Evaluation Results from a Pilot Test of a

Computerized Self-Administered
Questionnaire (CSAQ)

for the

1994 Industrial Research and
Development (R&D)
Survey

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Summary

The Computer-Assisted Survey Information Collection (CASIC) Policy Advisory Group has supported testing of a generalized Computerized Self-Administered Questionnaire (CSAQ) data collection tool. This tool is seen as one alternative to the paper and pencil data collection method currently used for most of the Bureau of the Census (BOC) economic survey reporting. Documented in this report are results from a third BOC small-scale test using a CSAQ instrument. This third test was conducted on a small sample of companies in the 1994 Industrial Research and Development (R&D) survey. In addition to presenting results from the 1994 R&D CSAQ test, this paper presents feedback from a screener survey conducted to identify R&D survey cases with the hardware/software capabilities for using the CSAQ system developed for the test, as well as feedback from the CSAQ respondents on their perceptions and expectations for CSAQ and electronic reporting in general.

From previous pilot-tests, we have established that the CASES[1] language, currently used for the Bureau's CAPI/CATI instruments, can also be used as an authoring language for CSAQ. We have also confirmed that at least a portion of economic survey respondents are interested and have the computer hardware/software to report via CSAQ. Unlike the two previous pilot-tests, a controlled experiment was designed for this pilot test. CSAQs were mailed to 100 R&D companies in sample. The regular 1994 R&D paper questionnaire was mailed to another 100 companies in sample. These 200 companies were similar in size and hardware/software capability, and had indicated in the screener questionnaire interest in trying CSAQ. The test allowed us to compare response rates, timeliness, data accuracy and costs between paper questionnaires and CSAQs, and the user burden associated with CSAQ reporting.

The 1994 R&D CSAQ was developed for this test by Census employees from the Technology Management Office (TMO) and CASIC staffs using the CASES CATI authoring language within a PEDRO menuing, installation, de-installation, and communications package. The Personal Computer Electronic Data Reporting Option, PEDRO, is a CSAQ-like system used by the Energy Information Administration (EIA).

In this test, the PEDRO/CASES CSAQ system produced a lower response rate than the traditional paper mailout/mailback panel. However, most of the respondents who used the instrument were satisfied with it and approximately 81 percent would choose a CSAQ in the future. For those respondents that received a CSAQ, approximately 53 percent successfully completed and returned it on-time, 12 percent decided not to use the CSAQ system and were diligent enough to request, complete and return a paper form on-time, 11 percent had not even attempted to try the instrument within the time allotted for the test, and 10 percent did not respond due to hardware or software problems or perception problems with the CSAQ. For the respondents that used the CSAQ system, it took significantly less time to complete the CSAQ than the burden hours estimated in the OMB package for the R&D paper questionnaire. In addition, the CSAQ panel had significantly fewer edit failures at headquarters than the control panel.

The primary recommendation from the CSAQ respondents was to develop a Windows based version of the CSAQ to provide easier movement within the instrument. It was also apparent that to obtain better acceptance of CSAQs by the user community, some public relations on the advantages of this

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[1] Computer-Assisted Survey Execution System, software developed by the Computer-Assisted Survey Methods program at UC-Berkeley.

type of reporting must occur. For example, we noticed from the screener questionnaire that approximately half of the respondents did not want to participate simply because they "thought" the CSAQ would be more work than a paper form. We suspect that many of the unwilling participants would have found reporting via CSAQ easy, given that 62 percent of the CSAQ respondents found the overall system easy to use and only 2 percent (one case) thought the system was difficult to use.

Particular features, such as the ability to import data from external files, are specifically geared toward making the electronic questionnaire less work than a paper form. Although for this test respondents did not take advantage of this option (only one respondent imported the data), we still believe this capability would be particularly beneficial for surveys where a company needs to report individually for all establishments, or for companies which report on the same survey regularly (e.g., monthly). Similarly, even though electronic transmissions were not used to the extent we expected based upon screener questionnaire responses, we feel respondent comments like, "Electronic filing eliminates time required to process and mail this document" are hopeful signs that companies will eventually embrace this form of communication.

A disadvantage of the R&D CSAQ system tested was the cost of the mail package. The cost of the mail package was 9 times higher than the corresponding mailout cost of the R&D paper questionnaire. Thirty percent of the CSAQ mail package cost resulted from the inclusion of an additional mailout, a PEDRO security requirement, of a certified letter to respondents containing their password for the PEDRO operating system. The postage for the mailout package containing the three CSAQ diskettes and User Guide was 24 percent of the entire mail package cost. The remaining 46 percent of the mail package cost was due to the cost of the mailing envelopes and three diskettes needed. Eliminated functions, such as keying the paper form, could not make up for this increase in mailing and material costs. In the current environment of restricted spending, the mailing of such a system, and specifically the PEDRO communications password package, is impractical. However, mailing cost is another factor that may depend a lot on the survey. A similar CSAQ mailout package cost may be considered reasonable for a survey such as the Company Organization Survey (COS) or the Annual Survey of Manufactures (ASM) for which companies normally receive boxes of questionnaires because they must report individually for all their establishments.

Based on this test, we have identified improvements we would like for a CSAQ system. Even though we would not recommend the implementation of the system tested here, both the BOC and respondents see computerized questionnaires and electronic reporting as the way of the future. Consequently, we recommend continued research into alternatives for CSAQ authoring/communications, with the vision of a respondent friendly system that is cost effective for the BOC. With this in mind, the BOC is currently looking into several CSAQ communications alternatives and is investigating the possible future use of the Internet for electronic reporting. Although only 26 percent of the screener respondents interested in CSAQ reported having access to the Internet, we are confident this number will increase at a very rapid pace. Other possible obstacles for Internet data collection are concerns with its capacity to handle the expected growth and, the required paradigm change in the user community concerning their reluctance to report via Internet due to confidentiality and security issues. In the meantime, the BOC must continue research of these other alternatives for CSAQ implementation.

1.   Purpose of the 1994 R&D CSAQ Test

The Computerized Self-Administered Questionnaire (CSAQ[2]) data collection tool is seen as a data collection/reporting alternative to the paper and pencil method currently used for most Bureau of the Census (BOC) economic surveys. This report documents results from the third small-scale BOC test using a CSAQ instrument. This third test was conducted on companies in the 1994 Industrial Research and Development (R&D) survey. The R&D survey, conducted annually by the BOC and sponsored by the National Science Foundation (NSF), is designed to measure levels of research and development activity for U.S. firms. Data are collected for company sales, employment, R&D expenditures disaggregated several ways, and other related information. NSF requested an evaluation of electronic data collection from a sample of companies which report annually for this survey. Depending upon the results of this evaluation, BOC would consider expanding the availability of the CSAQ to other annual reporters in the survey. This third pilot-test addresses the speculated advantages of CSAQ over a traditional paper mailout/mailback survey collection method, such as: better data quality, reduced respondent burden, cost savings for the BOC, and quicker survey timing.

2.   Summary of Previous CSAQ Pilot-Tests

Since 1993, the BOC has conducted several small-scale tests using different CSAQ options. The first two feasibility tests involved the 1993 Survey of Surveys (SOS) CSAQ, written by BOC personnel in CASES language and tested internally, and the 1993 Company Organization Survey (COS) CSAQ, written in a C and CLIPPER programming languages by an outside vendor. The main purpose of the SOS CSAQ test was to determine if CASES could be used as the authoring language for a CSAQ instrument. The objectives of the COS CSAQ test were to measure electronic capabilities and willingness to report via CSAQ for economic survey respondents and to investigate the BOC's capability to direct a CSAQ development process and efficiently handle the mailing/receipt operations.

Both of these tests were successful. Since CASES is the authoring language being used for CATI and CAPI applications, the use of CASES for CSAQ authoring was appealing in that the BOC would not have to purchase and train staff on another authoring language. From the SOS test, CASES proved to be an acceptable CSAQ authoring language, however, it did not satisfy all of the requirements. The installation, de-installation, and menuing system to call the CSAQ functions and utilities were custom coded for the SOS CSAQ. This would not suffice for a CSAQ production system since a generalized approach that could be used across surveys is desired. In addition, there were no means of electronic transmission or encryption of the CSAQ data. Therefore, a generic menuing/communication facility (or"shell") for the CSAQ system,

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[2] A Computerized Self-Administered Questionnaire, or CSAQ (pronounced see sack) is an executable computerized questionnaire the survey agency sends (usually on diskette) to the respondents who then install and run it on their personal computers with no interviewer present. The automated questionnaire controls the flow of survey questions, provides instructions and help and usually includes edit checks performed as the data are entered by the respondents. The respondent returns the answered questionnaire by mailing the diskette or transmitting the data by modem to the survey agency.

satisfying these requirements for all BOC surveys and functioning along with a CASES instrument was needed.

The COS CSAQ, authored by the Washington Publishing Company on a contract basis, was mailed to 114 companies/establishments that had previously indicated an interest in CSAQ reporting for this survey. (Ramos and Sweet, 1995) Results from the test indicate that the BOC can direct/implement CSAQ development and reporting and that companies self-identified to answer via CSAQ have a 77 percent rate of responding electronically. Approximately 85 percent of the users were satisfied with the COS CSAQ system and would use it again. An additional 10 percent would use it again, even though they found it somewhat difficult. The COS CSAQ provided the ability to respond by modem, but of the reporting companies, only 4 used this tool.

Another CSAQ designed by the Washington Publishing Company is currently being tested on 17 companies encompassing 189 establishments in the 1994 Annual Survey of Manufactures (ASM). Like the COS CSAQ, the ASM instrument is written in CLIPPER and C programming languages. The BOC has received data via CSAQ from 14 companies (184 establishments). Eleven of the 14 companies mailed their CSAQ, and the other three used a modem to transmit their data. Of the three companies which had not responded via CSAQ as of this writing, two opted for the paper form (MA-1000) because of time constraints, and one is in the process of completing the CSAQ.

3.   1994 R&D CSAQ Test Description

As requested by the NSF, the 1994 R&D survey was selected to test the development and implementation of a CSAQ instrument using CASES. During research for the Initial Technical Assessment of CSAQ (see Sedivi and Rowe, 1993), the BOC discovered that in 1988 the Energy Information Administration (EIA) developed a CSAQ software called Personal Computer Electronic Data Reporting Option (PEDRO). The PEDRO Operating System and the communications portion of PEDRO met most of the requirements of a BOC CSAQ system. EIA had successfully implemented PEDRO as the primary tool by which they electronically collect data. Since EIA was, at the time, making several enhancements to the PEDRO software, they agreed to incorporate BOC requests into the enhancements. EIA estimated that to enhance PEDRO to meet our needs and to provide us with technical assistance, help desk support, User's Guide, etc., would cost $38,200. The CSAQ team made up of representatives from around the Census Bureau determined that an enhanced version of PEDRO, along with CASES software could be the best and most cost effective software solution for the CSAQ system. For this CSAQ test, the BOC used an enhanced PEDRO for the CSAQ shell software, CASES for the CSAQ instrument software, and PEDRO's current communications software, Arbiter. The PEDRO/CASES CSAQ operated in a DOS environment and it was authored by Census employees from the Technologies Management Office (TMO) and the Computer Assisted Survey Information Collection (CASIC) staffs.

For the R&D CSAQ test a control experiment was conducted. This allowed comparison of the response rates and edit failure rates between paper questionnaires and CSAQs, and the user burden associated with the two media. The CSAQ was distributed to a sample of 100 companies in the 1994 R&D survey who expressed an interest in responding via CSAQ and had the

hardware/software to do so. They are referred to as the CSAQ panel. The CSAQ instrument contained the same questions in the same sequence as the 1994 R&D paper questionnaire or RD-1S.[3] The selected companies had to install the software on their personal computers and complete the survey. The electronic questionnaire controlled the flow of the survey questions, provided on-screen instructions and help, and performed consistency and validity checks as the respondent entered data. The data was then encrypted. The respondents had the option to copy the encrypted data to a diskette and mail it to the BOC or transmit the data to a separate Remote Disk Environment (RDE) space designated for each respondent on EIA's mainframe computer.[4] The BOC periodically downloaded the data in the RDE spaces to a BOC computer and at the same time deleted the data from the EIA mainframe using software provided by EIA. The data was not decrypted until it resided on a secured computer at the BOC.

At the same time, another 100 companies in the 1994 R&D who expressed an interest in responding via CSAQ and had the hardware/software capability, received instead the 1994 R&D paper questionnaire. They are referred to as the control panel. Both the CSAQ and control panels were mailed their respective CSAQ or paper questionnaire on February 22, 1995. The follow-up letter mailout timing was also the same for both panels. Other items differed. It is probably accurate to say that the CSAQ panel's task was somewhat more involved. In addition to answering the survey questions, they also had to install the instrument, familiarize themselves with the CSAQ, and proceed through the questionnaire using their computer screen. The CSAQ panel was also asked to complete an evaluation of their experience with the CSAQ. They were also asked to record the amount of time spent completing the CSAQ. These items were built into the computerized questionnaire. The control panel was only asked to record the time it took them to complete the paper questionnaire in the remarks section of that form.

This test was accomplished during the regular production of the 1994 R&D survey. Sixty days after initial mailout for the regular 1994 R&D survey a replacement questionnaire is sent to nonrespondents. The CSAQ test group decided that for this controlled experiment the replacement questionnaire would be mailed at 90 days after initial mailout. Since measuring CSAQ panel responses after they receive a paper questionnaire would not be appropriate, this would mark the end of the test data collection period. The BOC would accept late CSAQs or paper forms from the CSAQ panel respondents, but they would be late for the test purposes and thus considered nonrespondents for this evaluation.

Data from both the control and the CSAQ panels were uploaded to the 1994 R&D database and used for the survey estimates. All R&D companies not in the control or CSAQ panel, received the paper questionnaire. Their mailout was a little later than for the 200 cases in the experiment, but otherwise the process was as usual. See Sedivi and Sweet, 1995 for further detail.

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[3]   The RD-1S is the short form mailed to R&D Survey respondents every other year, alternating with the RD-1L, a longer questionnaire that collects more detailed information.

[4]   The Census Bureau received approval from the Department of Commerce's Office of General Counsel to use EIA's mainframe to collect the electronically transmitted encrypted CSAQ data for this test only. Collection of data through EIA's mainframe will not be supported in future BOC CSAQs.

4.   CSAQ Eligibility Requirements

Prior to selecting a sample of R&D cases to receive a CSAQ for the 1994 R&D survey, a screener questionnaire, titled the Survey of Potential Computerized Self-Administered Questionnaire (CSAQ) Respondents, was mailed to 1993 R&D respondent companies to determine both their interest in reporting via a CSAQ and their ability to use such an instrument for the 1994 R&D survey. (A copy of the screener questionnaire is provided in Attachment A and tallies of the responses are in Attachment B.)

The first question on the screener asked whether the respondent would be interested in completing the R&D survey using a CSAQ. Remaining questions concerned the hardware and software requirements for a case to be considered eligible for the test. In addition to gathering eligibility data, the screener gathered other information such as printer and modem type, that were deemed useful to ascertain future electronic report offerings.

Not all interested companies were eligible. For this test, a potential eligible company had to be interested in using a computerized questionnaire (respond positively to Question 1) and meet the following hardware and software requirements:

a.   An IBM compatible personal computer with a 3.5 inch high density floppy disk drive.

b.   A 386, 486, or Pentium processor.

c.   MS-DOS operating system, version 5.0 or higher.

d.   At least 4 megabytes of RAM.

e.   A color VGA or Super VGA monitor.

In evaluating the eligibility of a company, the following assumptions were made:

a.   Companies which failed to report their DOS version, but met all of the other hardware requirements, were assumed to have a DOS version of at least 5.0.

b.   Companies which reported having a color monitor, but did not indicate the color type, and which met all of the other requirements, were assumed to have either a color VGA or Super VGA monitor.

