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Survey of Radioactive Material Shipments in the United States

April 1976

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Battelle
Pacific Northwest Laboratories

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SURVEY OF RADIOACTIVE MATERIAL SHIPMENTS IN THE UNITED STATES

by

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April 1976

Approved for Distribution

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Our special thanks to all of the respondents who participated in the survey. We realize that completing the questionnaire required an extensive amount of time and effort. Further, we hope that the results will benefit everyone who is interested.

SUMMARY

The purpose of the Survey of Radioactive Material Shipments Program, sponsored by the Nuclear Regulatory Commission, was to collect, process and briefly analyze data on the transportation of radioactive material in the United States, excluding defense-related material. The survey period was from March 1, 1974 through February 28, 1975.

Of over 15,000 NRC and Agreement States licensees, and ERDA prime contractors, 2275 were selected to receive questionnaire packets. Approximately 59% of those recipients responded to the survey; of these respondents, 35% reported shipping activities. Based on the number of packages shipped annually, the major nuclides were ^{131}I, ^{125}I, ^{99m}Tc, ^{99}Mo, and ^{238}U, while those shipped in the greatest amounts (grams or curies) were ^{60}Co, ^{192}Ir, and ^{238}U. The majority of package types shipped were Types A and LS (low specific activity), while the most common modes of transport were rail and truck.

The shipping activities of approximately 14,600 minor shippers were estimated to be on the order of 200,000 radioactive packages/year based on a linear extrapolation of information from 545 minor shippers who responded to the survey. The combined annual shipping activities of 761 major shippers, SNM licensees, and ERDA contractors who responded were estimated to be approximately 300,000 packages of SNM and Source Material plus 800,000 packages containing nuclides other than SNM or Source Material (these annual totals are for the 761 respondees only and are not extrapolated to the total population). There were also about 800,000 packages (mostly exempt) shipped by 21 apparent major shippers who responded to a part of the survey intended for minor shippers. Also, classified data containing information regarding nonweapons shipments indicated 850 packages. However, since the classified data is insignificant to the total, it was not included in the data base.

Although a detailed estimation of the total U.S. shipping activity was not within the scope of this study, the possibility of using the data from

this survey for such a projection was briefly investigated. The results of this investigation indicate that the accuracy of linear extrapolations to total shipping activity, based solely on these program results, should be carefully evaluated. While no apparent statistical basis exists for linear extrapolation of the survey data, an "order-of-magnitude" estimate was calculated to obtain some perspective of the U.S. radioactive shipping activity; the results of this estimate are shown in the last column of Table 1. The total of the extrapolations is about 3 million package transfers per year, without regard to package contents, size, distance traveled or mode of transport. However, it is important to note that several assumptions were necessary to make this estimation. These assumptions are listed below and the validity of these assumptions is briefly discussed in Sections 4 and 5.

1) All nonrespondents are identical to the respondents regarding type and magnitude of shipping activity.

2) The 21 apparent major shippers who responded with Summary Questionnaires are the only significant major shippers existing in the minor shipper population (as defined in Section 2).

3) The shipping activities of the licensees in the NRC subcategories not represented by the data base are not significant relative to the total shipping activity.

4) The overlap and duplication of licenses and licensees in various shipping categories is not significant.

5) The combination of data from three population groups (SNM licensees, major shippers, ERDA contractors) into two groups based on material shipped, is correct, even though the sample response from each of the three groups may be different.

TABLE 1. Linear Extrapolation of Survey Results to Total U.S. Shipping Activity

Population Group	Type	Sent	Returned and Included in Data Base	Packages/Year for Shippers Responding Only	Packages/Year for Whole Population (by linear extrapolation)
SNM, ERDA, and Major Shippers reporting SNM/Source Material Shipments (906 total)	Detailed	906	702	300,000	400,000
SNM, ERDA, and Major Shippers reporting non-SNM/Source Material Shipments (1,049 total)	Detailed	1049	761	800,000	1,100,000
Potential Shippers (∿14,600 total)	Summary	1226	544	---	200,000
Major Shippers reporting on Summary Questionnaires (21)	Summary	---	21[a]	800,000 (mostly exempt)	>800,000 (mostly exempt)
Total	---	---	--	---	>2,500,000

(a) Not included in data base.

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1.0 INTRODUCTION

Interest in the safe transport of radioactive materials by the nuclear industry is expected to increase as more nuclear power plants are brought on line, more radioactive material is used for medical purposes, and more nuclear powered devices are developed. In April 1975, Battelle, Pacific Northwest Laboratory (PNL) initiated this program, sponsored by the U.S. Nuclear Regulatory Commission (NRC), to collect and summarize data on the current status of transportation of radioactive materials in the United States. Included are details on transportation modes, package contents, and shipping distances for radioactive material transported.

This report describes and explains our survey procedures (Section 2), data handling processes (Section 3), and presents the results (Section 4). The appendixes provide additional detail on questionnaire editing (Appendix A), Computer reports and flow charts (Appendix B), and questionnaire packets (Appendix C).

1.1 PROGRAM OBJECTIVE

The objective of this survey is to collect, process and briefly analyze data on the transportation of all radioactive material in the United States, excluding defense-oriented material. The survey addresses all common modes of transportation, package types and contents, and the shipping distances of the radioactive materials being transported during the survey period which varied from one week to one year depending on the type of license held by the respondent (see Section 2.1.1 for further discussion).

1.2 BACKGROUND

The NRC's Office of Standards Development conducted a one-week survey in late November 1973 through January 1974 to obtain shipment information related to air transport of radioactive materials.[1] Six large radiopharmaceutical companies and two commercial radioisotope production reactor operators were asked to provide information similar to that requested by the survey

described in this report. The NRC survey contained only data specifically related to the transport of radiopharmaceutical materials; it did not include the transport of radioactive materials by the entire nuclear industry.

Several other studies have been conducted recently on the potential radiation dose to the public caused by transporting radioactive material. One such study[2] was conducted by PNL for the Federal Aviation Administration (FAA) of the Department of Transportation (DOT). This study assessed the environmental impact of proposed changes in regulations for transporting radioactive material by aircraft. Another impact statement[3] is being prepared by Sandia Laboratories for the NRC. In addition to examining the impact of transporting radioactive materials by aircraft, this study also considers the alternative modes of transportation and will use information from this PNL survey to help evaluate the impacts.

1.3 SCOPE

The scope of this program includes developing a questionnaire, conducting a survey using the questionnaire, compiling the information obtained during the survey, and reporting the survey results. Using information from NRC, ERDA, DOT and industry representatives, PNL developed four questionnaire packets for the various license types [i.e., NRC licensees, Agreement State licensees and Energy Research and Development Administration (ERDA) prime contractors who are exempt from licensing requirements; see Section 2.2 for details]. These questionnaire packets were then mailed to 2,275 of approximately 15,000 organizations, and/or individuals who were allowed by law to possess, use or transfer radioactive material in the United States during the survey period from March 1, 1974 to February 28, 1975.

The six major program tasks were:

1) develop the questionnaire packets,
2) select questionnaire recipients,
3) distribute the questionnaire packets,
4) process returned questionnaires,

5) provide a computer output of the survey results, and
6) prepare a final program report including a discussion of the survey results and providing a perspective for these results.

The relationship of one task to another is illustrated in Figure 1.1. Each box in Figure 1.1 is numbered to indicate which of the above six tasks is represented by the activity indicated in the box. Section 2 (Survey Procedures) describes the first three tasks, Section 3 (Data Processing) details the fourth task, and Section 4 (Results and Discussion) and Section 5 (Survey Perspective) describe the last two tasks. A section dealing with future considerations (Section 6) has also been included as well as appendixes containing detailed supporting information. Appendix A describes the questionnaire editing process; Appendix B contains the computer reports and corresponding flow charts and calculations; and Appendix C shows samples of the questionnaire packets.

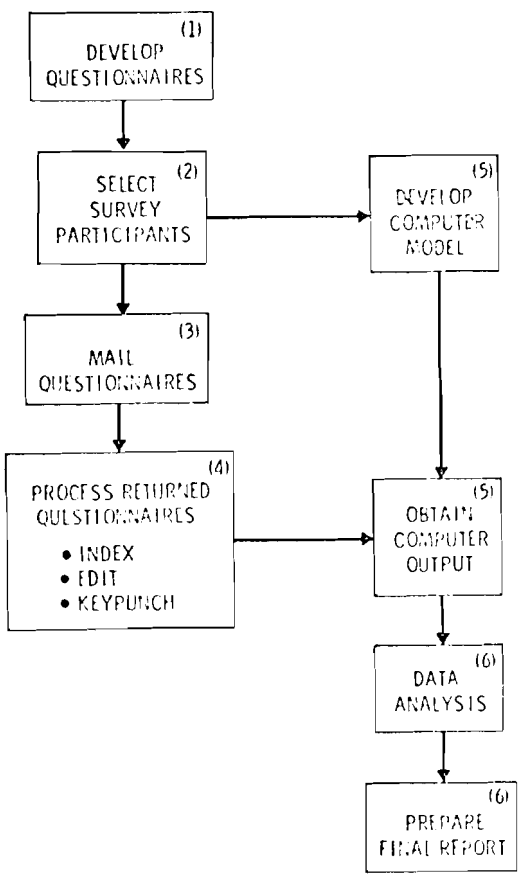

FIGURE 1.1. Relationship of Program Tasks

2.0 SURVEY PROCEDURES

This first phase of the Radioactive Material Shipment Survey Program involved three tasks. These tasks are included in the first three major tasks listed in Section 1.3. The first task was to develop a questionnaire to obtain as much useful transportation data as possible with a minimum effort for the respondent. The second task involved selecting the licensees and contractors to be surveyed, and the third task was to mail the questionnaire packets. These tasks are detailed in the following subsections.

2.1 DEVELOPMENT OF THE QUESTIONNAIRE PACKETS

The major objective in developing the questionnaire was to obtain as much useful information as possible, in a form that could be correlated for extrapolation purposes. In addition, since the survey was voluntary and the respondents were not compensated for their time, the questionnaire had to be easy to complete. Further, this information was market-oriented and could be considered business sensitive for some respondents. To encourage their response, we indicated that the survey results would be made available only in a "summary" form to protect proprietary business information.

Due to the complexity of the design objectives as well as the license categories and sampling procedures (see Sections 2.2.1 through 2.2.3), three questionnaires were ultimately developed: one Summary Questionnaire and two Detailed Questionnaires. These questionnaires are explained in the following subsections and samples of the questionnaire packets sent to the licensees and contractors are provided in Appendix C.

2.1.1 Detailed Questionnaires

The detailed questionnaires [SNM[a] Questionnaire and Non-SNM Questionnaire] were the same except for the units specified and the length of the survey period. The SNM Questionnaire requested that the radioactive material data be listed in grams, while the Non-SNM Questionnaire required this information in curies. The survey period for SNM licensees was one year, while the survey period for non-SNM licensees was flexible, depending on the frequency of their shipping activities: 1) one week for those shipping more than 500 packages a week, 2) one month for those shipping fewer than 500 but more than 10 packages a week, or 3) six months for those shipping fewer than 10 packages a week. Each questionnaire recipient was asked to select a representative time period since these results would be extrapolated to cover a one-year period.

Both questionnaires requested detailed information on the miles a consignment was shipped; its origin and destination; the major and secondary modes of transportation; the types of radioactive materials shipped, as well as chemical and physical forms; the types of shipping containers used; the Transport Index (TI);[b] and the amount in curies (for non-SNM/Source Material) or grams (for SNM/Source Material) of each package.

(a) The term "SNM," abbreviation for Special Nuclear Materials, is used throughout the text in reference to: 1) organizations or individuals who are licensed to possess, use, and transport Special Nuclear Matetial; 2) the questionnaire packet and questionnaire form used in this survey for reporting the transportation of Special Nuclear Material; and 3) Special Nuclear Material itself as defined in the U.S. Federal Code of Regulations (10CFR 70.4-m).[4] The term "SNM and Source Material," usually abbreviated "SNM/Source Material," is used throughout the text in reference to data regarding the transportation of Special Nuclear Material and/or Source Material (10CFR 40.4-h),[4] which includes all uranium, all plutonium, and all thorium.

(b) The Transport Index is the "number placed on a package to designate the degree of control to be exercised by the carrier during transportation." It is determined by "the highest radiation dose rate in millirem per hour at three feet from any accessible external surface of the package," or, for Fissile Class II packages only, the "number calculated by dividing the number '50' by the number of similar packages which may be transported together" (49CFR 173.389,390).[4]

2.1.2 Summary Questionnaire

This questionnaire requested summary information for a one-year period based on "best knowledge" rather than actual reference to the respondent's records. We intended that the respondent would be able to complete the questionnaire quickly and easily. The primary purpose of this questionnaire (sent on a random selection basis) was to obtain general information regarding the shipping activity of a large number of representative licensees (see Section 2.2.3).

2.2 SELECTION OF QUESTIONNAIRE RECIPIENTS

The most common method of surveying a population is to randomly select a relatively small fraction of a population that, ideally, forms a representative cross section of the total population. The information received from this cross section is then extrapolated to represent information for the total population. This method is reliable if the information obtained from the sampled population is reasonably uniform and if proper sampling procedures are used.

A strictly random selection was considered inadequate for this survey for two reasons: first, participation in the survey was voluntary. Even though a random cross section is selected to receive questionnaires, it is unlikely that the same (random) group will elect to return completed questionnaires. Thus, the cross section represented by the returned questionnaires may become quite selective. Our experience with returned questionnaires and contact with respondents and nonrespondents confirmed this trend. In some instances, companies with few personnel and small but significant shipping activities had no available man-hours for completing a Detailed Questionnaire, while a few refused outright to fill out even a Summary Questionnaire. Several licensees who had no shipping activities during the survey period did not respond, not realizing the importance of a "no activity" response. These and other problems encountered with the survey returns are detailed in Appendix A and Sections 4 and 5.

The most important reason that contributed to the inadequacy of a totally random survey was the various sizes and types of licensee categories. In some license categories (radiopharmaceuticals, for example) only a small fraction of the licensees may account for a vast majority of the shipping activity for that category. If these few are not correctly included in the random cross section, the extrapolation to the total population will be grossly in error, since the sample is not representative of the norm for the category. A random selection and response of this type would likely lead to inaccurate results. Only a very fortunate (and unlikely) coincidence of sampling and extrapolation would give accurate results.

In view of these problems, we combined random and selective survey methods. We first attempted to identify major shippers (those with unusually large amounts of shipping activities; see Section 2.2.2). We then sent Detailed Non-SNM Questionnaire packets to these major shippers and sent Detailed SNM Questionnaire packets to all SNM licensees and ERDA contractors (see Section 2.2.1).

The remaining licensees were sent Summary Questionnaires on a random sampling basis according to respective license categories (Section 2.2.3). The intent of this survey method was to obtain detailed information from a core group of respondents representing the major portion of the radioactive material shipping activity in the United States. Summary information obtained on a random sampling basis from the remaining licensees served a dual purpose. The primary purpose was to extrapolate, to a uniform total, shipping activity for the minor[a] shipper population. These data then contain evenly extrapolated information from which parametric and average values can be obtained. The secondary purpose of the summary data was to confirm that those licensees we considered major shippers did indeed represent the bulk of U.S. shipping activity.

Questionnaire packets were mailed to representatives in the three groups of organizations or persons that are allowed by law to handle radioactive materials in the U.S. One group is directly licensed by NRC

(a) A major shipper is any person or organization that annually ships an unusually large number of packages of radioactive material. A minor shipper is anyone other than a major shipper.

and constitutes slightly less than one-half of the U.S. licensees. Those in the second group are licensed by their respective state governments. These states, called Agreement States, have entered into an agreement with NRC for the transfer of authority for licensing and regulating the possession, use, and transportation of certain radioactive material within their boundaries. Agreement States regulate approximately one-half of the U.S. licensees. The third group (relatively small in number) consists of ERDA prime contractors which are regulated directly by ERDA. Table 2.1 indicates the Agreement States with the number of licenses in each state for each of four general license categories and the number of NRC licenses for each of the four categories. The 984 SNM licensees (see Section 2.2.1) listed in Table 2.1 completely overlap the NRC and Agreement States totals and include all of the ERDA contractors; therefore, these are not 984 additional licensees. There is also considerable overlap between and within license categories, with one licensee holding licenses in more than one category and/or holding more than one license in a single category. Note that Table 2.1 is not corrected for this overlap, but simply lists the number of existing licenses. This overlap is discussed further in the following subsections and in Sections 3, 4, and 5. In addition, the following subsections detail the process used to select the survey participants.

2.2.1 SNM and ERDA

A list of SNM[a] licensees was compiled on the basis of information from the NMIS[b] and a licensee list supplied by NRC. (The NRC SNM License Categories 21-100 through 55-000 are listed in Table 4.3.) No lists of SNM licensees were obtained from the Agreement States; therefore, the compiled list does not include SNM licensees from the Agreement States that did not ship any packages containing 1 g or more of Special Nuclear Material.

(a) See footnote (a), Section 2.1.1.

(b) NMIS, the Nuclear Materials Information System, is an automated data system containing information regarding the transportation of Special Nuclear Material. Every SNM licensee is required to record each transfer of SNM in an amount equal to or greater than 1 g on a 741 Form and forward this information to Oak Ridge National Laboratory (ORNL) where it is incorporated into the NMIS data system.

TABLE 2.1.[a] Agreement States and NRC Licenses and ERDA Operations and Area Offices

Regulating Body	Number of Licenses by General Category				Total for Regulating Body
	Medical	Academic	Industrial	Other	
Agreement States					
Alabama	114	9	120	9	252
Arizona	63	10	106	18	197
Arkansas	94	14	79	40	227
California[b]	583	89	573	155	1,400
Colorado	34	9	122	25	190
Florida	322	23	228	2	575
Georgia	146	16	135	56	353
Idaho	30	3	60	2	95
Kansas	65	12	99	13	189
Kentucky	59	22	91	8	180
Louisiana	183	16	162	24	385
Maryland	93	18	28	109	248
Mississippi	54	8	54	14	130
Nebraska	29	9	39	7	84
Nevada	23	3	23	10	59
New Hampshire	24	6	16	8	54
New Mexico	28	5	40	6	79
New York	544	107	292	297	1,240
North Carolina	105	51	141	11	308
North Dakota	25	3	24	3	55
Oregon	55	14	62	27	158
South Carolina	33	12	67	15	127
Tennessee	118	25	121	20	284
Texas	446	11	509	5	971
Washington	96	19	118	12	245
Total Agreement States	3,366	514	3,309	896	8,085
Total NRC	2,686	589	4,084	140	7,499
TOTAL NRC AND STATES	6,052	1,103	7,393	1,036	15,584
SNM[c]	---	---	---	---	984
ERDA Operations and Area Offices	---	---	---	---	19

(a) These figures are not corrected for overlap and duplication between and within license categories.

(b) Only a total number of licenses was available from California. The distribution of the 1400 licenses into the four categories was assumed using the overall average distribution existing in the other 24 Agreement States.

(c) The 984 SNM licenses overlap completely with the Agreement States, NRC, and ERDA groups.

All nine ERDA Operations Offices and one of the ten ERDA Area Offices were sent SNM Questionnaire packets for distribution to prime contractors as appropriate; Appendix C contains a list of the ERDA offices that received questionnaires.

The original mailing list of SNM licensees and ERDA contractors contained 984 entries of which 78 were duplications, leaving a net 906 SNM Questionnaire packets mailed (see Column 1a of Table 4.2A). Of the 906, 45 SNM licensees were identified as probable "major" shippers (see Section 2.2.2 for details).

2.2.2 Major Shippers

A "major shipper" for the purposes of this survey is defined as any organization or person that annually ships more than 500 packages of radioactive material. However, this definition is somewhat arbitrary. For example, 500 packages shipped per year by a radiopharmaceuticals manufacturer would not necessarily qualify the manufacturer as a major shipper, while 500 packages annually for a ^{90}Sr heat source producer would definitely be considered major shipping activity. Basically, we intended to select those licensees who shipped the majority of packages in a category.

A list of 109 probable major shippers was compiled based on recent publications[5,6] and input from NRC and ERDA staff. This list is referred to as the "Major List." A second list of 107 probable major shippers was compiled from lists supplied by the regulatory agencies in each of the Agreement States. This list is referred to as the "Agreement States Major List." After determining overlap and duplication of licensees in both lists, the Major List contained 96 unique licensees and the Agreement States Major List contained 92, for a total of 188 probable major shippers (see Table 4.2B).

As indicated in Section 2.2.1, 45 of these 188 probable major shippers (27 from the Major List and 18 from the Agreement States Major List) were also SNM licensees. Thus, SNM Questionnaire packets were mailed to each, and were counted as SNM packets mailed to SNM licensees that were also probable major shippers. Since the SNM packet contained both an SNM and a Non-SNM Detailed Questionnaire, these 45 packets were counted as 45 SNM

Questionnaires mailed plus 45 Non-SNM Questionnaires mailed and are included in both the 906 SNM and 1049 Non-SNM Questionnaires that were sent (listed in Column 2a of Table 4.2A). The remaining 143 probable major shippers listed in Column 1a of Table 4.2A were sent Detailed Non-SNM Questionnaires only. The remaining 861 [1049-(143+45)] of the 1049 Non-SNM Questionnaires listed in Column 2a represent the Non-SNM Questionnaires which were contained in the SNM Questionnaire packets sent to the remaining 861 (906-45) SNM licensees and ERDA contractors that were not considered probable major shippers.

2.2.3 Other Potential Shippers

The Summary Questionnaire was mailed to other potential shippers (hereafter referred to as "minor shippers") who were selected on a random sampling basis. A list of potential minor shippers was compiled from the licensee address lists supplied by NRC and the Agreement States.

Four general shipping categories were identified for the Agreement States licensees: Academic, Medical, Industrial, and Other. "Other" includes Civil Defense and other licensees who are members of state and local governments, as well as those who could not be assigned to any of the three other categories on the basis of their organizational names. The organizational name was the only basis that was consistently available for assigning a shipping category to the Agreement State licensees.

Key words, or derivations for assigning categories based on the licensee name, are as follows:

- Academic - college, university, school, academy
- Medical - hospital, M.D., medical, X-ray, clinic, pharmaceutical, pharmacy, radiology, biology
- Industrial - Inc., Corp., company, systems, chemical, any metal name, instruments, industry, engineering, testing, oil, service, technology, manufacturing, electric, mining, power, instruments, products, metal, consulting, energy
- Other - civil, institute, agency, public, commission, city, state, and any obvious member of city or state governmental services.

"Medical" takes precedence over all other categories; "Academic" takes precedence over "Industrial" and "Other;" "Industrial" takes precedence over "Other." For example, the "Silver City College of Medicine" would fall in the Medical category, even though its organization name contains key words for each of the other three categories. A certain amount of subjective judgment was necessary in order to assign a category to licensees in cases where the above system did not apply. For example, the "Acme X-ray Services, Inc." might well be involved in nondestructive testing and analysis (Industrial category), rather than in radiology (Medical category).

Recipients from the Agreement States list were then randomly selected from these four categories. The fraction selected from the Academic, Medical, and Other categories was about 5% of the total licensee population in each category. A larger fraction (about 10%) was selected from the Industrial category because a greater variation in amounts and types of nuclides shipped was expected.

A total of 528 Agreement States licensees were selected to receive Summary Questionnaires. The number of licenses in each category for each Agreement State is listed in Table 2.1. Note that only a total number of licenses (1400) was available for California; the distribution of these 1400 into the four categories was assumed using the overall average category distribution for the 24 other states. The number of Summary Questionnaires that were mailed out and returned in each of the four Agreement States categories is shown in Table 4.3B.

The number of licensees selected from each of the 39 NRC non-SNM license categories (Categories 01-100 through 11-700) are shown in Table 4.3A, third column. Generally, a larger fraction was selected from those categories where the greatest variation in types and amounts of nuclides handled was expected (Categories 03-120 through 03-800), while a smaller fraction was selected from those categories where some uniformity in types and amounts shipped was expected (for example, 02-100, 02-120). A total of 698 NRC licensees were selected to receive Summary Questionnaires.

The questionnaire returns and extrapolation of data from them are discussed in Sections 3, 4 and 5.

2.3 DISTRIBUTION MECHANICS

When the selection of survey participants was completed, the corresponding mailing addresses were entered into a data file for automated processing and printing of address labels. The address labels were affixed to the proper questionnaire packets according to category codes listed on the labels; the packets were then ready for mailing.

Figure 2.1 is a flow chart of the mailing process. Some SNM Questionnaire packets were mailed directly to SNM licensees and some were mailed to ERDA field office managers for distribution to the respective contractors under their jurisdiction. The SNM licensees were mailed a portion of the NMIS[a] printout which pertained to their own shipping activities to aid them in completing the questionnaire. Detailed Non-SNM Questionnaires and Summary Questionnaires were mailed directly to major and minor shippers. The cover letter for all three questionnaires explained the purpose of the survey and urged the recipients to complete the questionnaire and return it to PNL. Since several ERDA contractor questionnaires were distributed through ERDA Field Offices, those cover letters were sent out under ERDA letterhead. Some of the participants received more than one questionnaire packet due to some duplication on the address list. The survey returns are discussed in Section 4.1.

(a) For a description of the NMIS, see Section 2.2.1, footnote (b).

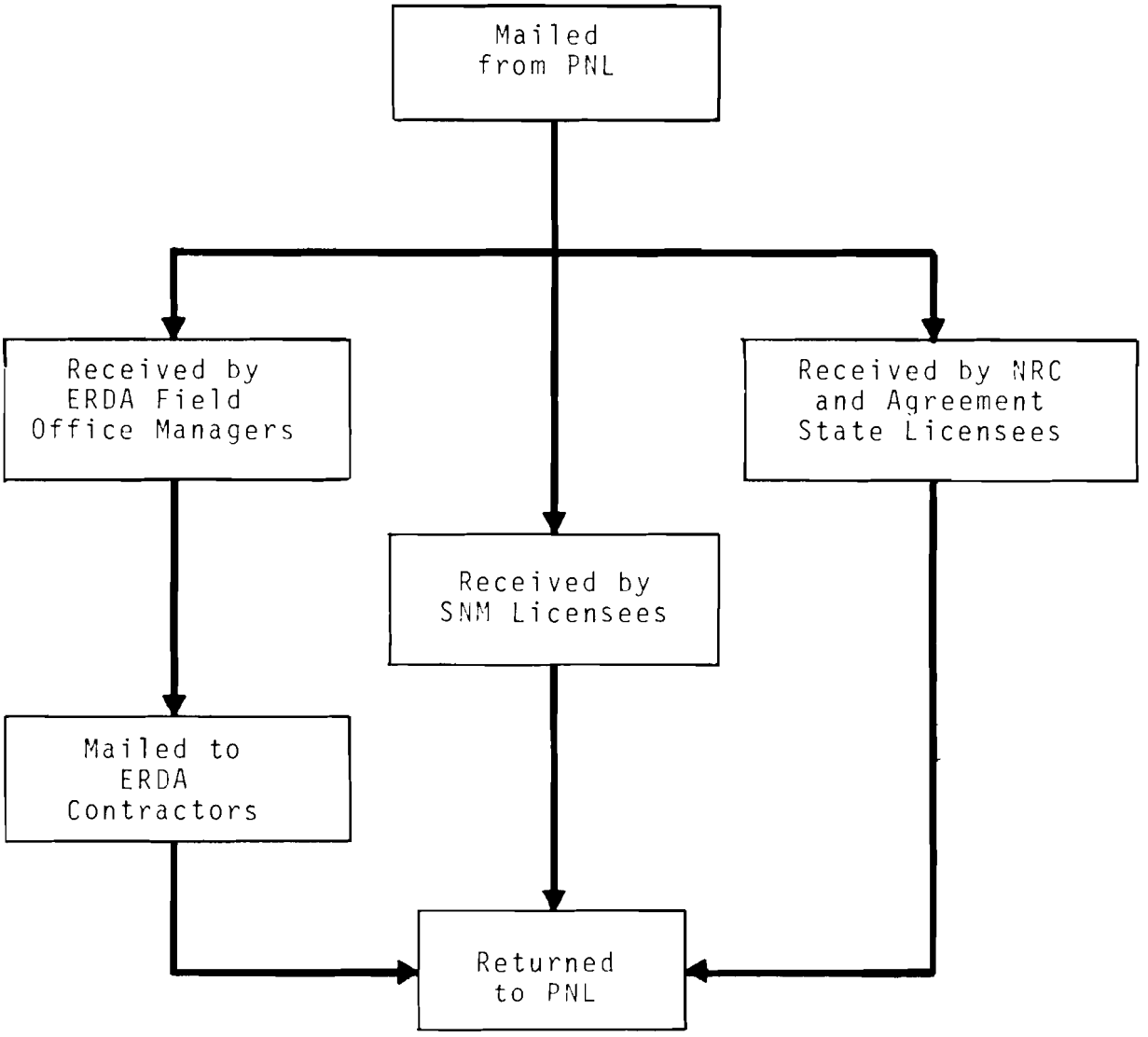

FIGURE 2.1 Distribution of Questionnaire Packets

3.0 DATA PROCESSING

The data from the returned questionnaires were edited manually in a two-phase procedure, then were keypunched onto data cards and manually verified for keypunch accuracy. Finally, the data were automatically verified by a program editor prior to inclusion on a mass storage device for processing. The following subsections describe these processes and present a brief description of the computer reports generated from the data base. The method of extrapolating the Summary Questionnaire data to population totals is also presented in Section 3.3; general calculations for all of the computer reports are included in Appendix B.

3.1 QUESTIONNAIRE EDITING

Although instructions were included with the questionnaire packets, an editing process was necessary to ensure that the data listed were uniform and compatible with established format. This editing process consisted of a preliminary identification/indexing step followed by a two-phase editing procedure to assure uniformity and to obtain missing information.

As the questionnaires were received, each was assigned a unique four-digit identification number. This number was recorded in a master address list and then used in place of the respondent's name in all subsequent data processing.

The editing process then proceeded. The first phase involved checking the questionnaires to assure that the information was consistent with the established format. In the second phase certain respondents were contacted to obtain necessary information not available on their returned questionnaires. Appendix A contains a detailed description of the assumptions and procedures used in the editing process.

3.2 COMPUTER PROCESSING

After questionnaire editing, the data from the questionnaires were keypunched onto cards. These cards were then put through two verification

processes. The first process compared the numeric data punched on the card with the actual questionnaire to ensure keypunching accuracy. In the second process the cards were run through a program editor to compare alphanumeric data punched on the cards with an acceptable set of syntax previously established. Any data rejected by the program editor were compared to the corresponding entries on the questionnaires, corrected as needed, and recycled through the program editor until accepted. Acceptable data were put on a direct access mass storage device to generate 19 report sets: 16 from the Detailed Questionnaire data and 3 from the Summary Questionnaire data. A brief description of each report follows; a standard detailed description of each report and calculations used to derive the reports are included in Appendix B. The massive volume (over 18 inches thick) of the reports prevents including all of this information. However, several reports have been summarized in Section 4. Computer reports that are totally included in this report are preceded by an asterisk (*) in the following list. A complete set of computer reports is available at the NRC Public Document Room, 1717 H Street NW, Washington D.C., 20555.

Detailed Questionnaire Reports

Report I. SNM/Source Material Data Base Sorted Alphabetically by Radionuclide

A. Summary of Information
B. Major Transportation Mode
C. Secondary Transportation Mode
D. Package Type
E. Transportation Information

Report II. Non-SNM/Source Material Data Base Sorted Alphabetically by Radionuclide

A. Summary of Information
B. Major Transportation Mode
C. Secondary Transportation Mode
D. Package Type
E. Transportation Information

Report III. SNM/Source Material Data Base Sorted in Descending Order of Total Gram Value

A. Summary of Information
B. Major Transportation Mode
C. Secondary Transportation Mode
D. Package Type
E. Transportation Information

Report IV. Non-SNM/Source Material Data Base Sorted in Descending Order of Total Curies Value

A. Summary of Information
B. Major Transportation Mode
C. Secondary Transportation Mode
D. Package Type
E. Transportation Information

Report V. Activity Frequency Distribution Using SNM/Source Material Data Base

A-Z. Each radionuclide in alphabetical order

Report VI. Activity Frequency Distribution Using Non-SNM/Source Material Data Base

A-Z. Each radionuclide in alphabetical order

Report VII. TI Frequency Distribution Using SNM/Source Material Data Base

A-Z. Each radionuclide in alphabetical order

Report VIII. TI Frequency Distribution Using Non-SNM/Source Material Data Base

A-Z. Each radionuclide in alphabetical order

Report IX. Summary Frequency Distribution by Transportation Mode Without Chemical/Physical Form Breakdown Accessing SNM/Source Material Data Base

A. Air Passenger
B. Air Non-Passenger
C. Truck
D. Ship
E. Rail
F. Mail
G. Unknown
H. All Transportation Modes Combined

*Report X. Summary Frequency Distribution by Transportation Mode Without Chemical/Physical Form Breakdown Accessing Non-SNM/Source Material Data Base

A. Air Passenger
B. Air Non-Passenger
C. Truck
D. Ship
E. Rail
F. Mail
G. Unknown
H. All Transportation Modes Combined

Report XI. Summary Frequency Distribution by Transportation Mode With Chemical/Physical Form Breakdown Accessing SNM/Source Material Data Base

A. Air Passenger
B. Air Non-Passenger
C. Truck
D. Ship
E. Rail
F. Mail
G. Unknown
H. All Transportation Modes Combined

Report XII. Summary Frequency Distribution by Transportation Mode with Chemical/Physical Form Breakdown Accessing Non-SNM/Source Material Data Base

A. Air Passenger
B. Air Non-Passenger
C. Truck
D. Ship
E. Rail
F. Mail
G. Unknown
H. All Transportation Modes Combined

*Report XIII. Summary Frequency Distribution by Transportation Mode Without Chemical/Physical Form Breakdown Accessing SNM/Source Material Data Base Including Only the Nuclides Not Convertible to Curies

A. Air Passenger
B. Air Non-Passenger
C. Truck
D. Ship
E. Rail
F. Mail
G. Unknown
H. All Transportation Modes Combined

*Report XIV. Summary Frequency Distribution by Transportation Mode Without Chemical/Physical Form Breakdown Accessing the SNM/Source Material Data Base Converted to Curie Amounts

A. Air Passenger
B. Air Non-Passenger
C. Truck
D. Ship
E. Rail
F. Mail
G. Unknown
H. All Transportation Modes Combined

Report XV. Summary Frequency Distribution by Transportation Mode with Chemical/Physical Form Breakdown Accessing the SNM/Source Material Data Base Including Only the Nuclides Not Convertible to Curie Amounts

A. Air Passenger
B. Air Non-Passenger
C. Truck
D. Ship
E. Rail
F. Mail
G. Unknown
H. All Transportation Modes Combined

Report XVI. Summary Frequency Distribution by Transportation Mode with Chemical/Physical Form Breakdown Accessing the SNM/Source Material Data Base Converted to Curie Amounts

A. Air Passenger
B. Air Non-Passenger
C. Truck
D. Ship
E. Rail
F. Mail
G. Unknown
H. All Transportation Modes Combined

Summary Questionnaire Reports

*Report I. Radionuclide Information

A. Academic Licensees
B. Medical Licensees
C. Industrial Licensees
D. Other Licensees
E. All Categories Combined

*Report II. Package Type Information

A. Academic Licensees
B. Medical Licensees
C. Industrial Licensees
D. Other Licensees
E. All Categories Combined

*Report III. Transportation Information

A. Academic Licensees
B. Medical Licensees
C. Industrial Licensees
D. Other Licensees
E. All Categories Combined

The Detailed Questionnaire Reports X.H, XIII.H, and XIV.H are included with this report, folded into the pocket on the inside back cover. Summary Questionnaire Reports I.A through III.E include the responses for NRC and Agreement States licensees combined into the four general shipping categories. These Summary Reports are in Appendix B. Summary Reports I, II, and III are also included in Appendix B for each of the NRC subcategories alone (Subcategories 01-100 through 11-700). This includes only the subcategories from which a questionnaire response was received. A complete set of computer reports is available at the NRC Public Document Room, 1717 H Street NW, Washington D.C., 20555.

3.3 EXTRAPOLATION OF SUMMARY DATA

Since the Agreement States had no specific license subcategories similar to the NRC categories (01-100, etc., see Table 4.3), a method was devised to extrapolate to an approximate total shipping activity for all shippers other than SNM and major shippers, and combine the totals from the NRC subcategories with the Agreement States general categories on a similar basis. The data from the NRC licensees were extrapolated independently in each subcategory, then the extrapolated data were combined with extrapolated Agreement States data into the four general categories (Academic, Medical, Industrial, and Other) as shown in Table 3.1.

TABLE 3.1. Combination of NRC Subcategories Into General Categories

General Category	Equivalent NRC Subcategories Combination
Academic	01-100 and 01-200
Medical	02-110 through 02-600
Industrial	03-110 through 03-620, 03-800, 04-100 through 11-700
Other	03-710

The Agreement States data were extrapolated to totals for the population in each of the four general license categories by direct extrapolation, modified by a factor which was determined by the results of extrapolating the NRC data to subcategory totals and combining these totals into each general category. This modification factor is based on the assumption that, while

the NRC subcategories are not specifically defined for the Agreement States, they do in fact exist. Therefore, errors could be introduced if the raw data from each Agreement State general category are extrapolated directly with no modification, since sample size variations with regard to subcategories will exist in the Agreement States data. This direct extrapolation is equivalent to combining the data from the NRC subcategories into a general category prior to extrapolation (which would be inaccurate) rather than extrapolating subcategory data independently and combining the results in the general category (which would be more accurate). For example, if the sample size of one subcategory was 20% but the overall sample size of the general category was only 2%, the overall extrapolation for the general category would be equal to 50 (1.0/0.02). The extrapolation factor for the subcategory would only be 5 (1.0/0.2), so if the factor of 50 is used for the combined extrapolation, the result from the subcategory will be a factor of 10 (50/5) greater than it should be.

Since the distribution of Agreement States licensees into subcategories is not known, the distribution from the NRC categories is assumed. The extrapolation factors for the Agreement States categories are then modified by the ratio of the subcategory-weighted average NRC extrapolation factor and the overall general category NRC extrapolation factor as in the example in the following subsection.

3.3.1 Example of Extrapolation Factor

Consider the data from two NRC subcategories, a and b, which are to be combined with the data from Agreement States general category, c (see Table 3.2). X_n, Y_n, Z_n, and N_n (n = a,b,c) represent the number of questionnaires returned, total number of licensees in category n, extrapolation factor, and the numerical value of an item of raw data (number of packages, in this case) from the returned questionnaires, respectively, for each subcategory or general category.

Note that X_n includes questionnaires returned with and without shipping activities indicated. Then, Z_n is the licensee population in a category divided by the number of licensees responding, or

$$Z_n = Y_n/X_n, \; n = a, b, c.$$

The overall NRC extrapolation factor for the combined NRC subcategories is Z_{ab}, where

$$Z_{ab} = (Y_a + Y_b)/(X_a + X_b).$$

The extrapolation of N_n to totals, M_n, for the licensee populations of NRC categories a and b is the product of N_n and Z_n, or, where an asterisk (*) signifies multiplication:

$$M_n = Z_n * N_n, \; n = a, b.$$

The subcategory weighted average extrapolation factor, $\overline{Z}_{ab}$, for the combination of the NRC subcategories is the ratio of the combined extrapolated parameters M_n (in this example, number of packages) to the raw data (unextrapolated) combined parameters, N_n, or

$$\overline{Z}_{ab} = (M_a + M_b)/(N_a + N_b).$$

The extrapolation of N_c to a total M_c for the Agreement States raw data is then the raw data parameter N_c multiplied times the category c extrapolation factor Z_c, modified by the ratio of the NRC combined category weighted extrapolation factor, $\overline{Z}_{ab}$, to the NRC combined category overall average extrapolation factor, Z_{ab}, or

$$M_c = N_c * Z_c * \frac{\overline{Z}_{ab}}{Z_{ab}}.$$

This is equivalent to

$$\begin{pmatrix}\text{Total for}\\ \text{a category}\end{pmatrix} = \begin{pmatrix}\text{amount}\\ \text{represented}\\ \text{by sample}\end{pmatrix} * \begin{pmatrix}\text{overall}\\ \text{average}\\ \text{extrapolation}\\ \text{factor}\end{pmatrix} * \left(\frac{\begin{matrix}\text{weighted average}\\ \text{extrapolation}\\ \text{factor}\end{matrix}}{\begin{matrix}\text{overall average}\\ \text{extrapolation}\\ \text{factor}\end{matrix}}\right)$$

such that the extrapolation of the Agreement States data to totals for the general category population is similar to the techniques used to extrapolate and combine the NRC subcategories into the same general category.

Sample data shown in Table 3.2 would be treated as follows:

$$Z_a = 100/10 = 10,\ Z_b = 20,\ Z_c = 20,$$

$$Z_{ab} = (100 + 400)/(10 + 20) = 16.7,$$

$$M_a = 10 * 29 = 290 \text{ (packages)},$$

$$M_b = 20 * 15 = 300,$$

$$\overline{Z}_{ab} = (290 + 300)/(29 + 15) = 13.4,$$

then

$$M_c = 45 * 20 * (13.4/16.7) = 722 \text{ (packages)}.$$

In this example, the total number of packages, $M_c = 722$, is less than the number of packages resulting from a direct extrapolation of Category c, or 900 packages (20 * 45). The total packages for the general category, C, is then $M_a + M_b + M_c$, or 1312 packages.

The results of the extrapolations are discussed in Sections 4 and 5.

TABLE 3.2. Sample Parameters for Extrapolation Example

Category	X # Of Questionnaires Returned	Y Category Population Total	Z Extrapolation Factor	N # Of Packages (raw data)
a (NRC)	10	100	10	29
b (NRC)	20	400	20	15
c (Agreement States)	25	500	20	45

4.0 RESULTS AND DISCUSSION

The returned questionnaires were processed (Section 3) and the resulting data compilation was analyzed in a summary manner. This section summarizes results of this data compilation and analysis as well as the overall response to the survey. Section 4.1 discusses Questionnaire Returns and Section 4.2 covers Computer Reports. A brief perspective on the overall survey results is presented in Section 5.

A total of 3181 questionnaires were sent to 2275[a] licensees and ERDA contractors. By the end of January 1976, 1334 (59%) had returned 2036 questionnaires. Of these 1334 respondents, 465 (35%) indicated shipping activities (on 530 of the 2063 questionnaires). The annual shipping activity for the probable major shippers, SNM licensees, and ERDA contractors responding to the survey was about 300,000 SNM/Source Material packages and approximately 800,000 non-SNM/Source Material packages. In addition, about 770,000 (mostly exempt) packages were reflected in 21 Summary Questionnaires returned from apparent major shippers. With regard to classified shipments, information was excluded on weapons, weapons components, and all materials transported in military vehicles. There were approximately 850 packages in the classified shipments which is insignificant in terms of the overall survey. Therefore, these packages were dropped from further consideration and were not included in the analysis of this report.

The shipping activity from the Summary Questionnaires was extrapolated to about 200,000 packages shipped annually by the minor shipper population of about 14,600 licensees.

4.1 QUESTIONNAIRE RETURNS

By November 15, 1975 we had a 54% overall response (1234 responses from 2275 licensees and ERDA contractors) to the survey: 585 SNM Detailed

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(a) Some of the participants received packets containing two questionnaires as described in Sections 2.2.1, 2.2.2, and Appendix C.

Questionnaire responses (65%), 85 major shipper responses (45%) and 564 Summary Questionnaire responses (46%). Since the major shippers and SNM licensees were of prime interest in the survey, and the questionnaire return rate had dropped to less than one a day, we telephoned as many nonrespondents as was practical to encourage the response. Of the 379 nonresponding major shippers and SNM licensees, we were able to contact 286; Table 4.1 summarizes the telephone campaign results. The initial response to our telephone calls was very positive. In many cases, we discovered that a questionnaire had not been returned because it had not reached the proper person. In other cases, there was insufficient time to complete the questionnaire. Further, we were asked to send another 181 questionnaires most of which we expected to be completed and returned. We also expected to receive responses from the 25 licensees who indicated that they had already received a questionnaire and planned to return it soon (see Table 4.1).

TABLE 4.1. Telephone Campaign Results

Results of Completed Calls	Totals
Send another questionnaire	181
Plans to return it soon	25
Do not plan to return it	18
No shipping activity	62
Unlisted telephone number	56
Other incomplete calls	37
Total initial calls	379
Total completed calls	286
Successful calls[a]	118

(a) This is the maximum number of responses that could be attributed to the telephone campaign.

The number of responses received from the end of the telephone campaign (mid-December) to January 27, 1976 (the cutoff date to include the responses in the data base) was 55 SNM Questionnaire Packets and one major shipper response for a total of 56 returned questionnaire packets that could possibly be attributed to the telephone campaign. In addition, nine more Summary

Questionnaires were returned. The 62 licensees who indicated that they had no shipping activities also count as a response, since the fact that they did no shipping was all the information needed for the survey purposes. Table 4.1 shows that the maximum possible successful calls totaled 118 (56 + 62) of 268 (181 + 25 + 62) or a maximum success rate of 44%. As a result of the telephone campaign, the SNM Questionnaire returns were increased from a 65% response to 77%. There were 28 additional calls made to licensees who had already responded to the survey. This occurred because of the duplicate entries in the address lists.

The final response to the survey has been tabulated in Table 4.2 which is divided into two parts: 4.2A - Overall Breakdown, 4.2B - Detailed Breakdown of Major Shippers. The relationship between Part A and Part B is as follows: Of the 188 probable major shippers (Table 4.2B, Column 1a) sent a questionnaire, 143 were sent the Non-SNM Questionnaire Packet (Table 4.2A, Column 1a), and 45 were sent the SNM Questionnaire Packet; these 45 are included in the 906 (Table 4.2A, Column 1a) SNM licensees who were mailed SNM Questionnaire Packets. Of the 86 probable major shippers who responded (Table 4.2B, Column 1b), 59 (Table 4.2A, Column 1b) returned the Non-SNM Questionnaire Packet contents and 27 returned the SNM Questionnaire Packet contents; the 27 are included in the 702 SNM licensees responding (Table 4.2A, Column 1b). The reason for this duality is explained in more detail in Sections 2.2.1 and 2.2.2.

Columns 1a and 1b of Table 4.2A show that of the 906 SNM licensees who were sent Detailed Questionnaire Packets, 702 responded (77%) and of the 143 probable major shippers who received Non-SNM Questionnaire Packets, 59 responded (41%). Of the 1226 Summary Questionnaire Packets that were mailed (698 to NRC licensees and 528 to Agreement States licensees), 573 (47%) were completed and returned (350 from the NRC licensees and 223 from the Agreement States licensees).

Columns 2a, 2b and 2c of Table 4.2A show the survey response in terms of the number of questionnaires that were returned. Of 906 SNM Questionnaires that were mailed (Column 2a), 77% or 702 were completed and returned

TABLE 4.2. Program Status

A. Overall Breakdown

	(1) Licensee Response		(2) Questionnaire Response			(3) Shipping Activities		(4)	(5)	(6)	(7)	(8)
	(a) Number Contacted	(b) Number Responding	(a) Number Sent	(b) Number Returned	(c) Percent Returned	(a) Number With	(b) Number Without	Number With Shipping Activities in Data File	Percent With Shipping Activities in Data File	Class-2 Responses	Class-3 Responses	Summary Questionnaire Major or SNM Shippers
Detailed Questionnaire												
SNM	906	702	906	702	77	133	569	132	99	1	0	--
non-SNM	143	59	1049	761	75	238	523	228	96	7	3	--
Total Detailed	1049	761	1955	1463	76	371	1092	360	97	8	3	--
Summary Questionnaire												
NRC	698	350	698	350	50	89	261	74	81	0	1	5 SNM* / 10 Major
Agreement States	528	223	528	223	42	70	153	57	82	0	2	11 Major
Total Summary	1226	573	1226	573	47	159	414	131	83	0	3	26
OVERALL TOTAL	2275	1334	3181	2036	65	530	1506	491	93	8	6	26

B. Detailed Breakdown of Major Shippers

	(1) Responses			(2) Shipping Activity		(3)
Detailed Category	(a) Number Sent	(b) Number Returned	(c) Percent Returned	(a) Number With	(b) Number Without	Number in Data File
Major List	96	38	40	27	11	37
Agreement States	92	48	52	26	22	48
TOTAL	188	86	46	53	33	85

* These five Summary Questionnaires were returned by SNM licensees who received the Summary form in addition to the SNM packet due to duplication in the address lists. One of the five indicated no shipping activities.

(Column 2c). Of the 1049 Non-SNM Questionnaires that were mailed, 761 were returned for a 73% response.

Columns 3a and 3b of Table 4.2A show that of 1463 Detailed Questionnaires that were returned, 371 reflected shipping activities:

- Of the 702 SNM Questionnaires that were returned (Column 2b) 133 were from licensees and ERDA contractors who indicated shipping activities, while 569 were from licensees and contractors who indicated no shipping activities. This includes 62 licensees who indicated no shipping activities when contacted by telephone.
- Of the 761 Non-SNM Questionraires returned (Column 2b), 238 indicated shipping activities while 523 indicated no shipping activities. This includes 62 SNM licensees who indicated no shipping activities when contacted by telephone.

As discussed in Section 2, some licensees and contractors were sent two questionnaires. Thus, 371 Detailed Questionnaires indicating shipping activities (Column 3a) were returned by 312 licensees and contractors. Of these 312, 53 probable major shippers (including 27 of whom were SNM licensees) returned 54 Detailed Questionnaires listing shipping activities as follows:

- 47 returned Non-SNM Questionnaires only,
- 5 returned SNM Questionnaires only, and
- 1 returned both a Non-SNM and an SNM Questionnaire.

The remaining 259 SNM licensees (other than major shippers) returned 317 Detailed Questionnaires listing shipping activities as follows:

- 132 returned Non-SNM Questionnaires only,
- 69 returned SNM Questionnaires only, and
- 58 returned both a Non-SNM and an SNM Questionnaire.

