highest state-of-the-art. The requirement that insect pest management be done with minimal environmental insult in CONUS and in host countries where host-country agreements so specify focuses special attention on hormone analogues and candidate biological control agents.

APPROACH: Field study areas will be identified at which developing mosquito control technology can be evaluated for suitability for use by the Army. Of immediate interest are hormone analogues and biological control agents nearing commercial availability.

ACHIEVEMENTS: Simulated field trials and a large number of laboratory bioassays have been conducted with four formulations of Bacillus thuringiensis israelensis (Bti) against several species of lab-reared mosquitoes at Ft. Detrick. Field trials with three formulations were conducted at Ft. Eustis, VA against natural mosquito populations. Residual activity and sedimentation rates of the various formulations are being studied. Laboratory experiments on the possibility of resistance to Bti developing in mosquitoes are underway. Data from these studies will substantiate the practicality of Bti as a larvicide for use in integrated mosquito control programs.

RELATED TO CORE PROGRAM: This project is a systematic approach to developing a vector control program for management of mosquitoes. Project emphasis will be on research in applied military vector control.
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<td>(U) To obtain a low capacity radiographic apparatus suitable to meet the requirements of portable field dental units.</td>
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| 28. PROGRESS | (U) Evaluate commercial sources for a functional device that can be adapted to meet the requirements. |
|---------------|
| (U) 8005 - 8009. Commercial manufacturers were canvassed to determine compatibility with military requirements. Several candidates appear promising. Several prototypes of commercial items have been obtained for packaging and evaluation. |
DETAIL SHEET

TITLE: Apparatus, X-Ray, Dental, Field

FUNDING: PY - OK; CY - 7K; BY - 35K

PROBLEM DEFINITION: New FDA regulations preclude use of previous X-ray units in field units, necessitating investigation of new X-ray units which will meet these standards.

IMPORTANCE: Current field dental TOE units do not have an authorized/certified X-ray unit.

APPROACH: Commercial sources will be searched for devices which will meet the requirements.
### Development of Resuscitative Equipment for Mass Casualties in a Chemical Warfare Environment

#### Scientific and Technological Areas
- 002400 Bioengineering
- 003200 Chemical, Biological and Radiological Warfare
- 009800 Medical and Hospital Equipment

#### Technical Objective
To develop a portable, mechanical unit suitable for the ventilation of mass chemical warfare casualties in a contaminated atmosphere under field conditions.

#### Approach
- Design, fabricate and evaluate a unit to meet established criteria.
- 8006 - 8009. Commercially fabricated items have been ordered while in-house components have been completed. Industry canvassed for a small, lightweight air compressor operating from 24 volt DC and 110 volt AC power sources with small success. Fabrication to continue upon receipt of all component elements.

### Funding Details
- **Funding Agency:** DA
- **Estimated Completion Date:** 8206
- **Fiscal Year:** 80
- **Amount:** 37
- **CUM. AMT.:** 256
- **Address:** Fort Detrick, Frederick, MD 21701

### Performing Organization
- **Name:** US Army Medical Bioengineering Research & Development Laboratory
- **Telephone:** (301) 663-7277; AUTOVON 343-7277

### Key Words
- Resuscitation
- Chemical Warfare Casualties
- Field
- Medical Materiel
- Breathing
- Ventilation

### Additional Information
- **Principal Investigator:** Malek, J.W.
- **Associate Investigator:**
- **POC:** DA
DETAIL SHEET

TITLE: Development of Resuscitative Equipment for Mass Casualties in a Chemical Warfare Environment

FUNDING HISTORY: PY - OK; CY - 37K; BY - 256K

PROBLEM DEFINITION: No equipment exists today which can ventilate chemical warfare casualties on a mass basis. Personnel surviving an initial exposure to chemical warfare agents may exhibit failure to breathe properly and will require mechanical assistance.

IMPORTANCE: It is anticipated that chemical warfare casualties will place a heavy burden on medical field personnel. Equipment designed to handle many patients, simply and at the same time, will help both the medical personnel and improve the capability of the patient to survive.

APPROACH: Using a set of fixed parameters established for a prior piece of equipment to aid a single patient, design has been expanded to place anywhere from one to four or eight patients on a single piece of apparatus.
II. TECHNICAL OBJECTIVE. The objective of the research is to evaluate the feasibility of various methods for delivering chemical warfare medications. This includes the evaluation of existing methods and the development of new methods.

III. APPROACH. The research will be conducted through a combination of theoretical analysis and practical experiments. The methods will be evaluated based on their effectiveness, ease of use, and cost.

IV. PROGRESS. The research is currently in its initial phase. The team has started collecting data on existing methods and has begun preliminary experiments.

V. FUTURE PLANS. The team plans to continue collecting data and conducting experiments throughout the course of the project. They hope to complete the research by the end of the fiscal year.

VI. STATEMENT OF PEFORMANCE. The team has made good progress on the project. The research is on schedule and is expected to be completed on time.

VII. REVIEW. The research is reviewed annually to ensure that it is on track and meeting its objectives. The team will present their progress and any issues they encounter at each review.

VIII. TECHNICAL INVESTIGATION. The research is being conducted by a team of experts in the field of chemical warfare delivery systems. They have extensive experience in this area and are well-equipped to conduct the research.

IX. FUTURE NEEDS. The research has identified several areas where further investigation is needed. These include the development of new methods and the improvement of existing ones.

X. ACKNOWLEDGEMENTS. The research is supported by a grant from the Department of Defense. The team is grateful for their support and looks forward to reporting on their progress.

XI. CONCLUSIONS. The research has shown that there are several promising methods for delivering chemical warfare medications. Further investigation is needed to determine the most effective method.

XII. REFERENCES. The research is based on a review of existing literature and previous research on chemical warfare delivery systems. The team has referenced several key studies in their research.

XIII. APPENDIX. The team has included an appendix containing additional data and information that was not included in the main report.

XIV. SURVEY. The team has conducted a survey of experts in the field to gain insights on the current state of chemical warfare delivery systems.

XV. NOTICES. The research team has received notices from several organizations regarding the potential impact of their work.

XVI. CONTACTS. The team has established contacts with several organizations and individuals who are interested in the research.

XVII. ACKNOWLEDGEMENTS. The research team would like to thank several individuals and organizations for their support and contributions to the project.

XVIII. APPENDICES. The research includes several appendices containing additional data and information.

XIX. CONCLUSIONS. The research has shown that there are several promising methods for delivering chemical warfare medications. Further investigation is needed to determine the most effective method.
DETAIL SHEET

TITLE: Technical Feasibility Testing (TFT) of Delivery Systems for Chemical Warfare Medicaments

FUNDING HISTORY: PY - OK; CY - 10K; BY - 19K

PROBLEM DEFINITION: There are various methods/types of delivery systems to inoculate personnel with liquid medicaments. This task is to review and evaluate the various known types of systems to ascertain the best method/appliance.

IMPORTANCE: FDA regulations preclude use of multiple type drugs which may be administered by individuals. Personnel operating in a contaminated chemical warfare environment will need candidate materiel for immediate use.

APPROACH: All known commercial injecting methods or systems were searched and obtained. A list of major characteristics was prepared and each method/system will be evaluated against those characteristics to determine which method/system is the best to contain medicaments.
(U) Evaluation of Foreign Medical Materiel for Use in a Contaminated Environment

11. SCIENTIFIC AND TECHNOLOGICAL AREAS—
   003200 Chemical, Biological, and Radiological Warfare;
   002400 Bioengineering; 002900 Medical & Hospital Equipment

13. START DATE
   0001

14. PERFORMANCE METHOD
   C. In-House

15. RESPONSIBLE DOD ORGANIZATION
   NAME: US Army Medical Bioengineering
   ADDRESS: Fort Detrick, Frederick, MD 21701

16. RESPONSIBLE INDIVIDUAL
   NAME: Boyer, K.H., COL
   PHONE: (301) 663-7277; AUTOVON 343-7277

21. KEYWORDS (Enter each with security classification code)
   (U) Chemical; (U) Biological; (U) Nuclear; (U) Field Equipment; (U) Medical Materiel; (U) Evaluation; (U) Casualty Management; (U) Patient Management; (U) Treatment; (U) Handling

23. (U) To evaluate foreign medical materiel/technology/doctrine for AMEDD adoption and use in contaminated field environments. Contaminated environments including nuclear, biological and chemical warfare. Evaluation and adoption of selected foreign medical materiel/technology/doctrine can rapidly and effectively improve AMEDD's casualty management capabilities.


25. (U) 8002 - 8009. Reports on equipment and/or procedures emanating from foreign sources are carefully reviewed for potential U.S. use. Contacts with Norway made for a visit during spring of 1981 to view their current chemical warfare medical operations
TITLE: Evaluation of Foreign Medical Materiel for Use in a Contaminated Environment

FUNDING HISTORY: PY - OK; CY - 27K; BY - 13K

PROBLEM DEFINITION: Several foreign countries have developed doctrine/technology/materiel for patient handling and treatment in contaminated field environments (nuclear, biological and chemical). To improve AMEDD's casualty management capabilities rapidly and effectively, observance and evaluation of selected foreign medical materiel will be addressed.

IMPORTANCE: AMEDD's doctrine for treatment and handling of field patients is currently being upgraded. Evaluation of foreign materiel would improve, enhance, and speed-up positioning of critical materiel to field elements.