5.   Sample Selection of CSAQ and Control Panels

Responses to the screener questionnaire were used to select the CSAQ and control panels. The entire 1994 R&D sample was not eligible for the screener; companies were eligible if they were likely to have some R&D expenditures in 1994. Eligibility was defined as those companies which received the RD-1L form (refer to footnote 3) for the 1993 survey. These companies would have been companies in the 1992 survey that had R&D expenditures greater than $1 million in 1992.

There were 2,862 companies eligible to receive the screener. An independent random sample of 500 companies was drawn from the 2,862 cases to receive the screener. Of the 500 selected companies, some were identified as out of business or company mergers, and others were duplicates on the file. Thus, only 486 companies were mailed a screener on November 4, 1994.

Our goal was to have at least 200 screener respondents that were both interested in using a CSAQ and had the required computer system (i.e., hardware and software) to upload and use the instrument. As of the beginning of December 1994, only 237 companies had returned their screener by mail, and not all of these companies were both interested and eligible. In order to obtain our goal of 100 companies in both the control and CSAQ panels, the screener nonrespondents were telephoned in a random order until we had enough responses to divide into the control and CSAQ panels. Of the outstanding companies, 201 were telephoned and asked a reduced screener questionnaire consisting only of the eligibility criteria. The remaining 48 companies were not contacted. In all analyses, we assume that the 48 companies not contacted would have provided similar responses as those companies contacted by telephone.

Using the screener data (both mail and telephone), 208 companies were interested and eligible. Eight of these were randomly deleted, leaving 200 companies to sort and sample for the 1994 R&D CSAQ test. Because companies which responded to the screener via mail might have a different reporting pattern with a CSAQ than those companies that responded via follow-up phone calls, the mail/phone distinction was recorded. In addition, the version of DOS was frequently not reported, adding a degree of uncertainty regarding the ability of those companies to execute the software. Therefore, we created four groups (mail case and version of DOS reported, mail case and version of DOS not reported, telephone case and version of DOS reported, and telephone case and version of DOS not reported). Within each group, a random number was assigned to each record. The records were sorted by random number and each group was split in half. One half was assigned to the CSAQ panel; the other was assigned to the control panel. The 100 CSAQ panel companies received the CSAQ and the 100 control panel companies received the paper questionnaire.

6.   Description of the R&D CSAQ Instrument

The R&D CSAQ contained two main sections: the PEDRO operating system and the CASES instrument. Even with data compression, three high density diskettes were needed to save the entire system. To use the CSAQ, the three diskettes had to be installed on the hard drive of the computer where the questionnaire would be completed. Only one person could use the CSAQ at a time. This was a problem with this CSAQ, because once the data were copied to a diskette and the instrument was de-installed, the CSAQ could not be reinstalled to access the data that were originally entered. However, these companies could have followed the instructions in the User's Guide for installation on their Local Area Network (LAN), if they had a LAN. Under the LAN scenario, more than one person could access the CSAQ.

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The instrument ran in a DOS environment, so a mouse did not work. During the development phase at the Census Bureau, we estimated that it would take approximately 10 minutes to install the system. However, there was some variability in this installation time and thus we did not provide the CSAQ panel with a time estimate for installation. After installation, the PEDRO menu was the first menu to appear. The PEDRO menu allowed for selection of the CSAQ survey, installation and de-installation of the CSAQ, creation of the transmission file, electronic communication to the RDE spaces at EIA, and printing of the questionnaire. The questionnaire could be printed both before and after data were entered. The printout's font and layout were different than the screen's, but the question wording, which followed the RD-1S questions, was identical on both the printout and screen. Any data entered onto the CSAQ appeared on the printout next to the corresponding question.

One menu item on the PEDRO menu was the RD1S CASES CSAQ. Because there was no ability to point and click on menu items, the user had to key the number or letter corresponding to the menu item and hit enter or highlight the selection and press enter. The introductory CASES CSAQ screens contained information about the R&D CSAQ, a list of suggested reading help items, and name and address verification and operational status questions. Next, the Main Menu appeared. From the Main Menu, the respondent could select the "Survey and CSAQ Information" item and arrive at a submenu of the following selections: (A) General Survey Information, (B) CSAQ Information, and (C) PEDRO Information. By selecting any of these three, a third level menu would appear with detailed topics about each of these categories. These same help screens could be accessed also by pressing the F1 function key. In addition to the general help information accessible from the Main Menu and F1, the respondent could access item specific help by entering "h" at any item.

Once at the Main Menu, the respondent could select the first question item and the instrument would advance the respondent automatically through the entire questionnaire. Also, on the Main Menu, the respondent could select any of the survey question items and directly go to that item. Questions pertaining to each item were asked on the screens and the respondent answered them accordingly. All questions in a screen had to be filled-in before proceeding to the next screen. However, at any item, the respondent could hit the F10 function key to return to the Main Menu, from where items could be skipped.

Within the instrument, if the respondent did not know an answer, (s)he was informed to place a "d" in the space. These "d's" could be completed at a later date when the respondent knew the answer. Automatic totals appeared as respondents entered parts of a sum. Each question item had one or more screens associated with it. Since the mouse did not work, to go to a particular screen from the Main Menu, the respondent had to key the letter associated with the screen and hit enter. The arrow keys did not work either due to a CASES restriction, and the respondent could only use some designated function keys and the enter key. After completing information on one screen, the respondent had to enter an "S" to save and move to the next screen.

Data entry could produce two types of messages. First, if the data did not pass specific field edits, such as range, numeric, alphabetic, etc. an error message appeared at the bottom of the screen immediately upon data entry of that field. Second, once the respondent hit "S", edits were run on

the entered data on that screen. There were 29 internal edits programmed. If entered data failed an edit, a pop-up screen appeared showing the inconsistency. Respondents were asked to identify and change data as needed or to record a reason for the discrepancy if the data reported were correct.

In addition to the R&D questions, there was also a menu item with an Evaluation Questionnaire. The questions on the evaluation section appear in Attachment C. This evaluation asked the respondent a number of questions rating different aspects of the CSAQ system. If the respondent did not complete the evaluation, before exiting the instrument, the respondent was prompted whether or not (s)he wanted to complete the evaluation. Regardless of the evaluation response, the respondent was asked to keep track and record within the instrument the amount of time it took to complete the entire CSAQ procedure.

Also available within the CSAQ was a feature that allowed respondents to import data from a predefined file directly into the instrument. Instructions were available at the first CASES CSAQ menu. To use this option the respondent was asked to create a flat ASCII file with the data in a particular format. Once the file was created, the respondent had to enter the CSAQ, select the import alternative and provide the location of the ASCII file. The edit function with the import feature was not fully developed. If the respondent imported data, to invoke the edits, the respondent had to go through each screen of the CSAQ, which now contained the imported data.

On the Main Menu, the word "Completed" appeared next to each menu item as it was finished. The respondent could not exit the CSAQ completely until the mandatory[5] items were answered. Even so, an option of exiting temporarily was provided so the respondent could come back after gathering necessary data or any other possibilities. Once the questionnaire was completed or the minimum exit requirements were met, the respondent was allowed to either electronically transmit the data to the RDE spaces at EIA using an 800 number or copy the data to a diskette to then mail directly to the BOC. To electronically transmit the data, a modem with 1200 or 2400 Baud Rate was required. After either copying the data to a diskette or transmitting the data, the respondent had to de-install the system off their hard drive and manually change their autoexec.bat and config.sys files back to the original status because the installation process altered these files.

7.   CSAQ Instrument and Material

A CSAQ mail package was sent to each of the 100 companies in the CSAQ panel. The cost of each CSAQ mailout package was $3.86. This cost is divided between the diskettes and the mailing envelopes. The 3.5" high density diskettes cost $0.66 each, for a total of $1.98 for the three diskettes per company. Each outgoing First Class board mailer envelope cost $0.90 and each 5¼" diskette mailer return envelope cost $0.98.

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[5]   The R&D Survey is a mandatory survey, but only four items on the questionnaire have the mandatory authority. For the remaining items, response is voluntary.

The mail package was sent through the U.S. Postal First Class Mail. The total postage for the R&D CSAQ for 1995 was $451, including the 100 Password letters (certified mail/return receipt) cost of $252 and the 100 CSAQ packages mail and return cost of $199.   The total cost for the CSAQ material and mailing was $837; thus, the average cost was $8.37 per company.

The CSAQ mail package contained the following material:

(1) 1 PEDRO Operating System Diskette (This diskette was slightly different for each respondent since it contained a unique encryption key and account information for the particular respondent. The label for this diskette contained the Census File Number (CFN) of the respondent.)

(2) 1 Arbiter Communications Diskette (This diskette was the same for all companies in the R&D CSAQ test.)

(3) 1 Diskette containing R&D Survey CASES instrument, CASES software, and previous period data specific to a company in the CSAQ panel. (This diskette was unique for each CSAQ company. The label for this diskette contained the CFN of the respondent.)

(4) One-page CSAQ Quick Guide (It contained installation/de-installation instructions.)

(5) PEDRO/R&D Survey CSAQ User's Guide (An eleven page paper copy.)

(6) Sample R&D Survey Paper Questionnaire with the word "SAMPLE" stamped on it (This was the last page of the User's Guide)

(7) R&D Survey CSAQ Transmittal Letters (one from the National Science Foundation and one from the Bureau of the Census)

(8) Labeled 5¼" diskette mailer return envelope (The three diskettes were inserted into this for added protection within the outgoing envelope.)

8.   Processing for the CSAQ and Control Panels

The CSAQ mail packages were mailed out from headquarters on February 22, 1995 to the 100 selected companies in the CSAQ panel. The paper questionnaires were mailed to the 100 control panel companies on the same date, out of Jeffersonville, Indiana. The mailout for the 2,092 regular R&D companies not in the test was completed at Jeffersonville in late February through early March.

In addition to the package containing the information described in Section 7, a letter was sent separately to the 100 CSAQ companies via Certified Mail/Return Receipt. This letter contained two passwords assigned to the respondent to gain access to the PEDRO software and their

remote disk environment (RDE) space on the EIA's mainframe. This separate mailing ensured the security of the data and the EIA RDE spaces.

The packages containing the diskettes were 100 percent verified to assure completeness of the package and the confidentiality of the respondent's data. The data on the diskette, the diskette label, and the diskette mailer label were matched. The passwords assigned were verified also. Then, all diskettes were checked for ability to install and access the RDE space. Immediately prior to mailout, the diskettes were checked for viruses. This was time consuming and probably would not be accomplished in this manner in production, but it assured us accurate packages/diskettes. As a result, no remails occurred because of package or diskette problems. All CSAQ packages were mailed to the correct address. One remail did occur, because the correct person did not receive the CSAQ package. It was later discovered that the R&D survey usual contact person, instead of the person who responded to the screener, received the original CSAQ package. One CSAQ panel company should not have received the CSAQ because they were out-of-scope.

The mailout operations, verification, and package contents for the control group were the same as for the regular R&D survey paper mail packages. The cover letter included in the initial mailout for the control panel had an added request for the respondents to keep track of the hours that everyone in their company spent in reading the survey instructions, gathering the data, and completing the questionnaire. The cover letter in the regular R&D survey mail packages did not include this request.

Mail follow-up letters tailored specifically for either the CSAQ or the control panel were sent to the CSAQ and control panel nonrespondents approximately 30 days and 60 days after the initial mailout. The first mail follow-up for the control and CSAQ cases was completed on April 3. There were 80 control nonrespondents and 89 CSAQ nonrespondents. The second mail follow-up letters for the R&D CSAQ and control panels were mailed on May 3. There were 71 CSAQ nonrespondents and 57 control nonrespondents.

After 112 days from the initial mailout, a R&D paper questionnaire (RD-1S) and a follow-up letter (RD-1Q-L4 or RD-1C-L4) tailored specifically for either the CSAQ or the control panel were mailed to the CSAQ and control panel nonrespondents, ending the CSAQ test.[6] This third and final mail follow-up was completed on June 14th. There were 26 control nonrespondents and 40 CSAQ nonrespondents. The CSAQ test officially ended June 20th, five business days after the final follow-up. This allowed us time to receive a CSAQ instrument or paper questionnaire mailed on or before June 14th.

All the follow-up letters were sent from Jeffersonville. For the regular R&D cases, a follow-up letter should have been sent at 30 days and a replacement questionnaire at 60 days after mailout. Since the R&D questionnaires were originally mailed in a scattered fashion for the regular R&D cases, the first mail follow-up was cancelled for the regular R&D cases. The regular R&D cases

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[6] During planning, we estimated that the paper questionnaire would be mailed 90 days after the initial mailout.

were sent a replacement questionnaire after 60 days. In contrast, the two test panels were sent follow-up letters at 30 and 60 days and then a replacement questionnaire at 112 days. This does not affect the test, since both the control and CSAQ panels had identical mailings of follow-up letters and replacement questionnaires. Thus, we can make comparisons between the CSAQ and control panels, but any other response rate comparisons to the universe are not appropriate.

9.   Results

This section provides analyses needed to address each of the five R&D CSAQ goals as stated in the Research Plan (Sedivi and Sweet, 1995). The following five questions were to be answered by this pilot-test:

1. Can the BOC easily create the PEDRO/CASES CSAQ?
2. Are respondents interested and able to run the PEDRO/CASES CSAQ in their PC environment?
3. Can respondents complete the PEDRO/CASES CSAQ without difficulty?
4. Do respondents prefer the CSAQ over a paper questionnaire for reporting?
5. Does the CSAQ impose a greater burden on the respondent in comparison with paper questionnaire reporting?

Answering these questions enables us to compare a CSAQ to a paper/pencil questionnaire in terms of data quality, reduced respondent burden, cost savings, and timeliness.

9.1.   Creation of the PEDRO/CASES CSAQ

(a)   Development Time

Development and internal testing of the 1994 PEDRO/CASES R&D CSAQ took a little over six months, from August 1994 when Ellen Soper the CASES author from TMO began working on the project to mid-February 1995 when comments from the final internal test were incorporated. There were no formalized specifications prepared for this CSAQ. The CASES author, using a copy of the draft 1994 R&D questionnaire and instructions as a guide, in addition to consultations with the R&D subject matter analysts, produced a computerized questionnaire that followed the same format as the paper version. At the same time, working with Ellen and Science Applications International Corporation (SAIC), the contractor that developed the PEDRO system for EIA, Diane Schapira from CASIC worked on integrating the PEDRO menuing/installation/de-installation/communication system with CASES.

The R&D CSAQ Test Group (members are listed on Attachment D, Page 1) met weekly during the fall of 1994 through early 1995 to review the instrument and discuss the progress on other test related issues. Oral and periodically written comments were provided to Ellen and Diane at these meetings. The group developed the write-ups for the CSAQ instructions and help screens, and the User's Guide. They also worked on the screener and evaluation questionnaire, discussed the appropriate edits and error messages to include in the CSAQ, worked on the selection, mailout and processing of the screener questionnaire cases from which the CSAQ and control cases were selected, developed appropriate mail correspondence for the test panels, including follow-up operations, and conducted three formal internal tests of the CSAQ. This process went smoothly. Comments were incorporated or discussions resulted when particular comments were not used. The turn around time was quick, usually within a week, and communications continued not only at the formal meetings but through electronic mail (e-mail) and telephone calls. After the CSAQ was completed, arrangements were made to duplicate the 300 diskettes (100 PEDRO, 100 Arbiter, and 100 R&D CASES) at headquarters.

The schedule that lists the detail of all activities involved in the test is provided in Attachment E. Barbara Sedivi (CASIC) determined the schedule and assigned tasks with the corresponding divisions approval. The schedule was followed fairly accurately, with deviations of one month in some instances. The date in parenthesis for each item on the schedule is the completion or estimated date of completion based on the last revised schedule, dated November 15, 1994. There were 94 items on the November 15th schedule compared with only 28 matching items on the earliest schedule dated June 24th. The [*] for some items on Attachment E denotes those items that matched on the two schedules. As seen in other projects, this increase in items demonstrates that not all the tasks are apparent at the beginning of a project and that details are filled in by the team as the project progresses. It also illustrates the involvement of the project. In designing the schedule, Barbara had experience in survey production. There also was no turnover of the two key programmers, Diane and Ellen.

