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COMPUTER-AIDED ENVIRONMENTAL IMPACT ANALYSIS FOR AIR FORCE RESE--ETC(U)
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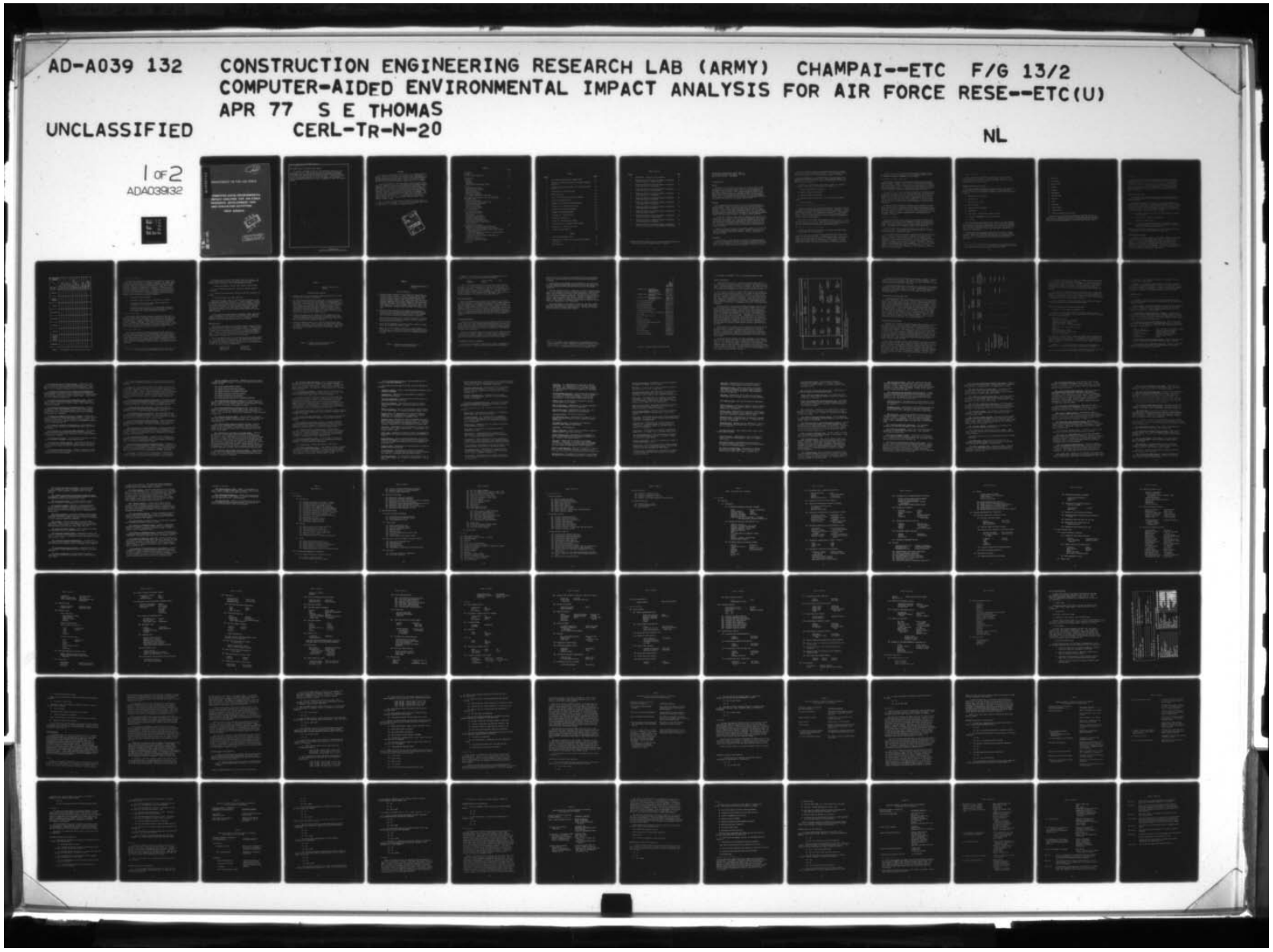

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DEPARTMENT OF THE AIR FORCE

COMPUTER-AIDED ENVIRONMENTAL IMPACT ANALYSIS FOR AIR FORCE RESEARCH, DEVELOPMENT, TEST AND EVALUATION ACTIVITIES:

USER MANUAL

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and suggests ways to mitigate these impacts.

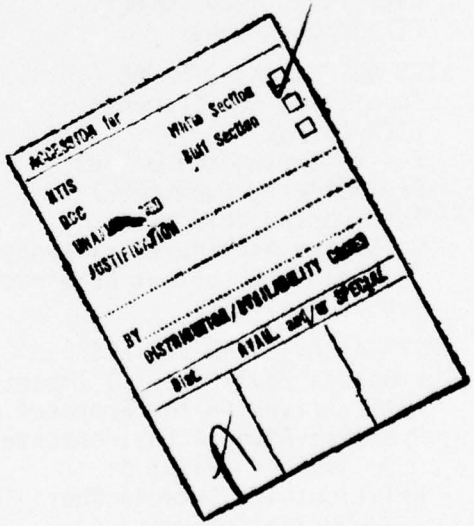
This manual is designed to help Air Force personnel prepare EIAs and EISs using the EICS. Detailed instructions for accessing the Research, Development, Test, and Evaluation Functional Area of EICS are included as is an input form necessary for obtaining EICS output. The manual discusses in detail procedures necessary for using EICS output for environmental impact assessment and outlines the steps for preparing a proper and complete EIA/EIS.

FOREWORD

This work was performed for the Air Force Civil Engineering Center (AFCEC), Tyndall Air Force Base, FL, by the U.S. Army Construction Engineering Research Laboratory (CERL) under Military Interdepartmental Purchase Request FQ8952-75-AC-00005. The Air Force technical monitor was LTC D. G. Silva, and the technical contact was CPT R. E. Padgett.

Original development of the Environmental Impact Computer System (EICS) was performed at the U.S. Army Construction Engineering Research Laboratory (CERL) for the Directorate of Military Construction. The modification of EICS for Air Force applications and the development of this manual were the result of interdisciplinary cooperation between personnel from CERL's Environmental Division (EN), Environmental Operations Team (ENO), Environmental Systems Team (ENS), and USAFCEC. The scientific team consisted of CPT R. E. Padgett (Air Force RDT&E Activities and Overall Review), Ms. S. E. Thomas (Revisions Supervisor; Overall Review), Mr. R. E. Riggins (General Review), and Mr. Bruce Goettel (Computer Input).

Dr. R. K. Jain is Chief of EN and Acting Chief of ENS, and Dr. E. W. Novak is Team Chief of ENO. COL J. E. Hays is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.



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* References for the Ecology and Earth Science Technical Specialties can be found in their introductory texts in Chapter 3.

COMPUTER-AIDED ENVIRONMENTAL IMPACT ANALYSIS FOR AIR FORCE RESEARCH, DEVELOPMENT, TEST, AND EVALUATION ACTIVITIES: USER MANUAL

1 INTRODUCTION

Purpose

The purpose of this manual is to help U.S. Air Force (USAF) personnel prepare and review Environmental Impact Assessments (EIAs) and Environmental Impact Statements (EISs) by means of the Environmental Impact Computer System (EICS). This system, developed by the U.S. Army Construction Engineering Research Laboratory (CERL), and maintained by the Air Force Civil Engineering Center (AFCEC), meets the requirements of the National Environmental Policy Act (NEPA) and subsequent guidelines published by the Council on Environmental Quality (CEQ).

Approach

This introductory chapter briefly discusses the philosophy behind the environmental impact assessment process and presents an overview of the EICS system. Chapter 2 describes and defines the specific EICS elements. The user should become thoroughly familiar with the elements available, as well as with newly defined terms which will be used repeatedly throughout the remaining text. Guidance is also provided on baseline elements and data sources necessary for adequate impact assessment.

The EICS uses Functional Areas (FAs) to categorize and classify military activities. Chapter 3 contains detailed instructions for accessing the Research, Development, Test, and Evaluation (RDT&E) FA and an input form which must be completed and forwarded to AFCEC to obtain EICS output. The input form includes space to answer filter questions which reduce the amount of irrelevant output and increase the site-specificity of the information.

Chapter 4 discusses in detail the procedure necessary to use the EICS output for assessing environmental impacts. Chapter 5 tells how to relate the information given in EICS output to specific requirements of the EIA/EIS format.

Background

The environment, which comprises both natural and man-made factors, is difficult to characterize due to its attributes (variables) and their complex interrelationships. Positive and negative changes in these attributes and their interrelationships are defined as *environmental impacts*.

An EIA or EIS characterizes the environment and describes changes that might be induced by specific activities. Such a document supplies enough information to meet the requirements set down by the NEPA.

Listing attributes is a shorthand method of focusing attention on important environmental characteristics. Due to the environment's complex nature, any such listing is limited and consequently may not contain all possible impacts.

A complete set of attributes would provide a model for predicting all impacts. The steps in constructing such a model are:

1. Identify environmental attributes

2. Identify impacts on attributes

3. Measure impacts on attributes

4. Aggregate impacts on attributes to distinguish environmental impacts

5. Report findings.

Identification of Environmental Attributes

Since the characteristics of the environment are practically infinite, it is necessary to reduce the number to be examined. Redundant, difficult to measure, and obscure attributes should be eliminated in favor of those that are more tractable. This procedure is valid only if the attributes chosen reflect all relevant aspects of the specific environment being studied. Some attributes that are difficult to measure or conceptualize may still need to be considered.

The nature of the probable impact depends on the *condition of the environment prior to the activity*. Baseline data, which are the measure of what the attributes would be (or are) prior to the proposed activity, are necessary for analyzing and measuring environmental impacts.

Identification of Impacts on Attributes

Impacts are identified and analyzed by reviewing attributes potentially affected by a given activity.

Geographical location is one factor that affects the relative importance of a particular attribute. For example, the impact of a water project on water quality in an area having abundant water supplies would differ significantly from the impact of a similar project in an area having scarce water resources. Differences in geographical location often make it difficult to compare the impacts of different activities.

Temporal characteristics also may pose problems in impact analysis. All impacts must be examined during the same projected period in order to adequately compare (or combine) activity impacts.

Measurement of Impacts on Attributes

Identifying an impact of a project leads directly to measuring the degree of impact. Ideally, impacts should be translatable into common units (groups having similar characteristics, such as ppm for air quality attributes); however, this is not possible for some impacts (e.g., income, rare and endangered species). Problems may also arise because quantification of particular impacts may go beyond the state of the art.

Quantitative measurements of impacts are measures of projected change in relevant attributes. The units of measurement must reflect projected changes that the activity or lack of activity will have on the future environment. One difficulty in assessing quantitative changes is that changes in attributes may not be seen in common units, and if they are, they may not have been measured in the same manner. In addition, there are difficulties in assessing the changes through the use of projection techniques.

Changes in some environmental attributes are not amenable to measurement. The attribute's relationship to the overall environment may not be defined well enough to determine the most adequate measurable parameter. Therefore, instead of a specific measure, a general title and definition may be all that is available. In such cases, it may be necessary to rely on expert judgment to answer the question of how attributes will be affected by a project.

Aggregation of Impacts

After measuring the project impacts, two aggregation problems must be addressed. The first is how to aggregate attributes (in both quantitative and qualitative measure) to arrive at a single common measure of impact. The second problem is how to compare impacts on specific attributes. Some methods use a weighting procedure to accomplish this.

Finally, impacts may be summed and compared with impacts of an alternative activity. The procedure described herein does not include an explicit weighting and summing procedure.

A single USAF activity may produce a negligible effect on the environment. A series of similar activities, however, may produce definite cumulative effects. The most obvious solution is to prepare impact assessments covering programs rather than a series of component actions. Unfortunately, definition of activities at the program level may be so vague as to preclude identification of impacts. Therefore, a review of impacts at the program level can be accomplished *only* if there is enough detail to evaluate individual impacts at the same time, or if such a cumulative and detailed impact evaluation of an essentially similar program has already occurred.

Reporting of Findings

Results of an impact assessment are reported in an environmental impact assessment or statement. It would be useful, however, to consider displaying the results in a manner that makes total impact easily comprehensible from a brief review.

Computer-Aided Assessment System

The computer-aided assessment system described here is designed to identify the potential environmental impacts of a specified project. Military programs can be conveniently grouped into the following Functional Areas:

1. Administration and Support
2. Construction
3. Industrial Activities
4. Mission Change
5. Operations and Maintenance
6. Procurement
7. Real Estate: Acquisition, Excess, or Grant
8. Research, Development, Test, and Evaluation
9. Training.

The Army Construction Functional Area, which is considered applicable to Air Force use without modifications, is available from the AFCEC. Mission Change[1] and Research, Development, Test, and Evaluation (RDT&E) Functional Areas have been modified for Air Force use and are now available. Other Functional Areas may be modified and/or implemented, as necessary, in the future.

The computer-aided assessment system relates activities from the Functional Areas to environmental attributes via environmental impact matrices. Attributes are also grouped into areas of environmental technical specialty. An impact matrix is available for each Technical Specialty:

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[1] *Computer-Aided Environmental Impact Analysis for Air Force Base Realignment Activities: User Manual*, Technical Report N-4/ADA027431 (Construction Engineering Research Laboratory [CERL], June 1976).

1. Aesthetics
2. Air Quality
3. Earth Science
4. Ecology
5. Economics
6. Groundwater
7. Health Science
8. Land Use
9. Noise
10. Sociology
11. Surface Water
12. Transportation
13. Energy and Resource Conservation.

Three levels of attributes were developed: detailed, review, and controversial. Ramification remarks on the potential impacts from each basic activity associated with Air Force programs (BAAPs) were developed, along with mitigation procedures for minimizing these adverse impacts.

2 THE EICS

The EICS matrix describes the relationships between the two basic elements of the EICS: (1) major environmental categories, referred to in the matrix as *Environmental Technical Specialties*, and (2) human actions which impact on those activities, referred to in the matrix as *USAF Functional Areas*. Figure 1 illustrates the general form of the EICS environmental matrix. An expanded matrix is currently available for each intersection relating to Construction, Mission Change, and RDT&E activities.

Need-to-Consider Scale

Intersections within each detailed matrix are identified with indicators of "need-to-consider" for the potential impact of the activity on the attribute.

Any activity may impact on virtually all the environmental attributes; however, a person who is assessing environmental impact must identify the relative importance of the attributes when describing an impact. A "need-to-consider" scale was developed, therefore, to indicate which attributes are most likely to be impacted and which ones are most likely to indicate impacts. The scale used is as follows:

A = Definitely consider this factor as being potentially impacted by the activity.

B = Possible effect, requires consideration.

C = Consider in special cases.

Blank = As far as we know, without knowing all the details of your project, you need not consider this intersection; please check the Ramifications/Mitigations output.

Intersections within the detailed matrix are identified with indicators of the appropriate rating on the need-to-consider scale.

Environmental Attributes

To relate activities to impacts, environmental elements (attributes) are defined and categorized under broad categories called *Environmental Technical Specialties* (horizontal axis of matrix as illustrated in Figure 1). Three types of attributes have been developed for each Technical Specialty area: detailed level attributes, review level attributes, and controversial attributes. Review level and controversial attributes supplement detailed attributes to provide an overview which may be necessary for some potential system users.

Environmental Attributes / Basic USAF Activities	Ecology	Health Science	Air Quality	Surface Water	Groundwater	Sociology	Regional Economics	Earth Science	Land Use	Noise	Transportation	Aesthetics	Energy–Resource Conservation
Construction													
Operation, *Maintenance*													
Training													
Mission Change													
Real Estate													
Procurement													
Industrial													
Research, Development, Test & Evaluation													
Administration													

Figure 1. Environmental impact matrix--general form.

Detailed Level Attributes

Detailed level attributes are defined as parameters or factors which can be used to describe the environmental condition. For example, under Ecology, detailed attributes include Rare or Endangered Animal Species, Food Webs, Warm Water Fishing, and Noxious Weeds; under Surface Water: Turbidity, Biochemical Oxygen Demand, Phosphorus, and Mercury; and in Sociology: Population Composition, Sex Categories, Religious Organizations, and Educational Organizations. A standard format for preparing descriptions of detailed environmental attributes is presented in the *Attribute Descriptor Package*.[2] Each description consists of sections A through D, which contain the following information:

A - Definition of the attributes

B - Information about the source of the effect or pollutant

C - Information on how the attributes might be affected or influenced by Air Force actions

D - Information on how the effect on an environmental attribute might affect other biophysical and socioeconomic attributes (interaction with other environmental attributes).

Review Level Attributes

Since review level attributes present an overview of the nature of potential impacts without the specificity provided by the detailed attributes, they provide a useful summary of potential impacts for management or general staff. Examples of review level attributes are Community Profile, Pathogenic Organisms, and Increase in Undesirable Species--from the areas of Sociology, Surface Water, and Ecology, respectively. A brief, general description of each review level attribute has been developed and is also available in the *Attribute Descriptor Package*.

Controversial Attributes

Many factors contribute to controversy regarding USAF activities, including intense public concern for environmental quality and confusion about potential environmental impacts and the need to establish trade-offs between economic gains or mission accomplishments and environmental damage. NEPA specifically requires that potentially controversial effects be considered when assessing environmental impact. Therefore, environmental attributes considered particularly prone to such reaction have been identified.

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[2] *Environmental Impact Computer System Attribute Descriptor Package Reference Document*, Technical Report E-86/ADA024303 (CERL, April 1976).

Controversy may arise out of the public's fear of a project. For example, many attributes of physical environmental pollutants may not be controversial themselves, but controversy may arise from:

1. Effects attributed to them at normal ambient concentrations

2. Cost of abating the pollutant, given the uncertain degree of its effect

3. Indecision concerning what constitutes available technology for control

4. The time necessary for legal compliance.

When USAF activities, plans, or policies affect attributes of the socioeconomic environment, controversy is likely to develop. Examples of economic attributes which could be identified as potentially controversial are those involving either basic philosophic questions dealing with political expediency, or those related to questions of economic efficiency and equity. Thus, controversy arises whenever there are responsible differences of opinion concerning the solution of environmental problems.

As mentioned earlier, descriptions of detailed, review, and controversial environmental attributes have been assembled into a separate document entitled *Attribute Descriptor Package*. Figures 2 and 3 are examples of attributes (descriptors) found in this package.

USAF Activities

USAF projects and programs are described in EICS by the use of Basic Activities Associated with Air Force Programs (BAAPs). A USAF *Functional Area* (vertical axis of matrix as illustrated in Figure 1) is described in BAAPs, which identify those actions likely to cause environmental impact. The user is responsible for carefully considering environmental impacts, including their significance, as long as his or her project falls within or includes any of the list of activities.

Each of the BAAPs listed for a Functional Area may be further expanded. In the Construction Functional Area, sub-items covered by the BAAPs are alternative methods of accomplishing the activity. For instance, the BAAP covering "topsoil stripping" includes all of the several methods by which the activity may be accomplished:

strip and store	fairway strip
contour strip	area strip
haul and fill	cut and dispose

EXAMPLE 1

Detailed Attribute No. 9
Ecology

Endangered Animal Species

A. Endangered species are those animals whose populations are so small that they are in danger of extinction.

B. The reason behind the decreasing population is usually the encroachment of man's activities and resource needs on the home ranges of the animal. The grizzly bear is an example of an endangered species. Some species, such as certain hawks and eagles, can be accidentally killed following predator and insect poisoning programs. Still other species have been destroyed by commercial hunting interests. The American bison and the alligator are classic examples of this exploitation. The California condor is in danger of extinction due to drastic reduction of its breeding habitat.

C. Land-clearing operations are probably the most common activities affecting endangered species, especially in otherwise remote areas. Insect and rodent control programs often have unwanted side effects when nontarget species consume poisoned bait.

D. Threats to endangered species are certainly among the most likely to engender controversy. Many scientific and conservation organizations keep a close watch on rare and declining species. These groups are certain to create public discussion of any potential danger to such species.

Figure 2. Example of attribute descriptor for Ecology Technical Specialty.

EXAMPLE 2

Detailed Attribute No. 2
Land Use

Access to Minerals

A. Access to mineral resources is the capability of exploration of valuable mineral resources. Mineral resources include iron and ferro-alloy metals (iron, boron, copper, molybdenum, silicon, titanium, vandium, chromium, cobalt, manganese, tungsten, zirconium); nonferrous metals (lead, copper, and zinc); light metals (bauxite, magnesium, and titanium); nonmetallic minerals (stone, limestone, sandstone, slate, granite, marble, sand, gravel, clay, lime, gypsum, salt, sulfur, phosphate, and potash); fossil fuel (coal, petroleum, and natural gas); and other fuel sources (uranium).

B. Access to mineral resources can be denied by the presence of structures, parks and recreational areas, and by other features associated with the presence of human activity, or an adjacent land use to which extraction operations may be in conflict.

   USAF activities can deny access to mineral resources. Activities or the results of activities can commit an area to a use which prevents extraction of minerals.

C. Use of the land adjacent to overlying mineral resources can deny access for an indefinite period of time.

D. Denial for access to mineral resources is largely a matter of incompatibility. If giving access to minerals would lead to health or safety threats, the existing land use is incompatible with extraction.

Figure 3. Example of attribute descriptor for Land Use Technical Specialty.

"Methods of accomplishment" may also include different types of equipment, such as for the Construction BAAP "Grading":

grader	front-end loader	hand
bulldozer	scraper	

A BAAP in the RDT&E Functional Area may include several alternative types, such as alternative tests, locations for performing a test, or items to be tested. A compendium of the various alternatives for each RDT&E BAAP is shown in Table 4 (Chapter 3). (For the Construction FA, the alternative methods of accomplishment are available in the computer printout of the complete list of BAAP names. There are no alternative methods for the Mission Change Functional Area.)

Ramification Remarks

Due to the complex nature of impacts and interactions associated with USAF programs, it is necessary to qualify matrix scores (attribute/activity interactions) with Ramification Remarks. These statements typically address causes of impacts as well as the reasons for differing degrees of impact due to the time of year, site condition, climate, and magnitude of activity. They are linked to impacting BAAPs and are available in the EICS in sections to be used with each Technical Specialty matrix. The Ramification Remarks illustrate the nature of the potential impact and demonstrate why a particular activity is an environmental concern.

Mitigation Statements

Along with an evaluation of activities' potential effects on environmental attributes, EICS indicates measures that minimize or avoid significant impacts and, where possible, the effectiveness of these measures. Choosing proper mitigation (abatement or avoidance) procedures greatly depends on local conditions, and critical evaluation of the problem by an expert may be necessary.

Mitigation Statements, which are supplied with EICS output following each Ramification Remark, indicate the general nature of the controls which might be exercised. Chapter 4 provides examples of Ramification Remarks and Mitigation Statements keyed to Construction FA BAAPs.

Environmental Baseline Information

Basic data and background information are required to properly prepare EIAs and EISs. This information constitutes the environmental

baseline and is useful not only in describing the existing environment, but also in relating project activities to the various environmental attributes.

Baseline data can be divided into two categories: data associated with environmental considerations available from "outside" sources, and available installation data applicable to the various environmental categories.

The first category of data is summarized in Figure 4. Because actual agency titles may vary from state to state, sources are listed in general terms; they are checked according to their relationship to attributes in the various environmental categories. Initiative at the installation level is required to obtain more specific information regarding sources and the types and detail of data available locally. A directory of federal, state, and local information sources keyed to Technical Specialties can be developed for each installation.

The second category of information is available from data, records, and reports generated on the installation (e.g., the Air Installation Compatible Use Zones [AICUZ] program reports). The TAB A-1, "Environmental Narrative," is particularly useful.*

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* TAB A-1 is an element of the Comprehensive Plan prepared by each Air Force installation. Further information concerning the TAB A-1 is contained in the *Environmental Planning Document TAB A-1, Environmental Narrative, Phase II* (Department of the Air Force, September 1975).