APPROACH: Intelligence documents are constantly reviewed for possible candidate materiel. Contacts initiated for a visit to selected countries by AMEDD/MRDC personnel to observe foreign doctrine/technology/materiel next spring.
(U) Technical Feasibility Testing (TFT) of Medical Equipment

002400 Bioengineering; 009800 Medical and Hospital Equipment

12. START DATE: 7903
   16. ESTIMATED COMPLETION DATE: 8309
   18. FUNDING AGENCY: DA
   22. C. In-House

23. (U) Medical Equipment; (U) Field Medicine; (U) Testing

24. (U) Specific items are evaluated for military relevancy after initiation by letter request from major commands, Military Intelligence Information Agency, or Department of Defense activities. Test protocols are written for each item evaluated and a final report written outlining specific recommendations.

25. (U) 7909 - 8012. Preliminary investigation was performed on a vital signs monitor set for high noise, high vibration environments to determine feasibility. This has since been converted to a separate task, supported by LOA, based on preliminary results. Work continues on a traction device for MUST hospital beds which originated as a nurse's suggestion.
TITLE: Technical Feasibility Testing of Medical Equipment

FUNDING HISTORY: PY - 0K; CY - 55K; BY - 20K

PROBLEM DEFINITION: To conduct an ongoing program of evaluating promising items of foreign or commercial medical equipment and instrumentation for possible application in the field. This effort also serves to maintain a technology base for the laboratory.

IMPORTANCE: From time to time new and interesting developments come to light in medical equipment having potential importance to the Army. These developments may come from the commercial market or may surface from intelligence sources. A mechanism must exist for conducting preliminary evaluations of such equipment without being driven by specific requirements.

APPROACH: To maintain an open work unit, funded at a modest level, which will permit periodic market surveys, evaluation of intelligence reports on foreign equipment, and the occasional procurement and evaluation of items of interest. The task also allows for the investigation of complaints against existing field equipment to provide a comparison base for evaluating new ideas and equipment.

ACHIEVEMENTS: Activity during the period covered consisted of work on two subtasks. One involved determining the feasibility of coming up with a vital signs monitor that would work in the high-noise, high-vibration environment of an armored vehicle or helicopter. This looked sufficiently promising to warrant moving the effort into a funded development task, which was done. The second effort, still going on, deals with evaluation of a suggestion from the field for a traction set to work with a MUST hospital bed. This item uses commercially available components.

RELATIONSHIP TO CORE PROGRAM: This task is consistent with the Laboratory's mission to develop medical field equipment.
COMBAT MEDICAL MATERIEL
11. TITLE (Provide with Security Classification Code)
(U) Evaluation of Rapid Non-Destructive Insect Detector

12. SCIENTIFIC AND TECHNICAL AREAS
002400 Bioengineering; 002600 Biology

13. START DATE
7703

14. ESTIMATED COMPLETION DATE
8005

15. FUNDING AGENCY
DA

16. IN-HOUSE
C

17. CONTRACT/GRANT

18. DATE/EFFECTIVE:

19. NUMBER:

20. TYPE:

21. KIND OF AWARD:

22. RESPONSIBLE OFFICE ORGANIZATION

23. RESPONSIBLE INDIVIDUAL

24. GENERAL USE
Foreign Intelligence Not Applicable

25. KEYWORDS (Provide each with Security Classification Code)
(U) Pest Control; (U) Insect Detector; (U) Stored Products; (U) Commodities; (U) Insect Surveillance

23. (U) To conduct evaluation of the Rapid Non-Destructive Insect Detector System developed at the U.S. Department of Agriculture, Agricultural Research Service, Stored Products Laboratory, Savannah, Georgia. This detector was developed under a research contract awarded by the Headquarters, US Army Medical Research and Development Command, Washington, DC.

24. (U) Test protocols will be developed and actual field evaluations will be conducted in US Army commodity storage warehouses to ensure that the Rapid Non-Destructive Insect Detector will effectively detect stored-products insect infestations in stored commodities.

25. (U) 7910 - 8005. The second prototype has been tested and evaluated. The results of both the first and second prototype evaluations are included in Technical Report 8001. The second prototype showed much improvement over the first prototype, but neither could meet the required performance criteria. The second prototype conceptually was technically usable and could detect three insects per pound of commodity, but other physical and mechanical problems made it operationally unacceptable.
TITLE: Evaluation of Rapid Non-Destructive Insect Detector

FUNDING HISTORY: PY - 35K; CY - 24K; BY - OK

PROBLEM DEFINITION: To develop an instrument for detection of stored product insect infestations in DoD procured food products.

IMPORTANCE: Infestation of food by insects represents a health hazard to the soldier and results in a major economic loss to DoD. Foods lose both palatability and nutritional quality when infested by insects. An instrument which can rapidly detect insect infestations will ensure an increased nutritional quality of food while reducing economic loss. This instrument can be a survey instrument for a control program for stored product insects.

APPROACH: Test protocols will be developed and actual field evaluations will be conducted in US Army commodity storage warehouses to ensure that the Rapid Non-Destructive Insect Detector will effectively detect stored-products insect infestations in stored commodities.

ACHIEVEMENTS: The second prototype has been tested and evaluated. The results of both the first and second prototype evaluations are included in Technical Report 8001. The second prototype showed much improvement over the first prototype, but neither could meet the required performance criteria. The second prototype conceptually was technically usable and could detect three insects per pound of commodity, but other physical and mechanical problems made it operationally unacceptable.

RELATIONSHIP TO CORE PROGRAM: Survey methods are important components of insect control programs. Through survey procedures control efforts can be accurately targeted. Project provided technical base for control strategies for stored-product insects.
**RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY**

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<tr>
<td>Boyer, K.H., COL</td>
<td>(301) 663-7277; AUTOVON 343-7237</td>
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<th>40. PRINCIPAL INVESTIGATOR</th>
<th>41. TELEPHONE</th>
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<tr>
<td>Patzer, N.H.</td>
<td>(301) 663-7237; AUTOVON 343-7237</td>
<td>US Army Medical Bioengineering Research &amp; Development Laboratory Fort Detrick, Frederick, MD 21701</td>
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<th>43. GENERAL USE</th>
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<td>Foreign Intelligence Considered</td>
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| 45. RESEARCH (Provide each with Security Classification Code): |
| (U) Litter Loading Device; (U) Mechanical Assist Device; (U) Personnel Assist |

<table>
<thead>
<tr>
<th>46. TECHNICAL OBJECTIVE</th>
<th>47. APPROACH</th>
<th>48. PROGRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(U) To develop a device that provides mechanical assistance in the loading and unloading of litter patients in field ambulances. Applies primarily to wheeled vehicles having high ground clearance.</td>
<td>(U) To design a mechanical litter lift device that can be permanently attached to the ambulance vehicle and which employs simple mechanical advantage, hydraulics, vehicle electrical power, or a combination of these, for motive power.</td>
<td>(U) 7909 - 8010. A draft letter requirement for this task was prepared and circulated for approval. The device is intended for use on the M886 ambulance which is due for replacement in 1983. The task is terminated because the combat developer has questioned the need for such a device.</td>
</tr>
</tbody>
</table>

1. Available to contractors upon originating agency's approval.
TITLE: Litter Loading Device, Field Ambulance

FUNDING HISTORY: PY - OK; CY - 50K; BY - OK

PROBLEM DEFINITION: A need is perceived for a device that will provide mechanical assistance in the loading and unloading of litter patients in wheeled tactical ambulances having high ground clearance.

IMPORTANCE: Loading of litter patients into high ground clearance vehicles provides a physically taxing situation. The existence of a device, attached to the vehicle, that would provide some of the lifting power necessary would enable reduction of the number of personnel required to handle litter patients and would also facilitate greater use of female personnel for such tasks.

APPROACH: To develop a type of platform lift that attaches to a field ambulance and uses either vehicle power or simple mechanical advantage devices to provide lifting assistance. Commercial lift gates are not suitable for this application.

ACHIEVEMENTS: Information has been gathered on the M886 ambulance as a candidate vehicle for this device. The combat developer, however, indicates that the M886 fleet will be replaced in the near future. The replacement vehicle has not yet been identified. For that reason, this task is being terminated for the present. It will be reestablished at a future date if requirements warrant.

RELATIONSHIP TO CORE PROGRAM: This task is ancillary to the Laboratory's basic mission of developing medical and medical-related field equipment.
MEDICAL SYSTEMS IN CHEMICAL DEFENSE
(U) Personnel Decontamination Sets, Design of

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

002400 Bioengineering; 009800 Medical and Hospital Equipment

13. FUNDING AGENCY

DA

14. PERFORMANCE METHOD

C. In-House

15. ESTIMATED COMPLETION DATE

E002

23. (U) To develop personnel decontamination sets for use by the US Army Biomedical Laboratory, Edgewood Arsenal, MD; one set for use in a fixed installation with the other unit developed for field use.

24. (U) Investigate and evaluate current decontamination practices and materials. Design, fabricate and test sets based on the data accrued from the evaluation.

25. (U) 7910-8002. Terminated for lack of progress.
TITLE: Personnel Decontamination Sets, Design of

FUNDING HISTORY: PY - 10K; CY - OK; BY - OK

PROBLEM DEFINITION: Personnel of the Biomedical Laboratory, Aberdeen Proving Ground, MD frequently exposed to chemicals are required chemical decontamination both in the field and in a fixed facility, the Toxic Exposure Aid Station (TEAS).

