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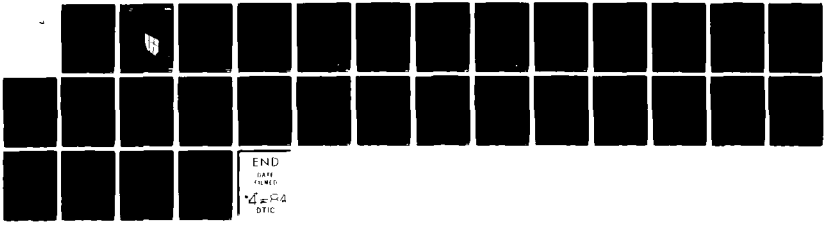

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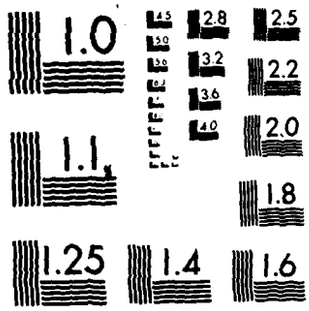

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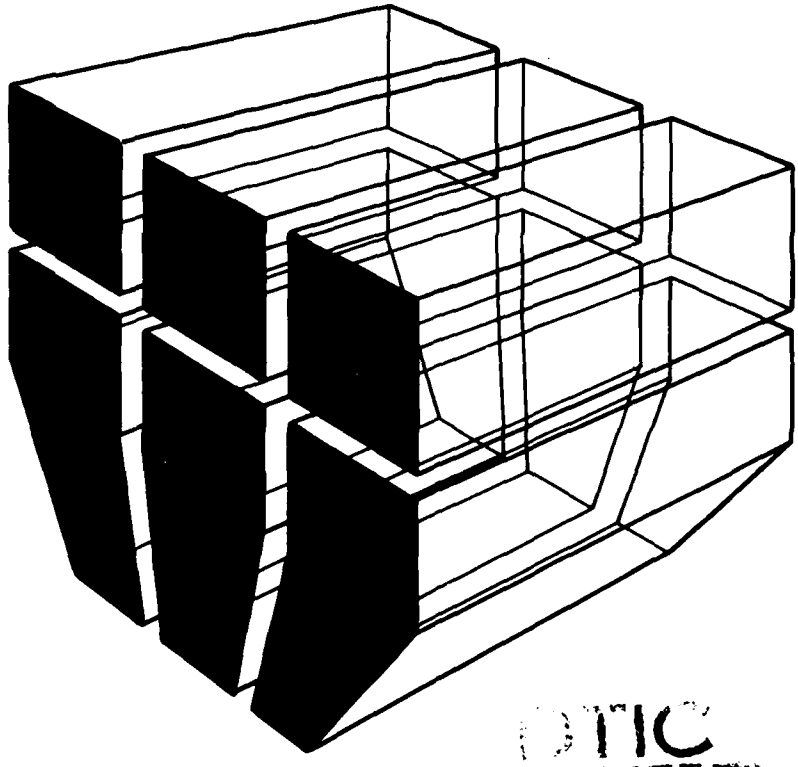
TECHNICAL REPORT N-169
December 1983

AD A139025

A STUDY OF MX ENVIRONMENTAL MANAGEMENT INFORMATION SYSTEM (MXEMIS) NEEDS

by
Ronald Webster
Ralph Mitchell
Valorie Young



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This report identifies and provides information about various environmental management information systems (EMIS) and subsystems which may be used to analyze the environmental impacts of MX missile deployment. Three categories of EMIS were investigated: The Environmental Technical Information System and its related systems; other environmental management systems; and geographic information systems. Information in this report can also serve as a reference guide to the EMIS subsystems available.

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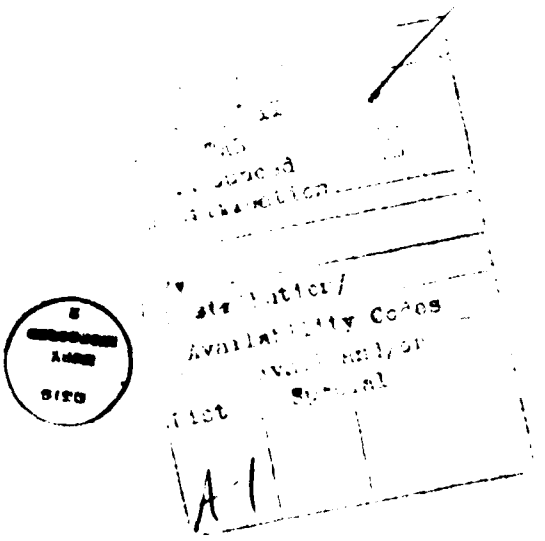
FOREWORD

This study was conducted for the Corps of Engineers MX Proponent Agency (CEMXPA) upon request and direction of the CERL Commander and Director.

The research was conducted by the Environmental Division (EN), U.S. Army Construction Engineering Research Laboratory (CERL).

Dr. R. K. Jain is Chief of EN. COL Paul J. Theuer is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.



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The Computer-Aided Environmental Legislative Data System (CELDS)
The Clearing House Information System (CHIS)
The Baseline Information System (BLIS)
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The Pollution Abatement Management System (PAMS)
The Hazardous Materials Management System (HMMS)
The Environmental Early Warning System (EEWS)
The Soils Information Retrieval System (SIRS)
The Pesticide Management System (PEST)
The Tracker System (TRKR)
The Management by Objective System (MBO)
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The Local Economic Consequences Study (LECS)
The Interagency/Intergovernmental Coordination of Environmental Planning (IICEP)
The Department of Energy CELDS (DOE CELDS)
The Environmental Protection Agency CELDS (EPA CELDS)
The Civil Works CELDS (CW CELDS)
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A STUDY OF MX ENVIRONMENTAL MANAGEMENT INFORMATION SYSTEM (MXEMIS) NEEDS

1 INTRODUCTION

Background

The performance of military activities involves the analysis of their environmental effects and compliance with applicable regulatory and statutory requirements. In meeting these analyses and documentation requirements, the Department of Defense (DOD) has historically used a number of computer information systems. The MX missile project, now being developed by the Air Force, has certain unique requirements because of its orientation controversy and its size. It seems reasonable to assume that attempts to develop an MX-specific Environmental Management Information System (EMIS) should be based on a review of existing environmental management systems, MX data which have already been collected, and the most cost-effective approach to meeting identified MXEMIS needs.

The mission for military-specific R&D in the areas of environmental protection and facility management is a mission of the U.S. Army Construction Engineering Research Laboratory (CERL). To support military environmental planning, CERL has developed the Environmental Technical Information System (ETIS)[1] – a computerized system which provides users with environmental data quickly and inexpensively–and a number of conceptual extensions. In addition, a number of other systems have been developed by other agencies active in the area of environmental protection.

Objective

The objective of this report was to identify and provide information about the range of environmental management information systems which may be used for analyzing the environmental impacts of MX missile deployment.

[1] R. D. Webster, et al., *Modification and Extension of the Environmental Technical Information System (ETIS) for the Air Force*, Special Report N-81/ADA079441 (U.S. Army Construction Engineering Research Laboratory [CERL], 1979).

2 EXISTING SYSTEMS CLASSIFICATION

To evaluate the many computer systems applicable to MX needs, including ETIS and related systems, other environmental management systems, and geographic information systems, the classification scheme shown in Tables 1 and 2 may be used. Chapters 3, 4, and 5 give a short description of each system.

3 ETIS AND RELATED SYSTEMS

ETIS was developed by CERL to support military needs for environmental planning and analysis; the system has received broad support within DOD and a number of other Federal, State, and international organizations. While a few ETIS systems are operational, many others are in varying stages of development. Most of the new efforts were the result of user support and recommendations identified through the ETIS User Group (ETISUG) and represent actual needs of ETIS field users.

The following brief abstracts summarize the systems related to ETIS and their functions.

The Environmental Impact Computer System[2]

The Environmental Impact Computer System (EICS) allows the user to determine both how an action affects various aspects of the environment and how to address these effects.