	AIR	WATER	LAND	BIOTIC	INSTITUTIONAL	DEMOGRAPHIC	ECONOMICS	RESOURCES	ACTIVITY SYST. & PLAN.
U.S. Department of Interior -Geological Survey		X		X				X	
-National Parks Service		X		X	X	X		X	
-Bureau of Land Management		X		X	X			X	
-Bureau of Mines				X				X	
-Fish and Wildlife Service		X		X	X			X	
U.S. Department of Commerce -National Oceanic and Atmospheric Administration	X	X						X	
-Bureau of Census					X	X	X		
U.S. Department of Agriculture-Soil Conservation Service		X		X	X			X	
-Agricultural Resources Service		X		X	X		X	X	
-Forestry Service		X		X	X		X	X	
U.S. Air Force Environmental Health Laboratory	X	X			X			X	
U.S. Air Force Regional Civil Engineers						X			X
U.S. Air Force Civil Engineering Center	X	X		X	X		X	X	X
USAF Base Bioenvironmental Engineer	X	X			X				
Major Command Environmental Coordinator	X	X			X				
U.S. Army Corps of Engineers--District Engineer		X		X				X	
U.S. Army Environmental Hygiene Agency	X	X				X	X		
Local Universities, Architectural-Engineering Firms, Interest Groups	X	X		X	X	X	X	X	X
Aerial Photography		X		X					
Museums, Libraries, Newspapers, Local Experts	X	X		X	X	X	X	X	X
County Records				X		X	X	X	
State Water Resources Agencies		X			X			X	
Local Water Conservation Districts		X						X	
City and County Health Departments and Boards of Education						X	X		
State Game and Fish Agencies	X	X		X				X	
Air Pollution Control Districts	X				X	X	X		
State Highway Departments				X		X			
Chambers of Commerce	X	X		X	X	X	X	X	X
Regional, State, and Federal EPA	X	X		X	X			X	X
State and Local Health Agencies						X	X		
Local and Regional Planning Agencies		X		X		X	X	X	X

Figure 4. Outside sources of baseline data.

3 THE RESEARCH, DEVELOPMENT, TEST, AND EVALUATION FUNCTIONAL AREA

General Introduction

Research by the military is generally product-oriented--that is, it is a tool used to produce and maintain a more effective military force by means of improved equipment, materials, or methods. The RDT&E Functional Area in EICS thus encompasses Air Force activities occurring at all stages of the acquisition management cycle of a research project (see Table 1).

This cycle is divided into several phases based on the development stage of a particular research program. The conceptual phase begins when the need for a new military capability is realized. A concept to provide this capability is studied and tested. To minimize future development risk, critical technical and operational issues and logistical support problems are identified for resolution. The conceptual phase generally encompasses research at the "exploratory" stage and may involve construction or manufacture of breadboards (See Table 1) and experimental prototypes.

After approval by the Secretary of Defense (SECDEF) based on review by the Defense Systems Acquisition Review Council (DSARC), the program moves into the validation phase. This consists of steps necessary to verify preliminary design and engineering, to solicit and evaluate proposals for engineering development, and to select a development contractor(s). Research at the "exploratory," "advanced," and "engineering" stages may all occur during this phase. The objective is to resolve unknowns and verify that the technical and economic bases for initiating full-scale development of the weapon system are valid. Brassboards and advanced prototypes are produced to confirm that the technology is feasible and that the design concept has military utility. Advancement to the next phase also requires SECDEF approval (DSARC II--the Ratification Decision).

Input from "basic" research may occur during both the conceptual and validation phases. "Basic" research is not specifically involved in developing items of equipment, although equipment may be involved in the tests in various ways. Researchers may not be trying to develop a particular end product but rather may be questioning how and why things work with the hope that some findings may eventually help solve a particular problem.

The weapon system, including its support equipment, is engineered, fabricated, and tested during the full scale development phase. Research here is in the "engineering" stage. Engineering or near-production prototypes are built to verify a product's final design or producibility. Tradeoffs between stated operational requirements, costs, and operational readiness dates are addressed. The major proportion of R&D funding outlays are expended during this phase. By the end of full scale development, all major problems should have been resolved.

Table 1

Acquisition Management Cycle

	PHASE				
	CONCEPTUAL	VALIDATION	FULL-SCALE DEVELOPMENT	PRODUCTION	DEPLOYMENT
DSARC REVIEW	PROGRAM DECISION I	RATIFICATION DECISION II	PRODUCTION DECISION III		
P.E. CATEGORY	61xxx 62xxx 63xxx	63xxx	64xxx	Depends on Force Program (1xxxx, 2xxxx, etc.) PROCUREMENT FUNDS	
TESTING	No Specific Category	DT&E * (CAT I)	DT&E * IOT&E **	FOT&E *** (CAT III) Production Validation	Production Validation
HARDWARE CONFIGURATION	BREADBOARD, EXPERIMENTAL PROTOTYPE	BRASSBOARD, ADVANCED PROTOTYPE	ENGINEERING DEVELOPMENT PROTOTYPE	INITIAL PRODUCTION ITEMS	FULL PRODUCTION ITEMS

*Development Testing and Evaluation
**Intermediate Operational Testing and Evaluation
***Full Operational Testing and Evaluation

Production contracts are negotiated and awarded if DSARC III approves beginning the production phase. The system, including equipment, spares, and facilities, is produced for operational use; user and production acceptance testing both occur during this phase.

During the deployment phase, the weapon is given to the using command. During this phase, operational units are trained, equipment is distributed, and necessary logistical support is provided. Product improvements are applied as required and as developed in the normal course of earlier-phase R&D activities.

Introduction to the Functional Area

The RDT&E Functional Area is designed to cover all Air Force research activities, regardless of the phase of the acquisition cycle in which they occur. Table 2 shows how the various sections of the FA (described under Functional Area Development) may apply to each of the five phases. Because USAF research programs and activities are so varied, no attempt has been made to specifically list all possible testing procedures which may be used by the researchers. Instead, RDT&E BAAPs are often general descriptions of kinds or groups of activities. A good example of this type of BAAP is No. 178--Physical and Mechanical Tests. As shown in Table 4, this BAAP covers a large variety of specific tests; the tests listed do not necessarily include all tests that might apply to the BAAP. That is, a test that is not listed in Table 4 as an "alternate item or test" should be considered under the BAAP which *appears* most applicable.

Functional Area Development

The BAAPs for the RDT&E Functional Area have been separated into three main activity types. The first--Research (BAAPs 100-219)--contains the significant activities specifically involved in research and testing during all phases of the materiel acquisition cycle. The second activity type is Accidents (BAAPs 220-237). Even though accidents can occur in many types of research and in many locations (laboratory, test production lines, field), it was felt that the likelihood of accidents (which may occur more easily or be more dangerous in a research program because of the unique, unusual, or hazardous items used in the tests) could be more easily assessed if considered separately. The third activity type falls under the category of Support Functions (BAAPs 240-294).

The first of the above activity types--Research--is further subdivided. "Planning" (BAAPs 110-145) refers generally to the project design, organization, and subjective evaluation that occurs before, during, and after any physical research. Its impacts will often be indirect, since decisions made early in a research program occur some time before the resulting physical research activities, economic drains, or changes in materiel production can directly affect the local or national environment. Therefore, these planning activities are those through which such indirect effects may be evaluated.

Table 2

Applicability of RDT&E FA to the Acquisition Management Cycle

	PHASE				
	CONCEPTUAL	VALIDATION	FULL-SCALE DEVELOPMENT	PRODUCTION	DEPLOYMENT
RESEARCH TYPE	basic exploratory	exploratory advanced (basic)	engineering (advanced)	engineering, production validation	engineering, on-site validation, production validation
RDT&E FA USE	X	X	X	X	limited
Applicable sections:					
Planning	X	X	X	X	limited
Prototype Development/ Test Preparation	X	X	X	limited	limited
Obtain/Analyze Data (incl. lab and field tests)	X	X	X	limited	limited
Accidents	X	X	X	X	limited
Support Functions	X	X	X	X	X

"Prototype Development/Test Preparation" (BAAPs 150-166) is the step in all stages of research between the planning of a test or research activity and the actual test itself. These BAAPs are mostly concerned with construction of models, construction of test structures, or small-scale manufacturing of items to be tested. For permanent large-scale test structures or facilities, the Construction Functional Area should be consulted.

The subdivision "Obtain/Analyze Data" (BAAPs 170-219), includes both laboratory and field research. Field tests are more likely to have direct impacts on environmental attributes due simply to proximity, whereas an intervening medium (air or water) may be required for toxic wastes produced in laboratories to affect environmental attributes.

NOTE: Development of Military Standards would involve all three of the above subdivisions of the Research activity type.

Special Terminology for the RDT&E Functional Area

Materiel: Military weapons, equipment, etc.

*Material: When used in a BAAP name, alternate method or test, or definition, an asterisk before the word "material" will be used to indicate some or all of the following:

Adhesives and seals
Ceramics, refractories, and glasses
Coatings, colorants, and finishes
Composite materials; cement
Fibers and textiles; clothing; parachutes
Metals
Oils, lubricants, and hydraulic fluids
Plastics
Rubber and rubber products
Solvents, cleaners, and abrasives
Wood and paper products

Software: The totality of programs and methods used in computing or data-processing systems, together with documentation such as manuals, diagrams, and operating instructions. (In the BAAP list, this definition is used in reference to communication and sensor/detector systems as well as computer systems.)

Hardware: A. Physical equipment and devices forming computer (or communication or sensor/detector) systems and peripheral equipment.

B. Items of metal such as equipment, munitions, tools, fittings, trimmings, fasteners, appliances, parts of machinery, etc.

Field Tests: Tests conducted outdoors or on equipment (or equipment parts) being used outdoors.

Prototype: An operational model suitable for evaluation of design, performance, or production potential. For EICS, this term applies to such models produced in all stages of research, including basic research not directly related to development of a specific item of USAF materiel. Breadboard, brassboard, and advanced prototypes are also included.

BAAP Definitions

100 Research

110 Planning. RDT&E activities which include paperwork and idea formation and execution in the areas of planning and design, forecasting, and decision-making.

111 Plan/design. Development on paper of ongoing and future research activities. Actual products will generally be in the form of studies, test plans or methods, or reports concerning new methods, materials, design of equipment, etc. Also see BAAP 171.

112 Plan/design equipment prototypes: hardware. Planning and design research aimed at production of new or improved equipment to assist the Air Force mission. Specifically refers to hardware (see definition p 25), i.e., the equipment itself, rather than to methods of use (although methods design may occur simultaneously).

113 Plan/design *materials and *materials use. Refers to planning for creation or improvement of the products shown below, or planning for their use. The word "materials," when used with an asterisk, will henceforth refer to these items.

adhesives and seals	oils, lubricants, and hydraulic fluids
ceramics, refractories, and glasses	plastics; composites, cement
	rubber products and rubber
coatings, colorants, finishes	solvents, cleaners, abrasives
	wood and paper products
fibers, textiles	metals

114 Plan/design weapons and weapons systems. Refers to design of new or improved equipment used to deliver destructive agents in warfare.

115 Plan/design fuels, ammunition, explosives. Design of actual destructive agents used in warfare. Planning new fuels and explosive chemicals and their methods of production.

116 Plan/design tests of military materiel. Preparation of test plans for conduct of design, engineering, developmental, production, and surveillance testing of materiel and military equipment. Covers BAAPs 111-121 as applied to items with strictly military application.

117 Plan/design chemical/biological warfare (CW-BW) material protective methods. Plan methods for use and delivery of chemical/biological material protectives (antidotes and detoxifiers). Design methods for interfering with delivery of toxic or lethal agents. Design formulation of antidotes and detoxifiers.

118 Plan/design biological/social experiments or tests. Plan and design methods of executing experiments in the biological, environmental, medical, behavioral, or social sciences. Also includes design of monitoring methods.

119 Plan/design engineering systems/methods or tests. Planning and design of large-scale equipment, such as boilers, pumps, electrical generators, etc. (engineering hardware), as well as the methods by which they are set up, methods for choosing one type of equipment over another, etc. (software).

121 Plan/design communications systems: software. Planning and design of methods for/of using communication systems in military-related (tracking or directing missiles, for example) or other actions. This software design process is related to design of the equipment (hardware) itself, covered under BAAP 112.

122 Plan/design information systems/analysis. Design methods for gathering, storing, retrieving, or analyzing information, with or without computers.

123 Plan/design for increased personnel efficiency. Plan methods by which personnel can be trained more efficiently, be chosen more effectively, or work together more effectively. May involve efficiency of individuals or groups.

124 Plan/design structures. Plan individual structures or the facilities (airfields, for example) in which they are used.

125 Plan/design structure interiors. Plan and design both the visible (furniture, work area arrangement, lighting, colors) and the concealed (utilities supply) portions of structure interiors (including vehicles).

126 Plan/design support functions. Planning of logistics, health care, recreation, and utilities supply for field, installation, or Air Force-wide activities and personnel.

127 Plan/design management methods. Design methods for controlling employees, money, materials, and facilities used to accomplish missions and tasks.

128 Forecast. Development of predictions or models of present and future RDT&E requirements, including those for national defense, in terms of manpower, equipment, costs, and research directions. Forecasting occurs at all stages of RDT&E: field and laboratory workers, their supervisors and project directors, and administrative planners not directly involved in research are all involved in predictive activities at one time or another in the life cycle of a research program, project, or proposal.

129 Defense weaponry and warfare predictions. Forecasting national defense needs based on knowledge of present and projected capabilities of possible adversaries of the United States, as related to U.S. protective/reactive capacity. Affects procurement and RDT&E directions.

131 *Materials/equipment predictions. Forecasting needs for equipment or *materials necessary to accomplish Air Force missions in peacetime and war. Affects procurement and RDT&E directions.

132 Environment/land use predictions. Forecasting USAF needs for land or property as compared to national or local requirements in land use policy or environmental protection. Includes forecasting the impacts that particular activities may have on the environment.

133 Biological/medical science predictions. Forecasting probable developments or future needs in biological (human, animal, plant) or medical (anatomy, pathology, toxicology, physiology, psychology, etc.) research.

134 Behavioral/social science predictions. Forecasting behavioral or social characteristics of USAF military or civilian personnel, or of the general public or portions thereof, in relation to USAF policy or actions. Predictions of behavioral or social characteristics of sample populations during research.

135 Energy needs predictions. Forecasting local, regional, or national requirements for energy or resources, as well as the possibilities for insuring that supplies are able to meet the most critical demands. Prediction of USAF effects on supply.

136 Engineering/scientific technology predictions. Forecasting in the areas of engineering methods, information gathering, analysis, and dissemination, space and weapons technologies, etc. May involve short-term or long-term predictions. May affect procurement, real estate disposal or acquisition, facilities development, and RDT&E directions.

137 Manage. Administrative decision-making as it specifically applies to RDT&E operations and program development. Includes supervision by persons in positions not classified or titled as managerial.

138-145 Management subcategories: Management and decision-making in regard to programs, projects, or tasks in the research areas defined in BAAPs 129-136.

138 Manage weapons/defense research.

141 Manage *materials/equipment research.

142 Manage research in environment/land use.

143 Manage biological or medical research.

144 Manage behavioral/social research.

145 Manage engineering/scientific technology research.

150 Prototype development/test preparation. Construction or production of model machines, electronic systems, structures, *materials, materiel, chemicals, or biological materials, for the purpose of testing the usability of the model or the production method.

151 Construct models/test structures on site. Construction of mechanical, electronic, or structural models, either small-scale or full sized, in order to test their design characteristics, efficiency, or utility. Also, construction, including site preparation, of test structures or facilities.

152 Construct mechanical models. Construct models of vehicles, industrial process equipment, hydraulic systems, etc. These models, when full sized, would be used for testing purposes, and not usually for actual regular use.

153 Construct model electrical/electronic systems. Construct prototype radio, telecommunications, computer, sensor and detector systems, or electrical devices. Although constructed for test, such systems may be converted to actual use if found adequate to meet particular current needs.

154 Construct test structures or structural models. Construct bridges, road sections, dams, hydrologic systems, or buildings for test outdoors. Such structures will be built in sizes large enough for testing, although they need not be as large as the eventual planned structure. For example, an insulation method which eventually may be used in several-story buildings may be tested in a one-room model house. The structure will almost always be built on the installation. (Very small-scale models used indoors for demonstration purposes are not considered environmentally significant.) The BAAP excludes construction of laboratories or structures that will normally continue in use after testing is completed; for these, see the Construction Functional Area.

155 Construct organizational systems/procedures. Produce methods by which particular organizations can be structured and operated effectively. This is the step at which a planned organizational structure or method is adopted or implemented.

156 Construct sample populations. Obtain information concerning the location and availability of persons to be surveyed (see BAAPs 173, 174) by personal contact, letter, or other means. Includes selection of test subjects or participants. Subjects selected may then be brought together (BAAPs 257, 267, 277) or sampled while still dispersed (BAAPs 173, 174).

157 Manufacture prototypes. Produce prototype items at machine shops, government-owned or private manufacturing facilities, etc. See p 26 for definition of special use of the term "prototype."

In general, impacts of prototype production will be minimal when occurring at a manufacturing facility, compared to the total impact of the manufacturing process. However, impact specifically due to the manufacture of the prototype may occur if its production requires a change in the normal industrial process, resulting in different or additional effluents; if the prototype is of a controversial nature; or, if production at a USAF installation or facility is at a small plant or shop designed specifically for production of test items.

170 Obtain/Analyze Data. Collection and analysis of data, either by experiment or by use of information sources from which previously collected data is available.

171 Collect available information. Obtain data by collection from government or public information sources, or by attitude or opinion surveys.

172 Information source data collection. Gathering information from knowledgeable persons or from stored sources (books, articles, regulations, manuals, computers) to ascertain state of the art and/or current findings and activities in a particular research area.

173 Conduct opinion or attitude surveys. Determine public opinion, or the opinion of experts in a research field, on an issue or USAF activity. Determine attitudes of civilian or military personnel on matters of USAF policy affecting their work, home life, or USAF-provided or -prohibited facilities or opportunities.

174 Field demographic survey. Similar to BAAP 173, except the information collected is factual (age, sex, and education of family members, for example) rather than attitudinal.

175 Conduct tests. Perform experiments to obtain data.

176 Materials/equipment tests. Tests performed with or on materials or mechanical or electronic equipment. Such tests are usually but not exclusively performed in laboratories or within buildings See Field Tests (BAAPs 190-218) for most impacts of outdoor testing, or for outdoor performance of some tests listed for BAAPs 176-180.

177 Electrical/electronic tests. Tests performed with or on electric or electronic equipment.

The following are only some of the many such tests that may be performed.

Acoustical analysis. Noise or sound measurement and analysis using electronic equipment.

Damping tests. Determination of the progressive reduction in amplitude of oscillations.

Electrical ground test. Determination of the effectiveness of a particular ground for electricity.

Electrical load tests. Tests of the ability of a circuit to carry a particular current; tests of the amount of current carried.

Magnetic core tests. Tests of a ferro-magnetic material placed in a coil which serves to increase the external magnetic field.

Magnetic tests. (1) Determination of a material's magnetic properties. (2) Determination of a component's or system's effectiveness while operating in a magnetic field.

Resonance tests. Determination of the reinforcement and prolongation of oscillating waves by a body or circuit. In structures, used to determine harmonica for earthquake evaluation. Includes laboratory determination of the characteristics of shock waves.

Spark test. Determination of the acceptability of rubber, plastic, or paint linings in steel process vessels. A high-voltage, low-energy current is used.

Static tests. Determine the presence of static (electromagnetic) pulses and/or their effect on the serviceability of components or systems.

System checkouts. Tests of functional operability of an entire electrical or electronic system by several of the alternate tests listed for this BAAP, or by testing its ability to perform its desired function.

Ultrasonic tests. Determination of discontinuities in a material. Commonly used in weld testing.

X-ray inspection. Determination of a material's properties through analysis of the reflection/refraction patterns of nonluminous radiation of extremely short wave length (X-rays).

Electronic detection. Use of electronic sensing devices such as radar, SONAR, lasers, etc., to monitor test operations. Also see BAAP 191.

Electric equipment tests. Determination of the reliability, heating losses, power output, and power consumption of electrical equipment (switches, wires, motors, transformers, generators).

Electronic hardware tests. Determination of the input/output characteristics and reliability of electronic equipment (radios, computers, telephones, switching circuits, tracking equipment, etc.).

Electronic software tests. Performance tests of radio, computer, telecommunication, tracking, or switching methods, systems, and processes.

178 Physical and mechanical tests. Tests with or on mechanical equipment and materials, specifically excluding such tests performed in the field (see Field Tests).

The following are only some of the many tests which may be performed.

Abrasion test. Determination of a material's resistance to abrasive wear under specified conditions.

Acceleration tests. (1) Determination of a component's ability to function under and after an accelerating force. (2) Laboratory determination of the acceleration characteristics of an engine.

Adhesive tests. Determination of the strength of the union (bond) between two entities.

Aging tests. Determination of the change in material properties with time.

Bearing tests. Determination of the acceptability of those parts of a machine which bear the friction when parts are in contact and have relative motion.

Certification. Determination that an item of equipment or a *material is usable, according to some standard, by application of several of the alternate tests listed for this BAAP.

Corrosive tests. Determination of the wearing away of solids (especially metals) by chemical or electrolytic attack.

Environmental tests. Determination of a system's ability to withstand a variety of environmental conditions (arctic, desert, tropics, underwater, vacuum, etc.).

Fatigue tests. Determination of the range of alternating stress to which a material may be subjected without risk of ultimate failure.

Fire tests. (1) Determination of a material's kindling temperature. (2) Determination of fire ratings for physical systems and/or components for use in/inside a structure. (3) Determination of a material's support of or resistance to combustion.

Flow measurements and tests. Tests of the flow characteristics of air, gas, or hydraulic or hydrologic liquids or systems in a laboratory or enclosed environment, or of the flow characteristics in such systems created by obstructions.

Hardness tests. Determination of a material's rigidity, lack of plasticity, or strength.

High altitude tests. Determination of a system's effectiveness at high altitudes (actual or simulated).

High pressure tests. Determination of a material's, component's, or system's properties at high pressures.

Low pressure tests. See "high altitude tests."

High temperature tests. Determination of a material's, component's, system's, or material item's properties at high temperatures.

Low temperature tests. Determination of a material's properties under cryogenic temperatures.

Inspections. Self-explanatory.

Impact or drop test. A test in which the stress or strain is suddenly applied. See also "notch test."

Liquid immersion tests. Determination of a component's or system's functioning ability during and after immersion in-lab. (See also "environmental tests.")

Load tests. Indoor tests of the ability of equipment, structures, or *materials to withstand loads applied mechanically by special laboratory or shop equipment (unlike BAAP 201, which refers to loads applied in field situations).

Boiler or pump load tests. Tests of (1) the ability of boilers, pumps, or other large-scale equipment to perform at various load capacities, and (2) the efficiencies with which they perform.

Lubricants tests. Determination of a material's effectiveness for reducing friction between two particular sliding surfaces.

Moisture content tests. Measurement of the percent hydration of *materials, chemicals, or soil samples.

Notch test. The measurement of energy absorbed in breaking a notched bar which is given a sudden blow.

Road construction tests. Determination of road construction parameters by physical testing (not involving any actual construction in the field) of soils, concrete, materials, etc.

Shock tests. The determination of a component's or system's serviceability and reliability after being subjected to a nearly instantaneous acceleration or deceleration. Also see "resonance test" (BAAP 177) and "impact test."

Specific gravity tests. Measurement of the specific gravity (mass relative to an equal volume of water or air) of a *material, chemical, or piece of equipment.