IMPORTANCE: Current methods of personnel decontamination are time consuming, labor and resource intensive; rendering existing materials and procedures unacceptable for use by the field Army.

APPROACH: Investigate and evaluate current decontamination practices and materials. Design, fabricate and test sets based on the data accrued from evaluation.

ACHIEVEMENTS: No progress due to lack of funding.
COMBAT MEDICAL MATERIEL
(U) Pesticide Formulations, Controlled Release, Environmentally Compatible

005900 Environmental Biology; 002600 Biology

23. (U) To identify and evaluate environmentally compatible controlled-release pesticide formulations of military relevance for use in support of tactical operations and fixed military installation pest management/vector control programs.

24. (U) Utilizing commercially prepared controlled-release pesticide formulations and carriers potentially suitable for military use, quantify release rates and degradation rates in the laboratory. Those formulations found to be best in laboratory tests will be evaluated in field tests to verify laboratory results under natural environmental conditions. Determinations both in the laboratory and in the field will be biological effectiveness, environmental compatibility, cost effectiveness, and compatibility with current standard pesticide dispersal equipment.

25. (U) 7909 - 8009. Field trials have been completed. The 10X Abate silicate formulation was effective for 9 weeks in controlling mosquito larvae in field plots. Due to analytical problems of detecting Abate in water, levels could not be monitored below 100 ppb. The Abate drops below this level within 3 to 4 days after treatment. The LC100 is less than 100 ppb.
DETAIL SHEET

TITLE: Pesticide Formulations, Controlled Release, Environmentally Compatible

FUNDING HISTORY: PY - 82K; CY - 87K; BY - 57K

PROBLEM DEFINITION: To develop and register long-lasting and environmentally compatible pesticide formulations.

IMPORTANCE: Controlled-release environmentally degradable pesticide formulations systems are needed to replace the long-lasting, broad-spectrum pesticides like DDT which have been cancelled or suspended. The current formulations of new compounds are short-lived and have relatively short shelf life, thus are overall militarily less acceptable. These shortcomings can be overcome through application of a controlled-release formulation. This should result in reduced pesticide use, an important aspect of military vector control programs.

APPROACH: The controlled-release pesticide formulation system envisions the formulation of pesticides into carriers having chemical or physical characteristics which release the pesticide at a predetermined rate into the environment so that, after a given time, the pesticide and carrier are completely degraded.

ACHIEVEMENTS: Experimental trials in Arkansas rice fields were successfully completed. Using an Abate formulation, effective control was obtained for 2 months. Data has been correlated to laboratory trials with field trials being similar to expected values as derived from laboratory results.

RELATIONSHIP TO CORE PROGRAM: This project is involved in evaluation and field testing of several new pesticide formulations. Outcome will provide the military with a new series of effective pesticides which are registered for medically important arthropods.
RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

(U) Field Clinical Analysis System

009800 Medical and Hospital Equipment; 010100 Microbiology

23. (U) To develop through exploratory studies field medical devices and laboratory equipment for clinical analysis of body fluids within Army field medical units.

24. (U) A problem definition study will be conducted to determine functional requirements of a field system. Lightweight self-contained, ruggedized and modular components will be developed to satisfy the identified requirements.

25. (U) 7910 - 8009. A list of test requirements has been developed. A survey of commercial equipment will be conducted to determine which requirements can be satisfied and which items can meet field needs.
TITLE: Field Clinical Analysis System

FUNDING HISTORY: PY - 5K; CY - 22K; BY - 121K

PROBLEM DEFINITION: To develop a modular, portable and integrated clinical analysis system for the determination of clinically important body fluid parameters in a field environment.

IMPORTANCE: Currently used equipment is a mixture of various commercial equipment which has not been designed to operate in the field. Additionally, the use of different manufacturer's equipment for the same determination increases the logistic, training and maintenance problems.

APPROACH: A determination of the various tests and location in the medical care chain will be determined. A survey of the procedures available to make the desired test will be made. Then a system will be developed which will use common procedures for as many tests as possible and which will provide a modular and integrated system.

ACHIEVEMENTS: Two lists of tests, one for "sick-call" and one for combat casualties have been obtained and compared for duplication. The tests have been grouped according to the determination method used. A survey of commercial items is underway.

RELATIONSHIP TO CORE PROGRAM: The program is directly related to the laboratory mission of developing field medical equipment.
COMBAT MEDICAL MATERIEL
(U) Cold Injury Rapid Rewarm and Treatment System, Prototype Design and Fabrication

DO9800 Medical and Hospital Equipment; 002400 Bioengineering

START DATE 7303
ESTIMATED COMPLETION DATE 8010
Funding Agency DA
Performance Method C. In-House

Responsibility

NAME: US Army Medical Bioengineering
Research & Development Laboratory
Address: Fort Detrick, Frederick, MD 21701

Responsibility Individual

NAME: Boyer, K.H., COL
TELEPHONE: (301) 663-7277; AUTOVON 343-7277

General Use

Foreign Intelligence Considered

POC: DA

Technical Objective:

23. (U) To locate from commercial sources, or alternatively develop and evaluate, a device for the rapid rewarming of frozen human extremities. The device must operate on the principle of immersion or spray with an aqueous solution at a controlled temperature and must have the capability of producing its own water supply from melting snow or ice by internal or supplementary heating. The item must be suitable for use in the forward areas of arctic field operations.

24. (U) Search the commercial market for a suitable design, contract for the development and fabrication of prototype units and conduct development testing on the items thus obtained. Major technical barriers are to achieve the required capabilities in a unit light enough and small enough for field use and utilize a safe and supportable power source for its operation.

25. (U) 7909 - 8003. Task terminated by IPR. Changing medical doctrine has eliminated the need for this equipment in forward areas. Adequate cold injury treatment equipment already exists at rear area medical facilities.
TITLE: Cold Injury Rapid Rewarm and Treatment System, Prototype Design and Fabrication

FUNDING HISTORY: PY - 3K; CY - 7K; BY - OK

PROBLEM DEFINITION: To provide a means of quick-thawing of frozen human tissue in forward areas of arctic and sub-arctic operations. The effort is directed primarily to the treatment of cold injuries to the extremities of field personnel.

IMPORTANCE: Cold region field medical units at the battalion aid and clearing station level are not currently equipped to provide the controlled temperature fluid bath required in the treatment of cold injuries. Thus, treatment cannot be provided below the level of the combat support hospital.

APPROACH: To develop a small controlled temperature bath device that either utilizes available electric power or has a self-contained heat source.

ACHIEVEMENTS: The original requirement called for a device that would accommodate an entire human limb. A prototype was built but was rejected due to the high electric power consumption of such a large bath and the safety consideration whereby an adequate electrical ground is difficult to obtain in the arctic. Requirements were revised to cover treatment of a hand or foot and a propane gas fired unit was developed with fuel supply and regulation circuits self-contained. Two prototype units were built and engineering tests indicated the design was viable. However, medical doctrine has recently been revised to prohibit treatment of cold injuries forward of the combat support hospital and the requirement for these devices has been officially deleted. The task has, accordingly, been terminated.

RELATIONSHIP TO CORE PROGRAM: This device comes under the mission of this Laboratory and research area to develop medical treatment equipment for field use.
(U) Sprayer, Powered, ULV, Portable

009300 Medical and Hospital Equipment; 002400 Bioengineering

23. (U) To identify a commercially available, lightweight, durable, portable unit capable of dispersing ULV pesticide formulations. This unit would be used by preventive medicine personnel in combat zones and CONUS for controlling disease vectors and pest arthropods.

24. (U) A review of commercially available portable ULV units will be made. Suitable units will be field evaluated. After entomological feasibility has been established, modifications, if necessary, will be made and formal testing coordinated with responsible agencies.

25. (U) 7910 - 8009. Development testing of gasoline engine driven and battery-powered units completed. A gasoline-engine model made by the Micro-Gen Corporation has been selected as the most promising unit. Operational testing will be conducted during March 1981.
TITLE: Sprayer, Powered, ULV, Portable

FUNDING HISTORY: PY - 0K; CY - 66K; BY - 36K

PROBLEM DEFINITION: To evaluate commercial hand-held ULV sprayers for adoption of an acceptable item into TOE units.

IMPORTANCE: Previous experiences in Southeast Asia and the Mideast have demonstrated the devastating effect outbreaks of arthropod-borne diseases can have on field operations. Many outbreaks start from a small localized area, too big for a field sanitation team to handle but too small for efficient treatment using current Corps equipment. To fill this technical gap, a small portable ULV sprayer could be used for local control of flies and mosquitoes.

APPROACH: To evaluate several commercially available hand-held, ULV sprayers which are either gasoline engine driven or battery powered. Units which pass engineering criteria will be subjected to NDI strategy.

ACHIEVEMENTS: Feasibility/Developmental testing of gasoline engine driven and battery-powered units completed. A gasoline engine model made by the MicroGen Corporation (San Antonio, TX) for the Navy has been selected as a more promising item.

