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FIELD USE OF THE ENVIRONMENTAL IMPACT COMPUTER SYSTEM,(U)
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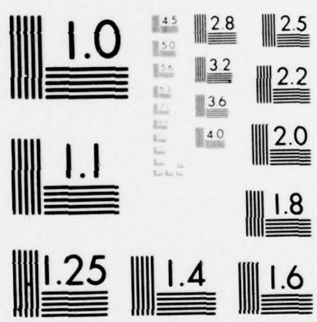


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# FIELD USE OF THE ENVIRONMENTAL IMPACT COMPUTER SYSTEM

JUN 1978

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## INTRODUCTION AND BACKGROUND

Planners of Army activities such as military construction, operation of installations, and conduct of training exercises have considered the environment when making decisions for decades. These considerations usually took the form of adapting the action to the demands of the local setting. Only rarely has the primary goal of an Army military activity been to alter the environment radically. The requirements of the National Environmental Policy Act of 1969 (NEPA) have refocused this environmental consideration. The perspective of environmental "consideration" has also changed. In response to AR 200-1, which adopts these requirements to the Army, a much more rigid, systematic consideration of the environment must be performed.

The requirement to prepare an Environmental Impact Statement (EIS) which discussed those actions which were significant enough to potentially alter the environment required an openness not common among government agencies. Further, the original legislation did not specify exactly what was to be examined, nor did it discuss the form that the EIS should take. Subsequent Executive Orders and the President's Council on Environmental Quality guidelines for the preparation of such documents helped answer some of these questions. The form of the EIS and general scope of coverage was now established. This did not, however, tell government agencies, including the Army, HOW to examine the environment. Neither did any of these supplementary regulations really indicate WHO should carry out the study

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leading to an EIS, although it was declared that the approach should be "interdisciplinary" (1). An interdisciplinary approach requires that persons knowledgeable of the biophysical and socioeconomic environment being affected and the project being assessed be used in the assessment process.

At this time, few government agencies or departments had the environmental complement of such an interdisciplinary group available. One common source of such expertise was the engineering consulting firm. Planners and decision makers were used to dealing with these consultants, and many contracts for EIS preparation were, and are, placed with such firms. Such private businesses were probably no more knowledgeable than government personnel with respect to the specific environment in question, but they had the capability of adding temporary personnel in almost any specialty in immediate response to a particular need. This mode of response was not generally available to government agencies, and is still not usually permitted.

How did these firms attack the problem of the content of an EIS? They did it in much the same way it was done within agencies--an ad-hoc or "off the top of the head" procedure. Lacking guidance as to content or depth of coverage, the EIS became, over the course of the first few years of NEPA, a weighty tome, or even multiple volumes. These hundreds and thousands of pages were expensive to produce, and took months or years to complete, and still did not address the primary points of an EIS adequately. Fifty percent or better of the information included in such documents contained useless information. So many agencies had important projects in abeyance, though, that funds were made available for this work. Such massive documents became the norm for an EIS in many areas. Decision makers neither had the time nor the interest to wade through hundreds of pages to locate the precious little information useful in making a decision. But was it possible for an agency to produce a legally and morally sufficient EIS internally? Could much of this cost be eliminated by using agency personnel already familiar with the action?

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DEVELOPMENT OF THE ENVIRONMENTAL IMPACT COMPUTER SYSTEMS

Rationale

In response to this type of question, the Construction Engineering Research Laboratory of the Corps of Engineers (CERL) began work, in late 1971, to develop procedures whereby Army personnel could prepare and review EIS's themselves, with a minimum of outside assistance. By this time the assessment called for by NEPA to determine if the action was potentially "significant" had become, in the Army as in many other agencies, a formal document in its own right. The Environmental Impact Assessment (EIA) was first suggested, then required, to follow the same format as the EIS. CERL's charge, then, included EIA's as well as EIS's, thus covering an extremely wide range of scope and significance required by the procedures eventually developed.

Within the Army, major commands place slightly varying burdens on field personnel to prepare formal, written assessments in the format required by AR 200-1. Whether written in this format or not, though, the considerations are supposed to be similar. It was especially strongly believed that these more preliminary examinations of environmental impact should be able to be done by Army personnel with a minimum input from outside specialists. Since written EIA's are ten times more frequent in the Army than are EIS's, savings in personnel time and costs are potentially even greater in the EIA than in the EIS process.