Given this, we would like to contrast the development time for the 1994 R&D PEDRO/CASES CSAQ with that of the 1993 COS CLIPPER/C CSAQ developed by Washington Publishing Company. First note that the COS CSAQ did not include an electronic evaluation questionnaire and did not offer importing capabilities as did the R&D CSAQ. In addition, the R&D and COS questionnaires are very different in the type of data collected, but both are considered relatively simple questionnaires. Furthermore, WPC was in charge of developing a customized CSAQ for the one survey only, while the in-house project intended to develop in addition a generic CSAQ system that could be easily used by other surveys once the CSAQ screens particular to the new survey were developed. Comparing this in-house project to the COS CSAQ project, we find that the COS CSAQ process of development and testing took longer than the R&D CSAQ. "The Washington Publishing Company (WPC) started work on August 1, 1993 and provided the final instrument in the beginning of March 1994. This is a total of 7 months. The development of specifications took approximately 4 months, starting in April 1993 and ending July 30, 1993." (Ramos and Sweet, 1995) So, the COS CSAQ development took

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almost a year to complete compared to 6 months for the R&D CSAQ project. One immediate difference between the two processes was the requirement to provide detailed written specifications for the vendor. (The COS CSAQ specifications were approximately 100 pages.) In addition, often communications with the vendor needed to be more formalized and turn around time was slower. Changes and/or additions to the COS CSAQ instrument once the COS development was started were sometimes difficult to obtain from WPC.

(b)   Full Time Equivalents Requirement

We estimate that it took approximately 4 full time equivalents (FTE) to complete this R&D CSAQ test, including development, implementation, and evaluation and approximately 2.6 FTE for development alone. Whereas it took approximately six months to create and test the CSAQ, it took another six months to implement and evaluate the R&D CSAQ test. See Attachment D for the R&D CSAQ Test Staff and FTE analysis. Items accomplished during the development phase included: OMB approval of the screener and evaluation questionnaires; inter-agency agreement and transfer of funds to EIA; development of the security plan; development of an EIA task list for changes to PEDRO; instrument creation and testing; database definitions; development of the research plan; screener questionnaire design, sample selection and mailout of screener cases, telephone follow-up operations for screener nonrespondents, and analysis of responses to identify cases eligible for the test; CSAQ sample selection; and creation of User Guide, letters, and packages. Items accomplished during the implementation phase included: mailout of instrument, password letters, and follow-up letters; answering respondent phone call questions; keeping track of the respondents and nonrespondents; and uploading the database with CSAQ output files. Items accomplished during the evaluation phase included: the statistical analysis and writing of the evaluation documentation; the follow-up telephone calls of the nonrespondent CSAQ companies; and the running of the database through the edit process.

(c)   Cost of the R&D CSAQ Test

Assuming that, including overheads, $100,000 is a reasonable cost estimate per person year, then the FTE cost of the CSAQ development, implementation and evaluation was $400,000. (The FTE cost of development alone was $260,000.) Given that the cost of the PEDRO system and support was $38,200, and that the total cost for the CSAQ material and mailing was $837, the total cost for this test is estimated at $439,037.

Future costs for use of a PEDRO/CASES CSAQ would be greatly reduced because the generalized PEDRO system would already be developed and the basic structure of a CASES CSAQ would already be agreed upon. Only the survey specific item and help screens would need to be coded.

Ellen Soper, Diane Schapira and Greg Fulton (CASIC) were the only BOC personnel creating the R&D CSAQ system. Their development task alone took 0.783 person years,

averaging to a cost of $78,300. That cost plus the $28,700 for the PEDRO system enhancements, can be compared to the $20,000 spent for the COS CSAQ developed by the WPC.[7] However, this was a cost for a one time CSAQ. Any new CSAQ developed by the contractor would result in extra charges. For example, the 1994 ASM CSAQ developed by the WPC cost the BOC another $25,000. In addition, with the WPC CSAQs the BOC still had to take part in the other phases of development, e.g., screening for potential CSAQ cases, creation of letters and user guides, writing specifications and commenting on versions of the CSAQ. These last two items were probably more costly than for the R&D CSAQ development because they had to be formalized. The BOC also had to supply and mail the materials for the COS and ASM tests as well as implement and evaluate the process.

The cost of remailing of diskettes every year, even if some diskettes are re-used, must be considered. The average material and mailout cost for the R&D CSAQ of $8.37 was 9.4 times as high as the average mailout cost of the R&D paper questionnaire of $0.89. Although there might be a bulk rate for diskettes and envelopes which was not available with this test, the average postal rate of $4.51 would not change drastically. The package with the 8.5"x11" User Guide of 11 pages, three diskettes and return envelope was heavy and bulky. (In the COS pilot-test, the materials were sent via Federal Express, which is even more expensive.) Even though the CSAQ eliminates the need for data entry, for the R&D survey this results in only a cost reduction of $1.30 per case. Allowing for this and the paper mailout cost, there is still $6.18 extra per-unit mailing cost that is not compensated for.

(d)   Internal Testing of the CSAQ

Three internal testing phases were completed on the CSAQ instrument prior to mailout. The first phase involved up to 50 Census Bureau employees and a couple of EIA testers. Comments from this first phase were incorporated and problems were remedied. The second phase involved approximately 10 testers who had serious problems in the first phase of testing. Likewise, the third phase involved a subset of the second phase testers.

Comments were obtained from testers at all three stages. A list of possibly correctable problems was composed and reviewed by the team. To the best of the team's ability, all correctable problems were fixed. There were some items that headquarters could not change. Three diskettes were needed to save this CSAQ system. Although we had already been successful in reducing the number of diskettes from five to three, headquarters still feared that willing companies would refuse to use such as system, because three diskettes might have looked intimidating. No respondents cited this as a problem. The BOC also called the CSAQ nonrespondents to determine their reason for nonresponse and none cited problems with the number of diskettes.

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[7] The total cost for PEDRO enhancements was $38,200. Approximately $9,500 of that cost was not related to system development, but rather implementation costs for utilizing EIA mailboxes and PEDRO help desk assistance for respondents.

The PEDRO operating system was not as flexible as we first thought it would be. The team assumed that PEDRO would be like a generic off-the-shelf product, but in reality we had to design the CASES instrument to fit into the PEDRO shell and not vice versa. Thus, the installation for this system was not as smooth as we had anticipated. Among other things, the installation resulted in minor modifications to the autoexec.bat file on the respondents' computers. When the instrument was de-installed, these changes remained. Although this is a standard procedure in most software installations and the changes would not adversely affect the user's computer, a few testers expressed concern about this.

Movement within the screen was also cited as a problem. Except for certain screen movement limitations caused by CASES restrictions, the test group felt that, we had produced the best CSAQ we could within the allotted time. Still, the R&D companies found some problems. These will be discussed in Section 9.4.

9.2.   Identification of Cases Eligible for CSAQ Reporting

(a)   Interest in Using a CSAQ

The first question on the screener questionnaire (Attachment A) asked whether or not the respondent would be willing to use a CSAQ for the 1994 R&D survey. Tallies of responses to the screener are provided in Attachment B. For the screener companies (companies with more than $1 million R&D expenditures in 1992), we found a 68.95 percent overall interest in responding by CSAQ. The percent of R&D companies that mailed in their response and were interested in the CSAQ was 74.68. The percent of R&D screener cases contacted by phone that were interested in the CSAQ was 62.19. See Table 1. There is a significant difference at the 0.10 significance level between these two percents. This means that for this experiment, companies which took the time to return a screener, were often more willing to report via CSAQ than those companies which did not respond by mail and had to be telephoned.

Table 1: Interest in Using a CSAQ for all R&D Screener Respondents

	Mail-Return	Telephoned	Overall %
Interested	74.68% (n=177)	62.19% (n=125)	68.95%
Not Interested	25.32%	37.81%	31.05%
Total	100.0% (n=237)	100.0% (n=201)	100.0% (n=438)

(b)   Hardware and Software Requirements Needed to Use this CSAQ

From the screener, we found that 68.87 percent of R&D companies interested in responding via CSAQ met the necessary hardware and software requirements needed to respond to the proposed CSAQ. Some of the uninterested companies might have been CSAQ capable respondents. For the cases that responded via mail, we did not record any

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hardware/software information provided by uninterested companies. (Very few uninterested companies provided hardware/software information.) For the cases contacted by phone, we only requested the information from interested cases.

Even though the telephone follow-up universe was overall not as interested in using a CSAQ as the mail-return universe (Table 1), we found that of the interested companies, the telephoned companies, at 84 percent, were significantly (.10 significance level) more likely to have the capability to use the proposed CSAQ, than the mail-return companies at 58.19 percent. See Table 2.

Table 2: Capability of Using a CSAQ for Interested R&D Screener Respondents

	Mail-Return	Telephoned	Overall %
Capable	58.19% (n=103)	84.0% (n=105)	68.87%
Not Capable	41.81%	16.0%	31.13%
Total	100.0% (n=177)	100.0% (n=125)	100.0% (n=302)

On the other hand, when we calculated the proportion of all R&D screener respondents that were both interested in CSAQ reporting and were capable (met our requirements), we found that only 47.49 percent of the sample fell in this category. This calculation indicates that given current PEDRO/CASES CSAQ requirements we can only expect approximately 47 percent of the R&D universe to use a CSAQ. The percent for mail-in responses was 43.56 and the percent for companies contacted by phone was 52.24. There was no significant difference (at the 0.10 significance level) in ability to use a CSAQ between the telephone follow-up and mail-return universe. See Table 3.

Table 3: Interest and Capability of Using a CSAQ for all R&D Screener Respondents

	Mail-Return	Telephoned	Overall %
Interested and Capable	43.56% (n=103)	52.24% (n=105)	47.49%
Otherwise	56.44%	47.76%	52.51%
Total	100.0% (n=237)	100.0% (n=201)	100.0% (n=438)

Of the hardware and software requirements needed for this CSAQ system, it appeared that a number of companies failed to have an adequate DOS version and/or random access memory (RAM). From the 302 interested screener respondents, there were thirty-one companies that met all the criteria, except they did not indicate having DOS or did not have a DOS version 5.0 or higher. Twenty-nine companies met all the criteria, except they did not have a minimum of 4 MB of RAM. Three companies only did not have a 3.5 inch, high density disk drive, three other companies had the wrong kind of processor and another three companies did not have the required color/VGA or Super VGA monitor.

9.3   Response Rates for 1994 R&D CSAQ Test

The following response rate analysis uses results from the implementation of the 1994 R&D CSAQ test. Table 4 provides response rates from the CSAQ panel and the control panel. All comparisons are as of June 20, 1995. This is 5 business days after final follow-up letter or approximately 120 days after the initial mailout of the CSAQ and control panel packages, which occurred on February 22. Any CSAQ data that arrived after the 120 days was not included in the final response rate comparison, except those who had requested filing extensions prior to the 120 days. In the CSAQ panel, one case was determined to be out-of-scope for the survey and is

excluded from the tabulations. As can be seen in Table 4, the response rate for on-time CSAQ panel respondents was 52.5[8] percent (52/99), which is significantly lower than the 73 percent control (paper) panel response rate. Only 35.5 percent of the CSAQ panel cases were nonrespondents as of June 20th because 12.5 percent of the cases had requested and returned a completed paper questionnaire. This nonresponse rate is still significantly higher than the 27 percent nonresponse rate for the control panel. Both comparisons were made at the 0.10 level of significance. Reasons for CSAQ panel nonresponse are provided in Section 9.4.

Table 4: Response Rates for the 1994 R&D CSAQ Test as of June 20th, 1995

Mailout	On-time Returns				Non-respondent	Out-of-scope	Total
	CSAQ			Paper			
	Mail-in	Modem	Total				
CSAQ	48	4	52	12	35	1	100
Paper	0	0	0	73	27	0	100
Total			52	85	62	1	200

As of August 1, 1995, of the 35 CSAQ panel nonrespondents, 2 had completed and returned a CSAQ and 15 had completed and returned a paper questionnaire. Of the 27 control panel nonrespondents, 13 had completed and returned a paper questionnaire by August 1st.

(a)   Timeliness of Responses

Figure 1 demonstrates the promptness of the 52 on-time CSAQ respondents compared to the 73 on-time paper respondents. This graph displays the cumulative number of returned questionnaires (CSAQ or paper) separately for the CSAQ and the control panels in two-week intervals from mailout through 3 months. Except for the first month, the control group had a consistently higher response rate than the CSAQ panel.

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[8] There were four CSAQ respondents that returned blank CSAQs. For response rate comparisons these cases are not considered CSAQ respondents. These cases subsequently requested and returned a paper questionnaire and are included in the 12 CSAQ cases that responded via paper. Treating these cases as CSAQ respondents would not have affected the test results.
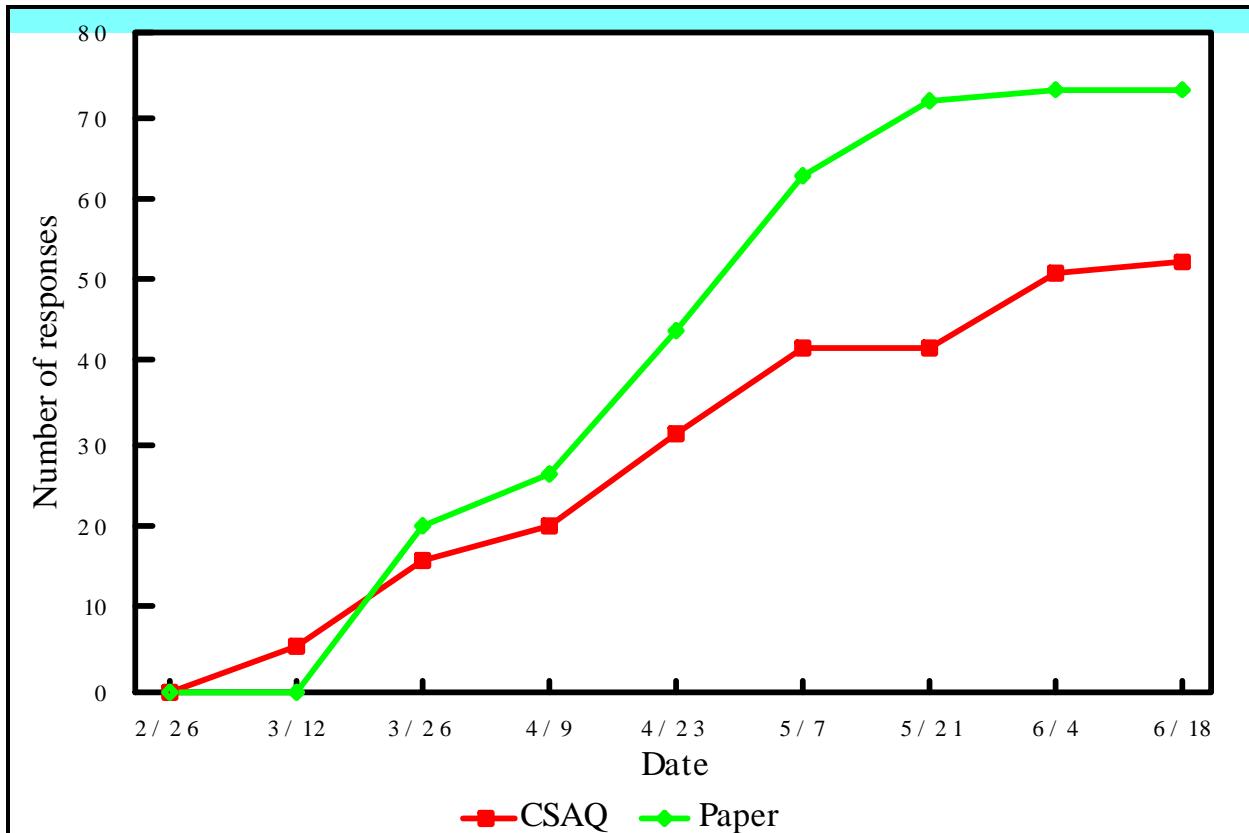
Figure 1 Timeliness of Response

(b)   Completeness of the Questionnaires

The R&D Survey contains both mandatory items and voluntary items. There were only four mandatory items. In Table 5 the amount and type of reporting was documented for the 52 on-time CSAQ respondents and the 73 on-time control respondents. A questionnaire could have all mandatory and some voluntary items recorded, only mandatory items recorded, not all mandatory items recorded but some voluntary items recorded, some mandatory items recorded and no voluntary items recorded, or nothing recorded.