RELATIONSHIP TO CORE PROGRAM: Project involves engineering and operational evaluation of insecticide dispersal equipment for inclosure in TOE of field medical units.
**RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY**

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**TITLE:** Bag, Patient Holding and Evacuation, Prototype Design and Fabrication

**SCIENTIFIC AND TECHNOLOGICAL AREAS:**
- Medical and Hospital Equipment
- Bioengineering

**START DATE:** 7304

**ESTIMATED COMPLETION DATE:** 8209

**FUNDING AGENCY:** DA

**C. In-House**

**RESOURCES ESTIMATE:**
- 6.0
- 0.3
- 20

**AMOUNT:**
- 81
- 0.2
- 16

**U.S. Army Medical Bioengineering Research & Development Laboratory**
- Fort Detrick, Frederick, MD 21701

**PRINCIPAL INVESTIGATOR:**
- Prensky, W.C.
- Telephone: (301) 663-7277; AUTOVON 343-7277
- Social Security Account Number: 21.76.0000

**ASSOCIATE INVESTIGATORS:**
- Conway, W.H.

**FOREIGN INTELLIGENCE CONSIDERED:**
- (U) Evacuation Bag; (U) Arctic Medicine; (U) Cold Climate Medical Material; (U) Patients, Transportation of

**TECHNICAL OBJECTIVE:**
- To develop a patient holding and evacuation system capable of maintaining casualties of desired, controlled temperatures in extreme cold climates for prolonged periods. Currently available evacuation bags cannot adequately maintain cold climate patients at required temperatures.

**APPROACH:**
- Design and fabricate developmental prototypes based upon previous engineering effort. Existing state-of-the-art materiel will be used. Major technical barrier is to achieve required temperature duration capability with required lightweight characteristics.

**PROGRESS:**
- Serious functional problems have developed with the prototype units necessitating cancellation of OT. The entire propane/thermoelectric concept is being reevaluated.

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DETAIL SHEET

TITLE: Bag, Patient Holding and Evacuation, Prototype Design and Fabrication

FUNDING HISTORY: PY - 18K; CY - 20K; BY - 16K

PROBLEM DEFINITION: The present means of protecting sick and injured personnel in cold environments from additional complications resulting from exposure to the cold is inadequate from the point of infliction through the evacuation system.

IMPORTANCE: Protection against exposure to cold must be provided through the evacuation organization until the patient can be moved by a temperature-controlled transportation medium or definitive treatment begins.

APPROACH: After problem definition, a number of proposals were evaluated before awarding a contract for prototype propane or propylene-fired heated liners to be placed inside medical evacuation bag. A second contract was awarded for prototypes of smaller, belt-mount versions of this system.

ACHIEVEMENTS: Operational problems have developed with the propane power units and associated plumbing. This has led to a reevaluation of the entire concept and different methods of providing heat to the bag are under study, as is the possibility of salvaging the propane units by means of redesign.

RELATIONSHIP TO CORE PROGRAM: This task is consistent with the Laboratory's mission to develop medical field treatment and evacuation equipment.
RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

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<th>C. Summary Act</th>
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- 63732A
- 64717B

B. CONTRACT/GRA

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I. TITLE

(U) U.S. Army Hi-Speed Mini Sterilizer

II. SCIENTIFIC AND TECHNOLOGICAL AREAS

- 010100 Microbiology; 009800 Medical and Hospital Equipment

III. START DATE

- 7607

IV. ESTIMATED COMPLETION DATE

- 8003

V. FUNDING AGENCY

- DA

VI. PERFORMANCE METHOD

- In-House

VII. CONTRACT/GRANT

- DA

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VIII. RESPONSIBLE DOD ORGANIZATION

- US Army Medical Bioengineering Research & Development Laboratory
  - Fort Detrick, Frederick, MD 21701

<table>
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<tr>
<th>A. Name</th>
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<tr>
<td>Prensky, W.C.</td>
<td>Fort Detrick, Frederick, MD 21701</td>
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IX. RESPONSIBLE INDIVIDUAL

- Boyer, K.H., COL
  - (301) 663-7277; AUTOVON 343-7277

X. GENERAL USE

- Foreign Intelligence Not Applicable

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<th>A. Technical Objective</th>
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<td>(U) Sterilizing; (U) Field Equipment; (U) Medical; (U) Engineering Evaluation; (U) Field Sterilizers; (U) Emergency Sterilizer</td>
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<th>B. Approach</th>
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<td>(U) To conduct an engineering evaluation of an improved emergency sterilizer.</td>
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<th>C. Progress</th>
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<td>(U) Conduct UT II and OT II testing on the second generation Mini Sterilizers.</td>
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<tr>
<td>(U) 7909 - 8007. IPR recommended sterilizer for type classification. Technical Data Package completed and transmitted to OTSG.</td>
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POC: DA
DETAIL SHEET

TITLE: US Army Hi-Speed Mini-Sterilizer

FUNDING HISTORY: PY - 18K; CY - 38K; BY - OK

PROBLEM DEFINITION: A requirement exists for a rapid sterilization capability not existent in US Army field medical treatment facilities.

IMPORTANCE: AMEDD must be prepared to provide material of guaranteed sterility when urgently required at the operating room level of field medical treatment facilities. This requirement applies to items contaminated during a procedure, items having unique value, items in limited supply or items whose need could not be foreseen.

APPROACH: A series of contracts starting with a problem definition study, then first prototype design and finally 12 prototypes intended for ultimate type classification.

ACHIEVEMENTS: Unit has been accepted at IPR for type classification, necessary documentation has gone forward and the task stands completed insofar as this Laboratory's involvement is concerned.

RELATIONSHIP TO CORE PROGRAM: This task relates to the mission of the laboratory to develop field medical equipment and apparatus.
I. TITLE: Field Optometry Set, Field, Combat

II. SCIENTIFIC AND TECHNICAL AREA:

009800 Medical and Hospital Equipment; 002400 Bioengineering

III. START DATE: 7405

IV. ESTIMATED COMPLETION DATE: 8109

V. CONTRACT/GRANT:

A. DATE/EFFECTIVE: 80

B. NUMBER: 1.0

C. TYPE: 1.0

D. KIND OF AWARD: 1.0

E. RESOURCES ESTIMATE: 1.5

F. PROFESSIONAL MAN-YRS: 108

G. FUND (in thousands): 24

H. CUM. AMT.: 81

VI. RESPONSIBLE GO/Organization:

NAME: US Army Medical Bioengineering Research & Development Laboratory

ADDRESS: Fort Detrick, Frederick, MD 21701

VII. RESPONSIBLE INDIVIDUAL:

NAME: Boyer, K.H., COL

ADDRESS: Fort Detrick, Frederick, MD 21701

VIII. FOREIGN INTELLIGENCE:

Not Applicable

IX. TECHNICAL OBJECTIVE:

(U) To modernize and update the field optometry set and to replace components which are no longer available from commercial sources with new designs.

24. Design and fabrication of engineering development prototypes for Developing Test (DT II) and Operational Testing (OT II).

25. 'U) 7910 - 8009. All components have been obtained and packaged. A chair was designed around a #3 medical chest with reduced weight and volume. OT II was conducted during 4th Quarter FY80 with no major problems. Awaiting test report.
TITLE: Optometry Set, Field, Combat

FUNDING HISTORY: PY - 69K; CY - 108K; BY - 24K

PROBLEM DEFINITION: To modernize and update the Field Optometry Set and to replace components which are no longer available from commercial sources with new designs.

IMPORTANCE: A functional optometry set is required for the use of optometry personnel assigned to the medical battalion providing division level medical support and other teams providing optometry services.

APPROACH: To design and evaluate engineering prototypes for test, technical data packages and type classification.

ACHIEVEMENTS: The basic chair included with the optometry equipment has successfully completed DT II and OT II. The chair has been redesigned to pass OT II. An augmentation set has been combined with the optometry set. The complete optometry set has successfully completed OT III. Final drawings are being produced for type classification.

RELATIONSHIP TO CORE PROGRAM: The Optometry Set is an integral part of the medical materiel program.
<table>
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<td>32. FORT DETRICK, FREDERICK, MD 21701</td>
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</table>

<table>
<thead>
<tr>
<th>33. RESPONSIBLE INDIVIDUAL</th>
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<tbody>
<tr>
<td>34. NAME: Boyer, K.H., COL</td>
</tr>
<tr>
<td>35. TELEPHONE: (301) 663-7277; AUTOVON 343-7277</td>
</tr>
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<table>
<thead>
<tr>
<th>36. MODIFICATION ORGANIZATION</th>
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<tbody>
<tr>
<td>37. NAME: US Army Medical Bioengineering</td>
</tr>
<tr>
<td>38. ADDRESS: Research &amp; Development Laboratory</td>
</tr>
<tr>
<td>39. FORT DETRICK, FREDERICK, MD 21701</td>
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<table>
<thead>
<tr>
<th>40. PRINCIPAL INVESTIGATOR (Provide SLC with Security Classification Code)*</th>
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<tbody>
<tr>
<td>(U) Helicopter Rig; (U) Solid Dispersal; (U) Aerial Applications; (U) Mosquito Control; (U) Solid Insecticide</td>
</tr>
</tbody>
</table>

23. (U) To identify a suitable commercial, helicopter slung, dispersal unit for applying solid formulations of insecticides, which would: (a) be capable of dispersing insecticides when slung beneath a helicopter; (b) require no modification of the aircraft; (c) be capable of applying adequate swath widths and deposition rates for controlling disease vectors in combat situations or CONUS.

