UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D C   20548

COMMUNITY AND ECONOMIC
DEVELOPMENT DIVISION

JAN 3 1 1978

The Honorable Edward W. Scott, Jr.   24
Assistant Secretary of Administration
Department of Transportation

Dear Mr. Scott:
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    Enclosed is a copy of our report on improvements needed in
the Coast Guard's computer-based Pollution Incident Reporting
System (PIRS). The report discusses inadequate and ineffective
controls for processing PIRS information.

    The Office of Audits has not participated in the design
and development of controls for PIRS and has not reviewed
the system to ensure that controls are adequate and effective.
Also, the Office is not involved in the Coast Guard's current
efforts to improve PIRS   Auditor participation is important
to ensure managers and users that the PIRS network of controls
is adequate and effective.

    The internal audit staff should, in our opinion, review
automated information systems such as PIRS to provide assurance
that the systems are properly designed, are operating efficiently,
economically, and effectively, and are producing reliable results.
As part of its review, the audit staff should test the adequacy
of controls, pointing out control weaknesses to management for
corrective action.

    We discussed with officials from the Office of Audits the
need for their participation in the design and development
of internal controls for PIRS and periodically auditing the
system. The officials indicated that their involvement in PIRS
was doubtful because PIRS was not a major Department of Trans-
portation system and their present capability to perform
computer-type audits was limited. They did indicate, however,
that they would consider conducting reviews in areas which would
have greater significance from a departmentwide standpoint, such
as a review of the adequacy of controls in the Transportation
Computer Center.

    As noted on page 5 of the enclosed report, Coast Guard
personnel are held accountable for PIRS, including safeguards
for ensuring that data is not lost, added to, or manipulated
during processing. We believe that the Transportation Computer

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Center, which processes PIRS data, should also be accountable for ensuring that data is processed according to acceptable control standards. Our evaluation of the Transportation Computer Center's procedures for processing PIRS indicated that controls are lacking in the Center

Therefore, we recommend that you direct the Office of Audits to assign a high priority to a review of the Transportation Computer Center's controls and include in that review appropriate test checks of PIRS. Such action would be consistent with your reply to the recommendations made in the GAO report dated September 28, 1977, on "Computer Auditing in the Executive Departments Is Enough Being Done?" (FGMSD-77-82).

We appreciate the cooperation received from the staff of the Office of Audits during our review and would appreciate receiving your advice as to any actions taken on the recommendation in this report. A copy of this report is being sent to the Director, Office of Audits.

Sincerely yours,

Hugh J Wessinger
Associate Director

Enclosure

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D C 20548

JAN 3 1 1978

Admiral Owen W. Siler
Commandant, United States Coast Guard

Dear Admiral Siler

In connection with our review of the Coast Guard's
response to oil spills, we evaluated major controls used
to process data in the Pollution Incident Reporting System
(PIRS)--a computer-based system for collecting certain in-
formation on oil and other spills reported to or detected
by the Coast Guard. Although the Coast Guard has taken
steps to improve the quality of PIRS data, our evaluation
disclosed that the network of controls is inadequate and
ineffective Consequently, the Coast Guard cannot be as-
sured that PIRS contains accurate and complete information.
This report contains recommendations which we believe
will strengthen PIRS controls and thereby improve the
quality of data.

We conducted our evaluation at the Coast Guard Head-
quarters and the Department of Transportation's Computer
Center in Washington, D.C., and the 8th Coast Guard Dis-
trict, New Orleans, Louisiana. We reviewed system docu-
mentation and other pertinent records dealing with PIRS
controls We discussed the management, control, and
processing of PIRS data with managers, operating personnel,
and computer specialists responsible for various aspects
of the PIRS process.

DESCRIPTION OF PIRS

Section 311 of the Federal Water Pollution Control Act
requires that any discharge of oil or hazardous substance
in harmful quantities be reported to the "appropriate
agency of the United States Government " The Coast Guard
has been designated as that agency by Executive Order 11735.
In response to this requirement, PIRS was started in
December 1971 to collect information on discharges reported
to or detected by the Coast Guard PIRS was expanded in
1973 to collect information on cleanup activities and pen-
alty actions Data elements include the spill's location,

size, source, and cause; the amount recovered; the penalty assessed and collected, and many other items. The Coast Guard emphasizes that PIRS records are maintained for management, statistical, and public information purposes, rather than as legal files.