Further, 523 Non-SNM Questionnaires were returned that indicated no shipping activities. These questionnaires include responses from:

- 33 probable major shippers (Table 4.2B, Column 2b),
- 22 responses from SNM licensees and ERDA contractors who returned the Non-SNM portion of the SNM Questionnaire Packet marked "no shipping activities," and

- 468 "assumed" responses of no shipping activities.

These 468 assumed responses were based on the return of 468 SNM Questionnaires (both with and without SNM shipping activities) that were returned without the Non-SNM Questionnaire. Since the Non-SNM Questionnaire had been removed by the respondent, it was assumed that the respondent had no non-SNM shipping activities. Although this assumption was not verified by contacting several of the participants who responded in this manner, it does seem reasonable.

Of the 573 Summary Questionnaires returned, 159 reflected shipping activities as shown in Column 3a of Table 4.2A.

Column 4 of Table 4.2A lists each type of questionnaire that was included in the computer data base. All of the Detailed Questionnaires that indicated no shipping activities were included in this data base by implication since the data from the Detailed Questionnaires was extrapolated only to annual totals for the licensees and contractors responding and not to any larger population. All of the data from the Summary Questionnaires indicating no shipping activities were physically included in the computer data base since these data were extrapolated to totals for the large minor shipper population (see Section 3.3).

Column 4 shows that 132 of the 133 SNM Questionnaires with shipping activities were included in the data base, as were 228 of the 238 Non-SNM Questionnaires with shipping activities. Thus, a total of 360 of 371 Detailed Questionnaires were included in the data base, or 97% (Column 5) of the Detailed Questionnaires that indicated shipping activities. Of the 11 Detailed Questionnaires not included in the computer data base, eight were Class-2 responses (Column 6) while three were Class-3 responses (Column 7). These class designations are briefly defined below and further explained in Appendix A on page A-11:

- Class-1 - Questionnaires that were complete enough to be used in the data base.

- Class-2 - Questionnaires that were only partially complete but contained some information regarding the respondent's shipping activities. The Class-2 responses are summarized in Table 4.9.
- Class-3 - Letters stating that the respondent did not intend to complete the questionnaire, as well as any other responses that did not indicate the magnitude and type of the respondent's shipping activities.

The response from the probable major shippers groups is shown in Table 4.2B. Detailed Questionnaire Packets were sent to 188 probable major shippers (96 from the Major List and 92 from the Agreement States Major List); 45 were sent the SNM Questionnaire Packet since they were SNM licensees as well as probable major shippers; and 143 were sent the Non-SNM Questionnaire Packet. Of these 188, 86 (46%) responded (Table 4.2B, Column 1b). One of the 86 responses was a Class-3 response, leaving 85 to be included in the data base: 53 included with shipping activities, and 33 with no shipping activities included by implication. With 33 of 86 responses (38%) from probable major shippers indicating no shipping activities, it appears that the selection of major shippers was not totally accurate (see Section 2.2.2 for a brief discussion of the means used to develop the list of major shippers). However, the percent of nonshippers for the Summary Questionnaires (randomly sampled) was 72% and for the SNM licensees and ERDA contractors (all-inclusive group) was 81%, which indicates that the selection of probable major shippers was somewhat better.

As shown in Table 4.2A, Column 3a, 159 Summary Questionnaires indicated shipping activities. However, only 131 (82%) of them were included in the data base for extrapolation to totals. The remaining 28 questionnaires includes:

- 2 questionnaires that were Class-3 responses,
- 21 questionnaires that reported shipping activities of sufficient magnitude to qualify each respondent as a major shipper (see Table 4.8 for a summary of the responses), and
- 5 questionnaires that were returned from SNM licensees (see Table 4.10).

One of the five SNM Summary Questionnaires listed in Table 4.2A, Column 8, indicated no shipping activities and is included in the 261 Summary Questionnaires listed in Column 3b, but is not in the data base.

The distribution of Summary Questionnaires that were mailed and returned is shown in Table 4.3A for the NRC license subcategories and Table 4.3B for the Agreement States general license categories. Note that there were no questionnaires returned from the licensees in NRC non-SNM subcategories 01-100, 02-110, 02-500, 03-213, 03-215, 03-218, 03-231, 03-232, 03-400, 03-800, 04-100, 04-200, 11-100 through 11-400, and 11-600. Thus, the shipping activities of the licensees from these subcategories are not represented in the results of the Summary Questionnaire data extrapolations. The last column of Table 4.3 lists the number of licensees used as the total population of each category for extrapolation to a total shipping activity. These total category populations are corrected for overlap with the SNM licensees and probable major shippers, but are not corrected for overlap between and among the NRC subcategories or Agreement States general categories themselves.

The correction for overlap with SNM licensees and major shippers is necessary because the major shippers and SNM licensees were already accounted for as separate groups represented by the Detailed Questionnaire returns. Therefore, they must not be included again in the extrapolation of Summary Questionnaire data to population totals. The overlap of probable major shippers was corrected by identifying categories in which each of the 188 probable major shippers appeared, then subtracting the total number of major shippers in each category (or subcategory) from the total population of that category.

Of the 906 SNM licensees, 45 were subtracted from category populations as probable major shippers, leaving 861 SNM licensees to be subtracted from the general category and subcategory population totals.

The overlap of SNM licensees with the Agreement States license categories population was corrected by assigning a category to each Agreement State licensee on the SNM licensee list on the basis of the organizational name. The total number of SNM licensees from each of the four categories was then subtracted from the total number of licensees in that category.

TABLE 4.3. License Categories with Number of Summary Questionnaires Mailed and Returned

A. NRC License Categories (as of April 1, 1975)

Code	Description	Number of Summary Questionnaires Mailed	Number of Questionnaires Returned	Number of Licenses in Category	Population[a] Used for Extrapolation
01-100	ACADEMIC BROAD LICENSE	1	0	16	12
01-200	ACADEMIC OTHER LICENSE	15	4	573	434
02-110	INSTITUTIONAL BROAD LICENSE	1	0	88	87
02-120	INSTITUTIONAL OTHER LICENSE	47	16	1255	1241
02-200	PRIVATE PRACTICE	35	10	741	733
02-300	TELETHERAPY	20	8	478	474
02-400	OTHER MEDICAL LICENSES	3	1	111	107
02-500	MEDICAL DISTRIBUTION	1	0	13	10
02-600	BY-PRODUCT PACEMAKER	0	0	0	0
03-110	WELL LOGGING	2	1	59	55
03-120	OTHER MEASURING SYSTEMS	316	186	1930	1857
03-211	MD&S BROAD LICENSES	10	3	63	61
03-212	MD&S OTHER LICENSES	36	22	225	214
03-213	GENERAL LICENSE DISTRIBUTION	2	0	46	44
03-215	EXEMPT QUANTITIES	4	0	39	36
03-216	EXEMPT WATCHES	10	1	59	57
03-217	OTHER EXEMPT DISTRIBUTION	7	4	71	69
03-218	NUCLEAR LAUNDRY	1	0	5	5
03-220	LEAK TEST LICENSE	5	4	28	27
03-231	WASTE DISPOSAL (BURIAL)	1	0	2	2
03-232	WASTE DISPOSAL (OTHER)	1	0	7	7
03-310	RADIOGRAPHY-SINGLE LOCATION (IN PLANT)	24	11	135	130
03-320	RADIOGRAPHY-MULTIPLE LOCATIONS (FIELD)	30	18	187	178
03-400	POWER SOURCE LICENSE	1	0	1	1
03-510	IRRADIATOR LICENSES AUTH <10,000 CURIES	8	3	168	162
03-520	IRRADIATOR LICENSES AUTH >10,000 CURIES	3	3	55	53
03-610	R&D BROAD LICENSES	12	4	85	78
03-620	R&D OTHER LICENSES	68	34	429	411
03-710	CIVIL DEFENSE LICENSE	19	11	140	140
03-800	BY-PRODUCT EXPORT	4	0	49	46
04-100	TRANSPORTATION (LARGE QUANTITY)	1	0	4	4
04-200	TRANSPORTATION (TYPE B)	1	0	1	1
11-100	MILLS	1	0	19	18
11-200	OTHER <150KGS	1	0	57	55
11-300	OTHER >150KGS	4	0	299	287
11-400	UF6 PRODUCTION PLANTS	1	0	2	2
11-500	MINES	0	0	0	0
11-600	SOURCE MATERIAL EXPORT	1	0	55	53
11-700	SOURCE MATERIAL IMPORT LICENSES	1	1	4	4
21-100	FUEL FABRICATION AND SCRAP RECOVERY	-	-	0	-
21-110	FUEL FABRICATION AND SCRAP RECOVERY	-	-	3	-
21-120	FUEL FABRICATION	-	-	3	-
21-130	OTHER USES INCLUDING R&D	-	-	3	-
21-210	UF6 CNVRSN, FUEL FBRCTN, & SCRAP RECOVERY	-	-	5	-

TABLE 4.3. (Contd.)

Code	Description	Number of Summary Questionnaires Mailed	Number of Questionnaires Returned	Number of Licenses in Category	Population[a] Used for Extrapolation
21-220	FUEL FABRICATION AND SCRAP RECOVERY	-	-	3	-
21-230	FUEL FABRICATION	1[b]	1	8	-
21-240	OTHER FABRICATION AND PROCESSING AND R&D	-	-	23	-
22-110	UNENCAPSULATED	-	-	27	-
22-120	NEUTRON SOURCES	-	-	307	-
22-130	POWER SOURCES (RTG,RPG,ETC.)	-	-	7	-
22-140	OTHER SOURCES	-	-	54	-
22-160	CARDIAC PACEMAKERS	-	-	52	-
22-200	URANIUM	-	-	54	-
23-100	FUEL STORAGE LICENSE	-	-	14	-
23-200	STORAGE ONLY LICENSE	-	-	3	-
24-100	IMPORT LICENSES	-	-	5	-
24-200	SNM EXPORT	-	-	132	-
25-110	IRRADIATED	-	-	3	-
25-120	UNIRRADIATED PLUTONIUM	-	-	0	-
25-130	UNIRRADIATED OTHER	-	-	2	-
25-200	LARGE QUANTITY TRANSPORTATION LICENSES	-	-	2	-
25-300	TYPE B TRANSPORTATION LICENSES	-	-	0	-
41-000	NUCLEAR POWER STATIONS	-	-	-	-
41-110	WATER COOLED REACTORS	-	-	-	-
41-111	TERRESTRIAL	1[b]	1	-	-
41-112	OFF-SHORE	-	-	-	-
41-120	GAS COOLED REACTORS	1[b]	1	-	-
41-130	LIQUID METAL COOLED REACTORS	-	-	-	-
41-180	OTHER LICENSED NUCLEAR POWER STATIONS	-	-	-	-
41-210	FACILITY DESIGN APPLICATIONS	1[b]	1	-	-
42-130	EXPERIMENTAL	-	-	-	-
42-140	TEST	-	-	-	-
42-150	RESEARCH	1[b]	1	-	-
42-160	CRITICAL	-	-	-	-
53-110	FUEL REPROCESSING PLANTS	-	-	-	-
53-130	ISOTOPE ENRICHMENT PLANTS	-	-	-	-
44-019	FUEL FABRICATION	-	-	-	-
45-110	REACTOR EXPORT LICENSE	-	-	-	-
55-000	EXPORT	-	-	-	-
B. Agreement States License Categories					
1	ACADEMIC	32	15	514	288
2	MEDICAL	100	42	3366	3324
3	INDUSTRIAL	354	134	3309	3037
4	OTHER	42	20	896	855

(a) These numbers corrected for overlap of SNM licensees (who shipped one gram or more of SNM material) and major shippers only. They are not corrected for overlap within and between other license categories.

(b) Mailed by Mistake to SNM licensees

The correction for overlap of SNM licensees in the NRC subcategories was not as straightforward since the list of NRC SNM licensees did not identify which of the other subcategories each of the SNM licensees held licenses in. Further, the assignment of subcategories to NRC licensees was not based on the organizational name. The correction for SNM licensee overlap in the NRC subcategories was based on the assumption that the distribution of NRC SNM licensees into the four general categories (Academic, Medical, Industrial, and Other) was the same as that for the Agreement States SNM licensees. It was also assumed that the NRC SNM licensees within a general category were evenly distributed among the category population such that the number of SNM licensees in any subcategory is proportional to the total number of licensees in that subcategory. For example, if a general category contained 20% of the Agreement States SNM licensees and an NRC subcategory of that general category contained 50% of the NRC licensees for the general category, then 10% (50% x 20%) of the NRC SNM licensees would be subtracted from the subcategory population to correct for overlap prior to extrapolation.

There was no apparent solution to the problem of eliminating overlap and duplication between and within license categories. The magnitude of the address list (over 15,000 entries) precludedany attempts to eliminate this overlap manually. The problem would be well suited for computer solution, except that the licensee names and addresses were not in any standardized format. Therefore, the multiple entries for any given licensee would not necessarily be identical, thus could not be eliminated automatically. Further complicating the problem is the fact that each licensee must be assigned to a single category, and the basis for such assignment is not immediately obvious. This is discussed further in Section 6.

The method of extrapolating the Summary Questionnaire data to the total minor shipper population was described in Section 3.3 and the results are presented in Sections 4.2.2 and 4.2.3.

4.2 COMPUTER REPORTS

There are several conventions used for identifying various package contents commonly encountered in the survey. Most of these terms used in the computer reports are defined in the instructions for the questionnaire (Appendix C). Some of these terms are defined more explicitly in the "Explanation for Reports X.H, XIII.H and XIV.H" included in the pocket in the back cover, and in Appendix A, Page A-8 (Column 7a). Other symbols are discussed below.

Throughout the computer reports, the ^{235}U enrichments of uranium mixtures are indicated by alphabetic characters A through Z following the isotope designation as is listed in Table 4.4. These enrichment values were a compromise between a need to cover the range of possible enrichments and an attempt to select values that were close to the most common enrichment. When enrichments were encountered that were between the values listed in Table 4.4, the letter corresponding to the closest value to the reported enrichment was used. For example, 16% ^{235}U would be entered as "U235M". If the reported value is exactly half-way between two from Table 4.4, the next higher enrichment is used. For example, 15% ^{235}U would be entered as U235M also. The gram amount listed for such uranium mixtures is the mass of ^{235}U in the mixture. For example, 100 g of "U235P" indicates a mixture of 40 mass % ^{235}U (100 g) and 60 mass % ^{238}U (150 g) with a total uranium mass of 250 g. When the package contents or an inventory is listed in curies, it is curies of ^{235}U.

TABLE 4.4. Alpha Symbols Representing 235U Enrichments

Symbol	Indicated Mass % ^{235}U	Symbol	Indicated Mass % ^{235}U
A (depleted)	0.25	N	30
B (depleted)	0.50	O	35
C (natural)	0.72	P	40
D	1.0	Q	50
E	1.5	R	65
F	1.8	S	75
G	2.0	T	80
H	2.5	U	90
I	3.0	V	92
J	5.0	W	94
K	8.0	X	96
L	10	Y	98
M	20	Z	Unknown
		Blank	100

For example, 0.001 Ci of U235P contains 0.001 Ci of ^{235}U (462 g ^{235}U) and 0.00023 Ci of ^{238}U (693 g ^{238}U for a total uranium mass of 1,155 g).

A blank space following the ^{235}U symbol indicates 100% pure ^{235}U. The letter Z, as in U235Z, indicates that the enrichment was not available. Note that it is also not known whether the inventory listed for "U235Z" is in grams of ^{235}U or total grams of uranium.

Another symbol appearing frequently on the computer reports indicates uranium/plutonium mixtures. This symbol is composed of the letters "UP" followed by three numbers which are, in turn, followed by an alphabetic character (i.e., UP359A). The first two numbers indicate the mass percent of plutonium in the mixture while the third number indicates the isotope of plutonium which predominates (9 = ^{239}Pu, 8 = ^{238}Pu, 0 = ^{240}Pu, etc.). Since no plutonium of isotopic weight of less than 236 or greater than 244 was encountered in the survey, only one number was adequate to indicate plutonium isotopes. The trailing alphabetical character indicates the ^{235}U enrichment in the total uranium fraction of the mixture. This trailing character has the same purpose as the letter for ^{235}U enrichment in strictly uranium mixtures. Thus, the information in Table 4.4 applies as well. The mass of the uranium/plutonium mixture listed is the mass of the total mixture, not of just one of the isotopes. For example, 1000 g of UP359M indicates a mixture of 35 mass % ^{239}Pu (350 g) plus 65 mass % uranium (650 g). The uranium fraction contains 20 mass % ^{235}U (130 g) and 80 mass % ^{238}U (520 g). However, when the uranium/plutonium mixtures are given in units of curies, it is curies of plutonium only. For example, 0.01 Ci of UP359M contains 0.01 Ci of ^{239}Pu (0.163 g ^{239}Pu) plus 65 mass % uranium (0.303 g uranium). The uranium fraction contains 20 mass % (from Table 4.4) ^{235}U (0.061 g) and 80 mass % ^{238}U (0.242 g), or 1.3×10^{-7} Ci ^{235}U and 8.1×10^{-8} Ci ^{238}U. Thus, the total mass of the 0.01 Ci of UP359M would be 0.466 g.

All nuclides listed (on questionnaire forms, and thus on the computer reports) as "U238" are assumed to be of less than or equal to 0.72 mass % ^{235}U.

The following subsections contain brief introductions to the computer reports for the Detailed Questionnaire and Summary Questionnaire data bases, respectively. Section 4.2.3 contains summarized information from the major computer reports.

4.2.1 Detailed Questionnaire Computer Reports

The Detailed Questionnaire computer reports described in Section 3.2 contain the shipping information that has been extrapolated to a uniform annual basis. These computer reports include information from 85 respondents from the probable major shippers group plus 674 SNM licensees and ERDA contractors (27 of the 85 major shippers were also SNM licensees) who returned Class-1 responses. The 759 respondents shipped approximately 7300 consignments containing about 270,000 packages of SNM/Source Material (37 billion grams) plus about 560,000 consignments containing approximately 780,000 packages of non-SNM/Source Material (14 million curies) over a one-year period. Reports X.H, XIII.H, and XIV.H from the Detailed Questionnaire data base are in the pocket in the back cover of this report. The information from these reports is sorted by transportation mode in Reports X.A through X.G, XIII.A through XIII.F, and XIV.A through XIV.G in Appendix B, beginning on page B-18. No other Detailed Questionnaire Computer Reports are included here since their total bulk exceeds 18 inches (there are a total of 19 sequences of reports containing 203 unique reports); however, some important data from these reports are summarized in Section 4.2.3.

Source Material data were combined with Special Nuclear Material data to form the SNM/Source Material data base for three reasons. First, with this combination, all uranium, thorium, and plutonium will appear together on the same computer reports, making it unnecessary to sort through several reports to extract information regarding any single element or isotope. Second, since the common units for inventories of both SNM and Source Material is grams (or other mass units), data manipulation is greatly simplified by combining the two. The remaining non-SNM/Source Material data base is then completely in units of curies. The third reason for the combination is that the SNM and Source Material together are generally associated with

the front end of the fuel cycle (except for spent fuel and some nuclear waste shipments), while the non-SNM/Source Material nuclides generally are related to the tail end of the fuel cycle or are from irradiation-produced materials, and are generally different in nature from the SNM/Source Material.

Again, note that all of the information presented from the Detailed Questionnaire data base represents shipping activity extrapolated to a uniform annual basis only for the Detailed Questionnaire survey participants, and is not extrapolated to a total for some larger population.

4.2.2 Summary Questionnaire Reports

The Summary Questionnaire Computer Reports I, II, and III are in Appendix B, beginning on page B-77. The shipping information received from 544 licensees (413 of whom had no shipping activities) was extrapolated (as described in Section 3.3) to a total non-SNM minor shipper population of 14,658 licensees. This extrapolation indicates that this group ships about 220,000 packages/year containing over 10 million Ci of radioactive material (see Report I.E, page B-86, Appendix B).

An important difference existed between the combined NRC Academic subcategories (01-100 and 01-200) and the Agreement States Academic category. Of the 16 Summary Questionnaires mailed to academic licensees in the two NRC subcategories (see Table 4.3A) only four were returned; all four were from subcategory 01-200 and indicated no shipping activities (see Report I.B, page B-98 of Appendix B). So all of the 4799 packages shipped by licensees in the Academic category (Report I.A, page B-79, Appendix B) were shipped by Agreement States licensees. Two factors contribute to this effect. First, and probably least important, is the fact that only four of the 446 NRC Academic licensees (the corrected combined populations of subcategories 01-100 and 01-200) responded to the survey and those four did not ship any radioactive material, while 15 of 288 licensees responded (Table 4.3B) from the Agreement States Academic category. More important than the difference in sample size is the fact that all schools (other than medical schools), academies, colleges, etc., with Agreement States licensees are considered part of the Academic category, while only the NRC licensees from Categories 01-100 and 01-200 are considered Academic licensees even

though many schools under NRC jurisdiction do hold licenses in other NRC categories yet have no license in Categories 01-100 and 01-200. Schools that hold a license only in Subcategories 01-100 and 01-200 may use radioactive materials but not necessarily transport them. The implication is, then, that the schools under NRC jurisdiction, which do transport radioactive materials, hold licenses in other subcategories, but do not necessarily have a license in Categories 01-100 or 01-200. The returns were, however, too sparse to confirm or deny such an explanation.

Much of the information from the Summary Questionnaire Computer Reports is summarized in the following section along with the results of the Detailed Questionnaire data bases. The responses from major shippers as well as SNM licensees that were received on Summary Questionnaires are also condensed into tables.

4.2.3 Data Compilation - Results Overview and Brief Analysis

Several nuclides constituted the major portion of the shipping activity for each of the data bases. These major nuclides are listed in Table 4.5 which has been divided into three parts:

- Part A is condensed from Summary Questionnaire Report I.E (Appendix B),
- Part B is from Detailed Questionnaire Report X.H, and
- Part C is from Reports XIII.H and XIV.H for the SNM/Source Material data base.

Part A of Table 4.5 indicates that ^{125}I, ^{131}I, ^{238}U, and ^{192}Ir together made up the contents of over 58% of the packages shipped, while ^{60}Co and ^{192}Ir together accounted for 98% of the total curies shipped by the minor shipper population. Some of the same nuclides made up the contents of the majority of the packages from the Detailed Questionnaire non-SNM/Source Material data base. This is shown in Table 4.5, Part B, which shows that ^{131}I, ^{125}I, ^{99m}Tc, ^{99}Mo, and ^{192}Ir were the contents of 67% of the packages shipped, while, as in the Summary Questionnaire data base, ^{192}Ir and ^{60}Co accounted for the majority (76.9%) of the curies shipped. Uranium (natural and depleted) was the major SNM/Source Material nuclide with respect to both number of packages (79.6%) and total grams (90.2%) shipped as shown in

TABLE 4.5. Major Nuclides[a]

A. Summary Questionnaire Data Base (Summary Questionnaire Report I.E)

Nuclide	% of Total Packages	% of Total Curies[e]
^{125}I	19.3	0.02
^{131}I	17.1	0.02
^{238}U	9.7	0.01
^{192}Ir	9.4	12.5
^{3}H	4.3	0.02
^{137}Cs	3.44	0.04
^{14}C	3.29	0.00
^{99}Mo	2.88	0.01
^{60}Co	1.2	85.5
Total	70.6	98.1

B. Non-SNM/Source Material Data Base (Detailed Questionnaire Report X.H)

^{131}I	25.2	0.065
^{99m}Tc	21.5	1.21
^{99}Mo	12.0	2.88
^{125}I	6.2	0.0027
^{192}Ir	2.80	59.0
^{60}Co	0.64	17.9
Total	68.3	81.1

C. SNM/Source Material Data Base (Detailed Questionnaire Reports XIII.H and XIV.H)

depleted, natural U[b]	79.6	90.2
enriched U[c]	12.6	0.26
U[d]	3.1	7.36
^{239}Pu	1.2	0.0008
Total	96.5	97.8

(a) The use of up to three significant figures here is primarily a matter of convenience and does not imply a like degree of accuracy in the survey results.

(b) Includes all U235A, U235B, U235C and U238 from Report XIV.H.

(c) Includes all U235D through U235Y and U235.

(d) Unknown isotopes and enrichments, but very likely made up of mostly ^{238}U.

(e) Percent of total curies for Parts A and B, and percent of total grams for Part C.

Table 4.2, Part C. The ^{238}U fraction of total grams of SNM/Source Material shipped is probably even higher than 90.2%, since most of the nuclide designated as "U" (Uranium, isotope unknown) was probably ^{238}U. Furthermore, if the ^{238}U portion of the enriched ^{235}U (U235D through U235Y and U235) shipments from Report XIV.H is considered, about 3 billion g can be added to the ^{238}U annual total, further increasing the ^{238}U fraction of grams shipped. The large number of packages of ^{85}Kr listed in Table 4.8 indicates that, from the standpoint of number of packages shipped, ^{85}Kr should also be considered a major nuclide.

The distribution of primary transportation modes (as a percent of the packages shipped) is presented in Table 4.6. The information for the Summary Questionnaire data base is from Report III.E, while the information for the Detailed Questionnaire data base in Table 4.6 was condensed from Computer Reports V and VI. The most common mode of transporting radioactive material was by rail for the SNM/Source Material shippers (51% of the packages); while the most common transport mode for the non-SNM/Source Material and Summary Questionnaire data bases was by truck (53% of the packages for each). The second most important transport mode for the SNM/Source Material shipments was by truck (44% of the packages); the second most common mode for the other two groups was by aircraft. The last column in Table 4.6 lists the overall distribution of the transport modes for all three groups combined.

Figure 4.1 illustrates how additional information can be obtained from Reports V (for SNM/Source Material) and VI (for non-SNM/Source Material). (These two reports are not included here due to size limitation.) The curve in Figure 4.1 is a visual fitting of the frequency distribution points of packages shipped annually versus the size of the packages (curie content in this case). For example, Point A on the curve indicates that the most frequently shipped package in the non-SNM/Source Material (Detailed Questionnaire) data base contained approximately 0.01 Ci, without regard to isotope or transport mode, and that about 200,000 such packages were shipped annually by the respondents. Theoretically, a curve similar to Figure 4.1

TABLE 4.6. Shipping Modes by Percent[a] of Packages Shipped (for shipments made from March 1, 1974 through February 28, 1975)

Transportation Mode	SNM/Source Material Data Base (Detailed Questionnaire Report V) % of Packages	Non-SNM/Source Material Data Base (Detailed Questionnaire Report VI) % of Packages	Summary Questionnaire Data Base (Report III.E) % of Packages	All Questionnaires Combined (Reports V, VI and III.E Combined) % of Packages
Aircraft			27.7	33.0
freight	0.28	10.9		
passenger	0.84	35.2		
government	0.0015	0.0013		
Auto[b]	0.041	0.58	1.26	0.61
Truck	43.8	52.8	53.0	51.0
Rail	51.0	0.047	4.63	11.4
Boat[c]	3.88	0.074	6.05	2.14
Mail	0.15	0.39	7.36	1.85
All Modes	100.	100.	100.	100.

(a) The use of up to three significant figures here is primarily a matter of convenience and does not imply a like degree of accuracy in the survey results.

(b) Including bus.

(c) Includes all watercraft.

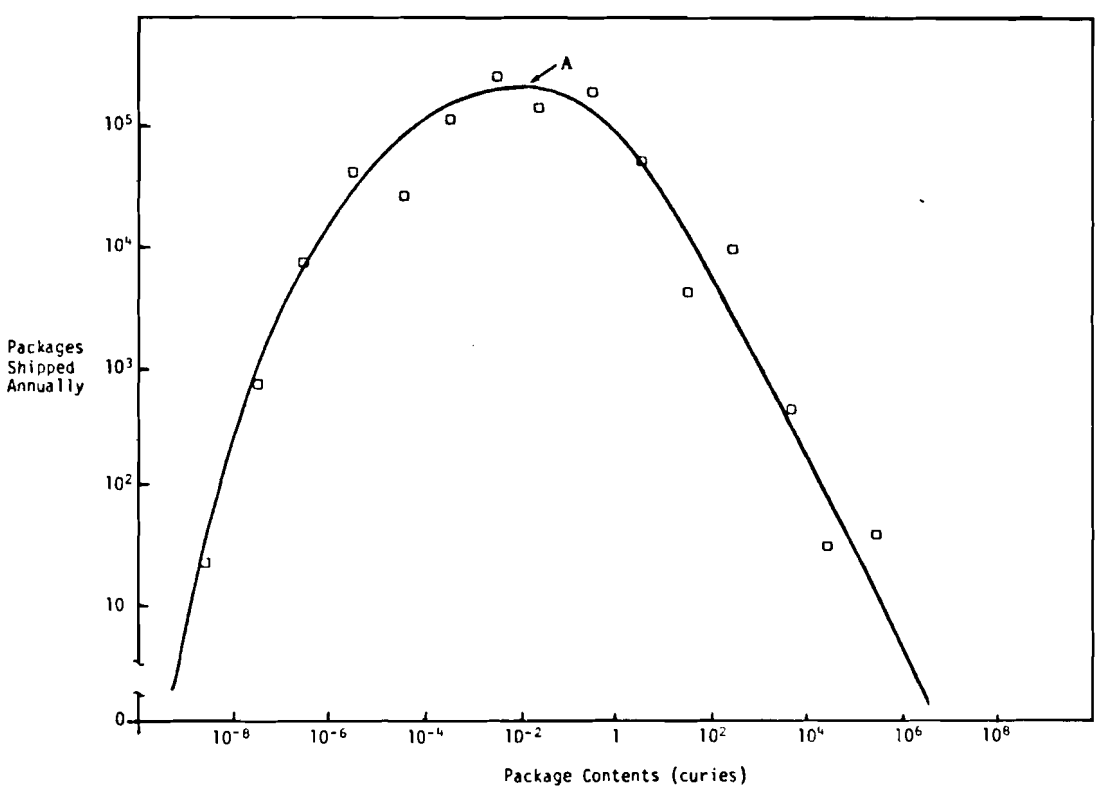

FIGURE 4.1. Frequency Distribution for Non-SNM Source Material Data Base - All Nuclides Combined, All Transportation Modes Combined (taken from Report VI).

can be drawn from Reports V and VI for each nuclide for each transportation mode, however for most detailed combinations (nuclide, transportation mode) the survey data is sparse.

Table 4.7 lists the package types as a percentage of the total packages shipped for each data base. Type A and LS (low specific activity) packages make up the majority of the packages shipped, totaling:

1) about 86% of the SNM/Source Material packages,

2) about 96% of the non-SNM/Source Material packages (Detailed Questionnaires), and

3) about 76% of the packages shipped by the minor shippers (Summary Questionnaires).

TABLE 4.7. Package Types by Percent[a] of Packages

Package[b] Type	SNM/Source Material Data Base (Detailed Questionnaire Report I.D) % of Packages	Non-SNM/Source Material Data Base (Detailed Questionnaire Report II.D) % of Packages	Summary Questionnaire Data Base (Summary Questionnaire Report II.E) % of Packages
AF	0.86	--	0.006
A	4.86	90.8	52.9
BF	10.9	--	3.82
B	0.87	1.56	9.33
E	1.31	1.94	9.64
LQ	0.49	0.014	0.895
LS	80.9	5.69	23.4
All Types	100.	100.	100.

(a) The use of up to three significant figures here is primarily a matter of convenience and does not imply a like degree of accuracy in the survey results.

(b) See Appendix A, page A-5 (Column 10) for an explanation of package types.

As mentioned earlier in the discussion of Table 4.2, 21 Summary Questionnaires were returned by apparent major shippers. Since the shipping activities of these 21 were considered not representative of their associated categories, they were pulled from the Summary data base and are not used in the extrapolation to totals for the minor shipper population. The data from these questionnaires are summarized in Table 4.8; most of the packages (over 600,000 of them) listed in Table 4.8 were exempt packages.

TABLE 4.8. Shipping Data from Apparent Major Shippers Responding to Summary Questionnaire

Nuclide	# Packages/Year by Type: Type E	Type A	Type B	# Packages/Year by Transportation Mode: Air	Avg. Ti	Avg. Miles	Land	Avg. TI	Avg. Miles	Annual Amount (Ci or g)
Kr-85	530,000			175,000	0.0	1000	355,000	0.0	500	2.1E-1 Ci
Cs-137		15,000								2.2E+4 Ci
Ra-226		25,000								2.5E+0 Ci
Co-60		15,000		275	2.0	1600	62,800	2.0	260	4.2E+0 Ci
Pu-238		5,000								8.0E+3 Ci
Am-241		10,000								1.2E+5 Ci
I-131		200								2.0E+0 Ci
I-125	118,363			117,963	0.0	936	400	0.0	300	7.9E-1 Ci
Am-241	29,040	2,200		3,792	0.0	2000	27,448	0.3	580	8.0E+3 Ci
I-129	75			75	0.5	2000				7.0E-6 Ci
H-3	1,138			1.138	0.0	480				1.9E+4 Ci
Co-60			1000	100	2.0	1500	5,900	2.0	25	3.4E+4 Ci
Ir-192			5000							2.0E+5 Ci
U-235	150	50	1320				1,550	0.8	550	1.2E+8 g
Th-232	541 (LS)						541	1.0	475	1.9E+7 g
U-238	2484 (LS)						2,484	1.0	1060	9.3E+9 g
Mixed		500					500	0.5	50	3.0E+1 Ci
Ra-226		400					400	0.4	1140	1.0E+0 Ci
H-3		170								2.5E+2 Ci
Kr-85		620		8	.05	1000	784	.07	200	9.0E+2 Ci
C-14		2								2.0E-3 Ci
Co-60	500	4					504	.01	900	4.0E-1 Ci
Cs-137		600					600	0.3	1500	5.0E+0 Ci
I-131		115					115	5.0	100	1.7E+3 Ci
Cs-137		4,752[a]								4.8E+1 Ci
Am-241		4,752[a]								2.4E+2 Ci
Ir-192			233[a]							9.5E+2 Ci

(a) Transportation mode not available

Also indicated on Table 4.2 were eight Class-2 responses. The information from these questionnaires is summarized in Table 4.9.

One respondent returned shipping forms (in lieu of a questionnaire) representing 1151 exempt radiopharmaceutical packages shipped by air and truck as "no label required." No information regarding the contents of these packages was available other than the fact that they were intended for medical use and that the TI per package was zero. These reported packages were shipped during a one-week representative period, and when extrapolated to a one-year period, they represent approximately 57,000 such exempt packages shipped by air and 3,000 such exempt packages shipped by truck annually.

Four of the five SNM licensees who were sent Summary Questionnaires due to duplication on the address lists (and returned them) indicated shipping activities. The information from these four is presented in Table 4.10.

TABLE 4.9. Annual Shipping Data from Class-2 Questionnaire Responses

Nuclide	Number of Consignments	Number of Packages	Total Miles	Average Grams or Curies per Package
U-238	32	83	14,835	N/A [b]
MC [a]	1	4	15	N/A
U-235Z	55	784	104,009	N/A
Pu	6	73	10,000	N/A
U	14	775	19,160	N/A
Cf-252	4	8	8,600	N/A
Am-241	3	3	6,000	66.8 g
EC [a]	44	557	57,290	N/A
Co-60	21	32	9,836	N/A
Ir-192	3	3	212	67.6 Ci
Th-232	2	2	3,017	N/A
MF [a]	31	1446	14,882	N/A
Sr-90	4	4	3,142	N/A
Tc-99	1	1	200	N/A
Ta-182	1	1	15	N/A
Cs-137	3	3	417	N/A
N/A [b]	2	2	400	240 Ci
Cs-137	150	150	45,000	.01 Ci
Am-241	150	150	45,000	.05 Ci
Mixed [a]	1500	1500	N/A [b]	N/A
Ir-192	150	150	N/A	N/A
Co-60			N/A	N/A
Cs-137			N/A	N/A
Tc-99	492	492	370	0.2 Ci
W [a]	6	779	N/A	1.0 Ci
H-3	N/A [b]	240	N/A	N/A
C-14	N/A		N/A	N/A

(a) See "Instructions" for Questionnaires (Appendix C) and Appendix A, Page A-8 (Column 7) for definitions of these terms.
(b) Not available

While some of the data received in the survey were extrapolated linearly to represent the total shipping activity of a group of licensees (minor shippers) for comparison purposes, the actual prediction of totals for the shipments of radioactive materials for the whole U.S. nuclear industry is beyond the scope of this survey. However, an estimation of the order of magnitude of the shipping of radioactive materials could be made using the survey results with several assumptions (see Summary). Certain parametric and average values available from the data are considered to be representative of the real situation. The above points are discussed in more detail in Section 5.

TABLE 4.10. Shipping Data from SNM Licensees Responding with Summary Questionnaire

Nuclide	# Packages/Year by Type			# Packages/Year by Transportation Mode						Annual Amount
	Type E	Type A	Type B	Air	Avg. TI	Avg. Miles	Land	Avg. TI	Avg. Miles	Curies or Grams
U-238		9								1.4E+6g
MF[a]		20	17	8	0.1	800	40	0.3	260	1.0E-3Ci
Au-198		6								2.4E-3Ci
U-238	57	125								3.9E+6g
Po-210		1								4.0E-2Ci
H-3		2		25	0.3	1500	159	0.1	393	1.4E+1Ci
MC[a]		4								1.9E-5Ci
W[a]	26,600 (LS)						22,600	0.1	100	2.7E+4Ci
SF[a]			22 (LQ)				22	2.0	100	8.5E+6g
MF[a]	6 (LS)						6	1.0	2,000	3.1E+2Ci
U-238	424 (LS)									1.1E+4g
U-235		32		49	0.0	400	476	2.5	900	8.0E+5g
W[a]			129							2.0E+6g

(a) See footnote (a), Table 4.9

Immediately prior to final report printing we identified apparent errors in our computer output for ^{238}Pu and ^{231}U (Computer Reports XIV.D, XIV.F and XIV.H, Appendix B). These and other apparent errors are discussed in detail in Appendix B (Pages B-i and B-ii, "ERRATA"). However, the time and funds budgeted for this program did not allow tracing these apparent errors back to the original questionnaires and resolving them. Although we made every effort to accurately process the data from returned questionnaires, this is an indication that the data base is not without error, although we feel any errors introduced during processing are minimal. Readers are cautioned to keep the above in mind, especially when using nuclide specific data from this report.

5.0 PERSPECTIVE

Most of the data from the returned questionnaires (essentially all of the data that was usable) were processed in an attempt to obtain as much useful information as possible about representative average values, parameters and trends regarding the transportation of radioactive materials. Enough data were obtained from a large enough (about 8% overall) sample of the licensee population to indicate that the average values obtained are reasonably accurate and are representative of normal shipping activities. The good agreement between the non-SNM/Source Material data base (Detailed Questionnaires) and the non-SNM minor shippers data base (Summary Questionnaires) regarding major package types (Table 4.7) and primary transportation modes (Table 4.6) tends to confirm the accuracy of the extrapolations and subsequent determination of parameters and averages, since these two data bases represent two different segments of a larger group of shippers, and were extrapolated independently. The Detailed Questionnaire data was extrapolated to a uniform annual total for the participants responding, while the Summary Questionnaire data was extrapolated to totals for the entire minor shipper population. The agreement between these two data bases is also fairly close regarding major nuclides shipped (Table 4.5).

Since there are fundamental differences between the SNM/Source Material data base and the above two data bases, the same general agreement does not occur. For most practical purposes the SNM/Source Material data base represents a separate group from the other two data bases. The SNM/Source Material shipments are generally associated with the front end of the fuel cycle (except for spent fuel and some nuclear waste shipments) while the shipments from the non-SNM/Source Material groups are generally either from the tail end of the fuel cycle or from irradiation-produced materials (i.e., ^{60}Co). With some exceptions, the packages from the SNM/Source Material shippers were generally of large mass and low activity (containing isotopes of long half-life) and were shipped most frequently by rail and truck as opposed to the non-SNM/Source Material packages which were

generally of lower mass and higher activity (containing isotopes of relatively short half-life) and were shipped most frequently by truck and air. Thus, the differences in primary transportation modes might well be expected, in view of the difference in size and weight of the packages. Further, since the elements and isotopes in the SNM/Source Material data base are completely different from the non-SNM Source Material data base, the major nuclides and major package types will also be different.

Generally, the parametric and average values available from the data base appear to be representative. However, it is important to note that the shipping activities for several of the NRC subcategories have no representation in the data base, since no questionnaires were returned from these subcategories. The subcategories involved are the source material subcategories 11-100 through 11-700 plus subcategories 01-100, 02-110, 02-500, 03-213, 03-215, 03-218, 03-231, 03-232, 03-400, 03-800, 04-100 and 04-200 (Table 4.3). These subcategories represent 674 licensees or about 9% of the total NRC minor shipper population. Another factor which may contribute to inaccuracy in extrapolating the Summary Questionnaire response to the total minor shipper population is that the extent of overlap and duplication within the license categories is not known. The overlap between and duplication within the NRC subcategories and Agreement States general categories was not eliminated prior to extrapolation. Further, the overlap of SNM licensees with the NRC subcategories was corrected in an approximate manner only. The net effect of the duplication and overlap is to cause overestimation of the shipping activities. The magnitude of this overestimation is not known.

It is interesting to note that ^{238}U was indicated as one of the major nuclides in the data base for the non-SNM minor shippers (Table 4.5A). The fraction of the total packages (or package contents) of ^{238}U would probably have been much higher if a more complete response had been received from the NRC Subcategories 11-100 through 11-700 (Table 4.3). Although the effect of this on the validity of the averages and parameters is not immediately obvious, it is clear that the nonrespondents must be considered with any application of the data.

Average values and parameters are of unquestionable value when applied to the analysis of complex systems. However, the dimensions of the system must eventually be established for a complete analysis. Many obstacles are encountered when estimating total shipping activities for the system of radioactive shipments. It is not clear what basis should be used for the estimation. Possible bases include total packages, consignments or curies (and grams) shipped annually, or parametric totals such as curie miles or package miles per year. To further complicate the problem, extrapolations lose some meaning if they are applied across category boundaries. In addition, many common modes of transportation exist and all must be treated separately, yet somehow be combined for extrapolation to a total. Ideally, a separate extrapolation would be made for all combinations of the basis for each nuclide, each transportation mode, and each unique category. Thus, a number of independent extrapolations should be made that would combine to the overall total.

Although a detailed projection of the total shipping activity in the U.S. was beyond the scope of this study, the possibility of using the data from this survey for such a projection was briefly investigated.

The possibility was investigated that a well-defined core group of major shippers existed (most of whom had been reached by the survey) which included only a small fraction of the licensee population, but represented a very large fraction of the shipping activity. Ideally, the shipping activities of each of these major shippers would be some orders of magnitude greater than the activities of any of the minor shippers. If this were true, the extrapolation method outlined below could be used.

Assuming the following definitions:

$*$ = "multiplied by"

the basis, u = a radioactive shipping unit (curie-mile, package, etc.),

Y = number of major shippers surveyed,

b = number of minor shippers surveyed,

m = average total u per major shipper,

n = average total u per minor shipper,

W = total number of major shippers,

D = total number of minor shippers such that $W+D$ = total U.S. licensees,

then $M = W*m$ = total u for major shippers,

$N = D*n$ = total u for minor shippers,

$V = Y/W$ = fraction of major shippers surveyed,

and P = fraction of total U.S. shipping activity which is represented by the survey,

$$I = \sum_{W+D} (u) = M+N$$ = actual total shipping activity for all licensees, and

$$i = \sum_{Y+D} (u) = Y*m + D*n$$ = total shipping activities for major shippers surveyed plus all minor shippers.

Then ideally,

$$m >> n \text{ and } M >> N \text{ such that } m/n = M/N \rightarrow \infty$$

Postulated acceptable values are $m/n > 10000$,

$M/N > 100$,

and $V > 0.85$,

such that $i \simeq Y*m$, and

$I \simeq M = W*m$, then

$$P = i/I \simeq \frac{Y*m}{W*m} = Y/W = V.$$

While m may be impossible to define accurately due to large deviation from the mean, the value of $Y*m$ is available from the survey results.

The total U.S. shipping activity of basis u is then,

$$T = Y*m/V \ (=W*m)$$

T may then be determined for each basis, nuclide, and category combination.

Using the preceding method, there are three general problem areas encountered when attempting to extrapolate to overall total shipping activity with the data received in this survey.

The first is that of the major shippers responding, their indicated total annual shipping activities were not orders of magnitude greater than the total for the entire minor shipper population (e.g., M/N is not > 100). In fact, the shipping activities of the major shippers combined with those of the SNM licensees responding were only about five times the magnitude of the activities of the estimated minor shippers population total activity on a basis of packages shipped annually (about 10^6 packages/year versus 220,000/year). In order words, M/N ≈ 5.0. On a basis of curies shipped annually, there were about 1.1×10^7 curies (extrapolated, see Report I.E, Appendix B, Page B-86) shipped by the minor shipper (Summary Questionnaire) population of about 14,600 licensees, compared to 1.4×10^7 non-SNM curies (see Report X.H in the pocket of the back cover) shipped by the major shippers, SNM licensees, and ERDA contractors together (in the Detailed Questionnaire Non-SNM/Source Material data base), for a ratio of M/N ≈ 1.3. Even if the probable major shippers who did not respond to the survey were somehow included, there is no definite evidence indicating that the total shipping activity for the major shippers would increase by orders of magnitude to warrant basing the overall total estimate on the major shippers alone.

The second problem is that W (the total number of actual major shippers) was not accurately known, therefore V (the fraction of the major shippers that responded to the survey) is not known. The 21 Summary Questionnaires that were returned from apparent major shippers indicate that there may be a large number of major shippers not yet identified. The fact that these 21 shipped over 770,000 (mostly exempt) packages annually may suggest that if all of the major shippers were identified and surveyed, their total shipping activity may well be orders of magnitude greater than that of the minor shippers. This would then indicate that the method for projecting total shipping activity outlined above may be applicable, since the first problem (discussed above) would be eliminated.

The third, and most important, problem is the lack of an obvious statistical basis for direct extrapolation of the raw data to totals for licensee populations. The most serious difficulty involves the nonresponses. These nonresponses constitute a significant fraction of the licensees who were

sent questionnaires (see Table 4.2). From the available data there is no way of knowing whether: 1) the nonresponse group consists mainly of licensees who have so much shipping activity that completing the questionnaire would have required too much effort, or 2) that the nonresponse group consists mainly of licensees who do no shipping at all. Thus, the magnitude and direction of possible bias are unknown. (However, the telephone contact with the Detailed Questionnaire nonrespondents offers some indication of the nature of the nonresponse group.)

There are three ways in which the nonresponses might be handled to alleviate this problem:

1) Calculate some reasonable extremes for nonresponses, both high and low. For instance, assume the mean of the nonresponses is 2 or 3 standard deviations above or below the mean for the responses, for whatever basis is controlling (packages shipped per year, for example). Thus, bounds can be obtained for the combined responses and nonresponses.

2) Calculate plausible values and limits for the nonresponses. This is basically a subjective judgment, and in addition would require more information than exists in the data base from this survey alone.

3) Use the responses in extrapolating to the total population (respondents and nonrespondents). The assumption is necessarily that there is no essential difference between the response and nonresponse groups.

Whichever alternative is selected, a statement about the accuracy of the resulting extrapolation based on statistical theory alone may be difficult.

The third method of handling the nonresponses was used with some modification (Section 3.3) to estimate the shipping activities of the minor shipper (Summary Questionnaire) population on a basis of packages shipped annually. The accuracy of that extrapolation was measurable to some degree by comparing the resultant averages and parameters from the minor shipper population with like parameters from a similar group (the non-SNM/Source Material data base) which had been extrapolated independently to a uniform annual basis, but not to a population total.

It should be mentioned that there is very likely some bias in the non-SNM/Source Material data base also due to the fact that the respondents were asked to choose a "representative" time period for reporting their shipping activities (see Appendix C). The concept of a representative period could be subject to a broad interpretation.

While processing the survey data, a great number of data entries were handled and a significant amount of editing work was done. Chances for error exist in every manipulation. A cross-checking (quality assurance) procedure was set up to minimize the errors introduced into the data base as a result of the manual processing. However, there still remains a possibility that errors do exist in the data base which was used to generate the output tables (Appendix B).

In summary, the accuracy of extrapolations to total shipping activity, based solely on these program results, should be carefully evaluated. Detailed extrapolations or detailed investigations of extrapolation accuracy were beyond the scope of this program.

6.0 FUTURE CONSIDERATIONS

During the course of the program, we identified several useful changes that may expedite the process if a similar survey was ever conducted in the future. More time and effort spent in developing the questionnaire would be effective in eliciting a more uniform response. After the questionnaire has been developed, it should be sent out to individuals in the nuclear industry to determine if it is understandable and usable. Although we did field test the questionnaire and incorporated the recommended changes, another field test would have been beneficial. As a consequence of not having this second field test, several ambiguous statements appeared on the questionnaire that caused uncertainty. Of particular importance for the Detailed Questionnaires are the suggested changes listed below:

- Change the heading information from "No Shipping Activities ☐ " to "Have you shipped any radioactive material during the survey period? Yes_____ No_____." Many respondents understood "No Shipping Activities" to mean "Number of Shipping Activities."
- Provide a list of the license categories so the respondent can select one rather than use his own terminology.
- Define consignments more clearly and explain the differences between consignments and packages.
- Determine a system for identifying packages containing mixed nuclides and provide a guide for the system in the questionnaire packet.
- Define dispersible versus nondispersible solids and provide symbols for their use in Column 9.
- Supply a list of the potential chemical and physical forms (Columns 8 & 9). Many of these forms can be identified from Summary Questionnaire Report I.E., Page B-84, Appendix B.

- Use the term "DOT number" or certificate of compliance number rather than "model number" for package model numbers (Column 11 on the questionnaire).
- The Transport Index (Column 12) should be more clearly defined and examples should be given for situations where a compartmentalized container is used or when multiple packages are put into one container.
- Add a column to the questionnaire requesting the enrichment of uranium and other fuels.
- Provide adequate spacing in the columns. For example, more space was needed in columns that required words rather than letters such as Columns 2, 6A, 6B, 8, 9, and 13 while less space was needed in Columns 5C and 7C.

Many of these suggested changes could be included on the Summary Questionnaire as well. Further, if correlation of the three parts of the Summary Questionnaire is desired, the three parts should be combined on one page.