The system considers eight broad areas of military activities called functional areas: construction; mission changes; operation and maintenance; training; industrial; research, development, test, and evaluation; procurement; and real estate. The "environment" includes 13 broad categories called technical specialties. These are ecology, health science, air quality, surface water, groundwater, sociology, economics, earth science, land use, noise, transportation, aesthetics, and energy and resource conservation. To make the system more site-specific, the user is asked to interactively answer a series of filter questions for each technical specialty.

[2] R. Baran and R. D. Webster, *Interactive Environmental Impact Computer System (EICS) User Manual*, Technical Report N-80/ADA074890 (CERL, 1979).

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Table 1

Existing Environmental Management Information Systems

System Name	Principal Data Type (See Note 1 Below)	Status	Sponsor (See Note 2 Below)	Abstract Page No.
ETIS and Related CERL Systems				
EICS	11, 4	Operational	OCE, ETISUG	7
EIFS	10, 1j	Operational	OCE, ETISUG	11
CELDS	3,9	Operational	OCE, ETISUG	12
CHIS	6	Pilot-Operational	OCE, ETISUG	12
BLIS	6	Pilot-ON HOLD	OCE	12
LUC	6	Pilot-Operational	OCE	13
PAMS	2	Pilot-Operational	OCE	13
HMMS	2	Pilot-Operational	OCE, ETISUG	14
EEWS	11, 8	Pilot	OCE	14
SIRS	1a	Pilot-Operational	OCE, Department of Agriculture	14
PEST	2, 5	Pilot-Operational	OCE, TRADOC	15
TRKR	5	Pilot-Operational	TRADOC	15
MBO	5	Under Development	OCE	15
AFLICS	11, 4	Operational	USAF, ETISUG	15
LFCS	10	Operational	USAF, ETISUG	15
IICEP	6	Operational	USAF, ETISUG	16
DOE CELDS	2, 3	Under Development	DOE, ETISUG	16
EPA CELDS	2, 3	Pilot-Operational	EPA	16
CW CELDS	2, 3	Pilot-Operational	OCE, ETISUG	16
EEIFS	10, 1j	Pilot-Operational	OCE	17
FRG CELDS	2, 3	Pilot-Operational	OCE	17
SAIFS	11, 4	Operational	OCE, IWR	17
MX MIS	1	Operational	USAF	17
MEWS	11, 8	Pilot	OCE	17
CEBIS	1	STUDY COMPLETED	USAF	18
Other Environmental Management Information Systems				
UPGRADE	1 (Limited Geographic Scope)	Operational	CEQ	18
WESTLAW	3	Operational	CEQ	18
LEXIS	3	Operational	CEQ	19
HMIS	3	Operational	DOD	20
GEOECOLOGY	1	Operational	DOD	21
WATSTORE	1C	Operational	USGS	21
SWIS	1c, 9	Operational	USGS	21
NEPSS	2, 5	Operational	USGS	21
DARE	2, 5	Operational	USGS	21
EPA-PCS	2, 5	Operational	USGS	21
CAPDET	10	Operational	USGS	22
RIMS	10	Operational	USGS	22
BREAM	10	Operational	Department of Reclamation	22
SEAM	10	Operational	Department of Reclamation	22
ONSITE/SITE II	1j, 10	Operational	Department of Reclamation	22
STORET	1C	Operational	Department of Reclamation	22
NAWDEX	1C	Operational	Department of Reclamation	23
CSIN	1	Operational	EPA	23

Table 1 (Cont'd)

System Name	Principal Data Type (See Note 1 Below)	Status	Sponsor (See Note 2 Below)	Abstract Page No.
		Geographic Information Systems		
ESRI	1	Operational	Hydrological Engineering Center	24
MOSS	1	Operational	U.S. Fish and Wildlike Service	24
ODYSSEY	1	Operational	Harvard University	24
RIA	1	Operational	Hydrological Engineering Center	24
IRIS/NARIS	1	Operational	CAC	24
INTERGRAPH	1	Operational	OCE	24
HOODMIS	1	Pilot-Operational	Fort Hood, ETISUG	24

Note 1:

1. Data Storage and Retrieval
   a. Soils
   b. Topography
   c. Water sources and drainage
   d. Vegetation
   e. Wildlife
   f. Archeologic resources
   g. Historic resources
   h. Native American resources
   i. Land use
   j. Socioeconomic factors
2. Permit Requirements and Management
3. Federal, State, and Local Laws and Regulations
4. Mitigation Requirements (could involve several programs)
5. Monitoring Requirements (could involve several programs)
6. Mailing List Coordination Requirements
7. Construction Labor Force Requirements
8. Life Support Requirements
9. Endangered Species List
10. Community Impact Model
11. Environmental Impact Model
12. Cultural Resources Model

Note 2:

ETISUG (ETIS User Group Multi-Agency)
OCE (Office of the Chief of Engineers)
Fort Hood (Fort Hood Environmental Office)
Department of Agriculture (U.S. Department of Agriculture Soil Conservation Service)
TRADOC (Training and Doctrine Command, U.S. Army)
USAF (U.S. Air Force)
DOE (Department of Energy)
EPA (Environmental Protection Agency)
Hydrological Engineering Center (U.S. Army Corps of Engineers)
U.S. Fish and Wildlife Service
CAC (Center for Advanced Computation, University of Illinois)
Harvard University
CEQ (President's Council on Environmental Quality)
DOD (Department of Defense)
USGS (U.S. Geological Survey)
Department of Reclamation
IWR

Table 2

Matrix of Environmental Management Information Service

SYSTEMS	EICS	EIFS	CELDS	CMIS	BLIS	LUC	PAMS	NMMS	EEWS	SIRS	PEST	TRKR	MBO	AFEICS	LECS	IICEP	DOECELDS	EPACELDS	CW CELDS	EEIFS	FRG CELDS	SAIFS	MXMIS	MEWS	UPGRADE	WESTLAW	LEXIS	HMIS	GEOECOLOGY	WATSTORE	SWIS	NEPSS	DARE	EPA-PCS	CAPDET	RIMS	BREAM	SEAM	ONSITE/SITE II	STORET	NAWDEX	ESRI	MOSS	ODYSSEY	RIA	IRIS/NARIS	INTERGRAPH	HOOD MIS
Soils	X				X				X	X				X									X	X					X																		X	
Topography	X				X				X					X									X	X					X																		X	
Water Sources & Drainage	X				X				X					X									X	X					X	X									X	X							X	
Vegetation	X				X				X					X									X	X					X																		X	
Wildlife	X				X				X					X									X	X					X																		X	
Archeologic Resources	X				X				X					X									X	X					X																		X	
Historic Resources	X				X				X					X									X	X					X																		X	
Native American Resources	X				X				X					X									X	X					X																		X	
Land Use	X				X	X			X					X									X	X					X																		X	
Socioeconomic Factors	X	X			X				X					X	X					X		X	X	X											X	X	X	X								X	
Permit Requirements and Management							X	X			X		X										X								X	X	X														X	
Federal, State, & Local Laws and Regulations			X					X			X					X	X	X	X		X		X			X	X	X																				
Mitigation Requirements	X								X					X									X																										
Monitoring Requirements								X			X	X	X										X								X	X	X															
Mailing List/Coord Requiremts				X	X								X			X			X																													X	
Construction Labor Force Requirements																																																
Life Support Requirements	X								X					X									X	X																									
Endangered Species List			X														X	X			X		X							X																		
Community Impact Model	X	X												X	X					X		X	X													X	X	X									
Geographic Mapping									X															X	X					X										X	X	X	X	X	X	X	X	

The functional areas are further broken down into basic activities. These activities are then compared to the attributes in each technical specialty using a "need-to-consider" scale. The system indicates the probability of impact occurrence, rather than the potential magnitude of the impact. Ramification and mitigation statements are keyed to the activity. Ramification remarks explain why the activities were scored as they were. Mitigation statements describe ways to lessen or avoid the impacts of that activity.

The user has the option of obtaining output at two levels. The review level contains attributes (environmental characteristics) that give an overview of that technical specialty without the specificity that the detailed-level attributes provide. It should be used primarily to assist reviewers of completed documents and to help select the best alternative from numerous actions. The detailed level, which is generally used to help prepare major Environmental Impact Statements (EIS's), contains all the atrributes of a technical specialty. Controversial attributes are presented at both levels. These are attributes that are controversial in nature i.e., historically they have caused some public concern whether or not the actual impact is scientifically significant.