24. (U) A Simplex spreader was evaluated with various pesticide formulations under a variety of conditions and was found to be unsatisfactory due largely to the vertically actuated gate system. A Chadwick, Inc. applicator, with horizontally actuated gate system, was procured and modified for remote control operation. Feasibility and military adaptability will be established under field conditions.

25. (U) 7910 - 8009. Modification of Chadwick unit is in progress. Development Testing II and Operational Testing II will be completed during FY81.
TITLE: Pesticide Dispersal Unit, Solid, Helicopter Slung

FUNDING HISTORY: PY - 41K; CY - 26K; BY - 57K

PROBLEM DEFINITION: To adapt a commercial item capable of dispensing solid pesticide formulations for use in the military operation environment.

IMPORTANCE: Medical personnel engaged in field operations need the capacity for aerial dispersal of solid pesticide formulations to ensure rapid treatment of large areas inaccessible by ground equipment but too small for efficient use of larger aerial dispersal equipment. Currently, field units have no item of equipment with the capability although their mission and TOE require it.

APPROACH: A commercially available spreader which is slung beneath a helicopter on the helicopter's cargo hook is being adapted for military use.

ACHIEVEMENTS: A Chadwick (Beaverton, OR) granular spreader has been upgraded to correct problems uncovered during OT I. This item is currently undergoing DT to ensure readiness for OT II.

RELATIONSHIP TO CORE PROGRAM: Project involves evaluation and modification of commercial unit as a military standard item. Item will replace current obsolete standard TOE item. Project is in concert with pest control equipment program.
(U) Environmental Protection Containers for Medical Supplies

12. SCIENTIFIC AND TECHNICAL AREAS

009800 Medical and Hospital Equipment; 002400 Bioengineering

23. TECHNICAL OBJECTIVE. (U) To develop a container to protect freezable military medical items in an Arctic environment.

24. (U) Design, fabricate and evaluate a container to meet the requirements of Arctic use.

25. (U) 7909 - 8009. New prototype fabricated and development testing completed. Item now meets the "8 hours without power" criterion that was at issue with the first iteration. Prototype is now undergoing a belated maintenance evaluation which may result in some minor modification.
TITLE: Environmental Protection Containers for Medical Supplies

FUNDING HISTORY: PY - 43K; CY - 63K; BY - 10K

PROBLEM DEFINITION: To provide a means of storing biologicals which are subject to damage by freezing during field operations in arctic or sub-arctic regions.

IMPORTANCE: The present lack of a dedicated piece of equipment to cope with this problem has led to spoilage of large quantities of biological materials in Alaska. Present methods of preserving freezables are makeshift and totally inadequate.

APPROACH: To develop a light-weight, insulated chest that includes electrical strip heaters and a temperature control circuit. This chest, issued to appropriate field units, would be dedicated to the storage and preservation of freezable medical materials. The chest is also to be designed to protect freezables during several hours of unpowered transport.

ACHIEVEMENTS: Two prototype units have been constructed and have been subjected to OT I and II and OT I and II. Since the previous test sequence, an additional inch of insulation has been added to the design to extend the unpowered survival time. The results of that modification have been presented to an IPR and deemed acceptable. The technical data package is being prepared and a maintenance evaluation is being scheduled for the near future. Any recommendations arising from that evaluation will be incorporated into a final prototype and tested prior to going on to type classification.

RELATIONSHIP TO CORE PROGRAM: This equipment performs an ancillary function related to medical treatment in a field environment. The development of field treatment is a primary function of this research area.
RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

(U) Cabinets, MUST, Redesign of

SCIENTIFIC AND TECHNICAL AREAS:

009000 Medical and Hospital Equipment; 004400 Containers and Packaging

17. CONTRACT/GRANT

18. RESOURCES ESTIMATE

19. PERFORMANCE METHOD

20. RESPONSIBLE DOD ORGANIZATION

21. GENERAL USE

22. REVIEWED (Provide DoD with Security Classification Code)

(U) Cabinets; (U) Tables; (U) MUST; (U) Field Containers; (U) Combat Support Hospital

23. TECHNICAL OBJECTIVE:

24. APPROACH:

25. PROGRESS (Provide all paragraphs identified by number. Present text of each with security classification code.)

26. (U) To redesign and develop new cabinets for the MUST Combat Support Hospital to reduce weight, procurement costs, and number of different sizes.

27. (U) Design and fabricate new cabinets and evaluate for acceptance.

28. (U) 7310 - 7909. All design completed. Drawings are completed for all cabinetry except the pharmacy/narcotics cabinet which is in the works. Some drawings previously submitted to DPSC are being revised, at their request, for the convenience of small vendors not accustomed to the latest drawing format. Task is essentially complete.
DETAIL SHEET

TITLE: Cabinets, MUST, Redesign of

FUNDING HISTORY: PY - 80K; CY - 102K; BY - OK

PROBLEM DEFINITION: Cabinets and utility tables currently in use with the MUST hospital system are too costly to procure. The intent of this task is to redesign the family of cabinets and tables to reduce fabrication cost and number of different cabinet sizes.

IMPORTANCE: In order to preserve the viability of the MUST concept, it is important to keep the cost of items used in that system to a minimum. The cabinetry in the MUST system represents a substantial cost item.

APPROACH: To perform a value engineering study on the existing cabinetry with emphasis on reducing the number of different types and sizes of cabinets, simplifying construction techniques, and reducing weight where possible. Prototypes of the redesigned items will then be built to demonstrate the techniques involved.

ACHIEVEMENTS: This task has been completed. The family of cabinets were redesigned in structure and some functions were consolidated to eliminate some of the out-sized items. A drawing package has been prepared to reflect the redesign and has been transmitted to DPSC for procurement action.

RELATIONSHIP TO CORE PROGRAM: The cabinetry referred to is medical specific so this task falls within the scope of the Laboratory's mission to develop field medical equipment.
**RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY**

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- **Project Number:** 64717A
- **Primary:** 354647170832
- **Secondary:** 354647170832
- **Contract:** CARDS 1423R

**Title:** Chair, Dental Operating, Portable

**Program Area:** US Army Medical Bioengineering Research & Development Laboratory

**Task Area Number:** CA

**Task Number:** 00

**PERFORMANCE METHOD**

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**START DATE:** 7610

**ESTIMATED COMPLETION DATE:** 8109

**FUNDING AGENCY:** DA

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**CUM. AMT:** 81

**Responsible for Organizational:**

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**PRINCIPAL INVESTIGATOR:**

<table>
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<tr>
<th>Name:</th>
<th>Malek, J.W.</th>
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<tbody>
<tr>
<td>Telephone:</td>
<td>(301) 663-7277; AUTOVON 343-7277</td>
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**GENERAL USE:**

| Foreign Intelligence Not Applicable |

**Keywords:** (Provide each with Security Classification Code)

- **Chair:** (U) Dental Chair; (U) Dental Operating; (U) Portable Chair

**Technical Objective:**

23. (U) To design and fabricate a new portable dental operating chair for Army field use, incorporating lightweight materials.

24. (U) Design, fabricate and evaluate a suitable chair.

25. (U) 7910 - 8009. Redesign to eliminate deficiencies were completed and prototype subjected to supplemental OT II evaluation. Prototype successfully completed this evaluation and forwarded to user test site for supplemental OT testing (1 Oct-15 Nov 80).
TITLE: Chair, Dental Operating, Portable

FUNDING HISTORY: PY - 85K; CY - 65K; BY - 21K

PROBLEM DEFINITION: A need exists to replace the current Chair and Stool Unit, Dental Operating, Portable (NSN 6520-00-181-7349) with an item which will provide essentially the same professional/operational capabilities but which will be less costly, require less maintenance/repair support, be lighter in weight and require less storage/transportation space.

IMPORTANCE: The current standard chair and stool unit has become extremely costly to procure. The current estimated cost (from one response only) has tripled since the standard item was placed into the supply system. In addition, the combat readiness and reliability of the chair is low, primarily due to the high repair rate to correct malfunctions of the hydraulic control systems. Nonportability is difficult because the weight and bulk exceed the transportability for the normal two-person user team.

APPROACH: Review of possible commercial sources revealed that none met the characteristics established by the Letter Requirement (LR). A design and fabrication was accomplished by an in-house effort.

ACHIEVEMENTS: Prototype subjected to additional development testing (DT IIA) and another maintenance evaluation by USAMMA. Both were successfully concluded. In June 1980, prototype forwarded to the 4th Mechanized Infantry Division, Ft. Carson, CO for operational testing (OT IIA). Testing was initiated on 30 Sep 1980.
(U) Light Trap, Portable, Mosquito

13. SCIENTIFIC AND TECHNOLOGICAL AREAS: D09800 Medical and Hospital Equipment; D02400 Bioengineering; D05900 Environmental Biology

14. START DATE: 7904
15. ESTIMATED COMPLETION DATE: 8003
16. FUNDING AGENCY: DA
17. PERFORMANCE METHOD: C. In-House

18. RESOURCES ESTIMATE:

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19. PROFESSIONAL MAN. | 40
20. FUND (in thousands) | 5

21. RESPONSIBLE DOD ORGANIZATION:

NAME: US Army Medical Biomedical Research & Development Laboratory
ADDRESS: Fort Detrick, Frederick, MD 21701

22. PERFORMER ORGANIZATION:

NAME: US Army Medical Biomedical Research & Development Laboratory
ADDRESS: Fort Detrick, Frederick, MD 21701

23. TECHNICAL OBJECTIVE:

23. (U) To develop a portable battery-operated mosquito light trap for use in disease vector and pest mosquito surveys. This will replace the standard light trap set (NSN: 6545-00-089-3766) which has proven unsatisfactory for field use.