Several improvements can be made in the design of the survey itself. As was discussed in Section 4, an overlap existed on the address lists due to some licensees possessing multiple licenses. The target populations should be identified by eliminating this overlap. This would probably require significant redefinition of shipping categories based on primary activity of the licensees, primary use of radioactive material, relative licensee size, or some other basis. The response of each group could then be extrapolated independently. For example, the following groups could possibly be identified:

- SNM/Source Material Group, consisting of the SNM licensees already identified, plus NRC Subcategories 11-100 through 11-700, plus similar groups from the Agreement States.
- Major Shippers Category that would overlap other category boundaries. These major shippers could perhaps be identified by an initial mini-survey sent to all licensees, asking only for the number of packages or consignments, and/or the amount of material the licensee ships in one year.

- Minor and Potential Shippers, in various categories similar to the NRC subcategories but identified for Agreement States licensees also.
- ERDA Prime Contractors Group that would be extrapolated independently from other shippers.

A detailed statistical evaluation of the survey design should be made in the initial survey stages to carefully define sample sizes required for each "population."

This evaluation may indicate that a large fraction of the total population should be sampled from the Major Shippers and ERDA Prime Contractors groups, since the variation among the members with regard to materials and amounts shipped appears to be considerable. If the minor shippers categories were well chosen on the basis of function of business activity, a good degree of uniformity could be expected. Thus, a reasonably small sample should provide representative data.

The problem of nonrespondents will still occur in any survey which depends on voluntary response. Limits could be established for the extrapolation to totals by assuming limiting, but reasonable, extremes for the nonrespondents similar to the following:

- First Extreme (upward boundary) - All of the licensees who had no shipping activities responded, thus the nonrespondees are similar to the respondees who had shipping activities.
- Second Extreme (lower boundary) - All of the nonrespondees had no shipping activities, and, not realizing the importance of such information, did not respond.
- Intermediate Case - All nonrespondees were identical to the respondees in every way.

The two extremes can then be narrowed down to an acceptable range of deviation from the norm (closer to the intermediate case) by comparing estimates from independent sources, plus limited follow-up contact with the nonrespondees.

Finally, improvements which could be made to the data handling system have been identified. Because of the evolutionary nature of the question and answer process encountered in the survey, it is suggested that the data be installed on an interactive data management system which incorporates a generalized query and report generation module. This type of system would allow anyone to address the data, base decisions on the initial results, and readdress the data without design, model or program changes.

7.0 REFERENCES

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APPENDIX A

QUESTIONNAIRE EDITING

APPENDIX A

QUESTIONNAIRE EDITING

Although instructions were included with the questionnaire packets, an editing process was necessary to ensure that the data listed were uniform and compatible with established format. After preliminary identification/indexing, the data were edited in two phases to assure uniformity and to obtain missing information as detailed in this appendix.

As a questionnaire was received, it was assigned a unique four-digit identification number. This number was recorded in a master address list and enabled us to quickly identify the respondent as well as the origin of the shipping activities. This identification number was then used in place of the respondent's name in all subsequent data processing. The editing process then proceeded. The first phase involved checking the questionnaires to assure that the information was consistent with the established format. The second phase necessitated contacting the respondents to obtain necessary information to help clarify their returned questionnaires.

DETAILED QUESTIONNAIRES - PHASE ONE

The purpose of the first editing phase was to ensure that the information on the questionnaires was compatible with the format established for computer processing. The editing activities and assumptions are detailed in the following subsections. A review of the questionnaire packets in Appendix C at this point could be helpful in understanding the discussion.

Heading

The questionnaire heading was checked to make sure that: 1) the company identification number and zip code were complete, 2) page numbers were in the correct order, and 3) the survey period was listed in units of weeks. Also, if numerical ranges were used for the estimated annual consignments

and curies (or grams) these ranges were averaged. If the license category classification was blank, the appropriate classification was determined.

Column 1

The date was checked to make sure that the year was entered as a four-digit number, the month as a three-letter code consisting of the three first letters of the intended month, and the day as a one- or two-digit number with no leading zero.

Column 2

The city names were checked for correct spelling and the names that were abbreviated were written out.

Column 3

The state names were compared to the standard U.S. Post Office abbreviations for consistency. If the shipment was an export, the name of the receiving country was listed in Column 3.

Column 4

The entries for the miles traveled by the shipment were spot-checked for accuracy. When no mileage entry was listed, or a numerical range was entered, a value was estimated using an atlas as well as the origin (in the heading information) and destination information (Columns 2 and 3).

Columns 5A and 5B

Entries for transportation modes were checked to make sure they conformed to the symbols listed in the questionnaire instructions. When "pedestrian" was entered as transportation mode, it was changed to "mail" (symbol M) in this column.

Columns 6A and 6B

City and state of export or import were checked for spelling and consistency with Post Office abbreviations.

Column 7A

The radionuclide name was checked to make sure it was in the form of one or two letters followed by one, two, or three numbers (H3, L16, C14, SR90, RA226, etc.) with no dashed lines separating the characters. The nuclide name column also contained a space (following the isotope number) for a letter (A-Z) indicating uranium enrichment. Other special cases of nuclide names existed which are discussed in the "Detailed Questionnaires - Phase Two" section of this appendix and in Section 4.

Column 7B

This column was first scanned to verify that the number of packages was listed for each consignment. Where no entry was made, the number of packages was assumed to be unity when other information on the questionnaire indicated that this was the case. When the number of packages could not reasonably be assumed equal to unity, the questionnaire was subjected to the second phase editing process discussed later in this appendix.

Column 7C

Three symbols were acceptable in this column as stated in the Questionnaire Explanation: M (Medical), R (Research), and X (Other). However, the words "medical research" were often entered in this column. All such entries were revised to the symbol M since the term "medical" (M) for the survey purposes included all medical (applied and research) use of radioactive material. A surprising number of detailed descriptions appeared in Column 7C; these entries were reduced to the proper symbol.

Column 8

The first task in editing Column 8 was to check that the chemical form listed was truly a chemical form. A physical form was often listed for chemical form. If the physical form listed was recognizable, it was transferred to Column 9, provided Column 9 was originally blank. However, if the chemical form was not recognizable, the entry was left blank. In addition, many organic compounds were listed as chemical form. To simplify

the survey and shorten the report, all identifiable organic compounds listed were categorized as "organic". Exceptions included "carbonate", "resin", and "carbide", which were left as unique chemical forms.

A few respondents indicated on the questionnaire that the chemical form was proprietary and could not be listed. Others listed specific chemical formulas (CH_3CHO rather than acetaldehyde, for example); these had to be changed to the proper form. About one-third of the line entries for chemical form required manual revision.

Column 9

As was previously mentioned in the discussion of Column 8, a physical form was often listed incorrectly in the chemical form column. If the physical form (Column 9) was blank, the entry in Column 8 was transferred to Column 9. An oversight in developing the questionnaire form led to the exclusion of a symbol describing monolithic, nondispersible solids as physical form. Many questionnaires were returned with the words "solid", "monolith", or "nondispersible solid" entered in Column 9. In these cases the symbol "NS" (nondispersible solid) was entered manually. Another common entry for the physical (and chemical) form designation, which was not anticipated in the questionnaire design, was "sealed source". It was assumed that this entry indicated that the actual chemical and physical forms were either unknown or not available, and that the package did not qualify as "special form" (SF; see "Instructions" for the Detailed Questionnaire, Appendix C). This assumption was generally confirmed by conferring with several respondents who had used the sealed source designation. Thus, all entries of "sealed source" in either Column 8 or Column 9 were deleted and considered a blank entry.

When the symbol "G", indicating gaseous physical form, appeared in Column 9, the radionuclide listed was one of the noble gases, and Column 8 was left blank, the chemical form was assumed to be "element" and was manually entered in Column 8 as such.

Frequently, more than one physical form was listed in Column 9, especially for packages containing mixed nuclides. When this occurred, the most dispersible physical form was retained. The assumed hierarchy of dispersibility was G > L > DS > NS (gas > liquid > dispersible solid > nondispersible solid).

Although many questionnaires were returned with no entry in Column 9, no attempt was made to determine the physical form based on the chemical form in Column 8, if listed.

Column 10

Package type entries were to reflect Code of Federal Regulations (CFR) definitions of Type A, B, AF, BF, E (exempt), LQ (large quantity), and LS (low specific activity) packages (see 49 CFR 173.389, 390, 391).[4] However, several respondents failed to indicate package type in Column 10. In these cases, the package type was manually determined from the amount of radioactive material listed in Column 13 for the particular radionuclide entered in Column 7A. When the nuclide listed was other than a single isotope, no attempt was made to determine the package type. When the entry in Column 10 was "homemade", or "wooden box", or similar listings, these were corrected (when possible) to reflect CFR definitions. Also the correct model number of the package was often entered in Column 10 rather than in Column 11. In this case, the entry was transferred to Column 11, if Column 11 had been left blank.

Column 11

The model number of the package was intended to reflect U.S. Department of Transportation (DOT) formal package model designations. The questionnaire instructions, however, were somewhat vague on this point, and as a result most of the entries in Column 11 were not correct. Package model numbers were repeatedly entered as commercial model numbers particular to a manufacturer. Various bottle and box sizes were also listed in an attempt to fill out Column 11. The great variety of model numbers and descriptions precluded any attempt to determine correct DOT model numbers. In some cases

the respondents did list DOT model numbers, particularly the ERDA prime contractors. All model number entries were accepted that were listed as combinations of numbers and letters, but were not common words (i.e., wooden box, 55-gal drum, homemade), while entries were deleted that obviously indicated commercial brand names or were otherwise indicative of a single organization or manufacturer. Most of the entries in Column 11 required some manual editing.

Column 12

The Transport Index (TI) (see "Instructions" for Detailed Questionnaires, Appendix C) entry was another frequently misunderstood item on the questionnaire. A few respondents entered a question mark in Column 12, while many others just left it blank. Some respondents confused TI with Transport Group or Fissile Class definitions (see 49 CFR 173.389,390)[4] and entered Roman numerals I through VII in Column 12. If a proper TI was not entered, the item was changed to a blank entry and no further attempt was made to determine this number.

Column 13

The amount (curies or grams) of the radionuclide per package was usually filled out; however, in many cases the units were not the ones requested on the questionnaire. Entries were frequently listed in millicuries, microcuries, kilocuries, micrograms, milligrams, kilograms, and ounces. To ensure consistency in the data base, these were revised to the correct units. The most serious deviations from the established format occurred when the entry for a "non-SNM/Source Material" radionuclide was listed in mass units (grams, etc.) or a SNM/Source Material nuclide was listed in activity units (curies, etc.). This required a lengthy unit conversion process, particularly when the package contained a mixture of nuclides (such as enriched ^{235}U).

General Editing

The preceding discussion on the first phase editing describes the most common editing problems associated with each column on the detailed

questionnaires. A variety of other problems were encountered in the returned data but are too numerous to detail here. Most of these problems occurred only once on just a few, or in some cases only one, of the questionnaires; however, few questionnaires passed the editing process without significant revision.

Some phase-one editing procedures did not apply to any particular column on the questionnaires. The most significant general editing procedure was used when respondents entered SNM information on the non-SNM questionnaire, or vice-versa. When this happened, the entire line entry was manually transferred to a different questionnaire form so that the entry would be included in the correct data file.

DETAILED QUESTIONNAIRES - PHASE TWO

The second phase of the editing process involved obtaining additional information from respondents who had filled out the questionnaire incorrectly, or obtaining data not specifically requested on the form. The problems are discussed in the approximate order in which they were encountered as the questionnaires were returned. The first problem area was blank or unreadable entries in essential item columns, including Columns 2, 3, and 4 (destination and miles traveled by consignment), Column 7A (radionuclide name), 7B (number of packages per consignment) and Column 13 (grams or curies per package); "essential" means necessary for uniform, meaningful automatic data processing.

Columns 2, 3 and 4

The essential information needed from Columns 2, 3 and 4 was the miles traveled by the consignment. If only Column 4 (miles) was blank, the mileage could be estimated from the origin and destination using an atlas. If all three columns were blank, no estimate could be made and the respondent was contacted for the information. This process was 100% successful for domestic shipments. In the case of import or export shipments, the U.S. city of receipt or origin was needed in addition to the respective foreign

origin or destination country (since it was usually different from the address of the respondent) in order to estimate the miles traveled by the consignment. In most cases, when respondents were contacted regarding ports of entry or exit for foreign shipments, they did not have the information since a contract carrier had handled the shipment. In lieu of accurate mileage entries for these cases, shipments to or from Western Europe, the Near East, Iceland, and Africa were assumed to originate at New York City (or be received at New York City in the case of imports). Shipments to or from Taiwan, the Far East, Japan, India, Australia, New Zealand, and the Philippines were assumed to originate or terminate at San Francisco while shipments to or from Mexico, Panama, or the South American nations were assumed to originate or terminate in Houston. The miles traveled were then estimated accordingly. All shipments to Canada were originally listed with a port of entry or exit, or the miles traveled by the shipment were listed. When this editing task was completed, every consignment had an entry for miles traveled.

Column 7A

The radionuclide name entered in Column 7A often was not a recognizable isotope. However, the intended nuclide was usually apparent from either the element designation (Ra, Na, Sr, etc.) or the isotope designation (226, 22, 90, etc.) plus other related information on the questionnaire. Although the error was usually an obvious typographical error, several entries in Column 7A were unidentifiable and the respondent was contacted for correct information. This effort was very successful. In the few cases where the nuclide name was not known by the respondent, the symbol "UN" (unknown) was entered.

For numerous entries in Column 7A more than one radionuclide or isotope was listed for one package. An initial effort was made to rectify this problem by contacting the respondent to determine which nuclide or isotope constituted the major contents of the package; however, this was essentially unsuccessful. Therefore, an attempt was made to devise a coded list of symbols consisting of two alphabetical characters and three numerical

characters (XX###) to represent the various combinations of isotope and nuclide mixtures. The first unique mixture encountered was assigned the symbol XX001, the second was assigned XX002, etc. This system was abandoned early in the process when the number of unique mixtures exceeded 200; the survey results were complicated enough without the addition of hundreds more unique nuclide names. It was finally agreed that all mixtures of nuclides or isotopes, with the exception of those already defined in the questionnaire instructions (MC, MF, etc.), would be entered "mixed". The SNM/Source Material nuclides (enriched uranium and uranium/plutonium mixtures) were another exception to this convention.

After the Detailed Questionnaires had been mailed, it was discovered that no provision had been made for the respondents to indicate uranium enrichments. Thus, every respondent who had listed any uranium shipments was contacted for information regarding ^{235}U enrichment and whether the entry in Column 13 represented grams of ^{235}U isotope or grams of uranium element. The enrichment was then manually recorded on the questionnaire form for each uranium shipment. When the information was available, an alphabetic character (A through Z) representing ^{235}U enrichment was later entered after the nuclide name in Column 7A for each ^{235}U shipment; Table 4.4 in Section 4 lists the symbols and their corresponding enrichments. The entry in Column 13 was then changed to equal the grams of ^{235}U contained per package. For example, 100 g of "U235J" indicates a package containing 2000 g of a mixture of 5 mass % ^{235}U (100 g) and 95 mass % ^{238}U (1900 g). All ^{235}U shipments for which no information regarding enrichment could be obtained were indicated as "U235Z". It is not known whether the entry in Column 13 represents grams of isotope ^{235}U or total grams uranium when U235Z is listed as nuclide. Pure (100%) ^{235}U is indicated by the normal designation U235.

On several returned SNM/Source Material questionnaires, mixtures of plutonium and uranium were listed as radionuclide in Column 7A. It was determined that these mixtures represented special fuel elements, and the nature of the mixture was too important to be hidden in the general term,

"mixed". Thus, after the nature of the mixture was determined, often by contacting the respondent, a new symbol was established to describe the mixture. This symbol consists of two alphabetical characters (UP) followed by three numbers and another alphabetical character, similar to the uranium enrichment characters. The first two letters (UP) indicate a uranium/plutonium mixture while the first two numbers represent the mass fraction of plutonium and the third number indicates the isotope of plutonium which exists in the mixture. The trailing letter indicates the enrichment of ^{235}U in the mixture based on the total uranium in the mixture (the same as in the uranium shipments described in the previous paragraph). The entry in Column 13 was then revised, if necessary, to represent the total grams of the mixture per package. For example, 100 g of nuclide UP219J (see Table 4.4) represents a package containing 21 mass % ^{239}PU (210 g) and 79 mass % uranium (790 g). The uranium fraction contains 5 mass % ^{235}U (39.5 g) and 95 mass % ^{238}U (750.5 g). When no information regarding the relative fractions of uranium and plutonium was available, the symbol "UP" was listed for nuclide name and the entry in Column 13 is the total grams of the mixture.

Occasionally, a radionuclide name was entered indicating only the element type without the isotope designation (Sr rather than ^{90}Sr etc.). In these cases an attempt was made to contact the respondents to obtain the correct information. Since this was not successful, the element designation alone was finally accepted for these few cases.

Column 7B

As noted previously, Column 7B was occasionally left blank. When there was no evidence that indicated the number of packages per consignment was to be unity, the respondent was contacted to obtain the correct information. This effort was relatively successful. Exceptions are discussed below under "General Editing Procedures".

Column 13

Occasionally, Column 13 was left blank, but no attempt was made to estimate the amount of radioactive material per package based on similar

information listed elsewhere on the questionnaire. In this situation, the respondents were contacted for the correct information. This effort was partially successful.

General Editing Procedures

The attempt to obtain missing essential information (such as Columns 4, 7A, 7B, and 13) was, as noted, generally successful. Exceptions were usually due to incomplete information in the respondent's records. In other cases the respondents were not willing to review the questionnaire or their records a second time. Also, a few respondents could not be contacted by any reasonable effort.

Most questionnaires for which essential information was unobtainable in this second effort contained blank entries in two or more essential columns on the same line. Although several questionnaires were missing the essential information on nearly every line, most had only one or two lines that contained blanks. When the questionnaires had only one or two incomplete lines out of many more correct lines, the incomplete lines were deleted from the questionnaire and not included in the computer data base. The remaining complete lines were considered representative of the respondent's shipping activities and were included in the data base.

After completing these steps, all lines containing blank entries in essential data items were excluded from the computer data base. Three classes of responses were then defined. Class-1 questionnaires were processed by computer and included all questionnaires that were complete in at least all four essential data items. Class-2 includes questionnaires that were missing essential data items but contained sufficient information to justify summarizing their contents. These responses are summarized manually in Section 4. Class-3 responses include letters indicating that the respondent did not intend to complete the questionnaire and other responses that did not indicate the respondent's shipping activities.

Several respondents apparently found the questionnaire form inadequate and constructed their own. Because these forms lacked the line numbering

system on the standard form, these numbers had to be added since they are essential for computer data handling. Many of these substitute forms were not in the same format as the standard survey questionnaire so all of the information had to be transferred to the standard form to enable systematic processing. In a few cases these substitute forms lacked essential data items which necessitated contacting the respondent to obtain the missing information.

A few respondents returned shipping forms in lieu of the completed questionnaire, thus shifting the burden of recording the data on the questionnaire to PNL staff. Many of these shipping forms contained no information regarding chemical and physical form, intended use, or nuclide amounts. In these cases, the respondent was contacted to obtain the information.

A few Summary Questionnaires were mistakenly mailed to SNM/Source Material shippers in addition to the appropriate Detailed Questionnaire. In some of these cases, the Summary form reached the licensee first and was filled out and returned. Subsequently, the respondent was understandably reluctant to complete the Detailed Questionnaire. An attempt was made to expand the information from these Summary forms and record it on the proper Detailed Questionnaire forms. This required considerable additional input from the respondents since the information on the first page of the Summary form did not necessarily correspond to that on the second and third pages. No information regarding destination or data of shipments was available in those cases, nor was there any information regarding secondary transportation mode or foreign transportation. This effort was successful for only one case.

Several of the Summary Questionnaires which were sent out on a random basis to assumed minor shippers were returned listing shipping activities indicating that the respondent was actually a major shipper (thousands of packages per year). These were pulled from the Summary data file and an attempt was made to expand and record the information on a Detailed Questionnaire. However, this attempt was unsuccessful since there was usually no

direct correspondence of data between the three pages of the Summary Questionnaires, and the name of the person filling out the Summary form was usually not listed making direct contact difficult and time consuming. Thus, the data from these questionnaires were summarized manually (see Section 4).

On many of the Detailed Questionnaires listing more than one package per shipment, it was unclear whether the Transport Index listed in Column 12 and the nuclide amount listed in Column 13 were on a per package basis or were totals for the shipment. Questionnaires that contained such lines were pulled from the data base until the respondent could be contacted for clarification. It was found that only a few (about 10% of those in doubt) had correctly listed totals. Thus, when the information was unavailable from the respondent on a per package basis, the entry in Column 13 was divided by the number of packages to indicate the average amount of nuclide per package. The entry in Column 12 was changed to a blank entry in this case, since the total TI of a group of packages is rarely the arithmetic sum of the individual packages' TI. To divide the original TI by the number of packages would lead to an incorrect interpretation of the data; the treatment of data for consignments with a blank entry in the TI column is described in Section 4 and Appendix B.

SUMMARY QUESTIONNAIRES

Most of the phase-one editing for the Summary forms consisted of checking to make sure the entries were consistent with the established format. Two numbers were also assigned to each Summary Questionnaire. The first number was for identification and indexing purposes while the second number indicated license category and was used for extrapolation to the total population.

No phase-two editing (actual contact by telephone) with the respondent occurred with the Summary Questionnaires, mainly because the person who completed the form was not identified. Furthermore, the Summary Questionnaires required less editing than the Detailed, possibly because such rigid format and detail were not required.

APPENDIX B

COMPUTER REPORTS

ERRATA

Page B-19. Note that in the first line of data in Report XIV.F (pages B-56, 57, 58) ^{238}Pu appears to be shipped in 247 packages containing greater than 1000 Ci (sixth Ci range) of ^{238}Pu each. The total amount of ^{238}Pu shipped is listed as 4.13785E+08 (last column). However, this is not correct. The apparent source of the error is that an entry of "^{238}U" on a questionnaire was keypunched as "PU 238" on the data card and the error was not discovered during proofreading. This apparent source of the error has not been verified. The impact on the overall ^{238}U data base is small, since the error involves 247 packages containing no more than 8.2 Ci of ^{238}U. This error is carried through onto Report XIV.H in the pocket of the back cover.

The net effect of the error on the ^{238}Pu data base is that the total curies of ^{238}Pu shipped by truck (Report XIV.F) and the total amount of ^{238}Pu shipped by all transport modes combined (Report XIV.H) is not available. However, the ^{238}Pu shipping information regarding other transportation modes is correct (Reports XIV.A through XIV.E, and XIV.G) as is the ^{238}Pu information under the first five curie ranges of Reports XIV.F and XIV.H.

A second data error exists in Reports XIV.D and XIV.H. The second line of data in Report XIV.D (and the 23rd line in Report XIV.H) show the nuclide "U 231" being shipped in 2757 packages containing over 1,000 Ci of ^{231}U each (sixth curie range). This is obviously in error. The apparent source of this error is that an entry for ^{238}U on a questionnaire was erroneously keypunched as "U 231" on a data card. Reports XIV.D and XIV.H show a total of "9.02645E+13" Ci of ^{231}U being shipped and Report XIV.H shows the conversion of this inventory to grams as "6.70766E+08" grams ^{231}U. If this is actually supposed to be ^{238}U, the total 6.7×10^8 grams ^{238}U (shipped by rail in 2757 packages) is correct. The impact of this is small compared to the total ^{238}U shipping activity shown on Report XIV.H of 3.3×10^{10} grams ^{238}U shipped in about 250,000 packages.

This source of the error has not been verified. Note also that the total curies shown at the bottom of both Reports XIV.D and XIV.H are incorrect due to the ^{231}U error.

These two errors have been taken into account in the calculations of parametric and average values in Section 4.

Page B-78. Note that in Summary Questionnaire Reports I.A (page B-78) and I.E (pages B-84, 85, 86), the nuclide designated "U235C" is shown being shipped in 58 packages containing ".1918E+06" curies annually. The ".1918E+06" is grams and not curies. The inventories listed for all other nuclides in the Summary Questionnaire Reports are correctly in curies.

A second error appears on Summary Questionnaire Reports I.C and I.E. The nuclides designated as "CI 36" and "CI 38" should both be "CL 36". The associated information for those entries should then be added to the totals for ^{36}Cl.

APPENDIX B

COMPUTER REPORTS

After technical editing, the responses to the questionnaires were keypunched onto data cards. These cards were then put through two verification processes. The first process compared the numeric data punched on the card with the actual questionnaire to ensure accuracy in keypunching. In the second process, the cards were run through a program editor to compare alphanumeric data punched on the cards with an acceptable set of syntax previously established.

Acceptable data were put on a direct access mass storage device where they were used to generate 19 report sets, 16 sets from the Detailed Questionnaire returns and 3 from the Summary Questionnaire returns. A detailed description of each report set follows. Detailed Questionnaire Reports I, III, V, VII, IX, XI, XIII, XIV, XV, XVI contain SNM/Source Material data; Detailed Questionnaire Reports II, IV, VI, VIII, X, XII contain non-SNM/Source Material data.

DETAILED QUESTIONNAIRE REPORT DESCRIPTIONS

The following subsections identify the order of the computer reports and provide a list of the components. Computer reports that are totally included in this appendix are preceded by an asterisk (*) in the following list.

A complete set of computer reports is available at the NRC Public Document Room, 1717 H Street, NW, Washington D.C.

SNM SOURCE MATERIAL REPORTS - ANNUAL SHIPMENTS

Report I.A. Summary Information (by alphabetical order of radionuclide)

Total packages, total grams, total TI, total miles, total TI miles, grams per package, TI per package, TI miles per package, maximum grams per package, predominant chemical form and its percent of the total grams for the radionuclide, predominant physical form and its percent of the total grams for the predominant chemical form, secondary chemical form and its percent of the total grams for the radionuclide, secondary physical form and its percent of the total grams for the secondary chemical form, freight forwarder package total, freight forwarder TI miles, freight forwarder total TI, freight forwarder total grams, number of packages in various applications (research, medical, and other) for SNM/Source Material radionuclides.

Report I.B. Major Transportation Mode (by alphabetical order of radionuclide)

Number of packages, TI miles, maximum grams per package, total TI, total grams for SNM/Source Material radionuclides, by major transportation mode.

Report I.C. Secondary Transportation Mode (by alphabetical order of radionuclide)

Number of packages, maximum grams per package, total TI, total grams for SNM/Source Material radionuclides, by secondary transportation mode.

Report I.D. Package Types (by alphabetical order of radionuclide)

Number of packages, TI miles, maximum grams per package, total TI, total grams for SNM/Source Material radionuclides and model number, by package type.

Report I.E. Transportation Information (by alphabetical order of radionuclide)

Number of packages, TI miles, maximum grams per package, total TI, total grams for SNM/Source Material radionuclides, origin (indicated by the first two digits of the zip code of the city of origin) and destination, by major and secondary transportation mode.

Report III.A. Summary of Information (by decreasing total grams)

Total packages, total grams, total TI, total miles, total TI miles, grams per package, miles per package, TI per package, TI miles per package, maximum grams per package, predominant chemical form and its percent of the total grams for the radionuclide, predominant physical form and its percent of the total grams for the predominant chemical form, secondary chemical form and its percent of the total grams for the radionuclide, secondary physical form and its percent of the total grams for the secondary chemical form, freight forwarder package total, freight forwarder TI miles, freight forwarder total TI, freight forwarder total grams, number of packages in various applications (research, medical, and other) for SNM/Source Material radionuclides in descending order of total grams.

Report III.B. Major Transportation Mode (by decreasing total grams)

Number of packages, TI miles, maximum grams per package, total TI, total grams for SNM/Source Material radionuclides, by major transportation modes in descending order of total grams.

Report III.C. Secondary Transportation Mode (by decreasing total grams)

Number of packages, maximum grams per package, total TI, total grams for SNM/Source Material radionuclides, by secondary transportation mode in descending order of total grams.

Report III.D. Package Types (by decreasing total grams)

Number of packages, TI miles, maximum grams per package, total TI, total grams for SNM/Source Material radionuclides and model number by package type in descending order of total grams.

Report III.E. Transportation Information (by decreasing total grams)

Number of packages, TI miles, maximum grams per package, total TI, total grams for SNM/Source Material radionuclides, origin, and destination, by major and secondary transportation mode in descending order of total grams.

Report V. Activity Frequency Distribution

For each radionuclide, packages per year by range of grams for major transportation mode.

Report VII. TI Frequency Distribution

For each radionuclide, packages per year by range of TI for major transportation mode.

Report IX.A. Summary Frequency Distribution (Air Passenger: AP major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides.

Report IX.B. Summary Frequency Distribution (Air Non-Passenger: AF, AG, H, AI major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides.

Report IX.C. Summary Frequency Distribution (Truck: TC, TK, TP, TR, A, BU major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides.

Report IX.D. Summary Frequency Distribution (Ship: S, B major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides.

Report IX.E. Summary Frequency Distribution (Rail: R major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides.

Report IX.F. Summary Frequency Distribution (Mail: M, PE major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides.

Report IX.G. Summary Frequency Distribution (Unknown: unspecified major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides.

Report IX.H. Summary Frequency Distribution (All: all major transportation modes combined)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides.

Report XI.A. Summary Frequency Distribution (Air Passenger: AP major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides, chemical and physical form.

Report XI.B. Summary Frequency Distribution (Air Non-Passenger: AF, AG, H, AI major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides, chemical and physical form.

Report XI.C. Summary Frequency Distribution (Truck: TC, TK, TP, TR, A, BU major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides, chemical and physical form.

Report XI.D. Summary Frequency Distribution (Ship: S, B major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides, chemical and physical form.

Report XI.E. Summary Frequency Distribution (Rail: R major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides, chemical and physical form.

Report XI.F. Summary Frequency Distribution (Mail: M, PE major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides, chemical and physical form.

Report XI.G. Summary Frequency Distribution (Unknown: unspecified major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides, chemical and physical form.

Report XI.H. Summary Frequency Distribution (All: all major transportation modes combined)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides, chemical and physical form.

*Report XIII.A. Summary Frequency Distribution (Air Passenger: AP major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclide (where information for conversion to curies is unavailable).

*Report XIII.B. Summary Frequency Distribution (Air Non-Passenger: AF, AG, H, AI major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclide (where information for conversion to curies is unavailable).

*Report XIII.C. Summary Frequency Distribution (Truck: TC, TK, TP, TR, A, BU major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclide (where information for conversion to curies is unavailable).

*Report XIII.D. Summary Frequency Distribution (Ship: S, B major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclide (where information for conversion to curies is unavailable).

*Report XIII.E. Summary Frequency Distribution (Rail: R major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclide (where information for conversion to curies is unavailable).

*Report XIII.F. Summary Frequency Distribution (Mail: M, PE major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclide (where information for conversion to curies is unavailable).

*Report XIII.G. Summary Frequency Distribution (Unknown: unspecified major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclide (where information for conversion to curies is unavailable).

*Report XIII.H. Summary Frequency Distribution (All: all major transportation modes combined)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclide (where information for conversion to curies is unavailable).

*Report XIV.A. Summary Frequency Distribution (Air Passenger: AP major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available).

*Report XIV.B. Summary Frequency Distribution (Air Non-Passenger: AF, AG, H, AI major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available).

*Report XIV.C. Summary Frequency Distribution (Truck: TC, TK, TP, TR, A, BU major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available).

*Report XIV.D. Summary Frequency Distribution (Ship: S, B major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available).

*Report XIV.E. Summary Frequency Distribution (Rail: R major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available).

*Report XIV.F. Summary Frequency Distribution (Mail: M, PE major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available).

*Report XIV.G. Summary Frequency Distribution (Unknown: unspecified major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available).

*Report XIV.H. Summary Frequency Distribution (All: all major transportation modes combined)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available).

Report XV.A. Summary Frequency Distribution (Air Passenger: AP major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides (where information for conversion to curies is unavailable), chemical and physical form.

Report XV.B. Summary Frequency Distribution (Air Non-Passenger: AF, AG, H, AI major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides (where information for conversion to curies is unavailable), chemical and physical form.

Report XV.C. Summary Frequency Distribution (Truck: TC, TK, TP, TR, A, BU major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides (where information for conversion to curies is unavailable), chemical and physical form.

Report XV.D. Summary Frequency Distribution (Ship: S, B major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides (where information for conversion to curies is unavailable), chemical and physical form.

Report XV.E. Summary Frequency Distribution (Rail: R major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides (where information for conversion to curies is unavailable), chemical and physical form.

Report XV.F. Summary Frequency Distribution (Mail: M, PE major transportation modes)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides (where information for conversion to curies is unavailable), chemical and physical form.

Report XV.G. Summary Frequency Distribution (Unknown: unspecified major transportation mode)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides (where information for conversion to curies is unavailable), chemical and physical form.

Report XV.H. Summary Frequency Distribution (All: all major transportation modes combined)

Packages per year, average TI per package, and average miles per package by range of grams for SNM/Source Material radionuclides (where information for conversion to curies is unavailable), chemical and physical form.

Report XVI.A. Summary Frequency Distribution (Air Passenger: AP major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available), chemical and physical form.

Report XVI.B. Summary Frequency Distribution (Air Non-Passenger: AF, AG, H, AI major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available), chemical and physical form.

Report XVI.C. Summary Frequency Distribution (Truck: TC, TK, TP, TR, A, BU major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available), chemical and physical form.

Report XVI.D. Summary Frequency Distribution (Ship: S, B major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available), chemical and physical form.

Report XVI.E. Summary Frequency Distribution (Rail: R major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available), chemical and physical form.

Report XVI.F. Summary Frequency Distribution (Mail: M, PE major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available), chemical and physical form.

Report XVI.G. Summary Frequency Distribution (Unknown: unspecified major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available), chemical and physical form.

Report XVI.H. Summary Frequency Distribution (All: all major transportation modes combined)

Packages per year, average TI per package, and average miles per package by range of curies for SNM/Source Material radionuclides (where information for conversion to curies is available), chemical and physical form.

Non-SNM/Source Material Reports - Annual Shipments

Report II.A. Summary of Information (by alphabetical order of radionuclide)

Total packages, total curies, total TI, total miles, total TI miles, curies per package, miles per package, TI per package, TI miles per package, maximum curies per package, predominant chemical form and its percent of the total curies for the radionuclide, predominant physical form and its percent of the total curies for the predominant chemical form, secondary chemical form and its percent of the total curies for the radionuclide, secondary physical form and its percent of the total curies for the secondary chemical form, freight forwarder package total, freight forwarder TI miles, freight forwarder total TI, freight forwarder total curies, number of packages in various applications (research, medical, and other) for non-SNM/Source Material radionuclides.

Report II.B. Major Transportation Mode (by alphabetical order of radionuclide)

Number of packages, TI miles, maximum curies per package, total TI, total curies for non-SNM/Source Material radionuclides, by major transportation mode.

Report II.C. Secondary Transportation Mode (by alphabetical order of radionuclide)

Number of packages, maximum curies per package, total TI, total curies for non-SNM/Source Material radionuclides, by secondary transportation mode.

Report II.D. Package Types (by alphabetical order of radionuclide)

Number of packages, TI miles, maximum curies per package, total TI, total curies for non-SNM/Source Material radionuclides and model number, by package type.

Report II.E. Transportation Information (by alphabetical order of radionuclide)

Number of packages, TI miles, maximum curies per package, total TI, total curies for non-SNM/Source Material radionuclides, origin, and destination, by major and secondary transportation mode.

Report IV.A. Summary of Information (by decreasing total curies)

Total packages, total curies, total TI, total miles, total TI miles, curies per package, miles per package, TI per package, TI miles per package, maximum curies per package, predominant chemical form and its percent of the total curies for the radionuclide, predominant physical form and its percent of the total curies for the predominant chemical form, secondary chemical form and its percent of the total curies for the radionuclide, secondary physical form and its percent of the total curies for the secondary chemical form, freight forwarder package total, freight forwarder TI miles, freight forwarder total TI, freight forwarder total curies, number of packages in various applications (research, medical, and other) for non-SNM/Source Material radionuclides in descending order of total curies.

Report IV.B. Major Transportation Mode (by decreasing total curies)

Number of packages, TI miles, maximum curies per package, total TI, total curies for non-SNM/Source Material radionuclides, by major transportation modes in decreasing order of total curies.

Report IV.C. Secondary Transportation Mode (by decreasing total curies)

Number of packages, maximum curies per package, total TI, total curies for non-SNM/Source Material radionuclides, by secondary transportation mode in descending order of total curies.

Report IV.D. Package Types (by decreasing total curies)

Number of packages, TI miles, maximum curies per package, total TI, total curies for non-SNM/Source Material radionuclides and model number in descending order of total curies.

Report IV.E. Transportation Information (by decreasing total curies)

Number of packages, TI miles, maximum curies per package, total TI, total curies for non-SNM/Source Material radionuclides, origin, and destination, by major and secondary transportation mode in descending order of total curies.

Report VI. Activity Frequency Distribution

For each radionuclide, packages per year by range of curies for major transportation mode.

Report VII. TI Frequency Distribution

For each radionuclide, packages per year by range of TI for major transportation mode.

*Report X.A. Summary Frequency Distribution (Air Passenger: AP major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides.

*Report X.B. Summary Frequency Distribution (Air Non-Passenger: AF, AG, H, AI major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides.

*Report X.C. Summary Frequency Distribution (Truck: TC, TK, TP, TR, A, BU major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides.

*Report X.D. Summary Frequency Distribution (Ship: S, B major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides.

*Report X.E. Summary Frequency Distribution (Rail: R major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides.

*Report X.F. Summary Frequency Distribution (Mail: M, PE major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides.

*Report X.G. Summary Frequency Distribution (Unknown: unspecified major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides.

*Report X.H. Summary Frequency Distribution (All: all major transportation modes combined)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides.

Report XII.A. Summary Frequency Distribution (Air Passenger: AP major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides, chemical and physical form.

Report XII.B. Summary Frequency Distribution (Air Non-Passenger: AF AG, H, AI major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides, chemical and physical form.

Report XII.C. Summary Frequency Distribution (Truck: TC, TK, TP, TR, A, BU major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides, chemical and physical form.

Report XII.D. Summary Frequency Distribution (Ship: S, B major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides, chemical and physical form.

Report XII.E. Summary Frequency Distribution (Rail: R major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides, chemical and physical form.

Report XII.F. Summary Frequency Distribution (Mail: M, PE major transportation modes)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides, chemical and physical form.

Report XII.G. Summary Frequency Distribution (Unknown: unspecified major transportation mode)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides, chemical and physical form.

Report XII.H. Summary Frequency Distribution (All: all major transportation modes combined)

Packages per year, average TI per package, and average miles per package by range of curies for non-SNM/Source Material radionuclides, chemical and physical form.

SUMMARY QUESTIONNAIRE REPORTS

*Report 1.A. Radionuclide Information for Academic Licensees

Total packages per year and total curies per year for radionuclide, chemical and physical form, extrapolated to total academic license population of category.

*Report 1.B. Radionuclide Information for Medical Licensees

Total packages per year and total curies per year for radionuclide, chemical and physical form, extrapolated to total population of medical license category.

*Report I.C. Radionuclide Information for Industrial Licensees

Total packages per year and total curies per year for radionuclide, chemical and physical form, extrapolated to total population of industrial license category.

*Report I.D. Radionuclide Information for Other Licensees

Total packages per year and total curies per year for radionuclide, chemical and physical form, extrapolated to total population of other than academic, medical, and industrial license categories.

*Report I.E. Radionuclide Information for All License Categories Combined

Total packages per year and total curies per year for radionuclide, chemical and physical form, extrapolated to total population of all license categories combined.

*Report II.A. Package Type Information for Academic Licensees

Total packages per year for each package type, for academic license category.

*Report II.B. Package Type Information for Medical Licensees

Total packages per year for each package type, for medical license category.

*Report II.C. Package Type Information for Industrial Licensees

Total packages per year for each package type, for industrial license category.

*Report II.D. Package Type Information for Other Licensees

Total packages per year for each package type, for other than academic, medical, and industrial license categories.

*Report II.E. Package Type Information for All License Categories Combined

Total packages per year for each package type, for all license categories combined.

*Report III.A. Transportation Information for Academic Licensees

Total packages per year and total TI per year for each transportation mode, for academic license category.

*Report III.B. Transportation Information for Medical Licensees

Total packages per year and total TI per year for each transportation mode, for medical license category.

*Report III.C. Transportation Information for Industrial Licensees

Total packages per year and total TI per year for each transportation mode, for industrial license category.

*Report III.D. Transportation Information for Other Licensees

Total packages per year and total TI per year for each transportation mode, for other than academic, medical, and industrial license categories.

*Report III.E. Transportation Information for All License Categories Combined

Total packages per year and total TI per year for each transportation mode, for all license categories combined.

The calculations used in each of these reports and the system flow charts are included in this appendix.

DETAILED QUESTIONNAIRE REPORTS

The following computer reports contain the information from Reports X.H, XIII.H, and XIV.H (in the pocket of the back cover) broken down into the various transportation modes. Reports X.A through X.G contain the data from Report X.H sorted by the seven transport mode types (air freight, passenger air, mail, rail, ship or boat, truck, and unknown). Reports XIV.A through XIV.G correspond identically to Report XIV.H, and Reports XIII.A through XIII.D and XIII.F correspond to Report XIII.H.

Note that each of the reports are in three parts (three pages). Combining the three pages to make the complete report in the form of Reports X.H, XIII.H and XIV.H in the back cover pocket can be done by reproducing the three pages and combining them as shown in Figure B.1.

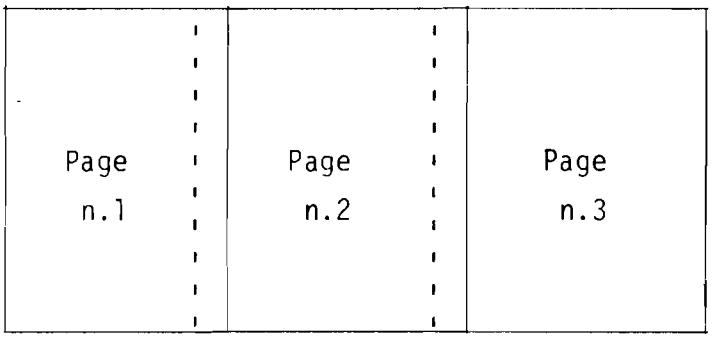


FIGURE B.1. Combination of the Three Pages for Detailed Reports

In Figure B.1, the character n = A, B, C, D, E, F, or G such that n = A for Reports X.A, XIII.A, XIV.A, etc. All three pages of each report have been reproduced here with the same reduction so that the lines and columns will line up correctly when the three pages are combined.

The dashed lines in Figure B.1 indicate the overlap of the pages such that page n.1 overlaps the radionuclide name column of page n.2, and page n.2 overlaps the radionuclide name column of page n.3.

The explanation for use of these reports (which is identical to the explanation for use of Reports X.H, XIII.H, and XIV.H) is located in the pocket in the back cover.

Note that these reports represent the shipping activities (extrapolated to a uniform one-year basis) only of the licensees and ERDA contractors that responded with the Detailed Questionnaire, and not for any total population. The number of respondents involved (as seen in Table 4.2, column 1b) were 640 SNM licensees and ERDA contractors plus 59 additional probable major shippers (27 of the 640 SNM Questionnaire responses were from major shippers for a total of 86 (59+27) probable major shippers). Of the 699 (640+59) Detailed Questionnaire responses, 11 were Class-2 or Class-3 responses, and, therefore are not included in the following reports, but are summarized in Section 4.