The Economic Impact Forecast System

The Economic Impact Forecast System (EIFS)[3] is an export base location quotient model designed to help the military planner determine if an action will have a significant impact on the local economy. This computerized system is a user-oriented, low-cost, systematic approach to socioeconomic impact analysis. EIFS also has an economic model of analysis which predicts community-level impacts on income, employment, population, schools, and public finance that would result from implementing the various alternative actions. The system is based on county units, with statistics available for every county in the nation. Specific counties are then aggregated to form the relevant economic region.

This system contains many different subfeatures called profiles. Some of these are explained below.

a. The overview profile gives an overview of the region, including population, governmental, and business statistics, either by defined region or constituent counties.

b. The time series profile highlights historical trends in income, employment, and population. These can also be displayed by occupation or category type.

c. The predictive model profile is broken into a number of submodels for construction, operation and maintenance, mission change, and training. Location quotient techniques are used to estimate an action's impact on the region.

d. The Rational Threshold Value (RTV) profile is a bracketing method to establish the significance of economic impact. Four areas of the regional economy are examined: change in business volume, change in personal income, change in total employment, and change in population. The historic changes in each of these parameters are examined. The positive RTV equals the largest positive percent deviation from the average growth in the historical record. The negative RTV is a fixed percentage of the maximum historic negative change. Actions that result in changes which fall within this bracket are not considered significant.

e. The detailed employment profile includes all Standard Industrial Classification codes for the area. At the user's option, these can be retrieved at the one-, two-, three-, or four-digit levels, which represent increasingly detailed data.

f. The export employment profile provides the four-digit location quotient derivations used in the predictive model.

g. The census tract profiles provide county data at the census tract level or at the minor civil division (town) level. These statistics deal with projections on household, per capita, and total personal income; group quarter counts; employment statistics; and other detailed data. They cover more than 30,000 individual reporting units.

h. The BLS profiles present Bureau of Labor Statistics (BLS) data on employment, unemployment, and labor participation on a monthly basis.

i. Several graphics profiles allow color graphics displays of multicounty maps, bar chart and pie chart distributions, and other display mechanisms associated with EIFS.

[3] R. D. Webster, et al., *The Economic Impact Forecast System Description and User Instructions*, Technical Report N-2/ADA029139 (CERL, 1976).

The Computer-Aided Environmental Legislative Data System

The Computer-Aided Environmental Legislative Data System (CELDS)[4] is an up-to-date summary of all Federal and State regulations related to the environment. It was developed to respond to the need for rapid and easy access to relevant environmental standards. CELDS has been developed for use by non-lawyers to determine environmental standards which might be important in regulating an on-going activity or which should be considered in planning a future action. Abstracts of the regulations are written in a straightforward, easy to understand, narrative style. These abstracts are not intended to replace the original documents or to resolve complex legal problems.

Each CELDS record is subdivided into the following 12 categories of information, called fields. Fields which can be used to conduct a search are indicated by an asterisk.

*ACC — accession number, which identifies the records as they were originally entered into the system.

TTL — title, a brief comprehensive title that reflects the scope of each regulation.

DAT — the date of enactment of the regulation, or the date of its most current amendment or change. Each time a regulation is amended, this date is changed.

REF — the referenced or official legal source of the regulation.

*MEC — the major environmental category. Each record has been indexed under one or more of the following environmental areas: Air Quality, Earth Science, Ecology, Health Science, Land Use, Noise, Sociology, Solid Waste, Transportation, and Water Quality.

*GPS — geographical/political scope, the political areas in which the regulation is applied, such as a State or the Federal government. States are identified by their two-letter postal code, e.g., "IL" for Illinois, "US" for the Federal government.

*AGY — administrative agency the name and address of the agency which promulgates and enforces each regulation.

BIB — bibliographic reference the source of the original text from which the regulation was abstracted.

ABS — abstract a concise, informative presentation of the regulation's details.

TBL — table of numerical standards, if any exist for the regulation.

*ATT — environmental attributes. Records are indexed under relevant attributes which are listed in the *CELDS User Manual*.[5]

*KEY — keywords used to index each record. A list of the keywords (or thesaurus) may be obtained in the *CELDS User Manual*.

The Clearing House Information System

The Clearing House Information System (CHIS)[6] identifies State and local agencies with which planners must coordinate environmental impact planning documents as required by OMB Cir. A-95. This system identifies these potential contacts based on their geographic designations (counties). Its reliance on county designations instead of State designations indicates a greater number of search terms and more differentiation because there are more search terms. The user merely supplies the county (or counties) of interest, and the local A-95 clearing houses are identified.

The Baseline Information System

The Baseline Information System (BLIS)[7] identifies sources of information and consultation which may be used to prepare and develop environmental planning documents. This project is intended to supplement EICS by identifying data sources keyed to each state and searchable by environmental attribute (or attribute

[4] J. van Weringh, et al., *Computer Aided Environmental Legislative Data System (CELDS) User Manual*. Technical Report N-56/ADA061126 (CERL, 1978).

[5] J. van Weringh, et al.

[6] R. Webster and B. Griffin, *Clearinghouse Information System Description and User Instructions*. Technical Report N-53/ADA059176 (CERL, 1978).

[7] B. Griffin and R. Webster, *The Baseline Information System User's Manual*. Technical Report N-72/ADA069324 (CERL, 1979).

designation). These entries are taken from directories, State agency lists, Federal agency lists, and many other sources. The system is designed to be a starting point for obtaining consultation, assistance, or data which can be used to clarify, substantiate, and assess the magnitude of potential impacts identified by EICS. The system will enable the user to make inquiries and receive feedback. A list of addresses, phone numbers, and supplemental qualifying information will be supplied initially, based on keyword inputs by the user (using EICS output to specify attributes). The update of BLIS is supplemented by user-suggested contacts which are fed back directly to the machine and stored in a directory accessible to maintenance personnel. This feedback mechanism provides a means of updating and refining the system to meet user needs by allowing good contacts to be transferred from one user to the rest of DOD community.

The Land Use Compendium

The Land Use Compendium (LUC)[8] identifies Federal and State agencies having designated land use authority. In keeping with Point 2 of the Council on Environmental Quality (CEQ) guidelines, LUC allows for efficient identification of agreements and resolution of conflicts between a given military program (or project) and other Federal, State, and local plans, policies, and programs. These agencies satisfy two criteria: (1) they control some aspect of land use, and (2) the uses of lands they control are related to Department of the Army (DA) actions. Up to 19 State agencies or points of contact are also included which satisfy the following criteria: (1) they administer a law or regulaton; (2) they are officially responsible, statewide, for some area concerned with land use; or (3) they are responsible, statewide, for the study of land use problems.

Areas of concern included within LUC are:

1. Statewide Planning (Coordination)
2. Statewide Planning (A-95 Review)
3. Coastal Zone Management
4. Wetlands Management
5. Floodplain Management
6. Surface Mining Regulations
7. Agricultural Lands Classification
8. Forest Land Management
9. Recreation Lands Management
10. Differential Assessment Laws
11. Historic/Archaeologic Sites
12. Critical Area Designation
13. Water Resources Management
14. Air Quality
15. Water Quality
16. Solid Waste Management
17. Noise Control
18. Power Plant Siting
19. Transportation Planning

LUC identifies information by geographic designation (state) and by category of interest (another keyword type of search).

The Pollution Abatement Management System

The Pollution Abatement Management System (PAMS)[9] is designed to help pollution abatement planners/engineers manage facility pollution problems and define alternative mitigation techniques to bring about legal compliance.

PAMS' interactive computer-supported data-based subsystems allow management of large quantities of data in a form that is readily available, reliable, and centrally located for effective and economic data management. Examples include (1) National Pollutant Discharge Elimination System (NPDES) permit management tool; (2) a computerized logic system for helping choose from various water and air pollution abatement technologies (the choice is based on

[8] R. Lacey, et al., *Compendium of Administrators of Land Use and Related Programs*, Technical Report N-40 (Revised)/ ADA128413 (CERL, 1983).

[9] E. Smith and R. Webster, *Concept Definition for the Problems Data Base Component of the Water Pollution Abatement Subsystem of the Pollution Abatement Management System (PAMS)*, Interim Report N-73/ADA072398 (CERL, 1979).

technical attributes (advantages/disadvantages, cost, and DA site-specific considerations); (3) a comprehensive environmental database to manage pesticides, hazardous materials, and related data; and (4) a systems approach to wastewater reuse applicability at DA installations.