Results documented in Table 5 demonstrate that the percent of companies in the CSAQ and control panels which completed all mandatory items and some voluntary items is not significantly different. Similarly, the percent of companies in the CSAQ and control panels which completed no items is not significantly different. On the other hand, significantly more companies in the control panel completed all or some mandatory items only compared to the CSAQ panel. Conversely, significantly more CSAQ companies completed a combination of some mandatory and some voluntary items than the corresponding control panel companies. Although this implies that CSAQ panel cases were more likely to complete more than just the mandatory items, it also indicates that more CSAQ cases left some mandatory items unanswered. The CSAQ system should not

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have allowed the respondent to exit the instrument completely until all the mandatory items were completed. Eleven CSAQ panel companies, however, managed to copy their data to a diskette before meeting this requirement. Further research is needed to determine how this occurred.

Table 5: Completeness of the Questionnaires by Mandatory/Voluntary Items by Panel

Panel	All Mandatory and at least some Voluntary Items	Only Mandatory Items	Some Mandatory and Some Voluntary Items	Some Mandatory Items only	No items completed	Total
CSAQ	77% (40/52)	0	21% (11/52)	0	2% (1/52)	100%
Control	81% (59/73)	4% (3/73)	10% (7/73)	2.7% (2/73)	2.7% (2/73)	100%
Difference Significant at .10 level?	No	Yes	Yes	Yes	No	N/A

Upon examining the question items (both mandatory and voluntary) completed by both the CSAQ and control panels, we find that the CSAQ panel completed more items. The CSAQ panel averaged 38.19 completed items with a standard error of 1.73 while the control panel averaged 17.89 completed items per case with a standard error of 1.36. These differences are significant. We suspect that some companies in the CSAQ panel reported more items because the default mechanism of the CSAQ instrument advanced the respondent through the electronic questionnaire. Once in a screen, the respondent was likely to answer questions because skipping questions was not an option unless the respondent exited the screen to return to the Main Menu.

It appears that most of the difference is due to more reported zeros by CSAQ respondents. The CSAQ panel averaged approximately 25 zero entries and 13 non-zero entries per case, while the control panel averaged approximately 8 zero entries and 10 non-zero entries per case. This difference on average reported zeroes is significant.

9.4   Difficulty Associated with Completing the PEDRO/CASES CSAQ

(a)   Summary of Problems Associated with the PEDRO/CASES CSAQ

The following lists problems that we did not detect during our development and testing phases. These problems were caught by the respondents and either communicated to the BOC through a help call or reported in the evaluation section of the CSAQ

Insufficient Memory

Six of the eighteen PEDRO help desk calls were from CSAQ panel cases who encountered problems with the computer memory requirements of the CSAQ. Three additional companies commented on the evaluation questionnaire that they had memory problems. When there was insufficient memory, sometimes the respondent could not advance beyond the PEDRO menu. No message appeared saying that insufficient memory was the problem; therefore, respondents had no other option but to call the help desk. After selecting screener respondents with TOTAL system memory (RAM) of 4 MB or higher for the CSAQ test, we expected that this problem normally would not occur. Trying to avoid all occurrences of this potential problem would have placed an undue burden on the screener respondents. It would have required reporting detail such as, how much available memory, existence of a conflicting memory manager, etc. Therefore, we decided to handle the occurrences of this problem via the help desk. This problem was, therefore, not an oversight during development and testing, but one that was expected infrequently and best resolved by the help desk. Some of the respondents in this situation managed to call the help desk and circumvent the problem; others gave up.

Blank Return Diskettes

Four respondents sent back blank diskettes. One of these respondents realized the diskette was blank and completed and returned the sample questionnaire included as an attachment in the User's Guide. The other three respondents thought they had properly copied their data onto the diskette. After conversations with some of these respondents, the CASIC staff determined that if the respondent had insufficient memory, sometimes the function which managed the copying of reported data to a file did not work. CASIC investigated and found that respondents were not notified when the file copy command did not work. This was a result of an unintentional omission in one of the programs used for integrating PEDRO with CASES. Therefore, it appeared to the respondent that the file had been copied even though it had not.

Transmitting the Data by Mail or Modem

Although headquarters found no problem with the data transmitted by modem, three nonrespondents claimed that they had trouble with the electronic transmission. This was never resolved. Headquarters knew that the communications portion of PEDRO would not be used in the future, so resolution of this problem was not given priority. Most likely, the respondent did not read the User's Guide and possibly attempted to transmit at 9600 Baud Rate, which was not acceptable.

One CSAQ company mailed its return package to Jeffersonville instead of to headquarters.

Transferring CSAQ Data to the R&D Survey Database

The output files from the CSAQ were uploaded to the database on a flow basis. There was one problem detected, but this was easily remedied. Blanks were not legitimate characters for the CASES instrument. To take care of this, as the respondents completed the instrument, they were instructed to place a "d" in fields for which they did not know the answer or were not applicable. These "d's" were part of the CSAQ output file, but had to be deleted upon uploading to the database. The problem resulted when an edit check for the uploading detected character data in a numeric field. Other than that problem, the output files uploaded easily to the database.

(b)   Analysis of CSAQ Panel Nonrespondents

Approximately two weeks after the third mail follow-up, an analyst from MCD contacted the CSAQ panel nonrespondents by telephone to determine their reason for nonresponse. Although there were 35 nonrespondents as of June 20th, by the time the telephone calls were being made, three companies had responded, so only 32 nonrespondent companies were contacted. Data were not requested from the nonrespondents during this telephone call. Instead reasons for nonresponse were collected. The following summarizes the results of the telephone calls made to the CSAQ nonrespondents.

Reason for Nonresponse (CSAQ Panel)		Number of Companies
Time (13)		
Have not had a chance to complete the instrument		11
Were given an extension		1
Mailed the diskette late (verified at headquarters)		1
Hardware/Software Problems (5)		
Modem return did not work		3
Errors running the instrument	1	
Unable to print the instructions		1
Perception Problem with CSAQ (5)		
Using the computer would make it more difficult		4
Company policy not to download and send by diskette		1
Did not meet Hardware Requirements (3)		
No access to a computer		2
Not the correct computer (they have a Macintosh)		1
Lack of Interest in Survey (4)		
Does not recall the reason or the survey		4
Company Change (2)		
Company bankrupt		1
Bought by a company		1
Total		32

Eleven of the nonrespondents (35 percent of the CSAQ panel nonrespondents or 11 percent of the mailed CSAQ cases) simply had not gotten around to completing the instrument. One company had a time extension and another mailed the disk but it arrived after the test cut-off date. This is not necessarily a CSAQ problem (recall that the control panel had 27 nonrespondents at this time), unless the CSAQ itself looked daunting enough to put it aside. These nonrespondents were probed about this issue directly. None of the eleven claimed that the CSAQ looked like a lot of work.

Five other companies had hardware/software problems with the CSAQ instrument; three of them claimed that the modem transmission did not work. Five companies had perception problems with the CSAQ instrument; four of them thought the computer was more difficult to use and one had a policy not to send data via diskette. Three other companies did not meet the hardware requirements and should not have received the CSAQ. From the remaining nonrespondents, four lacked interest in the survey altogether and two had undergone some type of company change that resulted in nonresponse.

In general, we can say that 10 percent of the CSAQ panel (31 percent of the nonrespondents) did not respond due to either hardware/software problems that actually prevented them from using the CSAQ or due to perception problems with the CSAQ.

(c)   Help Calls

During the R&D CSAQ test, there were two help desks. One was staffed by MCD personnel from the BOC and the other by EIA personnel. Neither help desks had 800 numbers. Respondents were to call these help desks if they had questions. The EIA help desk focused on problems with the PEDRO menuing, installation, de-installation, and communications system, while the BOC received calls concerning all other problems. A log of help desk calls from CSAQ recipients was maintained, categorized, and totalled by the two staffs. Examples of data recorded include date of call, time of call, company calling, person calling, kind of problem, and how it was resolved.

The PEDRO staff at EIA documented 18 phone calls requesting help. The PEDRO staff at EIA failed to log the time spent on each call. Two of the phone calls were from the same company. Six of the problem calls occurred because the respondents' computer did not have enough RAM available. The instrument locked-up for two other companies. Of these eight respondents, six returned a completed CSAQ. Two other companies called to report trouble with printing; these companies were ultimately nonrespondents.

Thirty-two calls and one letter by mail were recorded at the BOC help desk. These calls lasted approximately 4.31 minutes each. The calls primarily concerned the CASES instrument. Some companies were in contact more than once. Often the MCD contact person had to make a follow-up call on a previous help call placed by a company. Thus of the 33 contacts (32 calls and one letter), only 24 companies were in direct communication with the BOC.

Nine of these calls concerned CSAQ companies requesting paper forms. Some reasons for requesting a paper questionnaire included: did not have time to do it, computer problems (not correct DOS version or only have Macintosh computers), person who completed the screener is not the person who completes the survey, against company policy, consolidation problems, and installation was too intimidating.
Four other companies returned a blank diskette. MCD called them concerning their problems with the CSAQ. One of the four filled out and returned the sample form at the back of the User Guide; the other three blank diskette companies were subsequently

mailed a paper form. See the <u>Blank Return Diskette</u> discussion in Section 9.4.a for further details. That makes 12 companies in the CSAQ panel that were sent paper forms.

Four companies received a follow-up letter and called to make sure we had received their CSAQ, which we had. Two calls were referred to Diane Schapira, the PEDRO programmer in CASIC.

Table 6 provides a breakdown of response outcomes for the CSAQ panel help calls.

Table 6:   Outcome of CSAQ Panel Help Calls

	EIA	BOC
Total Number of Companies Making at least One Help Call	17	24
Returned CSAQ by Mail	8	5
Returned CSAQ by Modem	1	2
Returned CSAQ Late by Mail	0	1
Returned Paper Form	3	9
Nonrespondent as of June 20th	4	7
Missing	1	0

There is some overlap between companies that called the EIA and BOC. The three companies that called EIA for assistance and returned a paper form via mail, also called the BOC help desk and are included in the 9 listed under the BOC as well. Comparing Table 4 to Table 6 we can observe that although twelve CSAQ cases eventually reported on-time by paper, only 9 of them either called the BOC to request a paper form or were called by the BOC and mailed a form. Thus, three companies somehow managed to send in a paper form on-time without headquarters documenting their reason for not completing a CSAQ.

9.5   Evaluation of the CSAQ by CSAQ Panel Respondents

Responses to the evaluation questionnaire, which was built into the CSAQ instrument, are provided in Attachment C. Forty-two of the fifty-two on-time CSAQ respondents completed at least some of the CSAQ evaluation questions. The following summarizes the responses from these 42 on-time respondents to the questions which relate to the ease and/or difficulty of the CSAQ instrument.

(a)   General Feedback from the Evaluation Questionnaire on the CSAQ System

There were two questions in the evaluation section that asked about the entire CSAQ system. Question 1 asked, "In general, how satisfied were you with the CSAQ reporting system?" None of the on-time CSAQ respondents who completed the evaluation were very dissatisfied. Approximately, 76 percent were either satisfied or very satisfied with the entire CSAQ system.

Question 3.1 asked to rate the entire system in terms of ease or difficulty. Only one respondent claimed the overall system was difficult, while 62 percent indicated it was easy and 36 percent chose the neutral response. Areas that were noted as easier include "Entering data," "Moving between screens," "Changing answers," and "Exiting." Problem areas seemed to be "Moving within a screen" and "Backing up." The categories of "Resolving Errors" and "Making Comments" were neither particularly easy or difficult. Although many respondents found "Re-entry" easy; a number of respondents did not.

Respondents were also allowed open remarks. Questions 9, 10, and 11 asked respectively about what respondents liked least, most, and any improvements they might suggest.

Twenty-two or 81 percent of the twenty-seven respondents that answered Question 10, "What did you like most" claimed that the system was easy. A few companies claimed that they liked having last year's numbers available to easily change. Two companies liked the concept of electronically filing their data. One company said that the CSAQ did not take any longer than completing a neat paper version; another company claimed that they could have done it in half the time with a paper version.

Navigation (eg., need for Windows) was the complaint most often noted in Question 9, "What did you like least". Other comments included "too many menu levels" and "difficult printing." Four companies complained about the time it took to complete the instrument. Two companies claimed that more than one person enters the survey data. For this CSAQ the instrument needed to be installed on a local area network if more than one person needed to access and use it. Modifications made by the installation program to the computer's autoexec.bat file, the amount of computer memory needed, as well as the lack of wrap-around dialog boxes were also noted as problems.

A Windows-Based product was the most frequently suggested improvement on the Evaluation Questionnaire. Cursor movement within the screen and between screens was difficult for many. There was no capability for point and click and, in fact, a question had

to be answered before proceeding to the next question. The enter key had to be used to save each data entry. If the arrow key was used, data disappeared. This proved frustrating for a few companies. Other companies did not like that they could not leave a question blank and return to it later. They had to enter a "d" for do not know and then come back to it at a later time. It seems that respondents feel that a Windows-based product would solve many of these problems.

Two companies wanted better printing functionality. Two respondents commented that they would have liked wrap-around dialog boxes. Faster modem speed capability, transmissions via the Internet, better edit features, and fewer levels of menuing were all cited once.

(b)   Feedback from the Evaluation Questionnaire on the Help Features

Less than half of the respondents who completed the CSAQ evaluation reported using any of the HELP features that were built into the CSAQ. However, for those that used a HELP feature, most found it very useful. Use of the HELP features does not necessarily mean that the instrument was difficult to use, but does indicate that the instrument included the necessary feature help screens. The experience of not using the HELP features was also documented in the evaluation of the COS CSAQ. (Ramos and Sweet, 1995) This tells us that for electronic forms, as we already know for paper forms, if we want the respondent to know certain parameters or special instructions about an item we should include it as part of the questionnaire screens and not rely on help screens or instruction manuals.

9.6.   Respondent Preference: Paper or CSAQ

We estimated from the screener questionnaire that approximately 47 percent of the R&D universe would be willing and had the computer capability to report via CSAQ using the present system. From this test, we estimated that approximately 53 percent of willing and capable respondents would fully complete and return such a CSAQ instrument and, as we mention in (b) below, about 81 percent of them would choose a CSAQ in the future. Using these figures, we have estimated that approximately 20 percent (.47*.53*.81=.20) of the R&D universe that has over $1 million in R&D would want a CSAQ like the present system, possess the capability to complete it, and would actually complete it. We have determined this percent from the screener questionnaire, the R&D test results, and the evaluation questionnaire.

(a)   Feedback from the Screener Questionnaire

Question 1 of the screener asked if the respondent would be willing to report via CSAQ for the 1994 R&D survey. Of the 438 screener respondents, 124 or 28 percent said no, i.e., they preferred paper. These persons were probed as to the reason for their disinterest.

Of these 124 cases not interested, 115 provided a reason. The reason most reported (35 of the 115) was that the CSAQ would not be any easier than a paper form.

From the screener responses, we estimate then that 69 percent of R&D screener companies would be interested in a CSAQ, 3 percent are unsure of their interest, and for the 28 percent not interested, 8 percent would pick a paper form because they think it is easier, and another 20 percent also would choose a paper form for other reasons or no reason indicated. Refer to Attachment B.