REPORT 1, A, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (FREIGHT) NON-SNM/SOURCE MATERIAL PAGE A.1

RADIO-NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
AG110	52	1800	2.0E-01	52	0	0	0.	0	0	0	0.	0
AM241	79	786	2.8E-03	75	1455	941	9.9E-03	1441	16	3794	1.9E+00	16
AS 76	0	0	0.	0	24	1800	3.5E-01	24	0	0	0.	0
AU198	0	0	0.	0	88	1105	5.7E-01	88	52	1300	6.0E+00	52
BK249	0	0	0.	0	2	6500	1.0E-01	2	24	1198	1.0E-01	24
BR 82	0	0	0.	0	145	979	2.2E+00	145	0	0	0.	0
CA 45	9	2800	0.	9	13	1660	0.	13	0	0	0.	0
CA 47	97	664	3.9E-01	97	12	387	1.4E+00	12	0	0	0.	0
CD109	0	0	0.	0	12	2000	1.0E-01	12	0	0	0.	0
CE141	0	0	0.	0	52	1400	0.	52	0	0	0.	0
CE144	0	0	0.	0	24	795	3.0E+00	24	0	0	0.	0
CF249	0	0	0.	0	2	2700	1.0E+00	2	0	0	0.	0
CF252	2	5000	6.0E+00	2	2	450	2.8E+00	2	0	0	0.	0
CL 35	52	750	0.	52	0	0	0.	0	0	0	0.	0
CM244	6	1783	1.0E-01	2	0	0	0.	0	0	0	0.	0
CO 57	1456	1075	4.0E-02	1456	37	1269	2.5E-01	37	0	0	0.	0
CO 60	68	1025	9.7E-02	64	59	1071	1.0E+00	59	166	1997	1.9E-01	166
CR 51	422	1312	1.0E-01	420	1062	1206	1.3E-01	1062	0	0	0.	0
CS134	12	3000	3.0E-01	12	0	0	0.	0	0	0	0.	0
CS137	8	2096	3.0E-02	8	48	2179	4.3E+00	48	2	2000	2.5E-01	2
CU 64	0	0	0.	0	60	1700	2.0E-01	60	0	0	0.	0
C 14	4109	1028	3.1E-05	3822	447	1839	7.1E-01	368	0	0	0.	0
EC	77	2547	9.8E-01	65	0	0	0.	0	0	0	0.	0
FE 55	16	2764	1.0E-01	14	2	3000	1.0E-01	2	0	0	0.	0
FE 59	120	4011	3.1E-01	68	9	1550	3.5E-01	9	0	0	0.	0
GA 67	0	0	0.	0	991	392	4.1E-01	991	0	0	0.	0
GA 72	12	480	0.	0	0	0	0.	0	0	0	0.	0
GD153	52	700	0.	52	0	0	0.	0	0	0	0.	0
HG197	0	0	0.	0	520	1372	2.1E-01	488	0	0	0.	0
HG203	4	300	1.0E-01	4	106	7660	1.2E+00	106	0	0	0.	0
H 3	3200	1366	0.	2707	2438	1155	5.0E-04	2147	12	1956	0.	0
IN111	0	0	0.	0	838	1333	2.5E-01	766	0	0	0.	0
IR192	0	0	0.	0	26	558	4.6E-01	26	136	1055	8.4E-01	136
I 123	936	239	1.6E-01	728	0	0	0.	0	0	0	0.	0
I 125	4590	1087	2.9E-02	3394	2844	1074	5.7E-02	2844	0	0	0.	0
I 131	4641	1273	2.8E-01	4537	10796	1173	9.4E-01	10692	0	0	0.	0
KR 85	0	0	0.	0	104	6111	1.5E-01	104	97	2086	4.1E+00	97
K 42	0	0	0.	0	351	1765	9.3E-01	351	0	0	0.	0
K 43	0	0	0.	0	351	620	6.5E-01	351	0	0	0.	0
LU177	0	0	0.	0	12	2700	1.0E-01	12	0	0	0.	0
MO	2	150	0.	2	0	0	0.	0	0	0	0.	0
MP	35	1054	7.0E-01	35	42	3333	1.3E+00	10	16	2479	1.8E+00	16
MIXED	656	1725	3.9E-02	612	206	1130	4.2E-01	198	0	0	0.	0
MN 54	52	1900	1.0E-01	52	0	0	0.	0	0	0	0.	0
MO 99	52	2000	1.2E+00	52	17033	1431	1.9E+00	16392	884	6000	4.5E+00	884
NA 22	6	1305	1.0E-01	4	52	1800	1.6E+00	52	0	0	0.	0
NA 24	0	0	0.	0	460	1857	2.9E+00	460	0	0	0.	0
NB 95	0	0	0.	0	12	865	8.0E-01	12	0	0	0.	0
NI 59	0	0	0.	0	12	872	0.	0	0	0	0.	0
NI 63	2	3000	1.0E-01	2	12	1500	1.0E+04	12	0	0	0.	0
NP237	2	450	0.	0	0	0	0.	0	0	0	0.	0
PA231	12	441	1.0E-01	12	0	0	0.	0	0	0	0.	0
PM147	0	0	0.	0	12	3000	1.0E-01	12	6	1067	2.0E-01	6
PO210	574	2451	3.5E-04	574	805	2342	2.7E-03	805	0	0	0.	0
P 32	303	907	0.	260	1038	1561	2.4E-01	980	104	2500	1.5E+00	104
P 33	9	1000	0.	9	16	1377	0.	4	0	0	0.	0
RA226	54	532	1.0E-01	54	12	1449	1.7E+00	12	0	0	0.	0
RB 81	0	0	0.	0	156	670	2.5E+00	156	0	0	0.	0
RB 83	12	860	0.	12	0	0	0.	0	0	0	0.	0
RB 86	29	2304	2.3E-01	29	53	1367	2.1E-01	53	0	0	0.	0
RU103	0	0	0.	0	12	1496	1.0E-01	12	0	0	0.	0
RU106	0	0	0.	0	60	1829	1.7E+00	60	0	0	0.	0
SE 75	936	736	9.4E-02	936	314	2865	1.4E+00	262	0	0	0.	0
SN113	2	450	0.	0	52	6000	3.0E+00	52	0	0	0.	0
SR 85	0	0	0.	0	4	3000	1.0E-01	4	0	0	0.	0
SR 89	0	0	0.	0	12	795	2.0E-01	12	0	0	0.	0
SR 90	8	883	2.0E-01	8	147	6860	2.2E-01	144	0	0	0.	0
S 35	455	1137	0.	420	461	1243	6.1E-02	457	0	0	0.	0
TA182	0	0	0.	0	12	2700	7.0E-01	12	0	0	0.	0
TC 99M	0	0	0.	0	7176	267	9.8E-02	7124	0	0	0.	0
TC 99	0	0	0.	0	12	1956	0.	0	0	0	0.	0
TE123M	0	0	0.	0	2	800	0.	2	0	0	0.	0
TL204	0	0	0.	0	52	400	5.0E-01	52	0	0	0.	0
TM170	0	0	0.	0	3	350	3.7E+00	3	0	0	0.	0
XE133	0	0	0.	0	4469	1587	4.5E-01	2447	312	2833	1.6E+00	312
YB169	0	0	0.	0	24	2500	2.4E-01	24	12	3000	2.0E-01	12
ZN 65	0	0	0.	0	2	450	0.	0	0	0	0.	0

REPORT I, A, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (FREIGHT) NON-SNM/SOURCE MATERIAL PAGE A.2

RADIO-NUCLIDE	>20 THRU 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
AG110	0	0	0.	0	0	0	0.	0	0	0	0.	0
AM241	12	4395	5.0E+01	12	0	0	0.	0	0	0	0.	0
AS 76	0	0	0.	0	0	0	0.	0	0	0	0.	0
AU198	0	0	0.	0	0	0	0.	0	0	0	0.	0
BK249	0	0	0.	0	0	0	0.	0	0	0	0.	0
BR 82	0	0	0.	0	0	0	0.	0	0	0	0.	0
CA 45	0	0	0.	0	0	0	0.	0	0	0	0.	0
CA 47	0	0	0.	0	0	0	0.	0	0	0	0.	0
CD109	0	0	0.	0	0	0	0.	0	0	0	0.	0
CE141	0	0	0.	0	0	0	0.	0	0	0	0.	0
CE144	0	0	0.	0	0	0	0.	0	0	0	0.	0
CF249	0	0	0.	0	0	0	0.	0	0	0	0.	0
CF252	0	0	0.	0	0	0	0.	0	0	0	0.	0
CL 35	0	0	0.	0	0	0	0.	0	0	0	0.	0
CM244	0	0	0.	0	0	0	0.	0	0	0	0.	0
CO 57	0	0	0.	0	0	0	0.	0	0	0	0.	0
CO 60	0	0	0.	0	0	0	0.	0	0	0	0.	0
CR 51	0	0	0.	0	0	0	0.	0	0	0	0.	0
CS134	0	0	0.	0	0	0	0.	0	0	0	0.	0
CS137	0	0	0.	0	0	0	0.	0	0	0	0.	0
CU 64	0	0	0.	0	0	0	0.	0	0	0	0.	0
C 14	0	0	0.	0	0	0	0.	0	0	0	0.	0
EC	0	0	0.	0	0	0	0.	0	0	0	0.	0
FE 55	0	0	0.	0	0	0	0.	0	0	0	0.	0
FE 59	0	0	0.	0	0	0	0.	0	0	0	0.	0
GA 67	0	0	0.	0	0	0	0.	0	0	0	0.	0
GA 72	0	0	0.	0	0	0	0.	0	0	0	0.	0
GD153	0	0	0.	0	0	0	0.	0	0	0	0.	0
HG197	0	0	0.	0	0	0	0.	0	0	0	0.	0
HG203	0	0	0.	0	0	0	0.	0	0	0	0.	0
H 3	90	960	3.7E+03	94	36	1109	0.	0	48	795	0.	0
IN111	0	0	0.	0	0	0	0.	0	0	0	0.	0
IR192	2111	1562	1.9E+00	2061	66	3986	4.2E+00	66	104	2550	7.5E+01	104
I 123	0	0	0.	0	0	0	0.	0	0	0	0.	0
I 125	0	0	0.	0	0	0	0.	0	0	0	0.	0
I 131	121	912	2.0E+00	121	0	0	0.	0	0	0	0.	0
KR 85	36	6100	1.9E+00	36	0	0	0.	0	0	0	0.	0
K 42	0	0	0.	0	0	0	0.	0	0	0	0.	0
K 43	0	0	0.	0	0	0	0.	0	0	0	0.	0
LU177	0	0	0.	0	0	0	0.	0	0	0	0.	0
MC	0	0	0.	0	0	0	0.	0	0	0	0.	0
MP	12	4017	6.4E+00	12	0	0	0.	0	0	0	0.	0
MIXED	0	0	0.	0	0	0	0.	0	0	0	0.	0
MN 54	0	0	0.	0	0	0	0.	0	0	0	0.	0
MO 99	880	4612	3.3E+00	880	0	0	0.	0	0	0	0.	0
NA 22	0	0	0.	0	0	0	0.	0	0	0	0.	0
NA 24	0	0	0.	0	0	0	0.	0	0	0	0.	0
NB 95	0	0	0.	0	0	0	0.	0	0	0	0.	0
NI 59	0	0	0.	0	0	0	0.	0	0	0	0.	0
NI 63	0	0	0.	0	0	0	0.	0	0	0	0.	0
NP237	0	0	0.	0	0	0	0.	0	0	0	0.	0
PA231	0	0	0.	0	0	0	0.	0	0	0	0.	0
PM147	0	0	0.	0	0	0	0.	0	0	0	0.	0
PO210	4	1050	5.5E+01	4	0	0	0.	0	0	0	0.	0
P 32	0	0	0.	0	0	0	0.	0	0	0	0.	0
P 33	0	0	0.	0	0	0	0.	0	0	0	0.	0
RA226	0	0	0.	0	0	0	0.	0	0	0	0.	0
RB 81	0	0	0.	0	0	0	0.	0	0	0	0.	0
RB 83	0	0	0.	0	0	0	0.	0	0	0	0.	0
RB 86	0	0	0.	0	0	0	0.	0	0	0	0.	0
RU103	0	0	0.	0	0	0	0.	0	0	0	0.	0
RU106	0	0	0.	0	0	0	0.	0	0	0	0.	0
SE 75	0	0	0.	0	0	0	0.	0	0	0	0.	0
SN113	0	0	0.	0	0	0	0.	0	0	0	0.	0
SR 85	0	0	0.	0	0	0	0.	0	0	0	0.	0
SR 89	0	0	0.	0	0	0	0.	0	0	0	0.	0
SR 90	0	0	0.	0	0	0	0.	0	0	0	0.	0
S 35	0	0	0.	0	0	0	0.	0	0	0	0.	0
TA182	0	0	0.	0	0	0	0.	0	0	0	0.	0
TC 99M	0	0	0.	0	0	0	0.	0	0	0	0.	0
TC 99	0	0	0.	0	0	0	0.	0	0	0	0.	0
TE123M	0	0	0.	0	0	0	0.	0	0	0	0.	0
TL204	0	0	0.	0	0	0	0.	0	0	0	0.	0
TM170	0	0	0.	0	0	0	0.	0	0	0	0.	0
XE133	104	6000	7.5E+01	104	0	0	0.	0	0	0	0.	0
YB169	0	0	0.	0	0	0	0.	0	0	0	0.	0
ZN 65	0	0	0.	0	0	0	0.	0	0	0	0.	0

MODE OF TRANSPORTATION - AIR (FREIGHT) NON-SNM/SOURCE MATERIAL

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
AG110	52	93600	1,00000E+01	6,60000E+03
AM241	1562	1544990	5,07693E+01	7,77159E+02
AS 76	24	43535	8,46512E+00	4,47442E+01
AU198	140	105107	3,62065E+02	8,32889E+02
BK249	26	41987	2,61860E+00	1,8826E+02
BR 82	145	142093	3,14419E+02	7,71533E+00
CA 45	22	45847	0.	1,04000E+01
CA 47	109	68694	5,44188E+01	1,45721E+01
CD109	12	24186	1,20930E+00	3,02320E+01
CE141	52	72800	0.	5,20000E+01
CE144	24	19228	7,25581E+01	2,41860E+01
CF249	2	5400	2,00000E+00	1,28000E+02
CF252	4	10900	1,76000E+01	8,01900E+02
CL 35	52	39000	0.	5,20000E+03
CM244	6	10700	6,00000E+01	1,20400E+03
CO 57	1483	1612209	7,67558E+01	2,74970E+01
CO 60	293	464679	9,66206E+01	1,69180E+03
CR 51	1464	1918790	2,06157E+02	6,92357E+00
CS134	12	36279	3,62791E+00	1,2593E+03
CS137	58	126107	2,66351E+02	5,75601E+01
CU 64	60	102791	1,69302E+01	2,00744E+00
C 14	8556	5046844	3,16300E+02	2,27532E+02
EC	77	19633	7,59070E+01	7,70930E+05
FE 55	18	50479	1,80930E+00	7,20047E+02
FE 59	129	496507	3,98656E+01	4,02637E+02
GA 67	991	388667	4,04467E+02	5,26650E+01
GA 72	12	5805	0.	3,06320E+05
GD153	52	36400	0.	5,20000E+03
HG197	520	713180	1,09778E+02	5,31000E+00
HG203	110	81330	1,31233E+02	2,64003E+01
H 3	5825	7374860	1,69701E+00	1,25260E+05
IN111	838	1117084	2,07688E+02	4,18000E+01
IR192	2444	3964679	4,53842E+03	5,01970E+05
I 123	936	223600	1,47066E+02	4,06120E+01
I 125	7434	8044493	2,94257E+02	1,83406E+02
I 131	15558	18686011	1,19573E+04	5,07177E+03
KR 85	237	1058700	2,85614E+02	6,39196E+03
K 42	351	618860	3,20512E+02	4,95814E+00
K 43	351	217300	2,27349E+02	2,45486E+00
LU177	12	32651	1,20930E+00	6,04651E+02
MC	2	300	0.	2,00000E+05
MF	105	265020	1,86331E+02	4,05363E+02
MIXED	862	1364146	1,09864E+02	1,34995E+00
MN 54	52	98600	5,20000E+00	5,20000E+04
MO 99	18849	33848159	4,09143E+04	1,00707E+05
NA 22	58	101867	8,36333E+01	6,38133E+02
NA 24	460	853103	1,15367E+03	2,86605E+00
NB 95	12	10466	9,67442E+00	1,61395E+01
NI 59	12	5708	0.	1,45110E+02
NI 63	14	24140	2,01209E+01	4,38373E+00
NP237	2	900	0.	1,60000E+06
PA231	12	5333	1,20930E+00	1,14864E+03
PM147	18	82679	2,40930E+00	1,23037E+02
PO210	1383	3297656	4,60000E+00	7,26359E+02
P 32	1445	2155281	4,08868E+02	1,01962E+03
P 33	25	31201	0.	1,48150E+00
RA226	66	50928	2,52000E+01	4,01912E+02
RB 81	156	104520	3,84600E+02	3,12000E+01
RB 85	12	10400	0.	1,20930E+03
RB 86	81	137739	1,77969E+01	8,66742E+01
RU103	12	18115	1,20930E+00	1,20930E+01
RU106	60	110615	1,02791E+02	1,39070E+00
SE 75	1250	1588480	5,31116E+02	3,06222E+01
SN113	54	312900	1,56000E+02	1,56022E+01
SR 85	4	13000	4,33333E+01	8,66667E+03
SW 89	12	9614	2,41860E+00	1,20930E+01
SR 90	155	1012422	3,35715E+01	8,41855E+00
S 35	916	1090725	2,82655E+01	1,85320E+01
TA182	12	32651	8,46512E+00	2,41860E+02
TC 99M	7176	1910000	7,01884E+02	7,46844E+02
TC 99	12	23454	0.	8,16744E+01
TE123M	2	1000	0.	1,00000E+01
TL204	52	20800	2,60000E+01	2,60000E+05
TM170	3	1050	1,12000E+01	3,02200E+00
XE133	4885	8600790	2,58152E+03	1,16017E+04
YB169	36	96744	7,25581E+00	1,99533E+02
ZN 65	2	900	0.	1,00000E+02
TOTAL	84352	112950536	4,79568E+04	7,54200E+05

REPORT B. B. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (PASSENGER) NON-SNM/SOURCE MATERIAL PAGE B.1

RADIO-NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
AM241	66	2619	2.2E+02	64	115	1384	1.0E+01	111	8	3550	5.5E+00	8
AU197	0	0	0.	0	52	450	1.0E+00	52	0	0	0.	0
AU198	12	700	2.0E+01	12	1128	703	2.5E+00	1126	0	0	0.	0
BA133	4	1278	0.	2	8	800	1.0E+01	4	0	0	0.	0
BE 7	4	4000	1.0E+01	4	0	0	0.	0	0	0	0.	0
BK249	0	0	0.	0	2	2400	2.0E+01	2	0	0	0.	0
BR 77	0	0	0.	0	4	211	6.5E+01	4	0	0	0.	0
CA 45	76	814	2.6E+03	76	22	730	0.	22	0	0	0.	0
CA 47	36	805	4.3E+01	36	0	0	0.	0	0	0	0.	0
CD109	70	377	6.2E+03	70	7	1609	3.7E+02	7	0	0	0.	0
CE137	52	940	2.0E+01	52	0	0	0.	0	0	0	0.	0
CE144	0	0	0.	0	52	800	5.0E+01	52	0	0	0.	0
CF249	0	0	0.	0	2	2700	0.	0	0	0	0.	0
CF252	2	2700	2.0E+01	2	6	2133	5.0E+00	6	0	0	0.	0
CL 36	6	2179	0.	6	2	5900	0.	0	0	0	0.	0
CM242	0	0	0.	0	12	6000	1.0E+01	12	0	0	0.	0
CM244	0	0	0.	0	0	0	0.	0	12	685	0.	0
CO 56	2	1000	1.0E+01	2	0	0	0.	0	0	0	0.	0
CO 57	5114	1072	7.3E-02	4332	406	1631	4.6E+01	250	0	0	0.	0
CO 58	6	533	3.5E-02	6	2	2000	0.	2	0	0	0.	0
CO 60	56	1389	1.9E+01	56	52	760	2.0E+01	52	52	990	1.0E+01	52
CR 51	2158	1143	1.0E+01	2106	1921	836	2.2E+01	1921	0	0	0.	0
CS129	0	0	0.	0	40	550	2.5E+00	40	0	0	0.	0
CS137	78	564	1.6E+02	78	59	1253	2.2E+00	59	0	0	0.	0
CU 64	0	0	0.	0	48	1886	1.3E+01	45	0	0	0.	0
C 14	5008	1305	4.7E-05	4222	231	1383	3.6E+01	193	0	0	0.	0
FE 52	0	0	0.	0	30	417	2.0E+00	30	0	0	0.	0
FE 55	18	363	0.	18	12	2168	0.	12	0	0	0.	0
FE 59	1106	938	1.1E+01	689	0	0	0.	0	0	0	0.	0
GA 67	2	1000	1.0E+01	2	4079	961	4.5E+01	2953	2	1000	9.5E+00	2
GD153	0	0	0.	0	2	160	0.	0	0	0	0.	0
HG197	884	1222	2.4E+01	624	624	1168	2.5E+01	624	0	0	0.	0
HG203	260	1888	1.4E+01	260	108	3822	1.5E+01	108	0	0	0.	0
H 3	6721	1498	2.6E+04	3932	3695	1426	3.6E+03	3328	11	1528	1.0E+02	8
IN111	0	0	0.	0	1846	1167	9.6E+02	494	0	0	0.	0
IN114M	0	0	0.	0	12	500	2.0E+01	12	0	0	0.	0
IR192	0	0	0.	0	2	3000	0.	2	14	1114	1.2E+00	14
I 123	2548	750	9.5E-02	2340	1984	856	3.6E+01	1620	0	0	0.	0
I 125	23300	1383	2.6E-02	1596	3424	1188	6.7E+02	2904	24	840	6.0E+01	24
I 130	52	900	5.0E+01	52	0	0	0.	0	0	0	0.	0
I 131	40608	1129	4.0E+01	39152	88694	1001	9.5E+01	87342	52	1770	1.0E+00	52
KR 85	87	1166	0.	87	36	3433	1.4E+01	36	0	0	0.	0
K 42	0	0	0.	0	12	1200	2.5E+00	12	0	0	0.	0
K 43	0	0	0.	0	60	530	4.6E+01	60	0	0	0.	0
MC	0	0	0.	0	10	2200	1.4E+00	10	0	0	0.	0
MF	45	1400	4.5E+02	41	2	2200	0.	0	0	0	0.	0
MG 28	60	2948	1.1E+00	60	0	0	0.	0	0	0	0.	0
MIXED	298	822	5.6E-02	215	1077	1015	7.8E+01	999	0	0	0.	0
MN 54	52	1000	2.0E+01	52	0	0	0.	0	0	0	0.	0
MN 56	2	300	3.0E+01	2	0	0	0.	0	0	0	0.	0
MO 99M	0	0	0.	0	1040	878	1.5E+00	1040	0	0	0.	0
MO 99	104	660	4.0E+01	104	36280	1332	1.6E+00	35979	260	5620	4.0E+00	156
NA 22	15	397	2.1E+01	15	4	600	4.0E+01	4	0	0	0.	0
NA 24	18	411	1.0E+01	18	175	706	1.6E+00	175	0	0	0.	0
NI 63	12	320	0.	12	2	2000	0.	2	0	0	0.	0
NP237	0	0	0.	0	2	2024	5.0E+01	2	0	0	0.	0
PM147	0	0	0.	0	0	0	0.	0	0	0	0.	0
PO210	4	1000	0.	4	14	1129	1.4E+02	14	2	1450	2.3E+00	2
P 32	508	756	4.2E+02	369	3509	1076	2.4E+01	3383	0	0	0.	0
P 33	4	3000	0.	4	13	3467	0.	13	0	0	0.	0
RA226	26	427	4.7E+01	26	0	0	0.	0	0	0	0.	0
RB 81	0	0	0.	0	312	446	1.5E+00	312	0	0	0.	0
RB 82	0	0	0.	0	4	3200	1.0E+02	4	0	0	0.	0
RB 86	0	0	0.	0	33	1207	2.2E+01	33	0	0	0.	0
RB 87	12	5502	0.	0	0	0	0.	0	0	0	0.	0
RN222	2	800	0.	0	0	0	0.	0	0	0	0.	0
RU106	52	700	1.0E+01	52	0	0	0.	0	0	0	0.	0
SC 46	0	0	0.	0	52	850	2.6E+00	52	0	0	0.	0
SE 75	6772	1266	2.4E+01	6460	1508	711	4.1E+01	1456	0	0	0.	0
SI 31	16	550	1.2E+01	16	4	375	4.0E+01	4	0	0	0.	0
SN113	1	400	0.	0	48	3000	1.5E+00	48	0	0	0.	0
SR 82	2	500	5.0E+01	2	0	0	0.	0	0	0	0.	0
SR 85	180	699	2.3E+01	180	0	0	0.	0	0	0	0.	0
SR 89	0	0	0.	0	12	8091	4.0E+01	12	0	0	0.	0
SR 90	4	1791	5.0E+02	4	180	456	1.8E+01	180	0	0	0.	0
S 35	226	1294	0.	160	308	1112	1.7E+02	299	0	0	0.	0
TA182	2	30	0.	2	0	0	0.	0	0	0	0.	0
TC 99M	104	950	3.0E+01	104	14404	785	1.5E+01	11804	0	0	0.	0
TC 99	56	835	0.	56	104	630	2.5E+01	104	0	0	0.	0
TI 48	2	2200	0.	0	0	0	0.	0	0	0	0.	0
TL201	0	0	0.	0	36	2102	3.1E+01	28	2	2970	3.0E+01	2
TL204	2	2900	0.	2	0	0	0.	0	0	0	0.	0
UN	0	0	0.	0	52	900	1.0E+01	52	0	0	0.	0
V 48	52	600	2.0E+00	52	0	0	0.	0	0	0	0.	0
W	2	5000	5.0E+01	2	97	950	3.1E+01	97	0	0	0.	0
XE127	0	0	0.	0	22	825	1.5E+01	22	0	0	0.	0
XE133	52	560	0.	52	4257	1364	8.3E+02	3519	88	3831	4.0E+01	88
YB169	0	0	0.	0	8	1475	1.3E+01	4	0	0	0.	0
ZN 65	4	5000	2.0E+01	4	0	0	0.	0	0	0	0.	0

RADIO-NUCLIDE	>20 THRU 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
AM241	0	0	0.	0	0	0	0.	0	0	0	0.	0
AU197	0	0	0.	0	0	0	0.	0	0	0	0.	0
AU198	0	0	0.	0	0	0	0.	0	0	0	0.	0
BA133	0	0	0.	0	0	0	0.	0	0	0	0.	0
BE 7	0	0	0.	0	0	0	0.	0	0	0	0.	0
BK249	0	0	0.	0	0	0	0.	0	0	0	0.	0
BR 77	0	0	0.	0	0	0	0.	0	0	0	0.	0
CA 45	0	0	0.	0	0	0	0.	0	0	0	0.	0
CA 47	0	0	0.	0	0	0	0.	0	0	0	0.	0
CD109	0	0	0.	0	0	0	0.	0	0	0	0.	0
CE137	0	0	0.	0	0	0	0.	0	0	0	0.	0
CE144	0	0	0.	0	0	0	0.	0	0	0	0.	0
CF249	0	0	0.	0	0	0	0.	0	0	0	0.	0
CF252	0	0	0.	0	0	0	0.	0	0	0	0.	0
CL 36	0	0	0.	0	0	0	0.	0	0	0	0.	0
CM242	0	0	0.	0	0	0	0.	0	0	0	0.	0
CM244	0	0	0.	0	0	0	0.	0	0	0	0.	0
CO 56	0	0	0.	0	0	0	0.	0	0	0	0.	0
CO 57	0	0	0.	0	0	0	0.	0	0	0	0.	0
CU 58	0	0	0.	0	0	0	0.	0	0	0	0.	0
CO 60	0	0	0.	0	0	0	0.	0	0	0	0.	0
CR 51	0	0	0.	0	0	0	0.	0	0	0	0.	0
CS129	0	0	0.	0	0	0	0.	0	0	0	0.	0
CS137	4	1500	1.0E-01	4	0	0	0.	0	0	0	0.	0
CU 64	0	0	0.	0	0	0	0.	0	0	0	0.	0
C 14	0	0	0.	0	0	0	0.	0	0	0	0.	0
FE 52	0	0	0.	0	0	0	0.	0	0	0	0.	0
FE 55	0	0	0.	0	0	0	0.	0	0	0	0.	0
FE 59	0	0	0.	0	0	0	0.	0	0	0	0.	0
GA 67	0	0	0.	0	0	0	0.	0	0	0	0.	0
GD153	0	0	0.	0	0	0	0.	0	0	0	0.	0
HG197	0	0	0.	0	0	0	0.	0	0	0	0.	0
HG203	0	0	0.	0	0	0	0.	0	0	0	0.	0
H 3	6	1000	0.	6	0	0	0.	0	0	0	0.	0
IN111	0	0	0.	0	0	0	0.	0	0	0	0.	0
IN114M	0	0	0.	0	0	0	0.	0	0	0	0.	0
IR192	22	776	2.0E+00	16	0	0	0.	0	48	890	1.0E+01	48
I 123	0	0	0.	0	0	0	0.	0	0	0	0.	0
I 125	0	0	0.	0	0	0	0.	0	0	0	0.	0
I 130	0	0	0.	0	0	0	0.	0	0	0	0.	0
I 131	48	960	1.9E+00	48	0	0	0.	0	0	0	0.	0
KR 85	0	0	0.	0	0	0	0.	0	0	0	0.	0
K 42	0	0	0.	0	0	0	0.	0	0	0	0.	0
K 43	0	0	0.	0	0	0	0.	0	0	0	0.	0
MC	0	0	0.	0	0	0	0.	0	0	0	0.	0
MF	0	0	0.	0	0	0	0.	0	0	0	0.	0
MG 28	0	0	0.	0	10	3294	1.0E+00	10	0	0	0.	0
MIXED	0	0	0.	0	0	0	0.	0	0	0	0.	0
MN 54	0	0	0.	0	0	0	0.	0	0	0	0.	0
MN 56	0	0	0.	0	0	0	0.	0	0	0	0.	0
MO 99M	0	0	0.	0	0	0	0.	0	0	0	0.	0
MO 99	1088	3425	2.4E+00	1088	0	0	0.	0	0	0	0.	0
NA 22	0	0	0.	0	0	0	0.	0	0	0	0.	0
NA 24	2	300	1.5E-01	2	0	0	0.	0	0	0	0.	0
NI 63	0	0	0.	0	0	0	0.	0	0	0	0.	0
NP237	0	0	0.	0	0	0	0.	0	0	0	0.	0
PM147	6	2072	1.0E+01	6	4	6068	1.0E+01	4	6	6068	2.0E+01	6
PO210	4	1450	2.7E+00	4	2	1450	3.0E+00	2	0	0	0.	0
P 32	0	0	0.	0	0	0	0.	0	0	0	0.	0
P 33	0	0	0.	0	0	0	0.	0	0	0	0.	0
RA226	0	0	0.	0	0	0	0.	0	0	0	0.	0
RB 81	0	0	0.	0	0	0	0.	0	0	0	0.	0
RB 82	0	0	0.	0	0	0	0.	0	0	0	0.	0
RB 86	0	0	0.	0	0	0	0.	0	0	0	0.	0
RB 87	0	0	0.	0	0	0	0.	0	0	0	0.	0
RN222	0	0	0.	0	0	0	0.	0	0	0	0.	0
RU106	0	0	0.	0	0	0	0.	0	0	0	0.	0
SC 46	0	0	0.	0	0	0	0.	0	0	0	0.	0
SE 75	0	0	0.	0	0	0	0.	0	0	0	0.	0
SI 31	0	0	0.	0	0	0	0.	0	0	0	0.	0
SN113	0	0	0.	0	0	0	0.	0	0	0	0.	0
SR 82	0	0	0.	0	0	0	0.	0	0	0	0.	0
SR 85	0	0	0.	0	0	0	0.	0	0	0	0.	0
SR 89	0	0	0.	0	0	0	0.	0	0	0	0.	0
SR 90	0	0	0.	0	0	0	0.	0	0	0	0.	0
S 35	0	0	0.	0	0	0	0.	0	0	0	0.	0
TA182	0	0	0.	0	0	0	0.	0	0	0	0.	0
TC 99M	0	0	0.	0	0	0	0.	0	52	1200	0.	0
TC 99	0	0	0.	0	0	0	0.	0	0	0	0.	0
TI 48	0	0	0.	0	0	0	0.	0	0	0	0.	0
TL201	0	0	0.	0	0	0	0.	0	0	0	0.	0
TL208	0	0	0.	0	0	0	0.	0	0	0	0.	0
UN	0	0	0.	0	0	0	0.	0	0	0	0.	0
V 48	0	0	0.	0	0	0	0.	0	0	0	0.	0
W	0	0	0.	0	0	0	0.	0	0	0	0.	0
XE127	0	0	0.	0	0	0	0.	0	0	0	0.	0
XE133	0	0	0.	0	0	0	0.	0	0	0	0.	0
YB169	0	0	0.	0	0	0	0.	0	0	0	0.	0
ZN 65	0	0	0.	0	0	0	0.	0	0	0	0.	0

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
AM241	190	301513	5,72667E+01	1,34675E+02
AU197	52	23400	5,20000E+01	1,12324E+01
AU198	1140	831484	2,76667E+03	4,92647E+01
BA133	8	8843	4,33333E+01	1,30030E+02
BE 7	4	17333	4,33333E+01	1,08333E+03
BK249	2	4800	4,00000E+01	3,40000E+01
BR 77	4	644	2,60000E+00	7,00000E+02
CA 45	97	78450	2,00000E+01	2,43920E+01
CA 47	36	29205	1,57209E+01	3,62791E+02
CD109	77	37616	6,93333E+01	2,72263E+01
CE137	52	48680	1,64000E+01	5,20000E+02
CE144	52	41600	2,60000E+01	5,20000E+01
CF249	2	5400	0,	8,00000E+03
CF252	8	18200	3,04000E+01	1,02800E+01
CL 36	8	25600	0,	1,86333E+02
CM242	12	72558	1,20937E+00	1,81395E+03
CM244	12	6284	0,	2,41860E+02
CO 56	2	2000	2,00000E+01	4,00000E+06
CO 57	5520	6142135	5,82244E+02	1,65944E+01
CO 58	8	7200	2,10000E+01	6,04000E+03
CO 60	160	166680	2,42000E+01	4,86200E+02
CR 51	4079	4071933	7,93447E+02	2,97625E+01
CS129	40	22000	1,15000E+02	1,15000E+00
CS137	141	124334	1,33445E+02	3,73304E+02
CU 64	48	81626	6,04651E+00	1,93480E+01
C 14	5240	6856045	7,43363E+01	3,03962E+00
FE 52	30	12524	8,06000E+01	4,37800E+01
FE 55	30	33303	0,	1,69795E+01
FE 59	1106	1037800	1,20338E+02	8,24507E+02
GA 67	4083	3925158	1,65455E+03	2,33294E+02
GD153	2	340	0,	4,28000E+01
HG197	1508	1809600	3,95633E+02	2,87388E+00
HG203	368	904973	5,28667E+01	1,34333E+00
H 3	8433	12326203	1,54961E+01	1,18499E+03
IN111	1946	2154451	1,77163E+02	2,45803E+01
IN114M	12	6047	2,41860E+00	6,04651E+02
IR192	86	81731	6,55122E+01	7,54715E+06
I 123	4532	3610442	1,00374E+03	1,24330E+01
I 125	26744	36317235	8,50130E+02	1,66860E+02
I 130	52	44800	2,60000E+01	1,56000E+03
I 131	129403	134765183	1,01076E+05	3,0417E+03
KR 85	123	224749	5,20000E+00	2,02031E+01
K 42	12	14512	3,02328E+01	4,71400E+01
K 43	60	32516	2,78140E+01	3,25065E+01
MC	10	22000	1,44000E+01	3,40000E+01
MF	87	67570	2,01951E+00	4,18220E+02
MG 28	70	203800	7,52000E+01	5,67002E+03
MIXED	1335	1304770	8,51244E+02	2,99900E+01
MN 54	52	52000	1,04000E+01	5,20000E+03
MN 56	2	800	6,00000E+01	1,00000E+05
MO 99M	1040	912600	1,05180E+03	1,74200E+02
MO 99	39732	56258944	7,33290E+04	1,55411E+05
NA 22	14	8559	4,90000E+00	2,03707E+02
NA 24	195	131581	2,53720E+02	6,07471E+01
NI 63	14	7870	0,	3,19473E+02
NP237	2	4048	1,70000E+00	2,02000E+02
PM147	16	73112	2,20000E+00	1,29000E+04
PO210	26	31733	2,14000E+01	1,01454E+03
P 32	4017	4158087	6,65618E+02	7,56777E+01
P 33	17	58087	0,	6,28333E+02
RA226	26	11177	1,22930E+01	2,81981E+03
RB 81	312	139256	4,66000E+02	7,26100E+01
RB 82	4	12800	4,00000E+02	2,54000E+01
RB 86	33	39645	7,34651E+00	2,93863E+01
RB 87	12	66536	0,	1,20930E+05
RN222	2	1600	0,	3,66000E+04
RU106	52	38400	5,20000E+00	2,60000E+03
SC 46	52	44200	1,45600E+02	2,60000E+01
SE 75	8280	9647015	2,22744E+03	5,94863E+01
SI 31	20	10300	3,52000E+00	5,51100E+01
SN113	49	149516	7,13446E+01	1,06439E+00
SR 82	2	1000	1,00000E+00	4,00000E+04
SR 85	180	162247	4,22047E+01	5,58985E+02
SR 89	12	49473	4,63721E+00	5,44168E+01
SR 90	184	89176	3,24000E+01	6,47044E+00
S 35	534	835060	9,35072E+00	2,94820E+00
TA182	2	60	0,	1,00000E+04
TC 99M	14584	11468860	2,18843E+03	5,50017E+04
TC 99	160	112537	2,60000E+01	3,12719E+00
TI 48	2	4400	0,	2,00000E+06
TL201	32	68986	1,02286E+01	8,15220E+00
TL204	2	5000	0,	4,00000E+04
UN	52	46800	5,20000E+00	9,88000E+02
V 48	52	31200	1,04000E+02	5,20000E+02
W	99	191907	3,12326E+01	1,21133E+00
XE127	22	18158	3,40000E+00	1,93200E+00
XE133	4398	6293113	3,40679E+02	1,38222E+03
YB169	4	3900	5,00000E+01	5,15000E+00
ZN 65	4	21667	8,66667E+01	6,33333E+03
TOTAL	271165	304895386	1,92983E+05	7,81503E+06

REPORT X. C. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - MAIL

NON-SNM/SOURCE MATERIAL

RADIO-NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
AM241	48	1150	2.5E-02	48	0	0	0.	0	0	0	0.	0
BA133	0	0	0.	0	2	2316	0.	0	0	0	0.	0
CA 45	1	2700	0.	0	0	0	0.	0	0	0	0.	0
CL 36	1	2700	0.	0	0	0	0.	0	0	0	0.	0
CO 57	17	1300	9.4E-01	17	0	0	0.	0	0	0	0.	0
CO 60	20	942	8.0E-03	20	0	0	0.	0	0	0	0.	0
CS134	0	0	0.	0	2	2316	0.	0	0	0	0.	0
C 14	683	885	0.	10	24	791	0.	2	0	0	0.	0
FE 55	36	800	0.	36	0	0	0.	0	0	0	0.	0
GD153	12	2500	1.0E-01	12	0	0	0.	0	0	0	0.	0
HG203	12	1500	1.0E-01	12	0	0	0.	0	0	0	0.	0
H 3	656	1055	0.	2	30	770	1.0E-02	4	0	0	0.	0
I 125	420	670	0.	56	0	0	0.	0	0	0	0.	0
I 131	60	933	0.	60	0	0	0.	0	0	0	0.	0
KR 85	0	0	0.	0	4	1727	0.	0	0	0	0.	0
MC	4	1650	1.0E-02	4	0	0	0.	0	0	0	0.	0
MF	6	633	6.7E-03	6	0	0	0.	0	0	0	0.	0
MIXED	237	986	1.6E-02	149	4	50	0.	0	0	0	0.	0
NI 63	0	0	0.	0	4	900	0.	4	0	0	0.	0
PO210	690	1872	1.8E-03	688	2	4	1.0E-01	2	0	0	0.	0
P 32	4	267	0.	2	0	0	0.	0	0	0	0.	0
RA226	2	250	0.	2	0	0	0.	0	0	0	0.	0
SR 90	14	2745	8.6E-02	14	0	0	0.	0	0	0	0.	0
TA182	14	1716	0.	12	0	0	0.	0	0	0	0.	0
UN	2	130	1.0E-01	2	0	0	0.	0	0	0	0.	0
XE131	2	850	0.	2	0	0	0.	0	0	0	0.	0
XE133	6	1530	0.	6	0	0	0.	0	0	0	0.	0
ZN 65	1	3000	0.	1	0	0	0.	0	0	0	0.	0

REPORT X, C, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - MAIL

NON-SNM/SOURCE MATERIAL

RADIO- NUCLIDE	>20 THRU 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
AM241	0	0	0.	0	0	0	0.	0	0	0	0.	0
BA133	0	0	0.	0	0	0	0.	0	0	0	0.	0
CA 45	0	0	0.	0	0	0	0.	0	0	0	0.	0
CL 36	0	0	0.	0	0	0	0.	0	0	0	0.	0
CO 57	0	0	0.	0	0	0	0.	0	0	0	0.	0
CO 60	0	0	0.	0	0	0	0.	0	0	0	0.	0
CS134	0	0	0.	0	0	0	0.	0	0	0	0.	0
C 14	0	0	0.	0	0	0	0.	0	0	0	0.	0
FE 55	0	0	0.	0	0	0	0.	0	0	0	0.	0
GD153	0	0	0.	0	0	0	0.	0	0	0	0.	0
HG203	0	0	0.	0	0	0	0.	0	0	0	0.	0
H 3	2	90	0.	2	0	0	0.	0	0	0	0.	0
I 125	0	0	0.	0	0	0	0.	0	0	0	0.	0
I 131	0	0	0.	0	0	0	0.	0	0	0	0.	0
KR 85	0	0	0.	0	0	0	0.	0	0	0	0.	0
MC	0	0	0.	0	0	0	0.	0	0	0	0.	0
MF	0	0	0.	0	0	0	0.	0	0	0	0.	0
MIXED	0	0	0.	0	0	0	0.	0	0	0	0.	0
NI 63	0	0	0.	0	0	0	0.	0	0	0	0.	0
PO210	0	0	0.	0	0	0	0.	0	0	0	0.	0
P 32	0	0	0.	0	0	0	0.	0	0	0	0.	0
RA226	0	0	0.	0	0	0	0.	0	0	0	0.	0
SR 90	0	0	0.	0	0	0	0.	0	0	0	0.	0
TA182	0	0	0.	0	0	0	0.	0	0	0	0.	0
UN	0	0	0.	0	0	0	0.	0	0	0	0.	0
XE131	0	0	0.	0	0	0	0.	0	0	0	0.	0
XE133	0	0	0.	0	0	0	0.	0	0	0	0.	0
ZN 65	0	0	0.	0	0	0	0.	0	0	0	0.	0

MODE OF TRANSPORTATION - MAIL

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
AM241	48	55668	1,21243E+00	1,93005E+03
BA138	2	4032	0,	6,00000E+03
CA 45	1	2700	0,	1,00000E+03
CL 36	1	2700	0,	2,00000E+06
CO 57	17	22100	1,60000E+01	5,90000E+04
CO 60	20	16930	1,60000E+01	8,04837E+03
CS134	2	4032	0,	6,00000E+03
C 14	796	622834	0,	1,36920E+00
FE 55	36	29023	0,	3,62791E+03
GD153	12	30233	1,20930E+00	1,20930E+04
HG203	12	18140	1,20930E+00	3,62791E+05
H 3	688	715467	3,00000E+01	5,13[illegible]64E+01
I 125	420	281520	0,	7,67000E+03
I 131	60	56414	0,	6,04651E+05
KR 85	4	6906	0,	1,20600E+00
MO	4	6600	4,00000E+02	2,00300E+04
MF	6	3600	4,00000E+02	4,10000E+06
MIXED	242	234365	3,85045E+00	6,02602E+02
NI 63	4	3600	0,	6,00000E+02
PO210	692	1292007	1,41282E+00	2,78693E+01
P 32	4	1068	0,	2,02000E+04
RA226	2	500	0,	1,00000E+07
SR 90	14	38679	1,20930E+00	8,41860E+06
TA182	14	24177	0,	3,60930E+05
UN	2	260	2,00000E+01	2,00000E+05
XE131	2	1700	0,	3,68000E+04
XE133	6	9180	0,	5,60000E+05
ZN 65	1	3000	0,	1,00000E+05
TOTAL	3022	3490797	2,68441E+01	5,43390E+01

REPORT X. D. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - RAILROAD

NON-SNM/SOURCE MATERIAL

RADIO- NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
CO 60	0	0	0.	0	2	160	5.0E+00	2	0	0	0.	0
EC	206	525	0.	206	0	0	0.	0	0	0	0.	0
PU210	0	0	0.	0	156	1350	0.	156	0	0	0.	0

REPORT X. D. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - RAILROAD

NON-SNM/SOURCE MATERIAL

RADIO- NUCLIDE	>20 THRU 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
CO 60	0	0	0.	0	0	0	0.	0	0	0	0.	0
EC	0	0	0.	0	0	0	0.	0	0	0	0.	0
PO210	0	0	0.	0	0	0	0.	0	0	0	0.	0

REPORT X, D, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - RAILROAD

NON-SNM/SOURCE MATERIAL

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
CO 60	2	320	1,0000CE+01	1,75380E+01
EC	206	107930	0,	5,32093E+05
PO210	156	210600	0,	1,50800E+00
TOTAL	364	318850	1,0000CE+01	1,68343E+00

REPORT X. E. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - SHIP

NON-SNM/SOURCE MATERIAL

RADIO-NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
AM241	0	0	0.	0	6	4630	0.	0	4	8450	5.0E+00	4
EC	314	3191	0.	314	0	0	0.	0	0	0	0.	0
H 3	172	6000	0.	172	0	0	0.	0	0	0	0.	0
KR 85	0	0	0.	0	64	8009	9.7E+02	64	0	0	0.	0
MIXED	0	0	0.	0	2	6000	0.	0	0	0	0.	0
SR 90	0	0	0.	0	10	8890	1.2E+01	10	0	0	0.	0

REPORT X, E, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - SHIP

NON-SNM/SOURCE MATERIAL

RADIO-NUCLIDE	>20 THRU 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
AM241	0	0	0.	0	0	0	0.	0	0	0	0.	0
EC	0	0	0.	0	0	0	0.	0	0	0	0.	0
H 3	0	0	0.	0	0	0	0.	0	0	0	0.	0
KR 85	0	0	0.	0	0	0	0.	0	0	0	0.	0
MIXED	0	0	0.	0	0	0	0.	0	0	0	0.	0
SR 90	0	0	0.	0	0	0	0.	0	0	0	0.	0

REPORT X, E, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - SHIP

NON-SNM/SOURCE MATERIAL

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
AM241	10	61580	2.00000E+01	2.40000E+01
EC	314	1003334	0.	3.14419E-04
H 3	172	1032000	0.	8.08400E-03
KR 85	64	512570	6.20000E+00	3.94400E+01
MIXED	2	12000	0.	6.00000E-02
SR 90	10	88900	1.20000E+00	5.40000E-01
TOTAL	572	2710384	2.74000E+01	6.40484E+01

REPORT K. F. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - TRUCK

NON-SNM/SOURCE MATERIAL

RADIO-NUCLIDE	<.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
AG110M	12	50	2.0E+00	12	2	600	1.3E+01	2	0	0	0.	0
AM241	38	108	1.6E+02	32	168	404	7.9E+02	119	3113	92	3.4E+00	3113
AS 76	6	10	8.3E+01	6	0	0	0.	0	0	0	0.	0
AU198	4	40	0.	4	1522	139	1.3E+00	1470	145	50	1.8E+01	145
BA133	4	281	0.	2	0	0	0.	0	0	0	0.	0
BK249	0	0	0.	0	2	80	1.0E+01	2	0	0	0.	0
BR 82	0	0	0.	0	24	100	6.0E+00	24	0	0	0.	0
CA 45	54	21	0.	54	14	403	0.	14	0	8	0.	0
CD109	32	394	1.9E+01	32	10	497	4.0E+02	10	0	0	0.	0
CD115M	2	300	2.0E+01	2	16	300	0.	16	0	0	0.	0
CD115	2	300	0.	2	0	0	0.	0	0	0	0.	0
CE144	12	50	2.0E+00	12	0	0	0.	0	0	0	0.	0
CF252	5	524	1.7E+00	5	31	288	6.8E+00	29	26	295	6.8E+00	26
CL 36	3	207	2.2E+01	3	14	330	0.	0	0	0	0.	0
CL 38	62	13	1.0E+00	56	42	8	7.1E+01	32	0	0	0.	0
CM244	48	1042	1.0E+01	48	0	0	0.	0	0	0	0.	0
CO 57	3326	262	8.1E+02	2648	969	646	1.2E+01	917	0	0	0.	0
CO 58	1	1300	3.0E+02	1	0	0	0.	0	0	0	0.	0
CO 60M	0	0	0.	0	0	0	0.	0	2	1600	1.0E+01	2
CO 60	2628	407	1.1E+01	1228	1534	783	2.0E+01	972	164	843	3.7E+01	60
CR 51	1389	197	4.0E+01	1272	895	107	2.0E+01	836	0	0	0.	0
CS134	2	60	1.0E+01	2	3	656	3.8E+01	3	0	0	0.	0
CS137	74	729	5.9E+01	74	2673	171	2.9E+00	2514	18	302	3.5E+00	18
CU 64	4	40	1.0E+01	2	14	390	3.9E+00	14	0	0	0.	0
C 14	3248	336	0.	2968	245	223	4.4E+02	231	0	0	0.	0
EC	1272	628	3.2E+02	1238	32	1042	1.5E+00	32	4	1450	1.1E+00	4
ER165	0	0	0.	0	12	60	4.0E+01	12	0	0	4.	0
EU152	2	750	0.	0	12	770	6.0E+01	12	0	0	0.	0
FE 52	0	0	0.	0	2	70	6.0E+00	2	2	70	2.0E+00	2
FE 55	31	21	7.9E+02	31	20	410	6.7E+02	18	0	0	0.	0
FE 59	626	241	4.0E+01	522	8	706	1.7E+01	8	0	0	0.	0
F 18	2	25	1.0E+01	2	12	20	8.0E+01	12	0	0	0.	0
GA 66	0	0	0.	0	52	13	1.5E+01	52	0	0	0.	0
GA 67	0	0	0.	0	6658	73	1.4E+01	5722	0	0	0.	0
GA 71	0	0	0.	0	2	350	1.0E+01	2	0	0	0.	0
GE 68	0	0	0.	0	12	795	1.3E+00	12	0	0	0.	0
HF181	8	49	4.0E+01	8	0	0	0.	0	0	0	0.	0
HG197	624	392	1.9E+01	416	1156	306	3.0E+01	844	0	0	0.	0
HG203	52	700	4.0E+01	52	0	0	0.	0	0	0	0.	0
H 3	4141	268	7.8E+05	3854	1626	248	6.9E+02	1594	108	1250	0.	104
IN111	0	0	0.	0	6734	100	6.4E+02	1146	0	0	0.	0
IN114	0	0	0.	0	12	770	4.0E+01	12	0	0	0.	0
IR192	2	300	1.0E+01	2	69	278	6.9E+00	68	67	501	1.0E+00	67
I 123	15040	61	1.2E+01	11544	790	51	1.6E+01	738	2	25	1.0E+01	2
I 125	12203	317	4.4E+02	7083	1547	154	1.2E+01	1438	0	0	0.	0
I 129	12	50	1.0E+01	12	200	1300	0.	200	0	0	0.	0
I 131	23080	286	2.7E+01	22490	27683	250	6.4E+01	27111	97	50	1.3E+00	97
KR 85	2	5	2.0E+02	2	490	1060	8.9E+02	464	28	1185	2.2E+00	28
K 42	0	0	0.	0	65	10	6.0E+01	46	0	0	0.	0
LA140	0	0	0.	0	24	50	1.0E+01	24	0	0	0.	0
MC	3113	438	1.4E+01	1045	10847	505	6.0E+00	4254	196	606	3.2E+02	108
MF	771	258	1.4E+00	579	24542	262	8.2E+00	6450	644	528	1.6E+01	346
MIXED	1001	150	1.4E+00	813	11360	333	1.6E+00	6064	210	520	4.9E+01	54
MN 54	0	0	0.	0	16	300	0.	0	0	0	0.	0
MO 93	12	685	0.	0	0	0	0.	0	0	0	0.	0
MO 99	56	48	5.6E+01	56	32938	479	1.8E+00	32854	305	132	1.1E+01	305
NA 22	14	208	7.1E+02	14	2	8	8.0E+01	2	0	0	0.	0
NA 24	136	138	4.4E+01	134	52	125	1.4E+00	50	0	0	0.	0
NI 63	44	1103	1.0E+04	12	14	94	8.4E+05	14	0	0	0.	0
NP237	4	69	1.1E+01	4	0	0	0.	0	0	0	0.	0
OS191	4	60	0.	4	2	70	1.0E+01	2	0	0	0.	0
PA231	12	894	1.0E+01	12	0	0	0.	0	0	0	0.	0
PB210	0	0	0.	0	6	80	1.0E+01	6	0	0	0.	0
PD109	0	0	0.	0	2	20	1.0E+03	2	0	0	0.	0
PM147	8	123	0.	8	2	80	0.	2	2	1100	1.0E+01	2
PO210	374	200	3.2E+03	374	960	226	0.	940	0	0	0.	0
PT191	0	0	0.	0	12	65	1.0E+01	12	0	0	0.	0
PT197	8	60	0.	8	0	0	0.	0	0	0	0.	0
P 32	606	113	1.1E+01	338	2045	219	3.1E+01	1989	104	400	1.5E+00	104
P 33	4	200	0.	4	0	0	0.	0	0	0	0.	0
RA226	260	1596	5.5E+02	250	266	78	1.9E+01	266	0	0	0.	0
RB 81	0	0	0.	0	520	57	1.6E+00	260	0	0	0.	0
RB 86	2	350	1.0E+01	2	4	30	5.0E+01	4	0	0	0.	0
RE184	2	70	1.0E+01	2	0	0	0.	0	0	0	0.	0
RH101	4	300	1.5E+00	4	0	0	0.	0	0	0	0.	0
RU106	12	2000	1.0E+01	12	0	0	0.	0	0	0	0.	0
SB122	2	120	0.	0	0	0	0.	0	0	0	0.	0
SC 46	2	400	5.0E+01	2	1282	363	1.2E+00	1282	0	0	0.	0
SE 75	5668	299	2.4E+01	5512	1052	357	3.0E+01	1052	0	0	0.	0
SI 31	0	0	0.	0	60	66	7.6E+00	60	0	0	0.	0
SI 32	0	0	0.	0	12	100	8.2E+00	12	0	0	0.	0
SM153	26	17	9.5E+02	26	2	17	1.0E+01	2	0	0	0.	0
SN121	0	0	0.	0	2	15	1.0E+01	2	0	0	0.	0
SR 85	108	64	2.9E+01	108	4	350	1.0E+01	4	0	0	0.	0
SR 90	24	644	1.0E+00	16	240	885	5.5E+01	220	0	0	0.	0
S 35	171	261	0.	158	235	175	0.	225	0	0	0.	0
TA182	18	17	3.7E+01	18	8	46	6.3E+01	8	0	0	0.	0
TC 99M	676	143	3.3E+01	520	139975	69	2.2E+01	99054	0	0	0.	0
TC 99	20	105	1.5E+00	4	56	142	5.0E+01	52	0	0	0.	0
TH232	6	13	0.	6	12	2083	5.0E+02	12	0	0	0.	0
TL201	0	0	0.	0	8	128	6.8E+01	8	0	0	0.	0
TL204	18	80	0.	18	0	0	0.	0	0	8	0.	0
TM170	0	0	0.	0	0	0	0.	0	0	0	0.	0
UN	2	850	1.0E+02	2	57	350	1.0E+01	42	2	600	0.	0
U	6809	695	9.1E+01	6711	16644	524	1.8E+01	12770	198	701	7.7E+00	175
XE127	0	0	0.	0	2	70	1.0E+01	2	0	0	0.	0
XE130	0	0	0.	0	52	91	0.	52	0	0	0.	0
XE133	106	45	0.	0	8631	64	2.1E+01	2644	0	0	0.	0
YB169	2	350	2.0E+01	2	12	600	2.0E+01	12	12	400	5.0E+01	12
ZN 65	0	0	0.	0	1	24	3.5E+01	1	0	0	0.	0
ZR 93	0	0	0.	0	0	0	0.	0	0	0	0.	0
	8	70	1.0E+01	4	0	0	0.	0	0	0	0.	0