The Hazardous Materials Management System

The Hazardous Materials Management System (HMMS)[10] was originally programmed to identify, either by listing or definition, chemical substances subject to hazardous waste regulations. A variety of chemical information sources was searched to identify synonyms and trade names of the listed hazardous wastes, and the chemical, generic, and trade names of compounds described by one or more of the definitions of hazardous waste. This database contained 10,565 compounds as of February 1982 and is still under development.

The system has been expanded to provide regulatory and management information. Department of Transportation (DOT) regulations for hazardous materials have been provided in full. RCRA regulations for generators, a list of substances excluded from regulation under RCRA, and the four legal definitions of hazardous waste are also available. In addition, 31 Technical Data Sheets for Managing Hazardous Waste, developed by HQ TRADOC, are accessible under HMMS, along with supplementary information on these 31 compounds taken from the Coast Guard's Chemical Hazards Response Information System (CHRIS).

Plans for the system include: completing the database of chemicals subject to RCRA regulation upon disposal; providing detailed information, including substitution and waste reduction guidelines, on six classes of hazardous waste produced in large volumes by the Army; providing guidance on delisting procedures and points of contact; providing software to interactively access and search the Defense Logistics Agency's (DLA) Hazardous Materials Information System (HMIS) by chemical and trade name; and creating a database of chemical names correlated with trade names, Federal specifications, military specifications, registry numbers, and formulations.

[10] M. Messenger, et al., *Interactive Hazardous Materials Information System (HMIS): Description and Assessment*, Technical Report N-170 (CERL, 1983).

The Environmental Early Warning System

The Environmental Early Warning System (EEWS)[11] allows Army headquarters level decision-makers and environmental specialists to determine rapidly whether proposed mission changes can be expected to result in unacceptable environmental impacts at affected installations. EEWS is designed to be used at the earliest stages of action planning the "What if?" stage so that alternatives may be examined for possibly serious environmental consequences. The factors considered are restricted to those which have actually resulted in delay or reconfiguration of Army actions in the past. Background information will be based on existing reports and data sources. Therefore, results may be expected to be of at least equivalent accuracy to present practices, but will be obtained within a few minutes, without the necessity of repetitive, individual inquiries to the installations. Background information, which includes tabular data and mapped factors, may also be retrieved for certain comparisons. All commands are in English. No computer programming expertise is assumed.

The Soils Information Retrieval System

The Soils Information Retrieval System (SIRS)[12] was developed as an outgrowth of erosion modeling work done at CERL for expanding the ETIS system. The Soil Conservation Service (SCS) of the Department of Agriculture has developed an enormous database of soils-related information. Data from this source is required for erosion modeling. To obtain the needed data for all geographic areas of potential Army interest, CERL obtained a tape copy of the entire SCS database. A retrieval program was written which displayed any of the data available on any soil in a format interactively selected by the user. This capability is useful not only to the Army, but also to the Department of Agriculture, which can now retrieve data in minutes which previously required weeks. Moreover, the output format can be specified by each user to exactly fulfill his/her needs. The data are available for all soil series in the United States (more than 12,000) and include all interpretations performed by the SCS.

[11] R. Lozar and H. Balbach, *The Environmental Early Warning System (EEWS): Concept Description*, Technical Report N-144/ADA127356 (CERL, 1983).

[12] W. D. Goran, *An Interactive Soils Information System Users Manual*, Technical Report N-163/ADA133480 (CERL, 1983).

The Pesticide Management System

The Pesticide Management System (PEST)[13] helps Army personnel who manage pest control by automating certain reporting requirements in the areas of: (1) types and quantities of pesticides applied (where and for what pests) and (2) exposures to pesticides of personnel involved in actual application.

In cooperation with the TRADOC environmental office, CERL developed a design for an automated pesticide accounting system. A database was created which contained information on pesticide applications at all TRADOC installations: type and amount of agent applied, pest being controlled, time and site of application, and person applying the agent. A program was written to summarize and format the data, which was used in supervising the MACOM's overall pest control program and preparing necessary reports.

PEST has been well received at TRADOC and is being considered for Army-wide use.

The Tracker System

The Tracker System (TRKR) was developed to help MACOM environmental personnel track and manage Army Pollution Abatement Program (APAP) projects. APAP project data are entered into a database used by two user programs. The first routine validates the input to the project file, flags late projects, and produces a funding by media report. The format makes project searching easy through simple, word-processing-type commands. Projects can be searched and retrieved by media type (e.g., water, air); funding type (e.g., MMCA, OMA), project status (comp, preplan, LATE), project number, and other criteria. The second routine produces formatted listings of projects that can be printed on a high-speed line printer. The listings are in a format suitable for inclusion in reports, or any other use where a paper copy is needed.

The Management by Objective System

CERL has developed a pilot, automated Environmental Management by Objective (MBO) report generation system for the Army Environmental Office. The report begins with installations filling in interactively on the computer questionnaires about their progress in achieving pollution abatement. The responses are then aggregated through major subordinate commands, MACOMs, HQDA, and, finally, DOD. The automated MBO system greatly reduces the paperwork associated with the data collection and aggregation process. Installations interactively input their data to a central computer. The computer facilitates the review process associated with the MBO report's preparation by allowing reviewers to instantly call up any current or previously supplied data.

With MBO data available in a computer system, it can be retrieved in any format or level of aggregation desired. The information can be used for purposes other than MBO report generation. Its availability is a substantial aid to managing the Army's environmental program.

The Air Force Environmental Impact Computer System

The Air Force Environmental Impact Computer System (AFEICS) is an offshoot of EICS which was developed to reflect Air Force, rather than Army, activities. AFEICS allows the user to delete unwanted activities before receiving computer output. This modification was made to meet specific needs rather than complete system redevelopment. This feature was also later adapted in the Army system.

The Local Economic Consequences Study

The requirement for adequate assessment of socioeconomic impacts when preparing EISs has become increasingly important to military planners. To this end, DOD guidelines and suggestions have encouraged the use of a systematic approach and uniformity of documentation when considering the socioeconomic impacts of new military projects. This is due partly to the uniqueness of the DOD installations and their effects on local economies, the geographic distribution of those installations, and the complexity of problems associated with determining the economic and related social impacts associated with DOD actions. The approach to be selected must be efficient, systematic, and capable of providing "first-cut" estimates of impact before case-specific studies are undertaken.

To address the need for a systematic, first-cut approach to socioeconomic impact assessment, DA, with cooperation and substantial support from the Department of the Air Force, developed EIFS, which provides information useful for calculating socioeconomic changes caused by DOD actions.

New and changing laws, guidelines, directives, and executive orders have determined that a more detailed methodology to assess large and controversial proposed

[13] M. Messenger, R. Webster, and T. Brown, *Comparison of Alternative Modes of Data Input to the Pesticide Information Retrieval System*, Technical Report N-137/A122045 (CERL, 1982).

actions is needed. In response to this need, the Air Force Engineering and Services Center (AFESC) and CERL developed a highly disaggregated socioeconomic model of analysis and used the procedure to analyze Air Force installation realignments and closures. This model, called the Local Economic Consequences Study (LECS)[14] methodology, provides more temporal and geographical detail in the output results than EIFS. Substantial quantities of community-specific input data and numerous hand calculations are necessary to use LECS. Much of the required input data is already stored in the EIFS database, and the mathematical calculations are a simple task for the minicomputer on which EIFS operates. Therefore, it was both logical and beneficial to integrate LECS into ETIS.

The Interagency/Intergovernmental Coordination of Environmental Planning

The Interagency/Intergovernmental Coordination of Environmental Planning (IICEP)[15] identifies State environmental planning agencies with which Air Force planners must coordinate their actions. Agencies located in all 50 states, Guam, and Puerto Rico are included. The listed agencies are from the following environmental categories:

1. General
2. Air Resources
3. Energy
4. Health and Safety
5. Land Use
6. Natural Resources
7. Noise
8. Socioeconomic
9. Solid Waste
10. Transportation
11. Water

The system's information allows the user to identify the relevance of each agency in order to specify environmental planning issues, and lists the agency's address, telephone number, point of contact, and function.