Several shortcomings were identified in the EIA/EIS procedures which had evolved without real direction. The direct dollar costs were felt to be excessive. Capital outlay by the Army for approximately 690 written EIA's and EIS's per year was conservatively estimated to average 12.4 million dollars per year. Time delays of 12 to 24 months were seen in many cases. Part of this time was needed for the contractor to undertake the detailed studies deemed necessary for the preparation of a complete document. Depending on the stage of completion of the project, however, cost escalations due to inflation were often several times the direct cost of the EIS preparation. For all these reasons, among others, the existing procedures, or lack of them, were identified as excessively costly.

Other problems concerned the coverage of the document, itself. The challenges to the accuracy of an EIS were always pointing out some area of consideration that had not been included. Each agency of the government seemed to be able to identify, in the EIS's of other agencies, serious shortcomings which affected them. The procedures developed as a result of CERL's research would have to be comprehensive enough to include all reasonable areas of impact. Further, this comprehensive product would have to be capable of being used by Army military and civilian personnel of widely varying backgrounds and educational attainment.

## Approach

A basic premise was made by CERL researchers at the very beginning. This assumed that it was feasible to divide the actions of the Army into discrete activities, and that these activities could then be reaggregated as necessary to describe a particular action. A second major assumption was made that the "human environment" could be similarly divided into its characteristic parts, or attributes. Thus, if both premises were accepted, environmental impact could be examined as if it were a massive matrix, with activities along one axis, attributes along the other, and the impact of their coincidence at their intersection. In basic concept, there is a parallel to the matrix developed several years earlier by the Geogological Survey (2), though the Army "matrix" was several times larger initially.

As developed, Army activities were grouped into 9 broad areas. Construction, Training, Operation and Maintenance (of installations), Research, Development, Test & Evaluation, and Mission Change are examples of such areas. In all, approximately 900 different Army activities were developed. Examples of construction activities are shown in Table 1. The list is open-ended, and may be expanded if necessary to adequately describe an emerging area of military activity. The context of the continental United States was generally assumed when developing these activities, but they will apply well to almost any peacetime sphere of action.

Environmental attributes were also developed within a general context of the continental United States. The biophysical and socioeconomic environment was categorized into 700 attributes. These were placed in 13 areas, such as ecology (biology), water quality, air quality, economics, earth science, and noise. Examples of ecology

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| | |
|---|---|
| 60 support operations | 61 temporary roads |
| 64 equipment fueling/maintenance | 65 temporary food services |
| 66 solid waste disposal | 67 liquid waste disposal |
| 71 exploration of site | 73 clearing site |
| 74 grubbing site | 75 stumping site |
| 76 draining site | 80 demolition |
| 90 removal and disposal | 91 brush removal/disposal |
| 92 tree removal/disposal | 93 lumber removal/disposal |
| 94 concrete removal/disposal | 100 excavation |
| 105 channeling | 106 dredging |
| 120 earthworks and borrowing | 130 rock excavation and quarrying |
| 166 cassions | 167 cofferdams |
| 168 dewatering | 169 drainage |
| 180 bituminous construction | 185 placing-bitum |
| 187 curing/sealing-bitum | 262 pest/insect protection |
| 285 furbishing(landscape-planting-seeding) | |

Table 1. Activities, as included in EICS, which are involved in a small military construction project. Activities and numbers are the same as those on the matrices in Figure 1.

| | |
|---|---|
| 1 natural setting | 2 game animals |
| 3 game fish | 4 rare or endangered species |
| 5 increase in undesirable species | 10 impacts on game animals |
| 11 encroachment on natural habitats | 12 threatened species |

Table 2. Attributes included in EICS for Ecology for use in considering potential impacts. Attributes and numbers are the same as those on the matrices in Figure 1.

attributes are shown in Table 2. The "matrix" thus developed must consider at least 630,000 potential impacts generated by 900 activities on 700 environmental attributes. Since it was desirable to be able to consider each of these relationships in light of individual project specifications, geographic location, season of the year, type of units involved, etc., the number of variations present brings the total number of impacts which must be examined to several million.