MODE OF TRANSPORTATION - TRUCK

NON-SNM/SOURCE MATERIAL

RADIO-NUCLIDE	>80 THRU 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
AG110M	0	0	0.	0	0	0	0.	0	0	0	0.	0
AM241	28	1051	1.4E+00	28	36	630	1.5E+00	36	0	0	0.	0
AS 76	0	0	0.	0	0	0	0.	0	0	0	0.	0
AU198	0	0	0.	0	0	0	0.	0	0	0	0.	0
BA133	0	0	0.	0	0	0	0.	0	0	0	0.	0
BK249	0	0	0.	0	0	0	0.	0	0	0	0.	0
BR 82	0	0	0.	0	0	0	0.	0	0	0	0.	0
CA 45	0	0	0.	0	0	0	0.	0	0	0	0.	0
CD109	0	0	0.	0	0	0	0.	0	0	0	0.	0
CD115M	0	0	0.	0	0	0	0.	0	0	0	0.	0
CD115	0	0	0.	0	0	0	0.	0	0	0	0.	0
CE144	0	0	0.	0	0	0	0.	0	0	0	0.	0
CF252	0	0	0.	0	0	0	0.	0	0	0	0.	0
CL 36	0	0	0.	0	0	0	0.	0	0	0	0.	0
CL 38	0	0	0.	0	0	0	0.	0	0	0	0.	0
CM244	0	0	0.	0	0	0	0.	0	0	0	0.	0
CO 57	0	0	0.	0	0	0	0.	0	0	0	0.	0
CO 58	0	0	0.	0	0	0	0.	0	0	0	0.	0
CO 60M	0	0	0.	0	0	0	0.	0	0	0	0.	0
CO 60	52	530	2.3E+00	52	48	1306	8.6E+01	47	154	714	1.3E+00	106
CR 51	0	0	0.	0	0	0	0.	0	0	0	0.	0
CS134	0	0	0.	0	0	0	0.	0	0	0	0.	0
CS137	2	110	5.0E+00	2	8	250	0.	0	4	1320	5.0E+01	2
CU 64	0	0	0.	0	0	0	0.	0	0	0	0.	0
C 14	0	0	0.	0	0	0	0.	0	0	0	0.	0
EC	0	0	0.	0	0	0	0.	0	0	0	0.	0
ER165	0	0	0.	0	0	0	0.	0	0	0	0.	0
EU152	0	0	0.	0	0	0	0.	0	0	0	0.	0
FE 52	0	0	0.	0	0	0	0.	0	0	0	0.	0
FE 55	2	2328	4.0E-01	2	0	0	0.	0	0	0	0.	0
FE 59	0	0	0.	0	0	0	0.	0	0	0	0.	0
F 18	12	20	1.6E+00	12	0	0	0.	0	0	0	0.	0
GA 66	0	0	0.	0	0	0	0.	0	0	0	0.	0
GA 67	12	795	1.2E+00	12	0	0	0.	0	0	0	0.	0
GA 71	0	0	0.	0	0	0	0.	0	0	0	0.	0
GE 68	0	0	0.	0	0	0	0.	0	0	0	0.	0
HF181	0	0	0.	0	0	0	0.	0	0	0	0.	0
HG197	0	0	0.	0	0	0	0.	0	0	0	0.	0
HG203	0	0	0.	0	0	0	0.	0	0	0	0.	0
H 3	92	1697	1.5E-02	80	0	0	0.	0	36	1749	0.	0
IN111	0	0	0.	0	0	0	0.	0	0	0	0.	0
IN114	0	0	0.	0	0	0	0.	0	0	0	0.	0
IR192	1431	344	1.9E+00	1336	64	108	6.8E+00	94	52	30	5.0E-01	52
I 123	0	0	0.	0	0	0	0.	0	0	0	0.	0
I 125	0	0	0.	0	0	0	0.	0	0	0	0.	0
I 129	0	0	0.	0	0	0	0.	0	0	0	0.	0
I 131	0	0	0.	0	0	0	0.	0	0	0	0.	0
KR 85	97	868	3.0E+00	97	0	0	0.	0	2	1800	5.0E+01	2
K 42	0	0	0.	0	0	0	0.	0	0	0	0.	0
LA140	0	0	0.	0	0	0	0.	0	0	0	0.	0
MC	6	650	3.9E+01	6	0	0	0.	0	0	0	0.	0
MF	11	583	1.7E+01	6	158	20	3.0E+00	158	5	1298	3.2E+00	2
MIXED	4	1110	5.1E+00	4	7447	635	3.3E+01	7447	108	92	5.3E+01	108
MN 54	2	620	1.0E+00	2	0	0	0.	0	0	0	0.	0
MO 93	0	0	0.	0	0	0	0.	0	0	0	0.	0
MO 99	740	68	1.1E+01	740	0	0	0.	0	0	0	0.	0
NA 22	0	0	0.	0	0	0	0.	0	0	0	0.	0
NA 24	0	0	0.	0	0	0	0.	0	0	0	0.	0
NI 63	0	0	0.	0	0	0	0.	0	0	0	0.	0
NP237	0	0	0.	0	0	0	0.	0	0	0	0.	0
NB191	0	0	0.	0	0	0	0.	0	0	0	0.	0
PA231	0	0	0.	0	0	0	0.	0	0	0	0.	0
PB210	0	0	0.	0	0	0	0.	0	0	0	0.	0
PD109	0	0	0.	0	0	0	0.	0	0	0	0.	0
PM147	6	5	1.0E-01	8	0	0	0.	0	0	0	0.	0
PO210	0	0	0.	0	0	0	0.	0	0	0	0.	0
PT191	0	0	0.	0	0	0	0.	0	0	0	0.	0
PT197	0	0	0.	0	0	0	0.	0	0	0	0.	0
P 32	0	0	0.	0	0	0	0.	0	0	0	0.	0
P 33	0	0	0.	0	0	0	0.	0	0	0	0.	0
RA226	0	0	0.	0	0	0	0.	0	0	0	0.	0
RB 81	0	0	0.	0	0	0	0.	0	0	0	0.	0
RB 86	0	0	0.	0	0	0	0.	0	0	0	0.	0
RE184	0	0	0.	0	0	0	0.	0	0	0	0.	0
RH101	0	0	0.	0	0	0	0.	0	0	0	0.	0
RU106	0	0	0.	0	0	0	0.	0	0	0	0.	0
SB122	0	0	0.	0	0	0	0.	0	0	0	0.	0
SC 46	0	0	0.	0	0	0	0.	0	0	0	0.	0
SE 75	0	0	0.	0	0	0	0.	0	0	0	0.	0
SI 31	0	0	0.	0	0	0	0.	0	0	0	0.	0
SI 32	0	0	0.	0	0	0	0.	0	0	0	0.	0
SM153	0	0	0.	0	0	0	0.	0	0	0	0.	0
SN121	0	0	0.	0	0	0	0.	0	0	0	0.	0
SR 85	0	0	0.	0	0	0	0.	0	0	0	0.	0
SR 90	2	300	4.0E+00	2	0	0	0.	0	0	0	0.	0
S 35	0	0	0.	0	0	0	0.	0	0	0	0.	0
TA182	0	0	0.	0	0	0	0.	0	0	0	0.	0
TC 99M	0	0	0.	0	0	0	0.	0	52	10	1.0E+01	52
TC 99	0	0	0.	0	0	0	0.	0	0	0	0.	0
TH232	0	0	0.	0	0	0	0.	0	0	0	0.	0
TL201	0	0	0.	0	0	0	0.	0	0	0	0.	0
TL204	0	0	0.	0	0	0	0.	0	0	0	0.	0
TM170	2	1600	1.0E+01	2	0	0	0.	0	0	0	0.	0
UN	0	0	0.	0	0	0	0.	0	0	0	0.	0
W	62	723	3.1E+00	62	18	705	2.3E+01	18	20	716	1.2E+01	20
XE127	0	0	0.	0	0	0	0.	0	0	0	0.	0
XE130	0	0	0.	0	0	0	0.	0	0	0	0.	0
XE133	0	0	0.	0	92	110	0.	0	0	0	0.	0
YB169	0	0	0.	0	0	0	0.	0	0	0	0.	0
ZN 65	0	0	0.	0	0	0	0.	0	0	0	0.	0
ZR 93	2	2400	1.0E+01	2	0	0	0.	0	0	0	0.	0
	0	0	0.	0	0	0	0.	0	0	0	0.	0

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
AG110M	14	1805	5,01806E+01	3,20930E+02
AM241	3383	010967	1,05391E+04	4,05710E+04
AS 76	6	60	5,00000E+00	1,40000E+05
AU198	1671	219052	6,19821E+03	1,50393E+05
BA133	4	1124	0,	2,81355E+04
BK249	2	80	2,00000E+01	1,34000E+00
BR 82	24	2819	9,67442E+01	2,68279E+03
CA 45	73	8770	0,	3,95987E+01
CD109	42	17403	6,40930E+00	1,46807E+01
CD115M	18	5400	6,00000E+01	2,00220E+01
CD115	2	600	0,	2,30000E+04
CE144	12	605	2,41860E+01	1,20930E+02
CF252	62	19477	3,95233E+02	4,20230E+02
CL 36	17	5278	6,50000E+01	4,27791E+02
CL 38	104	1136	9,19625E+01	2,03547E+00
CM244	48	50428	4,83721E+00	4,35345E+03
CO 57	8295	1690475	3,87063E+02	1,30559E+01
CO 58	1	1300	3,00000E+02	2,00000E+05
CO 60M	2	3200	2,00000E+01	3,00000E+01
CO 60	4520	2559621	3,58435E+04	2,51787E+06
CR 51	2283	368712	7,36505E+02	1,62695E+01
CS134	5	2088	1,35000E+00	2,16400E+01
CS137	2773	523453	7,85533E+03	3,13397E+04
CU 64	18	5662	5,51907E+01	4,49275E+03
C 14	3493	1140863	1,27867E+01	4,69575E+05
EC	1308	836024	9,42748E+01	4,46810E+01
ER165	12	726	4,83721E+00	3,62791E+01
EU152	14	10888	9,67442E+00	4,81680E+02
FE 52	4	280	1,60000E+01	1,00000E+01
FE 55	53	13546	5,38150E+00	2,60294E+02
FE 59	634	157053	2,51354E+02	1,51415E+01
F 18	20	534	2,92233E+01	3,02521E+02
GA 66	52	676	7,80000E+00	1,56000E+01
GA 67	8670	638544	1,23999E+03	1,88520E+03
GA 71	2	700	2,00000E+01	4,00000E+02
GE 68	12	9614	1,57209E+01	2,40233E+01
HF181	8	390	3,20000E+00	2,24000E+03
HG197	1780	600884	4,02652E+02	2,78101E+01
HG203	52	36400	2,08000E+01	5,20000E+02
H 3	6003	1869835	1,14141E+02	9,43751E+04
IN111	8734	473998	3,60737E+02	1,50430E+01
IN114	12	8384	4,83721E+00	3,62791E+02
IR192	1715	557564	3,73524E+03	2,57197E+05
I 123	15972	957228	1,88211E+03	5,22054E+01
I 125	13750	4106409	7,31723E+02	2,36872E+01
I 129	212	280605	1,25935E+00	1,45064E+01
I 131	50860	13532999	2,40221E+04	9,40075E+02
KR 85	619	440629	3,99400E+02	4,53314E+04
K 42	85	1014	3,40688E+01	1,78470E+01
LA140	24	1209	2,45488E+02	4,61480E+00
MC	10162	8967036	1,35160E+05	5,57440E+03
MF	26131	8995995	2,13832E+05	1,08706E+05
MIXED	20130	7247634	1,58748E+04	2,13151E+06
MN 54	18	6040	2,00000E+00	1,59120E+02
MO 93	12	8284	0,	1,22930E+04
MO 99	34009	15862192	7,23948E+04	1,18629E+05
NA 22	16	2924	2,60000E+00	1,00017E+00
NA 24	188	24666	1,50174E+02	1,60141E+01
NI 63	58	49957	5,01848E+03	6,94562E+01
NP237	6	281	4,17657E+01	2,74596E+03
OS191	6	380	2,00000E+01	2,00000E+02
PA231	12	10611	1,25930E+00	1,14854E+03
PB210	6	240	6,00000E+01	2,20000E+01
PD109	2	40	2,00000E+03	4,00000E+03
PM147	20	3380	1,00000E+00	5,98000E+04
PU210	1318	288366	1,25935E+00	1,34470E+01
PT191	12	784	1,25935E+00	3,62791E+01
PT197	8	880	0,	4,42200E+06
P 32	8555	534619	8,35196E+02	7,85935E+02
P 33	4	867	0,	4,33333E-1
RA226	526	435465	4,95000E+03	2,22950E+01
RB 81	520	29640	8,32000E+02	2,18400E+00
RB 86	6	830	2,36667E+00	4,53333E+02
RE184	2	140	2,00000E+01	2,00000E+04
RH101	4	1200	6,00000E+00	4,00000E+03
RU106	12	28186	1,25935E+00	6,04651E+03
SB122	2	240	0,	9,80000E+05
SC 46	1284	801107	1,57435E+03	4,71987E+01
SE 75	6720	2068696	1,69850E+03	4,37171E+01
SI 31	60	3991	4,57116E+02	1,41393E+00
SI 32	12	1269	9,91625E+01	3,62791E+01
SM153	28	476	2,83000E+00	1,60154E+02
SN121	2	30	2,00000E+01	6,00000E+03
SR 85	112	8240	3,23000E+01	3,62200E+02
SR 90	246	233477	1,7983.E+02	1,34487E+02
S 35	436	85699	0,	1,37967E+00
TA182	28	671	1,10465E+01	3,59336E+00
TC 99M	140703	9717383	3,04125E+04	1,11849E+05
TC 99	76	10062	5,82000E+01	5,70000E+01
TH232	18	25083	8,00000E+01	8,00594E+02
TL201	8	1020	5,40000E+00	2,44000E+02
TL204	18	1440	0,	1,10000E+03
TM170	2	3200	2,00000E+01	5,10000E+01
UN	61	22441	5,72605E+00	4,53434E+01
U	23752	13659966	3,06183E+05	5,70334E+04
XE127	2	140	2,00000E+01	2,00000E+01
XE130	52	4732	0,	8,24000E+01
XE133	8787	582284	1,81185E+03	1,69174E+04
YB169	28	14793	8,86512E+00	1,02793E+02
ZN 65	1	22	3,50000E+01	2,00000E+03
ZR 93	2	6800	2,00000E+01	4,00000E+02
	8	280	4,00000E+01	4,00000E+04
TOTAL	411536	97180017	8,84361E+05	5,51237E+06

REPORT X, G, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - UNKNOWN

NON-SNM/SOURCE MATERIAL

RADIO- NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
CA 45	0	0	0.	0	1	2700	0.	1	0	0	0.	0
C 14	70	180	0.	0	4	1300	0.	0	0	0	0.	0
GA 67	0	0	0.	0	442	194	5.7E-01	390	0	0	0.	0
H 3	17	50	0.	0	4	300	0.	0	0	0	0.	0
IN111	104	20	2.0E-01	104	156	479	2.0E-01	52	0	0	0.	0
IR192	0	0	0.	0	2	600	1.0E-01	2	0	0	0.	0
I 123	208	46	3.8E-01	156	260	152	8.8E-01	260	0	0	0.	0
I 125	0	0	0.	0	8	2128	0.	8	0	0	0.	0
I 131	104	2075	1.5E-01	104	156	467	9.7E-01	156	0	0	0.	0
MC	6	1	5.0E-01	6	0	0	0.	0	0	0	0.	0
MIXED	4	450	0.	0	4	160	2.7E-01	4	0	0	0.	0
MO 99	52	4000	4.0E-01	52	880	1104	2.1E+00	273	0	0	0.	0
NI 63	0	0	0.	0	2	800	0.	2	0	0	0.	0
P 32	4	450	0.	0	0	0	0.	0	0	0	0.	0
BI 31	0	0	0.	0	2	160	3.0E-01	2	0	0	0.	0
S 35	4	50	0.	0	0	0	0.	0	0	0	0.	0
TC 99M	0	0	0.	0	4940	31	4.0E-01	4940	0	0	0.	0
TH232	2	100	0.	2	0	0	0.	0	0	0	0.	0
W	0	0	0.	0	88	596	2.5E+00	88	0	0	0.	0
XE133	0	0	0.	0	165	562	0.	0	0	0	0.	0

REPORT X, G, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - CANADA

NON-SNM/SOURCE MATERIAL PAGE G.2

RADIO-NUCLIDE	>20 THRU 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
CA 45	0	0	0.	0	0	0	0.	0	0	0	0.	0
C 14	0	0	0.	0	0	0	0.	0	0	0	0.	0
GA 67	0	0	0.	0	0	0	0.	0	0	0	0.	0
H 3	0	0	0.	0	0	0	0.	0	0	0	0.	0
IN111	0	0	0.	0	0	0	0.	0	0	0	0.	0
IR192	36	12076	3.0E+00	36	0	0	0.	0	0	0	0.	0
I 123	0	0	0.	0	0	0	0.	0	0	0	0.	0
I 125	0	0	0.	0	0	0	0.	0	0	0	0.	0
I 131	0	0	0.	0	0	0	0.	0	0	0	0.	0
MC	0	0	0.	0	0	0	0.	0	0	0	0.	0
MIXED	0	0	0.	0	0	0	0.	0	0	0	0.	0
MO 99	0	0	0.	0	0	0	0.	0	0	0	0.	0
NI 63	0	0	0.	0	0	0	0.	0	0	0	0.	0
P 32	0	0	0.	0	0	0	0.	0	0	0	0.	0
SI 31	0	0	0.	0	0	0	0.	0	0	0	0.	0
S 35	0	0	0.	0	0	0	0.	0	0	0	0.	0
TC 99M	0	0	0.	0	0	0	0.	0	0	0	0.	0
TH232	0	0	0.	0	0	0	0.	0	0	0	0.	0
W	0	0	0.	0	0	0	0.	0	0	0	0.	0
XE133	0	0	0.	0	0	0	0.	0	0	0	0.	0

MODE OF TRANSPORTATION - UNKNOWN

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
CA 45	1	2700	0.	1.00000E+02
C 14	74	18220	0.	7.48760E+02
GA 67	442	84690	2.52431E+02	2.91200E+00
H 3	22	2167	0.	1.04000E+01
IN111	260	76856	5.20000E+01	5.48600E+00
IR192	38	439306	1.09037E+02	3.69551E+03
I 123	468	49140	2.56533E+02	7.28000E+01
I 125	8	17733	0.	2.42667E+01
I 131	260	288600	1.66400E+02	2.21005E+00
MC	6	6	3.00000E+00	3.38000E+04
MIXED	8	2590	1.08000E+00	1.73333E+02
MO 99	932	1179563	1.90232E+03	1.38221E+03
NI 63	2	1600	0.	3.00000E+02
P 32	4	1950	0.	4.33333E+03
BI 31	2	320	6.00000E+01	1.20000E+01
S 35	4	217	0.	4.33333E+03
TC 99M	4940	150800	1.96560E+03	2.63042E+03
TH232	2	200	0.	3.80000E+06
W	88	52480	2.16800E+02	8.20000E+00
XE133	165	92465	0.	4.11667E+00
TOTAL	7726	2461823	4.92581E+03	7.93240E+03
GRAND TOTAL	778737	528007793	1.15029E+06	1.40896E+07

REPORT XIV, A, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (FREIGHT) SNM/SOURCE MATERIAL (CURIES) PAGE A.1

RADIO- NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU238	1	1425	0.	1	2	1311	0.	2	1	475	4.0E+02	1
PU239	10	1345	0.	8	24	3052	5.0E+02	14	7	1805	2.1E+00	2
PU240	0	0	0.	0	1	1500	2.0E+01	1	1	1548	0.	0
PU241	0	0	0.	0	2	1524	0.	0	0	0	0.	0
PU242	3	1699	6.7E+02	3	1	4395	0.	0	0	0	0.	0
PU244	3	1334	1.7E+01	1	2	1388	0.	0	0	0	0.	0
TH228	1	2700	1.0E+01	1	0	0	0.	0	0	0	0.	0
TH230	12	485	0.	0	0	0	0.	0	0	0	0.	0
TH232	24	3204	0.	1	12	1956	0.	0	0	0	0.	0
UP220Z	0	0	0.	0	0	0	0.	0	18	2020	2.0E+01	18
U 233	1	1548	1.0E+01	1	13	2142	4.0E+01	1	0	0	0.	0
U 235C	1	6250	1.0E+01	1	0	0	0.	0	0	0	0.	0
U 235H	5	4953	0.	2	3	5412	0.	0	0	0	0.	0
U 235I	1	1500	0.	0	0	0	0.	0	0	0	0.	0
U 235K	0	0	0.	0	11	263	4.0E+01	11	0	0	0.	0
U 235M	74	3192	1.0E+01	10	20	363	1.0E+01	20	0	0	0.	0
U 235N	2	1500	1.3E+00	1	24	1293	1.0E+00	24	0	0	0.	0
U 235S	10	6000	0.	0	9	588	1.0E+01	5	0	0	0.	0
U 235T	1	588	1.0E+01	1	7	588	1.0E+01	7	0	0	0.	0
U 235V	23	5219	1.3E+00	18	0	0	0.	0	0	0	0.	0
U 235*	13	5000	2.5E+01	13	37	587	1.0E+01	37	0	0	0.	0
U 235X	5	592	1.0E+01	5	0	0	0.	0	0	0	0.	0
U 235	45	3299	6.4E+02	14	0	0	0.	0	0	0	0.	0
U 238	31	3211	1.6E+01	5	8	1448	4.0E+01	8	0	0	0.	0

REPORT XIV. A. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (FREIGHT) SNM/SOURCE MATERIAL (CURIES) PAGE A.2

RADIO-NUCLIDE	>20 TO 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU238	13	3242	5.5E-01	13	8	3250	4.0E-01	3	1	3000	8.0E-01	1
PU239	0	0	0.	0	0	0	0.	0	0	0	0.	0
PU240	0	0	0.	0	0	0	0.	0	0	0	0.	0
PU241	0	0	0.	0	0	0	0.	0	1	1500	1.0E-01	1
PU242	0	0	0.	0	0	0	0.	0	0	0	0.	0
PU244	0	0	0.	0	0	0	0.	0	0	0	0.	0
TH228	0	0	0.	0	0	0	0.	0	0	0	0.	0
TH230	0	0	0.	0	0	0	0.	0	0	0	0.	0
TH232	0	0	0.	0	0	0	0.	0	0	0	0.	0
UP229Z	0	0	0.	0	66	2020	4.0E+00	66	0	0	0.	0
U 233	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235C	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235M	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235I	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235K	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235P	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235H	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235S	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235T	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235V	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235A	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235X	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 238	0	0	0.	0	0	0	0.	0	0	0	0.	0

REPORT NO. A, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (FREIGHT)

SNM/SOURCE MATERIAL (CURIES)

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
PU238	26	75711	1.099005E+01	5.41052E+03
PU239	41	99730	1.555505E+01	4.19932E+01
PU240	2	3764	2.000005E+01	5.944[illegible]E+00
PU241	3	6548	1.000005E-1	1.571005E+03
PU242	6	6492	2.000005E+01	3.971[illegible]E+02
PU243	5	4781	1.000005E+01	9.000[illegible]E+03
TH228	1	2700	1.000005E+01	1.679[illegible]E+05
TH230	12	4246	0.	1.237656E+03
TH232	38	1[illegible]03	0.	1.355[illegible]E+02
UP2292	46	1[illegible]	2.675005E+02	1.947[illegible]E+04
U 233	16	29597	5.337615E+ 0	1.5[illegible]E+01
U 235C	1	4255	1.000005E+01	5.979[illegible]E+[illegible]
U 235F	4	41[illegible]	0.	7.191[illegible]E+[illegible]
U 235I	1	15[illegible]	0.	9.0[illegible]E+[illegible]
U 235S	11	2493	4.400005E+00	1.1[illegible]E+01
U 235T	94	243[illegible]	7.348925E+02	1.757515E+01
U 235W	24	3[illegible]	2.[illegible]E+01	2.[illegible]E+01
U 235B	19	65292	9.000005E+01	1.627305E+01
U 235T	4	6704	4.000005E+01	1.449976E+01
U 235V	23	119950	3.047505E+01	2.995[illegible]E+03
U 235-	50	4[illegible]	7.000005E+00	1.0879[illegible]E+00
U 235X	5	2900	5.000005E+01	2.449135E+03
U 235	65	14[illegible]	2.492465E+00	4.507575E+04
U 238	39	11172[illegible]	4.197775E+00	5.63421E+01
TOTAL	555	1379437	1.121135E+03	2.69468E+04

REPORT XIV. B. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (PASSENGER)

SNM/SOURCE MATERIAL (CURIES) PAGE B.1

RADIO-NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU236	0	0	0.	0	1	5006	2.0E-01	1	0	0	0.	0
PU238	1	1217	0.	1	4	1481	0.	2	147	513	1.1E-02	103
PU239	13	2255	4.0E-02	8	14	1690	5.2E-02	11	2	1567	5.0E-01	1
PU240	2	2805	0.	1	2	3236	0.	0	0	0	0.	0
PU241	0	0	0.	0	2	2916	0.	0	0	0	0.	0
PU242	4	4531	0.	0	1	685	0.	0	0	0	0.	0
PU244	3	5031	0.	0	0	0	0.	0	0	0	0.	0
TH228	1	3000	0.	1	0	0	0.	0	0	0	0.	0
TH232	11	3309	0.	10	0	0	0.	0	0	0	0.	0
U 233	14	2332	9.1E-03	11	3	3180	1.9E-01	2	0	0	0.	0
U 235C	26	2738	0.	26	2	6000	0.	2	0	0	0.	0
U 235F	3	6750	0.	0	0	0	0.	0	0	0	0.	0
U 235G	1	850	5.0E-02	1	0	0	0.	0	0	0	0.	0
U 235H	17	1674	0.	5	0	0	0.	0	0	0	0.	0
U 235I	1	600	1.0E-02	1	0	0	0.	0	0	0	0.	0
U 235J	1	600	1.0E-01	1	0	0	0.	0	0	0	0.	0
U 235M	60	1979	6.4E-02	59	0	0	0.	0	0	0	0.	0
U 235N	7	1029	1.4E-01	5	1	1500	1.0E-01	1	0	0	0.	0
U 235V	1	950	0.	1	0	0	0.	0	0	0	0.	0
U 235W	33	4353	3.2E-03	31	1	2200	0.	0	0	0	0.	0
U 235	31	2069	0.	24	0	0	0.	0	0	0	0.	0
U 236	1	4395	1.0E-01	1	0	0	0.	0	0	0	0.	0
U 238	748	1833	5.3E-02	171	997	1810	3.6E-01	417	0	0	0.	0

REPORT XIV. B. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (PASSENGER)

SNM/SOURCE MATERIAL (CURIES)

RADIO-	>20 TO 200 CI				>200 THRU 1000 CI				>1000 CI			
NUCLIDE	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS
PU236	0	0	0.	0	0	0	0.	0	0	0	0.	0
PU238	5	1428	2.1E+00	5	3	2135	0.	1	6	2041	2.1E+00	5
PU239	0	0	0.	0	0	0	0.	0	0	0	0.	0
PU240	0	0	0.	0	0	0	0.	0	0	0	0.	0
PU241	0	0	0.	0	0	0	0.	0	0	0	0.	0
PU242	0	0	0.	0	0	0	0.	0	0	0	0.	0
PU244	0	0	0.	0	0	0	0.	0	0	0	0.	0
TH228	0	0	0.	0	0	0	0.	0	0	0	0.	0
TH232	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 233	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235C	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235F	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235G	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235H	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235I	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235J	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235P	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235R	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235V	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235W	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 236	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 238	0	0	0.	0	0	0	0.	0	0	0	0.	0

MODE OF TRANSPORTATION - AIR (PASSENGER)

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
PU236	1	5000	2,00000E-01	2,65979E-01
PU238	166	108266	2,45070E-01	1,52209E-04
PU239	29	56111	2,25182E-00	1,88427E-01
PU240	4	12080	0,	3,41155E-02
PU241	2	5832	0,	1,25622E-00
PU242	5	18807	0,	2,07925E-03
PU244	3	15092	0,	5,82690E-07
TH228	1	3000	0,	9,85932E-06
TH232	11	36400	0,	1,20088E-05
U 233	17	42192	5,77273E-01	2,13460E-00
U 235C	28	83200	0,	3,16639E-03
U 235F	3	20250	0,	2,62652E-04
U 235G	1	850	8,00000E-02	2,49954E-05
U 235H	17	28462	0,	1,14431E-03
U 235I	1	600	1,00000E-02	8,59154E-06
U 235J	1	600	1,00000E-01	1,90049E-04
U 235M	60	118769	3,86441E-00	1,65834E-04
U 235R	8	8700	1,08000E-00	1,41454E-03
U 235V	1	950	0,	2,34892E-05
U 235-	34	145849	1,06452E-01	3,42513E-02
U 235	31	64133	0,	7,02341E-05
U 236	1	4395	1,00000E-01	1,90303E-05
U 238	1746	3176131	4,00127E-02	6,19350E-00
TOTAL	2171	3955697	4,32974E-02	1,52497E-04

REPORT XIV. C. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - MAIL

SNM/SOURCE MATERIAL (CURIES) PAGE C.1

RADIO- NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU239	120	1450	0.	120	0	0	0.	0	0	0	0.	0
TH232	4	1250	0.	1	0	0	0.	0	0	0	0.	0
U 233	2	2114	0.	2	0	0	0.	0	0	0	0.	0
U 235F	1	567	0.	1	0	0	0.	0	0	0	0.	0
U 235G	5	1731	0.	2	0	0	0.	0	0	0	0.	0
U 235H	6	723	0.	5	0	0	0.	0	0	0	0.	0
U 235I	2	1725	1.0E-01	2	0	0	0.	0	0	0	0.	0
U 235J	2	500	0.	2	0	0	0.	0	0	0	0.	0
U 235K	78	1617	0.	77	0	0	0.	0	0	0	0.	0
U 235L	13	2369	1.4E-02	13	0	0	0.	0	0	0	0.	0
U 235M	25	414	0.	25	1	620	0.	0	0	0	0.	0
U 235	76	579	1.9E-02	72	0	0	0.	0	0	0	0.	0
U 238	62	801	6.9E-02	35	0	0	0.	0	0	0	0.	0

REPORT XIV, C, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - MAIL

SNM/SOURCE MATERIAL (CURIES) PAGE C.2

RADIO-NUCLIDE	>20 TO 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU239	0	0	0.	0	0	0	0.	0	0	0	0.	0
TH232	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 233	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235F	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235G	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235H	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235I	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235J	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235P	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235R	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235R	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 238	0	0	0.	0	0	0	0.	0	0	0	0.	0

REPORT XIV, C, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - MAIL

SNM/SOURCE MATERIAL (CURIES)

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
PU239	120	173951	0.	1.27827E-04
TH232	4	4999	0.	4.01642E-07
U 233	2	4228	0.	2.18017E-04
U 235F	1	567	0.	1.28123E-05
U 235G	5	8654	0.	5.99906E-05
U 235H	6	4335	0.	9.11363E-05
U 235I	2	3450	2.00000E-01	1.28123E-05
U 235J	2	1000	0.	2.34892E-04
U 235K	78	126089	0.	2.83618E-05
U 235G	13	30800	1.83030E-01	1.86284E-05
U 235M	26	10982	0.	3.46146E-02
U 235	76	43972	1.41844E+00	1.28270E-04
U 238	62	49935	4.28731E+00	6.23737E-03
TOTAL	397	462962	6.08475E+00	4.17847E-02

REPORT XIV. D. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - RAILROAD

SNM/SOURCE MATERIAL (CURIES)

RADIO-NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU239	1	1200	0.	0	2	785	0.	0	1	370	1.0E-01	1
U 231	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 234C	0	0	0.	0	34090	1210	2.0E+00	34090	0	0	0.	0
U 234F	0	0	0.	0	1	2114	5.0E-01	1	0	0	0.	0
U 234P	1	2700	1.0E+01	1	5	2146	7.0E-01	3	0	0	0.	0
U 235	1	425	0.	1	0	0	0.	0	0	0	0.	0
U 238	0	0	0.	0	100689	1378	2.0E-01	242	0	0	0.	0

REPORT XIV. D. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - RAILROAD

SNM/SOURCE MATERIAL (CURIES) PAGE D.2

RADIO- NUCLIDE	>20 TO 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU239	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 231	0	0	0.	0	0	0	0.	0	2757	1300	0.	0
U 235C	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235F	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235P	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 238	0	0	0.	0	0	0	0.	0	0	0	0.	0

REPORT XIV. D. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - RAILROAD

SNM/SOURCE MATERIAL (CURIES)

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
PU239	4	3140	1.000000E-01	1.026318E+01
U 231	2757	3560372	0.	9.026445E+13
U 235C	34090	41249181	6.818095E+04	1.420265E+02
U 235M	1	2114	5.000000E-01	5.363236E-02
U 235*	6	13438	1.350000E+01	2.103125E+00
U 235	1	425	0.	9.395720E-09
U 238	100689	138787405	2.013798E+04	8.317605E+03
TOTAL	137548	183640075	8.833248E+04	9.026445E+13

REPORT XIV. E. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - SHIP

SNM/SOURCE MATERIAL (CURIES) PAGE E.1

RADIO-NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU239	0	0	0.	0	0	0	0.	0	1	450	0.	0
U 235E	779	10000	2.5E-01	779	252	4574	6.8E-01	252	0	0	0.	0
U 235F	132	10000	2.5E-01	132	10	2350	4.1E+00	10	0	0	0.	0
U 235G	1499	10000	2.5E-01	1499	891	6658	6.8E-01	891	0	0	0.	0
U 235H	389	10000	2.5E-01	389	236	6051	8.5E-01	236	0	0	0.	0
U 235I	3314	10000	2.5E-01	3314	2205	6036	3.1E-01	2205	0	0	0.	0
U 235J	0	0	0.	0	28	438	5.0E+00	28	0	0	0.	0
U 235K	0	0	0.	0	13	438	6.0E+01	13	0	0	0.	0
U 235M	7	6489	1.4E+02	7	1	450	2.5E+01	1	0	0	0.	0
U 235	4	3828	0.	1	0	0	0.	0	0	0	0.	0
U 238	0	0	0.	0	653	9739	2.5E-01	653	0	0	0.	0

REPORT XIV. E. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - SHIP

SNM/SOURCE MATERIAL (CURIES)

RADIO NUCLIDE	>20 TO 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU239	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235E	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235F	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235G	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235H	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235I	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235J	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235K	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235M	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 238	0	0	0.	0	0	0	0.	0	0	0	0.	0

REPORT XIV. E. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - SHIP

SNM/SOURCE MATERIAL (CURIES)

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
PU239	1	450	0.	8.29645E+00
U 235E	1031	8982593	3.67000E+02	1.97769E+00
U 235F	102	1343504	7.35000E+01	8.55463E+01
U 235G	2390	20922347	9.77500E+02	9.59924E+00
U 235H	625	5314003	3.08250E+02	4.26943E+00
U 235I	5519	46449904	1.50325E+03	8.74486E+03
U 235J	28	12264	1.40000E+02	3.27106E+00
U 235K	13	5494	7.80000E+00	2.30452E+01
U 235M	8	45872	2.51000E+01	2.48408E+02
U 235	4	15310	0.	7.56917E+05
U 238	693	6362279	1.81976E+02	3.15816E+00
TOTAL	10414	89418220	3.56391E+03	4.02624E+01

REPORT XIV. F. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - TRUCK

SNM/SOURCE MATERIAL (CURIES) PAGE F.1

RADIO- NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU238	1	96	0.	1	1	250	2.0E+01	1	40	229	5.0E-01	40
PU239	55	564	5.2E+02	48	2775	972	8.7E+01	2744	124	1278	4.6E+00	110
PU240	0	0	0.	0	2	816	0.	2	1	350	1.0E+01	1
PU241	0	0	0.	0	2	989	2.0E+00	1	0	0	0.	0
PU242	0	0	0.	0	3	2113	2.0E+00	3	0	0	0.	0
TH232	276	404	2.8E+01	26	2189	334	3.6E+01	2123	0	0	0.	0
TH233	0	0	0.	0	0	0	0.	0	0	0	0.	0
UP169R	0	0	0.	0	1	900	5.0E+02	1	1	900	1.0E+00	1
UP229C	0	0	0.	0	0	0	0.	0	0	0	0.	0
UP229R	0	0	0.	0	0	0	0.	0	1	1600	1.0E+01	1
UP229Z	0	0	0.	0	0	0	0.	0	3	2560	1.0E+01	3
UP239R	0	0	0.	0	1	620	1.0E+01	1	0	0	0.	0
UP269C	0	0	0.	0	0	0	0.	0	0	0	0.	0
UP269R	0	0	0.	0	1	1600	1.0E+01	1	2	900	5.3E+00	2
UP309R	0	0	0.	0	1	620	3.2E+00	1	1	2000	1.0E+01	1
UP339R	0	0	0.	0	2	1110	5.1E+00	2	1	1600	5.0E-01	1
UP369R	0	0	0.	0	0	0	0.	0	1	620	1.0E+01	1
UP459R	0	0	0.	0	2	620	5.0E+00	2	1	900	1.0E+01	1
U 232	0	0	0.	0	24	1950	0.	0	0	0	0.	0
U 233	22	396	2.4E+01	5	1608	872	8.0E+01	6	1	1956	1.5E+00	1
U 235A	22	968	1.1E+00	22	1	250	5.0E+02	1	0	0	0.	0
U 235B	4	3300	2.5E+01	4	18	305	3.8E+01	18	0	0	0.	0
U 235C	76	2794	5.0E+01	75	61539	1210	2.0E+00	61539	0	0	0.	0
U 235D	30	3500	2.5E+01	30	69	1924	1.9E+01	69	0	0	0.	0
U 235E	68	3362	3.1E+01	87	206	512	6.1E+01	206	0	0	0.	0
U 235F	76	3049	1.1E+00	73	19	582	4.0E+00	19	0	0	0.	0
U 235G	4022	368	1.2E+01	4000	1118	621	9.2E+01	1117	0	0	0.	0
U 235H	2099	713	6.6E+01	1950	3161	872	7.3E+01	2590	0	0	0.	0
U 235I	224	2225	7.0E+01	184	2537	764	5.8E+01	2537	0	0	0.	0
U 235J	82	1007	7.0E+01	68	36	1275	3.8E+00	34	0	0	0.	0
U 235K	2	567	0.	2	3	2480	1.0E+01	3	0	0	0.	0
U 235L	2	5	4.3E+00	2	6	600	2.4E+00	6	0	0	0.	0
U 235M	34	1324	2.7E+00	23	8	1949	1.5E+00	8	0	0	0.	0
U 235N	82	478	4.3E+01	82	2	300	0.	0	0	0	0.	0
U 235P	0	0	0.	0	3	522	5.0E+00	3	0	0	0.	0
U 235Q	5	551	6.9E+01	5	0	0	0.	0	0	0	0.	0
U 235R	473	507	2.1E+00	17	100	1020	1.9E+00	78	0	0	0.	0
U 235S	25	513	0.	0	0	0	0.	0	0	0	0.	0
U 235T	1222	445	0.	0	10	843	1.6E+00	10	0	0	0.	0
U 235U	1087	445	0.	1	1	900	0.	0	0	0	0.	0
U 235V	24	398	4.5E+03	22	4	748	2.0E+00	4	0	0	0.	0
U 235W	422	714	1.2E+00	233	266	1491	1.1E+00	176	0	0	0.	0
U 235X	4	596	1.0E+01	2	0	0	0.	0	0	0	0.	0
U 235Y	217	386	2.5E+01	217	372	297	1.3E+01	372	0	0	0.	0
U 235	253	788	2.1E+00	201	22	880	6.7E+00	15	0	0	0.	0
U 237	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 238	2243	586	4.0E+01	765	13274	775	4.5E+01	8710	0	0	0.	0

REPORT XIV. F. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - TRUCK

SNM/SOURCE MATERIAL (CURIES)

RADIO-NUCLIDE	>20 TO 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU238	10	464	1.6E+00	10	7	389	4.5E+01	6	247	826	4.6E+00	32
PU239	150	1785	7.2E+01	150	0	0	0.	0	0	0	0.	0
PU240	0	0	0.	0	0	0	0.	0	0	0	0.	0
PU241	0	0	0.	0	0	0	0.	0	1	441	0.	0
PU242	0	0	0.	0	0	0	0.	0	0	0	0.	0
TH232	0	0	0.	0	0	0	0.	0	0	0	0.	0
TH233	0	0	0.	0	0	0	0.	0	3	107	1.4E+01	3
UP169M	0	0	0.	0	0	0	0.	0	0	0	0.	0
UP229C	9	1780	4.1E+00	9	7	1780	4.1E+00	7	0	0	0.	0
UP229M	0	0	0.	0	0	0	0.	0	0	0	0.	0
UP229Z	0	0	0.	0	20	2560	4.0E+00	20	0	0	0.	0
UP234M	1	900	3.0E+01	1	0	0	0.	0	0	0	0.	0
UP264C	0	0	0.	0	94	1780	4.1E+00	94	0	0	0.	0
UP269M	0	0	0.	0	0	0	0.	0	0	0	0.	0
UP309M	0	0	0.	0	0	0	0.	0	0	0	0.	0
UP339M	0	0	0.	0	0	0	0.	0	0	0	0.	0
UP369M	0	0	0.	0	0	0	0.	0	0	0	0.	0
UP459M	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 232	0	0	0.	0	0	0	0.	0	1	434	3.0E+01	1
U 233	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235A	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235B	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235C	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235D	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235E	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235F	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235G	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235H	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235I	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235J	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235K	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235L	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235M	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235N	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235P	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235Q	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235R	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235S	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235T	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235U	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235V	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235W	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235X	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235Y	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 237	0	0	0.	0	2	40	5.0E+01	2	0	0	0.	0
U 238	0	0	0.	0	0	0	0.	0	0	0	0.	0

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
PU238	310	222938	1.183826E+03	4.137856E+08
PU239	3104	3154499	3.107245E+03	1.801498E+04
PU240	3	1962	1.000006E+01	7.257094E+00
PU241	3	2418	4.000006E+00	1.357426E+03
PU242	3	6340	4.100005E+00	1.669645E+00
TH232	2465	842206	8.546578E+02	2.315598E+00
TH233	3	320	4.200005E+01	1.102855E+10
UP169N	2	1800	1.050005E+00	8.023598E+00
UP229C	16	28480	6.560005E+01	3.363006E+03
UP229N	1	1600	1.000005E+01	1.055925E+01
UP229Z	23	58220	8.030005E+01	5.947798E+03
UP239N	2	1520	4.000005E+01	2.320925E+01
UP249C	94	167320	3.850005E+02	2.587735E+04
UP269N	3	3400	2.050005E+01	2.522985E+01
UP309N	2	2620	1.320005E+01	1.043515E+01
UP339N	3	3620	1.070005E+01	6.854715E+00
UP349N	1	620	1.000005E+01	1.068585E+01
UP459N	3	2140	2.005005E+01	1.456305E+01
U 232	25	47597	3.000005E+01	1.179745E+03
U 233	1631	1413181	1.293275E+03	2.142085E+03
U 235A	23	21550	2.392005E+01	5.121975E-02
U 235B	22	18490	7.750005E+00	1.443205E-01
U 235C	61615	7465411 7	1.294595E+05	2.584735E+02
U 235D	99	237760	1.325255E+03	3.910975E-01
U 235E	294	401328	1.522115E+02	2.875195E+00
U 235F	95	242792	1.566355E+02	1.917005E+00
U 235G	5140	2172403	1.526745E+03	1.736215E+01
U 235H	5260	4251446	3.698975E+03	7.737945E+01
U 235I	2765	2445496	1.629445E+03	2.214925E+01
U 235J	118	128472	1.863975E+02	3.520455E+00
U 235K	5	8574	3.000005E-01	8.118745E-03
U 235L	8	3610	2.300005E+01	4.229135E-01
U 235M	42	60621	1.053525E+02	2.766175E-02
U 235N	84	39800	3.500005E+01	1.571675E-02
U 235P	3	1566	1.500005E+01	3.809495E-01
U 235Q	5	2755	3.470005E+00	2.711945E-04
U 235R	573	341750	1.182015E+03	6.214245E-01
U 235S	25	12529	0.	6.047415E-04
U 235T	1232	552220	1.575005E+01	7.409015E-02
U 235U	1088	484737	0.	2.236105E-02
U 235V	28	12542	8.100095E+00	1.212175E-01
U 235W	688	697740	7.910745E+02	2.712235E+00
U 235X	4	2384	4.000005E-01	6.724675E-04
U 235Y	589	194369	1.003005E+02	1.299905E+01
U 235	275	218624	6.765535E+02	4.984655E+01
U 237	2	80	1.000005E+00	6.531885E+02
U 238	15517	11606640	6.916615E+03	2.811925E+03
TOTAL	103296	104778576	1.501075E+05	1.144245E+10

REPORT XIV. G. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - UNKNOWN

SNM SOURCE MATERIAL (CURIES) PAGE G.1

RADIO-NUCLIDE	.001 CI OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>.001 THRU 3.0 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>3.0 THRU 20 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU238	0	0	0.	0	1	1300	0.	0	0	0	0.	0
PU239	1	141	0.	1	3	51	0.	0	0	0	0.	0
TH232	1	100	0.	1	0	0	0.	0	0	0	0.	0
U 235M	2	1	0.	0	1	400	0.	0	0	0	0.	0
U 235	3	634	0.	0	0	0	0.	0	0	0	0.	0
U 238	6	692	2.5E-01	3	1	650	2.5E-01	1	0	0	0.	0

REPORT XIV. G. SUMMARY OF ANNUAL SHIPMENTS - DETAILED GLEBTICKNAIRK

MODE OF TRANSPORTATION - UNKNOWN

SNM/SOURCE MATERIAL (CURIES)

RADIO- NUCLIDE	>20 TO 200 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>200 THRU 1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS	>1000 CI PKGS	MILES /PKG	TI/PKG	TI PKGS
PU238	0	0	0.	0	0	0	0.	0	0	0	0.	0
PU239	0	0	0.	0	0	0	0.	0	0	0	0.	0
TH232	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235A	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 238	0	0	0.	0	0	0	0.	0	0	0	0.	0

REPORT XIV, G, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - UNKNOWN

SNM/SOURCE MATERIAL (CURIES) PAGE G.3

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
PU238	1	1300	0.	2.53372E+00
PU239	4	263	0.	6.20697E+00
TH232	1	100	0.	1.88994E+06
U 235A	3	402	0.	9.43413E+03
U 235	3	1902	0.	6.40610E+05
U 238	7	5002	1.75000E+00	9.16736E+03
TOTAL	19	8969	1.75000E+00	8.75936E+00
GRAND TOTAL	250663	3836439E6	2.43565E+05	9.02780E+13

REPORT XIII. A. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (FREIGHT)

	1 G OR LESS				>1 THRU 100 G				>100 THRU 1000 G			
RADIO-NUCLIDE	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS
NP	8	1500	0.	0	1	100	1.4E+00	1	0	0	0.	0
PU	2	500	1.0E+02	2	18	1270	7.2E+02	18	1	2350	5.0E+01	1
UP	6	2500	0.	6	31	2249	9.7E+03	31	0	0	0.	0
U 235Z	2	751	1.9E+00	2	6	790	6.7E+01	6	28	2228	5.1E+01	10

REPORT XIII. A. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (FREIGHT)

RADIO-NUCLIDE	>1000 THRU 10,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>10,000 THRU 100,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>100,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS
NP	0	0	0.	0	0	0	0.	0	0	0	0.	0
PU	50	2367	1.0E+00	1	0	0	0.	0	0	0	0.	0
UP	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235Z	6	2500	4.1E+00	2	3	878	0.	3	0	0	0.	0

REPORT XIII. A. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (FREIGHT)

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL GRAMS
NP	9	12100	1.40000E+00	9.60000E+00
PU	71	144556	5.18200E+01	7.57779E+04
UP	37	84707	3.00000E+01	7.94900E+01
U 2352	45	86252	4.58800E+01	6.50015E+04
TOTAL	162	327615	9.94000E+01	1.40870E+05

REPORT XIII. E. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (PASSENGER)

RADIO-NUCLIDE	1 G OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>1 THRU 100 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>100 THRU 1000 G PKGS	MILES /PKG	TI/PKG	TI PKGS
PU	1	850	1.0E+01	1	1	2350	0.	0	0	0	0.	0
UP	3	753	1.0E-01	3	1	2106	2.0E+01	1	1	1418	1.0E-01	1
U 235Z	14	1612	2.0E-01	1	20	1701	5.7E-01	17	16	1649	0.	14
U	5	1075	4.0E+00	2	0	0	0.	0	1	1085	2.0E-01	1

REPORT XIII. B. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (PASSENGER)

RADIO-NUCLIDE	>1000 THRU 10,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>10,000 THRU 100,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>100,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS
PU	0	0	0.	0	0	0	0.	0	0	0	0.	0
UP	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235Z	2	508	5.0E-01	2	0	0	0.	0	0	0	0.	0
U	0	0	0.	0	0	0	0.	0	0	0	0.	0

REPORT XIII, B, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - AIR (PASSENGER)

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL GRAMS
PU	2	3200	1.00000E-01	5.00050E+00
UP	5	5762	4.00000E-01	8.44900E+02
U 235Z	52	83979	1.52118E+01	9.39245E+03
U	6	6459	2.02000E+01	3.05021E+02
TOTAL	65	99420	3.61118E+01	1.05474E+04

REPORT XIII, C, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - MAIL

RADIO-NUCLIDE	1 G OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>1 THRU 100 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>100 THRU 1000 G PKGS	MILES /PKG	TI/PKG	TI PKGS
PU	1	1100	0.	0	0	0	0.	0	0	0	0.	0
U 235Z	2	375	1.0E-01	2	1	550	0.	0	0	0	0.	0

REPORT XIII, C. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - MAIL

RADIO-NUCLIDE	>1000 THRU 10,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>10,000 THRU 100,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>100,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS
PU	0	0	0.	0	0	0	0.	0	0	0	0.	0
U 235I	0	0	0.	0	0	0	0.	0	0	0	0.	0

REPORT XIII, C. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - MAIL

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL GRAMS
PU	1	1100	0.	7.00000E-05
U 235Z	3	1300	2.00000E-01	8.80020E+01
TOTAL	4	2400	2.00000E-01	8.80021E+01

REPORT XIII. C. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - RAILROAD

RADIO-NUCLIDE	1 G OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>1 THRU 100 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>100 THRU 1000 G PKGS	MILES /PKG	TI/PKG	TI PKGS
EC	36	423	0.	0	0	0	0.	0	0	0	0.	0
SF	0	0	0.	0	0	0	0.	0	0	0	0.	0

REPORT XIII, C. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - RAILROAD

RADIO-NUCLIDE	>1000 THRU 10,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>10,000 THRU 100,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>100,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS
EC	0	0	0.	0	0	0	0.	0	0	0	0.	0
SF	0	0	0.	0	13	750	1.2E+00	13	0	0	0.	0

REPORT XIII, D, SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - RAILROAD

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL GRAMS
EC	36	15228	0.	3.60000E+05
SF	13	9750	1.62000E+01	3.04215E+05
TOTAL	49	24978	1.62000E+01	3.04215E+05

REPORT XIII. F. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - TRUCK

RADIO-NUCLIDE	1 G OR LESS PKGS	MILES /PKG	TI/PKG	TI PKGS	>1 THRU 100 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>100 THRU 1000 G PKGS	MILES /PKG	TI/PKG	TI PKGS
MF	0	0	0.	0	13	1988	2.8E+00	13	10	1717	3.3E+00	9
PU	1	1100	5.0E+01	1	13	1354	2.2E+00	11	2	1200	0.	0
BF	1	500	5.0E+01	1	1	500	5.0E+01	1	26	2462	5.1E+00	26
TH	0	0	0.	0	0	0	0.	0	2	445	2.0E+01	2
UP	0	0	0.	0	15	1353	1.4E+00	15	9	903	6.9E+00	9
U 235Z	10	855	5.9E+01	7	21	809	4.0E+01	17	1376	410	1.0E+01	1375
U	4	310	4.0E+00	1	3	310	1.0E+00	1	1	342	0.	0
R	4	115	1.0E+00	4	45	630	1.0E+02	3	1	200	1.0E+00	1
	0	0	0.	0	0	0	0.	0	67	1800	0.	0

REPORT XIII. F. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - TRUCK

RADIO-NUCLIDE	>1000 THRU 10,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>10,000 THRU 100,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS	>100,000 G PKGS	MILES /PKG	TI/PKG	TI PKGS
NP	2	2350	1.0E+01	1	0	0	0.	0	0	0	0.	0
PU	18	2000	0.	0	0	0	0.	0	0	0	0.	0
SR	113	1276	5.0E+01	65	38	1946	6.5E+00	2	16	1419	5.0E+01	6
TH	0	0	0.	0	1010	446	1.0E+01	1	0	0	0.	0
UP	5	900	8.1E+00	5	0	0	0.	0	0	0	0.	0
U 235Z	3451	121	2.6E+01	3451	10	622	8.8E+01	10	0	0	0.	0
U	0	0	0.	0	0	0	0.	0	8368	650	1.2E+01	8368
N	0	0	0.	0	0	0	0.	0	36	70	0.	36
	0	0	0.	0	0	0	0.	0	0	0	0.	0

REPORT XIII. F. SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE

MODE OF TRANSPORTATION - TRUCK

RADIO-NUCLIDE	TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL GRAMS
NP	25	47717	6,91667E+01	7,55804E+03
PU	34	57107	2,94545E+01	2,97702E+04
SF	195	305290	6,92900E+03	7,05619E+06
TH	1012	450468	1,01400E+02	6,88160E+07
UP	29	32923	1,22950E+02	1,21471E+04
U 235Z	4868	1011816	1,04657E+03	1,31375E+07
U	6376	5441954	1,02320E+03	2,73964E+09
M	86	31524	5,46000E+00	1,30154E+07
	67	120600	0.	3,04850E+04
TOTAL	14692	7500399	9,32723E+03	2,84174E+09
GRAND TOTAL	14972	7954812	9,47914E+03	2,84220E+09

SUMMARY QUESTIONNAIRE REPORTS - NRC AND AGREEMENT STATES COMBINED

The following computer reports contain the information from the Summary Questionnaires, extrapolated to represent the total shipping activity of the minor shipper population of NRC and Agreement States licensees. Reports I.A through I.E contain the information from page 1 (Table 1) of the Summary Questionnaires (See Appendix C). The numbers (1-1, 1-2, etc.) above the column headings on the reports refer to the columns on the Summary Questionnaire that the information is derived from. Reports II.A through II.E correspond to page 2 (Table 2) of the Summary Questionnaire and Reports III.A through III.E correspond to page 3 (Table 3).