Soil particle gradation. Separation of sized soil particles using a graded series of fine mesh sieves. Used in soil analysis.

Spin tests. Determination by application of centrifugal force of a component's or system's ability to operate under acceleration forces for a prolonged period.

Stability test. Determination of a cable's stability by subjecting it to a working voltage (or higher) while it is alternately heated and cooled. If the power factor increases, it is unstable.

Strain tests. Determination of a material's properties by subjecting it to a change in size. Includes tension tests.

Test engine compression. A test to determine the pressure in, and therefore the efficiency of, a cylinder or chamber of a gasoline or diesel engine.

Thermal cycling tests. Subjecting a substance to a number of successive temperature cycles.

Vacuum tests. Tests using equipment which creates extremely low air pressures in an enclosed environment. Tests of the reliability of seals and adhesives under vacuum.

Vibration tests. Determination of a component's or system's reliability under and after being subjected to prolonged vibrational stresses.

Wear tests. Determination of the serviceable life of a component or system subjected to friction or abrasion.

Weightlessness tests. Tests of the ability of equipment, test animals, or personnel to perform expected functions under conditions of low or no gravity. When performed in aircraft, see BAAP 197.

Weld tests. Determination of the continuity of welds by visual observation, ultrasonic testing, or X-ray inspection.

179 Chemistry tests. Tests involving chemical measurement:

Chemical analysis. Splitting up a material into its component parts or constituents by chemical methods to determine the composition of the material.

Chemical tests. Determination of a chemical's effectiveness for a particular function. Note: chemical/biological control agents have already been separated from this group.

Explosives tests. Laboratory tests of chemicals or compounds which are or will be used as explosives. Includes tests on the physics of explosives.

Propellant tests. Chemical tests for determining a material's effectiveness for and characteristics in use as a shell or missile propellant.

180 Radiation tests. Tests involving force fields or wave or particulate radiation:

Force field tests. Determination of the field strength or effects of gravity, electromagnetic, atomic, or nucleonic force fields.

Heat radiation tests. Determination of characteristics or effects of heat transfer from a source to a receiver without heating the intervening medium.

Non-ionizing radiation tests. Determination of presence, characteristics, and/or effects of non-ionizing electromagnetic waves (radio, light, lasers, infrared, etc.).

Ionizing radiation tests. Determination of presence, characteristics, and/or effects of radiation in the form of emitted particles or waves (α, β, protons, mesons, X-rays, gamma waves, etc.).

181 Full-scale manufacturing process tests. Determination of a production system's operational effectiveness.

Conduct industrial process test runs. Test operational effectiveness of a new or improved industrial process for production of materials or chemicals.

Conduct machine/equipment manufacturing test runs. Test operational effectiveness of a new or improved manufacturing process for production of machinery or equipment, either prototypes or final production models.

182 Firing tests. Determination of characteristics of weapons, explosives, or projectiles (including projectile ballistics) and suitability for use by firing in closed, or "laboratory" (as opposed to field) test ranges.

183 Ground or bench test engines indoors. Test the operating characteristics of conventional internal combusion, stratified charge, rotary, turbine, or jet engines.

184 Behavioral, social, and medical research analysis. Testing of humans or test animals, plants, or microbial organisms by electronic measurement, physical measurement, or observation. The purpose of such tests (including BAAPs 185-139) may be to examine subject (human or animal) response, or it may be to evaluate the safety or utility of equipment, methods, etc.

185 Learning and knowledge tests. Written, verbal, or performance tests of mental achievement, aptitude, or intelligence. These tests are at the theoretical level.

186 Performance tests. Tests, at the practical level, of a person's or animal's physical and mental performance ability under "normal" conditions: flight tests, navigation tests, tests of equipment operation ability, tests of strength, determination of performance in actual or simulated underwater or space conditions. Includes psychomotor tests, which determine the motor effects of mental processes. For performance tests of materiel, see BAAPs 175-183 and 190-219.

187 Endurance tests. Tests of a person's or animal's actual physical and mental performance ability during conditions of stress (physical, mental, emotional, physiological, battlefield conditions, or chemical/biological toxicants stress). For endurance tests of materiel, see BAAPs 175-183 and 190-219.

188 Physiological tests. Tests which examine the functions and vital processes of living organisms or their parts and organs. Especially in RDT&E, physiological tests would examine functional reactions to stress, chemical/biological toxicants and anti-toxicants, and medical treatment agents and methods. Surgery on test animals would be included under this BAAP.

189 Psychological and personality tests/evaluation. In RDT&E, the use of psychological and personality tests to predict personnel performance under specified conditions, or to evaluate the effectiveness of such test methods so as to determine possibilities for their future use. Specific definitions are:

Psychological tests. The determination of human behavior, including observations, investigation, and recordings of the mind and its functions.

Personality tests. Determination of the integrated organization of the psychological, intellectual, emotional, and physical characteristics of an individual as presented to other people.

190 Field tests. Tests which, because of the nature of the item being tested or the testing method itself, must be conducted in a "field" situation -- outdoors. Field test areas may be proving grounds; public, government-owned, or private lands in developed areas; or public, government-owned, or private lands in undeveloped areas.

191 Field test electronic transmitters. Test operations outdoors using electronic microwave or laser transmitters.

192 Field test explosives. Test firing of explosive chemicals, projectiles, or shells under field conditions. Also, performing field tests using explosives.

193 Test fire weapons hardware. Field testing of hand guns, rifles, missiles, rockets, cannons, incendiaries, gas, smoke bombs, etc. Includes tests of armor penetrability. For firing tests using weapons-carrying aircraft, also see BAAP 197.

194 Test fire non-destructive rockets or their fuels. Field testing of rockets with non-destructive payloads (manned or unmanned space vehicles, satellites) or missiles without their normal weapons payloads (1) to determine the ballistic, navigability, or tracking systems characteristics of the missiles or various operational characteristics of their non-destructive payloads, or (2) to determine the performance characteristics of new fuels.

195 Test fire missile/rocket engines or their fuels. Conducting rocket engine firing tests of power, acceleration ability, combustion efficiency, etc., at ground level or in underground test stands.

196 Road test vehicles or their fuels. Testing operational characteristics, mobility, or fuel performance of support or tactical vehicles on paved roads, unpaved roads, or cross country. Also, performing field tests using such vehicles.

197 Flight test aircraft or their fuels. Testing operations or performance of fixed-winged, rotary-winged, unmanned, or one-man air-cushion aircraft or their fuels at low or high altitudes. Also, performing field tests using such aircraft.

198 Field test watercraft or their fuels. Testing operation or performance of ships, boats, marine landing vehicles, amphibious vehicles, or hovercraft, or their fuels, on inland or coastal waters or at sea. Also, performing field tests using such watercraft.

199 Drop tests outdoors. The military's determination of a component's and/or machine's ability to withstand an air drop for airborne operations.

200 Field test general equipment. Military testing of general commodities not specifically covered in other categories, such as clothing, food, rations, individual pilot's/airman's equipment, supply items (laundry, bakery, POL-handling equipment), tools, machinery, engineer construction equipment, etc.

201 Load test outdoors. Determination of a material's or system's structural load-carrying properties.

202 Nuclear tests. Blast tests of nuclear weapons. (See BAAPs 180, 191, 192, and 203 for simulation of nuclear explosions or their effects.)

ABOVEGROUND NUCLEAR TESTS ARE SUSPENDED UNDER THE SALT BILATERAL AGREEMENT.

203 Shock tests. Analysis of wave characteristics or structural resistance characteristics during actual or simulated (using explosives) earthquakes or nuclear blasts.

204 Battle operations tests. Conduct war games or logistics exercises on- or off-base or at sea (during joint operations) to determine the overall efficiency of field military tactics and operations, logistics, etc.

205 Field sampling/testing. Obtaining data in the field by observation, tabulation, measurement, and/or collection. The term "testing" is used here to indicate that researchers adjust or change the area to be sampled prior to sampling; "sampling" may be done by untended monitoring equipment.

206 Field biological sampling/testing. Sampling of animal or plant populations by observation, tabulation, measurement, or collections. Animal collection may be by live capture methods, or the animals may be killed during or after capture. Plant collection is by removal of all or part of the plant. For collection of microorganisms or aquatic or soil macroinvertebrates, see field water, air, and soil sampling BAAPs. Testing includes any artificial manipulation of such populations, including introduction of plants or animals not previously present.

207 Field water sampling/testing. Measurement of water quality at a field site (pH, temperature, BOD, COD, CO, etc.) by use of monitoring equipment or by collection of small water samples followed by laboratory chemical and/or biological analysis.

208 Field air sampling/testing. Measurement of ambient or source air quality by (1) using electronic or chemical techniques at a field site; or by (2) field collecting samples, followed by laboratory analysis, to determine presence and concentrations of particulates, gases, biocides, radioactive substances, allergens, etc.

209 Meteorologic data collection/testing. Measurement of weather conditions by observation and instrumentation. Primarily refers to passive sampling at ground level, on buildings, in aircraft, or by satellite. Testing may include active intervention, however, such as cloud seeding.

211 Field noise sampling/testing. Collection of outdoor noise level data at various locations using electronic equipment.

212 Field soil sampling/testing. Collection of data about soils by observation of road cuts or eroded soil profiles, or by surface or core sampling of the soil followed by physical and chemical laboratory analysis. Includes testing soil bearing strength (the ability of a soil to support the passage of vehicles) using an instrument called a soil penetrometer.

213 Field geologic sampling/testing. Analysis of geologic conditions and presence of particular rocks or minerals, at surface, in mines, or underground; sample collection may require drilling or blasting. Some chemical and physical analysis may follow in a laboratory. Also includes analysis of terrain characteristics.

215 Survey land. Determining the topographic characteristics of land (terrestrial or underwater) using physical measurements, electronic instrumentation (particularly in oceanography), or satellites.

216 Field test biological control agents. Determining the field effectiveness of biological control agents (other than CW-BW materials). See Table 4, p 49, for alternative controls.

217 Field test CW-BW protectives. Determining the effectiveness of protectives (against CW or BW materials) applied in the field by spraying, incorporation into water, air, or food supplies, or shelling. *Protectives research requires that small amounts of CW or BW materials be used for defensive weapons testing. Research on CW and BW materials used as offensive weapons has been suspended. CW or BW materials may include lethal or non-lethal chemicals, riot control agents, biological agents, or herbicides.*

218 Field test other chemical agents. Determining field effectiveness of chemicals whose primary purpose is direct protection of personnel or equipment, such as camouflage, smoke bombs, paints, etc.

219 Analyze data. Determining experimental or test results and importance of collected raw data by tabulation, mapping, graphing, photointerpretation, mathematical analysis and modeling, statistical tests and analysis, simulations, cryptographic techniques, computer use, or subjective analysis by the researcher.

220 Accidents. Accidents may occur during many types of RDT&E research in laboratories, on test production lines (semiworks), or under field conditions. BAAPs 221-238 refer specifically to accidents connected with an RDT&E program.

221 Minor chemical spills. Minor spills of laboratory and industrial chemicals, CW materials, POL products, etc.

222 Catastrophic chemical spills or leakage. Major, usually outdoor, chemical or oil spills or leakage into water supplies or drainage systems. May occur on a single occasion or over an extended period.

223 Equipment damage. Minor damage to total destruction of test or support equipment. May be corollary to several other types of accidents.

224 Explosion. Unplanned detonation of test explosives (including ammunition prematures), or explosion due to ignition of superfine dust or leaking gases, fumes, or vapors.

225 Fire. Fire due to carelessness or hazardous conditions during tests or at test locations.

226 Intrusion by disease vectors. Unexpected influence on test results when test humans, animals, or plants contract some disease before, during, or after a test.

227 Escape of biological test agents. Unexpected release of test microorganisms, such that they may have some effect on researchers, support personnel, the general public, or local ecology.

228 Escape by test animals or unauthorized absence of human test subjects. Temporary or permanent escape of animals or unauthorized absence of humans which were involved in tests.

229 Bite by test animals. Biting of research or support personnel or member(s) of the general public by test animals.

231 Radiation exposure. Unexpected or undetected exposure of test organisms or humans (research or support personnel, or general public) to radiation. Exposure may be internal or external, and could be short-term at high dosage levels or long-term at low dosage levels.

232 Nuclear accident. An accident involving a nuclear weapon or radioactive material, including such possibilities as accidental detonation, hijacking of weapon, hijacking of radioactive substances, or loss of weapon or radioactive substances.

233 Sabotage. Action by enemy agents to prevent proper performance of tests, prevent timely execution of tests, or invalidate, steal, or destroy results. This BAAP excludes sabotage using methods defined by any other "Accidents" BAAPs (221-238).

234 Unexpected climatic change. Climatic change which affects the performance, results, or applicability of tests.

235 Unexpected secondary effects. Unexpected detrimental side effects to vegetation, local domestic or wild animals, test animals, or humans to which emergency countermeasures had not been prepared or were not available in time.

236 Intrusion by non-test humans/animals. Intrusion into a test area by non-test humans or animals which voids results, precludes performing the test, precludes secrecy, or endangers the intruder(s).

237 Contamination by toxic residues. Contamination of test site, equipment, or test organism(s) by toxic chemical or biological materials.

238 Noise overexposure. Accidental damage to property or human health as a result of blast overpressures or other excessive noise effects.

240 Support Functions. Activities which may be categorized as operations but which here are specifically restricted to those operations dealing with RDT&E programs or projects.

250 Obtain supplies. Obtaining items which are to be tested or which are to be used during tests. Any actions necessary to originally obtain or produce the items should be considered when use of the items for testing will be different from using them for any other reason. An example would be obtaining domestic animals (e.g., dogs) for testing purposes -- an action likely to be controversial. In many cases, however, merely obtaining the items for test will not create impacts greater than obtaining them for regular use.

260 Transport supplies. Transporting by either military or public means items which are to be tested or which are to be used during tests in an RDT&E program or project. Transport may be by fixed or rotary-winged aircraft, watercraft, railroad, car, truck, bus, MHE (materials-handling equipment), or cargo containers, or any combination of the above.

270 Store/maintain supplies. Storing and maintaining supplies before, during, and after their use in tests in an RDT&E program. Includes housing test animals and plants and operating decontamination rooms, procedures, and laundries.

290 Waste disposal. Disposal of waste, including POL, produced during operation of an RDT&E program or project.

291 Disposal of radioactive wastes. Disposal of radioactive materials or equipment, in small or large amounts, by underground storage in containers, underground injection, storage in bunkers, or dumping at sea (in containers or not).

292 Disposal of pathological waste. Disposal of pathologically contaminated waste from medical or biological research, by incineration, pathological incineration, autoclaving, burial, or sanitary landfill.

293 Disposal of chemicals, fuels, POL. Disposal of toxics and other chemicals, including heavy metals and their compounds, POL items, and biocidal chemicals by system recycling, salvage for resale, or by disposal via any of the following methods: public sewage systems, detoxification, air venting, incineration, burial, sanitary landfill, dumping, dumping at sea.

294 Disposal of off-specification or scrap materials. Disposal of prototypes, models, and off-specification ammunition, equipment, materials, or materiel produced in RDT&E programs or projects, which will not be reused as is (or will not be reused by researchers at all), by burial, dumping, detonation, incineration, sanitary landfill, chemical detoxification, system recycle, or salvage for resale.

Procurement Categories:

295 Funding source or level. Impacts of procurements will vary in degree according to the level of funding, source (61xxxx, 62xxxx, etc.), or stage of the acquisition cycle.

296 Items/equipment/materials. Impacts (particularly those involving the economy, social factors, or resource conservation) will vary according to *what* is being procured.

297 Decision point. Impacts of a procurement will vary according to whether the procuring agency actually is responsible for policy (on funding level or items to be purchased).

Table 3

RDT&E BAAP List

100 Research

110 Planning

111 Plan/Design

112 Plan/design equipment prototypes: hardware
113 Plan/design *materials and *materials use
114 Plan/design weapons and weapons systems
115 Plan/design fuels, ammunition, explosives
117 Plan/design CW-BW material protective methods
118 Plan/design biological/social experiments/tests
119 Plan/design engineering systems/methods or tests
121 Plan/design communications systems: software
122 Plan/design information systems/analysis
123 Plan/design for increased personnel efficiency
124 Plan/design structures
125 Plan/design structure interiors
126 Plan/design support functions
127 Plan/design management methods

128 Forecast

129 Defense weaponry and warfare predictions
131 *Materials/equipment predictions
132 Environment/land-use predictions
133 Biological/medical science predictions
134 Behavioral/social science predictions
135 Energy needs predictions
136 Engineering/scientific technology predictions

137 Manage

138 Manage weapons/defense research
141 Manage *materials/equipment research
142 Manage research in environment and land use
143 Manage biological or medical research
144 Manage behavioral/social research
145 Manage engineering/scientific technology research

150 Prototype Development/Test Preparation

151 Construction models/test structures on site

152 Construct mechanical models
153 Construct model electronic systems

Table 3 (cont'd)

154 Construct structural models/test structures
155 Construct organization systems/procedures
156 Construct sample populations

157 Manufacture Prototypes

158 Manufacture *materials prototypes
159 Manufacture equipment prototypes
161 Manufacture air support and tactical vehicle prototypes
162 Manufacture missile/rocket prototypes
163 Manufacture ammunition/explosives/incendiaries for test
164 Manufacture fuels and other POL for test
165 Manufacture CW-BW materials for protectives tests
166 Manufacture other chemicals for test

170 Obtain/Analyze Data

171 Collect available information

172 Information source data collection
173 Conduct opinion or attitude surveys
174 Field demographic survey

175 Conduct tests

176 *Materials/equipment tests
177 Electrical/electronic tests
178 Physical and mechanical tests
179 Chemistry tests
180 Radiation tests
181 Full-scale manufacturing process tests
182 Firing tests
183 Ground or bench test engines indoors

184 Behavioral, social, and medical research analysis

185 Learning and knowledge tests
186 Performance tests
187 Endurance tests
188 Physiological tests
189 Psychological and personality tests/evaluation

190 Field tests

191 Field test electronic transmitters
192 Field test explosives

Table 3 (cont'd)

193 Test fire weapons hardware
194 Test fire nondestructive rockets or their fuels
195 Test fire missile/rocket engines or their fuels
196 Road test vehicles or their fuels
197 Flight test aircraft or their fuels
198 Field test watercraft or their fuels
199 Drop tests outdoors
200 Field test general equipment
201 Load tests outdoors
202 Nuclear tests
203 Shock tests
204 Battle operations tests
205 Field sampling/testing

206 Field biological sampling/testing
207 Field water sampling/testing
208 Field air sampling/testing
209 Meteorologic data collection/testing
211 Field noise sampling/testing
212 Field soil sampling/testing
213 Field geologic sampling/testing

215 Survey land
216 Field test biological control agents
217 Field test CW-BW protectives
218 Field test other chemicals

219 Analyze data

220 Accidents

221 Minor chemical spills
222 Catastrophic chemical spills or leakage
223 Equipment damage
224 Explosion
225 Fire
226 Intrusion by disease vectors
227 Escape of biological test agents
228 Escape by test animals or absence of human test subjects
229 Bite by test animals
231 Radiation exposure
232 Nuclear accident
233 Sabotage
234 Unexpected climatic change
235 Unexpected secondary effects
236 Intrusion by non-test humans/animals
237 Contamination by toxic residues
238 Noise overexposure

Table 3 (cont'd)

240 Support Functions

250 Obtain Supplies

- 251 Obtain equipment/materials
- 252 Obtain ammunition/explosives
- 253 Obtain test fuels and other POL
- 254 Obtain CW-BW materials
- 255 Obtain other chemicals
- 256 Obtain test animals/plants
- 257 Obtain human test subjects
- 258 Obtain microbial cultures other than BW materials
- 259 Obtain radiation sources

260 Transport supplies

- 261 Transport equipment/materials
- 262 Transport ammunition/explosives
- 263 Transport test fuels and other POL
- 264 Transport CW-BW materials
- 265 Transport other chemicals
- 266 Transport test animals/plants
- 267 Transport human test subjects
- 268 Transport microbial cultures other than BW materials
- 269 Transport radiation sources

270 Store/maintain supplies

- 271 Store/maintain equipment/materials
- 272 Store/maintain ammunition/explosives
- 273 Store/maintain fuels and other POL
- 274 Store/maintain CW-BW materials
- 275 Store/maintain other chemicals
- 276 House/maintain test animals/plants
- 277 House human test subjects
- 278 Store/maintain radiation sources
- 279 Store/maintain microbial cultures other than BW materials
- 281 Operate radiation decontamination rooms/procedures
- 282 Operate laundry for radiologic decontamination room or clean room
- 283 Operate pathologic clean rooms/decontamination procedures
- 284 Operate laundry for pathologic clean room/decontamination room
- 285 Range preparation/rehabilitation

Table 3 (cont'd)

290 Waste disposal

- 291 Disposal of radiation wastes
- 292 Disposal of pathological waste
- 293 Disposal of chemicals, fuels, POL
- 294 Disposal of off-specification or scrap materials

Procurement Categories:

- 295 Funding source or level
- 296 Items/equipment/materials
- 297 Decision point

Table 4

RDT&E: Alternate Tests or Methods

100 Research

110 Planning

111 Plan/design

112 Plan/design equipment prototypes: hardware

parts
support vehicles
transport vehicles
electronic equipment
mechanical equipment
communications systems hardware -- including tracking systems, computer hardware, etc.
sensors and detectors
lasers
rockets
satellites

113 Plan/design *materials and *materials use

adhesives and seals
ceramics, refractories, and glasses
coatings, colorants, and finishes
composite materials, cement
fibers and textiles
metals
oils, lubricants, and hydraulic fluids
plastics
rubber
solvents, cleaners, and abrasives
wood and paper products

114 Plan/design weapons and weapons systems

aircraft
rockets and missiles
cannons
launchers
hand guns
rifles
machine guns
lasers
ballistics
mobility
operator efficiency
energy efficiency

Table 4 (cont'd)

115 Plan/design fuels, ammunition, explosives

- new/improved fuels
- bullets
- grenades
- shells and projectiles
- mines
- plastic and chemical explosives
- nuclear devices

116 Plan/design tests of military materiel

117 Plan/design CW-BW material protective methods

- CW antidotes and detoxifiers
- BW antidotes
- delivery interference

118 Plan/design biological/social experiments or tests

- biological sciences
- environmental sciences
- medical sciences
- behavioral sciences
- social sciences
- experimental test programs
- experimental testing methods
- standard test or monitoring methods

119 Plan/design engineering systems/methods or tests

- construction
- electrical systems
- sanitary facilities or systems
- hydrologic systems
- hydraulic systems
- energy production or conversion facilities
- pollution control systems
- industrial chemicals or *materials production systems

121 Plan/design communications systems: software

- radio
- audio-visual
- other
- radar
- SONAR
- laser

122 Plan/design information systems/analysis

- information storage and retrieval
- computer methods
- non-computer methods
- program design
- information analysis systems
- intelligence analysis systems
- data gathering and analysis methods

Table 4 (cont'd)

123 Plan/design for increased personnel efficiency

- improve training/indoctrination methods
- develop new training methods
- develop or upgrade personnel training requirements
- develop/improve organizational systems

124 Plan/design structures

- buildings
- roads and pavements
- bridges
- dams
- earthworks
- tunnels
- towers
- silos
- storage structures
- facilities and installations

125 Plan/design structure interiors

- plumbing
- lighting
- heating
- cooling
- materials use
- space utilization and design
- habitability design

126 Plan/design support functions

- feeding
- housing
- health care
- recreation
- transportation

127 Plan/design management methods

128 Forecast

- research program costs
- development costs
- implementation costs
- manpower requirements
- technology requirements
- research directions