(b)   Feedback from the Evaluation Questionnaire

Evaluation Question 12a asked the respondent what medium (paper or CSAQ) (s)he would choose in the future. Refer to Attachment C, page 9. About 81 percent, 34 of the 42 on-time CSAQ respondents that completed the evaluation, claimed that they would choose a CSAQ. Evaluation Question 12b asks the reason why they picked that medium. Most of the evaluation questionnaire respondents who picked a CSAQ in Question 12A claimed that it was easier and many said it would take less time. Similarly, the respondents who picked paper over CSAQ reporting in Question 12A on the evaluation questionnaire also maintained that the paper would be easier and would take less time. Respondents who chose CSAQs, however, also thought the instrument was more interesting and a few claimed that the reported data were more accurate. None of the respondents who indicated preference for paper reporting on the evaluation questionnaire claimed either of these two reasons for preferring paper.

The seven CSAQ respondents who indicated preference for paper questionnaire over a CSAQ said they thought the paper form would take less time. Given this, one would assume that these respondents probably spent more time on the CSAQ than the other 34 respondents who would choose a CSAQ. Ironically, using burden hour data described in Section 9.7.d, these seven respondents spent on average 2.57 hours to complete the CSAQ. This is significantly less (a t test with an $\alpha=0.10$) than the average 4.91 hours the other 34 respondents spent.

Using a log-linear model and treating the respondent's preference (paper or CSAQ) as our response variable, we found three variables listed in evaluation questions 1-3 of Attachment C significant using an $\alpha=0.10$. Not surprisingly, we found a relationship between satisfaction with the CSAQ (Question 1) and the respondent's preference. Respondents who were dissatisfied with the CSAQ were more likely to prefer paper, while respondents who were very satisfied, satisfied or had neutral response were more likely to prefer the CSAQ. We also found that respondents who had trouble installing the CSAQ (Question 2.1) were significantly less likely to choose a CSAQ in the future. Likewise, respondents who had difficulty in moving between screens (Question 3.3) were also significantly less likely to chose a CSAQ.

9.7.   Respondent Burden

Four items related either to measuring respondent burden or reducing respondent burden are examined in this section. The edit failure rate for the control and CSAQ panels, as well as the burden hours for each panel are compared. We also document the use of electronic transmissions and data importing functions.

9.7.1 Edit Failures

One of the advertised CSAQ advantages is that edits can be programmed into the instrument. As a result of this function, respondents are prompted to reexamine data that fails an edit while completing the CSAQ. This R&D CSAQ edit system allowed respondents to either change their answers or enter a note explaining that although the data failed the edit, it should be considered correct. When CSAQ data are received at headquarters, they are run through the regular edits along with the data from the paper questionnaires.

While the edits programmed into the CSAQ instrument promote higher data quality, the extra work involved for the respondent might be seen as added burden. On the other hand, edit failures detected from paper questionnaires often result in telephone follow-ups to clarify the data with the respondent. This can also be viewed as another form of respondent burden. We compared the burden associated with the CSAQ and control panels by comparing the proportion of edit failures, the follow-up phone calls conducted and the burden hour estimates provided by these respondents. We expected that if CSAQ resulted in higher data quality, this would lead to a decrease in edit failures at headquarters and the corresponding telephone follow-ups. Although, we intended to track and compare follow-up calls rectifying edit failures for the CSAQ and control panels, the resources were not available to accomplish this task in the time needed for this evaluation. Because there would have been so few calls made for both the control and CSAQ panels, (most of the edit failure rectifications would have been made without a phone call), this data would not have influenced our ultimate recommendation.

(a)   Edit Failures Detected by the CSAQ Instrument

There were 29 edits performed within the CSAQ. It was hoped that if the respondent caught the errors while (s)he was entering the information, then the respondent could quickly correct the error. This is touted as an advantage for both the respondent (no phone calls from headquarters at a later date) and for headquarters (accurate data). Twenty of these 29 edits are run again at headquarters and the remaining nine are new edits, run only within the CSAQ. Six of the nine new edits fail if the prior year data are missing. If this happens, the respondent is asked whether they want to fill in the prior year data. The respondent can respond yes or leave alone (i.e., no).

Within the CSAQ, edits pertaining to the question(s) on the screen were run once the respondent requested to go to the next screen by keying "S" for save. If entered data failed the edit check, a pop-up menu offered the respondent the opportunity to change any items involved, or leave the data alone and write a short note explaining why the data was correct. If data was changed, the edit was run again.

Attachment F, Pages 1 and 2 provide the results of the edit checks performed within the CSAQ instrument. Documented are the results for the 52 on-time CSAQ respondents for each of the 29 edits. Page 1 provides the results for the 20 edits which are performed again at headquarters. Page 2 provides the results for the nine new edits built into the instrument. The results for each edit check have been collapsed into one of four possible categories. These include a "no edit failure" category, a category of "leave alone" where data failed an edit, but the respondent noted that the data were correct, a category of "change data" where data failed the edit and the respondent subsequently corrected the data, and a category of "change data and leave alone" where data failed the edit, the respondent corrected the data, it failed again and then the respondent noted that the changed data were correct.

From Page 1 of Attachment F we observe that only three percent of the edits that are normally run at headquarters resulted in CSAQ edit failures and of that only one percent of the edit failures resulted in changes to the reported data. On the other hand, from Page 2 of Attachment F, we observe that 40 percent of the new edits included on the CSAQ resulted in edit failures. Of these, 14 percent of failures caused respondents to make changes to reported data. Most of these failures and resulting data changes involved prior year information. Given that corrections to prior year data are used to update R&D Survey published prior year estimates, we can conclude that the additional edits contribute to the overall data accuracy of the R&D Survey. On the other hand, there were 26 percent failures for the new edits that only resulted in respondents indicating to leave the existing data alone. The necessity for these new edits should be re-examined to assess if this extra burden to the respondents is acceptable. This decision would depend in part on whether or not explanations were provided for the discrepancies that resulted in edit failures, and if these explanations prevented any more contacts with the respondents.

(b)   Edit Failures Detected at Headquarters

We compared the average number of edit failures generated from the regular R&D survey data edits run at headquarters for the CSAQ and control panels. The edits run at headquarters are divided into three types: balance, inter-item, and logical. There are 18 balance tests, 47 inter-item tests, and 3 logical tests. Logical edits are a misnomer. They are not true edit failures. They instead warn the BOC analyst to examine company status items. These edits were not built into the CSAQ system, because the respondent does not have to change anything. Balance edits make sure that the sum of the parts equals the total. These edits fail if the respondent does not total items, if the respondent totals them inaccurately, or if the items were keyed inaccurately. Most of the balance edits were automatically performed in the CSAQ system. They were not called edits and therefore, they are not referenced in Attachment F. Inter-item edits compare one item to another, sometimes the same item in the prior year, and flag unreasonable relationships. Some, but not all, of the inter-item edits performed at headquarters were programmed into the R&D CSAQ. This was a subject matter/programmer decision. Ideally, all headquarter edits should have been included.

The 52 CSAQ and 73 paper on-time cases were run through the edit process at headquarters. Table 7 demonstrates that the proportion of edit failures in the paper panel was significantly higher than those edit failures in the CSAQ panel. Over half of headquarters' edit failures in the CSAQ panel originated from edits that were not built into the CSAQ. Logical edit failure rates are not included. Four balance edits that were programmed into the CSAQ failed. An inter-item edit that was programmed into the CSAQ failed for one respondent, but (s)he noted that the data were correct.

Table 7: Counts of Edit Failures Detected at Headquarters

Edit Failure Type	CSAQ			Paper
	Edits programmed into the CSAQ	Edits not programmed into the CSAQ	Total	Total
Balance	4	2	11.5% (6/52)	31.5% (23/73)
Inter-item	1	5	11.5% (6/52)	7% (5/73)
Total	10% (5/52)	13% (7/52)	23% (12/52)	38% (28/73)

9.7.2 Burden Hours

Both the CSAQ and the control panels were asked to keep track of their **total** time to complete the survey including preparation/gathering of data and reading instructions. They were to include the total amount of time required by all persons involved in these activities. Additionally, we asked the CSAQ panel for an optional percentage breakout of time spent on each of the following activities: (1) installing the computerized system, (2) reading the instruction manual and learning how to use the computerized system, (3) collecting the necessary information, and (4) completing the computerized questionnaire. The control panel was asked for percentages associated with (2)-(4), where 4 refers to the paper questionnaire.

(a)   CSAQ Panel Burden Hours

Fifty-one on-time CSAQ respondents took an average number of 4 hours with a standard deviation of 5.82 to complete the survey.[9] This is significantly less than the 20 burden hours associated with the R&D survey in the OMB package, using a 0.10 significance level.

Using data provided in Table 8, we find that for the CSAQ respondents, most of their time (approximately 42 percent) was spent gathering data; something both paper and CSAQ respondents have to do. The task that took the second longest was installing the computerized system.

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[9] One respondent did not complete the burden hour question.

Table 8: Distribution of Time Spent on CSAQ Respondent Activities

Respondent Activities	Percent of time	Standard Error
(1) install the computerized system	23.2% 15.2	
(2) read the instruction manual and learn how to use the computerized system	17.6%	11.2
(3) collect the necessary information	41.5%	22.4
(4) complete the computerized questionnaire	17.7%	10.3

In addition to the respondent estimates of time, the CSAQ instrument logged the amount of time it was "operating." The number of minutes was tracked from login to logout. From the 52 CSAQs that were returned on-time, we found the CSAQ instrument was "operating" an average of 85.69 minutes with a standard deviation of 94.3. So, with a 5 percent error margin, the CSAQ instrument was "operating" an average of 1.5 hours ± 3 hours. This is in keeping with the respondents self-assessment of the length of time it took them to complete the questionnaire. However, one should not rely heavily on this data as a comparison to the self-assessment because the login-logout time could reflect different scenarios. Possible examples include the following:

(a) The respondent may be logged in and leave the PC to go to lunch, meeting, answer a phone call, etc.

(b) The respondent may start experimenting/playing with the CSAQ because it is new, interesting, and fun.

(c) The respondent may allow someone else to try the CSAQ out of curiosity.

(d) The first time using the CSAQ may take the respondent longer.

(e) Some respondents may have gathered data and read some of the instructions before logging in. Others may have logged in and then read the User Guide and gathered the data.

(b) Control Panel Burden Hours

The cover letter included in the mailout package for the control panel requested respondents to record the time to complete the paper questionnaire. They were asked to record the amount of time and the breakdown in the remarks section of the paper questionnaire. Unfortunately, only two of the 73 on-time respondents from the control panel reported the time it took to complete the questionnaire. One respondent took 1 hour and the other respondent took 3 hours to complete the questionnaire. The respondent that completed the questionnaire in 1 hour noted that completing the survey form took 25 percent of the time, collecting the necessary information took 67 percent of the time, and reading the instruction manual took 8 percent of the time. The other respondent did not provide a breakdown. Because of the small sample size, we cannot compare this directly to the CSAQ panel.

9.7.3 Electronic Transfers

(a) 1994 R&D CSAQ Test

In the 1994 R&D CSAQ test, there was the option of transmitting CSAQ data via modem. This type of transmission is possibly less burdensome and more efficient than the typical Postal-mail-route. Of the respondents who completed the CSAQ, only 8.5 percent (4) returned their questionnaire via modem. This is about the same response seen in the COS CSAQ pilot-test. (Ramos and Sweet, 1995)

There were no security breaches with the modem transfers to EIA nor from EIA to the Census Bureau. Since the rate of modem return is similar to that on the COS CSAQ, we can assume that the respondents decision to use modem transmissions was not influenced by the fact that it was going to the EIA mainframe.

(b)   Feedback on Electronic Communication from the R&D CSAQ Screener Questionnaire
In contrast with the test results where only four companies returned their CSAQ questionnaire via modem, more than half (60 percent) of the R&D screener mail-return respondents who indicated a willingness to use a CSAQ also indicated a willingness to return a questionnaire electronically. Also, approximately 54 percent indicated a willingness to receive the instrument electronically.   See Table 9 below.

Table 9: Responses to Questions Concerning Electronically Receiving or Returning a CSAQ for the 177 CSAQ Interested R&D Screener Respondents, Regardless of Communications Availability[10]

Response	Receiving the Questionnaire Electronically	Returning the Questionnaire Electronically
Interested	54% (n=95)	60% (n=107)
Not Interested	34% (n=61)	29% (n=52)
Missing	12% (n=21)	10% (n=18)
Total	100% (n=201)	100% (n=177)

The screener questionnaire asked about three types of communication alternatives: Software (e.g., Smartcomm, Procomm Plus, and Cross Talk), the Internet, and On-Line Services (e.g., Compuserve, America-On-Line, and Prodigy). The following summarizes the communication capabilities of the 177 screener respondents who were interested in reporting via CSAQ and their willingness to receive and return a CSAQ electronically, given security capabilities. Respondents were allowed to check more than one box, so totals will not equal 100 percent.

Of the 177 mail-return screener respondents that were willing to use a CSAQ:

- 56% (100) have a modem
- 69% (123) reported availability of some type of communications
    - 72% (88) would be willing to receive electronically[10]

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[10] The percent of cases interested in receiving/returning CSAQ via modem in Table 9 are lower than those listed for cases that already have communications software. Percentages do not add to total due to rounding.

- 81% (100) would be willing to return electronically[10]
- 29% (52) indicated no communications
- 1% (2) left all communications questions blank

Of the 123 screener respondents who reported the availability of some type of communication, most of them have some sort of communications software. Many respondents had more than one type of software. The most popular communications software was Procomm Plus. Thirty-seven respondents had only Procomm Plus. A number of respondents had Cross Talk, but most of those respondents also cited another type of software. Many respondents possessed software that the screener did not specifically list. See Pages 7 and 8 of Attachment B for details. The most popular on-line service was Compuserve, followed by Prodigy and America-On-Line. Again, there was some overlap of services, but 35 respondents only had Compuserve. Table 10 provides an overview of the three types of communications and whether respondents were willing to receive and return questionnaires and data electronically.

Table 10: Detailed Distribution of 123 R&D Screener Respondents Willing to Use a CSAQ that had Electronic Communications Capability

Type of Capability:	Total Percent and (Number)	Reported willingness to:	
		Receive CSAQ electronically	Return CSAQ electronically
Communications Software	85% (104)	73% (76)	83% (86)
Internet	37% (46)	72% (33)	83% (38)
On-line Services	49% (60)	85% (51)	92% (55)

9.7.4. Usage of Importing Feature

(a)   1994 R&D CSAQ Test

Attempting to reduce respondent burden, an option of importing the data from a predefined file directly into the CSAQ instrument was offered. It was believed that this type of data entry would be less burdensome and more efficient and accurate than having the respondent type the data into their CSAQ. The mechanics of the import feature for this test required the respondent to create an ASCII file with the necessary data. The file format instructions were accessible in a file within the CSAQ instrument, but there was not as much item specific help associated with each question on that file as was available in the CSAQ itself. Also, there were no edits built into the importing feature. To edit the imported data, the respondents were requested to check their imported data in each screen. For a production CSAQ, the importing feature would need to improve. Although there was no time to do this for the test, ideally when importing data the respondent should not have to go through all the screens to perform the edits.

Only one respondent used the import feature of the R&D CSAQ. There were no comments concerning the import feature from this respondent; the output file was useable. Since the RD-1S is a short form and the respondents only provide one company based report, we believe the advantages of importing data from a predefined file directly into the instrument are not obvious. In large multi-establishment reporting, respondents might be more inclined to see the advantages of creating an import file.

(b)   Feedback on Importing from the R&D CSAQ Screener Questionnaire and the R&D CSAQ Evaluation

Both Question 7 in the CSAQ evaluation section (Attachment C) and Question 14 in the screener questionnaire (Attachment B) attempted to probe respondents about their perceptions on importing data from a predefined file into the instrument. Unfortunately, these questions were worded poorly, asking if CSAQ should be able to "directly access corporate data." We believe that as a result of this wording, 70 percent of the screener respondents indicated no interest in the import capability. However, we still believe that the BOC needs to pursue this capability which would be particularly beneficial for surveys where a company needs to report individually for all establishments, or for companies that have to report the same information regularly, (e.g., monthly). If the R&D Survey had either of these two characteristics, perhaps more respondents would have seen the benefits of creating the file needed to import data. Likewise, if the editing of imported data had been better prepared, then perhaps more respondents would have been willing to try it.