There are five parts of each of the three report series (series I, II, and III). Parts A (Reports I.A, II.A, or III.A) contain information from the Academic general category, Parts B contain information from the Medical general category, Parts C from the Industrial category, and Parts D from the Other category. Parts E contain the combined information from Parts A through D for all four general categories together.

For an example of the information available from the reports, consider Report I.A, "Radionuclide Information for Academic Licensees," on the following pages. Report I.A contains the number of packages shipped annually, the total curie content of the packages, and chemical and physical form (when available) of the nuclide for each nuclide, extrapolated to totals for the Academic licensee population. For example, the first entry on Report I.A indicates 38 packages of ^{241}Am were shipped annually (Column 1-2) by Academic licensees, containing a total of about 0.53 curies (Column 1-3); chemical and physical form (Columns 1-4) were not available. The second entry shows 58 packages of ^{241}Am shipped annually containing a total of 0.49 Ci, chemical form not available, with physical form listed as"SF", or Special Form (see instructions for questionnaires, Appendix C for explanation of abbreviations for physical form). Report I.A indicates that the Academic licensees shipped 4,799 packages containing about 192,000 Ci of radioactive material annually.

The information in Report I.A was extrapolated from questionnaires returned by 19 licensees to the total Academic licensee population (excluding SNM and major shippers) of 734, as noted at the bottom of the report. Of the 19 licensees responding, only 5 listed shipping activities, while 14 indicated no shipping activities. Reports I.B through I.E are identical in form to Report I.A.

Report Series II contains information regarding the package types being shipped by the minor shippers. For example, Report II.A indicates that 441 (Column 2-2) Type A packages (Column 2-1) were shipped annually by the academic licensees. Similarly, 730 exempt packages, 749 low-specific activity packages, and 576 packages of unknown type were shipped. This data was extrapolated from a sample of 19 respondents to a total population (excluding SNM and major shippers) of 734 Academic licensees, just as in Report I.A. Note that the total number of packages shipped annually from Report II.E (2496 packages) is not the same as the total packages shipped indicated in Report I.A (4799 packages). The difference is due to the fact that the data from the Summary Questionnaires are obtained from the respondents "best knowledge" rather than from a careful review of their shipping records, so the information listed on the first page of the questionnaire may not correlate directly to that listed on the second or third page. Reports II.B through II.E are identical in form to Report I.A.

Report Series III contains extrapolated information from the third page of the returned questionnaires (Table 3), regarding the packages shipped annually by the various transportation modes. For example, Report III.A indicates that the Academic licensee population ships 39 packages of radioactive material annually by aircraft of unspecified type (not specified if passenger or freight aircraft). The total transport index (TI) of the 39 packages was 2.44, for an average TI of 0.06. The sample of 19 respondents out of a total population of 734 Academic licensees is the same as for Reports I.A and II.A. Reports III.B through III.E are identical in form to Report III.A.

REPORT I. SUMMARY QUESTIONNAIRE TABLES

A. RADIONUCLIDE INFORMATION FOR ACADEMIC LICENSEES
(EXTRAPOLATED TOTALS)

(1=1) RADIONUCLIDE	(1=2) PKG/YR	(1=3) CI/YR	(1=4) CHEMICAL FORM	(1=4) PHYSICAL FORM
AM241	38	.5280E+00		SF
AM241	58	.4900E+00		
BA133	38	.4902E+00		
BI207	19	.4901E+00		
CL 36	58	.4903E+00		NS
CL 36	96	.5005E+00		
CO 57	19	.5476E+00		
CO 60	19	.4930E+00		NS
CO 60	58	.4905E+00		
CS134	77	.2967E+01		
CS137	154	.6145E+00		NS
CS137	154	.6223E+00		
C 14	96	.5591E+00	ORGANIC	L
C 14	576	.6315E+00		NS
C 14	173	.4966E+00		
FE 59	211	.5140E+00		NS
FE 59	19	.4900E+00		
HG203	134	.4961E+00		NS
H 3	58	.4938E+00	ORGANIC	L
H 3	641	.6376E+00		NS
H 3	250	.4960E+00		
I 125	576	.4925E+00	ORGANIC	L
I 125	19	.5280E+00		
KR 85	19	.4900E+00		
MF	19	.5092E+00		NS
MN 54	38	.4902E+00		NS
MO 99	58	.5266E+00		NS
NA 22	38	.5057E+00		NS
NA 22	38	.4901E+00		
NI 63	19	.7700E+00		NS
PM147	38	.4910E+00		
PO210	77	.4900E+00		
P 32	154	.9993E+00		NS
P 32	38	.4902E+00		
SR 89	38	.4903E+00		NS
SR 90	96	.4902E+00		
TL204	38	.4915E+00		
TM170	19	.2465E+01		NS
U 235C	58	.1918E+06		NS
W	576	.1009E+02		L
ZN 65	77	.5351E+00		NS
TOTAL	4799	1.9182E+05		

TOTAL NONSHIPPERS RETURNED = 14

TOTAL SHIPPERS RETURNED = 5

TOTAL QUESTIONNAIRES RETURNED = 19

TOTAL ACADEMIC CATEGORY POPULATION = 734

REPORT I. SUMMARY QUESTIONNAIRE TABLES

B. RADIONUCLIDE INFORMATION FOR MEDICAL LICENSEES
(EXTRAPOLATED TOTALS)

(1=1) RADIONUCLIDE	(1=2) PKG/YR	(1=3) CI/YR	(1=4) CHEMICAL FORM	(1=4) PHYSICAL FORM
CO 57	959	.2403E+03	CHLORIDE	NS
CO 57	640	.6913E+00	NITRATE	L
CO 57	160	.2888E+01	ORGANIC	DS
CR 51	160	.5300E+00		L
CR 51	465	.1021E+01		NS
C 14	4654	.2352E+01		NS
FE 59	160	.5766E+01	ORGANIC	DS
FE 59	1919	.6988E+00	ORGANIC	L
GA 67	80	.7298E+00	CITRATE	L
GA 67	160	.1289E+01		L
H 3	160	.1168E+02	ORGANIC	DS
H 3	4654	.1406E+02		NS
IN111	160	.4099E+00	CHLORIDE	L
I 125	480	.4846E+02	ORGANIC	DS
I 125	11232	.6624E+00	ORGANIC	L
I 125	3198	.5220E+00	SALT	L
I 125	14390	.6246E+00		L
I 131	3465	.1882E+02	CHLORIDE	L
I 131	19906	.1840E+04	ORGANIC	L
I 131	2079	.1654E+01	SALT	DS
I 131	5996	.2096E+02	SALT	L
I 131	1474	.6180E+00		NS
I 131	2079	.2589E+01		L
MO 99M	3997	.2398E+04		DS
MO 99	4157	.1156E+03		DS
MO 99	2079	.1247E+04		NS
PU238	80	.2030E+03		NS
P 32	400	.2489E+01	PHOSPHATE	L
RA226	400	.3862E+02	SALT	SS
RA226	440	.6377E+02	SULFATE	DS
RA226	320	.3213E+02	SULFATE	
SE 75	400	.5899E+00		L
SR 90	78	.6368E+01		NS
TC 99	698	.6298E+00	PHOSPHATE	L
TC 99	4033	.1944E+03		L
XE133	799	.8848E+01	CHLORIDE	G
YB169	2878	.7485E+01		L
MIXED	4956	.1251E+04	N/A	N/A
TOTAL	104745	7,7683E+03		

TOTAL NONSHIPPERS RETURNED = 61

TOTAL SHIPPERS RETURNED = 16

TOTAL QUESTIONNAIRES RETURNED = 77

TOTAL MEDICAL CATEGORY POPULATION = 5975

C. RADIONUCLIDE INFORMATION FOR INDUSTRIAL LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
AM241	255	.255AE+03	OXIDE	SF
AM241	510	.2600E+02	SALT	
AM241	31	.5205E+00		DS
AM241	104	.1087E+02		NS
AM241	95	.8847E+01		SS
AR 41	12	.2854E+01	ELEMENT	G
AU198	20	.1516E+01	METAL	L
AU198	156	.4900E+00	METAL	NS
AU198	26	.5206E+00	OXIDE	NS
BA133	244	.4902E+00	CHLORIDE	L
BR 82	13	.1128E+01		L
CA 45	12	.5021E+00	CARBONATE	L
CD109	153	.4902E+00	CHLORIDE	NS
CI 36	122	.4900E+00	ACID	L
CI 38	18	.1197E+01	SALT	DS
CO 57	183	.6901E+00	CHLORIDE	NS
CO 57	20	.5076E+00	METAL	NS
CO 58	31	.5510E+00		DS
CO 60	1007	.4906E+00	CHLORIDE	L
CO 60	20	.4900E+00	CHLORIDE	NS
CO 60	416	.1602E+05	METAL	NS
CO 60	13	.1325E+02	OXIDE	DS
CO 60	26	.1766E+01	OXIDE	NS
CO 60	195	.3415E+01	SALT	L
CO 60	62	.6026E+00		DS
CO 60	192	.9070E+07		NS
CO 60	52	.5759E+04		SF
CO 60	26	[illegible]		SF
CO 60	52	.3926E+04		SS
CO 60	52	.1047E+04		
CR 51	4021	.6772E+01	CHLORIDE	NS
CR 51	102	.2076E+02	SALT	L
CR 66	105	.2657E+01	METAL	NS
CS134	98	.2518E+01	SALT	L
CS137	5128	.3828E+04	CHLORIDE	NS
CS137	12	.6534E+01	METAL	NS
CS137	510	.5593E+01	SALT	
CS137	10	.5677E+01		DS
CS137	106	.6507E+01		NS
CS137	1990	.6510E+03		SS
C 14	216	.5008E+00	AMINO ACID	S
C 14	641	.5130E+00	CARBONATE	L
C 14	754	.1679E+02	ORGANIC	L
C 14	128	.6174E+00	ORGANIC	NS
F	124	.4901E+00	OXIDE	G
FE 55	78	.6850E+00	METAL	NS
FE 55	639	.4906E+00		SS
FE 59	35	.5763E+00	METAL	NS
HG197	13	.8727E+00	METAL	L
HG203	79	.6232E+01	METAL	L
HG203	21	.1527E+01	METAL	NS
H 3	166	.3535E+02	ELEMENT	G
H 3	26	.6868E+01	HYDRIDE	NS
H 3	734	.5286E+03	ORGANIC	L
H 3	31	.5205E+00	ORGANIC	NS
H 3	79	.1766E+03	OXIDE	L
H 3	273	.1070E+04		G
H 3	730	.1751E+02		L
H 3	1595	[illegible]		NS
IN114	18	.9137E+00	METAL	NS
IR192	1505	.4427E+02	CHLORIDE	L
IR192	128	.8292E+04	ELEMENT	DS
IR192	10037	.7765E+06	METAL	NS
IR192	128	.2551E+04	METAL	SF
IR192	10	.1552E+03	METAL	SS
IR192	366	.1785E+05	OXIDE	DS
IR192	408	.3126E+04	OXIDE	NS
IR192	255	.1021E+05	SOLID	DS
IR192	1261	.3746E+05		NS
IR192	3229	.3158E+06		SF
IR192	2368	.1266E+06		SS
IR192	52	.5235E+04		

Report I.C (continued)

(1=1) RADIONUCLIDE	(1=2) PKG/YR	(1=3) CI/YR	(1=4) CHEMICAL FORM	(1=4) PHYSICAL FORM
I 125	326	.4998E+00	CHLORIDE	NS
I 125	306	.4974E+00	IODIDE	NS
I 125	10704	.5330E+03	ORGANIC	L
I 125	755	.5585E+01	ORGANIC	NS
I 125	204	.4905E+00	SALT	NS
I 125	114	.8041E+00		L
I 125	183	.1567E+04		
I 131	3891	.3652E+03	SALT	L
I 131	24	.2908E+01		
KR 85	5002	.3055E+03	ELEMENT	G
LA140	71	.1554E+01	CHLORIDE	DS
MC	638	.1766E+01		L
MC	2500	.1582E+02		NS
MF	472	.5028E+00	OXIDE	L
MN 54	153	.4901E+00	CHLORIDE	L
MN 56	18	.1073E+01	METAL	NS
NA 22	183	.4961E+00	CHLORIDE	NS
NA 24	83	.2310E+01	SALT	DS
NI 63	33	.9233E+00	METAL	NS
NI 63	415	.6715E+01	OXIDE	NS
NI 63	153	.2021E+01		SS
NB193	59	.4900E+00	METAL	NS
PM147	30	.1087E+02	OXIDE	NS
PM147	255	.5219E+00		SS
PO210	176	.1017E+01	METAL	NS
PO210	397	.4900E+00	NITRATE	NS
PO210	24	.7314E+00	OXIDE	NS
PO210	283	.3317E+01		NS
PT197	78	.4900E+00	METAL	NS
PU238	31	.2242E+01	OXIDE	NS
P 32	230	.5404E+02	ORGANIC	DS
P 32	12	.6109E+00	PHOSPHATE	L
RA225	41	.6767E+00		NS
RA226	1327	.2600E+02		NS
RA226	10	.4901E+00		SF
RA226	10	.2046E+01		
SB122	18	.6137E+00	METAL	NS
SB124	124	.1709E+02	SALT	SS
SB 125	18	.5253E+00	ORGANIC	L
SR 90	549	.4900E+00	CHLORIDE	L
SR 90	39	.4929E+00	OXIDE	
SR 90	104	.2124E+02	SALT	NS
SR 90	519	.1346E+02		DS
S 35	10	.4900E+00	ORGANIC	L
S 35	10	.4900E+00	ORGANIC	NS
TC 99M	18	.4907E+01	ORGANIC	L
TE123M	39	.7374E+01	METAL	NS
TL204	122	.4931E+00	NITRATE	L
UN	156	.1561E+03	METAL	NS
U 235	9012	.2945E+02	OXIDE	DS
U 238	13050	.4909E+03	OXIDE	DS
U 238	115	.2276E+01	OXIDE	NS
U 238	13	.5091E+00	SALT	DS
W	36	.6109E+00		L
Y 88	13	.4900E+00		NS
MIXED	100	.4212E+01	N/A	N/A
MIXED	UNKNOWN	.7914E+03	N/A	N/A
TOTAL	96128	1.0415E+07		

TOTAL NONSHIPPERS RETURNED = 317

TOTAL SHIPPERS RETURNED = 101

TOTAL QUESTIONNAIRES RETURNED = 418

TOTAL INDUSTRIAL CATEGORY POPULATION = 6954

REPORT I. SUMMARY QUESTIONNAIRE TABLES

D. RADIONUCLIDE INFORMATION FOR OTHER LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) KG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
AM	270	.1400E+02		SF
CO 60	64	.4910E+00	SALT	NS
CO 60	482	.1376E+02		NS
CS	270	.3191E+01		SF
H 3	90	.6306E+03	ELEMENT	G
IR192	340	.2181E+05	ELEMENT	NS
MO	150	.4904E+06	METAL	NS
PO210	45	.2291E+01		US
RA226	2341	.1103E+02		SF
RA	450	.1351E+04		SF
TC 99	810	.3732E+01		
U 238	8194	.5829E+02	METAL	NS
MIXED	585	.3425E+02	N/A	N/A
TOTAL	14101	2.3730E+04		

TOTAL NONSHIPPERS RETURNED = 21

TOTAL SHIPPERS RETURNED = 9

TOTAL QUESTIONNAIRES RETURNED = 30

TOTAL OTHER CATEGORY POPULATION = 995

REPORT I, SUMMARY QUESTIONNAIRE TABLES

E. RADIONUCLIDE INFORMATION FOR ALL LICENSEES
(EXTRAPOLATED TOTALS)

(1=1) RADIONUCLIDE	(1=2) PKG/YR	(1=3) CI/YR	(1=4) CHEMICAL FORM	(1=5) PHYSICAL FORM
AM241	255	.255[illegible]E+03	OXIDE	SP
AM241	510	.[illegible]E+02	SALT	
AM241	31	.52[illegible]E+00		DS
AM241	104	.1[illegible]E+02		NS
AM241	36	.5[illegible]E+00		SP
AM241	95	.[illegible]E+01		SS
AM241	59	.[illegible]E+00		
AM	270	.1[illegible]E+02		SP
AR 41	12	.2[illegible]E+01	ELEMENT	G
AU198	20	.1[illegible]E+01	METAL	L
AU198	156	.[illegible]E+00	METAL	NS
AU198	26	.52[illegible]E+00	OXIDE	NS
BA133	244	.[illegible]E+00	CHLORIDE	L
BA133	36	.[illegible]E+00		
BI207	19	.[illegible]E+00		
BR 82	13	.112[illegible]E+01		L
CA 45	12	.5[illegible]E+00	CARBONATE	L
CD109	153	.[illegible]E+00	CHLORIDE	NS
CI 36	122	.[illegible]E+00	ACID	L
CI 36	16	.1197E+01	SALT	DS
CL 36	54	.[illegible]E+00		NS
CL 36	96	.5[illegible]E+00		
CO 57	1142	.2[illegible]E+03	CHLORIDE	NS
CO 57	25	.5[illegible]E+00	METAL	NS
CO 57	440	.[illegible]E+00	NITRATE	L
CO 57	160	.25[illegible]E+01	ORGANIC	DS
CO 57	19	.5[illegible]E+00		
CO 58	31	.551[illegible]E+00		DS
CO 60	1067	.[illegible]E+00	CHLORIDE	L
CO 60	20	.[illegible]E+00	CHLORIDE	NS
CO 60	418	.1[illegible]E+05	METAL	NS
CO 60	13	.1325E+02	OXIDE	DS
CO 60	26	.1766E+01	OXIDE	NS
CO 60	195	.3415E+01	SALT	L
CO 60	64	.[illegible]E+00	SALT	NS
CO 60	62	.[illegible]E+00		DS
CO 60	653	.9[illegible]E+07		NS
CO 60	52	.57[illegible]E+04		SP
CO 60	26	[illegible]		SP
CO 60	52	.3[illegible]E+04		SS
CO 60	110	.1[illegible]E+04		
CR 51	4021	.[illegible]E+01	CHLORIDE	NS
CR 51	102	.2[illegible]E+02	SALT	L
CR 51	16[illegible]	.53[illegible]E+00		L
CR 51	465	.1421E+01		NS
CR 66	106	.2557E+01	METAL	NS
CS134	98	.251[illegible]E+01	SALT	L
CS134	77	.2[illegible]E+01		
CS137	5120	.3[illegible]E+04	CHLORIDE	NS
CS137	12	.65[illegible]E+01	METAL	[illegible]
CS137	510	.5543E+01	SALT	
CS137	10	.5[illegible]E+01		NS
CS137	260	.[illegible]E+01		NS
CS137	1990	.[illegible]E+03		SS
CS137	154	.[illegible]E+00		
CS	270	.3191E+01		SP
C 14	216	.5[illegible]E+00	AMINO ACID	S
C 14	641	.513[illegible]E+00	CARBONATE	L
C 14	850	.1[illegible]E+02	ORGANIC	L
C 14	128	.617[illegible]E+00	ORGANIC	NS
C 14	5230	.2[illegible]E+01		NS
C 14	173	.[illegible]E+00		
E	124	.[illegible]E+00	OXIDE	G
FE 55	70	.6[illegible]E+00	METAL	NS
FE 55	635	.[illegible]E+00		SS
FE 59	35	.57[illegible]E+00	METAL	NS
FE 59	160	.57[illegible]E+01	ORGANIC	NS
FE 59	1914	.[illegible]E+00	ORGANIC	L
FE 59	211	.516[illegible]E+00		NS
FE 59	19	.[illegible]E+00		

Report I.E (continued)

(1=1) RADIONUCLIDE	(1=2) PKG/YR	(1=3) CI/YR	(1=4) CHEMICAL FORM	(1=4) PHYSICAL FORM
GA 67	80	.7298E+00	CITRATE	L
GA 67	180	.1298E+01		L
HG197	13	.8727E+00	METAL	L
HG203	79	.4632E+01	METAL	L
HG203	21	.1527E+01	METAL	NS
HG203	134	.4581E+00		NS
H 3	256	.6656E+03	ELEMENT	G
H 3	26	.6648E+01	HYDRIDE	NS
H 3	160	.1188E+02	ORGANIC	DS
H 3	792	.5688E+03	ORGANIC	L
H 3	31	.5600E+00	ORGANIC	NS
H 3	79	.1708E+03	OXIDE	L
H 3	273	.1177E+04		G
H 3	730	.1751E+02		L
H 3	5115	.1421E+02		NS
H 3	1595	[illegible]		NS
H 3	250	.4608E+00		
IN111	160	.8498E+00	CHLORIDE	L
IN114	18	.8137E+00	METAL	NS
IR192	1505	.8427E+02	CHLORIDE	L
IR192	120	.8292E+04	ELEMENT	DS
IR192	360	.2181E+05	ELEMENT	NS
IR192	10037	.7708E+06	METAL	NS
IR192	120	.2551E+04	METAL	SF
IR192	10	.1056E+03	METAL	SS
IR192	366	.1785E+05	OXIDE	DS
IR192	408	.3128E+04	OXIDE	NS
IR192	255	.1021E+05	SOLID	DS
IR192	1261	.3784E+05		NS
IR192	3229	.3158E+06		SF
IR192	2866	.1288E+06		SS
IR192	52	.5635E+04		
I 125	326	.4904E+00	CHLORIDE	NS
I 125	306	.4978E+00	IODIDE	NS
I 125	480	.4854E+02	ORGANIC	DS
I 125	22512	.5331E+03	ORGANIC	L
I 125	755	.5585E+01	ORGANIC	NS
I 125	3190	.5220E+00	SALT	L
I 125	204	.4956E+00	SALT	NS
I 125	10504	.7387E+00		L
I 125	202	.1588E+04		
I 131	3665	.1882E+02	CHLORIDE	L
I 131	19906	.1800E+04	ORGANIC	L
I 131	2079	.1854E+01	SALT	DS
I 131	9887	.4037E+03	SALT	L
I 131	1474	.8108E+00		NS
I 131	2079	.6569E+01		L
I 131	24	.6982E+01		
KR 85	5002	.3655E+03	ELEMENT	G
KR 85	19	.4900E+00		
LA140	71	.1554E+01	CHLORIDE	DS
MO	180	.4598E+00	METAL	NS
MO	838	.1768E+01		L
MO	2500	.1562E+02		NS
MF	472	.5028E+00	OXIDE	L
MF	19	.5092E+00		NS
MN 54	153	.4918E+00	CHLORIDE	L
MN 54	38	.4902E+00		NS
MN 56	18	.1073E+01	METAL	NS
MO 99M	3997	.2348E+04		DS
MO 99	4157	.1158E+03		DS
MO 99	2137	.1248E+04		NS
NA 22	183	.4901E+00	CHLORIDE	NS
NA 22	38	.5097E+00		NS
NA 22	38	.4901E+00		
NA 24	88	.2310E+01	SALT	DS
NI 63	33	.9203E+00	METAL	NS
NI 63	415	.8715E+01	OXIDE	NS
NI 63	19	.7708E+00		NS
NI 63	153	.2021E+01		SS
OS193	59	.4902E+00	METAL	NS
PM147	30	.1087E+02	OXIDE	NS
PM147	255	.5219E+00		SS
PM147	38	.4910E+00		

Report I.E (continued)

(1=1) RADIONUCLIDE	(1=2) PKG/YR	(1=3) CI/YR	(1=4) CHEMICAL FORM	(1=4) PHYSICAL FORM
PU210	176	.1617E+01	METAL	NS
PU210	597	.6910E+00	NITRATE	NS
PU210	24	.7318E+00	OXIDE	NS
PU210	45	.2641E+01		US
PU210	283	.3317E+01		NS
PU210	77	.4500E+00		
PT197	76	.4500E+00	METAL	NS
PU238	31	.2242E+01	OXIDE	NS
PU238	89	.2130E+03		NS
P 32	230	.5410E+02	ORGANIC	US
P 32	412	.2810E+01	PHOSPHATE	L
P 32	154	.7553E+00		NS
P 32	38	.4502E+00		
RA225	41	.2787E+00		NS
RA226	400	.3582E+02	SALT	SS
RA226	640	.8377E+02	SULFATE	US
RA226	320	.3213E+02	SULFATE	
RA226	1327	.2810E+02		NS
RA226	2351	.1103E+02		SF
RA226	16	.2046E+01		
RA	450	.1351E+04		SF
SB122	18	.1137E+00	METAL	NS
SB124	124	.1709E+02	SALT	SS
SE 75	400	.5499E+00		L
SR 85	18	.5253E+00	ORGANIC	L
SR 89	36	.4503E+00		NS
SR 90	549	.4500E+00	CHLORIDE	L
SR 90	39	.4529E+00	OXIDE	
SR 90	104	.2124E+02	SALT	FS
SR 90	519	.1346E+02		US
SR 90	76	.3568E+01		FS
SR 90	96	.4502E+00		
S 35	19	.4500E+00	ORGANIC	L
S 35	10	.4500E+00	ORGANIC	NS
TC 99M	18	.4907E+01	ORGANIC	L
TC 99	698	.6256E+00	PHOSPHATE	L
TC 99	6433	.1966E+03		L
TC 99	812	.3732E+01		
TE123M	39	.7374E+01	METAL	NS
TL204	122	.4931E+00	NITRATE	L
TL204	30	.4915E+00		
TM170	19	.1455E+01		NS
UN	156	.1561E+03	METAL	NS
U 235C	58	.1918E+06		NS
U 235	9012	.2445E+02	OXIDE	US
U 238	8194	.5229E+02	METAL	FS
U 238	13050	.4519E+03	OXIDE	US
U 238	115	.2276E+01	OXIDE	NS
U 238	13	.5591E+00	SALT	US
W	512	.1121E+02		L
XE133	799	.4488E+01	CHLORIDE	G
YB169	2875	.7685E+01		L
Y 88	13	.4500E+00		NS
ZN 65	77	.5351E+00		NS
MIXED	5641	.1284E+04	N/A	N/A
MIXED	[illegible]	.7914E+03	N/A	N/A
TOTAL	219773	1.0838E+07		

TOTAL NONSHIPPERS RETURNED = 413

TOTAL SHIPPERS RETURNED = 131

TOTAL QUESTIONNAIRES RETURNED = 544

TOTAL POPULATION OF CATEGORIES = 14658

REPORT II. SUMMARY QUESTIONNAIRE TABLES

A. PACKAGE TYPE INFORMATION FOR ACADEMIC LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	441
EXEMPT	730
LOW SPECIFIC ACTIVITY	749
UNKNOWN	578
TOTAL	2498

TOTAL NONSHIPPERS RETURNED = 14

TOTAL SHIPPERS RETURNED = 5

TOTAL QUESTIONNAIRES RETURNED = 19

TOTAL ACADEMIC CATEGORY POPULATION = 730

REPORT II, SUMMARY QUESTIONNAIRE TABLES

B. PACKAGE TYPE INFORMATION FOR MEDICAL LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	72769
TYPE B	1194
EXEMPT	8220
LOW SPECIFIC ACTIVITY	31731
TOTAL	113914

TOTAL NONSHIPPERS RETURNED = 61

TOTAL SHIPPERS RETURNED = 16

TOTAL QUESTIONNAIRES RETURNED = 77

TOTAL MEDICAL CATEGORY POPULATION = 5975

REPORT II. SUMMARY QUESTIONNAIRE TABLES

C. PACKAGE TYPE INFORMATION FOR INDUSTRIAL LICENSEES (EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(Z=1) TYPE	(Z=2) PKG/YR
TYPE A (FISSILE)	13
TYPE A	41757
TYPE B (FISSILE)	4000
TYPE B	20118
EXEMPT	11203
LARGE QUANTITY	2095
LOW SPECIFIC ACTIVITY	22690
TOTAL	106882

TOTAL NONSHIPPERS RETURNED = 317

TOTAL SHIPPERS RETURNED = 100

TOTAL QUESTIONNAIRES RETURNED = 417

TOTAL INDUSTRIAL CATEGORY POPULATION = 6954

REPORT II. SUMMARY QUESTIONNAIRE TABLES

D. PACKAGE TYPE INFORMATION FOR OTHER LICENSEES (EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	11262
TYPE B	380
EXEMPT	2709
LOW SPECIFIC ACTIVITY	460
UNKNOWN	64
TOTAL	14875

TOTAL NONSHIPPERS RETURNED = 21

TOTAL SHIPPERS RETURNED = 8

TOTAL QUESTIONNAIRES RETURNED = 29

TOTAL OTHER CATEGORY POPULATION = 995

REPORT II. SUMMARY QUESTIONNAIRE TABLES

E. PACKAGE TYPE INFORMATION FOR ALL LICENSEES (EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A (FISSILE)	13
TYPE A	125079
TYPE B (FISSILE)	9000
TYPE B	22023
EXEMPT	22765
LARGE QUANTITY	2114
LOW SPECIFIC ACTIVITY	55284
UNKNOWN	640
TOTAL	236918

TOTAL NONSHIPPERS RETURNED = 413

TOTAL SHIPPERS RETURNED = 129

TOTAL QUESTIONNAIRES RETURNED = 542

TOTAL POPULATION OF CATEGORIES = 14658

REPORT III. SUMMARY QUESTIONNAIRE TABLES

A. TRANSPORTATION INFORMATION FOR ACADEMIC LICENSEES (EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	39.	2.44
AUTOMOBILE	20.	UNKNOWN
TRUCK--UNSPECIFIED	9657.	86.23
TOTAL	9716.	87.69

TOTAL NONSHIPPERS RETURNED = 14

TOTAL SHIPPERS RETURNED = 5

TOTAL QUESTIONNAIRES RETURNED = 19

TOTAL ACADEMIC CATEGORY POPULATION = 734

REPORT III, SUMMARY QUESTIONNAIRE TABLES

A. TRANSPORTATION INFORMATION FOR MEDICAL LICENSEES (EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	25771.	103829.46
UNSPECIFIED--AIRCRAFT	19809.	UNKNOWN
AUTOMOBILE	1808.	181.25
AUTOMOBILE	83.	UNKNOWN
BARGE	2219.	632.99
MAIL	18789.	UNKNOWN
TRUCK--UNSPECIFIED	45039.	71904.75
TRUCK--UNSPECIFIED	6119.	UNKNOWN
TOTAL	119633.	176546.49

TOTAL NONSHIPPERS RETURNED = 61

TOTAL SHIPPERS RETURNED = 15

TOTAL QUESTIONNAIRES RETURNED = 76

TOTAL MEDICAL CATEGORY POPULATION = 5975

REPORT III. SUMMARY QUESTIONNAIRE TABLES

C. TRANSPORTATION INFORMATION FOR INDUSTRIAL LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3=1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	24516.	34081.82
UNSPECIFIED--AIRCRAFT	7890.	UNKNOWN
AUTOMOBILE	1586.	842.96
MAIL	5805.	304.91
RAIL	13234.	5356.72
SHIP	15080.	7540.49
TRUCK--COMMON CARRIER	25.	UNKNOWN
TRUCK--UNSPECIFIED	79573.	82441.92
TRUCK--UNSPECIFIED	687.	UNKNOWN
TOTAL	148392.	130565.88

TOTAL NONSHIPPERS RETURNED = 317

TOTAL SHIPPERS RETURNED = 99

TOTAL QUESTIONNAIRES RETURNED = 416

TOTAL INDUSTRIAL CATEGORY POPULATION = 6954

REPORT III. SUMMARY QUESTIONNAIRE TABLES

D. TRANSPORTATION INFORMATION FOR OTHER LICENSEES (EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	2273.	2177.23
AUTOMOBILE	78.	UNKNOWN
MAIL	474.	.49
TRUCK--UNSPECIFIED	10777.	930.08
TOTAL	15601.	3108.33

TOTAL NONSHIPPERS RETURNED = 21

TOTAL SHIPPERS RETURNED = 8

TOTAL QUESTIONNAIRES RETURNED = 29

TOTAL OTHER CATEGORY POPULATION = 995

REPORT III. SUMMARY QUESTIONNAIRE TABLES

E. TRANSPORTATION INFORMATION FOR ALL LICENSEES (EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1). MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	52598.	146089.47
UNSPECIFIED--AIRCRAFT	26698.	UNKNOWN
AUTOMOBILE	3393.	1023.71
AUTOMOBILE	180.	UNKNOWN
BARGE	2219.	632.99
MAIL	6276.	304.91
MAIL	14789.	UNKNOWN
RAIL	13234.	5356.72
SHIP	15080.	7540.49
TRUCK--COMMON CARRIER	25.	UNKNOWN
TRUCK--UNSPECIFIED	145045.	155361.51
TRUCK--UNSPECIFIED	6806.	UNKNOWN
TOTAL	286341.	310306.85

TOTAL NONSHIPPERS RETURNED = 413

TOTAL SHIPPERS RETURNED = 127

TOTAL QUESTIONNAIRES RETURNED = 540

TOTAL POPULATION OF CATEGORIES = 14658

SUMMARY QUESTIONNAIRE REPORTS - NRC LICENSEES ONLY

The following reports are identical in form to Report Series I, II, and III for the Agreement States and NRC licensees combined (preceding pages). Reports I, II, and III are listed for each NRC category for which at least one Class-1 Summary Questionnaire response was received. Category populations listed (last line of each report) are corrected for overlap with SNM licensees and major shippers, but are not corrected for overlap between and within license categories (see Table 4.3).

REPORT I. SUMMARY QUESTIONNAIRE TABLES

B . RADIONUCLIDE INFORMATION FOR 01200 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
TOTAL	0	0.		

TOTAL NONSHIPPERS RETURNED = 4

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 4

TOTAL 01200 CATEGORY POPULATION = 434

REPORT I. SUMMARY QUESTIONNAIRE TABLES

D . RADIONUCLIDE INFORMATION FOR 02120 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
CR 51	865	.1421E+01		NS
C 14	4654	.2352E+01		NS
H 3	8654	.1406E+02		NS
I 131	1474	.6180E+00		DS
SR 90	78	.4368E+01		NS
TC 99	698	.6296E+00	PHOSPHATE	L
TC 99	4033	.1940E+03		L
TOTAL	16056	2.1441E+02		

TOTAL NONSHIPPERS RETURNED = 13

TOTAL SHIPPERS RETURNED = 3

TOTAL QUESTIONNAIRES RETURNED = 16

TOTAL 02120 CATEGORY POPULATION = 1241

REPORT I. SUMMARY QUESTIONNAIRE TABLES

E. RADIONUCLIDE INFORMATION FOR 02200 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
I 125	1319	.5633E+00	ORGANIC	L
I 131	3665	.1882E+02	CHLORIDE	L
TOTAL	4984	1.8403E+01		

TOTAL NONSHIPPERS RETURNED = 9

TOTAL SHIPPERS RETURNED = 1

TOTAL QUESTIONNAIRES RETURNED = 10

TOTAL 02200 CATEGORY POPULATION = 733

REPORT I. SUMMARY QUESTIONNAIRE TABLES

F. RADIONUCLIDE INFORMATION FOR 02300 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
TOTAL	0	0.		

TOTAL NONSHIPPERS RETURNED = 8

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 8

TOTAL 02300 CATEGORY POPULATION = 474

REPORT I. SUMMARY QUESTIONNAIRE TABLES

G . RADIONUCLIDE INFORMATION FOR 02400 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
TOTAL	0	0.		

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 02400 CATEGORY POPULATION = 107

REPORT I. SUMMARY QUESTIONNAIRE TABLES

I . RADIONUCLIDE INFORMATION FOR 03110 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
TOTAL	0	0.		

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 03110 CATEGORY POPULATION = 55

REPORT 1, SUMMARY QUESTIONNAIRE TABLES

J . RADIONUCLIDE INFORMATION FOR 03120 LICENSEES
(EXTRAPOLATED TOTALS)

(1=1) RADIONUCLIDE	(1=2) PKG/YR	(1=3) CI/YR	(1=4) CHEMICAL FORM	(1=5) PHYSICAL FORM
AM241	104	.1087E+02		NS
CO 60	20	.4900E+00	CHLORIDE	NS
CO 60	21	.2565E+01	METAL	NS
CO 60	31	.1631E+01		NS
CS137	10	.5677E+01		DS
CS137	93	.6507E+01		NS
E	124	.4901E+00	OXIDE	G
HG203	41	.3094E+01	METAL	L
HG203	21	.1527E+01	METAL	NS
H 3	166	.3535E+02	ELEMENT	G
H 3	166	.5154E+00	ORGANIC	L
H 3	31	.5200E+00	ORGANIC	NS
H 3	135	.5578E+00		L
IR192	10	.1916E+02		NS
IR192	124	.1867E+04		SS
I 125	10	.4907E+00	ORGANIC	L
I 125	21	.4902E+00	ORGANIC	NS
I 125	114	.6041E+00		L
NI 63	21	.7390E+00	METAL	NS
NI 63	415	.6715E+01	OXIDE	NS
PM147	10	.1086E+02	OXIDE	NS
PU238	31	.2242E+01	OXIDE	NS
RA225	41	.6757E+00		NS
RA226	10	.4901E+00		SF
RA226	10	.2046E+01		
SB124	124	.1769E+02	SALT	SS
SR 90	104	.2124E+02	SALT	NS
SR 90	519	.1346E+02		DS
S 35	10	.4900E+00	ORGANIC	L
S 35	10	.4900E+00	ORGANIC	NS
UN	156	.1561E+03	METAL	NS
U 238	10	.5616E+00	OXIDE	DS
MIXED	61	.3406E+01	N/A	N/A
TOTAL	2774	2.1785E+03		

TOTAL NONSHIPPERS RETURNED = 156

TOTAL SHIPPERS RETURNED = 23

TOTAL QUESTIONNAIRES RETURNED = 179

TOTAL 03120 CATEGORY POPULATION = 1857

REPORT I. SUMMARY QUESTIONNAIRE TABLES

K . RADIONUCLIDE INFORMATION FOR 03211 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
AM241	31	.5205E+00		DS
BA133	244	.4902E+00	CHLORIDE	L
CD109	153	.4902E+00	CHLORIDE	NS
CL 36	122	.4900E+00	ACID	L
CO 57	183	.4901E+00	CHLORIDE	NS
CO 58	31	.5510E+00		DS
CO 60	1007	.4906E+00	CHLORIDE	L
CO 60	62	.6425E+00		DS
CS137	1525	.4906E+00	CHLORIDE	NS
C 14	641	.5130E+00	CARBONATE	L
MN 54	153	.4901E+00	CHLORIDE	L
NA 22	183	.4901E+00	CHLORIDE	NS
PO210	397	.4900E+00	NITRATE	NS
SR 90	549	.4900E+00	CHLORIDE	L
TL204	122	.4931E+00	NITRATE	L
TOTAL	5403	2.7241E+01		

TOTAL NONSHIPPERS RETURNED = 0

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 2

TOTAL 03211 CATEGORY POPULATION = 61

REPORT I. SUMMARY QUESTIONNAIRE TABLES

L . RADIONUCLIDE INFORMATION FOR 03212 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
CO 60	204	.1529E+05	METAL	NS
CR 51	102	.2087E+02	SALT	L
C 14	204	.9295E+01	ORGANIC	L
IR192	6726	.7133E+06	METAL	NS
I 125	326	.4908E+00	CHLORIDE	NS
I 125	306	.4976E+00	IODIDE	NS
I 125	10659	.5329E+03	ORGANIC	L
I 125	734	.5585E+01	ORGANIC	NS
I 125	204	.4905E+00	SALT	NS
I 125	183	.1567E+04		
TOTAL	19648	7.3072E+05		

TOTAL NONSHIPPERS RETURNED = 12

TOTAL SHIPPERS RETURNED = 9

TOTAL QUESTIONNAIRES RETURNED = 21

TOTAL 03212 CATEGORY POPULATION = 214

REPORT 1. SUMMARY QUESTIONNAIRE TABLES

O . RADIONUCLIDE INFORMATION FOR 03216 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
TOTAL	0	0.		

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 03216 CATEGORY POPULATION = 57

REPORT 1. SUMMARY QUESTIONNAIRE TABLES

P . RADIONUCLIDE INFORMATION FOR 03217 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
CS137	3850	.8940E+00	CHLORIDE	NS
KR 85	4646	.7476E+01	ELEMENT	G
TOTAL	8496	7.8900E+00		

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 3

TOTAL 03217 CATEGORY POPULATION = 69

REPORT 1. SUMMARY QUESTIONNAIRE TABLES

R . RADIONUCLIDE INFORMATION FOR 03220 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
TOTAL	0	0.		