129 Defense weaponry and warfare predictions
131 *Materials/equipment predictions
132 Environment/land use predictions
133 Biological/medical science predictions
134 Behavioral/social science predictions
135 Energy needs predictions
136 Engineering/scientific technology predictions

Table 4 (cont'd)

137 Manage

develop research programs
accept/reject items or programs
obtain funding
evaluate priorities

138 Manage weapons/defense research
141 Manage *materials/equipment research
142 Manage research in environment and land use
143 Manage biological or medical research
144 Manage behavioral/social research
145 Manage engineering/scientific technology research

159 Prototype Development/Test Preparation

151 Construct models/test structures on site

152 Construct mechanical models

engines	small-scale
other machinery	full-sized
measuring devices	

153 Construct model electronic systems

154 Construct test structures or structural models

mock-ups and models	test structures
full sized structures or models	test facilities
buildings	on-base
roads	off-base
dams	
bridges	
earthworks	

155 Construct organization systems/procedures

156 Construct sample populations

157 Manufacture prototypes

158 Manufacture *materials prototypes

Table 4 (cont'd)

159 Manufacture equipment prototypes

- electrical and electronic
- mechanical
- parts

161 Manufacture air support and tactical vehicle prototypes

- land vehicles
- watercraft
- aircraft

162 Manufacture missile/rocket prototypes

163 Manufacture ammunition/explosives/incendiaries for test

164 Manufacture fuels and other POL for test

165 Manufacture CW or BW materials for protectives tests

166 Manufacture other chemicals for test

170 Obtain/Analyze Data

171 Collect available information

172 Information source data collection

- libraries
- public information agencies
- government offices
- computer systems

173 Conduct opinion or attitude surveys

- interviews
- questionnaires
- panels
- delphi techniques
- data analysis programs/systems
- experts
- employees
- public

174 Field demographic survey

175 Conduct tests

Table 4 (cont'd)

176 Materials/equipment tests

- electronic measurement
- physical measurement (microscopes, scales, calipers, tape measures, etc.)
- chemical measurement
- item or system checklist analysis
- calibration
- observation
- safety evaluation

177 Electrical/electronic tests

- acoustical analysis
- damping tests
- electrical ground tests
- electrical load tests
- magnetic core tests
- magnetic tests
- resonance tests
- spark tests
- static tests ---
- system checkouts
- ultrasonic tests
- X-ray inspection

- electric/electronic hardware tests
- electronic equipment software tests
- electronic detection

178 Physical and mechanical tests

- abrasion tests
- acceleration tests
- adhesion tests
- aging tests
- bearing tests
- certification
- compression tests
- corrosive tests
- environmental tests
- fatigue tests
- fire tests
- flow measurements and tests
- hardness tests
- high altitude tests
- high pressure tests
- low pressure tests
- high temperature tests
- low temperature tests
- load tests
- boiler or pump load tests
- lubricants tests
- moisture content tests
- notch tests
- non-destructive tests
- road contruction tests
- shock tests
- specific gravity tests
- soil particle gradation
- spin tests
- stability tests
- strain tests
- test engine compression
- thermal cycling tests
- vacuum tests

Table 4 (cont'd)

inspections
impact or drop tests
liquid immersion tests
vibration tests
wear tests
weightlessness tests
weld tests

179 Chemistry tests

chemical analysis
chemical tests
explosives tests
propellant tests

180 Radiation tests

Force field tests

electromagnetic fields
atomic fields
nucleonic fields
gravity

Thermal radiation tests

Non-ionizing radiation tests

radio
radar
light
lasers
infrared
characterize
measure

Ionizing radiation tests

alpha
beta
protons
mesons
other atomic particles
X-rays
gamma waves
characterize
measure

181 Full-scale manufacturing process tests

Conduct industrial process test runs
Conduct machine/equipment manufacturing test runs

182 Firing tests

hand weapons
explosives
projectiles
projectile ballistics
armor penetrability

Table 4 (cont'd)

183 Ground or bench test engines indoors

conventional internal combustion	jet
stratified charge	turbine
	rotary

184 Behavioral, social, and medical research analysis

electronic measurement	humans
physical measurement	test animals
observation	test insects
	test plants
	microbes
	wildlife
	wild plants

185 Learning and knowledge tests

achievement tests	written
aptitude tests	oral
intelligence tests	performance

186 Performance tests

flight	underwater
navigation	space conditions
equipment operation	
strength	

187 Endurance tests

- physical stress reactions
- mental stress reactions
- emotional stress reactions
- physiological stress reactions
- battlefield stress reactions
- chemical/biological toxicant reactions

188 Physiological tests

- stress reactions
- chemical or biological toxicants
- medical treatment agents or methods

189 Physiological and personality tests/evaluation

- performance prediction
- test methods development

Table 4 (cont'd)

190 Field Tests

proving grounds
developed lands
undeveloped lands
public lands
private lands

191 Field test electronic transmitters

radio
laser
other microwave
SONAR
radar

192 Field test explosives

shells
projectiles
plastics and other high explosives
grenades
incendiaries
non-nuclear warheads

193 Test fire weapons hardware

cannons
hand guns
rifles
missiles
launchers
rockets

armor penetrability

(For test firing of airborne weapons on the aircraft, see also BAAP 197.)

194 Test fire non-destructive rockets or their fuels

space or surveillance rockets
missiles without weapons payloads

195 Test fire missile/rocket engines or their fuels

196 Road test vechicles or their fuels

support
tactical
wheeled
tracked

197 Flight test aircraft or their fuels

fixed-winged
rotary-winged
low altitude
high altitude

Table 4 (cont'd)

one-man air cushion
unmanned

198 Field test watercraft or their fuels

ships and boats	hovercraft
amphibious craft	drone recovery

199 Drop tests outdoors

200 Field test general equipment

clothing	bakery items
food	POL-handling equipment
rations	tools
individual pilot's/ airman's equipment	machinery
laundry items	engineer construction equipment

201 Load test outdoors

roads	wharfs
bridges	towers
vehicles	antennas
hardened facilities	airfields
dams	buildings
pilings	

202 Nuclear tests

underground	underwater
extraterrestrial	

HIGH- AND LOW-ALTITUDE NUCLEAR BLAST TESTS ARE SUSPENDED UNDER THE SALT BILATERAL AGREEMENT.

203 Shock tests

wave analysis	earthquake simulation
*materials and structural resistance analysis	nuclear blast
	nuclear blast simulation
vibration tests	simulate other explosions

206 Battle operations tests

on-base war games	logistics exercises
off-base war games	security exercises
war games at sea	

Table 4 (cont'd)

205 Field sampling/testing

- 206 Field biological sampling/testing
- 207 Field water sampling/testing
- 208 Field air sampling/testing
- 209 Meteorologic data collection/testing
- 211 Field noise sampling/testing
- 212 Field soil sampling/testing
- 213 Field geologic sampling/testing

215 Survey land

- physical measurement
- electronic measurement
- satellites

216 Field test biological control agents

- cutting
- mowing
- chemicals
  - pesticides
  - herbicides
- natural controls (introduction of a predator of the pest)
- aural or visual disturbance

217 Field test CW or BW protectives

- lethal chemicals anti-agents
- non-lethal chemicals anti-agents
- riot control chemicals
- biological materials anti-agents
- herbicides

218 Field test other chemicals

- paints and other coatings
- other chemical *materials
- smoke bombs

219 Analyze data

- tabulation
- mapping
- graphing
- statistical tests and analysis
- mathematical modeling

Table 4 (cont'd)

photointerpretation	cryptography
mathematical analysis	subjective analysis
simulations	computer use

220 Accidents

221 Minor chemical spills

standard lab	lab
toxics	semiworks
POL products	field

222 Catastrophic chemical spills or leakage

standard lab	lab
toxics	semiworks
POL products	field

223 Equipment damage

breakage	*deformation*
corrosion	

224 Explosion

major	lab
minor	semiworks
	field

225 Fire

major	lab
minor	semiworks
	field

226 Intrusion by disease vectors

human	major	lab
test animals	minor	field
test plants		

227 Escape of biological test agents

pathogenic	within lab	from lab
highly patho-genic	within field test site	from field test site
non-pathogenic		

Table 4 (cont'd)

228 Escape by test animals or absence of human test subjects

within lab	from lab
within field test site	from field test site

229 Bite by test animals

research personnel	public
support personnel	

231 Radiation exposure

humans	research personnel	long-term low dosage
test animals	support personnel	short-term high dosage
test plants	public	
wildlife		
wild plants		

232 Nuclear accident

accidental detonation	capture of weapon
capture of radioactive substances	loss of weapon
loss of radioactive substances	

233 Sabotage

CW or BW protectives test	capture of test item
weapons test	covert test interference
other test	

234 Unexpected climatic change

235 Unexpected secondary effects

vegetation	test animals
wildlife	humans
domestic animals	

236 Intrusion by non-test humans/animals

chemicals test	weapons test
CW or BW protectives test	other test

237 Contamination by toxic residues

rapidly biodegradable	long-lasting

Table 4 (cont'd)

238 Noise overexposure

property damage | human health effects

240 Support Functions

250 Obtain Supplies

251 Obtain equipment/materials

sensors and detectors	parts
electronic equipment	*materials
mechanical equipment	
vehicles	
weapons	

252 Obtain ammunition/explosives

bullets	nuclear devices
rockets and missiles	chemical and plastic
shells and projectiles	explosives

253 Obtain test fuels and other POL

254 Obtain CW or BW materials

lethal chemicals	anti-agents
non-lethal chemicals	
riot control chemicals	
biocides	

255 Obtain other chemicals

standard lab chemicals	pesticides
industrial chemicals	herbicides

256 Obtain test animals/plants

257 Obtain human test subjects

258 Obtain microbial cultures

bacteria	fungi
viruses	protozoans

Table 4 (cont'd)

259 Obtain radiation sources

α, β, λ	X-ray
electromagnetic waves	

260 Transport Supplies

fixed-winged aircraft		military
rotary-winged aircraft		public
watercraft		commercial freight
rail	car	
truck	bus	

261 Transport equipment/materials
262 Transport ammunition/explosives
263 Transport test fuels and other POL
264 Transport CW or BW materials
265 Transport other chemicals
266 Transport test animals/plants
267 Transport human test subjects
268 Transport microbial cultures
269 Transport radiation sources

270 Store/Maintain Supplies

271 Store/maintain equipment/materials

outdoor	laboratory
warehouse	cold rooms

272 Store/maintain ammunition/explosives

outdoor	underground
warehouse	cold rooms

273 Store/maintain fuels and other POL

outdoor	underground
warehouse	cold rooms
cans	tanks
hardened facilities	

274 Store/maintain CW or BW materials

laboratory	cold rooms
quarantine or clean room	refrigerator

Table 4 (cont'd)

275 Store/maintain other chemicals

outdoor	laboratory
warehouse	cold rooms

276 House/maintain test animals/plants

outdoor cages	greenhouse
indoor cages	field plots
outdoor pens	controlled environment rooms
ranges	

277 House human test subjects

military housing	commercial housing
special housing	

278 Store/maintain radiation sources

outdoor	laboratory
warehouse	cold rooms
refrigerator	radiologic clean rooms

279 Store/maintain microbial cultures

laboratory	cold rooms
quarantine or clean room	refrigerator

281 Operate radiation decontamination rooms/procedures

282 Operate laundry for radiologic decontamination room or clean room

283 Operate pathologic clean rooms/decontamination procedures

284 Operate laundry for pathologic clean room/decontamination room

285 Range preparation/rehabilitation

clearing	seeding	spraying
grading	mowing	burning

290 Waste disposal

incineration	sanitary landfill
burial	chemical detoxification (DEMIL)

Table 4 (cont'd)

dumping
dumping at sea

thermal detoxification (DEMIL)

291 Disposal of radioactive wastes

underground containers
underground injection
storage bunker

dumping
municipal sewage treatment

292 Disposal of pathological waste

incineration
pathological incineration

autoclaving
burial
sanitary landfill

293 Disposal of chemicals

POL items
adhesives
paints and other coatings
standard laboratory
spent metals
chemical agents and toxics

public sewage treatment
chemical or thermal detoxification
air vent
incineration
sanitary landfill
dumping
dumping at sea

system recycle
salvage for resale
permanent storage

294 Disposal of off-specification or scrap materials

burial
sanitary landfill
dumping
detonation
incineration
chemical detoxification

system recycle
salvage for resale
permanent storage

Procurement Categories:

295 Funding source or level

level of funding
source of funds
stage of acquisition cycle

Table 4 (cont'd)

296 Items/equipment/materials

- aircraft
- ammunition
- weapons
- explosives
- vehicles
- missiles
- electronics/telecommunication equipment
- construction equipment
- materials handling equipment
- combat support equipment
- medical support equipment
- POL items
- supplies
- clothing
- canned goods
- expendable spare parts
- batteries
- utilities
- services
- personnel support facilities
- commissary items
- post exchange items

297 Decision point

- installation level
- command level
- USAF level
- DOD level

User Input Requirements

To obtain EICS output for the RDT&E Functional Area, the user must complete the input form (see Figure 5) and send it to the Air Force Civil Engineering Center (AFCEC), Tyndall AFB, FL. The following instructions are numbered to correspond with the items on the input form.

1. Project name

Designate any name or description that does not exceed 75 characters. (Each letter, space, number, or punctuation mark is one character.)

2. Installation

Write your installation's name.

3. Respondent's name, address, and telephone number

The user should supply his/her *complete* military mailing address, including office or organization symbols, stating commercial telephone numer, and then adding Autovon or FTS telephone number (indicate by circling).

4. Site number

One input form should be completed for each site, test course, facility, etc., being used for RDT&E activities. Site designation should include consideration of topography, vegetation, usage of the area, and geopolitical features. Degree of detail required for the assessment should be considered when deciding how many different sites to designate. In the blank provided, list an arbitrary one-digit number (for user information only) to label the site.

5. Preliminary BAAP selector

In the blank provided, list the letter corresponding to *one* of the following responses describing the RDT&E activities to be assessed.

A. Activities restricted to "planning and design": research involving no physical laboratory or field work.

B. Research involving physical laboratory (indoor) work as well as planning and project design.

C. Activities involving physical field (outdoor) research, tests, etc., as well as planning and project design.

D. Research involving planning and design, laboratory work, and field work.

INPUT FORM NO.7–RESEARCH, DEVELOPMENT, TEST & EVALUATION FUNCTIONAL AREA

1. PROJECT NAME: _____
2. INSTALLATION: _____
3. RESPONDENT'S NAME: _____

COMPLETE MILITARY ADDRESS:

_____
_____
_____

COMMERCIAL TEL. NO.: _____
FTS OR AUTOVON TEL. NO.: _____

4. SITE NO.: _____
5. BAAP SELECTOR CODE: _____
6. PRINT RAMIFICATION-MITIGATION TEXT ?
YES _____ NO _____
7. DETAILED OR REVIEW LEVEL ?
DETAILED _____ REVIEW _____ BOTH _____
8. DATE OF REQUEST _____

9. TECHNICAL SPECIALTIES REQUESTED:

ECOLOGY _____
HEALTH SCIENCE _____
AIR QUALITY _____
SURFACE WATER QUALITY _____
GROUNDWATER QUALITY _____
SOCIOLOGY _____
ECONOMICS _____
EARTH SCIENCE _____
LAND USE _____
NOISE _____
TRANSPORTATION _____
AESTHETICS _____
ENERGY/RES. CONS. _____

10. ANSWERS TO FILTER QUESTIONS

	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7	Q-8	Q-9	Q-10
ECOLOGY										
HEALTH SCIENCE										
AIR QUALITY										
SURFACE WATER QUALITY										
GROUNDWATER QUALITY										
SOCIOLOGY										
ECONOMICS										
EARTH SCIENCE										
LAND USE										
NOISE										
TRANSPORTATION										
AESTHETICS										
ENERGY/RES. CONS.										

Figure 5. RDT&E input form.

6. Ramifications-Mitigation texts

Check (X) to receive texts of Ramification Remarks and Mitigation Statements.

7. Detailed or review level

These terms refer to the depth of information desired. Check (X) the level being requested.

8. Date of request

Indicate date the input form was mailed to the AFCEC.

9. Technical Specialties requested

Check (X) the Technical Specialties for which output is desired.

10. Answers to RDT&E filter questions

Fill in this matrix with the numbers corresponding to the responses to the RDT&E filter questions on the following pages. Questions should be referred to the Air Force Civil Engineering Center, Planning Division (AFCEC/EVP), Tyndall AFB, FL.

Filter Questions

To accurately assess the total environmental impact of a research installation or program, it is necessary to be aware of critical data to be collected at and surrounding the area of operations. On the following pages, filter questions for each Technical Specialty are presented separately, along with an introduction and a list of information sources pertinent to that specialty. The questions can be answered by using a few simple tools (rulers, installation maps, plans, or in some cases a site visit), and the assistance of professionals in the various environmental Technical Specialties, who have already compiled most of the necessary baseline information. Honest answers to these questions will eliminate many extraneous considerations in the matrix of potential impacts. After reading the introductory paragraphs for each Technical Specialty, record the answers to the filter questions on the input form in the matrix under Point 10.

Ecology

The impacts of Research, Development, Test, and Evaluation activities in the USAF vary so widely that it is difficult to anticipate every interaction these activities might have with ecological attributes. Much research is primarily paper planning and desk work. Impacts associated

with such work are not unique to the Air Force and are generally related to support of the human occupants of the buildings. Solid and sanitary waste disposal, heating plant emissions, and generation of traffic-related noise as employees travel to and from work are examples of typical impacting activities.

Of much greater concern are the unique effects attributable to possible contamination of air, land, and water with exotic chemical materials, or the testing of large items of destructive equipment or explosives. USAF research programs often use locations dedicated to testing, thereby minimizing generalized ecological impact. This concentration of activities, however, concentrates the effects of the tests too, and its effect must be recognized as an unavoidable result of the existence of the specific test program being examined by the user.

Many research-related actions may be more properly examined for their environmental impact by using other areas within EICS. The requirement to build new structures, for example, should be assessed through the Construction FA. These construction impacts should then be added to the impacts determined when the EICS system is used for evaluating RDT&E activities.

It is recognized that RDT&E-related activities may take place within or adjacent to buildings, as well as at remote test sites which are surrounded, for reasons of safety or security, by large tracts of uninhabited land. The ecological impacts resulting from the actions are obviously more critical if such a natural habitat is the test site. The filter questions which follow this introduction request that the user indicate the nature of the site to be used. If, as is common in many types of programs, several different laboratories and remote field test sites are used, then a separate input form *must* be prepared for each location.

In Question 5, the user is asked to measure the sound levels at the edge of the test site while tests are in progress. This response assumes the availability of a small, hand-held noise meter of the type used for measuring industrial noise levels for employee safety and health. An ANSI type II meter reading in dBA is specified, and should be available for use from the safety officer or audiologist or through the Bioenvironmental Engineer. For purposes of this question, the edge of the site is defined as either the perimeter fence or wall around the test location *or* the closest zone of more or less natural vegetation (habitat), whichever is closer to the test site.

In Question 7, the user is asked to compare the field test site to its surrounding area. For these purposes, the field test site is defined as any area from which unprotected personnel are excluded for safety reasons during testing. For example, an explosives test

may take place on a test pad of a few square meters, in a clearing only 100 meters across. Safety requirements, however, may not permit unprotected personnel to approach closer than 1000 meters to the center during tests. For purposes of answering Question 7, the "field test site" would be a circle having a 1000-meter radius. whose center would be the test pad itself. Similarly, when weapons are fired, the entire safety fan would constitute the field test site.

To answer the questions, the user will need to consult a good map of the site and make a personal visit to each location being considered. The safety officer or project manager should be able to indicate the safety zone, if any, on the map. The installation land management personnel, from the office of the Base Civil Engineer, will be able to assist in answering Questions 9 and 10. If such persons are not available, the state Department of Conservation or Fish and Game should be able to delineate areas where the different types of hunting and/or fishing are not permitted.

Question 3 asks if toxic substances are handled during the RDT&E activity. The level of toxicity is defined as one having an acute oral LD_{50}* of less than 500 mg per kilogram of body weight. Commercial products of this toxicity are required to have the words "Warning, may be fatal if swallowed" on the label. If development of chemical products or substances is an inherent part of the research effort, determination of potential toxicity of new compounds should be an integral part of the program.

Question 2 asks (in part) if the research involves exotic species. An exotic species is any plant, animal, bacterium, protozoan, virus, or other organism not found free-living in the surrounding environment. Thus, primate colonies, tropical insectaria, and cultures of mutated bacteria are clearly exotic. Native species may effectively be exotic, as well, as for example in a case where a colony of animals native to Florida is maintained in a California laboratory. The state Department of Conservation or Fish and Game will usually be able to provide information about whether a species is exotic.

• RDT&E/Ecology Filter Questions

1. Which of the following best describes the environment within which the RDT&E activities under consideration take place? (NOTE: A separate input form must be submitted for each separate office/lab or field test site used for this project.)

(1) Activity takes place entirely within a building and/or adjacent enclosed grounds where no naturally occurring wildlife is found.

* LD_{50} is a dosage fatal to 50 per cent of the treated animals.

(2) Activity takes place on a field test site remote from continuously occupied offices and/or laboratories. At least some natural vegetation or wildlife is present on or adjacent to the site. (REMINDER: Questions 2-10 should be answered separately for each test site.)

(3) The site contains both office/lab buildings and an adjacent test site. At least some natural vegetation or wildlife is adjacent to the building or test area.

2. Does the RDT&E activity involve maintenance or use of cultures or test populations of pathogenic, exotic, or potentially pestiferous organisms?

(1) Yes, or don't know

(2) No

3. Does the RDT&E activity involve the handling or application of any hazardous or toxic compounds (toxic here defined as LD_{50} < 500 mg/kg)?

(1) Yes, or don't know

(2) No

4. Does the RDT&E activity involve the handling of radioactive materials in quantities sufficient to require a license or permit under either USAF or Nuclear Regulatory Commission (NRC) regulations?

(1) Yes, or don't know

(2) No

5. Which of the following descriptions best characterizes the noise environment at the edge of the laboratory or test site while testing is in progress?

(1) Sound pressure levels are less than any of the following descriptions:

level 105 dBA - testing takes 1 sec or less
level 85 dBA - testing takes 2 min or less
level 65 dBA - testing takes 3 hr or less

(2) Sound pressure levels are greater than any one of the above categories, but less than any of the following descriptions:

level 115 dBA - testing takes 1 sec or less
level 95 dBA - testing takes 2 min or less
level 75 dBA - testing takes 3 min or less
level 65 dBA - testing is 24 hr per day

(3) Sound pressure levels are greater than any one of the above categories, but less than any of the following descriptions:

level 125 dBA - testing takes 1 sec or less
level 105 dBA - testing takes 2 min or less
level 85 dBA - testing takes 3 hr or less
level 75 dBA - testing is 24 hr per day

(4) Sound pressure levels are greater than any one of the above levels.

(5) Noise produced by this testing is impulse (blast) noise not measurable by simple meters.

(6) Sound pressure levels are not known at this time.

6. Which of the following best describes any areas of naturally occurring habitat adjacent to the research building or present on or near the test site?

(1) Tundra-type grasses, sedges, mosses, and dwarf shrubs

(2) Desert-type shrubs and grasses

(3) Marsh-type shrubs and grasses

(4) Ground cover is mostly grasses and weeds

(5) Frequent but scattered shrubs or small trees (less than 10 cm or 4 in. in diameter)

(6) Continuous cover of shrubs or larger trees (more than 10 cm or 4 in. in diameter)

(7) Landscaped and regularly mowed

7. Taking the field test site and all adjacent naturally vegetated areas as a whole (equal to 100 percent), what proportion of this whole is involved in active testing on any one day?

(1) < 10 percent

(2) 10-25 percent

(3) 25-65 percent

(4) > 65 percent

(5) No field tests are considered for this site.