The Department of Energy CELDS

The Department of Energy CELDS (DOE CELDS) is a part of the operational CELDS component of ETIS. DOE has used CELDS frequently, and some of its personnel realized that the CELDS approach would be useful for storing and retrieving mining regulations relevant to their work. As a result, DOE data have been entered and the CELDS thesaurus altered to meet DOE needs.

The Environmental Protection Agency CELDS

CERL developed the pilot Environmental Protection Agency CELDS (EPA CELDS) to respond to needs of the EPA's Office of Water Planning and Standards. Specifically, a system was needed in which an individual body of water (river, lake, creek, etc.) could be retrieved, along with its "use" classification (i.e., recreation, drinking water, navigation, etc.) and its water quality parameters (i.e., pH, temperature, dissolved oxygen, etc.). Five states were selected for inclusion in the pilot project: Texas, Iowa, Pennsylvania, Montana, and Arizona.

The Civil Works CELDS

The Civil Works CELDS (CW CELDS)[16] was developed for OCE to help Corps civil works planners comply with OMB Circular No. A-11.[17] This circular requires that any Federal agency:

> Performing water resources activities will submit [as part of its annual budget request] . . . a certification by the agency that each project in the planning or construction stage is in compliance with applicable environmental statutes.

Fifteen of the applicable statutes for environmental protection and cultural heritage preservation are referenced by the OMB directive and are listed in the Water Resources Council's "Principles and Standards for Water and Related Land Resources Planning Level C" (Final Rule, 29 Sep 80, *Federal Register*,

[14] J. Hamilton and R. Webster, *Local Economic Consequences Study (LECS) Preliminary User Manual*, Interim Report N-94/ADA088261 (CERL, 1980).

[15] R. Webster and D. Putnam, *Interagency/Intergovernmental Coordination of Environmental Planning (IICEP) Systems Considerations*, Technical Report N-87/ADA085991 (CERL, 1980).

[16] E. Herrick and R. Webster, *CW CELDS User Manual*, Technical Report N-141/ADA125974 (CERL, 1983).

[17] *Preparation and Submission of Budget Estimates*, Circular A-11 (Revised) (Office of Management and Budget, 25 May 1978).

p 64398, Table 711.71-2). These laws are also cited by ER 200-2-2.[18]

To conform with these requirements, Corps planning, engineering, and construction personnel can use CW-CELDS for guidance to determine which of the laws apply to a given project and whether the specified procedures have been followed. This system is a planning tool for ascertaining whether a project is in a state of noncompliance which must be rectified before the work may proceed further. It can be userful early in the planning stage by showing the course that a project must follow to assure its timely compliance with the appropriate laws and thereby avoid errors that lead to procedural delays.

This system is designed to take the user through a series of queries concerning tasks mandated for Federal agencies for each of the 15 statutes. Each query is also reinforced by additional helpful information. The user can obtain this help at three levels of detail: Level I gives the legal citation for the question; Level II gives the full text of the cited portion of the law or regulations; and Level III gives an abstract of that text.

At the conclusion of a session, the user will be given two options. The first will allow the user to see a graphic display of the logic path used in the session. The second will allow this graphic display to be saved in a file for later use.

European EIFS

The need for demographic and economic data for inclusion in military planning in Europe led to the development of a German version of EIFS called European EIFS (EEIFS). This system, which has data on Kreis (county) regions for the Federal Republic of Germany (FRG), contains both data and economic models for analyzing military activities.

Federal Republic of Germany CELDS

Using the same criteria as for the stateside version of CELDS, CERL developed a pilot system called Federal Republic of Germany CELDS (FRG CELDS), which contains German regulations.

Socioeconomic Assessment and Impact Forecast System

The Socioeconomic Assessment and Impact Forecast System (SAIFS) is being developed jointly by CERL/IWR. This effort involves modifying EIFS to provide additional analysis capabilities to Civil Works users. The military orientation of EIFS requires modification to meet the needs of water resource planners. Efforts include the addition of statistical packages, subcounty (tract and MCD) data analysis, and color-graphics displays.

The MX Management Information System

The major databases for MX environmental planning are maintained at AFRCE-MX Norton AFB, CA. Although the data are gathered and analyzed by various Air Force contractors, data transfers are being made so that all information will be deposited with the AFRCE-MX office.

The MX Management Information System (MXMIS) database falls into three categories, with overlap in various subject areas. The categories are:

1. The environmental impact analysis process. This is data gathered on human, cultural, natural, and physical resources in support of the great basin EIS effort. The data include information on Utah, Nevada, Texas, and New Mexico as well as some information to support the silo basing mode in the Northern United States.

2. Comprehensive siting and planning. Data exist at the 10,000-acre level of detail and were developed for detailed site selection at four locations in Nevada, Utah, and New Mexico. The data were collected by extensive field work at Cannon AFB, NM; Coyote Springs, NV; Milford, UT; and Beryl, UT.

3. Geotechnical. Water and geology data exist for 36 valleys within Nevada/Utah and parts of New Mexico. The data for these valleys are fairly extensive, with most existing in hard-copy form. The data will be available from the National Technical Information Service (NTIS). There is also information available (primarily hard copy) on legal, archaeological, American Indian, historical, and community resource conservation requirements.

The Mobilization Early Warning System

To increase internal planning responsiveness, the HQ Training and Doctrine Command (TRADOC) Engineer asked CERL to develop a system to allow quick, flexible response to mobilization plans. A modification of the Environmental Early Warning System (EEWS) was therefore prepared. EEWS already contained the capability to compare new installation demands with installation assets to predict the environmentally related consequences of such mismatches.

[18] *Policy and Procedures for Implementing NEPA*, Engineer Regulation (ER) 200-2-2 (Office of the Chief of Engineers, 25 August 1980).

The Mobilization Early Warning System (MEWS) uses the same general approach, but presents the match between demand and assets as the final result, rather than predicting environmental effects.

MEWS uses basic installation information, such as the available square feet of billeting area and the number and type of ranges; it then compares these assets with demands derived from the installation's mobilization tasking. The resulting surplus or shortfall in any category is then displayed for each weekly increment following "Mobilization Day" (M-Day). Tabular and graphic outputs are available, and outputs may be configured for all common types of access devices. Tabular response to an altered demand or revised supply of a facility may be examined within minutes of the proposed change, and the element either further restructured or permanently installed. Graphic output is also immediately available, and is especially useful for presenting the broad overview, or in preparing briefings where the response is evaluated. Key variables under the control of TRADOC planners include trainee loads, number, type and scheduling of any troop demands, and training course length.

The Computer-Aided Environmental Baseline Information System

CERL and the Air Force are developing the Computer-Aided Environmental Baseline Information System (CEBIS),[19] a system that will store and allow analysis of environmental information from sources such as the TAB A-1. Environmental Narrative. Revised TAB A-1 formats provided by Stanford Research Institute (SRI) and the Air Force were used to develop a pilot CEBIS system for use by AFESC in environmental planning and impact analysis. The pilot system demonstrated use of CEBIS with TAB A-1 data for three selected bases. CERL analyzed the TAB and identified TAB elements regarding data usefulness, interfacing, and sources. The programming was begun on the TAB structure, and interfaces were made with ETIS and other database systems. Data from the three Air Force installations were incorporated for the pilot study, with the addition of information update capability. The next phase of CEBIS development will involve: (1) full-scale implementation of CEBIS and identified refinements for all Air Force installations, and (2) the integration of CEBIS data into other ETIS systems.

[19] R. Webster and D. Putnam, *Preliminary Analysis of Computer-Aided Environmental Baseline Information System (CEBIS), Phase I: System Requirement*, Interim Report N-88/ADB046908 (CERL, 1980).

4 OTHER ENVIRONMENTAL MANAGEMENT INFORMATION SYSTEMS

In addition to ETIS, several other systems have been developed for use by environmental planners. The sponsors for these systems are listed in Table 1. The following sections discuss some of these systems and their functions.

UPGRADE

UPGRADE was designed primarily to support the development of the annual Council on Environmental Quality (CEQ) report. It provides statistical and graphic capability for analyzing user-supplied databases. Current efforts are to move the UPGRADE software to a VAX mini-computer and expand the user community.