TOTAL NONSHIPPERS RETURNED = 4

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 4

TOTAL 03220 CATEGORY POPULATION = 27

REPORT I. SUMMARY QUESTIONNAIRE TABLES

U. RADIONUCLIDE INFORMATION FOR 03310 LICENSEES
(EXTRAPOLATED TOTALS)

(1=1) RADIONUCLIDE	(1=2) PKG/YR	(1=3) CI/YR	(1=4) CHEMICAL FORM	(1=4) PHYSICAL FORM
AR 41	12	.2854E+01	ELEMENT	G
IR192	118	.2836E+04	METAL	NS
IR192	24	.5087E+03	OXIDE	NS
IR192	24	.4969E+03		NS
LA140	71	.1554E+01	CHLORIDE	DS
TOTAL	249	3.8440E+03		

TOTAL NONSHIPPERS RETURNED = 7

TOTAL SHIPPERS RETURNED = 4

TOTAL QUESTIONNAIRES RETURNED = 11

TOTAL 03310 CATEGORY POPULATION = 130

REPORT I. SUMMARY QUESTIONNAIRE TABLES

V. RADIONUCLIDE INFORMATION FOR 03320 LICENSEES
(EXTRAPOLATED TOTALS)

(1=1) RADIONUCLIDE	(1=2) PKG/YR	(1=3) CI/YR	(1=4) CHEMICAL FORM	(1=4) PHYSICAL FORM
CO 60	178	.1068E+04	METAL	NS
CO 60	52	.5759E+04		SF
CO 60	52	.3926E+04		SS
CO 60	52	.1047E+04		
CR 51	4021	.6772E+01	CHLORIDE	NS
H 3	524	.5240E+03	ORGANIC	L
IR192	2440	.1152E+05	METAL	NS
IR192	10	.1052E+03	METAL	SS
IR192	366	.1785E+05	OXIDE	DS
IR192	42	.6331E+02	OXIDE	NS
IR192	921	.3330E+05		NS
IR192	3203	.3151E+06		SF
IR192	2744	.1267E+06		SS
IR192	52	.5235E+04		
TOTAL	14457	5.2218E+05		

TOTAL NONSHIPPERS RETURNED = 2

TOTAL SHIPPERS RETURNED = 15

TOTAL QUESTIONNAIRES RETURNED = 17

TOTAL 03320 CATEGORY POPULATION = 178

REPORT I. SUMMARY QUESTIONNAIRE TABLES

X. RADIONUCLIDE INFORMATION FOR 03510 LICENSEES
(EXTRAPOLATED TOTALS)

(1=1) RADIONUCLIDE	(1=2) PKG/YR	(1=3) CI/YR	(1=4) CHEMICAL FORM	(1=4) PHYSICAL FORM
C 14	216	.5008E+00	AMINO ACID	S
TOTAL	216	1.0800E-02		

TOTAL NONSHIPPERS RETURNED = 2

TOTAL SHIPPERS RETURNED = 1

TOTAL QUESTIONNAIRES RETURNED = 3

TOTAL 03510 CATEGORY POPULATION = 162

REPORT I. SUMMARY QUESTIONNAIRE TABLES

Y. RADIONUCLIDE INFORMATION FOR 03520 LICENSEES
(EXTRAPOLATED TOTALS)

(1=1) RADIONUCLIDE	(1=2) PKG/YR	(1=3) CI/YR	(1=4) CHEMICAL FORM	(1=4) PHYSICAL FORM
AM241	18	.1020E+01		SS
CI 38	18	.1197E+01	SALT	DS
CO 60	36	.2692E+07		NS
CR 66	106	.2857E+01	METAL	NS
FE 59	35	.5783E+00	METAL	NS
H 3	18	.8421E+03		G
H 3	583	.5348E+01		L
IN114	18	.6137E+00	METAL	NS
I 125	35	.5077E+00	ORGANIC	L
MN 56	18	.1073E+01	METAL	NS
NA 24	88	.2310E+01	SALT	DS
PO210	283	.3317E+01		NS
P 32	230	.5400E+02	ORGANIC	DS
SB122	18	.6137E+00	METAL	NS
SR 85	18	.5253E+00	ORGANIC	L
TC 99M	18	.4907E+01	ORGANIC	L
TOTAL	1540	2.6930E+06		

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 3

TOTAL 03520 CATEGORY POPULATION = 53

REPORT I. SUMMARY QUESTIONNAIRE TABLES

Z . RADIONUCLIDE INFORMATION FOR 03610 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
AU198	20	.181AE+01	METAL	L
AU198	156	.0900E+00	METAL	NS
CO 57	20	.507AE+00	METAL	NS
CO 60	195	.3415E+01	SALT	L
CS134	98	.251AE+01	SALT	L
C 14	40	.5297E+00	ORGANIC	L
FE 55	78	.AA50E+00	METAL	NS
H 3	20	.462AE+01	ORGANIC	L
H 3	79	.17A6E+03	OXIDE	L
KR 85	215	.279AE+03	ELEMENT	G
OS193	59	.0900E+00	METAL	NS
PM147	20	.5017E+00	OXIDE	NS
PO210	176	.1017E+01	METAL	NS
PT197	78	.0900E+00	METAL	NS
SR 90	39	.0920E+00	OXIDE	
TE123M	39	.7374E+01	METAL	NS
TOTAL	1332	4.7313E+02		

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 3

TOTAL QUESTIONNAIRES RETURNED = 4

TOTAL 03610 CATEGORY POPULATION = 78

REPORT I. SUMMARY QUESTIONNAIRE TABLES

AA. RADIONUCLIDE INFORMATION FOR 03620 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
CA 45	12	.5021E+00	CARBONATE	L
CO 60	48	.5348E+00		NS
CS137	12	.6534E+01	METAL	NS
C 14	444	.4116E+01	ORGANIC	L
H 3	24	.9735E+00	ORGANIC	L
H 3	12	.125AE+02		L
I 131	24	.2908E+01		
NI 63	12	.6713E+00	METAL	NS
PO210	24	.7318E+00	OXIDE	NS
P 32	12	.6109E+00	PHOSPHATE	L
W	36	.6109E+00		L
TOTAL	700	2.5387E+01		

TOTAL NONSHIPPERS RETURNED = 28

TOTAL SHIPPERS RETURNED = 6

TOTAL QUESTIONNAIRES RETURNED = 34

TOTAL 03620 CATEGORY POPULATION = 411

REPORT I. SUMMARY QUESTIONNAIRE TABLES

KK. RADIONUCLIDE INFORMATION FOR 03710 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
CO 60	64	.4910E+00	SALT	NS
CO 60	127	.4308E+01		NS
TOTAL	191	3.8120E+00		

TOTAL NONSHIPPERS RETURNED = 9

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 11

TOTAL 03710 CATEGORY POPULATION = 140

REPORT I. SUMMARY QUESTIONNAIRE TABLES

JJ. RADIONUCLIDE INFORMATION FOR 11700 LICENSEES
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
U 235	9012	.2945E+02	OXIDE	DS
U 238	13040	.8908E+03	OXIDE	DS
TOTAL	22052	9.1929E+02		

TOTAL NONSHIPPERS RETURNED = 0

TOTAL SHIPPERS RETURNED = 1

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 11700 CATEGORY POPULATION = 4

REPORT II. SUMMARY QUESTIONNAIRE TABLES

B . PACKAGE TYPE INFORMATION FOR 01200 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TOTAL	0

TOTAL NONSHIPPERS RETURNED = 0

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 0

TOTAL 01200 CATEGORY POPULATION = 430

REPORT II. SUMMARY QUESTIONNAIRE TABLES

D . PACKAGE TYPE INFORMATION FOR 02120 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	9540
EXEMPT	698
TOTAL	10238

TOTAL NONSHIPPERS RETURNED = 13

TOTAL SHIPPERS RETURNED = 3

TOTAL QUESTIONNAIRES RETURNED = 16

TOTAL 02120 CATEGORY POPULATION = 1201

REPORT II. SUMMARY QUESTIONNAIRE TABLES

E . PACKAGE TYPE INFORMATION FOR 02200 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	3665
EXEMPT	1319
TOTAL	4984

TOTAL NONSHIPPERS RETURNED = 9

TOTAL SHIPPERS RETURNED = 1

TOTAL QUESTIONNAIRES RETURNED = 10

TOTAL 02200 CATEGORY POPULATION = 733

REPORT II. SUMMARY QUESTIONNAIRE TABLES

F . PACKAGE TYPE INFORMATION FOR 02300 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TOTAL	0

TOTAL NONSHIPPERS RETURNED = 8

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 8

TOTAL 02300 CATEGORY POPULATION = 474

REPORT II. SUMMARY QUESTIONNAIRE TABLES

G . PACKAGE TYPE INFORMATION FOR 02400 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TOTAL	0

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 02400 CATEGORY POPULATION = 107

REPORT II. SUMMARY QUESTIONNAIRE TABLES

I . PACKAGE TYPE INFORMATION FOR 03110 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TOTAL	0

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 03110 CATEGORY POPULATION = 55

REPORT II. SUMMARY QUESTIONNAIRE TABLES

J . PACKAGE TYPE INFORMATION FOR 03120 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	1847
TYPE B	278
EXEMPT	289
LOW SPECIFIC ACTIVITY	268
TOTAL	2682

TOTAL NONSHIPPERS RETURNED = 156

TOTAL SHIPPERS RETURNED = 24

TOTAL QUESTIONNAIRES RETURNED = 180

TOTAL 03120 CATEGORY POPULATION = 1857

REPORT II. SUMMARY QUESTIONNAIRE TABLES

K . PACKAGE TYPE INFORMATION FOR 03211 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	122
EXEMPT	5338
TOTAL	5460

TOTAL NONSHIPPERS RETURNED = 0

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 2

TOTAL 03211 CATEGORY POPULATION = 61

REPORT II, SUMMARY QUESTIONNAIRE TABLES

L . PACKAGE TYPE INFORMATION FOR 03212 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	1795
TYPE B	6807
EXEMPT	204
LARGE QUANTITY	102
LOW SPECIFIC ACTIVITY	7562
TOTAL	16470

TOTAL NONSHIPPERS RETURNED = 12

TOTAL SHIPPERS RETURNED = 9

TOTAL QUESTIONNAIRES RETURNED = 21

TOTAL 03212 CATEGORY POPULATION = 214

REPORT II, SUMMARY QUESTIONNAIRE TABLES

O . PACKAGE TYPE INFORMATION FOR 03216 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TOTAL	0

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 03216 CATEGORY POPULATION = 57

REPORT II, SUMMARY QUESTIONNAIRE TABLES

P . PACKAGE TYPE INFORMATION FOR 03217 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	10560
TOTAL	10560

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 3

TOTAL 03217 CATEGORY POPULATION = 69

REPORT II, SUMMARY QUESTIONNAIRE TABLES

R . PACKAGE TYPE INFORMATION FOR 03220 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TOTAL	0

TOTAL NONSHIPPERS RETURNED = 4

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 4

TOTAL 03220 CATEGORY POPULATION = 27

REPORT II, SUMMARY QUESTIONNAIRE TABLES

U . PACKAGE TYPE INFORMATION FOR 03310 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	83
TYPE B	166
TOTAL	249

TOTAL NONSHIPPERS RETURNED = 7

TOTAL SHIPPERS RETURNED = 4

TOTAL QUESTIONNAIRES RETURNED = 11

TOTAL 03310 CATEGORY POPULATION = 130

REPORT II, SUMMARY QUESTIONNAIRE TABLES

V . PACKAGE TYPE INFORMATION FOR 03320 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	4587
TYPE B	10071
TOTAL	14658

TOTAL NONSHIPPERS RETURNED = 2

TOTAL SHIPPERS RETURNED = 15

TOTAL QUESTIONNAIRES RETURNED = 17

TOTAL 03320 CATEGORY POPULATION = 178

REPORT II, SUMMARY QUESTIONNAIRE TABLES

X . PACKAGE TYPE INFORMATION FOR 03510 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
EXEMPT	216
TOTAL	216

TOTAL NONSHIPPERS RETURNED = 2

TOTAL SHIPPERS RETURNED = 1

TOTAL QUESTIONNAIRES RETURNED = 3

TOTAL 03510 CATEGORY POPULATION = 162

REPORT II, SUMMARY QUESTIONNAIRE TABLES

Y . PACKAGE TYPE INFORMATION FOR 03520 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	1025
TYPE B	18
EXEMPT	707
LARGE QUANTITY	18
TOTAL	1768

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 3

TOTAL 03520 CATEGORY POPULATION = 53

REPORT II. SUMMARY QUESTIONNAIRE TABLES

Z . PACKAGE TYPE INFORMATION FOR 03610 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	1249
LOW SPECIFIC ACTIVITY	20
TOTAL	1269

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 3

TOTAL QUESTIONNAIRES RETURNED = 4

TOTAL 03610 CATEGORY POPULATION = 78

REPORT II. SUMMARY QUESTIONNAIRE TABLES

AA. PACKAGE TYPE INFORMATION FOR 03620 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	269
TYPE B	12
EXEMPT	350
LOW SPECIFIC ACTIVITY	24
TOTAL	675

TOTAL NONSHIPPERS RETURNED = 28

TOTAL SHIPPERS RETURNED = 6

TOTAL QUESTIONNAIRES RETURNED = 34

TOTAL 03620 CATEGORY POPULATION = 411

REPORT II. SUMMARY QUESTIONNAIRE TABLES

KK. PACKAGE TYPE INFORMATION FOR 03710 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
LOW SPECIFIC ACTIVITY	127
UNKNOWN	64
TOTAL	191

TOTAL NONSHIPPERS RETURNED = 9

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 11

TOTAL 03710 CATEGORY POPULATION = 140

REPORT II. SUMMARY QUESTIONNAIRE TABLES

JJ. PACKAGE TYPE INFORMATION FOR 11700 LICENSEES
(EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE B (FISSILE)	9000
EXEMPT	12
LOW SPECIFIC ACTIVITY	13040
TOTAL	22052

TOTAL NONSHIPPERS RETURNED = 0

TOTAL SHIPPERS RETURNED = 1

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 11700 CATEGORY POPULATION = 4

REPORT III. SUMMARY QUESTIONNAIRE TABLES

A . TRANSPORTATION INFORMATION FOR 01200 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
TOTAL	0.	.00

TOTAL NONSHIPPERS RETURNED = 4

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 4

TOTAL 01200 CATEGORY POPULATION = 434

REPORT III. SUMMARY QUESTIONNAIRE TABLES

B . TRANSPORTATION INFORMATION FOR 02120 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	84.	8.81
TRUCK--UNSPECIFIED	14895.	149.44
TRUCK--UNSPECIFIED	5131.	UNKNOWN
TOTAL	20109.	157.27

TOTAL NONSHIPPERS RETURNED = 13

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 15

TOTAL 02120 CATEGORY POPULATION = 1241

REPORT III. SUMMARY QUESTIONNAIRE TABLES

E . TRANSPORTATION INFORMATION FOR 02200 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	4986.	733.59
TOTAL	4986.	733.10

TOTAL NONSHIPPERS RETURNED = 9

TOTAL SHIPPERS RETURNED = 1

TOTAL QUESTIONNAIRES RETURNED = 10

TOTAL 02200 CATEGORY POPULATION = 733

REPORT III. SUMMARY QUESTIONNAIRE TABLES

F . TRANSPORTATION INFORMATION FOR 02300 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
TOTAL	0.	.00

TOTAL NONSHIPPERS RETURNED = 8

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 8

TOTAL 02300 CATEGORY POPULATION = 474

REPORT III. SUMMARY QUESTIONNAIRE TABLES

G . TRANSPORTATION INFORMATION FOR 02400 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
TOTAL	0.	.00

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 02400 CATEGORY POPULATION = 107

REPORT III. SUMMARY QUESTIONNAIRE TABLES

I . TRANSPORTATION INFORMATION FOR 03110 LICENSEES (EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
TOTAL	0.	.00

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 03110 CATEGORY POPULATION = 55

REPORT III. SUMMARY QUESTIONNAIRE TABLES

J . TRANSPORTATION INFORMATION FOR 03120 LICENSEES (EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	516.	819.35
AUTOMOBILE	74.	7.84
RAIL	105.	105.32
TRUCK--UNSPECIFIED	1249.	102.50
TRUCK--UNSPECIFIED	350.	UNKNOWN
TOTAL	2293.	1033.06

TOTAL NONSHIPPERS RETURNED = 156

TOTAL SHIPPERS RETURNED = 22

TOTAL QUESTIONNAIRES RETURNED = 178

TOTAL 03120 CATEGORY POPULATION = 1857

REPORT III. SUMMARY QUESTIONNAIRE TABLES

K . TRANSPORTATION INFORMATION FOR 03211 LICENSEES (EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	306.	153.49
MAIL	5309.	.49
TOTAL	5615.	153.00

TOTAL NONSHIPPERS RETURNED = 0

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 2

TOTAL 03211 CATEGORY POPULATION = 61

REPORT III. SUMMARY QUESTIONNAIRE TABLES

L . TRANSPORTATION INFORMATION FOR 03212 LICENSEES (EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	7385.	8153.87
UNSPECIFIED--AIRCRAFT	7539.	UNKNOWN
TRUCK--UNSPECIFIED	5468.	10841.18
TOTAL	20392.	18994.07

TOTAL NONSHIPPERS RETURNED = 12

TOTAL SHIPPERS RETURNED = 9

TOTAL QUESTIONNAIRES RETURNED = 21

TOTAL 03212 CATEGORY POPULATION = 214

REPORT III. SUMMARY QUESTIONNAIRE TABLES

O . TRANSPORTATION INFORMATION FOR 03216 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
TOTAL	0.	.00

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 03216 CATEGORY POPULATION = 57

REPORT III. SUMMARY QUESTIONNAIRE TABLES

P . TRANSPORTATION INFORMATION FOR 03217 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	691.	69.54
TRUCK--UNSPECIFIED	9549.	644.69
TOTAL	10239.	713.25

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 3

TOTAL 03217 CATEGORY POPULATION = 69

REPORT III. SUMMARY QUESTIONNAIRE TABLES

R . TRANSPORTATION INFORMATION FOR 03220 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
TOTAL	0.	.00

TOTAL NONSHIPPERS RETURNED = 4

TOTAL SHIPPERS RETURNED = 0

TOTAL QUESTIONNAIRES RETURNED = 4

TOTAL 03220 CATEGORY POPULATION = 27

REPORT III. SUMMARY QUESTIONNAIRE TABLES

U . TRANSPORTATION INFORMATION FOR 03310 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	465.	2241.31
UNSPECIFIED--AIRCRAFT	25.	UNKNOWN
TRUCK--UNSPECIFIED	119.	119.17
TOTAL	608.	2359.51

TOTAL NONSHIPPERS RETURNED = 7

TOTAL SHIPPERS RETURNED = 4

TOTAL QUESTIONNAIRES RETURNED = 11

TOTAL 03310 CATEGORY POPULATION = 130

REPORT III. SUMMARY QUESTIONNAIRE TABLES

V . TRANSPORTATION INFORMATION FOR 03320 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	2247.	7366.34
AUTOMOBILE	1048.	524.27
TRUCK--UNSPECIFIED	8113.	5587.95
TOTAL	11428.	13477.09

TOTAL NONSHIPPERS RETURNED = 2

TOTAL SHIPPERS RETURNED = 15

TOTAL QUESTIONNAIRES RETURNED = 17

TOTAL 03320 CATEGORY POPULATION = 178

REPORT III. SUMMARY QUESTIONNAIRE TABLES

X . TRANSPORTATION INFORMATION FOR 03510 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	217.	.49
TOTAL	217.	.00

TOTAL NONSHIPPERS RETURNED = 2

TOTAL SHIPPERS RETURNED = 1

TOTAL QUESTIONNAIRES RETURNED = 3

TOTAL 03510 CATEGORY POPULATION = 162

REPORT III. SUMMARY QUESTIONNAIRE TABLES

Y . TRANSPORTATION INFORMATION FOR 03520 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
AUTOMOBILE	390.	311.82
MAIL	496.	304.91
TRUCK--UNSPECIFIED	1171.	150.29
TOTAL	2056.	765.56

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 3

TOTAL 03520 CATEGORY POPULATION = 53

REPORT III. SUMMARY QUESTIONNAIRE TABLES

Z . TRANSPORTATION INFORMATION FOR 03610 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	333.	439.49
UNSPECIFIED--AIRCRAFT	40.	UNKNOWN
TRUCK--UNSPECIFIED	1094.	844.44
TOTAL	1467.	1282.95

TOTAL NONSHIPPERS RETURNED = 1

TOTAL SHIPPERS RETURNED = 3

TOTAL QUESTIONNAIRES RETURNED = 4

TOTAL 03610 CATEGORY POPULATION = 78

REPORT III. SUMMARY QUESTIONNAIRE TABLES

AA. TRANSPORTATION INFORMATION FOR 03620 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	353.	1.75
TRUCK--COMMON CARRIER	25.	UNKNOWN
TRUCK--UNSPECIFIED	305.	47.28
TOTAL	682.	48.05

TOTAL NONSHIPPERS RETURNED = 28

TOTAL SHIPPERS RETURNED = 6

TOTAL QUESTIONNAIRES RETURNED = 34

TOTAL 03620 CATEGORY POPULATION = 411

REPORT III. SUMMARY QUESTIONNAIRE TABLES

KK. TRANSPORTATION INFORMATION FOR 03710 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
AUTOMOBILE	78.	UNKNOWN
TRUCK--UNSPECIFIED	128.	.49
TOTAL	206.	.00

TOTAL NONSHIPPERS RETURNED = 9

TOTAL SHIPPERS RETURNED = 2

TOTAL QUESTIONNAIRES RETURNED = 11

TOTAL 03710 CATEGORY POPULATION = 140

REPORT III. SUMMARY QUESTIONNAIRE TABLES

JJ. TRANSPORTATION INFORMATION FOR 11700 LICENSEES
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	13.	.62
RAIL	13129.	5251.89
SHIP	15080.	7540.49
TRUCK--UNSPECIFIED	1275.	510.49
TOTAL	29496.	13301.53

TOTAL NONSHIPPERS RETURNED = 0

TOTAL SHIPPERS RETURNED = 1

TOTAL QUESTIONNAIRES RETURNED = 1

TOTAL 11700 CATEGORY POPULATION = 4

E. RADIONUCLIDE INFORMATION FOR ALL NRC LICENSEES COMBINED
(EXTRAPOLATED TOTALS)

(1-1) RADIONUCLIDE	(1-2) KG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
AM241	31	.5205E+00		DS
AM241	104	.1087E+02		NS
AM241	18	.1020E+01		SS
AR 41	12	.2854E+01	ELEMENT	G
AU198	20	.1816E+01	METAL	L
AU198	156	.4900E+00	METAL	NS
BA133	244	.4902E+00	CHLORIDE	L
CA 45	12	.5021E+00	CARBONATE	L
CD109	153	.4902E+00	CHLORIDE	NS
CI 36	122	.4900E+00	ACID	L
CI 38	18	.1197E+01	SALT	DS
CO 57	183	.4901E+00	CHLORIDE	NS
CO 57	20	.5076E+00	METAL	NS
CO 58	31	.5510E+00		DS
CO 60	1007	.4906E+00	CHLORIDE	L
CO 60	20	.4900E+00	CHLORIDE	NS
CO 60	403	.1636E+05	METAL	NS
CO 60	195	.3415E+01	SALT	L
CO 60	64	.4910E+00	SALT	NS
CO 60	62	.6428E+00		DS
CO 60	242	.2692E+07		NS
CO 60	52	.5759E+04		SF
CO 60	52	.3926E+04		SS
CO 60	52	.1047E+04		
CR 51	4021	.6772E+01	CHLORIDE	NS
CR 51	102	.2067E+02	SALT	L
CR 51	465	.1421E+01		NS
CR 66	106	.2857E+01	METAL	NS
CS134	98	.2518E+01	SALT	L
CS137	4975	.9968E+00	CHLORIDE	NS
CS137	12	.6534E+01	METAL	NS
CS137	10	.5677E+01		DS
CS137	93	.6507E+01		NS
C 14	216	.5008E+00	AMINO ACID	S
C 14	641	.5130E+00	CARBONATE	L
C 14	728	.1296E+02	ORGANIC	L
C 14	4654	.2352E+01		NS
E	124	.4901E+00	OXIDE	G
FE 55	78	.6850E+00	METAL	NS
FE 59	35	.5783E+00	METAL	NS
HG203	41	.3084E+01	METAL	L
HG203	21	.1527E+01	METAL	NS
H 3	166	.3535E+02	ELEMENT	G
H 3	734	.5286E+03	ORGANIC	L
H 3	31	.5200E+00	ORGANIC	NS
H 3	79	.1766E+03	OXIDE	L
H 3	18	.9421E+03		G
H 3	730	.1751E+02		L
H 3	9654	.1406E+02		NS
IN114	16	.6137E+00	METAL	NS
IR192	9284	.7277E+06	METAL	NS
IR192	10	.1052E+03	METAL	SS
IR192	366	.1785E+05	OXIDE	DS
IR192	66	.5715E+03	OXIDE	NS
IR192	955	.3381E+05		NS
IR192	3203	.3151E+06		SF
IR192	2868	.1286E+06		SS
IR192	52	.5235E+04		

REPORT I.E (continued)

(1-1) RADIONUCLIDE	(1-2) PKG/YR	(1-3) CI/YR	(1-4) CHEMICAL FORM	(1-4) PHYSICAL FORM
I 125	326	.890RE+00	CHLORIDE	NS
I 125	306	.497RE+00	IODIDE	NS
I 125	12023	.5330E+03	ORGANIC	L
I 125	755	.5585E+01	ORGANIC	NS
I 125	205	.4905E+00	SALT	NS
I 125	114	.6041E+00		L
I 125	183	.1567E+04		
I 131	3665	.1882E+02	CHLORIDE	L
I 131	1474	.6180E+00		DS
I 131	26	.2906E+01		
KR 85	4861	.2864E+03	ELEMENT	G
LA140	71	.1554E+01	CHLORIDE	DS
MN 54	153	.4901E+00	CHLORIDE	L
MN 56	18	.1073E+01	METAL	NS
NA 22	183	.4901E+00	CHLORIDE	NS
NA 24	88	.2310E+01	SALT	DS
NI 63	33	.9203E+00	METAL	NS
NI 63	415	.6715E+01	OXIDE	NS
OS193	59	.4900E+00	METAL	NS
PM147	30	.1087E+02	OXIDE	NS
PO210	176	.1017E+01	METAL	NS
PO210	397	.4900E+00	NITRATE	NS
PO210	23	.7318E+00	OXIDE	NS
PO210	283	.3317E+01		NS
PT197	78	.4900E+00	METAL	NS
PU238	31	.2242E+01	OXIDE	NS
P 32	230	.5404E+02	ORGANIC	DS
P 32	12	.6109E+00	PHOSPHATE	L
RA225	61	.6767E+00		NS
RA226	10	.4901E+00		SF
RA228	13	.2046E+01		
SB122	18	.6137E+00	METAL	NS
SB124	124	.1709E+02	SALT	SS
SR 85	14	.5253E+00	ORGANIC	L
SR 90	549	.4900E+00	CHLORIDE	L
SR 90	39	.4929E+00	OXIDE	
SR 90	104	.2124E+02	SALT	NS
SR 90	519	.1346E+02		DS
SR 90	78	.4368E+01		NS
S 35	10	.4900E+00	ORGANIC	L
S 35	10	.4900E+00	ORGANIC	NS
TC 99M	14	.4907E+01	ORGANIC	L
TC 99	698	.6296E+00	PHOSPHATE	L
TC 99	4033	.1944E+03		L
TE123M	39	.7374E+01	METAL	NS
TL204	122	.4931E+00	NITRATE	L
UN	156	.1561E+03	METAL	NS
U 235	9012	.2945E+02	OXIDE	DS
U 238	13050	.8909E+03	OXIDE	DS
*	34	.6109E+00		L
XX040	61	.3446E+01		DS
TOTAL	97898	3.9536E+06		

TOTAL NONSHIPPERS RETURNED = 260

TOTAL SHIPPERS RETURNED = 74

TOTAL QUESTIONNAIRES RETURNED = 334

TOTAL POPULATION OF CATEGORIES = 7154

REPORT II. SUMMARY QUESTIONNAIRE TABLES

E. PACKAGE TYPE INFORMATION FOR ALL NRC LICENSEES COMBINED (EXTRAPOLATED TOTALS BY PACKAGE TYPE)

(2-1) TYPE	(2-2) PKG/YR
TYPE A	34782
TYPE B (FISSILE)	9000
TYPE B	17352
EXEMPT	9133
LARGE QUANTITY	120
LOW SPECIFIC ACTIVITY	21041
UNKNOWN	64
TOTAL	91492

TOTAL NONSHIPPERS RETURNED = 260

TOTAL SHIPPERS RETURNED = 75

TOTAL QUESTIONNAIRES RETURNED = 335

TOTAL POPULATION OF CATEGORIES = 7154

REPORT III. SUMMARY QUESTIONNAIRE TABLES

E. TRANSPORTATION INFORMATION FOR ALL NRC LICENSEES COMBINED
(EXTRAPOLATED TOTALS BY MODE OF TRANSPORT)

(3-1) MAJOR MODE	PKGS / YR	TOTAL TI / YR
UNSPECIFIED--AIRCRAFT	17612.	19983.25
UNSPECIFIED--AIRCRAFT	7603.	UNKNOWN
AUTOMOBILE	1511.	842.96
AUTOMOBILE	78.	UNKNOWN
MAIL	5805.	304.91
RAIL	13234.	5356.72
SHIP	15080.	7540.09
TRUCK--COMMON CARRIER	25.	UNKNOWN
TRUCK--UNSPECIFIED	43368.	18993.01
TRUCK--UNSPECIFIED	5481.	UNKNOWN
TOTAL	109788.	53018.88

TOTAL NONSHIPPERS RETURNED = 260

TOTAL SHIPPERS RETURNED = 72

TOTAL QUESTIONNAIRES RETURNED = 332

TOTAL POPULATION OF CATEGORIES = 7154

SYSTEM DESIGN CHARTS

The following pages contain the system design charts for the Computer Programs used for this program. The legend (Figure B.2) for the charts is provided below.

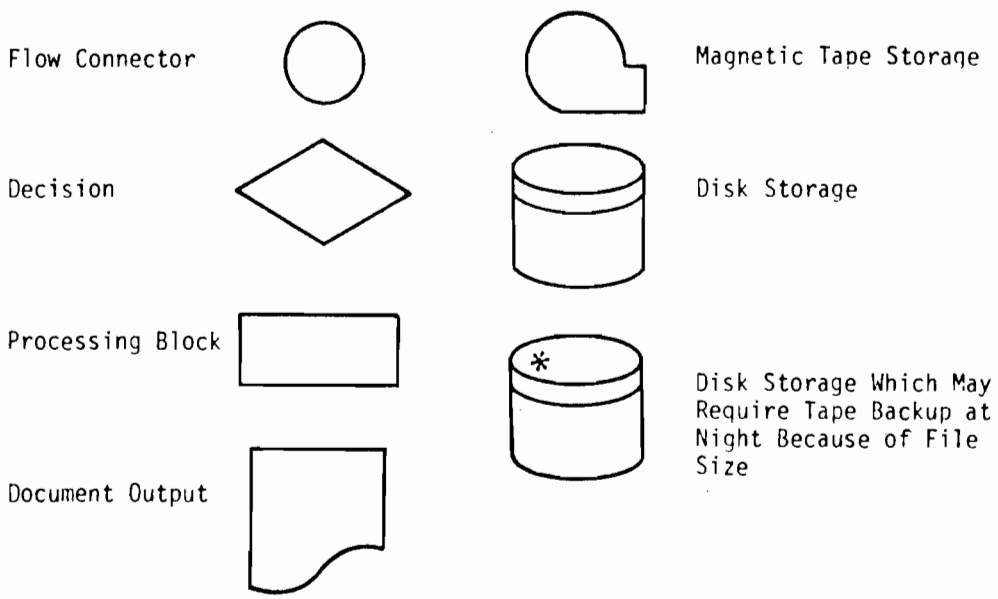


FIGURE B.2. Legend for System Design Charts

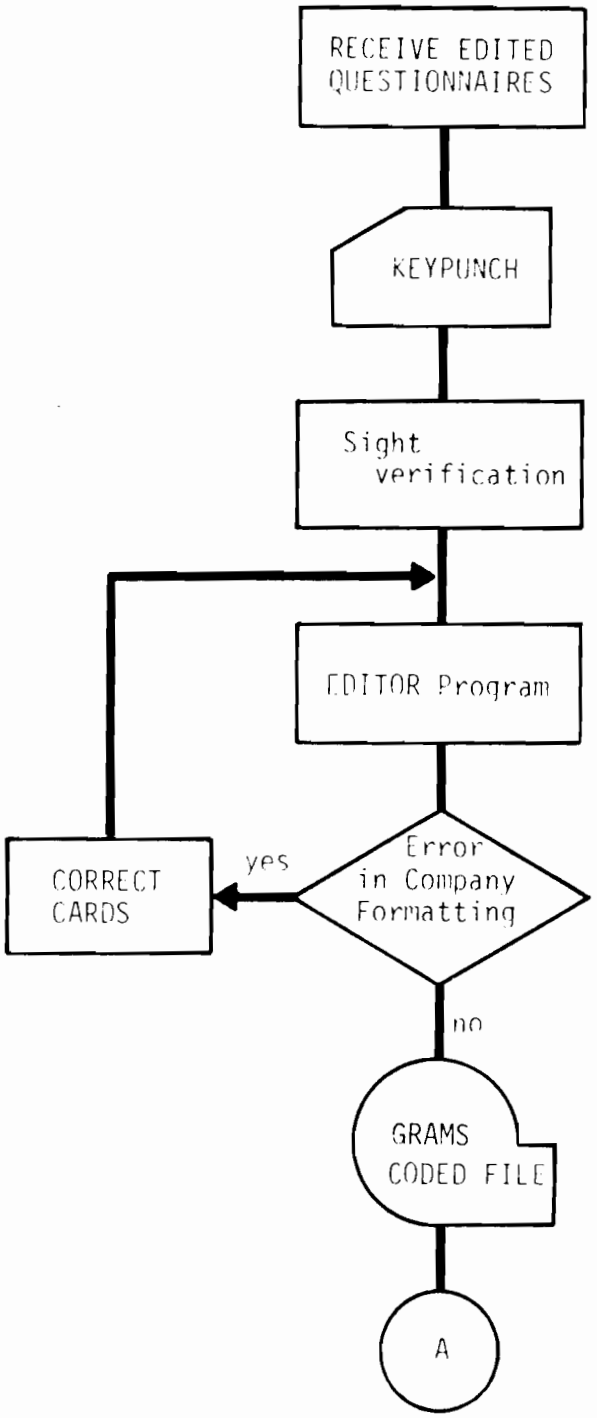


FIGURE B.3. System Design for SNM/Source Material Reports

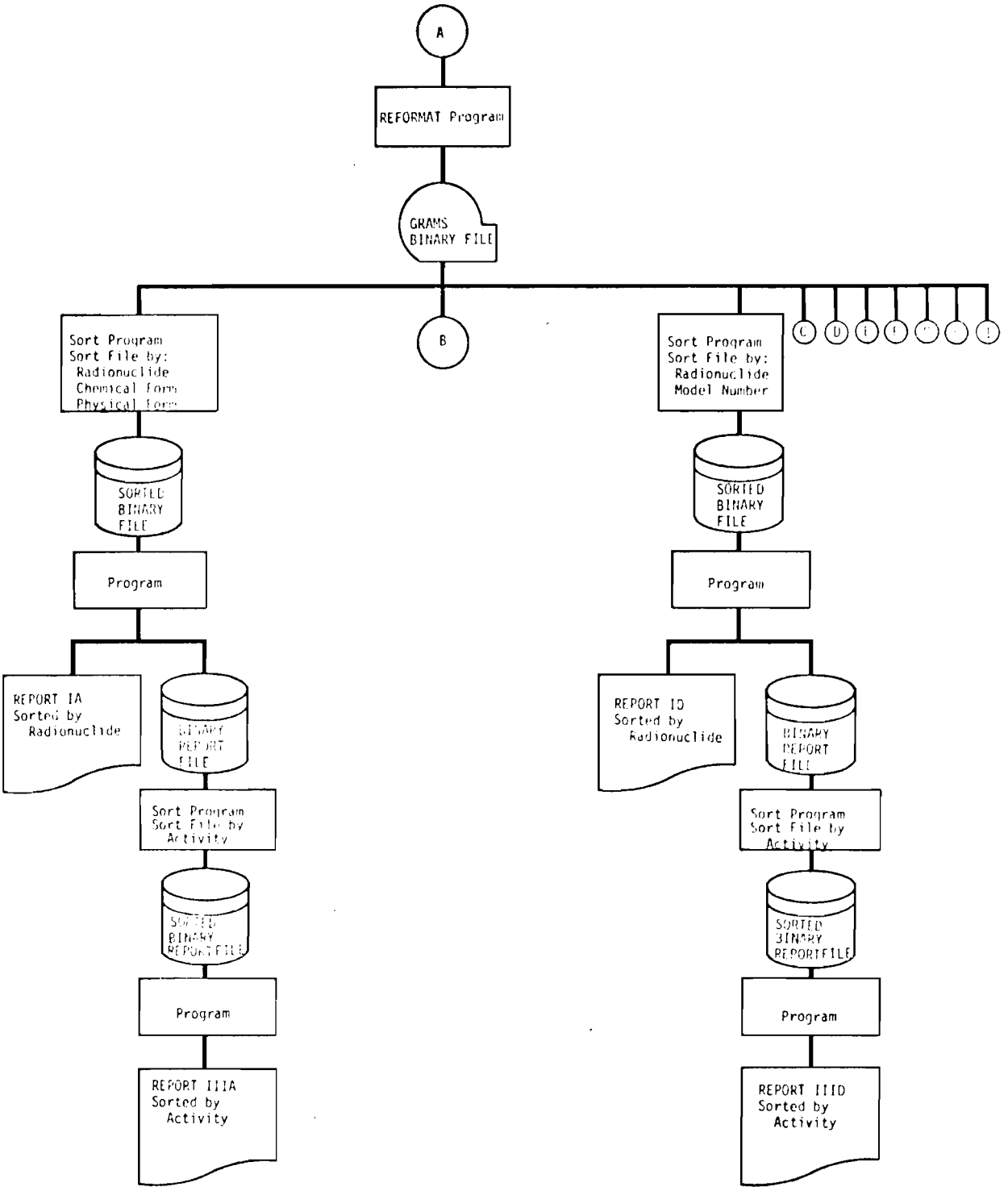


FIGURE B.3. (contd)

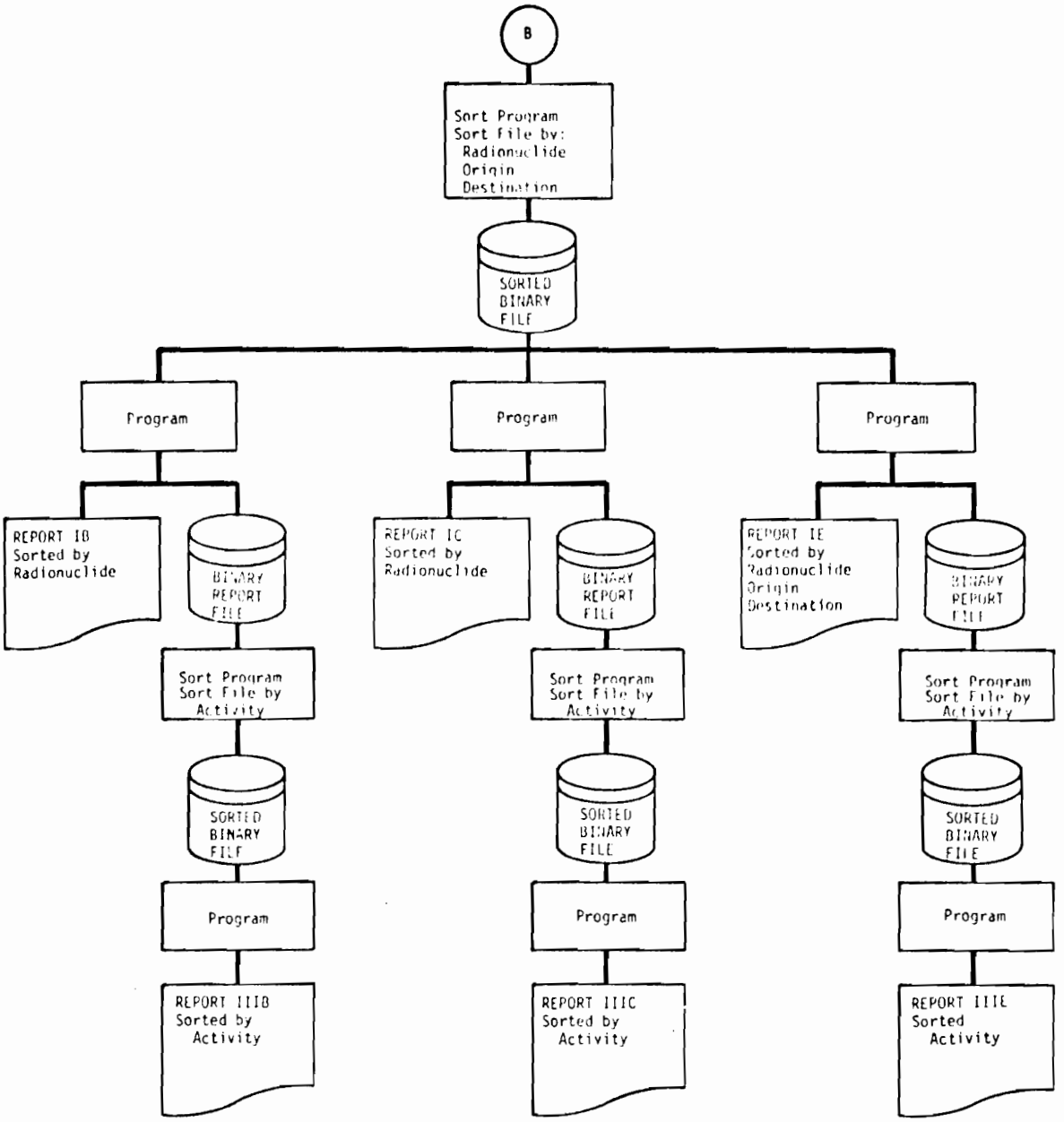
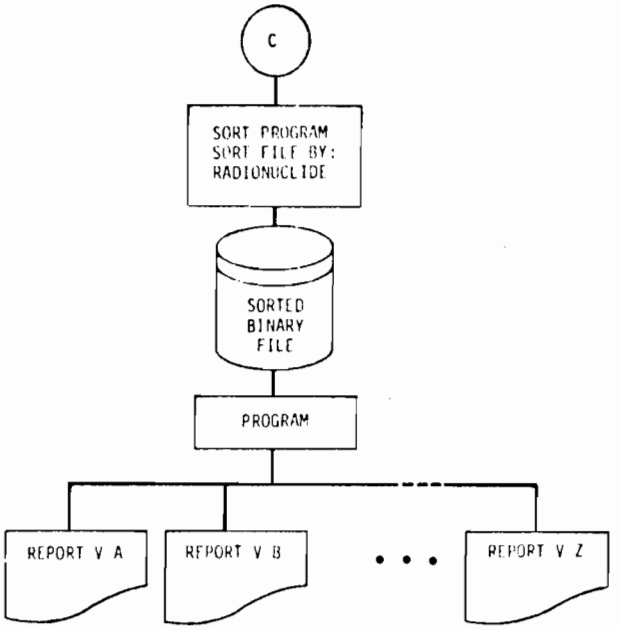


FIGURE B.3. (contd)



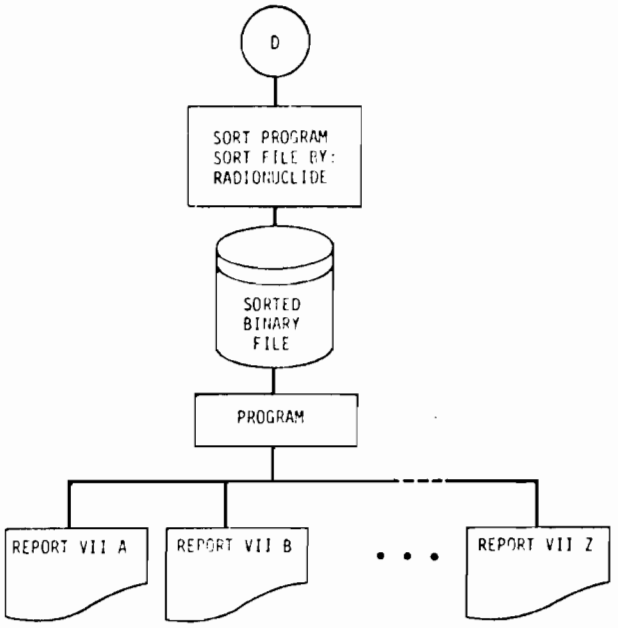


FIGURE B.3. (contd)

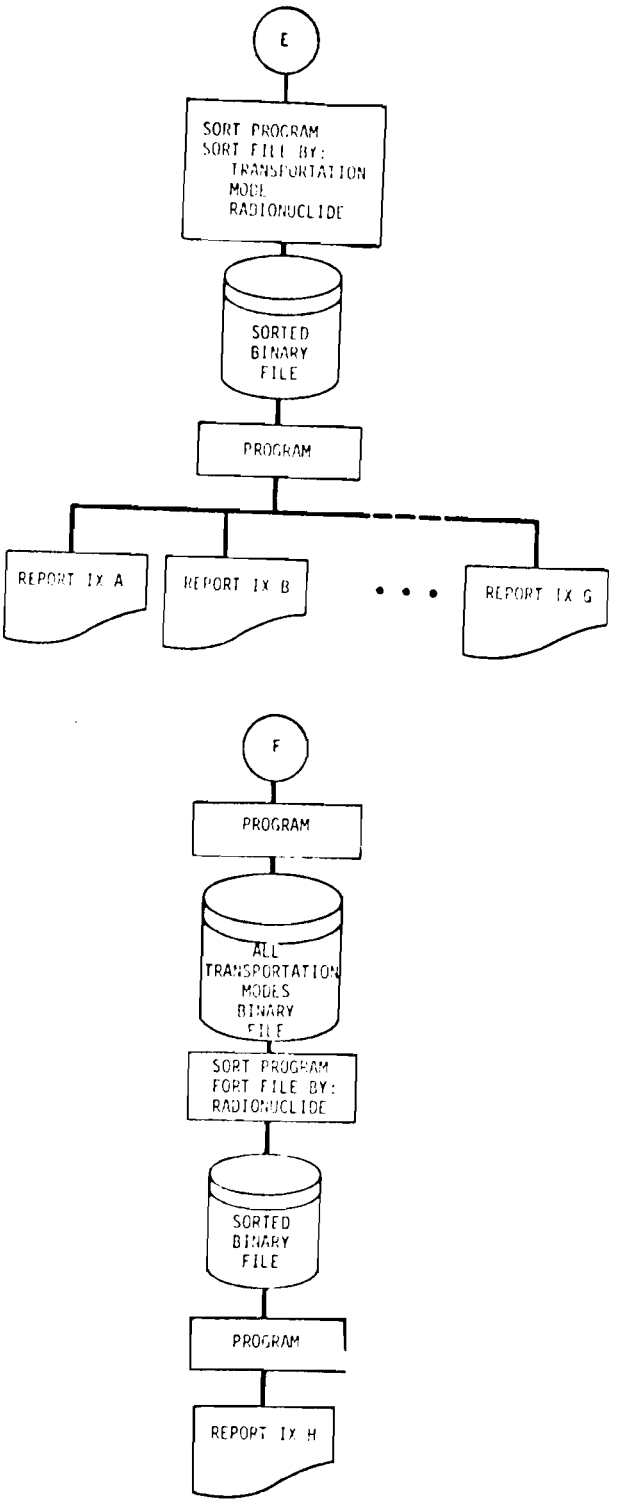


FIGURE B.3. (contd)

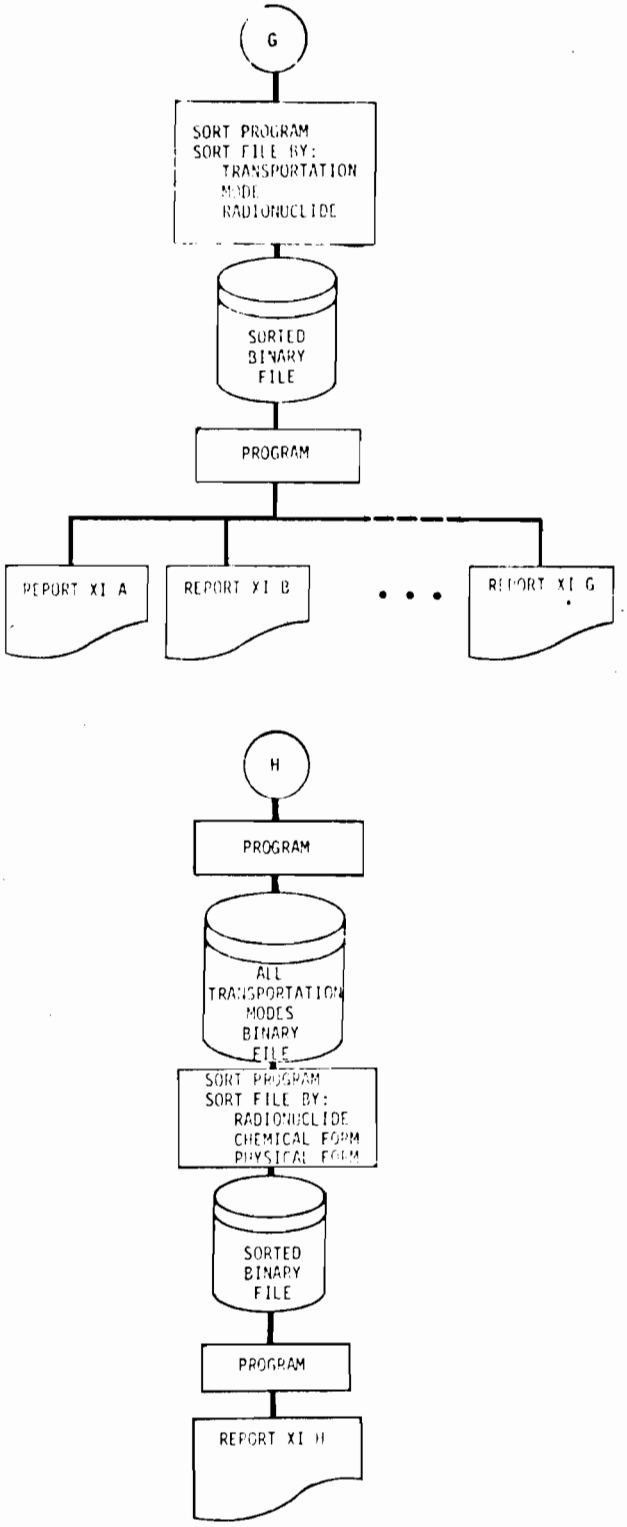


FIGURE B.3. (contd)

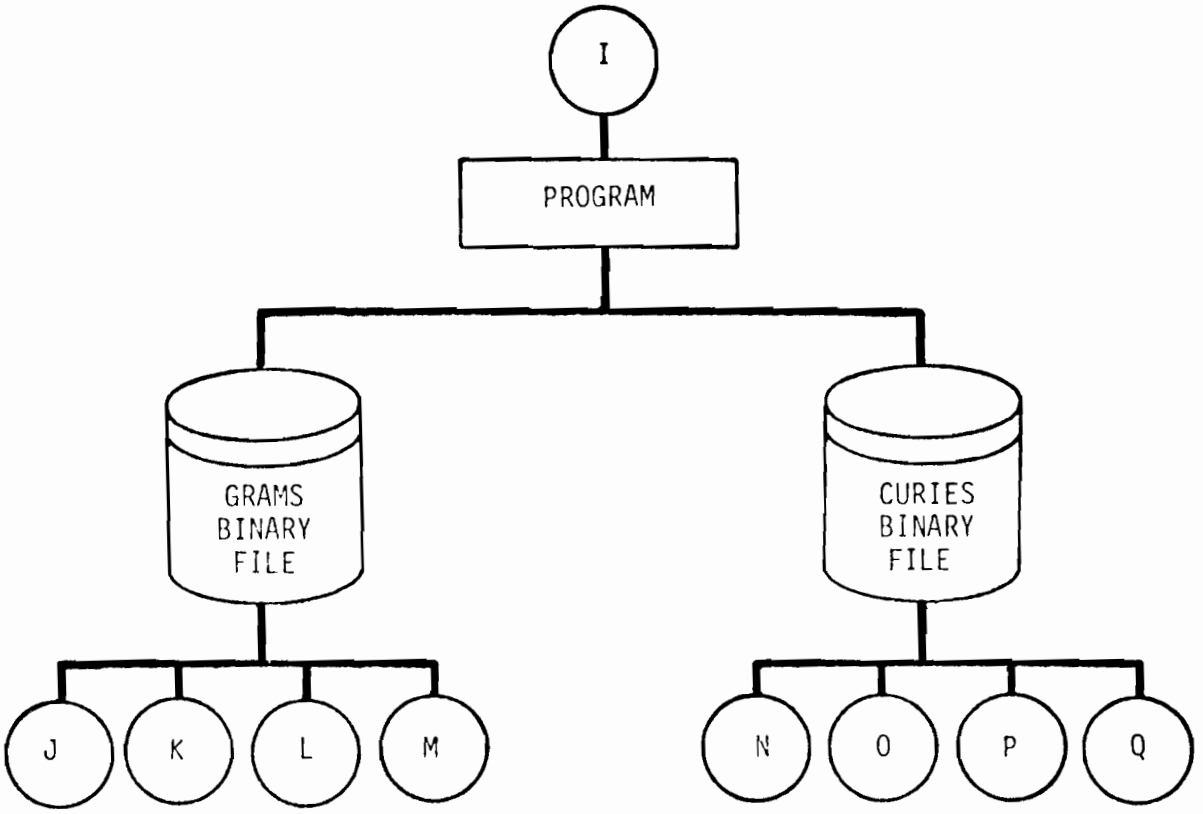


FIGURE B.3. (contd)