Since no personnel could be asked to examine these several million relationships individually, the Environmental Impact Computer System (EICS) was developed (3). This system selects, from among the impacts covered, those applicable to the project, location, and magnitude of the action under consideration. The results are given to the user in the form of a set of matrices, and are scored by the "need to consider" that particular relationship (Fig 1). The severity of impact is not generally predictable through the basic EICS, however, but must be estimated by the preparer of the EIA/EIS. Approximation of the magnitude of an impact requires specific background information and mathematical models not generally available either to the Army or to other document preparers.

One quantitative model, the Economic Impact Forecast System (EIFS), has been prepared by CERL for Army use. This was possible only because nationwide data sources existed which could be used for the background. EIFS has proven especially useful because economic impact is a consideration in most actions, and is an area where quantification is traditionally expected.

In addition to the indication of the need to consider an area, supplemental parts of EICS give other information and guidance to the user. Each of the attributes is completely defined in a separate handbook (4) where examples of types of impacts and interactions with other attributes are also covered. An explanation of each type of impact is also retrieved, as are parallel suggestions for the avoidance or minimization of impact. If impacts are considered unavoidable in the practical sense, this judgment is given for use in the EIA/EIS. Current modules of EICS include, as well, reference to positive effects, especially those which are not intended or not obvious to the planner or engineer.

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ECOLOGY ATTRIBUTES

| CONSTRUCTION ACTIVITIES | 1 | 2 | 3 | 4 | 5 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|
| 60 | | | | | | | A | B |
| 61 | A | A | A | | | A | B | B |
| 64 | | | A | | | | | |
| 65 | | | | | A | | | |
| 66 | | | | | A | | | |
| 67 | | | B | | A | | | |
| 71 | C | C | | | | C | C | |
| 73 | A | A | | C | B | B | A | A |
| 74 | | | A | | A | | | |
| 75 | | | A | | A | | | |
| 76 | | A | B | | C | A | | A |
| 80 | B | B | | | | B | B | |
| 90 | A | | B | | | | | |
| 91 | | | | | C | | | |
| 92 | | | | | C | | | |
| 93 | | | | | C | | | |
| 94 | B | | B | | | | B | |
| 100 | A | B | A | | A | B | A | B |
| 105 | | | | | | A | | |
| 106 | | | | | | A | | |
| 120 | A | B | A | | A | B | A | B |
| 130 | | | C | | | | | |
| 166 | | | A | | | A | | |
| 167 | | | A | | | A | | |
| 168 | | | B | | B | C | | |
| 169 | | | | | B | | | |
| 180 | | | B | | | | | |
| 185 | C | | | C | | | C | C |
| 187 | | | B | | | | | |
| 262 | | B | A | | | | | B |
| 285 | C | B | B | | B | | | B |

ECOLOGY ATTRIBUTES

| CONSTRUCTION ACTIVITIES | 1 | 4 | 5 | 11 | 12 |
|---|---|---|---|---|---|
| 60 | | | | B | C |
| 61 | B | | | C | C |
| 65 | | | A | | |
| 66 | | | A | | |
| 67 | | | A | | |
| 71 | C | | | C | |
| 73 | B | C | B | A | B |
| 74 | | | A | | |
| 76 | | | C | | B |
| 80 | B | | | B | |
| 90 | B | | | | |
| 91 | | | C | | |
| 92 | | | C | | |
| 94 | B | | | B | |
| 100 | B | | A | B | C |
| 120 | B | | A | B | C |
| 168 | | | B | | |
| 169 | | | B | | |
| 285 | C | | B | | C |

Figure 1. EICS impact matrices for a small construction project. Numbering of activities and attributes corresponds with numbers in Table 1 and Table 2. Score of "A" represents greatest need to consider, "B" and "C" show lesser need. Figure 1A includes all potential impacts on the attributes. Figure 1B illustrates the reduction in potential impacts when filter questions have been answered to reduce extraneous impact presentation.