10.   Conclusions

In this document we have discussed several issues pertaining to the feasibility of implementing an electronic questionnaire system for economic survey respondents. From past studies we know that some respondents can upload and use electronic questionnaires, and that the BOC can handle limited dissemination and retrieval of this data format. In the current climate of customer satisfaction and limited budgets, two questions are often asked: "What are the advantages of a CSAQ for the respondent?" and "What are the advantages of a CSAQ for the BOC?" In this third BOC pilot-test, we have attempted to answer these questions in terms of response rates, data quality, timeliness, user burden, and cost.

CSAQ advantages for the BOC would include higher response rates, greater data quality and lower costs than the standard paper questionnaire system. The CSAQ system used in this pilot-test resulted in lower response rates, but higher data quality (fewer edit failures detected at headquarters) than the corresponding control (paper) panel. The overall costs associated with the CSAQ package mailout are significantly higher than for the regular R&D paper mailout. The savings in data entry and edit failure follow-ups cannot make up for the large mailing cost and diskette purchases. Although for the R&D Survey there was no cost savings, this cost factor may depend a lot on the survey. For other surveys such as the Annual Survey of Manufactures (ASM) or the Company Organization Survey (COS) where data are collected for all establishments of the company, the cost of one CSAQ mailout package per company may be fully justified when compared to mailout costs of boxes of questionnaires per company and the associated data entry costs. In addition, since we estimated that only approximately 20 percent of the R&D universe

that has over $1 million in R&D would want to complete the system as is and do so on-time, a mixed-mode data collection processing system would be necessary, which is always more costly. This results in only one advantage for the Census Bureau through the use of this CSAQ for this survey, i.e., better data quality.

A CSAQ system would be advantageous for respondents if it was easier to fill out, and took less time than a paper form. For those respondents that completed this R&D CSAQ, most indicated that it was relatively easy to use and approximately 81 percent claimed that they would choose a CSAQ again. This satisfaction rate is similar to the 85 percent rate seen with the COS CSAQ. The CSAQ system itself took significantly less than the 20 burden hours cited in the OMB package for this survey. Even with this apparent decrease in respondent burden, the response rate for the CSAQ panel decreased. We must put this into perspective. It is likely that the burden hour estimate in the OMB package of the time needed for completing this survey by paper respondents may be an overstatement. Even so, only four companies complained about the amount of time it took to complete the instrument. One company did note that this type of reporting would be more useful for questionnaires that take a longer amount of time to complete.

Even though most CSAQ respondents would choose "this CSAQ system" over a paper form, a large number indicated that movement within this CSAQ was not ideal. Some had memory and printing problems. A number of CSAQ respondents recommended a Windows-based CSAQ. The current PEDRO/CASES CSAQ system would not be able to incorporate these recommendations. There are advantages to this CSAQ system, e.g., no license fees and BOC familiarity with the CASES authoring language. Still, given overall test results, we do not recommend future use of the PEDRO/CASES CSAQ tested. Attachment G contains a summary of features that the BOC would like to see incorporated in future CSAQ systems. This list arose from our experience with this test.

We estimate that the development of a CSAQ instrument in a different authoring language, would take no longer than what it took to develop this CSAQ, approximately 4 to 5 months. In fact, with the same authoring staff it might take less time, because they are now familiar with the general requirements and features of CSAQs. Development of this CSAQ at the BOC took less time than it took an outside vendor to develop the COS CSAQ based on a questionnaire of similar difficultly, and communications were smoother. Using an outside vendor is a deviation from previous in-house BOC paper/pencil forms design. Before decisions regarding outside CSAQ authors are made we must have a vision of the future system. If outside vendors are used, the ability to change systems could potentially be more difficult.

11.   Recommendations

Perhaps eventually there will be a system in place, that can be easily accessed by respondents, where the BOC only has to send a postcard or even an e-mail reminder. The respondent would then bring up the questionnaire and with a few keystrokes import the data, edit it, and then send it electronically to the BOC. Although we are not at that stage yet, this third pilot-test demonstrates that electronic questionnaires are not any more time consuming than a paper/pencil form and can be more accurate. Comments from CSAQ respondents on this test also demonstrate that electronic reporting is an acceptable way of reporting.

However, we saw from the R&D screener questionnaire that even though 69 percent of R&D companies might have been interested in responding via CSAQ, only 47 percent had the computer capability. Inadequate DOS versions and memory restrictions were the two main reasons for the 20 percent decrease. The BOC should strive to develop a system that can take advantage of the majority of respondents who are interested in electronic reporting. At the same time, we must be careful not to build an "unsophisticated" system that "everyone" can use, but that lacks important features such as electronic communication, editing, etc.

One factor that needs particular attention is memory requirements. We observed during the test that problems resulted when respondents' computers lacked memory requirements to utilize the system. Some of these companies had to call the BOC or EIA for assistance with these problems. Memory problems tend to be a more complex problem to resolve for users even with the use of a help desk, and therefore can be a frustration to the respondent.   As expected, the companies that experienced memory problems were more likely to choose (on the evaluation questionnaire) paper instead of CSAQ as the medium for future reporting.   These problems occurred even after we spent a lot of time evaluating, testing and implementing measures to minimize memory problems during the development and testing stages of the test. For future CSAQ implementations, minimizing possible memory problems should be a priority. We should also note that, since the development of the PEDRO/CASES CSAQ, CASIC's staff has continued research which has identified better hardware and software alternatives that are expected to further alleviate any problems with PC memory requirements.

The BOC's CSAQ group believes that this test may have become more involved than originally intended, perhaps because we had to meet production deadlines, but also because we required a split panel design to measure mode effects. This design allowed us to statistically test some assumptions surrounding electronic data reporting via CSAQ. This was appropriate for this test given that CASIC believed that CASES would be the appropriate authoring language for CSAQ applications at the BOC. However, in situations where the intent is to quickly test applications that we are unsure will go into production, testing a prototype without a control panel could be considered.

The BOC has recently been looking into an off-the-shelf forms package for possible use in a CSAQ system. Even though this package has Windows capability and initial programming of the system was easy, the five diskettes needed by respondents to install the system if the packages were sent via First-Class Mail, the 50 minutes needed to download the software to the respondent's PC via modem transmission, and the license fee associated with each copy of the CSAQ, are unreasonable from a cost and time perspective. The system we envision is something that can work well in a mixed-mode data collection environment, such as an executable file that can either be mailed via "one" diskette, sent over the Internet, or printed and FAXed for businesses that refuse to electronically report. The system should also have a low, if any, license fee associated with the medium, easy movement within the screens, functionality in the Windows environment, editing capabilities, database access features, and fully developed/user friendly import and electronic transmission capabilities. With this in mind, the BOC is currently looking into several CSAQ communications alternatives and is investigating the possible future use of the Internet for electronic reporting. Although only 26 percent of the screener respondents interested in CSAQ reported having access to the Internet, we are confident this number will increase at a

very rapid pace. Another obstacle that needs to be overcome for Internet data collection involves the required paradigm change in the user community concerning their reluctance to report via Internet due to confidentiality and security issues. In the meantime, the BOC must continue research of these other alternatives for CSAQ implementation.

12.	Acknowledgements

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13.	References

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Tabulated Responses from the Survey of Potential Computerized Self-Administered Questionnaire (CSAQ) Respondents

Question 1 of this survey contains the tabulated responses from all 486 mailed screeners, to which 438 cases responded either by mail or through the telephone follow-up operation. The 48 nonrespondents did not mail-in their questionnaire and were not contacted by telephone. For questions 2, 3, 4, 5, and 7 the tabulations include data from only the 302 respondents that indicated an interest in trying the CSAQ. These questions were used to determine the eligibility of the respondents willing to report via CSAQ. Tabulations for the remaining questions (Questions 6, and 8-15) contain data from only the 177 mail-return respondents who were interested in the CSAQ. During the screener telephone follow-up, questions other than those pertinent to eligibility were not asked. Most of the mail-return respondents who were not willing to use a CSAQ, did not complete the remaining questionnaire.

1. **Willingness to report by CSAQ rather than a paper questionnaire for the 1994 R&D survey**

	Total	**Mail-Return**	**Phone**
Yes	302	177	125
No	124	58	66
Missing	12	2	10
Subtotal	438	237	201
Nonrespondents	48	0	0
Total	486	237	201

Reasons for cases not willing to use CSAQ:

Reasons	Frequency	Percent of Total
●not easier, said "prefer paper" or not worth it	35	30%
●not enough time to train personnel	16	14%
●either no PC, or PC hooked to mainframe or MacIntosh	14	12%
●their answer implied that they did not understand what we were asking them to do (e.g., "we don't have a communications package")	11	10%
●in the future they might be interested, but not now	10	9%
●wrong hardware (phone follow-ups)	10	9%
●they have to consolidate information from several people	7	6%
●out-of-scope of survey	5	4%
●they have a security concern	4	3%
●frustration with filling out all census forms	3	3%
	115	100%

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2. **Reported PC Processors**

PC Processor Type	Total
286	3
386	55
486	223
Pentium	12
Other	9

Other Includes: 86 Compac (1), Compaq Contura L (1), IBM (1), Macintosh (5), Power PC (1)

3. **Reported Operating Systems** (Respondents checked all that applied)

Type	Version	Frequency
DOS	3+	2
	5+	74
	6+	108
	Missing	71
	Total	**255**
Windows	2.1	1
	3.0	1
	3.1	84
	3.11	11
	3.2	1
	4.0	1
	Missing	111
	Total	**210**
OS/2	S	2
	2.1	4
	Total	**6**

Other Includes: (Alpha Micro, Macintosh, Finder, System, Realworld, and System 7)

4. **Reported size and density of floppy disk drives**

Drive Type	3.5 low		3.5 high		5.25 low		5.25 high	
Total	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
302	25	8%	290	96%	11	4%	94	31%

Frequency Distribution of Disk Drive Combinations

Disk Drive Size/Density Combinations	Frequency
3.5 low only	3
3.5 low and high	12
all four	7
3.5 low and 5.25 low	2
3.5 low, 5.25 high	1
3.5 high only	185
3.5 high, 5.25 low	2
3.5 high and 5.25 high	84
5.25 high only	2

5. **Reported total memory and hard disk space**

Processor	System Memory (RAM) (MB)	Hard Disk	Frequency
286	.6	Missing	1
	4	80 MB	1
	5	Missing	1
	Total		3
386	1	80MB	2
	2	20MB-210MB	7
	4	30-500 MB	15
	8	50-420 MB	12
	12	1 GB	1
	16	1 GB	1
	Missing	Missing	11
	Total		49
486	.6	8MB-212MB	6
	1	124MB-337MB	2
	2	200MB	2
	4	40MB-420MB	44
	8	40MB-540MB	79
	10	1GB	1
	12	118MB-10GB	15
	13	Missing	1
	15	Missing	1
	16	35MB-540MB	36
	Missing	Missing	16
	Total		203
Pentium	4	220MB	1
	8	200MB-500MB	4
	12	426MB	1
	15	502MB	1
	16	340MB-500MB	4
	28	340MB	1
	Total		12

Each company reported their processor type, their system memory, and their hard disk space. The ranges in the column labeled Hard Disk indicate the lowest and highest reported hard disk space for those companies reporting that particular system memory.

6. Printers of PC to be used for CSAQ reporting (Frequencies are in parenthesis)

Dot Matrix
(Frequency= 18)

Epson (8)
    LQ1170 24 PIN
    LQ 2550
    LQ 2550
    LQ 1070
    LQ 1050
NEC Pinwriter 7 24 PIN
HP 3SI
Okidata (2)
Panasonic (4)
    KXP1124I
    KXP-1624
    KY-P1621
Compaq Pagemaker
IBM Proprinter XL

Laser
(Frequency=152)

Missing (3)
HP Laserjet Series ? (15)
HP Laserjet Series II (25)
HP Laserjet Series III(46)
HP Laserjet Series IV(52)
HP Rugged Writer (1)
Laserwriter (3)
IT Microlaser Plus (2)
Printronix (1)
Brother HL10V (1)
Apple Laserwriter II (1)
QMS PS 410 (1)
QMS PS 825 (1)

Inkjet
(Frequency=5)

Epson EQ570
HP Deskjet 500
HP Deskjet
IBM Execjet 4072
HP Deskjet 560 C

7. **Reported Monitor Type**

Type	Frequency	Percent
Monochrome	8	3
Color/CGA	2	1
Color/EGA	2	1
Color/VGA	141	47
Super VGA	105	35
Color, do not know type	40	13
Missing	4	1
Total	302	100

8. **Reported Modem Availability**

Modem Availability	Frequency	Percent
Yes	100	57
No	76	43
Missing	1	-
Total	177	100

Kind of modems reported:

Baud Rate<=2400
(Frequency=25)

Hayes

  2400 (3)
  Smart Modem 2400 (3)
  Pocket Edition (1)
  Smartcom (1)

Everex EMAC (2)
Prac Periperal PM2400 SA
US Robotics Courier
Shiva Network Modem
Zoom MX2400R
Intel
Micro Com AX/2400 C
Courier 2400
Compaq
Packard Bell 2400
Qubie 212A/1200 OE
Viva 9642E
Internal Dell
MTEZ
2400
Ventel

Baud Rate=9600
(Frequency=29)

Hayes
  9600 (2)
  Optima 9600 (3)
  Compatible (2)
  Ultra Smartmodem (2)
  Vitra (1)
  V Series Optima (2)

U.S. Robotics (3)
  Courier HST
  Courier V.32BFS

Sportster

Practical Model 9600
Shiva Net Modem/E
Gateway Telpath
Intel 9600 EX (2)
Multitech MT932 EAB (2)
Microcom AX/2400
Compaq
V32 Multiplex
Supra Corp. Suprafax V-32BI
Telepath FM144
Sportster 14.4 PCFaxModem
XModem

Baud Rate=14.4 (Frequency=32)

Hayes
  Optima (3)
  Accura 5120 AM (3)
  14.4INT FAX/MOD
  Compatible Internal
  Smartmod Optima 14.4 (2)

Pract Periphera (4)

US Robotics
  14.4 Sportster (2)
  V.32BIS Courier

ZOOM Telephonic (2)
Gateway 2000
Intel (2)
Boca (3)
Multitech Multimodem II (2)
Digicom Systems Scout Plus Terb
Microcom
AT&T
Supra Fax Modem 144LC
Various

High
(Frequency=5)

Pract Periphera V.32BIS (2)
Telebit T3000 19.2
Telebit World Blazer 19.2
KB
Racal 57.6

9. **Communications options and on-line services reported**
(Companies could have reported more than one software or service.)