24. (U) Design and fabricate a suitable portable mosquito light trap and conduct field evaluation in various habitats.

25. (U) 7910 - 8003. Per results of IPR on 20 Feb 1980 light trap will be standardized under NSN 3740-01-010-8578. Project has been completed.
DETAIL SHEET

TITLE: Light Trap, Portable, Mosquito

FUNDING HISTORY: PY - 40K; CY - 5K; BY - 0K

PROBLEM DEFINITION: To develop a new DC powered, portable mosquito light trap with associated accessories to replace the current miniature light trap and standard trap set.

IMPORTANCE: Portable, DC powered light traps are used in remote areas to assess mosquito populations, determine control effectiveness, and collect live specimens for arbovirus surveillance. In a fluid, combat situation where locations are both remote and frequently changing, a self-contained trap set using DC power is essential for surveillance. All IPM programs have their fundamental basis in surveillance to determine when and if control is needed and effectiveness of control.

APPROACH: A portable DC powered light trap using solid state circuitry to control operations is the core of this system. Because of the electronic system, the trap need only be visited once a day to operate, unlike current traps which require visits twice a day. By using more efficient motors, fans, and lamps, the total collection of the individual trap will be increased. The traps will be grouped in sets of six with sufficient accessories provided to maintain the system in the field indefinitely assuming availability of either standard D-cell batteries or an AC source for operation of the gel-cell battery charger.

ACHIEVEMENTS: Item was recommended for standardization in March 1980. Trap is currently being assigned an NSN with procurement actions being initiated.

RELATIONSHIP TO CORE PROGRAM: The light trap is a medical item used for vector surveillance. Equipment support of this surveillance relates two-fold with the core program. Primarily the trap is intended for TOE Preventive Medicine Units. Secondarily, the trap will become an important item for the surveillance requirements of an integrated pest management program.
RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

I. PROJECT NUMBER
DA 64717A

II. PROJECT NUMBER
35467170532

III. TASK AREA NUMBER
BA 041 APC F573

IV. CONTRACTOR NUMBER
00

V. CONTRACTOR ACCESS
YES

VI. WORK UNIT NUMBER

(U) LOW CAPACITY RADIOGRAPHIC SYSTEM, FIELD

19. SCIENTIFIC AND TECHNOLOGICAL AREA
003500 Clinical Medicine; 009800 Medical and Hospital Equipment

20. START DATE
7901

21. ESTIMATED COMPLETION DATE
8209

22. FUNDING AGENCY
DA

23. PERFORMANCE METHOD
C. In-House

30. RESOURCES ESTIMATE
80

31. A. PROFESSIONAL MAN YRS
0.2

32. B. FUNDS (in thousands)
12

33. CUM. AMT.
81

34. 1.1

35. 77

51. CONTRACT/GRANT

52. EFFECTIVE:

53. EXPIRATION:

54. NUMBER:

55. TYPE:

56. AMOUNT:

57. KIND OF AWARD:

58. RESPONSIBLE ADO ORGANIZATION

59. NAME:
US Army Medical Bioengineering Research & Development Laboratory

60. ADDRESS:
Fort Detrick, Frederick, MD 21701

61. RESPONSIBLE INDIVIDUAL

62. NAME:
Boyer, K.L., COL

63. TELEPHONE:
(301) 663-7277; AUTOVON 343-7277

64. GENERAL USE

65. FOREIGN INTELLIGENCE NOT APPLICABLE

66. KEYWORDS

67. TECHNICAL OBJECTIVE

68. APPROACH

69. PROGRESS

70. (U) X-RAY; (U) FIELD MEDICINE; (U) FIELD EQUIPMENT

23. (U) To identify suitable low capacity radiographic system to include film processor(s) and compatible film(s), cassettes and other operating accessories for AMEDD usage (except dental).

24. (U) Search existing industrial sources for functional devices that can be adopted. If none are available, modify, design or contract for the design of new devices.

25. (U) 7910 - 8009. A survey of commercial processing units was made. None would satisfy the letter requirement. A wet processor assembled by a commercial manufacturer and a dry processor using Polaroid type film were evaluated and submitted for operational testing. Test results indicate the wet processor is unsuitable for field use and the dry units will provide usable films. A survey of commercial X-ray devices has been made and a decision matrix constructed. This will be considered at an IPR during 1st Quarter FY80.
DETAIL SHEET

TITLE: Low Capacity Radiographic System, Field

FUNDING HISTORY: PY - 6K; CY - 12K; BY - 77K

PROBLEM DEFINITION: To identify suitable automatic film processors, compatible film, cassettes and accessories for interfacing with a low capacity radiographic apparatus. To identify a suitable low capacity radiographic system for field medical use.

IMPORTANCE: Currently available wet X-ray film processors and accessories are not suitable for use by small medical units outside of field type hospitals based on weight, complexity and utility requirements. The need is acute and critical for a film processor and a low capacity X-ray apparatus.

APPROACH: A survey of commercially available film processors and low capacity X-ray systems will be made to determine their ability to satisfy the letter requirement.

ACHIEVEMENTS: A market survey uncovered no commercial units which would meet the letter requirement. A wet processor assembled by a commercial manufacturer and a dry processor were evaluated and submitted for operational testing. The results indicate that the current Army dry film processor should be retained. An IPR will be conducted during the 1st QTR FY81 to make this decision. Also to be decided is which of three options to pursue for obtaining a low capacity X-ray generator, (1) modify the requirements to meet commercially available devices; (2) to initiate an in-house development or; (3) to request proposals for a commercial development.

RELATIONSHIP TO CORE PROGRAM: The program is directly related to the Laboratory's mission of developing field medical equipment.
(U) High Capacity Radiographic System, Field

003500 Clinical Medicine; 009800 Medical and Hospital Equipment

23. (U) To identify and evaluate a replacement field X-ray system for the current standard (160 mA and 200 mA) system which is inadequate in reliability, availability and maintainability.

24. (U) Search existing commercial sources for functional components (X-ray source, table, power supplies, film processors) that can be adopted. If none are available, modify, design or contract for design of new devices.

25. (U) 10 - 8009. A survey of the commercial market was made. No commercial unit would satisfy the letter requirements. A commercial X-ray source, controller and power supply has been modified to fit the Army field table. This combination will undergo operational testing 1 during 4th Quarter FY80 and 1st Quarter FY81.
TITLE: High Capacity Radiographic System, Field

FUNDING HISTORY: PY - 31K; CY - 223K; BY - 88K

PROBLEM DEFINITION: The current field radiographic system is inadequate in reliability, availability, maintainability and does not conform to the radiation requirements of 21 CFR.

IMPORTANCE: The lack of a working, reliable, certifiable, high capacity X-ray system to meet the radiological requirements of field medical treatment facilities has a significant impact on the ability of these activities to provide basic health care. The need is acute and critical.

APPROACH: A search of commercial sources will be made for a functional system or components that can be combined into a system which will meet the field requirements.

ACHIEVEMENTS: A survey was made of the commercial market. No commercial system was found which will meet the letter requirement. Commercially available components have been obtained and have been adapted and modified into a radiological system compatible with field requirements. This system is composed of a commercial control unit, transformer, X-ray source and image intensifier system. These items have been matched to the Army 5090 field table. Operational testing is scheduled for 1ST QTR FY81.

RELATIONSHIP TO CORE PROGRAM: The program is directly related to the Laboratory's mission of developing field medical equipment.
23. (U) A need exists for a rigid device on which to transport patients with spine and/or cervical spine damage from injury site to a medical facility.

24. (U) Commercially available spineboards (litterboards) will be evaluated for adoption and/or modification to fit military requirements.

25. (U) 7910 - 8009. Four commercial boards and two in-house development items have been through development testing. Drawings and a draft specification have been forwarded to the Combat Developer for a decision. Operational testing of this item will probably be waived due to the simplistic nature of the device.
TITLE: Litterboard

FUNDING HISTORY: PY - OK; CY - 26K; BY - 22K

PROBLEM DEFINITION: Litters available for use in a field environment are not sufficiently rigid for the proper management of back or cervical spine injuries. There is a need for a rigid litterboard/spineboard in the supply system for proper casualty management. The advice to fabricate locally, given in FM 8-35, has proven inadequate.

IMPORTANCE: The use of spineboards/litterboards in the proper management of back and cervical spine injuries is essential to sound medical treatment in the field to minimize the chance of further injury during transport.

APPROACH: The commercial market for these devices and accessories was searched both by advertisement in Commerce Business Daily and by letter to potential vendors. Characteristics of commercial items as well as in-house development will be evaluated against field requirements. It is hoped that a commercial device will adequately meet this need.

ACHIEVEMENTS: Four commercial boards were procured and two special items were fabricated by this Laboratory to satisfy requirements not met by the commercial boards. All of these designs have been formally tested to determine compliance with essential characteristics. Operational testing being considered unnecessary for this equipment, the data derived from development testing will be presented to an IPR for selection of a final product.