PIRS is managed by the Marine Environmental Protection Division in Coast Guard Headquarters under the direction of a PIRS manager. PIRS data on pollution incidents originate at the Coast Guard's 12 districts. These districts transmit data, usually by means of a telecommunications network, to a central computer operated by the Department of Transportation's Computer Center in Washington, D.C. The districts are responsible for establishing and adhering to procedures assuring timely, accurate, and complete reporting of all pollution incidents.

USE MADE OF PIRS DATA

According to the Coast Guard, PIRS is the only comprehensive source of information on oil pollution incidents which occur in and around U S waters There is a relatively high demand for information from this system Government users include Members of Congress, other Federal agencies (primarily the Environmental Protection Agency, the Geological Survey, the Council on Environmental Quality, and the Maritime Administration), and State governments. Nongovernment users are primarily consultants and contractors who use the data for Environmental Impact Statement purposes, members of the academic community, and individual citizens Many requests can be satisfied by providing published information, but some can only be filled by special computer runs using programs written specifically for these requests

PIRS is also intended to provide management information to the Commandant, district commanders, and unit commanders to effectively administer the Marine Environmental Protection Program In congressional testimony during March 1977, the Coast Guard stated that PIRS data is used to develop policies and strategies to execute its mandated responsibilities in marine environmental protection.

POOR QUALITY OF PIRS DATA

In a May 1977 memorandum sent to all districts, the Acting Chief, Office of Marine Environment and Systems, stated that in many cases the PIRS data base did not contain current and accurate data He noted that gross errors in spill volumes, pollution fund expenditures, and civil penalty assessments have resulted in time-consuming efforts to obtain original

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information from district files. He also stressed the
importance of maintaining a current and accurate
computerized data base and referred to a number of steps
underway or under consideration for improving PIRS.

As an example of the extent of erroneous data in PIRS,
in June 1977 the 8th Coast Guard District corrected 44 of
209 spills over 500 gallons reported by the District during
1976. The 44 spills totaled 309,705 gallons before correc-
tions and 237,819 gallons after corrections, a net change of
about 72,000 gallons.

We believe that a major cause for the erroneous data
in PIRS is the lack of adequate and effective controls.
Although the Coast Guard has made efforts to correct data
currently in PIRS, errors will continue at a high rate
until the controls for managing and processing data are
strengthened.

INADEQUATE CONTROLS FOR PROCESSING
PIRS INFORMATION

The automated system which processes the information
required by PIRS must have adequate and effective controls
to ensure that information is complete and accurate.
These controls involve

--maintaining adequate documentation of system controls,

--counting and controlling records processed by the
  system (record counts),

--developing arithmetic totals to compare data input
  with data processed (predetermined control totals),

--using the computer to check the validity of data
  (edit checks),

--maintaining an error log or computerized suspense
  file,

--operating an independent or central control group to
  ensure separation of duties and to review and balance
  computer input and output, and

--auditing of system development, design, and maintenance
  by the agency's internal audit staff.

A discussion of individual control weaknesses in PIRS
follows.

Documentation of controls

Current and complete documentation is necessary for
the continued efficient and effective operation of any
data processing system Generally, documentation describ-
ing the flow of data through the system was available for
PIRS. However, documentation identifying and describing
the system's controls was not available

PIRS controls should be adequately documented to
provide users, managers, and internal auditors with
assurance that PIRS data is processed according to
acceptable standards.

Control totals (record counts and predetermined control totals)

Properly designed automated systems include controls to
assure that information flowing from one phase of the proces-
sing cycle to another is not lost, added to, or otherwise
manipulated These controls include

--counting all documents (record counts) and

--developing arithmetic totals of quantitative infor-
   mation contained in these documents (predetermined
   control totals).