8. Which of the following typifies the frequency of use of the field test area?

(1) Used for this or similar purpose more than 100 days per year

(2) Used for this or similar purpose 50 to 100 days per year.

(3) Used for this or similar purpose 10 to 50 days per year.

(4) Used for this or similar purpose for fewer than 10 days per year.

(5) No field tests are conducted.

9. Which of the following characterizes use made of any water bodies or wetlands on or adjacent to the test site?

(1) Neither fishing nor waterfowl hunting is permitted.

(2) Fishing is permitted, but waterfowl hunting is not.

(3) Waterfowl hunting is permitted, but fishing is not.

(4) Both fishing and waterfowl hunting are permitted.

10. Which of the following best characterizes the use of the test site or immediately adjacent areas for hunting?

(1) No hunting is permitted.

(2) Big game hunting is prohibited, but small game may be hunted.

(3) Big game may be hunted, but small game may not.

(4) Both big and small game may be hunted.

Health Science

Health science is concerned with both the physical and mental well-being of man. Thus, it covers a wide range of effects, ranging from physical, chemical, and psychological stress, to the creation of unsafe environs. The various pathways by which stressors reach the population are also important in estimating environmental health impacts.

In addressing human health impacts, primary considerations are the distance from the site to occupied areas, and the routes that potential stressors may follow in covering that distance. Site visits and maps

are the major sources of this type of information. Much related material is developed in other Technical Specialties (e.g., Air Quality, Surface Water, and Groundwater).

While direct impacts of RDT&E activities can be important, particularly in case of accidents, the major health science impact of research and development is due to the later impact of developed products. The life cycle impact of an item--everything from initial R&D to ultimate disposal--should be considered. Characteristics of an item that are fixed in the R&D stage can substantially determine the life cycle health impact. Similarly, if a given standard of environmental impact is to be maintained, it can be accomplished in a much more cost-effective manner during development of the item. It is almost always less efficient and more costly to add environmental control measures after the product itself has been developed. This is why planning, designing, and managing research are indicated as having substantial potential health impacts. While these activities in themselves produce essentially no direct health science impacts, decisions made at this stage can greatly influence the eventual health impact of developed systems.

The wide diversity of possible RDT&E activities and the range of different test types that might actually be involved in any single BAAP make it difficult to determine any specific potential effect. In many cases, the review level provides the best level of approach. Impact statements for RDT&E activities will undoubtedly require much more individual consideration than those for more standardized activities.

Some general guidelines can be provided. Particular care must be taken when testing involves human subjects. Tests may introduce changes in the subjects themselves, their families, and even their community. Possibly more important, later implementation of the program in larger populations may involve substantial health impacts. The lack of experience with new materials and processes being developed, and the possible production of waste products for which adequate treatment methods are not available, are cautionary areas.

Table 5 provides a list of sources of information for the Health Science area.

- RDT&E/Health Science Filter Questions

1. Are any toxic chemicals (excluding pesticides or herbicides) being used or to be used in the RDT&E program or project?

   (1) Yes, or don't know

   (2) No

Table 5

References Helpful in Assessing Impacts or Answering Filter Questions for Health Science

References Helpful in Assessing Health Science Impacts	Information Supplied
Installation Bioenvironmental Engineer	This is the first person to contact regarding potential environmental health impacts.
Local and State Health Departments	These contacts are best coordinated through the installation surgeon.
Army Environmental Hygiene Agency	This office is the Army's in-house source of environmental health expertise and can also assist the AF.
USAF Environmental Health Laboratory Aerospace Medical Division, Brooks AFB, TX	Monitoring, testing environmental parameters related to health.
Registry of Toxic Effects of Chemical Substances, Herbert E. Christiansen and Thomas T. Luginbyhl, Eds. (U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute of Occupational Safety and Health, Rockville, MD 20852, June 1975). Available as HE 20.2809:975 from Superintendent of Documents US Government Printing Office Washington, DC 20402	Contains information on toxic dose levels and safety standards for more than 100,000 chemical substances.

2. Does the activity or program produce or involve any (biological) organisms considered pathogenic or pests?

(1) Yes, or don't know

(2) No

3. Does the activity or program produce or involve any type of radiation (ionizing, laser, microwave, other) or radioactive substances?

(1) Yes, or don't know

(2) No

Air Quality

To assess the impact of RDT&E activities on air quality, information about the number of construction projects currently under way and/or planned, as well as the extent of usage of chemical, biological, and radioactive agents in current and proposed projects must be obtained. For all projects using chemical, biological, and radioactive agents, the manner in which they are stored, transported, and disposed of after the completion of the tests must be ascertained. The incineration practices of the installation should also be reviewed. This information should include the kinds of materials burned, when they are burned, and the nature of the effluents from the combustion chamber.

Accidents occurring during the performance of RDT&E activities could cause major impacts on air quality. Therefore, the safety record of the installation should be examined. The major exception is air pollution caused from incineration of materials associated with RDT&E activities.

Table 6 provides sources of baseline information about air quality.

• RDT&E/Air Quality Filter Questions

1. Are there any toxic chemical or biological materials associated with the project or installation?

(1) Yes

(2) No, or don't know

Table 6

References Helpful in Assessing Impacts or Answering Filter Questions for Air Quality

References Helpful in Assessing Air Quality Impacts	Information Supplied
Principal investigators	Information on how dangerous agents are stored, transported, and disposed of.
Bioenvironmental Engineer	Information on installation incineration practices.
Safety officer	Safety record of installation.
Test directors	General information on vehicle/weapon emissions, smoke generation, dust clouds, etc.
U.S. Weather Bureau, base weather station, major command Staff Weather Officer	Climatological conditions which might be expected during RDT&E activities.
U.S. Soil Conservation Service	Soil types in areas of outdoor RDT&E activities.

2. Is there an operating incinerator or burning facility on the base?

(1) Yes

(2) No, or don't know

Surface Water

RDT&E activities of military organizations introduce few new general types of potential impacts on surface waters not found in other Functional Areas, but these impacts can be severe and complex.

The nature of virtually all RDT&E activities is similar to that of other non-research related military activities, since most tests involve improving present operations or equipment. However, it is possible that the effects of certain RDT&E activities could be far more severe than those of comparable non-research related military activities for three reasons. The first is that new and untried products, compounds, dosages, and techniques are associated with RDT&E activities. The second reason is that while proven techniques for avoiding impacts on surface water may be available for established military activities, there is less opportunity for such procedures to have become established for RDT&E activities. The third reason is that the uncertain nature of research activities increases the possibility that the consequences of activities will not be adequately anticipated or that accidents will occur.

There are appreciable possibilities for minimizing the impact of military activities associated with RDT&E on the environment, since there is potential for selecting military alternatives which minimize water quality impacts at the time that RDT&E activities are carried out. For example, selection of products with preferred characteristics related to biodegradability, toxicity, and leachability is possible and should be considered in RDT&E decisions.

The stage of RDT&E activity which most profoundly influences the overall impact of these military activities on surface water is the planning phase (BAAPs 110-145). Decisions reached during this phase influence not only the impact of RDT&E activities, but also the long-term effects of overall military activities on the environment. The indicated interactions of RDT&E planning activities on the environmental matrix are actually inadequate to show the importance of the planning function. It is the long-range implications of the RDT&E planning activity which are most likely to have significant effects on water quality. For this reason, indications of the actual potential effects of planning

RDT&E activities can best be sought by consulting the specific RDT&E activity influenced by the planning.

It should be noted that, as with other military functions, RDT&E activities must be carried out in accordance with pollution control laws. Provisions of some regulations are specifically oriented toward the types of water quality degradation which could accompany military research activities. For example, regulations developed in accordance with the 1972 Marine Protection, Research, *and Sanctuaries Act and the 1972 Amendments to the Federal Water* Pollution Control Act specifically forbid ocean dumping of radioactive materials and chemical-biological materials.

Table 7 lists some useful sources of information about water quality impacts.

- RDT&E/Surface Water Filter Questions

1. Do electrical components being tested or being used in tests contain polychlorinated biphenyls?

   (1) Yes

   (2) No, or no electrical/electronic equipment involved

2. Do radiation testing procedures involve the use of ionizing radiation?

   (1) Yes

   (2) *No, or no radiation testing involved*

3. Are nuclear or shock tests to be conducted underwater?

   (1) Yes

   (2) No

4. Do shock tests involve nuclear explosives?

   (1) Yes

   (2) No, or no shock testing

5. Does field testing of biological control agents (BAAP 216) involve only techniques which control pest plants/animals by

Table 7

References Helpful in Assessing Impacts or Answering Filter Questions for Surface Water

References Helpful in Assessing Surface Water Impacts	Information Supplied
RDT&E Organization	Type of equipment to be tested.
	Type of material to be tested or used.
	Type of weapons to be tested.
	Type of fuel, ammunition, and explosives to be tested.
	Nature of chemical, biological, or radiological materials involved.
USAF Environmental Health Laboratory Aerospace Medical Division Brooks AFB, TX	Monitoring, testing water quality parameters.
Air Force Regional Civil Engineers	Information on Coastal Zone Management Program.
Army Corps of Engineers	Appropriate surface water quality control practices for chemical, biological, or radiological materials involved. Dredging and piling information.
Appropriate military contractor	Specific characteristics of materials, chemicals, or equipment.
Appropriate civic service groups	Attitudes concerning the military activity involved.
Appropriate state water pollution control authority	Applicable surface water quality standards.
	Historical and current quality of receiving waters.

Table 7 (cont'd)

Water quality control expert	Potential water quality effects of specific alternative materials or agents.
	Potential water quality effects of specific alternate construction or testing procedures.
	Possible effects of RDT&E practices and performance of wastewater treatment plant.
	Possibility of removal of waterborne material in a wastewater treatment plant.
	Appropriate treatment and/or disposal practices for chemical, biological, and/or radiological agents involved.
U.S. Weather Bureau, base weather station, major command Staff Weather Officer	Climatological conditions which might be expected to prevail at time of RDT&E activities.
U.S. Geological Survey	Topographic maps of area involved in RDT&E activities.
U.S. Soil Conservation Service	Soil types in area involved in RDT&E activities.

introducing their natural predators, parasites, or diseases, as opposed to use of chemical control agents?

(1) Yes

(2) No, or no field testing of biological control agents

Groundwater

The severity of RDT&E impacts on groundwater depends to a large extent on the nature of the activity and its areal extent. Groundwater velocities are approximately 1 to 5 ft (0.3 to 1.5 m) per day or less; thus, they have a very slow response to either adverse or positive impacts. Because of this slow response time, extreme care must be taken in examining potential impacts. Obviously, groundwaters near the surface are highly susceptible to degradation by surface application of any material.

Only those RDT&E activities of a relatively large areal extent or involving highly toxic materials seriously affect the quality of the groundwater. Impacts are most likely to result from storage and use of chemicals as well as disposal of solid and liquid wastes.

See Table 8 for information sources useful in assessing impacts on groundwater.

• RDT&E/Groundwater Filter Questions

1. Which of the following best characterizes conditions at the locale of the RDT&E activity?

(1) No defined aquifer exists.

(2) Confined aquifer with recharge area more than 1000 m from the activity. No wells are in use.

(3) Confined aquifer with either (1) recharge area less than 1000 m from the activity *or* (2) wells in use.

(4) Characterized by fissures and/or solution channels extending to within 20 m of the surface.

(5) An unconfined aquifer with the water table more than 20 m below the surface.

(6) An unconfined aquifer with the water table less than 20 m below the surface.

2. Which of the following best characterizes the location of the RDT&E activity?

(1) The area around the activity is completely built up. The action is a continuation of an existing program.

(2) The area around the activity is completely built up. The activity is new or at an increased level.

(3) The area around the activity is rural. The action is a continuation of an existing program.

(4) The area around the activity is rural. The action is a new one or an increase in current levels of activity.

(5) The area around the activity is suburban.

3. Which of the following best describes the RDT&E activity?

(1) The activity is primarily above grade and covers less than 4000 m^2.

(2) The activity is primarily above grade and covers more than 4000 m^2 but less than 20 000 m^2.

(3) The activity is above grade and covers more than 20 000 m^2, or is below grade and penetrates the water table.

Sociology

Residents of communities adjacent to RDT&E activities will be concerned about what is going on, and their concern is increased by the secrecy usually associated with such activities. Concern is greatest in areas which are predominantly residential. The most specific questions to be asked by the EICS user are: "What has been the reaction of the community to prior RDT&E events?" and "Who are the community leaders who influence public opinion?"

Table 9 lists sources of sociological data which may help to assess impacts.

- RDT&E/Sociology Filter Questions

1. Are any weapons, destructive agents, or their delivery systems being tested which could affect the local community if an accident should occur?

Table 8

References Helpful in Assessing Impacts or Answering Filter Questions for Groundwater

References Helpful in Answering Groundwater Filter Questions	Information Supplied
Site visits Topographic maps	Surface conditions at site of activities
State water survey agencies Water supply offices	Subsurface and aquifer conditions at site of activities

Table 9

References Helpful in Assessing Impacts or Answering Filter Questions for Sociology

References Helpful in Assessing Sociology Impacts	Information Supplied
Installation	
Information officer	Analysis of "clippings file" for reports of community reactions to prior events.
Staff judge advocate	Information on community complaints.
Community	
Media representatives Educational officials Clergymen Other organizational leaders	Informal expressions of concern for activities and implications for the community opinion-forming process.

(1) Yes

(2) No

(3) Don't know

2. Are any experiments planned or in progress which involve the use of human test subjects?

(1) Yes

(2) No

(3) Don't know

Answer Filter Questions 3, 4, and 5 if any human population is being sampled during research or testing.

3. Does the construction of any sample population accurately represent the racial and ethnic composition of the total population in question?

(1) Yes

(2) No

(3) Don't know

4. Are surveys being conducted which involve personal interviews with respondents?

(1) Yes

(2) No

(3) Don't know

5. Are the tests designed to demonstrate differences between or among socially significant groups of the population, such as racial or ethnic minorities?

(1) Yes

(2) No

(3) Don't know

6. Are any medical, biological, or fitness tests being performed on human test subjects which may possibly induce deviate physiological

or psychological conditions, such as stupors, eccentric behavior, erratic judgment, genetic damage, etc.?

(1) Yes

(2) No

(3) Don't know

If the answer to Question 6 is (1) "yes," answer Questions 7, 8, and 9.

7. Will any human subjects be exposed to public view while being transported to or from the test location?

(1) Yes

(2) No

(3) Don't know

8. Will any human subjects be exposed to public view at any time during the course of the experiment?

(1) Yes

(2) No

(3) Don't know

9. Have the U.S. Department of Housing, Education, and Welfare guidelines for human subject participation been followed in the selection of all test subjects?

(1) Yes

(2) No

(3) Don't know

Economics

Almost all RDT&E activities are conducted within the bounds of a military installation or facility. Therefore, the impact of specific BAAPs on various attributes of the region are expected to be relatively minor. Generally unless there are purchases from the local economy for RDT&E activities or RDT&E activities affect adjacent land values, the economic impacts are expected to be minimal. The value of land for residential or possibly commercial purposes by the non-military public would be reduced to the extent that experiments or tests affected it through noise, dust, or undesirable effluents.

See Table 10 for sources of economic baseline information.

- RDT&E/Economics Filter Questions

1. Do local purchases of goods and services exceed $100,000 yearly?

(1) Yes

(2) No

2. Is the installation in a county with a population of 50,000 or more?

(1) Yes

(2) No

Earth Science

The attributes of the Earth Science Technical Specialty are of two basic types: *characteristics* of the earth, such as slope and bedrock, and *processes* that shape landforms, such as erosion and mass wasting. Human activities might have primary effects on the characteristics of the earth, but the activities would have to have severe or catastrophic consequences to affect major landforms. The geomorphologic processes, on the other hand, have been going on since before man's time, and will not be altered by human activities. Human activities might alter the rate or frequency at which these processes occur; these would be secondary impacts. Also these processes may be the means of transmission of environmental effects. For example, the process of erosion may be accelerated by the activity of removing vegetative cover, causing increased siltation or turbidity of a stream, and thus impacting water quality attributes. In this case, the Surface Water and Groundwater Technical Specialties would discuss these types of secondary impacts.

Research, development, and testing may involve actions that could change the rates or frequency of geomorphologic processes. These activities or techniques may be completely new and untried, and their consequences unpredictable. Selection of suitable test sites, therefore, requires greater-than-usual attention to site characteristics, both in terms of primary effects to the site and secondary effects to technical areas such as air and water quality. Since test results may be unknown, waste products from testing may be unusual or have unknown side effects. Again, these waste products may either affect Earth Science attributes or use these attributes as media to affect other Technical Specialty attributes. This unknown aspect of test results or waste products may cause RDT&E activities to be highly controversial.

Table 10

References Helpful in Assessing Impacts or Answering Filter Questions for Economics

References Helpful in Assessing Economic Impacts	Information Supplied
Local, state employment offices	Number unemployed Percent unemployed Skills of those available for work.
Local and state planning commissions	Employment data Employment development plans Land use plans Income and employment trends.
Publications of the United States Department of Commerce, Bureau of Census, including Census of Population and Census of Manufacturing	Population data Work force data Local skills Sizes of local business and industry Types of local business and industry.
Economic Impact Forecast System (EIFS) USAF Civil Engineering Center, Planning Division, Tyndall AFB, FL	Baseline economic data for any U.S. county or counties, predictions of changes resulting from USAF base realignments, construction, etc.

One result of an RDT&E effort is the generation of ideas--an intangible yet important product. The development of a prototype or testing of a new process may have limited environmental consequences, but the potential for future impacts may be tremendous. For example, development of improved hardware for nuclear devices may (or may not) produce limited environmental impacts, but the use of these devices underground on a widespread scale or in an uncontrolled manner could affect Earth Science attributes. Also, the development of an entirely new product could preclude development of improvements to current products, thus shaping future avenues of product development.

The USAF must coordinate any test and/or disposal activities which may have off-installation impacts with appropriate state and federal pollution control agencies. These requirements are explained in the air quality and water quality technical areas. Information on pertinent legislation may be obtained from the Computerized Environmental Legislative Data System (CELDS).

Other agencies and organizations which may be able to assist planners with Earth Science information are:

State geological and water surveys

American Institute of Professional Geologists

Universities

U.S. or State Environmental Protection Agency

- RDT&E/Earth Science Filter Questions

1. Does the project being assessed involve any disruption, excavation, movement, or use of soils, gravel, rock, or other geologic materials, or any vibration which could disturb surface or subsurface geologic features?

(1) Yes

(2) No

(3) Don't know

Land Use

Land-use impacts associated with USAF RDT&E are numerous and varied. These impacts, both direct and indirect, include:*

- Restricting access to natural resources/minerals
- Interfering with off-post activities and land uses
- Creating incompatible uses on post
- Inducing land use changes
- Restricting access to environmental resources
- Modifying land use suitability
- Consuming fragile land
- Destroying existing land uses

USAF activities associated with RDT&E that are most likely to directly cause these land use impacts are:

1. Field testing of weapons, vehicles, or hazardous materials/substances.

2. Accidents involving hazardous materials/substances.

Land areas that may be sensitive to RDT&E activities are:

- Civilian controlled/owned areas adjacent to USAF test facilities
- Land areas that have been previously undisturbed
- Wetland areas

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* Direct impacts are impacts that have a direct cause and effect relationship. For example, field testing bombs will destroy or alter land on site, interfering with future use of that land for other purposes. Indirect impacts are impacts that are at least once removed from the actual activity being assessed. For example, if the USAF were conducting tests that created noise problems, this could, in turn, produce interference with certain land use activities, e.g., housing.

- Coastal areas
- Publicly owned lands, e.g., parks adjacent to test areas
- Land that is highly populated or heavily used
- Land areas that contain natural resources (resources that have commercial/recreational/aesthetic value)
- Wildlife preserves adjacent to test areas
- Land areas that are designated by federal or state government as "wild scenic areas" or "critical areas."

Table 11 provides sources of information on land use impacts, as well as assistance on determining consistencies/conflicts with local, state, regional, or federal land use plans.

- RDT&E/Land Use Filter Questions

1. Are you conducting or contracting field tests using ammunition/explosives, nuclear materials, or chemical or biological toxics?

(1) Yes

(2) No, or no field tests are being conducted

2. Will any field test be conducted on non-military land, or in unusual, fragile (wetlands, seismically active areas, etc.) or scenic areas, or in areas which have not been disturbed previously?

(1) Yes, if any of the above apply

(2) No, or no field tests are being conducted

3. Does the field test area contain any known or "likely to exist" mineral, cultural, or historical resources?

(1) Yes

(2) No

(3) No field tests are being conducted.

4. Are there any residential areas or activity centers (e.g., shopping centers, PX, sports complex) adjacent to or near

Table 11

References Helpful in Assessing Impacts or Answering Filter Questions for Land Use

References Helpful in Assessing Land-Use Impacts	Information Supplied
City Planning Department	City land use plan Zoning map Capital improvement plan Transportation plan Demographic information Tax information Housing Recreation and open space plan
Public Utility Company	Easements Rights-of-way Underground utility information
Regional Planning Commission	Regional land use plan Transportation plan Water and sewer plan Capital improvement plan A-95 review process[1] Demographic information Federal and state laws Housing information 208 plan[2] Recreation and open space plan
County Engineering Department	Highway maps Zoning maps Transportation maps
City/County Tax Assessor's Office	Tax information

[1] U.S. Office of Management and Budget Circular A-95 delineates procedures for implementing federal laws concerning projects using federal funds. There must be a review process by which affected federal, state, and local agencies determine the consistency of the proposed project or policy with relevant land use and land use related plans, policies, and programs.

[2] Federal Water Pollution Control Act of 1972 (Public Law 92-500), Section 208, enables drainage basin studies.

Table 11 (cont'd)

State Agencies, e.g.. Natural Resources, Planning, Water Pollution Control, Environmental Protection, Highway Commission, Historical Society, etc.	State transportation plan State land use plan A-95 review Highway maps Recreation and open space plan Highway capacity statistics Demographic information Historic information State and federal laws Housing information Ecology: Wildlife information Vegetation information Critical areas information Air quality information Geologic information Water and oil well boring logs Capital improvement plan
U.S. Department of Agriculture, Soil Conservation Service	Soil information, e.g., productivity and erodibility Land use plans (watershed development plans) Aerial photos
U.S. Geological Survey	USGS maps (maps identifying topographic, vegetation, and physical features) Geological information, e.g., water availability and mineral deposits Aerial photos Seismic areas Aquifer recharge areas
Air Force Regional Civil Engineer	Regional coordination of land use policies
U.S. Army Corps of Engineers	Water quality Discharge limitations Flooding information Flood plain information Transportation (water) Ecology: Wildlife information Vegetation information

Table 11 (cont'd)

	Federal water laws Maps A-95 review Recreation and open space plan Demographic information Urban studies (land use and wastewater treatment data) Point and non-point water pollution
U.S. Forest Service	Recreation and open space Vegetation information Fish and wildlife information Land use plan Aerial photos
U.S. Department of the Interior, *e.g.*, Bureau of Outdoor Recreation, Fish and Wildlife Services, etc.	Recreation and open space Vegetation information Fish and wildlife information Land uses Mineral deposits Federal laws and regulations A-95 review
U.S. Department of Housing and Urban Development, U.S. Department of Health, Education and Welfare	Housing information Capital improvements Health information Education information Demographic information A-95 review
Office of Management and Budget	A-95 review Nuclear, chemical, and ordnance precaution regulations

AFR 19-1	Policy is established and responsibilities are assigned for the development of an organized, integrated, multidisciplinary, environmental protection program.
AFR 19-2	Establishes policies, assigns responsibilities, and provides guidance for the preparation of environmental assessments and statements.
AFR 12-30	Outlines policy and procedure on the disclosure of records, establishes mandatory time limits, and explains how the public may inspect or obtain copies of Air Force records.

