UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

COMMUNITY AND ECONOMIC
DEVELOPMENT DIVISION

JAN 31 1973

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 information 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 assured 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 Headquarters and the Department of Transportation's Computer Center in Washington, D.C., and the 8th Coast Guard District, New Orleans, Louisiana. We reviewed system documentation 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 penalty 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

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 corrections 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 describing 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 processing 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 information 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 contractor keypunched data from PIRS coding forms (CG-4890, CG-4890A. and CG-4890B) onto standard 80 column computer

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; however, 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 anticipating 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 organizational 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 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.

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 qua' cy of PIRS data.

We are sending copies of this report t· 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