Counts and totals should be taken before and after each
processing step and then compared Agreement indicates
that all data has been accurately processed. Differences
in record counts show that records were added or lost, and
differences in predetermined control totals show that the
information was accidently altered or otherwise manipulated

Control totals and predetermined record counts should
be used throughout the processing cycle In the case of
PIRS, they should be used when (1) data is transcribed from
coding forms to punched cards, (2) data is transmitted from
the district to the Transportation Computer Center via the
telecommunications network, (3) data is transferred from
one magnetic tape to another during a computer run, and
(4) output is generated by the computer.

Control totals are seldom used when processing PIRS
data. For example, during our visit to a district office,
we noted that control totals were not used when the con-
tractor keypunched data from PIRS coding forms (CG-4890,
CG-4890A, and CG-4890B) onto standard 80 column computer

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cards. The staff at the district office did not verify
that the number of coding forms sent to the contractor
were returned nor calculate the number of cards that
should have been punched   This is particularly important
because several punched cards can be prepared from a single
coding form   Furthermore, predetermined control totals
were not taken of quantitative information (for example,
gallons spilled) on the coding forms for comparison with
corresponding totals taken from the punched cards Therefore,
there was no assurance that all data was accurately and
completely transcribed from the coding forms onto punched
cards.

In addition, the district and the Transportation
Computer Center make only limited use of record counts
and no use of predetermined control totals to ensure that
accurate and complete data is transmitted to Washington
and processed by the computer center   We observed that
PIRS managers in Washington and in the districts are held
accountable for PIRS, including safeguards for ensuring
that data is not lost, added to, or manipulated during
processing   We believe that the Transportation Computer
Center, in addition to PIRS managers, must be responsible
for ensuring that data is processed according to acceptable
control standards

Need to improve edit check performed by the computer

In a properly controlled computer system the computer
programs include instructions--called edit checks--to identify
and reject from further processing information that is missing,
invalid, incorrect, or unreasonable   The PIRS managers have
recognized that the system's edit routines are inadequate and
have taken steps to develop and install improved edit routines
These new edits should improve the quality of PIRS data; how-
ever, additional edits need to be developed to detect missing
or improperly coded data   Two techniques which could be helpful
are "anticipation controls" and "self-checking digits "

Anticipation control

PIRS is not programmed to detect missing input by antici-
pating each record or transaction entering the system
(anticipation control). PIRS is designed so that information on
each pollution incident is transmitted to the Transportation
Computer Center by means of numbered computer cards fed into
terminals at district offices   Discharge data received at the

Transportation Computer Center on a new spill should include two cards numbered 1 and 2; response data should include two cards numbered 3 and 4; and penalty action data can include one or more cards numbered 6, 7, 8, or 9, depending on the number of penalty actions initiated. The existing edit routine does not check for the presence or absence of appropriate card numbers. Consequently, when the districts transmit data on new spills or make corrections to previously reported spills, there is no assurance that all cards are received and entered into PIRS.

Also, each district office assigns a case number for each reported incident The numbers are assigned on a sequential basis for identification and control purposes The computer edit routine does not check for missing case numbers. Therefore, there is no assurance that all spills are reported and processed or that records are not deleted, either accidentally or intentionally.

Self-checking digit

Spill volume is a critical PIRS data item. It is a factor in allocating resources, imposing penalties, and recovering money for cleanups performed by the Government Case number is another example of a critical data element For these and other critical items, the Coast Guard should employ the "self-checking digit" technique to identify transpositions and similar types of coding errors This technique is not built into the current computer edit routine.

Under this technique a self-checking digit is developed as part of the critical number (for example, volume or case number) by a mathematical process. In subsequent processing of this number, the check digit is calculated to verify the accuracy of the number.

Control of errors

When district offices transmit PIRS data to the computer in Washington which is programmed to detect certain errors, it provides a computer printout--an error listing--at the district's computer terminal. Corrected information must be resubmitted to Washington via the computer terminal. Neither a PIRS error log nor suspense file is maintained by the Coast Guard Headquarters or the Transportation Computer Center.

Since error correction procedures are outside the mainstream for handling regular computer input, they can be easily overlooked. The maintenance of an error log and the

regular investigation of its open items are therefore essential to ensure that all data is ultimately re-entered where appropriate. As an alternative to a manual error log, control over the clearing and re-entry of errors can be maintained by the computer As the computer accepts corrected entries, it clears the original error records and retains the incorrect items for investigation and ultimate disposition. A computerized suspense file would facilitate the correction of errors and improve the reliability of the PIRS data. We believe that the Coast Guard should institute a correction procedure which includes maintaining a log or computerized suspense file whereby open, uncorrected items could be periodically investigated.