WESTLAW

WESTLAW is a management information system which provides access to several files of legal information, including:

1. Supreme Court Report. Full text, including headnotes, of U.S. Supreme Court cases, from 1932 to the present.

2. Federal Reporter. Full text, including headnotes, of reported cases from the U.S. Courts of Appeals, Court of Claims, Court of Customs and Patent Appeals, and Temporary Emergency Court of Appeals, from 1945 to the present.

3. State Cases. Full text, including headnotes, of all reported cases for Minnesota (since 1945), New Jersey (since 1948), California (since 1967), Louisiana (since 1956), and Washington (since 1965). Headnotes for all states are available from 1957 to 1966. During 1982, full text from 1967 to the present will be added for the remaining states.

4. Military Justice Reporter. Decisions of the U.S. Court of Military Appeals, and Courts of Military Review for the Army, Navy, Air Force, and Coast Guard.

5. New Jersey Tax Court Reporter. Full text, including headnotes, of the Tax Court of New Jersey cases, from 1980 to the present.

6. WESTLAW Case Highlights. A weekly information file of specially prepared summaries of the most significant State and Federal cases around the country.

7. Shepard's Citations. Provides citations to subsequent histories of cases and to all other cases that cite a given case.

8. Quick Opinion File. Provides pre-publication coverage of Federal court decisions from the 5th and 9th Circuit Courts.

9. West Bankruptcy Reporter. Full text, including headnotes, of Federal bankruptcy cases since 1979; U.S. Code Title 11, CFR Title 28, and SEC Reorganization Reports.

10. West Key Number Digest topics (currently covering Civil Rights, Drugs, and Narcotics). Public Contracts, Product Liability, and Securities Regulations are reported on the database from the earliest reported case to the present. Any case retrieved will have a case citation.

11. U.S. Code. Full text of the United States Code, Titles 1 through 50.

12. Code of Federal Regulations. Full text of the Code of Federal Regulations. Titles 1 through 50 were scheduled for completion during 1982.

13. Federal Tax Files. Full text of the Internal Revenue Code, Federal tax cases reported for the U.S. Supreme Court since 1932, the Court of Appeals since 1954, the Court of Claims since 1954, the District Courts since 1954, and the U.S. Tax Court Reports and Memorandum Decisions since 1954; Code of Federal Regulations-Title 26, Federal tax administrative materials, including revenue rulings, revenue procedures, delegation orders, executive orders, and Treasury Department orders since 1954; and Internal Revenue Service written determinations, including private letter rulings and National Office Technical Advice memoranda since 1954. IRS news releases and tax notes were to be added during 1982.

14. Forensic Services Directory. Contains the names of thousands of scientific, medical, and technical experts available to serve as consultants to attorneys and as expert trial witnesses. Also lists translators, testing laboratories, investigators, and other specialists providing trial support services.

15. Securities. Covers securities cases from the U.S. Supreme Court since 1932, U.S. Courts of Appeals since 1945, U.S. District Courts since 1950, U.S. Court of Claims since 1961, relevant sections of the U.S. Code, Titles 7 and 15, and CFR Titles 7, 12, and 17, SEC Decisions since 1934, SEC Interpretive Releases since 1933, and SEC No Action Letters since 1971.

16. Labor. Covers labor cases from the U.S. Supreme Court since 1932, U.S. Courts of Appeals since 1945, U.S. District Courts since 1950, U.S. Court of Claims since 1961, and relevant sections from the U.S. Code. Contains Titles 26, 29, 40, 42, and 45, and CFR Titles 20, 28, 29, 30, and 42, National Labor Relations Board (NLRB) decisions since 1972, and Occupational Safety and Health Review Commission (OSHRC) Reports since 1971.

17. Antitrust and Business Regulation. Covers antitrust and business regulation cases from the U.S. Supreme Court since 1932, U.S. Courts of Appeals since 1945, U.S. District Courts since 1950, U.S. Court of Claims since 1961, relevant sections of the U.S. Code and CFR, and Federal Trade Commission (FTC) Decisions since 1959.

18. Communications. Covers communications cases from the U.S. Supreme Court since 1932, U.S. Courts of Appeals since 1956, U.S. District Courts since 1950, U.S. Court of Claims since 1961, relevant sections from the U.S. Code and CFR, and Federal Communications Commission (FCC) decisions.

19. Government Contracts. Covers government contract cases from the U.S. Supreme Court since 1932, U.S. Courts of Appeals since 1945, U.S. District Courts since 1950, U.S. Court of Claims since 1961, relevant sections of the U.S. Code and CFR, and Board of Contract Appeals decisions.

20. Insurance. Covers state insurance cases from the 50 U.S. states. West Key Number Digest topics (currently covering civil rights, drugs and narcotics, public contracts, product liability, and securities regulation) are reported in the database from the earliest reported case to the present. Any retired case will always have a case citation.

WESTLAW does not require any special hardware or terminals for searching.

LEXIS

LEXIS is a database system with a family of files (called libraries) that contain the full text of court decisions, statutes, regulations, and other legal materials. These include:

1. General Federal Library. Contains the current version of the U.S. Code, Federal Register (from July

1980), and Code of Federal Regulations. Supreme Court decisions from 1925, Courts of Appeals decisions from 1938, District Courts decisions from 1960, and Court of Claims decisions from 1977. Also contains Supreme Court Briefings beginning with the fall term of 1979.

2. Federal Patent, Trademark, and Copyright Law Library. Contains patent, trademark, and copyright case decisions from the Supreme Court since 1850, the Courts of Appeals since 1938, the District Courts since 1960, and the Court of Claims since 1977. Also contains patent and trademark case decisions from the U.S. Court of Customs and Patent Appeals since 1952.

3. Tax Library. Contains the current version of the Internal Revenue Code, final, temporary, and proposed regulations, and the Cumulative Bulletin since 1954; rulings under the 1954 Code and 1939 Code, the Internal Revenue Manual, private rulings released to the public by the Internal Revenue Service (IRS) since 1977 and private rulings from 1954 to 1977 released to the public and classified as "reference" by the IRS; tax case decisions from the Supreme Court since 1913, from the Courts of Appeals since 1938, from the District Courts since 1960, and from the Court of Claims since 1943; Tax Court opinions and memorandum decisions since 1942; Board of Tax Appeals opinions from the beginning (1924); and public laws and House, Senate, and conference reports for the 1954 Code and amendments thereto.

4. Securities Library. Contains relevant sections of Title 15 of the U.S. Code; securities case decisions from the Supreme Court since 1933, the Courts of Appeals since 1933, and the District courts since 1933; final and proposed rules and regulations promulgated under the Securities Act and those issued by the Board of Governors of the Federal Reserve System; no-action letters since 1971, selected administrative decisions and interpretative releases from the Securities and Exchange Commission since 1933, and House, Senate, and conference reports associated with the 1933 and 1934 acts and amendments.

5. Trade Regulation Library. Contains trade regulation case decisions from the Supreme Court since 1890, from the Courts of Appeals since 1938, and from the District Courts since 1950. Also contains Administrative Law Judges' initial decisions since 1950 and procedural orders since 1976, Federal Trade Commission opinions since 1950, and consent and interlocutory orders since 1970.

6. Communications Library. Contains communications case decisions from the Supreme Court since 1936, from the Courts of Appeals since 1929, and from the District Courts since 1960. Also contains the following volumes of the Federal Commission Reports: Volume 39 (frequency allocations) since 1939; Volume 40 (sponsorship identification, equal time, fairness doctrine, FM frequency allocations) since 1941; Volume 41 (television matters) since 1950; and Volume 42 (common carrier and safety and special radio services) since 1947.

7. Labor Library. Contains the National Labor Relations Board Reports since 1972, and labor case decisions from the Supreme Court since 1932, the Courts of Appeals since 1938, and the District Courts since 1947.

8. Bankruptcy Library. Contains bankruptcy case decisions from the Supreme Court since 1925, the Courts of Appeals since 1938, and the District Courts since 1960. Also covers Bankruptcy Judges' decisions beginning in October 1979.

9. State Law Libraries. Contains court decisions, primarily from State courts of last resort, intermediary courts, and lower courts, for the 50 U.S. states and the District of Columbia. Earliest information is from 1821.