Table 11 (cont'd)

AFR 190-12	Establishes policy and responsibility concerning the release of unclassified information to the public.
AFR 190-17	States Air Force security and policy review functions and processes required to establish the releasibility of certain information to the public. Also establishes policy and procedures on writing for publication by Air Force personnel.
AFR 169-2	Laboratory animals: procurement, transportation, use, care, and publicity.
AFR 127-102	Sets forth the essentials of the USAF Explosives Accident Prevention Program, the responsibilities of the Department of Defense Explosives Safety Board (DDESB). and the relationship between Air Force activities and the DDESB.
AFR 136-4	Responsibilities for technical escort of dangerous materials.
AFR 136-10	Responsibilities and procedures for explosive ordnance disposal.
AFR 122-XX	Procedures pertaining to nuclear weapon system developments.
	Nuclear weapons and nuclear material safety.
	Nuclear weapons safety studies, standards and reviews, procedures, and responsibilities.
AFR 161-18	Use of chemical agents and hazardous chemicals.

AD-A039 132 CONSTRUCTION ENGINEERING RESEARCH LAB (ARMY) CHAMPAI--ETC F/G 13/2
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any test area from which persons can hear, smell, feel, or see testing operations?

(1) Yes

(2) No

5. Will land use activities adjacent to or near any test area be prevented or disrupted because of danger to health and/or safety considerations caused by the test activity?

(1) Yes

(2) No

6. Will tests using explosives, ammunition, nuclear materials, or chemical or biological toxics result in waste material which will be stored or disposed?

(1) Yes

(2) No

Noise

RDT&E is essential to implementing USAF programs; it is divided into three main components in EICS: "Research," "Accidents," and "Support Functions." Noise generation is principally associated with the "Research" and "Accidents" sections. However, the primary emphasis should be placed on research activities, since noises associated with accidents occur on an infrequent, random basis with few mitigating techniques available.

The most significant aspect of research concerns the step in which actual data is obtained; particularly, conducting field tests can potentially impact the environment. Impulsive noise sources associated with field tests of explosives, firing weapons hardware, test firing missiles and rockets, nuclear tests, and battle operations tests (war games) represent the primary problem area.

Several factors will influence the degree of community impact, in addition to the acoustical level of the activity. These factors include:

1. Site Location

Conducting these tests on military-owned property is preferred, followed by government-owned, non-military property. Off-installation

testing, particularly where occurring infrequently, will generally be the most objectionable to a civilian population.

2. Occurrence

Time of day influences the degree of community response. Conducting field tests generally is most acceptable during daytime hours (0700-1800). Nighttime testing interferes with several essential residential activities (i.e., communication, relaxation, recreation, sleeping).

3. Pattern

The pattern of field tests may influence community response. Intermittent and random testing creates a greater impact than one which occurs non-randomly. The latter requires a certain degree of community accommodation.

4. Awareness

Alerting or informing the affected community of the impending test program reduces potential community objections. The actual public information disseminated to the community may depend on the magnitude of noise impact, classification of the test, etc.

Other field testing involving transportation sources (vehicles, aircraft, and watercraft) may also potentially impact the civilian community. Vehicle testing (particularly of large vehicles operating under maximum load conditions) may generate extremely high noise levels. Ground or bench testing of engines, when done in an outdoor environment under maximum load conditions, is also a primary source of community impact. In-flight testing of aircraft involving low-altitude aircraft flyovers can be a major source of community impact.

The primary areas of noise impact among the "Support Functions" section are transportation and maintenance of supplies.

Table 12 lists some persons and agencies which can provide assistance in noise impact analysis.

- RDT&E/Noise Filter Questions

1. Are the existing or proposed testing activities in conflict with existing or proposed federal, state, or local noise emission regulations?

(1) Yes

(2) No

(3) Don't know

Table 12

References Helpful in Assessing Impacts or Answering Filter Questions for Noise

References Helpful in Assessment of Noise Impacts	Information Supplied
USAF Installation	
Bioenvironmental Engineer	Acoustical survey of noise-producing material and installation activities.
Base Civil Engineer	Siting of facilities and activities, including base map and aerial photographic information.
Training officer	Information on scheduling source(s) to be tested, method of test, and location.
Base weather station	Local climatic conditions during noise-producing activities.
U.S. Air Force	
USAF Environmental Health Center Aerospace Medical Division Brooks AFB, TX	Noise repository of military-related sources, including weapons, aircraft, and construction equipment. Hearing conservation survey, community noise impact survey.
USAF Civil Engineering Center Tyndall AFB, FL	Air Installation Compatible Use Zone (AICUZ) output or information.
Major command Staff Weather Officer	Local climatic conditions during noise-producing activities.

Table 12 (cont'd)

Municipal Level	
Executive office/City Clerk	Noise legislation information, including existing or proposed ordinances.
Planning department	Land use, social and geographic information for subject area; may include aerial data.
State Level	
Office of the Governor	Noise legislation information, including existing or proposed laws.
Environmental agency	Noise legislation requirements, general resource information.
Federal Level	
U.S. Environmental Protection Agency Office of Noise Abatement and Control, Washington DC	Federal noise legislation and guidelines; general resource information.
U.S. Weather Bureau	Local climatic conditions during noise-producing activities.

2. Are the areas of outdoor activity geographically isolated from potentially sensitive (residential, institutional, recreational) land uses?

(1) Yes, or no outdoor RDT&E activity

(2) No

(3) Don't know

3. Are all indoor activities and machinery acoustically isolated, thereby eliminating or minimizing outdoor propagation?

(1) Yes, or no outdoor activity

(2) No

(3) Don't know

4. Is outdoor testing (particularly involving impulsive noise sources) conducted during daytime periods with recognition of prevailing weather conditions so as to minimize adverse impact?

(1) Yes, or no outdoor testing

(2) No

(3) Don't know

5. Is a procedure established to advise the community of impending tests involving impulsive noise sources, particularly during nighttime hours?

(1) Yes

(2) No

(3) Don't know

(4) No impulsive noise is produced

Transportation

In most cases, RDT&E activities are closely aligned with BAAPs in other Functional Areas such as Training, O&M, and Construction. However, transportation impacts that occur in other Functional Area activities may be alleviated by RDT&E actions. For example, in

planning or forecasting activities where equipment, energy, and land use needs can be identified at an early stage, accommodation in planning actions can prevent an unnecessary burden on public facilities.

Potentially, the most critical transportation impacts occur when traffic on public roadways is interrupted in some way (e.g., having to reroute traffic because of a field test or RDT&E accident, or having to reschedule rail and air travel because of the need to transfer bulky, numerous, or dangerous test items or subjects to a test site via public transport systems).

Another potentially significant area of transportation impacts could occur as a result of further energy shortages or the depletion of a natural resource necessary to manufacture or maintain vehicles. If the military had to requisition a portion of a limited supply of resources or equipment to carry out its mission, the civilian transportation sector could be seriously impacted. Considering the national goal of reducing foreign energy dependency, the USAF would be well advised to encourage the use of public transportation services or carpooling in military communities as a part of the energy conservation program. Air Force planners should begin to establish a working relationship with city and state transportation services to USAF installations and provide a cooperative network for contingency planning.

A general familiarity with the transportation network in the community will be necessary to answer the filter questions. Both city and state planning agencies will provide the majority of information and data; however, other sources may be used where more specific data is needed.

See Table 13 for data sources in the transportation area.

- RDT&E/Transportation Filter Questions

1. Is traffic congestion or parking a problem on or around the installation?

   (1) Yes

   (2) No

2. Will any field tests involve the use of public transportation facilities (airfield or aircraft, railroad, waterway or cargo ships), or could field tests ever cause interruption or interference with public transportation facilities (for example, personnel or equipment crossing a highway or railway, or tests that might generate dust, smoke, or fog that would be a hazard to public roadways)?

Table 13

References Helpful in Assessing Impacts or Answering Filter Questions for Transportation

Sources Helpful in Assessing Transportation Impacts	Information Supplied
Installation Master Planning Office	In the vicinity of the installation: location of military and civil airfields and heliports; low altitude airways, airport control zones, and restricted airspace; location of highways and harbor facilities. Airspace utilization map, flight hazard strip map, and airfield map for installations having airfields.
City, county, regional, state, or federal Department of Transportation; transportation engineer	Existing and projected traffic flow around the RDT&E site; highway and pavement design criteria. Planned highway extensions and construction schedules. Carpooling programs (funds available to initiate carpool matching program). Office contacted depends on classification of roadway (state or U.S. highway, for example).
City, county, or regional planning department	Availability of public transportation services (commuter trains, buses, etc.).
Military Traffic Management Command (MTMC), Eastern Command: Bayonne, NJ; Western Command: Oakland, CA	Information on management of DOD freight traffic, CONUS ocean terminals, and non-temporary storage.
Military Traffic Management Command (MTMC), Transportation Engineering Agency (TEA), Newport News, VA	Traffic and safety engineering studies. transportability studies, transportability guidance.

Table 13 (cont'd)

Materiel Test Directorate Aberdeen Proving Ground, MD	Transportability testing and information.
Airport authority	Flight schedules and traffic patterns, carrying capacity of runways, planned extensions and construction schedules. Location and use of private airfields.
Port authority	Number and size of berthing areas, type of cargo handling equipment and cargo handling capacity, schedule of operation of passenger and cargo freighters, depth of channel or dock area.
City, county, or state Department of Recreation, or Army Corps of Engineers or National Park Service if national waterway is involved	Maps of waterway or body of water, designated recreational use of water (power boats, canoeing, sailing, or swimming), restricted areas. Size, location, and managing authority of parks and picnic areas. Maps of access roads to recreation areas, docking and fueling areas, traffic loads, and seasonal information (if road or docking area is not open all year).

(1) Yes

(2) No, or no field tests are being conducted

Aesthetics

Potentially, the most significant aesthetic impact in the RDT&E Functional Area is the lack of consideration of visual characteristics during project development, including even the smallest project or prototype product. Though many research projects are temporary (e.g., the testing of a structural component for a building), the fact that they may eventually be adopted for USAF use on a large scale makes the design quality of the initial development important. A trained designer or architect can, in most cases, offer attractive design alternatives that are cost-effective to produce and which could ultimately improve the overall appearance of USAF installations and test sites. The design disciplines (architecture, landscape architecture, industrial design) should be included as regular participants in interdisciplinary RDT&E activities. Adopting design criteria at an early stage of development and planning can save the expense of trying to mitigate poor design later and, in some cases, as human factors and habitability studies show, good design can mean improved productivity and may strengthen personnel morale.

For information about aesthetic impact analysis, review the sources listed in Table 14.

• RDT&E/Aesthetics Filter Questions

1. If the activity involves the development and testing of a prototype structure, or construction or use of any test equipment, buildings, etc., will the item be constructed or used outdoors and be large enough to be visible to the general public?

(1) Yes

(2) No, or no such models or structures involved

2. If a storage facility for research or test items is needed, which is true?

(1) No additional storage building or areas will be required

(2) A temporary structure (shelter) is required and will be constructed

(3) A permanent structure is necessary and will be constructed

Table 14

References Helpful in Assessing Impacts or Answering Filter Questions for Aesthetics

Resources Helpful in Assessing Aesthetic Impacts	Information Supplied
Construction Engineering Research Laboratory Architecture Branch P.O. Box 4005 Champaign, IL 61820	Human habitability criteria.
General Services Administration Interior Design Staff Special Projects Division 19th and F Streets Washington, DC 20405	Professional interior design services.
National Furniture Center, GSA Crystal Square, Building 5 Washington, DC 20405	Industrial design services and schedules.
National Endowment for the Arts Federal Design Improvement Program 2401 E Street Columbia Plaza Washington, DC 20506	General federal government design information. This is a relatively new agency, and responsibilities are still being defined. Publications and research reports will be updated periodically.
Marilyn D. Bagley, *Aesthetics and Environmental Planning*, EPA 600/5-73-009 (Nov., 1973) (Available through Government Printing Office)	Methodologies for assessing aesthetics for environmental impact assessment. Discussion of criteria, definitions in environmental terminology.
Marilyn D. Bagley, "Aesthetic Assessment Methodology," in L. Edwin Coate and Patricia Bonner, *Regional and Environmental Management* (J. Wiley & Sons, 1975)	Evaluation criteria for aesthetic attributes.

3. Has there been professional aesthetic design input (architecture, landscape architecture, industrial design) in either the development of the product being researched or in the planning of research and testing facilities?

(1) Yes

(2) No, or don't know

Energy and Resource Conservation

Although many on-going RDT&E activities have relatively minor effects on energy and resource conservation attributes, the application of research results to future material and energy requirements can produce potentially highly significant effects in this technical area. Research efforts which consume large quantities of materials will probably generate a significant amount of waste products. These could cause negative impacts on natural resources during their disposal; recycling of waste products may impact natural resources. Other research efforts may consume fuels or energy resources at an intensive rate, which may impact on availability of critical supplies.

To verify potential impacts on energy or resource conservation, each RDT&E program should be considered on the basis of the following types of questions when reviewing EICS matrix output:

- What are the kinds and quantities of materials consumed in the research effort, either directly or in terms of energy consumption?
- Is recycling a part of the overall program or any part of the research effort?
- What is done with waste products generated by the research program?
- What safeguards are in effect to protect natural resources during the testing phase?
- What are the potential resource or energy conservation benefits from the research? Can the results of the research be applied to other uses (e.g., an energy-efficient engine which could have many applications)?
- What type of pollutants are emitted? In what quantities?

Answers to these or similar questions can place the role of energy and resource conservation considerations into perspective in environmental impact analysis of RDT&E programs and activities.

Further assistance may be provided by sources listed in Table 15.

- RDT&E/Energy and Resource Conservation Filter Questions

1. Is or was any consideration given to the substitution of other materials for critical materials in products under evaluation, and were energy conservation aspects considered in the planning and design of equipment (hardware, materials, weapons, etc.) under evaluation?

(1) Yes

(2) No, or don't know

2. Are energy/resource conservation considerations incorporated into the design of buildings or other structures being used for RDT&E efforts?

(1) Yes

(2) No, or don't know

3. Has a comprehensive environmental impact analysis been made for field testing programs, and has an environmental protection plan been formulated for the test phase?

(1) Yes

(2) No, or don't know

(3) No field tests are included in the RDT&E program

4. Are contingency plans in effect to deal with environmental damage resulting from accidents (spills, contamination, nuclear or radiation accident, etc.)?

(1) Yes

(2) No, or don't know

Table 15

References Helpful in Assessing Impacts or Answering Filter Questions for Energy and Resource Conservation

References Helpful in Answering Energy/ Resource Conservation Filter Questions	Information Supplied
On-Base	
Procurement Officer	Material quantities and requirements, records, sources of supplies.
Operational officers and research investigators	Details of on-going and proposed research programs, materiel requirements, environmental safeguards, contingency plans.
Utilities engineer	Waste disposal programs, recycling efforts, energy needs.
Test director	Details on test programs.
Off-Base	
U.S. Environmental Protection Agency	Recycle/reuse potential, effects of wastes on environment due to test programs, and waste production. Discharge/emission requirements.
Colleges and universities	Critical materials availability, recycle/reuse potential, research needs, future projections. Records, data, and assistance on specific problems concerning waste production and pollution control.
Federal Energy Administration	Research development of topics relating to energy production and use. Records, data, and assistance on energy-related topics.

Table 15 (cont'd)

State Energy and Conservation Office	Not available for every state. This type of agency generally acts as an advisory board to the state's executive department and can provide information on regulatory requirements of that state.

4 EICS OUTPUT AND ITS USE

The EICS can assist in tasks other than EIA/EIS preparation. Used early in projects and program development, the system can help planners assess project alternatives. Management can use the system to assist in its review of an EIA/EIS. The review level output from the system is specially designed for these tasks.

The following paragraphs provide a step-by-step procedure of total EICS use. The material is slanted toward use of detailed level output, but a similar procedure can be followed when using the EICS to review documents or evaluate alternatives. Where appropriate, special reference to the use of review level output is made.

Specifying Requirements

Procedures for requesting EICS output are outlined in detail in Chapter 3 for the RDT&E Functional Area. Output received depends on what was requested on the input form. Figure 6 outlines the steps for using EICS material.

EICS Output

Environmental information available to the user consists of EICS output and supportive materials (*Attribute Descriptor Package*, User Manual).[3,4] The user must study, verify, and manipulate this information to prepare an EIA/EIS. Since EICS is designed for general use, it does not provide all the information required to perform the analysis. The user must provide or acquire additional (environmental baseline) information. Some information requirements are initially used to answer filter questions. The user should refer to the baseline information section in Chapter 2 and to the information source lists in Chapter 3 for assistance.

Because the user may not be able to understand all environmental attributes and perform all impact analyses, he should consult with experts as the need arises. The output and supportive materials will help the user prepare scopes of work and communicate with experts in each Technical Specialty area.

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[3] L. V. Urban, H. E. Balbach, R. K. Jain, E. W. Novak, and R. E. Riggins, *Computer-Aided Environmental Impact Analysis for Construction Activities: User Manual*, Technical Report E-50/ADA008988 (CERL, March 1975).

[4] R. E. Riggins and R. K. Jain, *Computer-Aided Environmental Impact Analysis for Air Force Base Realignment Activities: User Manual*, Technical Report N-4/ADA027431 (CERL, June 1976).

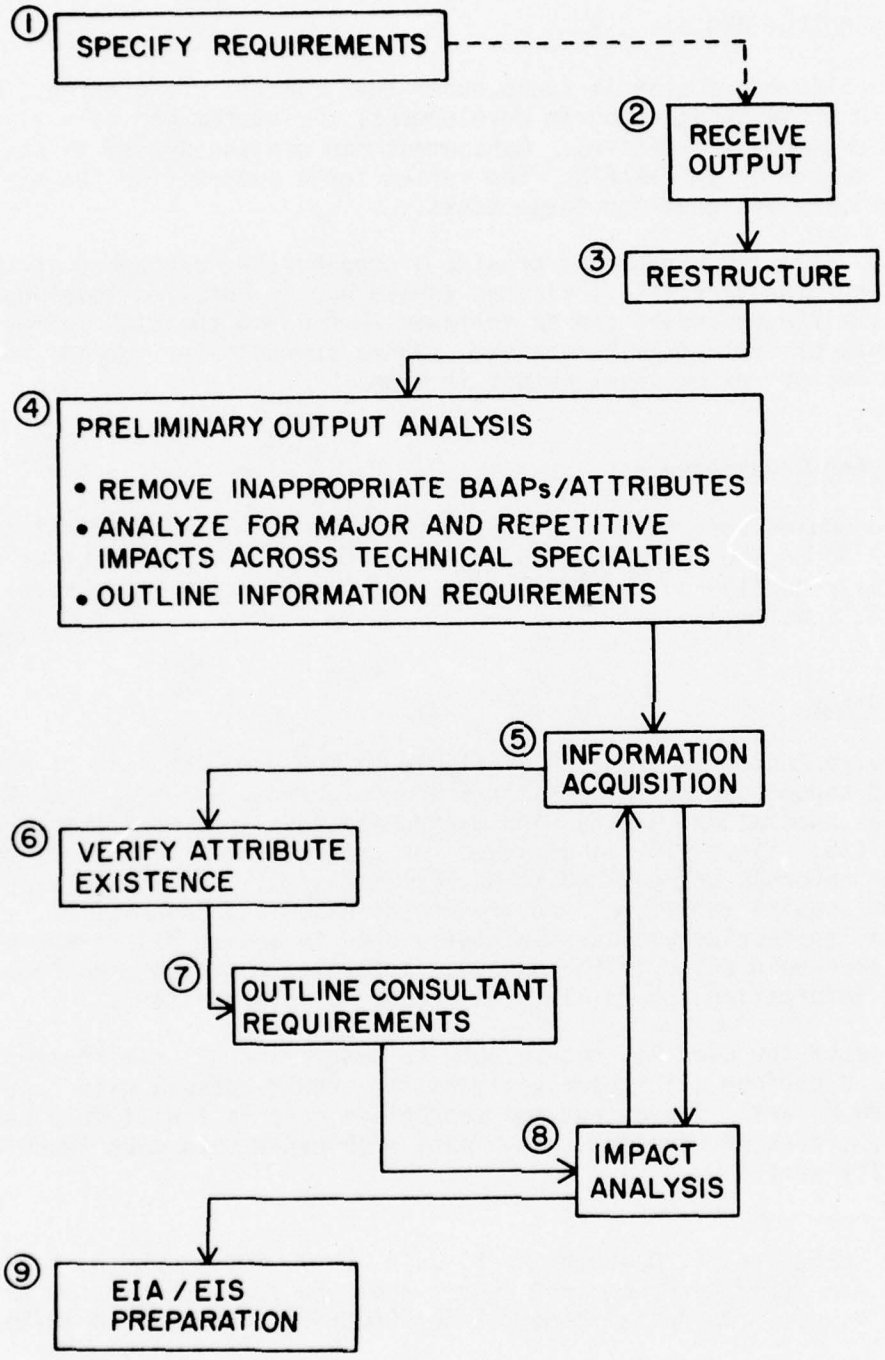

Figure 6. Steps in the EICS impact analysis procedure.

EICS output is furnished to the user with a copy of the original input form(s) to show what output was requested. EICS computer output consists of a complete list of all BAAPs for the Functional Area, plus sets of information for each Technical Specialty requested. A set of information for a Technical Specialty consists of the following items.

The Technical Specialty Matrix

Impact predictions appear in matrix form. Attributes are coded by numbers which appear horizontally as the first line of data (Figure 7). The left column of numbers, entitled "BAAP No.," refers to the potentially impacting activities being performed during the project for a particular subprogram. A possible impact is shown by the letter A, B, or C at the intersection of the horizontal and vertical axes corresponding to a given activity and attribute. (For an explanation of these letters, see the "Need-to-Consider Scale" section of Chapter 2.) Absence of a letter at an intersection means that no impact is predicted. A column at the right side of the matrix, headed "RAM-MIT CODE" with four-digit numbers arranged below it, corresponds to Ramification Remarks and Mitigation Statements. Ramification Remarks explain why the activity, or some test listed for that BAAP, will cause a problem; Mitigation Statements give possible means to reduce the problem or level of impact.

Impacted Attributes

The next output is a decoded list of attribute numbers which corresponds to the horizontal column of attribute numbers previously described for Figure 7 (see Figure 8).

Impacting Activities

Next is the decoded list of names of impacting activities. Only those activities applicable to the requested subprogram and those predicted to cause impact are listed (see Figure 9).

Ramifications-Mitigations

Decoded sets of Ramification Remarks and Mitigation Statements are provided with output. Each set contains one or more Ramification Remarks and one or more Mitigation Statements and is identified by a code number corresponding to a code number in the right-hand column of Figure 7, labeled "RAM-MIT CODE." A specific Ramification Remark or Mitigation Statement may be used more than once or in different combinations with other Remarks or Statements if it applies to more than one activity. Figure 10 illustrates typical Ramification-Mitigation output.