Need for a central control group

Neither the Coast Guard's Headquarters PIRS staff nor the Transportation Computer Center exercise control over data as it flows through the PIRS processing cycle. Under the current process, each of the 12 district offices is responsible for the accuracy and completeness of data it submits for processing. There is no independent or central control group at the headquarters level responsible for the accuracy and integrity of the PIRS data base. Such a group could exercise control over data submitted by district offices and processed by the Transportation Computer Center to ensure that the data is not lost, added to, or otherwise manipulated.

Specific duties of a control group could include

--performing normal "housekeeping" routines, such as reconciling differences in control totals,

--monitoring the error log or computerized suspense file to ensure that all errors are corrected promptly,

--serving as a central point for district offices to contact for (1) interpretation of the standard coding manual, (2) ways to handle exceptions to the manual, (3) making changes to procedures to meet unit and district office needs, and (4) exchanging ideas on ways to improve PIRS;

--monitoring the processing of PIRS data at the district offices to ensure uniformity in procedures;

--checking with users of PIRS regarding their satisfaction with the quality of data; and

--serving as the mechanism for effective organiza-
tional control through separating the functions
of employees processing PIRS data.

Opportunities for internal audit
to improve PIRS controls

The internal audit staff should, in our opinion review
automated information systems such as PIRS to provide as-
surance that the systems are properly designed, are operating
efficiently, economically, and effectively, and are producing
reliable results As part of its review, the audit staff
should test the adequacy of controls, pointing out control
weaknesses to management for corrective action

The Department of Transportation's Office of Audits has
not audited PIRS nor has it participated in the Coast Guard's
current efforts to improve the system Auditor participation
is important to ensure managers and users that the PIRS
network of controls is adequate and effective

RECOMMENDATIONS

We recommend that the Commandant direct his Headquarters
PIRS staff to

--prepare and maintain adequate documentation of system
controls;

--establish record counts and predetermined control totals
to make sure that PIRS data is not lost, added to, or
altered during processing;

--develop additional computer edit routines to detect
missing data and screen out invalid and erroneous data;

--establish an error log or computerized suspense file to
control correction of errors, and

--establish a central control group at the headquarters
level to assume responsibility for (1) ensuring that
all errors detected during processing are corrected
and re-entered, (2) maintaining the integrity of the
PIRS data base, and (3) assuring that all district
offices uniformly report and process data consistent`
with a single Coast Guard standard.

These recommendations were discussed with officials from the Coast Guard's Office of Comptroller and Office of Marine Environment and Systems and the Department of Transportation's Computer Center They agreed with our recommendations and emphasized their recent efforts to improve PIRS Although they recognized the importance of a central control group, there is some question as to whether the Coast Guard would add staff to such a group because of personnel constraints
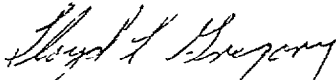
We also discussed with officials from the Office of Audits the need for their participation in the design and development of controls for PIRS and for periodic auditing of the system The officials indicated that their involvement in PIRS was doubtful because PIRS was not a major Department of Transportation system and their present capability to perform computer-type audits was limited They did indicate, however, that they would consider conducting reviews in areas which would have greater significance from a departmentwide standpoint, such as a review of the adequacy of controls in the Transportation Computer Center.

Consequently, we have recommended in a separate report to the Assistant Secretary for Administration that he direct the Office of Audits to assign a high priority to conducting a review of the Transportation Computer Center s controls and include in that review appropriate test checks of PIRS Such a review should help improve the quality of PIRS data

We are sending copies of this report to the Assistant Secretary for Administration and the Office of Audits, Department of Transportation, and to the Subcommittee on Transportation and Related Agencies, Senate Committee on Appropriations

We appreciate the cooperation received from your staff during our review and would appreciate receiving your advice as to any actions taken on our recommendations

Sincerely yours,

Lloyd L. Gregory
Assistant Director

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