Hazardous Materials Information System

The Hazardous Materials Information System (HMIS) was developed by the Defense Logistics Agency (DLA) in 1978/79 and is fully described in "DOD Hazardous Materials Information System Procedures,"[20] which states:

> The data system is intended to provide technical information about the hazardous properties of items that in some manner affect DOD personnel by the unique aspects associated with hazardous items. The data in the system is intended as reference data to assist all levels of DOD management to develop procedures for prevention of mishaps, to apprise DOD personnel of hazards of materials encountered in DOD workplaces, and to assist the development of environmentally acceptable disposal procedures.

The system will initially store data in two files: the Safety Data (SD) file, and the Transportation

[20] *DOD Hazardous Materials Information System Procedures*, DOD 6050.5-M (Department of Defense, May 1979).

Data (TD) general item identification, item transportation, and safety and health data files. Those using the data will generally be safety and health or transportation DOD personnel.

Geoecology

The Geoecology Database is a unique compilation of computerized environmental data for research planning for energy development requiring rapid access to data at appropriate spatial and temporal scales. The Environmental Sciences Division (ESD) at Oak Ridge National Laboratory (ORNL), has developed an integrated database of diverse environmental resource information from extant sources. Data are stored at the county level of resolution for the contiguous United States, with some data available for subcounty units within larger, more diverse eastern counties. The Geoecology Database contains selected data on terrain and soils, water resources, forestry, vegetation, agriculture, land use, wildlife, air quality, climate, natural areas, and endangered species. Basic files on human population are also included to complement the environmental files. The Geoecology Database is currently fulfilling diverse ongoing research needs while it is being expanded and updated as needs and new data are identified.

WATSTORE

The U.S. Geological Survey (USGS) investigates the occurrence, quantity, quality, distribution, and movement of the nation's surface and underground water resources. The investigations, conducted by the Water Resources Division, include: systematic collection, analysis, and interpretation of water data; investigation of industrial, domestic, and agricultural water requirements; research and development to improve study techniques and methodologies to better understand hydrologic principles that form the scientific basis of investigation; and publication and other forms of release to the public of results and data from these investigations.

A large-scale computerized storage and retrieval system stores and disseminates water data acquired through USGS activities. The USGS Water Data Storage and Retrieval System (WATSTORE) was implemented in November 1971. Besides its data processing, storage, and retrieval capabilities, WATSTORE can provide computer-printed tables, computer-printed graphs, statistical analyses of data, and digital plots.

Sensitive Wildlife Information System

The Sensitive Wildlife Information System (SWIS) is a user-accessed computerized information system for rare, endangered, and legally protected animal species and subspecies in the United States and its territories. The system was prepared in response to the increasing concern for preservation of wildlife. Information for the taxa is arranged by state or territory, and for each taxon. The recorded information includes: the degree of protection or welfare benefits accorded the taxon under Federal and State or territorial law; its geographic distribution, including a distribution map that is plotted automatically when requested by the user; the known behavioral characteristics and habitat requirements that relate particularly to its adaptability to structural changes in its environment; its population structure and trends; and a list of information source documents (the reference bibliography).

NEPSS

The Navy has developed NEPSS, a computer system that will help it comply with NPDES permits. Personnel at Navy facilities enter Self Monitoring Report data onto coding forms. These forms are periodically mailed to one of six Regional Computer Centers at which the data is punched onto cards and entered by "Remote Job Entry" (RJE) to the main computer facility at Port Hueneme. The system generates Self Monitoring Reports which are returned to the installations for the responsible officer's signature. Summary reports of various kinds are available at the regional centers via RJE to Port Hueneme. The system has recently been modified to accept "interactive" access and use. In addition, a transfer to minicomputer technology is anticipated.

Department of the Army Registry of the Environment

Department of the Army Registry of the Environment (DARE) is a system being developed by USGS to help with the Development and Readiness Command's (DARCOM) Installation Restoration and Pollution Abatement programs. The system consists of installation contamination database information. These data support determination of contaminant migration based on site survey data, and an Environmental Project Information System (EPIS) which provides reports on the status of MCA pollution abatement projects.

The EPA Permit Compliance System

The EPA has a family of computer systems which store and manipulate environmental data. Currently, the EPA Permit Compliance System (EPA-PCS) contains information only on major emitters, while many DOD pollution sources are minor. Federal facilities can be culled from the overall database, but there is no

mechanism to identify which of these are military-related.

Computer-Assisted Procedure for the Design and Evaluation of Wastewater Treatment Systems

The Computer-Assisted Procedure for the Design and Evaluation of Wastewater Treatment Systems (CAPDET) is a computer-based technique for estimating both capital and operating and maintenance (O&M) costs for a large number of wastewater treatment alternative processes. The cost estimating technique is unit-process-oriented, allowing the model user to synthesize alternative wastewater treatment plans.

Regional Industrial Multiplier System

Researchers performing regional economic impact analyses are often faced with impact alternatives in which only one or a few of the local industrial sectors are directly affected by a proposed project or action. The Regional Industrial Multiplier System (RIMS) can calculate input-output multipliers for any multicounty area in the United States and for any four-digit level Standard Industrial Classification (SIC) industrial sector that an analyst desires. RIMS is not an economic model per se, but is basically a methodology for estimating regional, industry-specific output multipliers which can be used to measure project impacts on output. Changes in income and employment in a region due to a project or action can be estimated from the output changes. A version of the RIMS methodology is available as an EIFS enhancement.

Bureau of Reclamation Economic Assessment Model

The Bureau of Reclamation Economic Assessment Model (BREAM) was developed and implemented by Mountain West Research, Inc., at Tempe, AZ, for the Bureau of Reclamation, U.S. Department of the Interior. It assesses and projects the regional economic impacts caused by Bureau of Reclamation construction projects. Like EIFS and LECS, BREAM is an economic base model, which means that a regional economy is divided into two sectors: the basic sector and the nonbasic sector. It assumes that the basic sector's activity depends on factors that are external to the region (e.g., exports). On the other hand, the nonbasic sector is assumed to depend on the basic sector for its demand.

A significant conceptual improvement provided by BREAM involves the development of some measure of intercounty dependence. This is done by measuring each county's ability to satisfy its own service needs and its necessary dependence on higher-level county units to account for deficits. This natually produces a system of first order, second-order, third-order, etc., counties, depending on service sector dependencies. This information could assist in the function of the region of influence (ROI). Also, if coupled with an input-output (I-O) model of some type, BREAM could provide a mechanism to better estimate the effects of constructing large buildings for large projects.

The Socioeconomic Assessment Model

The Socioeconomic Assessment Model (SEAM), administered by the Argonne National Laboratory, is very similar to BREAM. The concepts are closely aligned with some modification in refinement. A modified version of the SEAM mdethodology is being incorporated into EIFS-related work.

Onsite/Site II

The Onsite/Site II systems allow the aggregation of demographic statistics for any geographic area in the United States. Statistics are aggregated based on the location of block population centroids. Summary demographic statistics can then be displayed and used. Primary use of these systems is by marketing firms and planning groups.

STORET

STORET is a national system that provides data on lakes, streams, wells, reservoirs, rivers, and other waterways from more than 200,000 unique collection points throughout the United States. STORET users include Federal agencies, more than 40 states, river basin commisions, and regional and local agencies.

STORET analysis programs can help users monitor water quality trends, measure compliance with water quality standards, trace pollutants, and file water quality reports, budget requests, and management basin plans. STORET files include:

Water Quality File

Progress Report File. Public Law 92-500 requires the submission of annual reports to EOA concerning all sources of pollution. The reports include information on the nature and extent of the sources, recommendations for pollution control, and costs of the controls. This file provides a format for compliance with this requirement.

Standards and Criteria File. STORET has several report programs that document the effects of water pollution abatement activities' relation to state and national criteria for specific water quality standards and goals, especially in relation to 1983 goals of water quality established by Public Law 92-500.

Toxic Substances File. All toxic substances for which water quality analyses have been performed are defined within STORET. If a user wants to determine levels of toxic substances (such as mercury, cadmium, an toxaphene), the STORET Toxic Substances File contains formats to analyze the presence or absence of these materials.

Basin Planning File. River basin planning is primarily the responsibility of the states and is given by certain sections of Public Law 92-500. This file provides a format to display and analyze water quality data for an entire river basin or a section of that basin.