SUB-PROGRAM CODE = 1710 SUB-PROGRAM NAME = FAMILY HOUSING

TECHNICAL SPECIALTY = ECOLOGY

BAAR NO.	ATTRIBUTES 2	3	4	5	6	8	10	11	12	13	14	15	16	17	18	19	20	21	22	23	26	27	28	30	31	32	33	34	35	36	37	41	42	43	RAM-MIT CODE
60																																	C		1060
61																													A	B	C				1061
64			A							B											B	A	A	B	A										1064
66	B																										A		A							1066
67			B							B																	B		A							1067
73	C	A	A	A	A				A		A		C	H	A	A	C	C	C	C									A	B	C	H	A	C	1073
74	C	B	A	A	A	C		C	A	A					C	B			C		B	A	A					A	A						1074
75	C	B	A	A	A	C		C	A	A					C	B			C		B	A	A					A							1075
76			B	H	A	H	C	H	A				H		H	A		B	B	H	B	B	A	B	B							C		C	1076
90																														B					1090
91			C	B	C			C	H		A				H				B		C	B	B				C		C						1091
92			C	B	C			C	H		A				B				B		C	B	B				C		C						1092
100																													A	B	C	B	B		1100
101		A	A	B	A	H		B	A	A			H	C	B	A			A	A	H	A	A	A				B							1101
102			A	B	A	B	A	B	A	A			C		B	A			A		B	A	A	A				B							1102
104							B																				B	A							1104
120																													A	B	C	B	B		1120
122			A		A	H		B	A	A			C		B	A			B		B	A	A	A				B							1122
124							H																												1124
125				B		H	A						C		C													B							1125
126																												H							1126
127																												H							1127
168		H	C	B	C	B				B											C	A	A		A		C		H						1168
169		H	C																								C								1169
180																													B						1180
185							C																												1185
187			H	A	A	A				A					C	B					C	B	A	B	B										1187
204																						C	B												1204
206																						C	B												1204
211			C	C	C					B												C	B												1211
227			C	C	C					H												C	B												1211
262		B	B	B		A				A	H	B	B	C	H	A			C	A	C	B	A	B	B	B	C	B							1262
285		H	C			C	C	B	B	C			B		C	C	C		C	A	C	B	A	B	B	B	C	C	B	B					1285

Figure 7. Technical Specialty matrix.

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SUB-PROGRAM CODE = 1710 SUB-PROGRAM NAME = FAMILY HOUSING

TECHNICAL SPECIALTY = ECOLOGY

IMP. ATTRI. CODE	ATTRI. NAME	SUB-PARAMETRIC NAME	PARAMETRIC NAME
2	SMALL MAMMALS	KINDS OF ANIMALS	ECOSYSTEM
3	BIRDS	KINDS OF ANIMALS	ECOSYSTEM
4	FISH	KINDS OF ANIMALS	ECOSYSTEM
5	REPTILES	KINDS OF ANIMALS	ECOSYSTEM
6	AMPHIBIANS	KINDS OF ANIMALS	ECOSYSTEM
8	OTHER ANIMALS	KINDS OF ANIMALS	ECOSYSTEM
10	TREES	KINDS OF PLANTS	ECOSYSTEM
11	SHRUBS	KINDS OF PLANTS	ECOSYSTEM
12	HERBS	KINDS OF PLANTS	ECOSYSTEM
13	ALGAE	KINDS OF PLANTS	ECOSYSTEM
14	FUNGI	KINDS OF PLANTS	ECOSYSTEM
15	LICHENS	KINDS OF PLANTS	ECOSYSTEM
16	OTHER PLANT SPECIES	KINDS OF PLANTS	ECOSYSTEM
17	ENDANGERED PLANT SPECIES	KINDS OF PLANTS	ECOSYSTEM
18	FOOD WEBS	SYSTEM STABILITY	ECOSYSTEM
19	PRODUCTIVITY	SYSTEM STABILITY	ECOSYSTEM
20	SEASONAL ASPECT	SYSTEM STABILITY	ECOSYSTEM
21	STRATIFICATION	SYSTEM STABILITY	ECOSYSTEM
22	SUCCESSIONAL STAGE	SYSTEM STABILITY	ECOSYSTEM
23	SMALL GAME HUNTING	HUNTING	WILDLIFE MANAGEMENT
26	BOTTOM LIFE	FISHING	WILDLIFE MANAGEMENT
27	WARM WATER FISHING	FISHING	WILDLIFE MANAGEMENT
28	COLD WATER FISHING	FISHING	WILDLIFE MANAGEMENT
30	COASTAL WATER FISHING	FISHING	WILDLIFE MANAGEMENT
31	SHELLFISH	FISHING	WILDLIFE MANAGEMENT
32	DEEP SEA FISHING	FISHING	WILDLIFE MANAGEMENT
33	DISEASE VECTORS	PESTS	WILDLIFE MANAGEMENT
34	NOXIOUS WEEDS	PESTS	WILDLIFE MANAGEMENT
35	OTHER UNDESIRABLE SPECIES	PESTS	WILDLIFE MANAGEMENT
41	IMPACT ON GAME ANIMALS		CNTRVSL
42	ENCROACHMENT ON NATURAL HABITATS		CNTRVSL
43	THREATENED SPECIES		CNTRVSL

Figure 8. Decoded list of detailed level attributes.

IMP. BAAP CODE	IMP. BAAP NAME	IMP. BAAP CODE	IMP. BAAP NAME
60	SUPPORT OPERATIONS	122	EARTH EXCAVATION
61	TEMPORARY ROADS	124	HAULING EARTH MATERIALS
64	EQUIPMENT FUELING/MAINTENANCE	125	DUMPING EARTH MATERIALS
66	SOLID WASTE DISPOSAL	126	CONSOLIDATE/COMPACT SOIL
67	LIQUID WASTE DISPOSAL	127	TRIM AND FINISH
73	CLEARING SITE	148	DEWATERING
74	GRUBBING SITE	149	DRAINAGE
75	STUMPING SITE	180	BITUMINOUS CONSTRUCTION
76	DRAINING SITE	185	PLACING-BITUM
90	REMOVAL AND DISPOSAL	187	CURING/SEALING-BITUM
91	BRUSH REMOVAL/DISPOSAL	204	MIXING-CONCRETE
92	TREE REMOVAL/DISPOSAL	206	HAULING-CONCRETE
100	EXCAVATION	211	STRIP AND CLEAN FORMS
101	TOPSOIL STRIPPING	227	CLEANING
102	GRADING	262	PEST/INSECT PROTECTION
104	TRENCH AND BACKFILL OPERATIONS	285	FURNISHING(LANDSCAPE-PLANTING-SEEDING)
120	EARTHWORKS AND BORROWING		

Figure 9. Decoded list of impacting activities.

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1061
/RAMIFICATIONS/
CONSTRUCTION OF TEMPORARY ACCESS ROADS MAY REPRESENT THE FIRST MAJOR INTRUSION INTO A REMOTE BUILDING SITE. NUMEROUS SUPERFLUOUS ROADS MAY CAUSE MORE TERRAIN DAMAGE THAN THE PROJECT ITSELF.

/MITIGATIONS/
PLAN ACCESS ROADS CAREFULLY; IMPROVE THEM IF NECESSARY; THEN RESTRICT DEVELOPMENT OF ALL OTHER ROADS AND PATHS.

1067
/RAMIFICATIONS/
TEMPORARY TOILET FACILITIES MAY CAUSE SEVERE, HAZARDOUS CONTAMINATION OF SMALL, LOCAL DRAINAGE WAYS.

/MITIGATIONS/
REQUIRE THAT ALL TEMPORARY TOILETS ON SITES BE EQUIPPED WITH APPROVED SEPTIC TANKS WITH SAFE DRAINAGES OR WITH CLOSED HOLDING TANKS WHICH ARE EMPTIED ONLY INTO APPROVED TREATMENT PLANTS, AND NEVER DUMPED INTO WATERWAYS OR ON THE SOIL SURFACE ON OR OFF THE INSTALLATION.

1071
/RAMIFICATIONS/
REMOVAL OF TREES DRASTICALLY ALTERS THE ECOLOGICAL BALANCE AND AESTHETIC INTEREST OF ANY AREA WHERE IT IS DONE. IT REMOVES HABITAT FOR MANY ANIMALS, REMOVES FOOD SOURCES FOR STILL OTHERS, STRESSES REMAINING SMALLER PLANT ASSOCIATIONS AND OFTEN LEADS TO INCREASES IN PLANT AND ANIMAL PESTS.

/MITIGATIONS/
REMOVAL OF TREES IS AN UNAVOIDABLE IMPACT IF THE SITE IS TO BE USED. BUT CONTRACTS SHOULD CLEARLY SPECIFY LIMITS OF CLEARING. ALTERNATE SITES MIGHT BE USED IF FORESTED AREAS ARE LOCALLY SCARCE.

1074
/RAMIFICATIONS/
NATURALLY WET SITES SUPPORT A VERY WIDE VARIETY OF PLANT AND ANIMAL SPECIES. DRAINAGE OF THESE SITES MAY HAVE FAR-REACHING SECONDARY EFFECTS ON OTHER ANIMAL POPULATIONS WHICH DEPEND ON THE MARSHY AREAS FOR FOOD PRODUCTION.

/MITIGATIONS/
IF NATURALLY WET SITES MUST BE UTILIZED FOR LACK OF AN ALTERNATE, THESE EFFECTS ARE UNAVOIDABLE. INDISCRIMINATE DRAINAGE OF ALL WET SITES WHERE NO PRESSING PLANS EXIST FOR USE OF THE AREA IS ENVIRONMENTALLY UNACCEPTABLE.

1091
/RAMIFICATIONS/
BURNING OF BRUSH ON-SITE MAY STERILIZE SOILS THROUGH HEAT, CAUSE UNCONTROLLED WOOD FIRES AND EVENTUALLY CAUSE SOIL EROSION. ITS DISPOSAL NEAR OR IN WATER FEATURES CAUSES FLOODING, DETERIORATION OF WATER QUALITY AND THE POSSIBILITY OF ENHANCING CONDITIONS FOR ANIMAL PESTS.

/MITIGATIONS/
PREFERABLE DISPOSAL TECHNIQUES FOR BRUSH INCLUDE CHIPPING FOR SALE OR DISPENSED DISPOSAL, INCINERATION IN APPROVED DEVICES, SHREDDING FOR COMPOSTING AND POSSIBLE SALE FOR FUEL.

1092
/RAMIFICATIONS/
BURNING OF TREES ON-SITE WILL DAMAGE REMAINING VEGETATION NOT INTENDED TO BE REMOVED, CAUSE EVENTUAL SOIL EROSION AND RESULT IN SAFETY HAZARDS DUE TO POSSIBILITY OF UNCONTROLLED FIRES, WITH SUBSEQUENT DESTRUCTION OF ADJACENT ANIMAL AND PLANT POPULATIONS.

/MITIGATIONS/
PREFERABLE DISPOSAL TECHNIQUES FOR TREES INCLUDE SALE FOR TIMBER OR FIREWOOD, CHIPPING FOR USE IN MAINTAINING UNPAVED ROADS AND FOOT PATHS, ON-POST USE FOR RUSTIC RECREATIONAL STRUCTURES AND INCINERATION OF UNUSABLE TREES IN APPROVED DEVICES.

1101
/RAMIFICATIONS/
WHEN THE UPPER STRATA OF THE SOIL ARE REMOVED, ALL PLANTS AND ALMOST ALL ANIMAL SPECIES ARE DESTROYED. SUBSEQUENT EROSION OF THE AREA MAY ALSO LEAD TO SILTATION OF NEARBY BODIES OF WATER.

/MITIGATIONS/
SOIL SHOULD BE STRIPPED FROM AS SMALL AN AREA AS POSSIBLE, AND AS CLOSE TO THE DATE OF CONSTRUCTION AS POSSIBLE. SPOIL PILES WHICH WILL REMAIN LONGER THAN 45 DAYS MUST BE SEEDED HEAVILY WITH ANNUAL GRASSES IMMEDIATELY. SEDIMENT TRAPS MUST BE USED IF ANY WATER BODIES ARE WITHIN 200 M. (ABOUT 800 FT) DOWNSLOPE.

1180
/RAMIFICATIONS/
WHEN LARGE AREAS ARE PAVED, AS IN MAKING PARKING LOTS, THE INCREASED RUNOFF WATER MAY CREATE BODIES OF STANDING WATER ON PREVIOUSLY DRY SITES. THIS STAGNANT WATER MAY LEAD TO INCREASED NUMBERS OF MOSQUITOS AND OTHER INSECT PESTS.

/MITIGATIONS/
PROVIDE IMPERVIOUS DRAINAGE CHANNELS FOR ALL PAVED SURFACES WHICH DIRECT WATER TO EXISTING STORM CHANNELS OF ADEQUATE CARRYING CAPACITY. AVOID GENERALIZED SURFACE SPILLAGE OF WATER.

1262
/RAMIFICATIONS/
ALL COMMON WOOD PRESERVATIVES ARE HIGHLY TOXIC TO LIVING PLANTS AND ANIMALS, ESPECIALLY FISH. DISPOSAL OF EXCESS QUANTITIES HAS OFTEN STERILIZED SOIL, KILLED FISH AND CAUSED THE DEATH OF DESIRABLE ORNAMENTAL PLANTS.

/MITIGATIONS/
ENSURE THAT LEFTOVER QUANTITIES ARE NEVER DISPOSED OF ON-SITE ON THE SOIL, IN WATER BODIES, IN DRAINAGE DITCHES OR DOWN STORM DRAINS OR SANITARY SEWERS. DISPOSAL OF EMPTY CONTAINERS AND EXCESS CHEMICALS SHOULD FOLLOW EPA GUIDELINES.

1285
/RAMIFICATIONS/
LANDSCAPING WITH EXOTIC SPECIES OR WITH POORLY ADAPTED SPECIES HAS OFTEN INTRODUCED WEEDS AND PESTS INTO DISTURBED AREAS AROUND CONSTRUCTION SITES, WHERE THEY FLOURISH. FUNGICIDES, INSECTICIDES AND FERTILIZERS USED ON NEW PLANTINGS OFTEN WASH INTO BODIES OF WATER, UPSETTING EXISTING PLANT AND ANIMAL LIFE.

/MITIGATIONS/
USE CERTIFIED SEED SOURCES AND NURSERY STOCK KNOWN TO BE ADAPTED TO THE AREA. PLANT IMMEDIATELY FOLLOWING CONSTRUCTION SO SITE IS NOT LEFT OPEN TO INVASION. FOLLOW LABEL DIRECTIONS IN USE OF CHEMICAL PRODUCTS RIGOROUSLY. APPLY FERTILIZERS IN QUANTITIES CALCULATED NOT TO EASILY LEACH OUT OF THE SOIL.

Figure 10. Typical Ramifications/Mitigations.

Supportive Documents

Other than the computer printouts, materials available to the user include the *Attribute Descriptor Package* (described in Chapter 2) and the BAAP definitions, alternative BAAP methods/tests (Table 4), and Technical Specialty introductions and information source lists found in Chapter 3 of this manual.

EIFS

An Economic Impact Forecast System (EIFS) was developed to address impacts related to expenditures of military dollars in local communities. This system is an export-based location-quotient technique that uses an export multiplier to measure local economic vitality. Data were obtained from the Bureau of Census and similar organizations. EIFS uses these baseline data, along with data supplied by the user, to estimate the magnitude of related economic changes in the following areas:

- Total business volume
- Total personal income
- Total employment
- Property values
- Housing expenditures, investments
- Non-housing expenditures, investments
- Tax revenues
- Schools--costs, government aid
- Local government operating costs

Restructuring the Output

It would be most convenient for the user if the activities, attributes, Ramifications, and Mitigations could be printed on the matrix without the use of code numbers, but computer printout limitations presently make this impossible; however, the user can "cut and paste" the output to arrange it in a more convenient form.

First, the activity list is placed at the left side of the matrix so that the code numbers are covered by the corresponding activity and the activities align with the proper row of scores. Next, the attribute list is cut into sections of approximately five attributes. These sections are placed above, but not covering, the attribute codes at the top of the matrix. Ramification Remarks and Mitigation Statements can be aligned to the right of the Ramification/Mitigation codes, although reference to them in their present arrangement should not be difficult. An example of restructured output is illustrated in Figure 11.

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SUB-PROGRAM CODE = 1710 SUB-PROGRAM NAME = FAMILY HOUSING

TECHNICAL SPECIALTY = ECOLOGY

IMP. ATTRI. CODE	ATTRI. NAME	IMP. ATTRI. CODE	ATTRI. NAME	IMP. ATTRI. CODE	ATTRI. NAME
2	SMALL MAMMALS	14	FUNGI	27	WARM WATER FISHING
3	BIRDS	15	LICHENS	28	COLD WATER FISHING
4	FISH	16	OTHER PLANT SPECIES	30	COASTAL WATER FISHING
5	REPTILES	17	ENDANGERED PLANT SPECIES	31	SHELLFISH
6	AMPHIBIANS	18	FOOD WEBS	32	DEEP SEA FISHING
8	OTHER ANIMALS	19	PRODUCTIVITY	33	DISEASE VECTORS
10	TREES	20	SEASONAL ASPECT	34	NOXIOUS WEEDS
11	SHRUBS	21	STRATIFICATION	35	OTHER UNDESIRABLE SPECIES
12	HERBS	22	SUCCESSIONAL STAGE	41	IMPACTS ON GAME ANIMALS
13	ALGAE	23	SMALL GAME HUNTING	42	ENCROACHMENT ON NATURAL HABITATS
		26	BOTTOM LIFE	43	THREATENED SPECIES

IMP. BAAP CODE	IMP. BAAP NAME
60	SUPPORT OPERATIONS
61	TEMPORARY ROADS
64	EQUIPMENT FUELING/MAINTENANCE
66	SOLID WASTE DISPOSAL
67	LIQUID WASTE DISPOSAL
73	CLEARING SITE
74	GRUBBING SITE
75	STUMPING SITE
76	GRADING SITE
90	REMOVAL AND DISPOSAL
91	BRUSH REMOVAL/DISPOSAL
92	TREE REMOVAL/DISPOSAL
100	EXCAVATION
101	TOPSOIL STRIPPING
102	GRADING
104	TRENCH AND BACKFILL OPERATIONS
120	EARTHWORKS AND BORROWING

ATTRIBUTES

BAAP NO.	2	3	4	5	6	8	10	11	12	13	14	15	16	17	18	19	20	21	22	23	26	27	28	30	31	32	33	34	35	36	37	41	42	43	PAR-MIT CODE
60																															C				1060
61																												A	B	C					1061
64			A							H											H	A	A	R	A										1064
66	H																										A		A						1066
67			H							A																	B		A						1067
73	C	A	A	A	A				A		A		C	H	A	A	C	C	C	C									A	B	C	H	A	C	1073
74	C	H	A	A	A	C		C	A	A					C	B			C		H	A	A					A	A						1074
75	C	H	A	A	A	C		C	A	A					C	H			C		H	A	A					A							1075
76			B	H	A	H	C	H	A				H		H	A		H	R	H	H	B	A	B	H						C		C	1076
90																														B					1090
91			C	R	C			C	H		A				H				R		C	B	B				C		C						1091
92			C	H	C			C	H		A				H				H		C	B	B				C		C						1092
100																													A	B	C	R	R		1100
101		A	A	R	A	H			H	A	A			H	C	B	A			A	A	H	A	A	A			H							1101
102			A	H	A	H	A	A	A	A				C		H	A			A		H	A	A	A			H							1102
104							H																				B	A							1104
120																													A	B	C	R	B		1120
122			A		A	H			H	A	A			C		B	A			R		H	A	A	A			B							1122
124							H																												1124
125				R		H	A							C		C												R							1125
126																												R							1126
127																												H							1127
168		H	C	R	C	H				H												C	A	A		A		C		H					1168
169		H	C																									C							1169
180																													B						1180
185							C																												1185
187			B	A	A	A				A					C	B					C	B	A	B	B										1187
204																						C	B												1204
204																						L	B												1204
211			C	C	C					H												C	B												1211
227			C	C	C					H												L	B												1211
262		B	B	B		A				A	B	B	B	C	B	A			C	A	C	B	A	B	B	C	B								1262
285		H	C			C	C	H	H	C			B		C	C	C		C	A	C	B	A	B	B	C	C	B	B						1285

Figure 11. Example of restructured output.

Preliminary Output Analysis

The user should perform preliminary analysis of the output to further tailor it to the site, familiarize himself with the impacts associated with the project, and organize his approach to the assessment process. He should first remove obviously inappropriate BAAPs and attributes. If an activity will not be performed, it can be deleted; if it is certain that an attribute does not exist at the site, it can be deleted.

After reviewing the Ramifications and Mitigations (in a Technical Specialty) for each BAAP, the user can study the matrix output to identify major impacts in each Technical Specialty and repetitive and associated impacts among several Technical Specialties. To assist the user in this procedure, a simple worksheet has been developed for use during the impact analysis process. (It is a *suggested* worksheet; others may be developed by the individual user.)

Figure 12--Worksheet #1: Output Analysis--is a sample worksheet which may be used to organize the information obtained during output analysis of a Technical Specialty matrix. (Several sheets may be required for each Technical Specialty.) Working from left to right, the three main sections of the worksheet can be used as listed below:

1. Matrix Factors Section

a. Each BAAP may be examined individually across a horizontal matrix row by listing it in the left-hand portion of the section, and then placing pertinent attributes or groups of attributes in the right-hand column. Individual scores may be noted, if necessary, in the center. (The examples in Figure 13 follow this procedure.)

b. A similar procedure may be followed for the vertical matrix columns of individual attributes.

c. Several attributes performed by a particular organization or at a particular location may be examined as a group.

d. Particular attention may be given to horizontal rows and vertical columns which have large numbers of impacts scored.

2. Implications Section

This column provides space to note (a) the essential implications of the Ramification Statements, (b) the suggested mitigations, and (c) which impacts may be unavoidable, short-term, or long-term. (Although the Ramifications/Mitigations should be fairly easy to use as provided with the computer output, the individual "Rams" and "Mits" could also be attached here in particular cases where note-taking proves overly repetitious.)

3. Information/Consultant Requirements Section

a. Questions raised about specific impacts, mitigations currently in use, and their success in reducing impacts, etc., should be listed in this section of the worksheet.

b. This portion can also be used to list persons or organizations which should be consulted to provide the answers to these questions. Such names could be obtained from the user's own knowledge, from the information sources listed for each Technical Specialty in Chapter 3, or from suggestions on the Ramification Remarks or Mitigation Statements.

c. Known documentation of relevant information should be noted.

d. When information needed to determine extent of impact is not currently available, field work requirements should also be noted; include whether the work can be provided in-house or through some government or educational institution, or whether it will require contracting to an outside consultant.

Figure 13 is an example analysis from the Construction Functional Area showing how the Output Analysis Worksheet can be used to summarize the possible impacts of an activity and the steps to verify its presence and significance.

During the analysis of matrix output, the user should arrange the potential impacts into categories such as the following:

1. Impacts which the preparer can address

2. Impacts which will occur simply by the presence of an attribute

3. Impacts requiring scientific consultation for analysis

4. Impacts about which information is readily available

5. Impacts for which field work will be required to obtain adequate information

6. Impacts associated with more than one Technical Specialty which might require analysis in the primary specialty being impacted before analysis of secondary or cumulative impacts in other specialties

7. Impacts associated with more than one Technical Specialty which can be adequately analyzed in any of the Technical Specialties (duplication)

MATRIX FACTORS	SCORE	IMPLICATIONS (RAMS-MITS)	INFO/CONSULTANT REQUIREMENTS

Figure 12. Worksheet #1: Output Analysis.

MATRIX FACTORS	SCORE		IMPLICATIONS (RAMS–MITS)	INFO/CONSULTANT REQUIREMENTS
Example of Output Analysis: 2 BAAPs from the Construction Functional Area.				
BAAP		Ecology Technical Specialty attributes		
65 Solid Waste	A	Disease vectors	User's Notes:	
		Other undesirable species	Debris on site: rates, bugs, etc. Control problem by weekly disposal (landfill, incinerator)	See contracting officer (Procurement Office) on past construction. How was debris and other solid waste disposed of, by whom, and how often? Is contractor's landfill "sanitary"?
	B	Small mammals	(Original Ram-Mit: "Ramification: Temporary, on-site disposal of packing materials and other organic debris may lead to increased populations of rats, mice, roaches, termites, and other undesirable animals." "Mitigation: Require, by contract provision or by providing service, that all organic solid waste be disposed of in an approved landfill or incinerator no less frequently than once a week.")	See pest control records for rat, bug problems on past construction sites, overall base pest problems. Site visit--find best spot for temporary dump. Can we get separate contract for waste disposal on this project, or will current disposal contractors be able to handle it? Looks like a controllable problem -- probably not significant impact if controlled. Require fencing to conceal debris?