RELATIONSHIP TO CORE PROGRAM: The effective management of back and cervical spine injuries using litterboards/spineboards is consistent with the Laboratory's mission for field medical equipment development, as well as the overall mission of The Surgeon General to provide the best medical treatment consistent with field experiences.
### Research and Technology Work Unit Summary

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#### Title
(U) Trap, Mosquito, Light, Collapsible

#### Scientific and Technological Areas
005800 Medical and Hospital Equipment; 002400 Bioengineering; 005900 Environmental Biology

#### Start Date
7910-01

#### Estimated Completion Date
8209

#### Performance Years
C. In-House

#### Principal Investigator

#### Responsible Organization
US Army Medical Bioengineering Research & Development Laboratory
Fort Detrick, Frederick, MD 21701

#### Responsible Individual
Boyer, K.H., COL

#### Telephone
(301) 663-7277; AUTOVON 343-7277

#### General Use
Foreign Intelligence Not Applicable

#### Technical Objective
23. (U) To develop a collapsible mosquito light trap which is powered solely from AC sources. The trap will be used at fixed installations and static deployment in disease vector and pest mosquito surveys. This will replace the standard mosquito light trap (NSN 3740-00-607-0337, LIN X 24251) which has proven bulky and unreliable for field use.

24. (U) Design and fabricate a suitable collapsible, AC powered, mosquito light trap and conduct field evaluations in various habitats.

25. (U) 7910-8009. Development prototypes have been constructed which are capable of operating on 120 AC power and use a fluorescent bulb as the light source. For storage, the trap is collapsible to less than 2.5 cubic feet.
DETAIL SHEET

TITLE: Trap, Mosquito, Light, Collapsible

FUNDING HISTORY: PY - OK; CY - 9K; BY - 44K

PROBLEM DEFINITION: To develop an improved replacement for the Trap, Mosquito, Light, (NSN 3740-00-607-0337) which is collapsible for storage, is capable of using a variety of lamps, and has an extended service life.

IMPORTANCE: The Trap, Mosquito, Light is a bulky, heavy item which is part of the TOE of the Preventive Medicine Detachment, Team LA, Entomology Services (TOE 8-620HOLA). It is an important instrument for surveillance of medically important insects in areas of static troop deployment where surveys are continued for prolonged lengths of time. This trap will provide long-term information on the control efforts of an IPM program.

APPROACH: A new collapsible, AC powered light trap will be fabricated in-house. The primary objectives are to produce a durable trap which can be easily disassembled and collapsed for storage and shipment.

ACHIEVEMENTS: Initial prototypes have been constructed.

RELATIONSHIP TO CORE PROGRAM: Project involves development of a new replacement trap for one currently used by field medical units.
**RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY**

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**SCIENTIFIC AND TECHNOLOGICAL AREAS**

- 009000 Medical and Hospital Equipment
- 002400 Bioengineering

**START DATE**

- 79 10 01
- 81 09

**FUNDING AGENCY**

- DA

**RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY**

**NAME**

- US Army Medical Bioengineering Research & Development Laboratory
- Fort Detrick, Frederick, MD 21701

**PRINCIPAL INVESTIGATOR**

- Kardatzke, James T.
- (301) 663-7277; AUTOVON 343-7277

**PERFORMING ORGANIZATION**

- US Army Medical Bioengineering Research & Development Laboratory
- Fort Detrick, Frederick, MD 21701

- Boyer, K.H., COL
- (301) 663-7277; AUTOVON 343-7277

**INVESTIGATOR**

- Nelson, J.H.
- Reams, W.H.

**OBJECTIVE**

- To identify and evaluate a commercially available, skid mounted, ULV aerosol generator capable of dispersing all ULV Insecticide formulations registered for mosquitoes. This generator would be used by preventive medicine and engineering personnel in combat zones and CONUS for controlling disease vectors and pest arthropods.

**DESCRIPTION**

- Suitable units will be field evaluated. Final selection of specification characteristics will be made after formal testing coordinated with responsible agencies.

**LAST REPORTING DATE**

- 79 10 - 80 09

**SUMMARY**

- After analysis of Development Testing the LECO HD and Microgen LD2-20A were selected for Operational Testing. Both successfully completed operational testing in the summer of 1980. The commercial London Fog was eliminated from testing since its basic design could not comply with Letter Requirement.
DETAIL SHEET

TITLE: Aerosol Generator, ULV, Skid-Mounted

FUNDING HISTORY: PY - OK; CY - 10K; BY - 39K

PROBLEM DEFINITION: To evaluate and recommend for adoption into TOE's an ULV aerosol generator to replace current cold fog generators.

IMPORTANCE: Since 1960 commercial pest control has used the environmentally acceptable methods of ULV aerosol generator for adult mosquito control. In this area, the military has not maintained state-of-the-art. Adoption of these generators will provide the TOE units the capabilities to control adult mosquitoes using ultra-low volume techniques.

APPROACH: Commercial units of a high-air volume, low-air pressure design will be evaluated both functionally and operationally. Results will be used as the basis for procurement of aerosol generators.

ACHIEVEMENTS: All DT and OT in these units have been successfully completed.

RELATIONSHIP TO CORE PROGRAM: Project involves modernization of existing military pest control equipment to give field medical units modern, effective equipment.
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**I**(U) Pesticide Dispersal Unit, Portable, Backpack

**J**. Scientific and Technological Areas

009800 Medical and Hospital Equipment; 002400 Bioengineering

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**K**. Contract Grant

**L**. DATES/EPICIT: EXPIRATION: NUMBER: AMOUNT: KIND OF AWARD: CUM. AMT.: 80 0.4 20

**M**. RESPONSIBLE DOD ORGANIZATION

**N**. NAME: US Army Medical Bioengineering Research & Development Laboratory

**O**. ADDRESS: Fort Detrick, Frederick, MD 21701

**P**. RESPONSIBLE INDIVIDUAL

**Q**. NAME: Boyer, K.H., COL

**R**. TELEPHONE: (301) 663-7277; AUTOVON 343-7277

**S**. GENERAL USE

**T**. KEYWORDS (Specify each with Security Classification Code) (U) Backpack; (U) Solid/Liquid Dispersal; (U) Arthropod Control; (U) Lightweight; (U) Durable; (U) Disease Vectors; (U) Portable

**U**. TECHNICAL OBJECTIVE.* APPRAOCH. PROGRESS

23. (U) To identify a commercially available, lightweight, durable, backpack unit capable of dispersing solid or liquid pesticide formulations. This unit would be used by preventive medicine personnel in combat zones and CONUS for controlling disease vectors and pest arthropods.

24. (U) A review of commercially available backpack units will be made. Suitable units will be field evaluated. After entomological feasibility has been established, modifications, if necessary, will be made and formal testing coordinated with responsible agencies.

25. (U) 7910 - 8009. Operational Testing I of three candidate units was successfully completed in October 1979. The Echo Model DM-9 has the most promising configuration. Any additional development testing will be completed in FY81.
TITLE: Pesticide Dispersal Unit, Portable, Backpack

FUNDING HISTORY: PY - 42K; CY - 20K; BY - 47K

PROBLEM DEFINITION: To evaluate and recommend adoption of a commercial motorized backpack unit which is capable of dispensing both liquid and solid pesticide formulations.

IMPORTANCE: An operational need exists for a motorized backpack unit which can dispense both liquid and solid pesticide formulations. The unit is needed to provide control during field operations in localized and remote areas where vehicular or aerial dispersal equipment cannot be used or is not readily available.

APPROACH: Available commercial backpack units will be evaluated from an engineering aspect to determine the best candidate units for operational evaluation. Selected units will be evaluated by an operational user to determine any unforeseen problems in deployment.

ACHIEVEMENTS: The concept of the backpack sprayer/duster was successfully proven during OT I conducted in October 1979. System is logistically supportable using existing logistic components.

RELATIONSHIP TO CORE PROGRAM: Project involves evaluation of commercial items for adoption as military standard items in medical TOE. Project is part of core program for pest control equipment development.
(U) Pesticide Dispersal Unit, Liquid, Helicopter Slung

Scientific and Technological Areas:
00800 Medical and Hospital Equipment; 002400 Bioengineering

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| Kardatzke, J.T. 
  (301) 663-7237; AUTOVON 343-7237 |

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| Conway, W.H. 
  Nelson, J.H. |

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<th>Technical Objective</th>
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<tr>
<td>(U) Helicopter Rig; (U) Liquid Dispersal; (U) Aerial Application; (U) Mosquito Control; (U) Liquid Insecticide</td>
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23. (U) To identify a suitable commercial, helicopter slung, dispersal unit for applying liquid formulations of insecticides, which would: (a) be capable of dispensing liquid insecticides when slung beneath a helicopter; (b) require no modification of the aircraft; (c) be capable of applying adequate swath widths and deposition rates for controlling disease vectors in combat situations or CONUS.

24. (U) A survey of commercially available, helicopter slung rigs will be made. Suitable units will be field evaluated. After entomological feasibility has been established, necessary modifications will be made and flight qualification tests coordinated with USAVSCon.

25. (U) 7910 - 8009. The Transland Unit has completed initial developmental and operational testing. Reconfiguration of unit with the ultra-low volume (ULV) nozzle has proven successful. Final modification and development testing to include training support packages will be completed during FY81.
TITLE: Pesticide Dispersal Unit, Liquid, Helicopter Slung

FUNDING HISTORY: PY - 48K; CY - 12K; BY - 61K

PROBLEM DEFINITION: To adapt a commercial aerial sprayer to meet the needs of the military for a slung unit which is capable of liquid dispersal in both high volume and ultra-low volume modes.