# FIELD APPLICA N OF EICS

For which sorts of actions was the EICS intended to be applied? The comprehensiveness of the system was designed with the larger project in mind. Especially logical is its use on actions suspected or known in advance of assessment to be wide-ranging or environmentally controversial. In practice, a decision is often made in advance of formal assessment that a full-fledged EIS will be needed to answer questions that have already arisen. Particularly controversial, in the military activity context, is the ongoing realignment of installations, functions, and personnel. EICS has been utilized for analysis of these problems, and has generally been of considerable utility in pointing out considerations in areas not within the personal expertise of the team conducting the initial study.

Application has also been made to major construction projects, including troop housing, family housing, and test site proposals. Other applications have been to installation ongoing operations assessments, training program reorganizations, and a variety of smaller construction projects. Applicability to construction projects is even more logical when the planner is choosing among several possible sites for a project. EICS assists in pointing out potential problems associated with each site. The planner may then assess the sites, and rank them in order of acceptability. Or, EICS may indicate, after examination of the output, that several sites are equally acceptable from an environmental point of view. This relieves the planner of some concerns at this stage, or reduces the uncertainty factor greatly.

## User Procedure

What procedure does the planner, or other preparer of an EIA or EIS follow to use the EICS? Since the system has been released for interim use while research is still taking place to develop associated modules of the systems, CERL processes requests for output at this time. The EICS user manuals for construction (5) and for mission change, operations & maintenance and training (6) contain detailed instructions to the user. Questions are asked in the manuals concerning aspects of the proposed action, its location, and the surrounding environment. These questions are designed so that they may normally be answered by non-specialists following a visit to the site, examination of topographic maps of the vicinity, and brief consultation with installation personnel possessing specialized input. In any case, if a question should be unanswerable, input may be made without that answer. Input forms, with the question answers, are then mailed to CERL according to instructions in the manuals.

What is the purpose of these questions? They represent a way to save effort for the assessment preparer through reducing the number of potential considerations presented by EICS. Earlier, we pointed out that EICS was capable of relating Army activities to the environment in several million ways. No person can be expected to examine them all. The computer, however, does so very rapidly, and relatively inexpensively. Information supplied by the system user on the input form allows the computer to select from among these relationships the tiny fraction most applicable to the action under consideration. Thus, this user may be shown the few hundred--or, in a larger action, few thousand--potentially important impacts. Figure 1 represents actual EICS output showing the difference between an unfiltered and a filtered matrix.

What must the user do with those potential impacts? Ideally, they will serve to plan and focus the examination which must take place before a document is prepared. EICS output does not do the writing of the EIA/EIS. A person, or group, must still do so. They must determine if the activity predicted to cause a problem will take place at all. If not, then it will cause no impacts. Does the attribute which is predicted to be impacted exist at that site? The preliminary "filter" questions cannot cover all possible site characteristics, so certain of these attributes may not be present on the actual site. If they are not present, then no impact can be postulated. In this manner, the potential impacts presented by EICS may be reduced to the most likely and serious. These are then discussed as the main body of the EIA/EIS. The knowledgeable human at the end of the chain is still the ultimate filter determining the problems which are important.

## Applications to Date

Who has used EICS? First, Army civilian and military personnel at all levels have used all presently available modules of the system. These include installation facility engineer and training directorate personnel, as well as those in major command headquarters and in various research organizations. EICS has also been applied by contractors retained by the Army to prepare assessments and statements by specifying in the contractor's scope of work that EICS output should be examined to identify all major potential impact areas before site-specific information is collected and before an ad-hoc group decides indiscriminately the major impact areas to be investigated. Also, the EICS output has been used, prior to retaining a contractor, to identify major problem areas of the investigation and then specify these in the scope of work. A potential for savings in the Army exists through employing either of the above methods as compared to the traditional general specifications.