Internet Access	Frequency	Would Receive Electronically (%)	Would Return Electronically (%)
E-mail access only	9	100	100
Direct access	37	65	78
Total	46	72	83

Communications Software	Frequency	Would Receive Electronically (%)	Would Return Electronically (%)
Smartcomm	11	73	73
Procomm Plus	59	68	78
Comworks	1	100	100
Kermit	6	50	83
Cross Talk	23	74	78
Other	36	81	82
Total	104	N/A	N/A

Other Includes:

Windows Terminal (8)
PC Anywhere (4)
Carbon Copy (4)
Reflections (3)
Comit (2)
Z Term (1)
Telix (1)
X-Modem Protocol (1)
CC:MAIL 2.0 (1)
Shareware (1)
Close-up (1)
Cross-Line (1)
Quickmail (1)
Bitcom (1)
Comet PCtools - Teleco (1)
Pacer Term (1)
Relay/Elink Edgar (1)
Dynacomm (1)
Proterm (1)
Winfax (1)

Notes: 35 of the 59 companies have only Procomm Plus
7 of the 11 companies have only Smartcomm
25 of the 36 companies only have one type of "Other" software

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On-Line Services	Frequency	Would Receive Electronically (%)	Would Return Electronically (%)
Compuserve	50	84	92
America-On-Line	8	63	75
Prodigy	9	89	100
GEnie	0	0	0
MCIMail	4	75	74
Fidonet	0	0	0
ATT Mail	1	100	100
Other	5	80	80
Number of companies reporting at least one service	60	N/A	N/A

Other includes: (Advantis, Eprinet, Lexis, NASDAQ, Sprint Mail)

Notes: 35 of the 50 companies have only Compuserve
4 of the 9 companies have only Prodigy
4 of the 5 companies only have one type of "Other" service

10.   **Willingness to use any of these communication options or on-line services to receive the CSAQ or respond and return the CSAQ to the Bureau of the Census**

Receive the CSAQ	Total	Percent of Total
Yes	88	72%
No	28	23%
Missing	7	6%

Respond/return the CSAQ	Total	Percent of Total
Yes	100	81%
No	18	15%
Missing	5	4%

11.   **Response to number of people that would be involved in completing the CSAQ**

Category	Frequency
● Completed by one person	107
● Distributed to more than one person for completion and returned to one person for consolidation of the responses into one report	68
● Other	1
● Missing	1

12.   **Reported PC connected to a local area network (LAN)**

	Total
Yes	130
No	46
Missing	1

13.   **Reported network operating systems**

System	Total
Novell/Netware	91
UNIX NFS	2
LAN Manager	9
Banyan Vines	11
AppleShare	5
DEC PathWorks	4
Missing	47
Other	11

Other includes: (As-400 NetWorkSe, As/400 PCS, C, COAX, Lantastic, Microsoft NTADV, OS/2 Lan Server, Power Lan, Windows for Workgroups, and Windows NT NTAS

14.   **Responses to "How important is it to you for the CSAQ to be able to directly access your company's corporate data and automatically extract the R&D survey data?" Question**

Options	Total	Percent of Total
● Extremely important, I would not use the CSAQ otherwise	0	0
● Important, it would be nice.	12	7%
● Neutral	37	21%
● I would prefer to key the data.	55	31%
● I would not use the CSAQ if it could access and extract corporate data	69	39%
● Missing	4	2%
Total	177	100%

15.   **Reported interest in printing a hard copy of the CSAQ:**

Without reported data?	Total	Percent of Total
Very important	125	70%
Neutral	37	21%
Not important	12	7%
Missing	3	2%
	177	100%

With reported data?		
Very important	85	48%
Neutral	56	32%
Not important	29	16%
Missing	7	4%
	177	100%

Schedule

The date in the ( ) is the completion or estimated date of completion based on the last revised schedule, dated November 15, 1994. The [*] denotes a matched item to the earlier schedule dated June 24, 1994. The other ( ) reflects the who is responsible for accomplishing the task.

a [*]   Write task list for EIA to enhance PEDRO for Census use. (Jun 94) (CASIC)

b [*]   Discuss R&D CSAQ requirements. (Jun 94) (team)

-    item screens
-    help screens
-    menus
-    function keys
-    import/export data
-    edits
-    branching
-    fills
-    previous periods data
-    mode of transfer
-    quality control
-    security
-    management information
-    output format

c Receive cost estimate from EIA for PEDRO Census enhancements. (Jul 94) (CASIC)

d   Write the Memorandum of Understanding concerning the use of EIA's mainframe for the collection of CSAQ data transmitted via modem. (Jul 94) (CASIC)

e [*]   Provide CASES author with information concerning the R&D CSAQ screens, edits, input files, and output files. (Jul 94) (MCD/ESMPD)

f [*]   Finalize the 1994 R&D questionnaire. (Aug 94) (NSF/MCD)

g [*]   Write the generic CSAQ screening letter/questionnaire/instructions. (Aug 94) (CASIC)

h [*]   Design R&D CSAQ item screens in CASES. (Aug 94) (TMO)

i [*]   Send the generic CSAQ screening letter/questionnaire/instructions for OMB approval. (Sep 94) (CASIC/MSSD)

j [*]   Receive funds from NSF and transfer some to CASIC. (Sep 94) (MCD)

k [*]   Write Statement of Work for the interagency transfer of funds to EIA for PEDRO enhancements and support. (Sep 94) (CASIC)

l   Create R&D CSAQ instrument edits in CASES. (Sep 94) (TMO)

m [*]   Receive the PEDRO tool kit from EIA. (Sep 94) (CASIC)

n [*]   Select about 500 cases for the R&D CSAQ screening sample. (Oct 94) (MCD)

o [*]   Write the generic CSAQ evaluation questionnaire. (Oct 94) (MCD)

p   Send the generic CSAQ evaluation questionnaire for OMB approval. (Oct 94)
         (MCD/MSSD)

q [*]   Write R&D CSAQ research plan. (Oct 94) (CASIC/ESMPD)

r   Change the PEDRO survey specific source code. (Oct 94) (CASIC)

s   Specify R&D CSAQ screen flow and menus. (Oct 94) (CASIC)

t   Create R&D CSAQ instrument help screens in CASES. (Oct 94)
   (EPCD/MCD/TMO)

u [*]   Print the R&D CSAQ screening letter/questionnaire/instructions. (Oct 94) (MCD)

v Receive a Wordperfect file of the PEDRO User's Guide from EIA. (Oct 94) (CASIC)

w   Receive the Security Plan from EIA and send it to MSSD. (Oct 94) (CASIC)

x Write generic program to reformat the CASES output into EDI transaction set 152 format.
   (Oct 94) (CASIC)

y Generate labels for the 500 cases in the R&D CSAQ screening sample. (Oct 94) (ESMPD)

z [*]   Mail the R&D CSAQ screening letter/questionnaire/instructions. (Oct 94)
         (MCD/DPD)

a1 [*]   Write a User's Guide for the R&D CSAQ respondents. (Nov 94) (EPCD)

b1   Provide criteria for selection of the R&D CSAQ respondents based on their responses
         to the screening questionnaire. (Nov 94) (CASIC)

c1   Provide test cases (all files needed to process a case) including latest instrument and
         output templates to CASIC. (Nov 8, '94) (TMO)

d1   Provide test input file to CASIC. (Nov 14, '94) (TMO)

e1   Provide FINAL file layouts for the data, evaluation, and trace files to CASIC. (Nov
         14, '94) (TMO)

f1   Provide FINAL CASES R&D instrument to CASIC. (Nov 16, '94) (TMO)

g1   Provide 10 actual R&D cases (their CFN and input file which includes their live data) to CASIC. (Nov 18, '94) (TMO)

h1   Conduct a site visit to the EIA computer facility. (Nov 94) (CASIC/MSSD/EIA)

i1 [*] Set up hardware for R&D CSAQ mail return of floppy diskettes. (Nov 94) (EPCD)

j1   Run EDI formatted output through the EDI translation software to test the EDI format program. (Nov 94) (EPCD)

k1   Write program to map output translated from EDI into the format requested by the ESMPD programmers. (Nov 94) (EPCD)

l1 [*] Write programs to apply returned CSAQ data to R&D database. (Nov 94) (ESMPD)

m1   Link all menu calls from PEDRO to CASES. (Nov 94) (CASIC)

n1   Determine the PEDRO/CASES survey specific program logistics. (Nov 94) (CASIC)

o1 [*] Determine the layout and contents of the summary print report of the CASES output. (Nov 94) (MCD/TMO)

p1   Add encryption software to the PEDRO/CASES group of programs. (Nov 94) (CASIC)

q1   Order about 1,400 3.5" high density diskettes. Need 100 by Dec 2, 300 by Dec 14, and 1,000 by Jan 18. (Nov 94) (CASIC)

r1   Order 200 diskette outgoing envelopes. (Nov 94) (CASIC)

s1   Order 200 diskette return envelopes. (Nov 94) (CASIC)

t1   Write the CSAQ, Control, and password (Certified Mail) letters. (Nov 94) (MCD)

u1 [*] Test the R&D CSAQ instrument. (Nov 94) (test team/CSMR/NSF)

v1   Receive the enhanced version of PEDRO. (Nov 30, '94) (CASIC/EIA)

w1   Receive check and gather software and encryption software from EIA and programs for generating encryption keys. (Nov 30, '94) (CASIC)

x1   Receive the RDE spaces sweeping software from EIA (Nov 30, '94) (CASIC)

y1   Create a database and queries to query and select the CSAQ cases from the R&D CSAQ screening questionnaire responses. (Dec 94) (EPCD)

z1   Set up two 800 number lines at EIA for modem transmission of CSAQ data. (Dec 94) (CASIC)

a2   Receive the new version of CASES. Recompile the R&D CSAQ instrument using the new version. (Dec 1, '94) (TMO)

b2   Combine the R&D CSAQ CASES instrument with the enhanced PEDRO operating system. (Dec 2,'94) (CASIC/EIA/TMO)

c2   Set up 10 RDE spaces on EIA's mainframe for test purposes (Dec 2, '94) (EIA)

d2   Conduct test transmissions of CSAQ data for 10 cases to EIA's mainframe. (Dec 7, '94) (CASIC/SAIC)

e2   Distribute a set of diskettes containing PEDRO, Arbiter, CASES instrument and input data for a case for testing to Test CSAQ team, EIA, NSF, and others. (Dec 16, '94) (CASIC)

f2 [*]   Incorporate comments from the R&D CSAQ test and retest. (Dec 94) (TMO/CASIC)

g2 [*]   Select 100 R&D CSAQ test respondents and 100 R&D Control respondents. (Dec 16, '94) (MCD)

h2   Send User's Guide to Forms Design after team review. (Dec 19, '94) (MCD)

i2   Assign special follow-up codes for the CSAQ and Control group cases in the R&D database. (Dec 94) (ESMPD)

j2   Create a program to run set-up on the CASES R&D instrument and the previous period data file for a particular company and compress it and copy it to a diskette. (Dec 94) (CASIC)

k2   Provide to CASIC the R&D CSAQ respondents previous period data input file. (Dec 23, '94) (ESMPD)

l2   Send a set of R&D CSAQ respondents labels to EIA for assignment of user names, account numbers, and passwords. (Dec 94) (ESMPD/CASIC)

m2   Write specifications concerning the diskette label contents and layout. (Dec 94) (CASIC)

n2   Split the CASES input previous period data file by individual company. (Jan 95) (CASIC)

o2   Generate diskette identification labels and company identification labels. (Jan 95) (ESMPD/CASIC)

p2   Receive the diskettes for the actual CSAQ mail packages. (Jan 18, '95) (CASIC)

q2   Create follow-up letters for the CSAQ and control group non-respondents. (Jan 95) (MCD)

r2   Make 100 copies of the PEDRO operating system diskette and label them. (Jan 95) (EPCD/CASIC)

s2   Make 100 copies of the Arbiter communications diskette and label them. (Jan 95) (CASIC)

t2   Create the CASES R&D instrument and input data diskettes for the CSAQ respondents and label them with diskette identification and company identification labels. (Jan 95) (CASIC)

u2 [*] Print the R&D CSAQ User's Guide. (Jan 95) (CASIC/EPCD)

v2   Print the CSAQ, Control, and password (Certified Mail) letters. (Jan 95) (MCD)

w2   Prepare the password letter Certified Mail packages and verify. (Jan 95) (CASIC)

x2   Set up the RDE spaces on the EIA mainframe for the BOC CSAQ respondents. (Jan 95) (EIA)

y2   Receive the diskette testing routine from EIA and run all 100 of the CSAQ test respondent's diskettes through the test. (Jan 95) (CASIC)

z2 [*] Prepare the R&D CSAQ mail packages and perform quality control and virus checking. (Jan 95) (CASIC)

a3   Create the CSAQ evaluation database. (Jan 95) (EPCD/ESMPD)

b3   Mail the password letter Certified Mail packages. (Feb 95) (CASIC)

c3   Hold the CSAQ cases out of the 1994 R&D Survey paper form mail out. (Feb 95) (ESMPD)

d3   Mail the 1994 R&D paper forms. (Feb. 22, 1995) (DPD)

e3 [*] Mail the 1994 R&D CSAQ. (Feb. 22, 1995) (CASIC)

f3   Print CSAQ and control group follow-up letters. (Mar 95) (MCD)

g3   Mail the first follow-up letter to the CSAQ and control group non-respondents. (Mar 95) (MCD/DPD)

h3   Mail the second follow-up letter to the CSAQ and control group non-respondents. (Apr 95) (MCD/DPD)

i3   Mail the third follow-up letter and an R&D survey paper questionnaire to the CSAQ and control group non-respondents. (May 95) (MCD/DPD)

j3 [*]   Perform telephone follow-up on all R&D CSAQ non-respondents. (May 95) (MCD)

k3   Sweep the EIA RDE's daily. (Jun 95) (EPCD)

l3 [*]   Assimilate the respondents' CSAQ output into the R&D database and CSAQ evaluation database. (Jun 95) (ESMPD)

m3   Provide EIA with recommendations on improvements to the PEDRO tool kit. (Jun 95) (CASIC)

n3   Virus check, decrypt, map, and send to ESMPD the returned CSAQ R&D output. (Aug 95) (EPCD)

o3   Maintain a log of help calls. (Aug 95) (EIA/MCD/TMO)

p3 [*]   Evaluate the R&D CSAQ. (Aug 95) (MCD/ESMPD/EPCD/CASIC)

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT EVALUATION OF COMPUTERIZED SELF-ADMINISTERED QUESTIONNAIRE (CSAQ)
(Includes questions and responses)

Would you fill out the evaluation questionnaire?

Answer	Frequency
yes	42
no	10

Notice: The purpose of this evaluation is to obtain your opinions about the computerized self-administered questionnaire (CSAQ) designed for the 1994 Survey of Industrial Research and Development. Your responses to this inquiry are protected under Title 13, United States Code, and will be kept strictly confidential. Although your participation is voluntary, the Census Bureau would greatly appreciate your help in evaluating this data collection system. By learning from you, we can be more responsive to your needs. This questionnaire consists of 13 questions which should take about 10 minutes to complete.

1.   In general, how satisfied were you with the CSAQ reporting system?

		Answer	Frequency	Percent of Total
1.	☐	Very satisfied	6	14%
2.	☐	Satisfied	26	62%
3.	☐	Neutral	7	17%
4.	☐	Dissatisfied	2	5%
5.	☐	Very dissatisfied	0	0
		(Missing)	1	2%

2.   Did you have any problems with either installation or memory?

1.   <u>Installation:</u>   <u>Frequency</u>   <u>Percent of Total</u>
                         Yes   6   14%
                         No   36   86%

If yes, please explain

Responses:
Memory
I needed the aid of our systems specialist
Required network manager to install - cost money
Software "died" at revenue entry
Did not modify autoexec.bat; surveys should not
First installation failed. Had to try a second time.