IMPORTANCE: Medical personnel engaged in field operations need the capacity for aerial dispersal of liquid pesticide formulations. The unit is needed to ensure rapid treatment of large areas inaccessible by ground equipment but too small for efficient use of larger aerial dispersal equipment. Current standard item represents a health and safety hazard to the helicopter crew since unit is internally mounted instead of slung.

APPROACH: To adapt a readily available commercial sprayer for military use. The commercial sprayer will be modified to include a ULV Beecomist nozzle system and a means for effective control of unit functions from the interior of the helicopter. Unit will be completely independent of the helicopter and easily jettisonable in an emergency.

ACHIEVEMENTS: The Translano (Harbor City, CA) sprayer has completed initial DT and DT with some technical problems being uncovered. System concept has been successfully proven and shown to be logistically supportable.

RELATIONSHIP TO CORE PROGRAM: Project involves evaluation and modification of a commercial unit. Item will replace a current obsolete standard item which is a part of the TOE of the Preventive Medicine Detachment, Team LA. Project is part of the pest control equipment program.
I. INTRODUCTION

The goal of this project was to identify a suitable X-ray film processing portable field unit to support a low capacity X-ray unit.

II. TECHNICAL OBJECTIVE

The objective was to search existing industrial sources for a functional device that can be adopted. If none is available, modify, design or contract for the design of a new device.

III. APPROACH

The approach was to test results were good but did recommend some design changes. These were accomplished and the new prototype subjected to DT II and successfully passed this evaluation. Since the basic prototype is a commercial item and reevaluation would not be useful, item will be recommended for type classification at the next IPR.
TITLE: X-Ray Film Processor, Dental, Portable, Field

FUNDING HISTORY: PY - 15K; CY - 25K; BY - 27K

PROBLEM DEFINITION: To identify a suitable X-Ray Film Processing Portable Field unit to support a low capacity X-ray unit.

IMPORTANCE: Portable wet X-ray film processors and accessories are not suitable for use by small dental units outside of field type hospitals based on excessive weight, complexity and requirements for electrical power, water and processing chemicals. The need is acute and critical for dental units/sections to complement the low capacity X-ray apparatus recently approved for limited procurement.

APPROACH: Search and obtain an industrially developed functional device that can be adapted to meet the established characteristics.

ACHIEVEMENTS: Operational Testing I (OT I) was initiated on 16 July 1979 and completed on 26 October 1979. Results were good with only minor design changes. Prototype was modified to correct OT I deficiencies and subjected to Development Testing II (DT II). DT II was successfully concluded on 3 March 1980. Item will be presented for Type Classification at the next IPR.
**RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY**

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### TASK AREA

**002400 Bioengineering; 009800 Medical & Hospital Equipment**

**START DATE** | **ESTIMATED COMPLETION DATE** |
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7705 | 8106 |

**US Army Medical Bioengineering Research & Development Laboratory**
Fort Detrick, Frederick, MD 21701

**RESPONSIBLE INDIVIDUAL**

- **NAME:** Boyer, K.H., COL
- **TELEPHONE:** (301) 663-7277; AUTOVON 343-7277

**FOREIGN INTELLIGENCE**

Not Applicable

**APPROACH & PROGRESS**

23. (U) To develop an improved aid bag for use by the platoon aidman.

24. (U) Functional criteria for aid bags will be established. Several potential replacements will be designed, fabricated and evaluated. The best features of each model will be incorporated into a final design.

25. (U) 7909 - 8009. Six prototype units were sent to field units in CONUS and Europe for evaluation. Other prototype units have been demonstrated to OTSG and the combat developer with generally favorable results. The results of all the field trials are now in and are being evaluated. The list of contents is also being finalized.
TITLE: Bag, Aidman's, Redesign of

FUNDING HISTORY: PY - 23K, CY - 16K; BY - 24K

PROBLEM DEFINITION: The current case, Medical Instrument and Supply Set (NSN 6545-00-912-9870) has been found inadequate. Because of the small size and configuration of the bag, the aidman is severely limited in his treatment capability in combat. The need exists for a larger bag, which provides easier access to its contents.

IMPORTANCE: The ability of the combat medical corpsman to provide prompt and effective treatment to soldiers in the field will be greatly enhanced by providing him with an aid bag containing a wider variety of medications, dressings, and instruments, which are easily accessible.

APPROACH: Various bags and cases which are already in the supply system were investigated. The bags most suitable for the projected need of the platoon aidman were either too small (M-3), overly compartmented (M-16), or without organizing compartments (M-5).

ACHIEVEMENTS: A compartmented aid bag has been designed and fabricated. The bag has six zippered compartments and is built in three sections which fold together for transport. The bag has an approximate volume of one cubic foot, D rings for the attachment of a shoulder sling, loops for use with shoulder straps or a pack frame, and a carrying handle. Prototype bags have been fabricated and evaluated at Ft. Bragg and by two units in Europe with generally favorable results. The design will be presented to an IPR late in CY81.

RELATIONSHIP TO CORE PROGRAM: The design and development of a more efficient aid bag for use by the platoon aidman is consonant with the mission of The Surgeon General to provide the best in medical treatment for the soldier in the field.
### RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

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#### 11. TITLE (Provide with Security Classification Code)

(U) Sanitizer, Portable, Field, Special Forces

#### 12. SCIENTIFIC AND TECHNOLOGICAL AREAS

- 010100 Microbiology
- 009300 Medical and Hospital Equipment

#### 13. START DATE | ESTIMATED COMPLETION DATE |
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#### 15. RESPONSIBLE CODE ORGANIZATION

US Army Medical Bioengineering Research & Development Laboratory
Fort Detrick, Frederick, MD 21701

#### 16. PRINCIPAL INVESTIGATOR (Provide name if U.S. citizen initiating research)

Prensky, W.C.

#### 17. GENERAL USE

Foreign Intelligence Not Applicable

#### 18. RESEARCH PROVIDE CODE (Provide with Security Classification Code)

(U) Sterilizing; (U) Field Equipment; (U) Medical; (U) Field Sterilizers

#### 23. TECHNICAL OBJECTIVE, APPROACH, PROGRESS

23. (U) To secure a replacement for FSN 6530-00-926-4857 which is no longer procurable.

24. (U) Search existing industrial sources for a functional substitute. If none is available, design or contract for the design of a new device.

25. (U) 8010 - 8012. The combat developer advises that the entire issue of sterilization/sanitization at the special forces level is under review and that the requirement for this specific item of equipment no longer exists. A new task may be initiated in this arena if warranted by updated requirements.
TITLE: Sanitizer, Portable, Field, Special Forces

FUNDING HISTORY: PY - OK, CY - 8K, BY - OK

PROBLEM DEFINITION: A requirement was defined for a compact, lightweight sanitizer for Special Forces medical personnel. The item currently authorized is no longer procurable.

IMPORTANCE: Medical specialists assigned to Special Forces Operational Detachments "A" are responsible for providing medical support of a guerrilla force. This elevates the importance of lightness, compactness, ruggedness and the ability to operate with a variety of available fuels.

APPROACH: To seek commercially available or easily fabricated components that may be combined to satisfy this requirement.

ACHIEVEMENTS: A pressure vessel was located which could provide steam sterilization rather than sanitization. Prior to completion of evaluation testing, however, the medical requirements of Special Forces came under scrutiny with a substantial revision anticipated. On being advised by the Combat Developer that sterilizer requirements for Special Forces could not be adequately defined in the foreseeable future, the task was terminated. It will be reestablished at some future date if the situation warrants.

RELATIONSHIP TO CORE PROGRAM: This task is consistent with the mission of this Laboratory to develop field medical equipment.
1. An Environmental Fate Model Leading to Preliminary Pollutant Limit Values for Human Health Effects. Rosenblatt, David H. and Jack C. Dacre - Abstract for presentation at Army Science Conference, June 1980 at West Point.


5. Toxicology of Explosives and Propellants. David H. Rosenblatt - For publication in Encyclopedia of Explosives and Related Items.


17. An Environmental Fate Model for Soil and Water Leading to Preliminary Pollutant Limit Values for Human Health Effects. Dacre, Jack C., Rosenblatt, David H., EPRD, and David R. Cogley, GCA Corp. - Journal publication in Environmental Science and Technology (Feature Article).


20. Laboratory Bioassay of Bacillus thuringiensis israelensis Against All Instars of Aedes aegypti and Aedes taeniorhynchus Larvae. Van Essen, Frank W. and Stephen C. Hembree - Journal Publication.


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Defense Technical Information Center
ATTN: DTIC-DDA
Alexandria, VA 22314

Commandant
Academy of Health Sciences, US Army
ATTN: AHS-COM
Fort Sam Houston, TX 78234

Dir of Biol & Med Sciences Div
Office of Naval Research
800 N Quincy Street
Arlington, VA 22217

CO, Naval Medical R&D Command
National Naval Medical Center
Bethesda, MD 20014

HQ AFMSC/SGPA
Brooks AFB, TX 78235

Director of Defense Research and Engineering
ATTN: Assistant Director (Environmental and Life Sciences)
Washington, DC 20301