Figure 13. Example for Worksheet #1.

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MATRIX FACTORS (SICORE)			IMPLICATIONS (RAMS-MITS)	INFO/CONSULTANT REQUIREMENTS
Construction Output	Analysis Example, continued:			
BAAP		Ecology attributes		
73 Clearing site	A	trees, shrubs, fish, amphibians, food webs, encroachment on natural habitat	User Notes: Removes animal habitat, animal food sources, stresses small plants, can lead to pests increase, increased runoff, and thus siltation. Unavoidable in area cleared. Specify clearing limits clearly, or choose alternate sites. (Original Ram-Mit: "Ramification: Removal of trees drastically alters the ecological balance and aesthetic interest of any area where it is done. It removes habitat for many animals, removes food sources for still others, stresses remaining smaller plant associations, and often leads to increases in plant and animal pests. It can also allow increased runoff after rains, impacting, downstream aquatic organisms." "Mitigation: Removal of trees is an unavoidable impact if the site is to be used. But contracts should clearly specify limits of clearing. Alternate sites might be used if forested areas are locally scarce.")	See base forester, resource manager, bioenvironmental engineer, or environmental engineer. Reference the base master plan, section on forests. What percent of proposed site is currently forested? Same question for entire base. May need field survey of timber, other plants, animals--how much baseline information already in current master plan? How much contractable? Call university forestry and biology departments. Can we shift construction site so less forest cut? Is current site of any particular importance? Any nearby streams/ponds (see base maps)? What is planned to control erosion? Any pests or weeds of particular importance around (so increases would be problem)? Any threatened species known to site, to base, to the region?
	B	herbs, birds, endangered plants, impacts on game animals		
	C	small mammals, reptiles, productivity, seasonal aspect, small game hunting threatened species		

Figure 13. (cont'd)

The user can now organize the verification analysis in a manner which could include:

1. Designating those impacts to be further examined by others.

2. Outlining impact analysis information requirements.

3. Establishing a convenient order in which to investigate the presence (or absence) of impacts and their relative severity and degree of significance.

Information Acquisition

Information is needed primarily for the steps labeled 6 and 8 in Figure 6. The user will be most interested in information about attributes he/she will analyze; however, the user could also acquire information for attributes designated to others for analysis.

Information acquisition for impact analysis has two general forms: existing sources and collection in the field. Existing sources which include reports, studies, personal interviews, etc., should always be searched first.

Information requirements can vary considerably. It might be sufficient to establish an attribute's presence; on the other hand, detailed information about its location and condition might be required. Requirements should be determined (as suggested for section 3 of Worksheet #1) before acquisition begins.

Another factor to be considered during information acquisition is the completeness of the description of any current, ongoing activities. The user needs to obtain baseline information which answers such questions as:

- What activities (BAAPs) are actually being performed by the facilities, organizations, or test groups being considered in this environmental assessment?

- How is the activity being performed?

- How often is it performed?

- If any waste is being produced, what is it and what quantities are produced?

- Are any mitigation procedures already being performed? If so, what are they?

The answers to all but the last question are needed for use somewhere in either Part 1 or Part 2 of the environmental assessment, in the descriptions of the existing activities and environments (before the project). This simplifies considerably the later sections of the document involving the actual impacts. The answers to the last question would be used in Part 5-B of the EIA, "How Avoidable Adverse Impacts Will Be [or Are] Avoided."

Verifying Attribute Existence

When known nonexistent attributes have been filtered out, a preliminary site visit should be made to verify the existence of each remaining attribute. Impacts resulting because an attribute is present can then be analyzed. The presence, location, and condition of attributes will determine the extent of further analysis. Preliminary determination of the presence of impacts on these attributes can be started during the site visit; determination of degree and significance of the impacts may require consultation with various in-house and out-of-house experts. In some cases, it may be desirable to obtain field surveys or investigations of certain attributes. Such investigations may be obtained at little or no cost from government agencies, at minimal cost from professors or graduate students at local colleges or universities, or at fairly reasonable cost from professional consultants.

Outlining Consultant Requirements

The user should by now have compiled a list of information which must be obtained by consultants. The key to obtaining professional (or amateur) consultant services, at a cost which can reasonably be borne by the sponsoring organization, is to use the previously performed output analysis, plus the no-cost in-house and out-of-house expertise available, to narrow down the scope of work for the paid consultant. The consultant should obtain *only* that *specific* information which is not otherwise available. In some cases, after reading the Ramifications, Mitigations, and attribute descriptors, the user may be able to perform adequate impact analysis by asking questions of his various information sources and consultants rather than by assigning work to them.

Impact Analysis

Impact analysis includes determining the nature, scope, and significance of environmental impacts resulting from a program or project. Ramification Remarks and attribute descriptors aid in the analysis. After completing a matrix analysis by some systematic means, such as use of Worksheet #1, the information acquired from existing sources (documents and records of personal interviews), as well as that acquired

in any field investigations (conducted by USAF personnel or by contracted consultants), should be cataloged according to the categories listed for *potential* impacts on p 120. Each occurring impact should also be categorized according to its degree and significance. Ramification Remarks, observable problems in the field, results of field studies, and contracts with experts knowledgeable about particular environmental areas (such as those listed in Chapter 3, consultants contacted, etc.) can all be used to determine the degree and significance of impacts.

Mitigation techniques should be categorized according to whether they are being used, may be used, or unlikely to be used. The latter can be considered for possible inclusion as management alternatives in Point 4 of the EIA/EIS.

5 PREPARATION OF AN EIA/EIS

The EIA/EIS format used here is that given in AFR 19-2[5] (see Figure 14); when preparing an EIA, it is mandatory. Using a format for an EIA similar to that used for an EIS can save time and trouble if an EIS is necessary later.

The latest guidelines emphasize that environmental considerations should be taken into account from the *beginning of the decision-making process*. Initial environmental studies should be conducted along with initial technical and economic studies. Too often, assessments and statements are written to justify decisions long since made. If environmental assessments were made when a project began, environmental information could be integrated into, rather than tacked onto, the decision-making process and, in many cases, delays could be avoided. Present guidelines require that draft impact statements (and thus the required prior assessments) be prepared and circulated during the earliest possible stage of the decision-making process.

Attachment 2 of AFR 19-2 and the *Handbook for Environmental Impact Analysis*[6] provide guidance for the format and contents required in environmental impact assessments and statements. These documents interpret and tailor the CEQ and Department of Defense guidelines to assure consistency of effort in preparing statements.

It is impossible to determine appropriate responses for the 11 points without information about the nature of the project. This chapter describes how EICS output can assist the preparer in responding to certain points. Each user must tailor his responses to each case, and the detail necessary depends on the particular circumstances. It is conceivable that, in some cases, the anticipated environmental impact of a USAF program or project would be negligible in many of the Technical Specialty areas. In other cases, considering these same Technical Specialty areas would be the most significant part of evaluating a potential environmental impact.

The EICS has been developed to assist the user in responding to Points 3, 4, 5, 6, 7, and 9. It can also be of assistance in indicating items which should be included under Points 1 and 2. The following explains how to relate the information in EICS output to the requirements of these points.

---

[5] *Environmental Assessments and Statements*, AFR 19-2 (Department of the Air Force, November 1974).

[6] *Handbook for Environmental Impact Analysis* (Department of the Air Force, 1976).

1. PROJECT DESCRIPTION
   A. Purpose of action
   B. Description of action
      (1) Name
      (2) Summary of activities

2. EXISTING ENVIRONMENT
   A. Natural Environment
      (1) Earth (3.1)*
      (2) Water (3.2)
      (3) Air (3.3)
      (4) Biotic (3.4)
      (5) Resources (3.5)
      (6) Special Interest Areas (3.6)
      (7) Natural Hazard (3.7)
   B. Human Environment
      (1) Demographic (4.1)
      (2) Economics (4.2)
      (3) Institutional (4.3)
      (4) Activity Systems and Plans (4.4)
      (5) Air Operations (4.5)

3. PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT
   A. Positive and negative effects
      (1) National and international environment
      (2) Environmental factors
         (a) Natural Environment
            (1) Earth (3.1)
            (2) Water (3.2)
            (3) Air (3.3)
            (4) Biotic (3.4)
            (5) Resources (3.5)
            (6) Special Interest Areas (3.6)
            (7) Natural Hazard (3.7)
         (b) Human Environment
            (1) Demographic (4.1)
            (2) Economic (4.2)
            (3) Institutional (4.3)
            (4) Activity Systems (4.4)
            (5) Air Operations (4.5)
      (3) Impact of proposed action
   B. Direct and indirect consequences
      (1) Primary effects
      (2) Secondary effects
   C. Conformity or conflict with other land use plans, policies and controls
      (1) Federal, state and local
      (2) Clean Air Act and Federal Water Pollution Control Act Amendments of 1972
      (3) Other applicable laws, administrative procedures, ordinances, etc.
   D. Conflicts and/or inconsistent land use plans
      (1) Extent of reconciliation
      (2) Reasons for proceeding with action

4. ALTERNATIVES TO THE PROPOSED ACTION
   A. Reasonable alternative actions
      (1) Those that might enhance environmental quality
      (2) Those that might avoid some or all adverse effects
   B. Analysis of alternatives
      (1) Benefits
      (2) Costs
      (3) Risks

5. PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED
   A. Adverse and unavoidable impacts
   B. How avoidable adverse impacts will be mitigated

6. RELATIONSHIP BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY
   A. Trade-off between short-term environmental gains at expense of long-term losses
   B. Trade-off between long-term environmental gains at expense of short-term losses
   C. Extent to which proposed action forecloses future options

7. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES
   A. Unavoidable impacts irreversibly curtailing the range of potential uses of the environment
      (1) Labor
      (2) Materials
      (3) Natural
      (4) Cultural

8. OTHER INTERESTS AND CONSIDERATIONS OF FEDERAL POLICY THAT OFFSET THE ADVERSE ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION
   A. Countervailing benefits of proposed action
   B. Countervailing benefits of alternatives

9. DETAILS OF UNRESOLVED ISSUES

10. BIBLIOGRAPHIC REFERENCES

11. SUPPORTING ATTACHMENTS

Figure 14. Outline for prescribed EIS content.

* Numbers in parentheses are the TAB A-1 Air Force Environmental reference numbers.

Probable Environmental Impacts (Point 3)

Potential impacts are identified in the matrices (Figure 7). Although both positive and negative impacts will be described in an EIA/EIS, the matrices usually identify only potential detrimental impacts. Ramification Remarks describe the nature and scale of potential negative impacts. The *actual* negative impacts are determined during impact analysis, as described in Chapter 4.

It is probable that many positive aspects of a proposed action will have been firmly established during its conception. Within EICS, the Mitigation Statements may indicate some positive impacts. The environment may benefit during mitigation of a particular impact if it or a similar impact was present before the project began. Specifically, activities performed for the new project that are *less environmentally damaging than the methods formerly used* could be said to be beneficial when the new project occurs in an area where military activities have occurred previously. The "Purpose of the Proposed Action" from Point 1 of the EIA/EIS can also indicate positive impacts, usually socioeconomic ones, which can be referenced in this section.

Both direct and indirect impacts will be considered. Direct impacts are shown in the matrices and discussed in the Ramification Remarks; indirect impacts are also considered but may not be specifically indicated. An impact described with one Technical Specialty may actually be a secondary effect of an impact in another Technical Specialty. For example, erosion can affect water quality, and poor water quality can affect floral and faunal communities, human health, and economics. Possible secondary effects of impacts are described for each attribute in the *Attribute Descriptor Package*.

Note that the project activities listed as impactors on the natural and human environment in Point 3 should already have been thoroughly described in the "Summary of Activities" of Point 1. Similarly, the "normal" state (before the project) of the various natural and human factors, including ongoing installation operations if applicable, should have been detailed in Point 2. (Large amounts of environmental baseline data or lengthy activities descriptions can be placed under Point 11, the "Supporting Attachments" section.) The purpose of Point 3 (plus Points 5-7) is to describe specific *changes* in the environment (impacts) resulting from the proposed action. These changes may be new, or they may be ongoing impacts which have a relationship to the project (or to current military activities at the site) and which the project will allow to continue.

Alternatives to the Proposed Action (Point 4)

The EICS is an excellent tool for evaluating alternatives and can be used most effectively during the project's early planning. Several acceptable courses of action can be evaluated to determine which alternative will have the least environmental impact.

Alternatives discussed in this section may be alternative *projects*, alternative *sites* for the project, or alternative *methods* by which a particular project may be accomplished. To evaluate alternatives involving different *projects* or *sites*, the preparer should obtain review-level EICS output for each alternative and examine the matrices to identify the environmental costs of each. Information about advantages and disadvantages of each alternative can be used in this procedure. Analysis of benefits, costs, and risks will indicate the best choice.

Evaluation of alternative *methods* of accomplishing a project will involve reviewing suitable methods of mitigating the project's impacts. These management alternatives should be alternatives which would require changes in USAF policy at the installation level or higher. Mitigation procedures which can (and will) be used during the life of the project without affecting policy would be discussed under Point 5-B.

Probable Adverse Environmental Effects Which Cannot be Avoided (Point 5)

The EICS Mitigation Statements help identify ways to avoid, eliminate, or reduce adverse impacts. Those mitigation procedures which can and will be implemented during the life of the project (or which are already in effect) can be discussed in part B of this section, leaving unavoidable adverse impacts to be discussed in part A.

Relationships Between Short-Term Uses and Long-Term Productivity (Point 6)

Ramification Remarks and attribute descriptors can help the writer of an environmental assessment distinguish short- and long-term benefits (of the project) from short- and long-term impacts on the environment. Short-term impacts should be well-established in Point 3, "Probable Environmental Impacts"; some of these may be repeated over the long-term (as long as the project continues). Other long-term impacts can arise from cumulative effects due to continuous or repeated activities. The significance of long-term effects can be evaluated by the extent to which future options are foreclosed.

Irreversible and Irretrievable Commitments of Resources (Point 7)

The Energy and Resource Conservation Technical Specialty was developed to assist in addressing this point. Resources such as labor, materials, and fuels are described by attribute descriptors. The Technical Specialty matrix identifies impacts, and Ramification Remarks describe the effects on resources.

Unresolved Issues (Point 9)

The attributes of each Technical Specialty include those parameters considered particularly prone to intense public concern. These "Controversial Attributes" can be identified in the *Attribute Descriptor Package* or by the "CNTRVSL" parametric name in the Technical Specialty attribute lists of the computer output (Figure 8). The attribute descriptors and identified impacts for these attributes, plus the related Ramification/Mitigation Statements, will assist the user in identifying and resolving issues of controversy.

Preparing an EIA/EIS Document

During the environmental impact analysis procedure, the EICS user should have two primary goals: (1) to determine the probable environmental impacts of the project and ways to mitigate them; and (2) to document such information so that the pertinent decision-maker can make an informed decision about whether to go ahead with the project as is, modify it, choose an alternate site, or cancel the project entirely.

Meeting the first goal can be greatly facilitated by using EICS, since it was developed as a *tool* to assist the user in considering all environmental factors and the ways they may be affected by a USAF action. Meeting the second goal of adequate and useful impact documentation requires more than just the computer output, attribute descriptors, and BAAP definitions, however. It is not intended, for instance, that the Ramification Remarks be inserted word-for-word into Point 3 of the EIA/EIS. Instead, the EICS tool should be used in an overall impact analysis work plan developed by the user. Some considerations which can be helpful in reaching the goal of useful documentation are discussed below.

Making an Outline

The basic outline for the EIA/EIS is that given in Figure 14. At the outset of the project, the environmental assessor should prepare a working outline which expands the basic one by listing items requiring specific discussion for that particular project. These could include specific functions, organizations, facilities, test ranges, environment (attribute) categories, etc., that are pertinent to the site(s) being considered for the project.

For example, the user might make extensive notes about what should be covered under just one item, "Water," in Point 2, as shown in Figure 15, even before receiving EICS computer output. The user should have developed the information in such an outline by consulting the *Attribute Descriptor Package* and user manuals from EICS, as well as mission

2. EXISTING ENVIRONMENT

A. Natural Environment

(2) Water

a. Surface Water

1. Natural waters -- Locations (maps), descriptions

a. Streams (list)
b. Rivers (list)
c. Lakes & Ponds (list)

2. Man-made -- Locations, descriptions

a. Holding ponds (maps)
b. Drainage systems

b. Groundwater -- Locations, descriptions

1. Aquifers -- on- and off-base
2. Wells (map)

c. Current Water Quality

1. Treatment Systems -- Locations, descriptions

a. Drinking water

b. Wastewater

1. Sewage treatment plants (list)
2. Vehicle washracks (list)
3. Aircraft cleaning (list)
4. Laboratory chemical waste (list sources, types, amounts, etc.)

c. Petroleum, oil, & lubricants waste

1. Contingency plans
2. Recent spills of stored fuel
3. Fuel dumping by aircraft

2. Standards

a. EPA region
b. NPDES permits
c. Compliance record
d. Recent water quality tests (data in an appendix)
e. Planned treatment system upgrading

Figure 15. Example section of expanded EIA/EIS outline.

and function statements, base maps, and other installation information available from the Base Civil Engineer.

Dividing the Work

Especially on a large project, the person in charge of producing an environmental assessment document should be planning work assignments during the preparation of the working outline. The work of environmental assessment and document preparation can be divided among the available persons in several ways:

- By Technical Specialty area (or groups of Technical Specialties),
- By activity locations,
- By research (or other activity) types, such as aeronautics, weaponry, medical research, etc., *or*
- By section of the outline (Point 1, Point 2, Point 3, etc.).

As much as is possible, the project leader should seek workers for a large assessment who represent various disciplines. Such a multidisciplinary approach will result in a document superior to one produced from a single viewpoint.

EICS Output Analysis

By developing a working outline for the EIA/EIS on a particular project, the user is in a better position to begin analysis of EICS computer output as described at the end of Chapter 4. The entire analysis procedure, including evaluation of impact presence, degree, and significance, can be conducted with this working outline in mind. Then as specific information is obtained during analysis, it can be labeled according to its location in the outline and future location in an EIA or EIS.

Information Organization

During the preliminary EICS output analysis, the user will have developed several types of information (see item 3, top of p 122) which he/she originally noted on Worksheet #1 or on some similar summary sheet. As mentioned previously, this information can be inserted into the expanded outline as it becomes available. However, since details regarding impacts must be placed in so many different portions of the EIA/EIS document, a second worksheet (Figure 16) was developed to aid in organizing the results of the impact analysis investigation according to the points of the basic EIA/EIS outline. As before, the worksheet could be used to organize information in several ways:

TYPE OF IMPACTS		CEQ POINTS		REMARKS
POSITIVE	DIRECT	3b		
	INDIRECT	3b		
	LONG TERM BENEFITS	6		
	SHORT TERM BENEFITS	6		
NEGATIVE	DIRECT, AVOIDABLE	3b 5b		
	DIRECT, UNAVOIDABLE	3b 5a		
	INDIRECT, AVOIDABLE	3b 5b		
	INDIRECT, UNAVOIDABLE	3b 5a		
	SHORT TERM LOSSES	6		
	LONG TERM LOSSES	6		
LAND USE RELATIONSHIPS		2,3		
COMMITMENT OF RESOURCES		7		
CONTROVERSIAL				

Figure 16. Worksheet #2: impact organization.

1. One sheet could be used to summarize impacts for each research area or project being assessed.

2. One sheet could be used for each problem discovered during the analysis process. This is the method used in the example, Figure 17, in which the impacts of operating an unlined landfill are summarized. Items followed by a question mark were those the user was still unsure of at the time the sheet was filled out. As field studies were completed, and personal conversations with nearby residents, city officials, and civil engineers were conducted, these items could be crossed off or expanded, whichever was appropriate.

3. One sheet could be used to summarize impacts on a particular attribute, such as "Rare and Endangered Species," or even for a single species.

4. One sheet could be used for each Technical Specialty.

Completing the Report

After the impact analysis is complete and impacts have been summarized in some way convenient to the writer(s), all that remains is for the actual text to be written. If sufficient planning has gone into the analysis and summary work, each writer will be able to produce his/her portion of the report by inserting the appropriate information (already collected) while proceeding through the expanded outline. A few points follow which may be helpful to remember.

1. Large quantities of data, for baseline information or for impact evaluation, should be placed in appendices (Point 11, "Supporting Attachments") whenever possible. This reduces the need for decision-makers and other readers of the document to skip pages constantly to follow the text.

2. Except when discussing land use plans, Point 3 discussion of negative impacts should minimize mention of impact avoidance or mitigation methods in use or to be used, except by referencing the portions of Point 5-B, "How Adverse Impacts Will Be Mitigated," in which they are thoroughly discussed.

3. Often, specific details of a project are not known at the time an environmental assessment is begun; this makes impact evaluation rather difficult. Nonetheless, the EIA/EIS writer should make every effort to discuss those impacts that may occur. In fact, the USAF is obligated to do so. If project information is at a very general stage, then the discussion of impacts will have to be general as well.

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TYPE OF IMPACTS		POINTS		PROBLEM: SOLID WASTE DISPOSAL: Unlined landfill, possible groundwater contamination suspected. REMARKS
POSITIVE	DIRECT	3b		Generally - sanitary and safe disposal of waste reclaim waste land?
	INDIRECT	3b		Jobs; salvage; mosquito control
	LONG TERM BENEFITS	6		Land reclamation resulting in recreation?
	SHORT TERM BENEFITS	6		Waste disposal
NEGATIVE	DIRECT, AVOIDABLE	3b 5b		Erosion due to equipment (reduce by seeding ASAP); Noise. Odor. Fire hazard.
	DIRECT, UNAVOIDABLE	3b 5a		Loose trash (visual impact). Leaching into groundwater? Energy use (refuse transport). Reduction land value. Commitment of land.
	INDIRECT, AVOIDABLE	3b 5b		Health hazard to nearby wells, streams, until lined? Safety of workers.
	INDIRECT, UNAVOIDABLE	3b 5a		Weeds encouraged, undesirable birds and mammals attracted. Loss of recycleable materials. Loss of real property value. Decreased land values nearby?
	SHORT TERM LOSSES	6		Vegetation and wildlife, land, labor, recreation, nearby land values.
	LONG TERM LOSSES	6		Soil loss, soil productivity. Land use. Energy and equipment. Loss of recycleable materials.
LAND USE RELATIONSHIPS		2,3		Decreased land values nearby? Limits land usage Utilities must be diverted Zoning effects? (burning) Decrease in site stability (affects future uses)
COMMITMENT OF RESOURCES		7		Energy Labor Land Use Equipment Money Recycleable materials not used Water use (if leachate causes contamination or contains toxic materials)?
CONTROVERSIAL				Aesthetics--loose trash Noise Archaeological sites? Non-recycling Health hazards related to water (wells, stream)? Nearby land relationships?

Figure 17. Example for Worksheet #2.

4. The same problem is particularly true for evaluation of long-range impacts of an RDT&E project or program. For instance, a research project at one of the early stages of the acquisition cycle is only a small portion of an overall program whose goal may be to develop a new aircraft. The short-term impacts of that research project may be very different from and significantly more limited than those of finally putting the new aircraft into production and use. Still, the writer of a project-level assessment should make an attempt to make some general predictions about the long-range effects that might occur if the project were successful. The "Plan/Design," "Forecast," and "Manage" sections of the RDT&E Functional Area were developed to help the EICS user think about these long-range effects.

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