Research File. This file provides many formats in which researchers can display and analyze their water quality data. For example, a broad-ranging Great Lakes research program, coordinated at EPA's Grosse Isle Laboratory, uses this STORET file.

The Waste Facilities Municipal Wastes Inventory File

This file is in the repository for data on municipal waste facilities in the United States, including those privately owned. Data are maintained on the location, capacity, and treatment process of each facility as well as on several other related characteristics.

Biological Data Summaries and Fish Kill File

Whenever water pollution is responsible for killing fish, the state submits a report to EPA, indicating the location, the time, the type of water body, the pollution involved, and the estimated type and number of fish killed. These reports, dating back to 1960, are maintained on this file, and summary reports can be retrieved.

Award Summaries Contract Awards File

This file provides information dating back to 1952 on the thousands of award grants authorized by the Federal Government to municipalities for construction of sewage treatment plants. Data are maintained for each award grant and report forms allow users to trace the pattern and progress of these grants.

Each of the previous files has analytical and graphic programs that can process and display data in a variety of forms for specific uses.

The National Water Data Exchange

The National Water Data Exchange (NAWDEX) is an index of sources, but is not a source itself. NAWDEX was established in 1976 to link collectors and users of water data. Information is available through NAWDEX from the Water Data Source Directory and the Master Water Data Index. The Water Data Source Directory lists:

1. Organizations that collect water data
2. The geographic area in which an organization collects data
3. The type of water data collected and available
4. Sources where these data may be obtained

The Master Water Data Index provides information on:

1. Sites for which water data are available
2. Location of these sites
3. The organization collecting data at a site
4. The type of data collected
5. Period of time for which data are available
6. Major parameters measured
7. Frequency of measurements of these parameters
8. Media of storage.

Chemical Substances Information Network

The Chemical Substances Information Network (CSIN) was developed by the Interagency Toxic Substances Data Committee, formed jointly by the EPA and the Council on Environmental Quality. It was developed to organize the many diverse computer resources pertaining to chemical substances.

The system is designed to make searching for and retrieving chemical information easier. It is not a database itself, but rather a network providing access to other on-line databases. It operates as an intelligent interface between the user and the databases containing chemical information. CSIN allows users to format search strategies on the CSIN computer and then run these preformatted strategies against an existing database. The results of the search can then be stored in a file in the CSI computer for later manipulation. CSIN's utilities include:

1. Automatic system dial-up and log-in

2. Storage of data in the CSIN computer

3. Scripts to help the novice user perform searches

4. A text editor to manipulate data

5. Standard query lists for subjects

6. Translations to allow for the searching of multiple databases.

CSIN has access to the following computer systems:

1. Chemicals in Commerce Information System (CICIS)

2. Chemical Information System (CIS)

3. National Library of Medicine databases

4. Chemical Abstracts Services On-Line

5. Systems Development Corporation's Orbit System.

5 GEOGRAPHIC INFORMATION SYSTEMS

With the current interest in geographic database systems, it is also desirable to review this type of analysis and display systems for possible use in identifying MX environmental impacts.

Environmental Systems Research Institute

The Environmental Systems Research Institute (ESRI) program is a geographic information system which can use either polygon or grid cell format. It can update, display, and statistically analyze data.

The Mapping Overlay and Statistical System

The Mapping Overlay and Statistical System (MOSS) was developed by the U.S. Fish and Wildlife Service. It is an interactive system and can plot overlays on a variety of plotters. It is primarily a polygon system, although it is grid cell compatible.

Odyssey

Odyssey is a color graphics display program rather than a true geographic information system. This system permits the display of data in three-dimensional color.

The Resource Information and Analysis Program

The Resource Information and Analysis (RIA) program performs selected geographic-type environmental analysis by using a BASE DATA FILE that is a grid cell data bank. The BASE DATA FILE (that contains the grid cell representation of all resource, land use, and other grid data needed to perform the desired analysis) must have been previously created and available for access by the RIA program. RIA can perform four major types of analyses and generate computer printer graphic displays or tabulations of the analysis results.

The Illinois Resource Information System/ Natural Resource Information System

The Illinois Resource Information System/Natural Resource Information System (IRIS/NARIS) contains geographical information developed to meet the needs of a planning commission and to help with decision-making. The smallest unit of resolution is a quarter-quarter section. This system has been implemented for northeastern Illinois.

Intergraphics

The Intergraphics Company has developed a drafting quality information system for use in the DA master planning process. The Intergraphics system is oriented toward recent software and hardware concepts.

Fort Hood MIS

The Fort Hood MIS is a pilot environmental management information system currently under development and evaluation. Digitized Landsat data are being entered into a geographically referenced database. Powerful graphics routines have been developed which allow the user to display the databank's information rapidly and with great flexibility.

Three types of data are entered into the Fort Hood MIS database: point, line, and areal. Point data include features such as well sites, towers, and other structures with no significant area. Line data describe features such as roads and pipelines. Areal data include vegetation, soil type, and other continuous surface covered items. All this information is useful in environmental planning.

The data system allows multi-attribute searches of the database to display machine-oriented overlaying of criteria. This helps identify areas meeting multivariant

criteria. While the system supports both color and black-and-white graphics, the software has been designed to insure compatibility with 16-bit microprocessors, allowing stand-alone capability and eliminating phone problems unlike interactive graphics.

6 EXISTING MX DATABASES

In support of the MX project, a large amount of environmental and other planning data has been gathered and is already in databases. The major MX databases which could be used for environmental planning are maintained by MX contractors: HDR, EDAW, ERTEC, and HERCORP.

The HDR database contains primarily data gathered on natural resources in support of the Great Basin EIS effort. Data are included on Utah, Nevada, Texas, and New Mexico, with minor information to support basing in northern U.S. area silos.

The EDAW database is comprehensive planning data at the "footprint" level of detail. Data are being developed for detailed site selection in four locations in Nevada and Utah. The data were collected by extensive field work at the following sites:

Cannon AFB, NM, by EDAW
Coyote Springs, NV, by EDAW
Milford, UT, by EDAW
Beryl, UT, by EDAW

The ERTEC databases are oriented toward geotechnical data (water and geology), archaeological data, biological data, and so forth, for the entire Great Basin area. The geotechnical data are the main area of emphasis, and most of the data are in hard-copy form.

The HERCORP database includes information and legal requirements, archaeological conservation requirements, and community conservation requirements. It is primarily hard copy.

The MXMIS study led to the development of an overall information management system (coexisting with ETIS as an independent, separate database and system). Efforts are underway to complete such a system with non-ETIS components based on a central USAF computer in San Antonio, TX.

7 COORDINATING WITH MX FIELD AGENCIES

CERL's extensive coordination with MX field efforts has been ongoing over the past 3 years. These efforts have involved coordinating field data collection efforts through CEMXPA, participating Corps of Engineers districts, and AFESC. Many AFRCE-MX personnel have extensively used ETIS and related developments in the USAF environmental planning environment. CERL's involvement in MX-related activities and its participation in the development of military environmental analysis systems indicate an awareness of MXEMIS data needs and system requirements.

In support of the MX Program, CERL's Environmental Division has completed nine tasks for the Corps of Engineers MX Program Agency (CEMXPA) between April and September 1981:

1. Coordinating of biological and archaeological study techniques for uniform reporting

2. Review and evaluation of the proposed base comprehensive plan (BCP)

3. Design and performance of preliminary field studies in archaeology, biology, soils, geology, and hydrology in support of site development.

4. Assistance in revision and environmental evaluation of transportation and utility corridors

5. Preliminary field evaluation of potential aggregate sources and associated environmental consequences

6. Review and evaluation of BCP deliverable on hydrology, geology, soils and ranching

7. Review and evaluation of the mitigation procedures proposed by the Air Force contractors

8. Evaluation of future MX research needs for CEMXPA

9. Supplied baseline information concerning candidate military installations for closely based spacing.

8 SUMMARY AND RECOMMENDATIONS

This report has identified and provided information about various environmental management systems which may be useful for analyzing the environmental impacts of MX missile deployment.

The response of the MXEMIS to management needs must be quick if current timetables for MX deployment are on schedule. Therefore, the following recommendations are made:

1. Current systems should be adapted to MXEMIS needs, when possible, to allow use of existing software and to avoid duplicate databases.

2. An MXEMIS should be implemented as soon as possible, since enough data for its development are now available.

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