What cost-savings may be expected through use of EICS? Our experience indicates that they may be considerable in some cases, and small in others. The largest savings may be projected for those larger projects where the nature of the activity and its impacts are generally unfamiliar to those preparing the EIA/EIS. The "focusing" effect, here, is estimated to result in cost savings of about 50%. Time savings may also be evident. Contractors familiar with the system may wish to make its use a part of their contract, and this has been done in several cases. Fewer economies are apparent when the system is applied to very small or very large projects. When small, or routine, activities are covered by EICS, only a fraction of the potential effects will be determined to be likely or probable in any one case. In such cases it may be acceptable for one accession of EICS to be made for a category of actions taking place in one general setting, and then consulted from time to time when brief assessments are prepared. When very extensive actions having very severe impacts over wide areas are assessed, most of the cost of preparing the EIS may be field studies which determine just what the baseline conditions are. If such studies account for most of the contractor's costs, then the savings to be derived from focusing on certain impacts are a lesser proportion of the total contract cost.

## FIELD APPLICATION OF EIFS

The estimation of economic impact, through EIFS, was the first area where quantified estimates of impact were attempted. It also is being maintained temporarily by CERL. Requests for its use may be directed to CERL or to the environmental offices within TRADOC or

FORSCOM headquarters. This system is interactive, with telephone connections being possible by offices with appropriate computer terminals. After access is gained, the user is queried about the numbers of personnel affected, their salary, their status as civilian or military, changes in installation procurements, if any, and other pertinent input information as described in DA PAM 200-2 (7). An estimate of the magnitude of economic impact on the local economy is then returned within seconds to the user. Any region of the United States may be so examined, and the user aggregates the region to fit the nature and location of the project. This subsystem has received very wide usage by the Army, and other DOD and government offices, for hundreds of possible actions, including thousands of alternatives to them. Current costs are only a few dollars per use, a savings of several hundred to several thousand dollars over other techniques. In fact, EIFS has made possible routine examination of the economic impact of every action including those previously believed too small to bother assessing. Total cost savings to the Army is estimated at well over .5 million dollars per year.

## SUMMARY AND CONCLUSIONS

### Lessons Learned

What has been learned by field use of computer systems for environmental assessment? First, the value of such systematic examination of environmental impacts has been shown many times over. Almost any written EIA or EIS may be made more complete and more responsive to the legal and moral commitments required of the Army by legislation, executive orders, and Army regulations. Personnel without proper educational background or knowledge of the project and the affected environment, or ad-hoc groups organized to put together a quick document rarely have the outlook necessary to utilize EICS initially. Such a group will probably best relate to a handbook method such as DA PAM 200-1 (8). Contractors and consultants are often able to make excellent use of EICS products, and may be able to realize time and cost savings through its use. Improvement in the quality and completeness of the resulting EIA/EIS may be the single most obvious result of its use. As more persons become trained, however, and familiar with the system, savings will be realized in personnel time as well, both in length of time required and in the numbers of hours spent in analysis of EICS output and preparation of the EIA/EIS document.

Have problems arisen? The basic difficulty we have seen is that EICS does too good a job of bringing up potential impacts. Those persons who have treated the EIA/EIS process as an exercise in paper shuffling, with little specific consideration of the purpose of the assessment, frequently see presentation of this large number of potential problem areas as an added burden. If personnel are few, and already burdened with other duties, it may not be possible for them to do a better job of assessing actions. If it is possible for their supervisors to believe in doing a better, but not necessarily faster, job, then EICS certainly allows this. Improvement of quality and thoroughness is clearly the most common effect of EICS application, assuming personnel so tasked are allotted adequate time to do a good job.

Because of simplicity and ease of use, rapid access, and availability of regionally specific economic baseline information, the EIFS continues to be very useful for virtually all EIA/EIS's requiring economic consideration regardless of the turnaround time required to complete a document.

## Keeping Abreast

What may be expected to change in the future? The nature of Army military activities may be expected to change to accommodate new weapons systems and new tactics. EICS can certainly accommodate such changes, and allow assessment of the peacetime training effects of the new procedures. All activities of the government, including the military, will certainly be expected to manage the real property allocated to them in a responsible way. Public scrutiny of Army activities can only become more intense. Development of tools such as the Environmental Impact Computer System and its associated components will assist Army personnel and consultants to predict, and therefore be able to minimize, those adverse environmental effects which might potentially interfere with a particular Army mission. In addition, legal requirements are constantly changing. Environmental legislation is being reviewed and new provisions and interpretations of NEPA are being prepared. Development and adptation of EICS and other systems to meet newly arising actions must continue if this goal is to be assured.

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