2.   <u>Memory:</u>   <u>Frequency</u>   <u>Percent of Total</u>
                         Yes   7   17%
                         No   35   83%

If yes, please explain

<u>Responses:</u>
Memory
Required more memory than available on my computer.
Had to remove HIMEM line to allow PHARLAP to work
Local PC/LAN problem
Not enough memory, my support got around the problem
Made conv mem available, msg still "INSUF MEM"
Had to unload mainframe connectivity program

3. **Please rate the characteristics of the computerized system listed below in terms of their ease of use. Use the following scale:**

	Frequency	Percent (Total=42)
1. The overall system		
1 = Easy	26	62%
2 = Neutral	15	36%
3 = Difficult	1	2%
4 = Did not use	0	0%
2. Moving within a screen		
1 = Easy	21	50%
2 = Neutral	10	24%
3 = Difficult	11	26%
4 = Did not use	0	0%
3. Moving between screens		
1 = Easy	26	62%
2 = Neutral	13	31%
3 = Difficult	3	7%
4 = Did not use	0	0%
4. Backing up		
1 = Easy	8	19%
2 = Neutral	14	33%
3 = Difficult	5	12%
4 = Did not use	15	36%
5. Entering data		
1 = Easy	35	83%
2 = Neutral	6	14%
3 = Difficult	1	2%
4 = Did not use	0	0%
6. Changing answers		
1 = Easy	27	64%
2 = Neutral	10	24%
3 = Difficult	2	5%
4 = Did not use	3	7%
7. Resolving errors		
1 = Easy	15	36%
2 = Neutral	12	29%
3 = Difficult	2	5%
4 = Did not use	13	31%
8. Accessing HELP features		
1 = Easy	18	43%
2 = Neutral	5	12%
3 = Difficult	1	2%
4 = Did not use	18	43%
9. Making comments		
1 = Easy	14	33%
2 = Neutral	8	19%
3 = Difficult	2	5%
4 = Did not use	18	43%
10. Exiting		
1 = Easy	32	76%
2 = Neutral	7	17%
3 = Difficult	2	5%
4 = Did not use	1	2%
11. Re-entry		
1 = Easy	27	64%
2 = Neutral	9	21%
3 = Difficult	6	14%
4 = Did not use	0	0%

4.   Did you use one or more of the HELP features?

	Answer	Frequency	Percent of Total
1. ☐	Yes	15	36%
2. ☐	No	27	64%

5.   Please rate the HELP features listed below in terms of their usefulness. Use the following scale:

The **HELP** features are:

	Frequency	Percent of Total=15
1. General Survey Information (Main Menu)		
1 = Very useful	11	73%
2 = Somewhat useful 4	27%	
3 = Not useful 0	0%	
4 = Did not use this feature	0	0%
2. CSAQ Information (Main Menu)		
1 = Very useful	9	60%
2 = Somewhat useful 6	40%	
3 = Not useful 0	0%	
4 = Did not use this feature	0	0%
3. PEDRO Information (Main Menu)		
1 = Very useful	8	53%
2 = Somewhat useful 6	40%	
3 = Not useful 0	0%	
4 = Did not use this feature	1	7%
4. **F1**(General Help)		
1 = Very useful	5	33%
2 = Somewhat useful 6	40%	
3 = Not useful 2	13%	
4 = Did not use this feature	2	13%
5. h (item-specific help)		
1 = Very useful	6	40%
2 = Somewhat useful 4	27%	
3 = Not useful 1	7%	
4 = Did not use this feature	4	27%

6.   How would you rate the overall screen appearance?

	Answer	Frequency	Percent of Total=42
1. ☐	Excellent	7	17%
2. ☐	Very good	18	43%
3. ☐	Good	12	29%
4. ☐	Fair	5	12%
5. ☐	Poor	0	0%

7.   How important is it to you for the CSAQ to be able to directly access your company's corporate data and automatically extract the R&D survey data?

	Answer	Frequency	Percent of Total
1.	☐ Extremely important. I would not use the CSAQ otherwise.	0	0%
2.	☐ Important	2	5%
3.	☐ Neutral	14	33%
4.	☐ I would prefer to key the data.	13	31%
5.	☐ I would not use the CSAQ if it could access and extract corporate data.	13	31%

8.   How important is it for you to be able to print a hard copy of the survey questions?

1.   With reported data?

Answer	Frequency	Percent of Total=42
Important	13	31%
Neutral	13	31%
Not Important	16	38%

2.   Without reported data?

Answer	Frequency	Percent of Total=42
Important	36	86%
Neutral	5	12%
Not Important	1	2%

Note: The numbering in Questions 9-11 allow you to track a particular companies response. Thus, the same company (#1) made the first comment listed under Questions 9, 10 and 11.

9.   What did you like least about the CSAQ?

1.   Moving within and between the screens if you wish to skip over information already complete/correct.
3.   Entering the information.
7.   Just running it the first time.
10.   Navigating the screen, I wasn't sure whether to use tab, arrows or enter key.
11.   Tried to modify my AUTOEXEC.BAT questions must be answered by several different individuals - need a copy of questions to distribute to proper parties.
13.   Ability to move within the screen.
16.   It did not save time. Consolidation had to be done on another spreadsheet.
20.   It is difficult to move around a screen. Also, the remarks section for some questions did not provide enough room for an adequate answer. It was difficult to edit remarks.
22.   Not being windows can give some people problems. I needed to exit and return many times to get all information required.
26.   Somewhat more time consuming than the forms. Not being able to pass a field then return later.
27.   Time of installation more appropriate to a more detailed survey than a short report like the RD-1.
28.   We send this survey to several individuals that have this survey in order to complete it. We were unable.
32.   That it is required in the first place.
33.   You need to fix this! I keep losing the cursor and my input. It is very difficult to move around these screens. I never knew whether to use the enter key or the arrows. Very frustrating!
34.   Screen movement.
35.   I had trouble printing the report.
37.   Not in the windows environment. Therefore, I had to move in and out of windows to run the necessary reports to fill in the correct information. Also, too many screens to move through to exit/enter.
38.   I thought it was broken up into too many screens. I think it would be better to do it in sections as the original report was.
39.   Couldn't enter what I knew and leave a screen without data to fill in at a later date. Took too long. Often had to go through all screens instead of selecting the ones you had the info on.
41.   No comment.
42.   Could not find anywhere that you needed to enter for your data to remain. Also, did not know why our last year's data was not there. Printing was horrible!!!!!
46.   Not windows. No facility to upload to mainframe. Uses to much conventional memory on the PC.
48.   Not related to the CSAQ, but I found that the data I was provided was different than that expected in the current questionnaire: I had answers to unasked questions and no answers to asked questions.
49.   It would have been easier to use a windows-based product.
50.   Not being able to enter data directly from the PEDRO data processing menu.
51.   Nothing.

10.   What did you like most about the CSAQ?

1.   Instructions easy to follow - user's guide had accurate instructions.
3.   Easy to use.
4.   Very simple, easy to use program.
7.   It will be easier the second time. If it is not radically changed next year.
8.   Fast, easy to use.
9.   Easy installation.
10.   Easy to complete the form - last year's data in the next column made it easy to remember which items to complete.
13.   Screen appearance easy to follow instruction for installation.
16.   It is an easy program to use.
20.   It did not take any longer than preparing a neat paper copy of the return.
22.   I had last years numbers and could change them if better information was available. I can get directly to the place I left off, when returning to the form.
26.   Ease of use clear and concise instructions.
30.   Ease of use.
32.   Easy to use overall.
33.   The on-screen help for each item was helpful. But, truthfully, I could have done this survey in half the time with a pen and paper!
34.   The concept of using a PC versus a manual form
35.   It was quick and easy to use.
37.   That the form is computerized and after data entry a clean copy can be printed for review.
38.   After reviewing the process, I thought it was pretty simple to do. As this becomes the standard format it will become easier.
39.   Easy to change current or prior year data.
41.   Was easy to do.
42.   Ease of use.
44.   Electronic filing eliminates time required to process and mail this document. Easy to use. After install.
46.   Easy to use.
49.   It was fairly easy to use.
50.   It is easy to use. Very friendly system.
51.   Ease of use.

11. **What improvements or enhancements would you recommend to improve the CSAQ reporting system?**

1.   ?
3.   None.
7.   Windows version.
8.   Get a windows version so AUTOEXEC and system files do not have to be updated.
9.   I would recommend using a windows software so that a mouse can be used to move across the entry screens.
16.   None.
20.   Better remark sections. Wrap around type.
22.   Windows or DOS based questionnaire.
27.   None.
30.   None at this time.
32.   None.
33.   Ease of movement within the screens. I spent half my time trying to get the cursor where I wanted it.
35.   Make printing the report before and after completion easier to all users.
37.   Update for the windows environment. Make your modem connections faster than 2400 BAUD.
38.   I found it very difficult to try to go back and change something without starting all over again on that screen. A better edit feature would be nice.
39.   Needs to be easier to use. Would be better if window based and could move around with a mouse and leave some things blank until info could be found.
40.   Make the CSAQ reporting system windows compatible.
41.   None at this time.
42.   Easier printing.
44.   Enhance functionality of arrow keys to allow scroll text.
46.   I would like to be able to export the completed data files to the corp. mainframe. From the mainframe I could access the internet and transmit the data file.
48.   It may be able to be streamlined some: fewer levels of menus to get to needed areas. It certainly was not as bad as some (windows, for example), but could be better.
49.   The best would be window-based. Also, the capability for wrap-around in these dialog boxes would be great (like in a word processor).
50.   None.
51.   Send better copy of questionnaire out with instructions.

12a. **In the future, if you were given the choice of reporting via paper or CSAQ for similar information, which one would you choose?**

	Answer	Frequency	Percent of Total
1.	☐ CSAQ	34	81%
2.	☐ Paper	7	17%

12b. **Please explain your answer to question 12a (mark all that apply):**

			CSAQ	Paper
1.	☐	It is easier to use	26	6
2.	☐	It takes less time	18	7
3.	☐	Reported data are more accurate	5	0
4.	☐	It is more interesting	23	0
5.	☐	Other: (Please explain):	5	1

> Paper: Need to locate a PC with adequate resources
>
> CSAQ: More things are becoming computer oriented, and I'm comfortable with that
>
> The process should become easier in time, learning curve
>
> It will become easier if all required forms are done in this manner
>
> It is not a big difference on a small survey like R&D, but if you used this for the MA-1000 it would be a big time saver (especially if you just had one file with columns for multiple locations).

13a. **How much time was required to:**
(1) install the computerized system,
(2) read the instruction manual and learn how to use the computerized system,
(3) collect the necessary information, and
(4) complete the computerized questionnaire?

Include the total amount of time required by all persons involved in these activities. If you are not sure how much time was spent by others, please provide your best estimate, rounded to the nearest whole number.

Response:
Fifty-one responses: an average number of 4 hours with a standard deviation of 5.82.

13b. **Of the total number of hours just reported (___ hours), what PERCENT was required to:** (Average percents are reported with standard deviation in parenthesis.)

(1) install the computerized system	23.2% (15.2)
(2) read the instruction manual and learn how to use the computerized system	17.6% (11.2)
(3) collect the necessary information	41.5% (22.4)
(4) complete the computerized questionnaire	17.7% (10.3)

Results of Edits Performed Within the R&D CSAQ

New Edits for CSAQ	No Edit Failure	Respondent Action After Edit Failure		
		Leave Alone	Change Data	Change Data and then Leave Alone
Total	283	121	45	19
Percent of Total Edits (Total /468), where (468=52 records x 9 edits)	(61%)	(26%)	(10%)	(4%)
Item 1: Sales and Employment				
1. No PY data	49	1	2	
2. Zero Sales	50	1	1	
3. Zero Employment	52			
Item 2: Number of Research and Development Scientists and Engineers				
1. No PY data	45	6	1	
Item 3A: Report Cost Incurred within the Company				
1. No PY data	15	20	10	7
10. Company & Other	1	42		9
Item 3B: Report Costs Outside the Company				
1. No PY data	25	13	12	2
Item 5: Energy Research and Development Performed within the Company				
1. No PY data	20	18	13	1
Item 6: Pollution Abatement Research Development Performed within this Company				
1. No PY data	26	20	6	

Notes:
The edits listed under the items are edits performed on the entered data within that part of the questionnaire. Most of the edits compare the relationship of one item to another. Many of them compare a py (prior year) entry to a cy (current year) entry. When prior year data is missing (No PY data), an edit will pop-up and ask the respondent whether (s)he wants to fill-in prior year data.

New edit = edit that is not performed at headquarters. All edits on next page are performed again at headquarters.

Results of Edits Performed Within the R&D CSAQ

Existing Edits at Headquarters	No Edit Failure	Respondent Action After Edit Failure		
		Leave Alone	Change Data	Change Data and then Leave Alone
Total	1,007	20	10	3
Average (Total divided by 20 edits)	50	1	0.5	0.15
Percent of Total Edits (Total/1,040), where (1,040=52 records x 20 edits)	(97%)	(2%)	(1%)	-
Item 1: Sales and Employment				
4. Sales py/cy	52			
5. Employment py/cy	52			
6. Sales/Employment	50	2		
7. Sales/R&D	52			
Item 2: Number of Research and Development Scientists and Engineers				
2. #Scientist py/cy	51	1		
Item 3A: Report Cost Incurred within the Company				
2. Zero R&D				
3. Total Basic py/cy	46	1	3	2
4. Total Appl. py/cy	50	2		
5. Total Dev. py/cy	51	1		
6. Federal Basic py/cy	48	2	1	1
7. Federal appl py/cy	52			
8. Federal dev. py/cy	50	1	1	
9. Sales/R&D	50	1	1	
	49	2	1	
Item 3B: Report Costs Outside the Company				
2. Outside py/cy	49	2	1	
3. Foreign py/cy	51	1		
Item 5: Energy Research and Development Performed within the Company				
2. Total energy py/cy	51	1		
3. Federal energy py/cy	52			
4. 95/94 Total energy	51	1		
Item 6: Pollution Abatement Research Development Performed within this Company				
2. Total Pollution py/cy	49	2	1	
3. Federal pollution py/cy	51		1	

Specific BOC Recommendations for Development of Future CSAQ Systems

Systems Design

1   Number of diskettes for the CSAQ should be reduced--an executable file only would be ideal for the CSAQ.
2   The CSAQ should use a graphical user interface (GUI) where the respondent can use a mouse for selection/movement and interact in a Windows environment.
3   Time for installation should be faster.
4   The CSAQ should require less conventional memory than it does.
5   If the respondents reboot their PC, they should not be locked out of the CSAQ.
6   Allow the respondent to use more than COM 1 or COM 2 for modem transmission and more than 1200 and 2400 Baud Rate.
7   Data import capability needs further development, including capability for automatic editing of imported data.
8   Printing of the CSAQ should be made easier.
9   The number of introduction screens should be reduced.
10   The error messages should be less cryptic--provide more information.
11   The amount of paper materials in the package should be reduced.
12.   Allow data collection via Internet.
13.   Low, if any, license fee.

Survey Specific

15   Put a filter question in the beginning of the survey concerning reporting entity, instead of providing instructions on help/introductory screens on who should report.
16   Ensure all applicable edits are included.

Movement within CSAQ/Functionality

15   Provide more space for respondent comments when reported data produces edit failures.
16   The respondent should be given the ability to go back to a previous screen without having to go to the main menu.
17   Movement between screens and items should be made easier.
18   The cursor should be made more apparent.
19   The respondent should be able to use the tab key for movement.
20   The respondent should be able to use a function key instead of "C" or "S" to continue or save the screen entries.
21   After the respondent enters a data correction, an arrow down should save it as well as an enter.
22   Text entries should wrap automatically.
23   The respondent should be able to bypass blank fields when going back to make a correction.

Table of Contents

Figures

Tables

1994 R&D CSAQ Test Staff and Estimates of Project Time

Staff*

	MCD	Other (CASIC)
ESMPD	Stacey Cole	Peggy Little
Magda Ramos	Ronanne Capps	Robin Deese
Beth Sweet	Ron Taylor	Greg Fulton
Edward Bates	Nancy Higgins	
Nestor Baez	Lisa Feldman	
CASIC	**EPCD**	
Barbara Sedivi	Debbie Dillon	
Diane Schapira	Diane Harley	
Cheryl Querry	Don Sturm	
	Don Hundertmark	
TMO		
Ellen Soper		

Project Time Estimates

Project Activity		Time frame	Days	Person Years
Total Time for Development of System		(June 1994-February 1995)	616	2.6
	Instrument Development		188	0.8
	Remaining Development		402	1.7
	Other Items		26	0.1
Implementation and Evaluation		(January 1995-September 1995)	320	1.3
Total Project Time		(June 1994-September 1995)	936	3.9

Other items:
1.　　Follow-up for Screener (6.4 days)--There were 203 telephone calls made for screener nonresponse follow-ups. Each call took approximately 15 minutes, thus approximately 51 hours were spent by 10 people ranging in grades.
2.　　Testing In-house (20 days)--

　　　　First in-house test: 50 testers tested and commented on the CSAQ (avg 4 hours/tester) (25 days)
　　　　Second in-house test: 10 testers (avg 4 hours/tester) (4.5 days)
　　　　Third in-house test: 10 testers (avg 4 hours/tester) (4.5 days)

　　　　Note: This is a total of 34 days, but we reduced it to 20 days because time for some of the testers is included in other development time estimates.

* These members do not include administrative or managerial support.