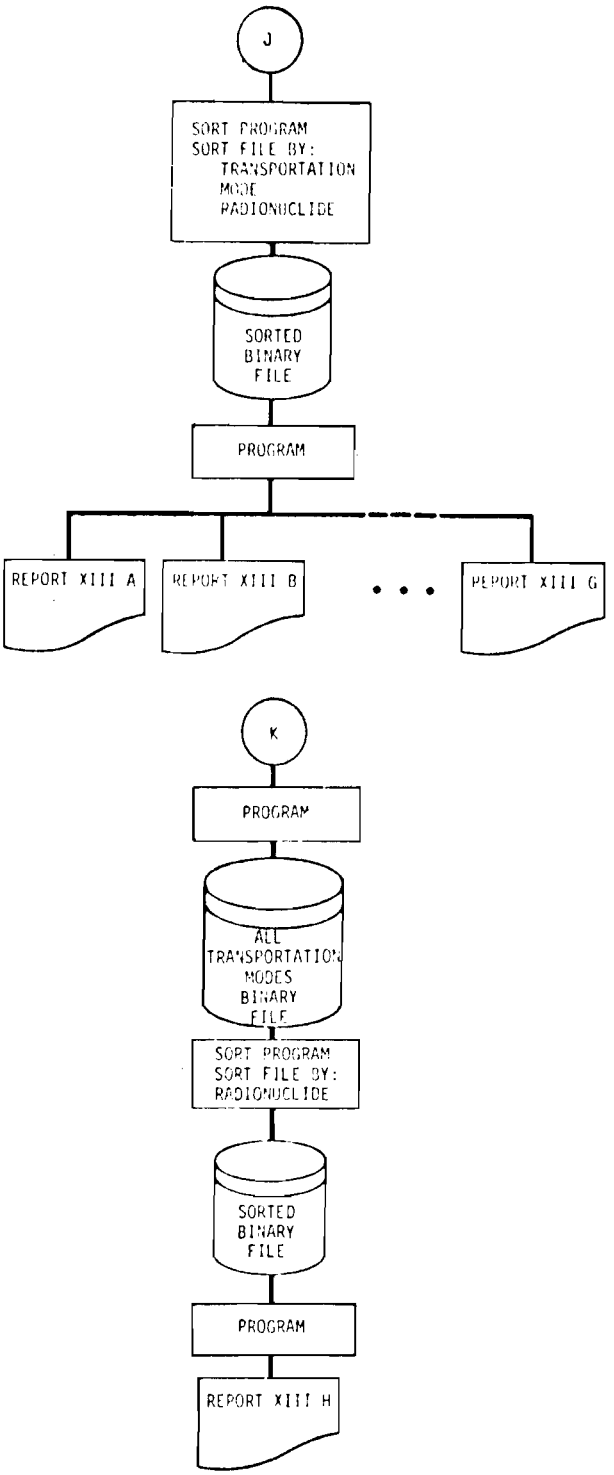


FIGURE B.3. (contd)

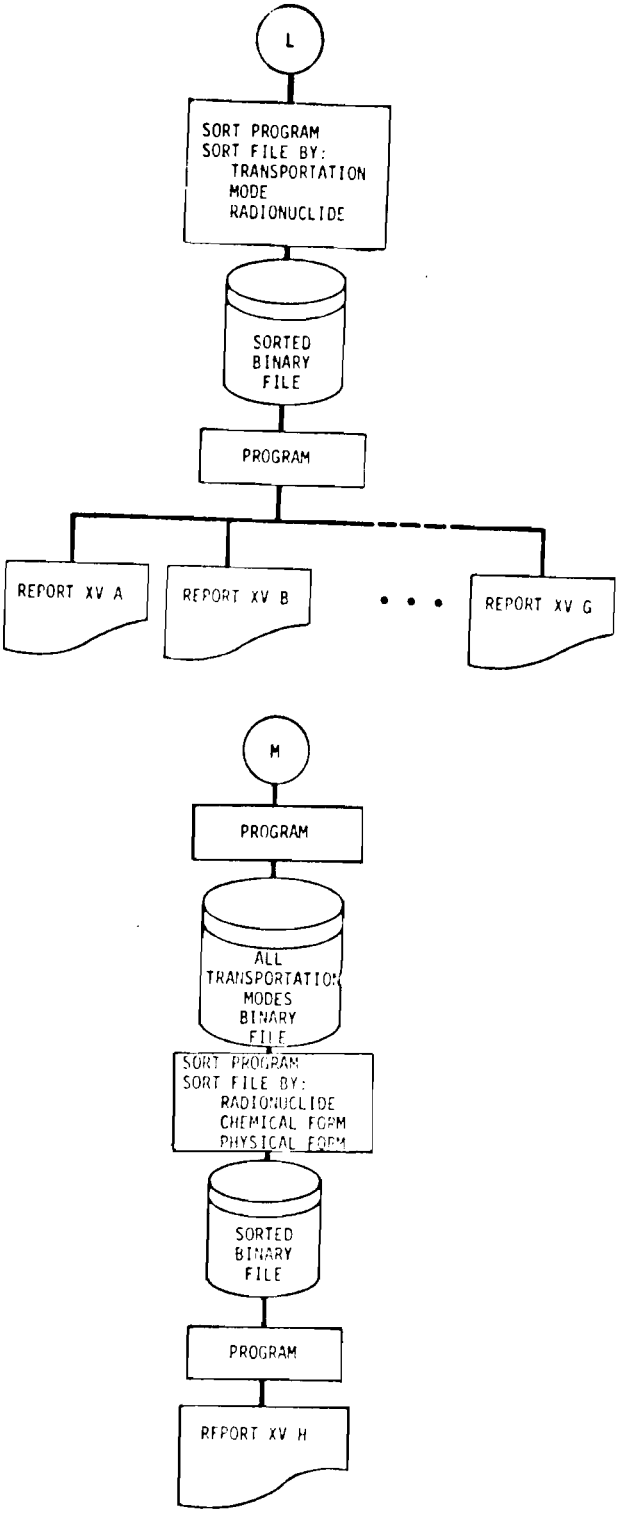
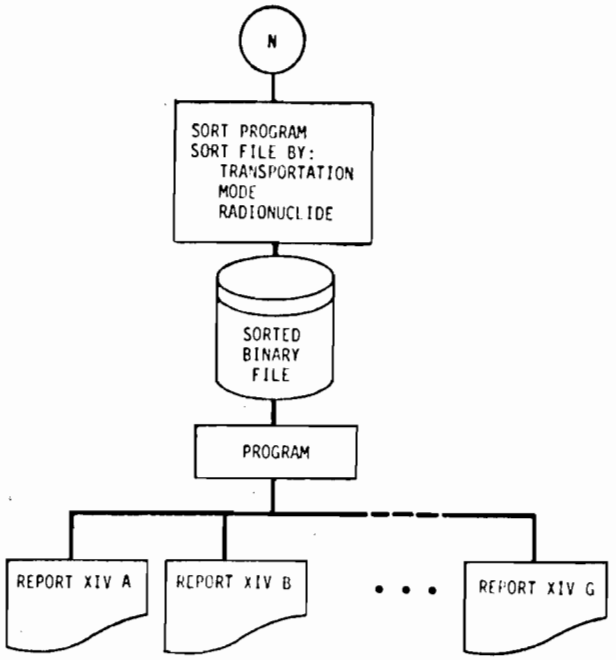


FIGURE B.3. (contd)



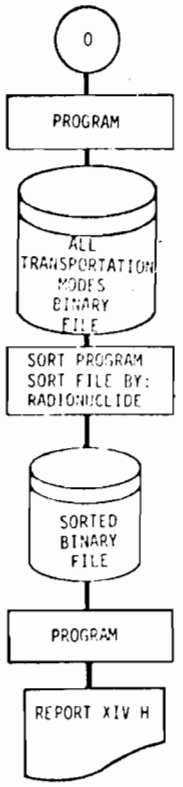


FIGURE B.3. (contd)

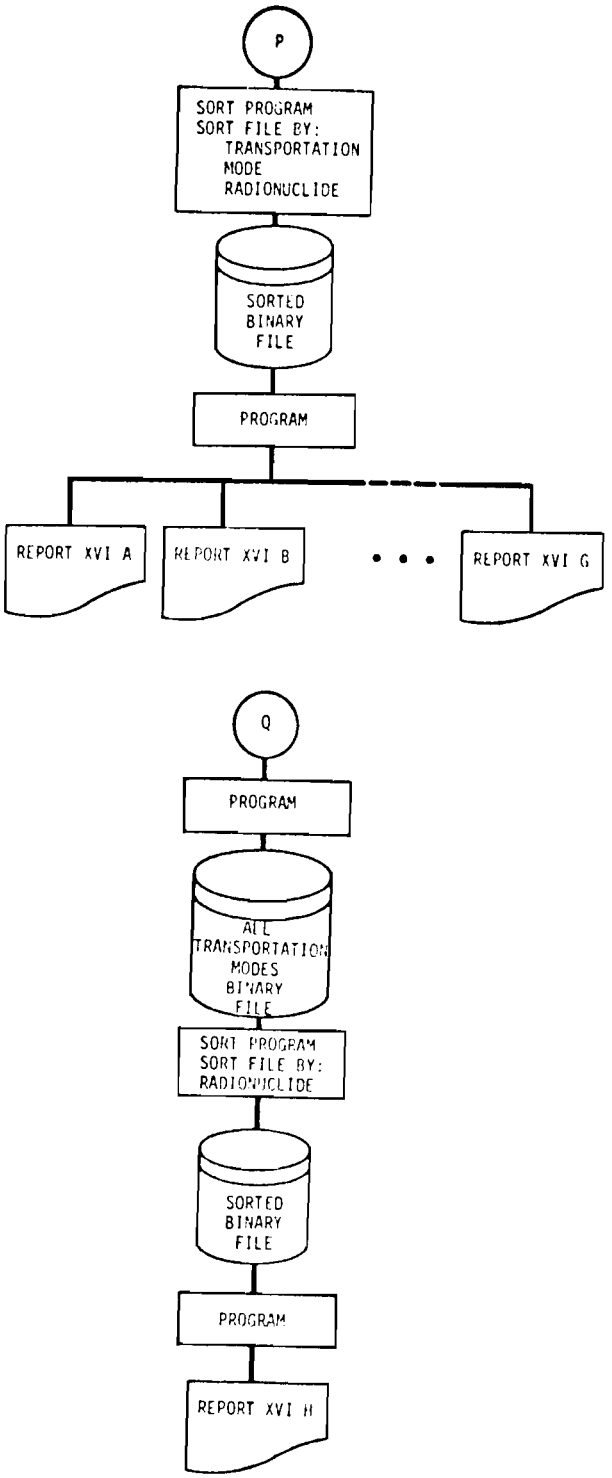


FIGURE B.3. (contd)

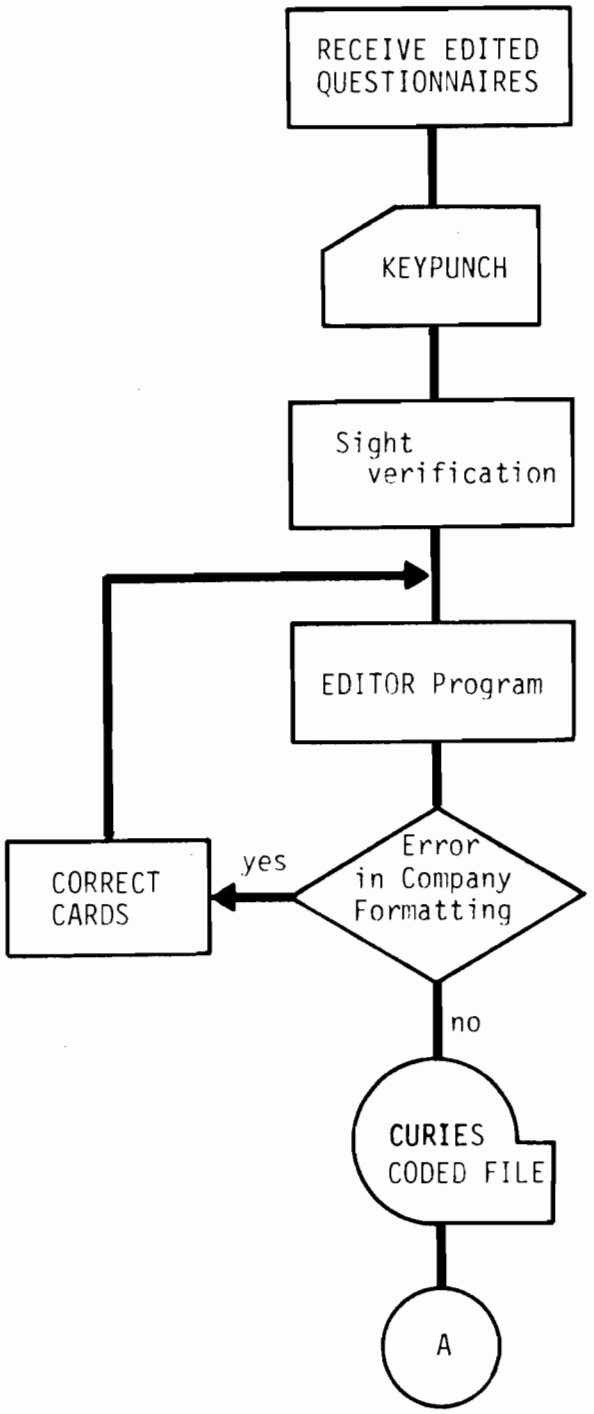


FIGURE B.4. System Design for Non-SNM/Source Material Reports

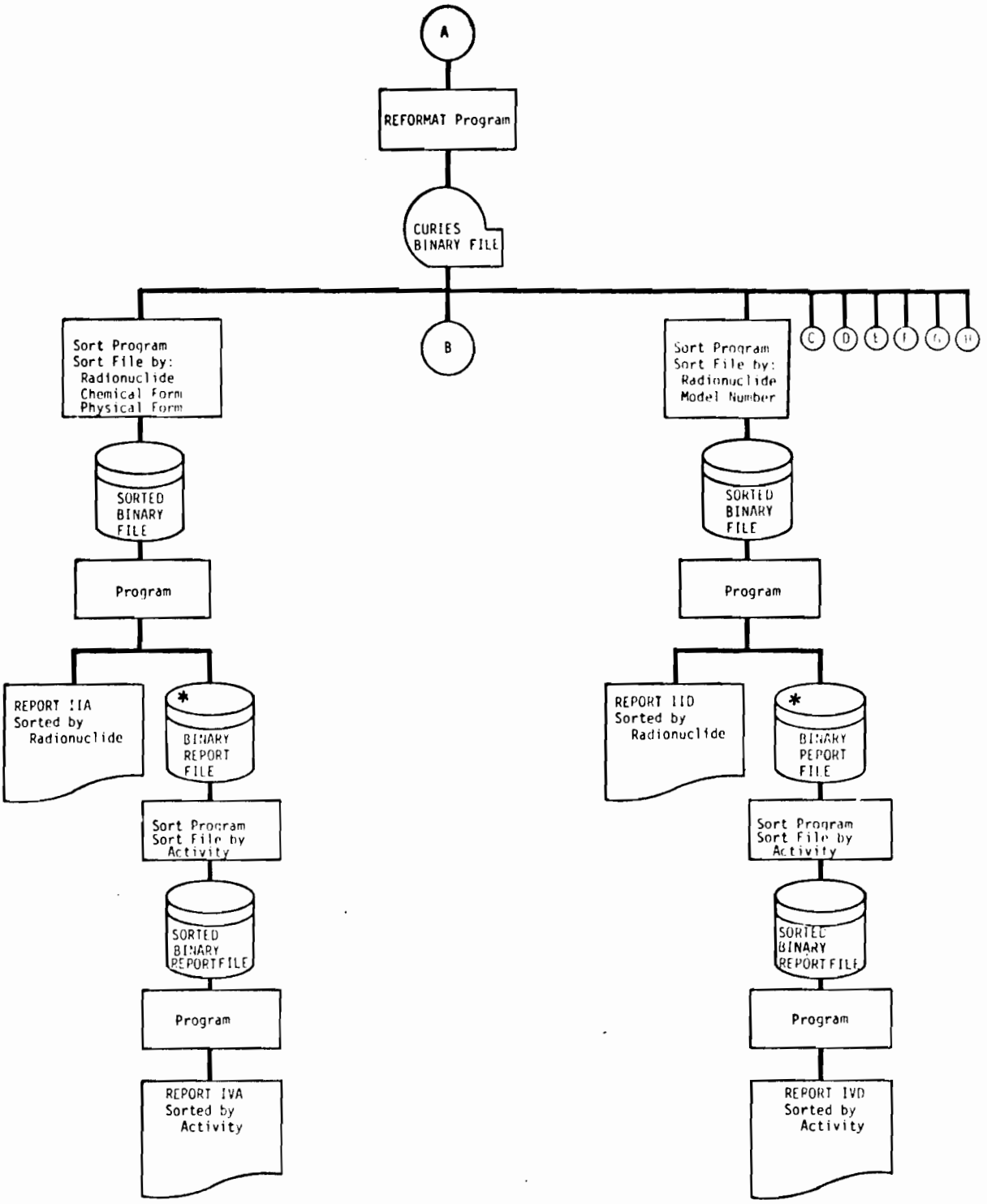


FIGURE B.4. (contd)

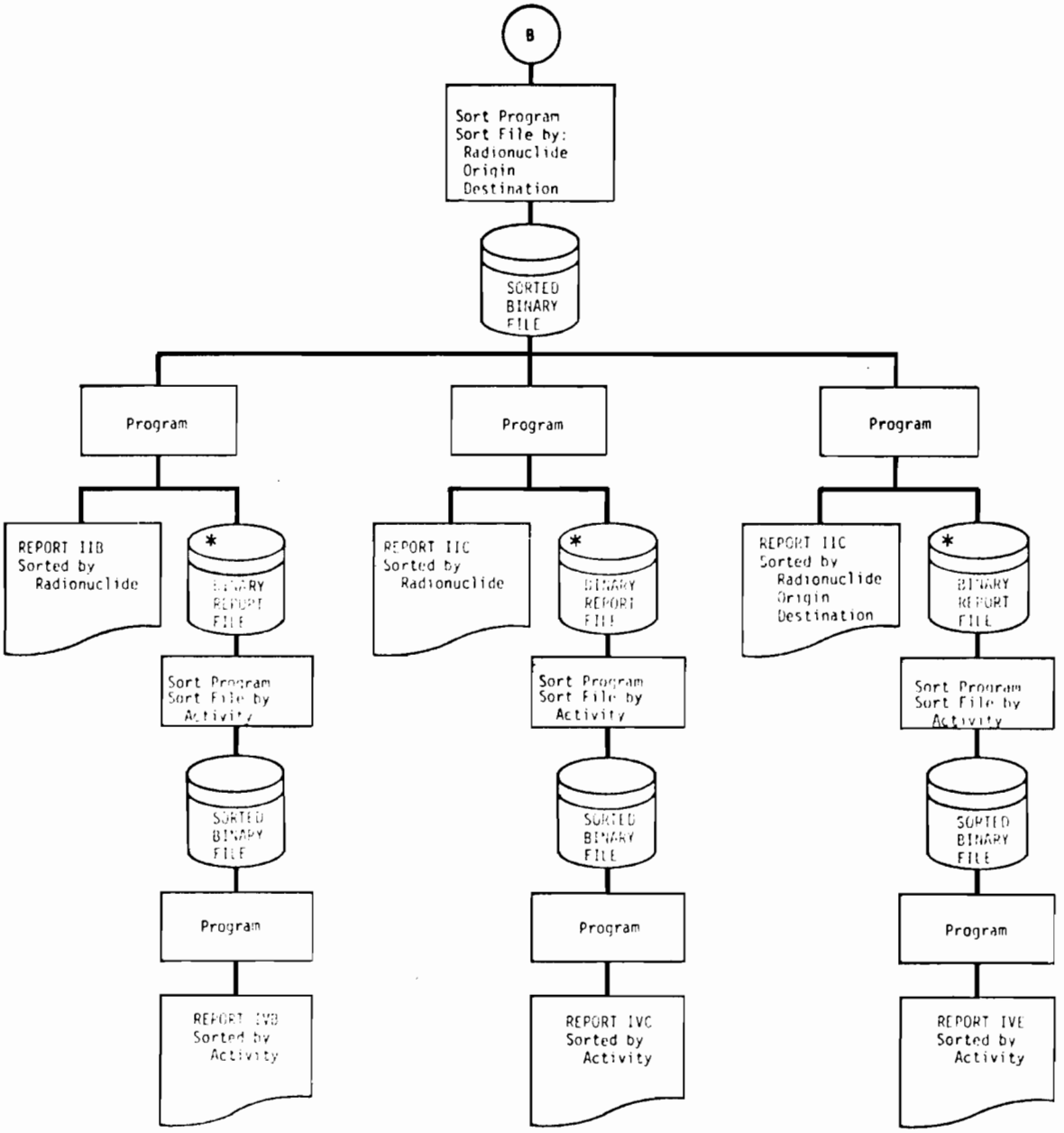
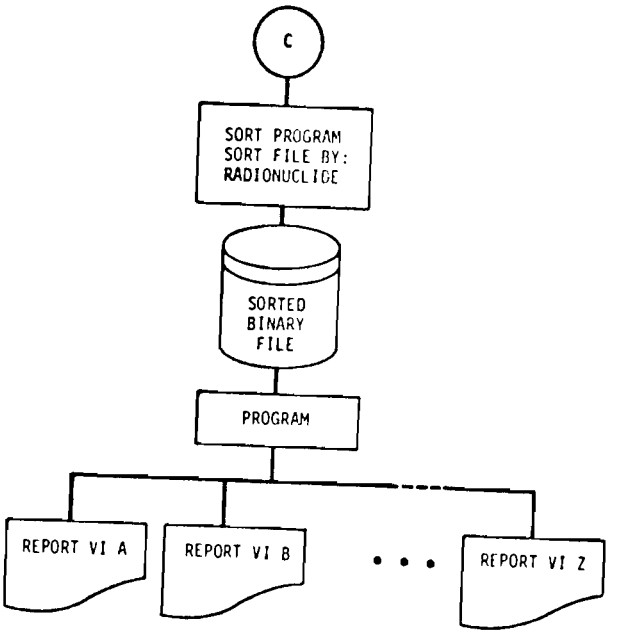


FIGURE B.4. (contd)



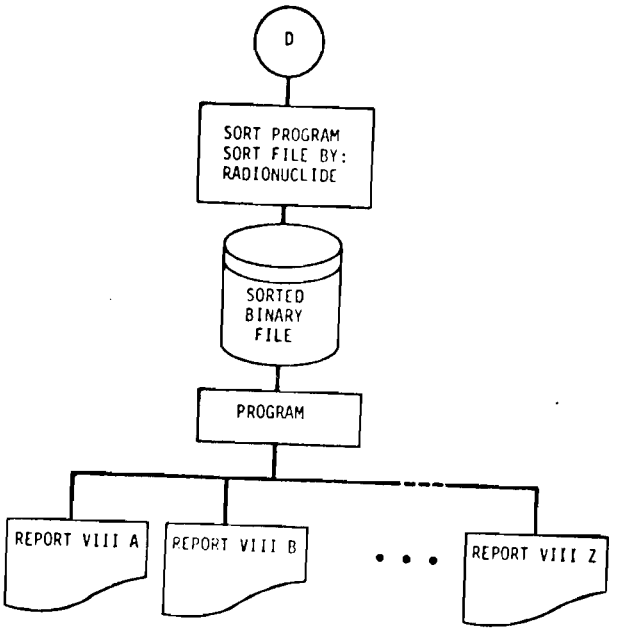
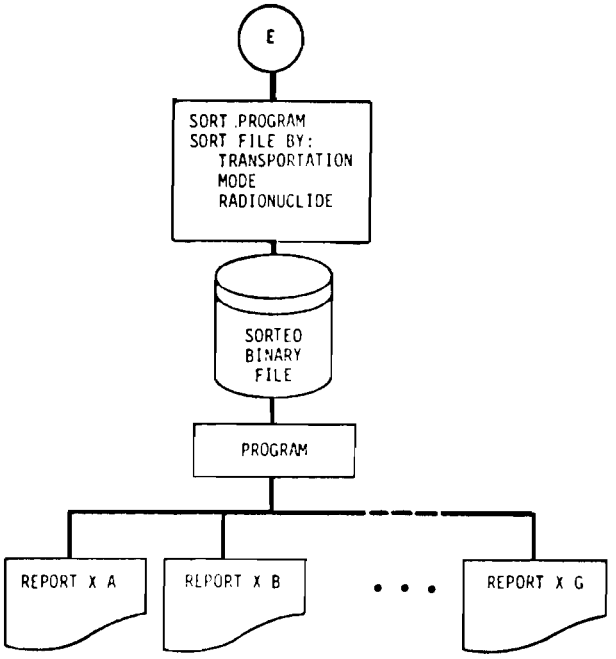


FIGURE B.4. (contd)



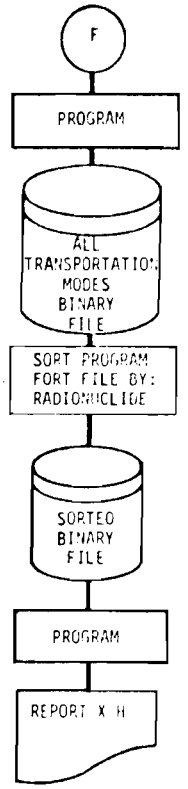


FIGURE B.4. (contd)

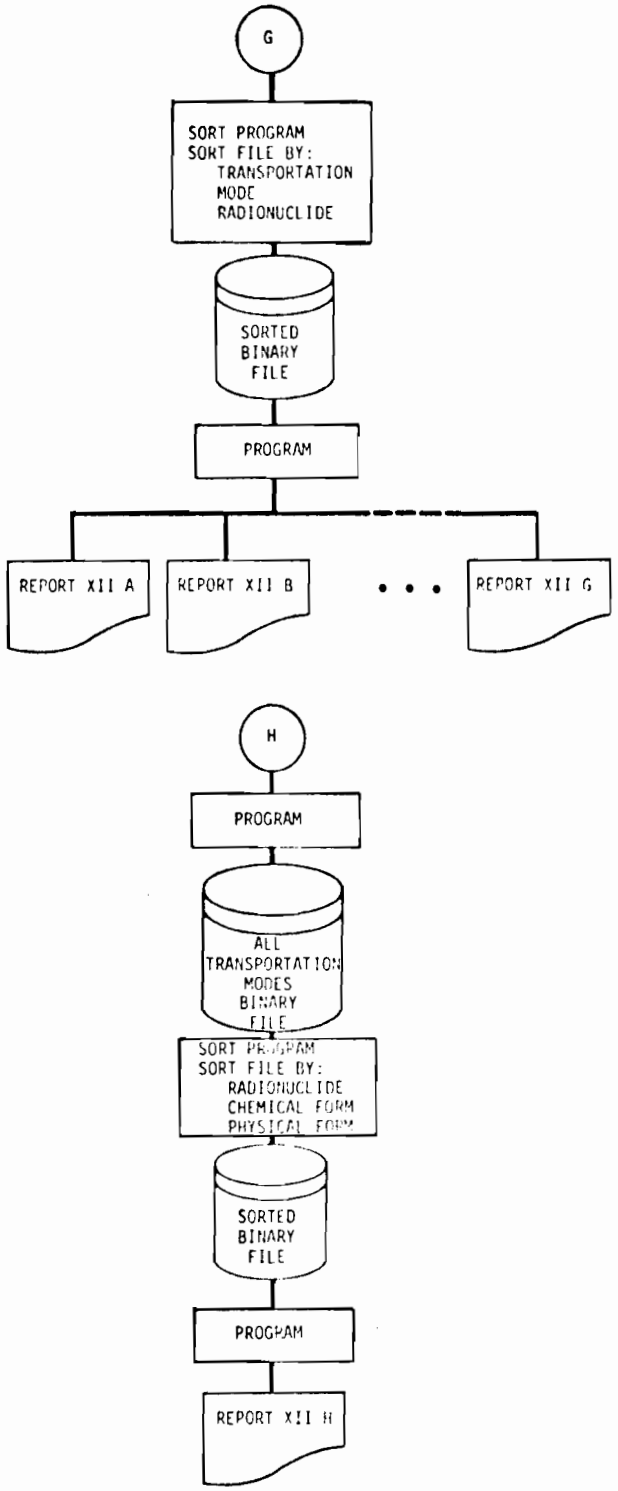


FIGURE B.4. (contd)

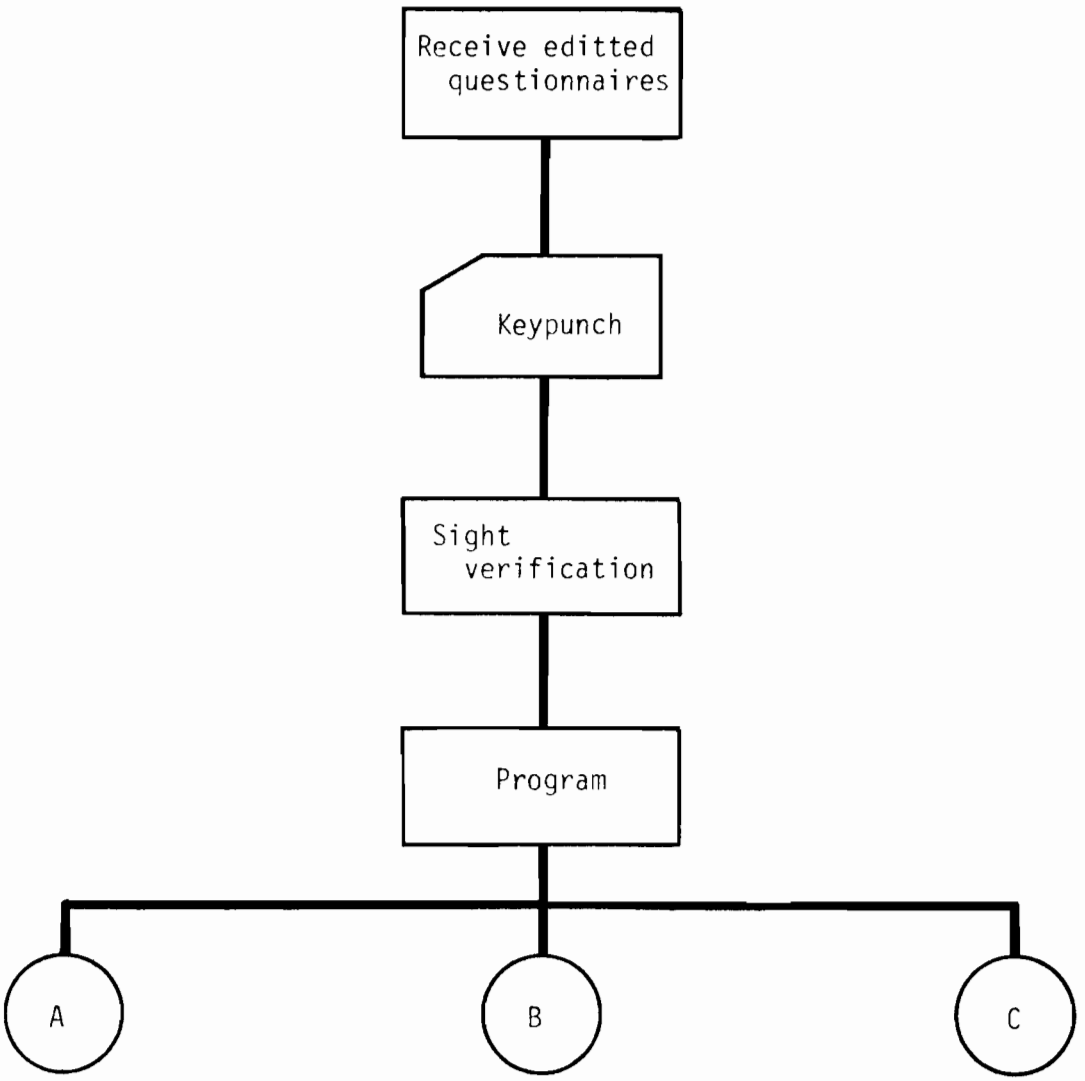


FIGURE B.5. System Design for Summary Questionnaire Reports

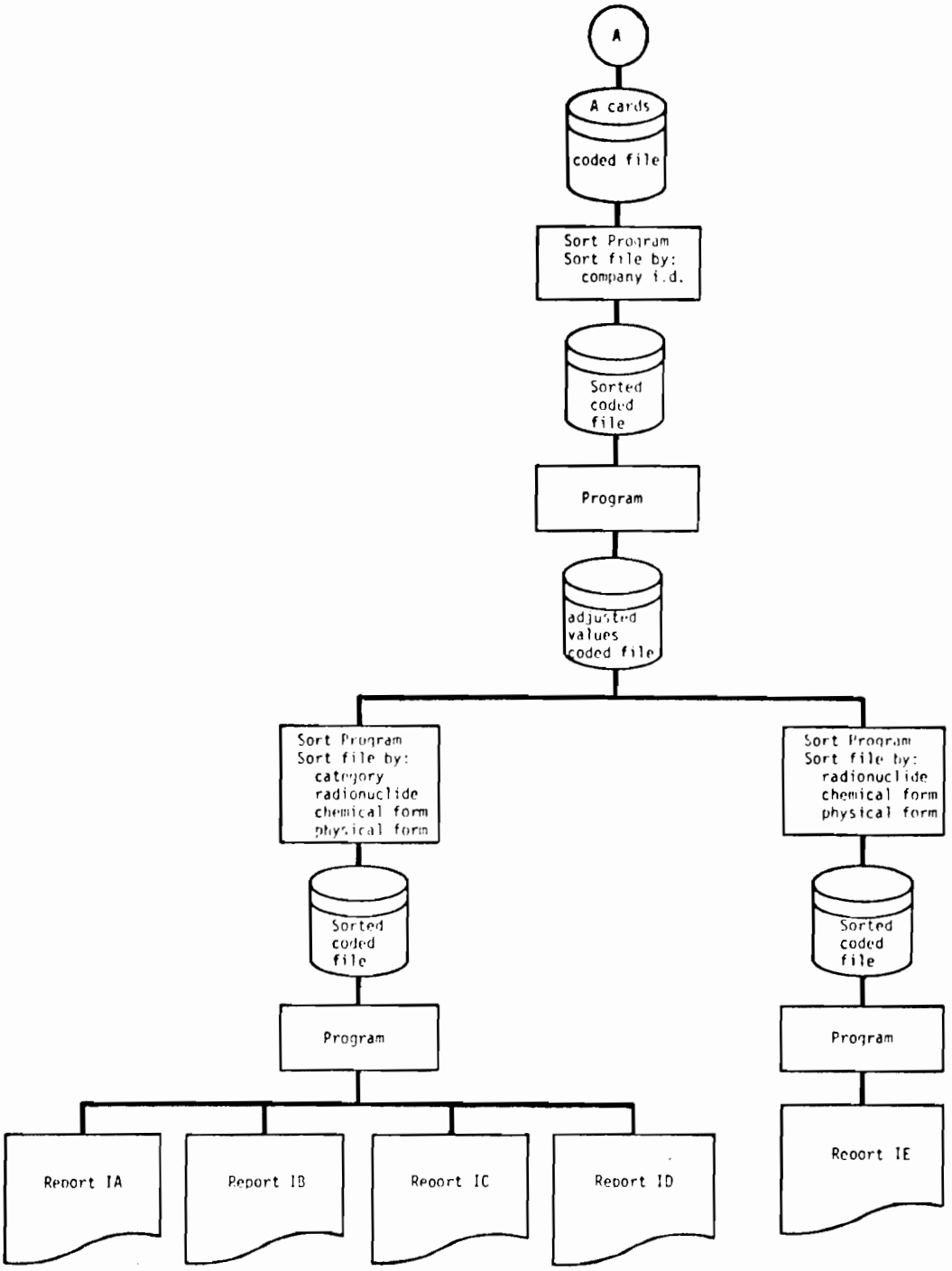


FIGURE B.5. (contd)

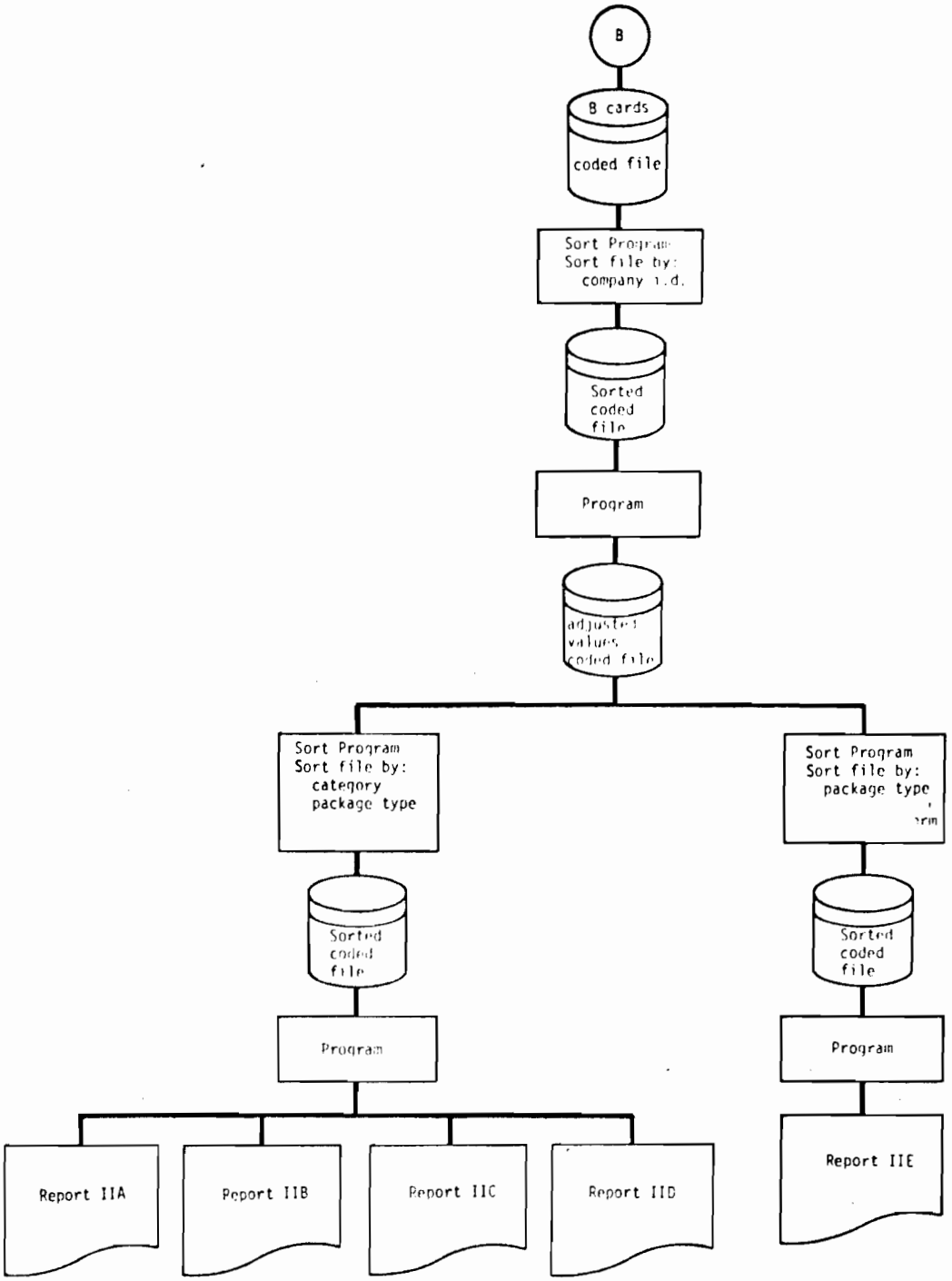


FIGURE B.5. (contd)

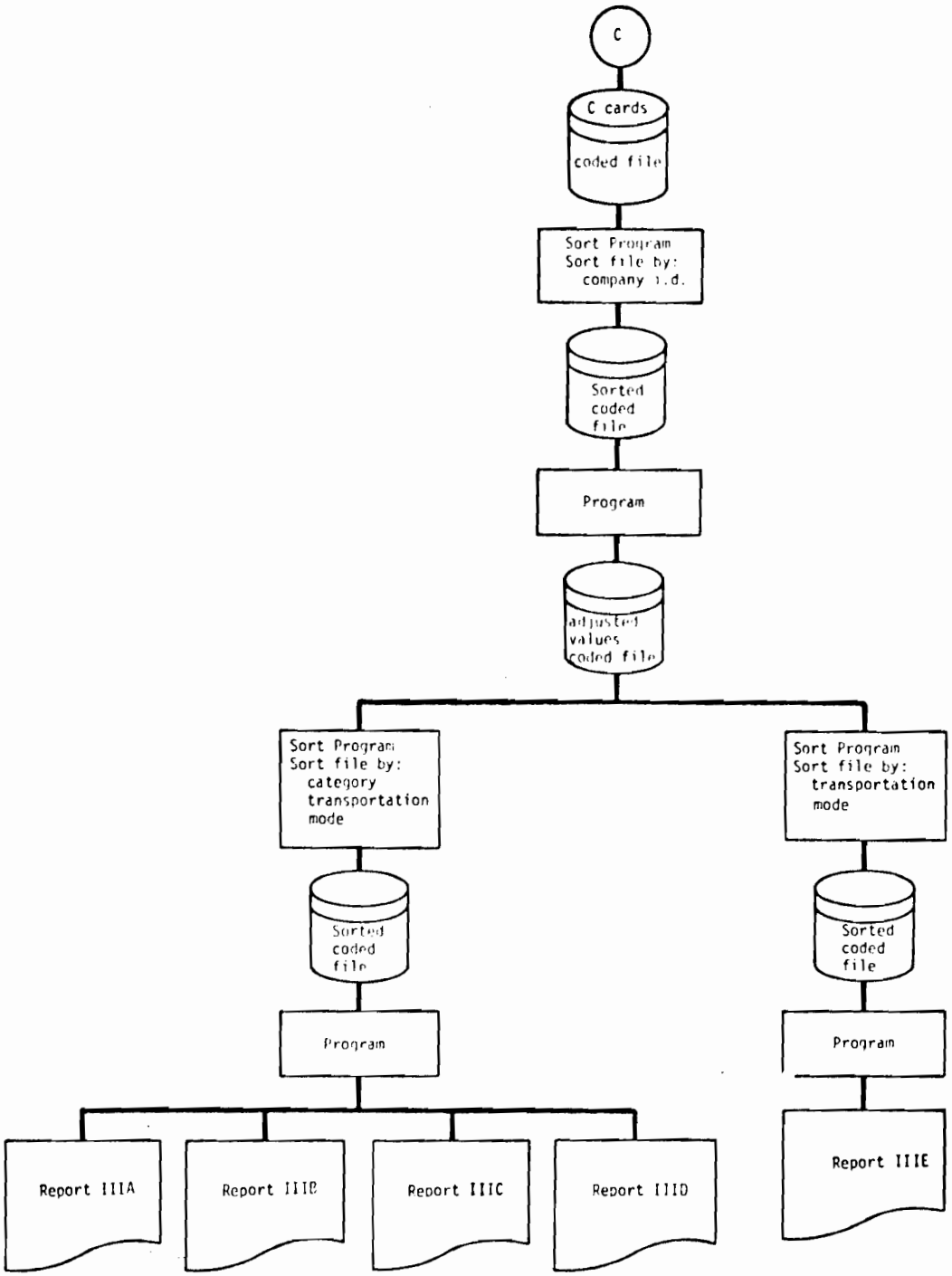


FIGURE B.5. (contd)

CALCULATIONS FOR COMPUTER REPORTS

The calculations for the reports briefly described in Section 3.2 and detailed in the first part of this appendix are given in the following text.

DETAILED QUESTIONNAIRE REPORTS

Since the survey period for the detailed questionnaires varied, the input values from each questionnaire for the calculations had to be extrapolated to a one-year period. This was accomplished by multiplying the value by ADJ, where

$$ADJ = 52./\text{survey period in weeks.}$$

The survey periods include 1.0, 4.3, 5.0, 12.0, 26.0, 52.0 and 56.0 weeks, in which 1.0, 4.3, 26.0 and 52.0 were the most frequent.

The following basic nomenclature was applied to describe the detailed, questionnaire report calculations.

- ACT_i — The activity (grams or curies) given for the ith package designation (see Figure B.6).
- ADJ_i — As described above for the ith package designation.
- $DIST_i$ — The miles given for the ith consignment designation (see Figure B.6).
- $PACKS_i$ — The number of packages recorded for the ith package designation.
- QTI_i — The TI value recorded for the ith package designation.

QUESTIONNAIRE ON SPECIAL NUCLEAR MATERIALS

SURVEY PERIOD: March 1, 1974 to February 28, 1975

NAME _____ PHONE NO _____ DATE _____

NO SHIPPING ACTIVITIES ☐

POSITION _____ DEPARTMENT _____

HOW MANY CONSIGNMENTS AND GRAMS DO YOU ESTIMATE THAT YOUR COMPANY TRANSPORTS DURING A 1-YEAR PERIOD?

CONSIGNMENTS _____ GRAMS _____

WHAT IS YOUR LICENSE CATEGORY CLASSIFICATION (i.e., RADIOPHARMACEUTICAL, RADIOIC, APPLIER, GAUGE, ETC.)? _____

INFORMATION RELATED TO EACH CONSIGNMENT

CONSIGNMENT DESIGNATION

	1 Shipping Date			2 Destination		3	4 Approximate Miles Traveled by Consignment	5 Transportation Mode					6 Foreign Transportation			
								A Major		B Secondary		C Freight Forwarder	A Import Port of Entry		B Export Port of Exit	
	Year	Month	Day	City	State			1 Type	2 Sole Use	1 Type	2 Sole Use		City	State	City	State
D011																
D021																
D031																
D041																
D051																
D061																
D071																
D081																
D091																
D101																
D111																
D121																
D131																
D141																
D151																
D161																
D171																
D181																
D191																
D201																
D211																
D221																
D231																
D241																

INFORMATION RELATED TO EACH PACKAGE IN EACH CONSIGNMENT

PACKAGE DESIGNATION

	7 Material Identification			8 Form		9	10 Packages	11	12	13
	A Radionuclide	B No. of Pros. Radionuclide	C Application	Chemical	Physical		Type	Model Number	N	Q
D012										
D022										
D032										
D042										
D052										
D062										
D072										
D082										
D092										
D102										
D112										
D122										
D132										
D142										
D152										
D162										
D172										
D182										
D192										
D202										
D212										
D222										
D232										
D242										

FIGURE B.6. Consignment and Package Designations from the Detailed Questionnaire Forms

CALCULATIONS FOR COMPUTER REPORTS IA, IIA, IIIA, IVA FOR SUMMARY OF INFORMATION, DETAILED QUESTIONNAIRES

The calculations to produce each of the Summary of Information Reports are the same. The data file which is being accessed and the manner in which the reports are presented is the difference between the reports. Reports IA and IIIA access the SNM/Source Material data file, while Reports IIA and IVA access the non-SNM/Source Material file. Reports IA and IIA are in alphabetical order by radionuclide and Reports IIIA and IVA are in descending order of total activity.

Predominant Form

The predominant chemical form is the chemical form of the radionuclide with the greatest total activity, where the total activity for each chemical form (CTA_k) is calculated

$$CTA_k = \sum_{i=1}^{na} (ACT_i * PACKS_i * ADJ_i)$$

where na is the number of ACT values which apply to the kth chemical form. The related percentage is determined as follows:

$$Percent_k = (CTA_k / \sum_{i=1}^{nk} CTA_i) * 100$$

where nk is the number of chemical form total ACT values for a radionuclide.

The predominant physical form is the physical form of the radionuclide with the greatest total grams under the predominant chemical form. The total activity of the physical forms (PTA_p) is calculated

$$PTA_p = \sum_{i=1}^{nc} (ACT_i * PACKS_i * ADJ_i)$$

where nc is the number of ACT values which apply to the kth chemical form and the pth physical form. The related percentage is determined as follows:

$$Percent_p = (PTA_p/CTA_k) * 100$$

Secondary Form

The Secondary Form is obtained in the same manner as the Predominant Form, although the second greatest activity values are the deciding figures.

In the case where the Chemical and Physical Forms are identical for the Predominant and Secondary Form, only the Predominant Form is printed.

Freight Forwarder

Calculations of indicated freight forwarder shipments are made for each radionuclide as follows:

$$\text{Number of Packages} = \sum_{i=1}^{nf} (PACKS_i * ADJ_i)$$

$$\text{TI Miles} = \sum_{i=1}^{nf} (QTI_i * DIST_i * PACKS_i * ADJ_i)$$

$$\text{Total TI} = \sum_{i=1}^{nf} (QTI_i * PACKS_i * ADJ_i)$$

$$\text{Total Grams (or Curies)} = \sum_{i=1}^{nf} (ACT_i * PACKS_i * ADJ_i)$$

where nf is the number of freight forwarder entries.

Application

$$Res = \sum_{i=1}^{nr} (PACKS_i * ADJ_i)$$

where nr is the number of shipments which indicated "R" application.

$$\text{Med} = \sum_{i=1}^{nm} (\text{PACKS}_i * \text{ADJ}_i)$$

where nm is the number of shipments which indicate "M" application.

$$\text{Other} = \sum_{i=1}^{nx} (\text{PACKS}_i * \text{ADJ}_i)$$

where nx is the number of shipments which indicate "X" application and other than "R" or "M".

Total

The "Total" heading is interpreted to mean "Total for Package" for each radionuclide. The related fields are derived as follows:

$$\text{Packages} = \sum_{i=1}^{np} (\text{PACKS}_i * \text{ADJ}_i)$$

where np is the number of package entries for a radionuclide.

$$\text{Grams (or Curies)} = \sum_{i=1}^{na} (\text{ACT}_i * \text{PACKS}_i * \text{ADJ}_i)$$

where na is the number of ACT entires for a radionuclide.

$$\text{TI} = \sum_{i=1}^{nt} (\text{QTI}_i * \text{PACKS}_i * \text{ADJ}_i)$$

where nt is the number of QTI entires for a radionuclide.

$$\text{Miles} = \sum_{i=1}^{nd} (\text{DIST}_i * \text{PACKS}_i * \text{ADJ}_i)$$

where nd is the number of DIST entires for a radionuclide.

$$\text{TI Miles} = \sum_{i=1}^{nt} (\text{QTI}_i * \text{DIST}_i * \text{PACKS}_i * \text{ADJ}_i)$$

where nt is the number of QTI entires for a radionuclide.

Per Package

This category is an average figure for each radionuclide. They are calculated as follows:

$$\text{Grams (or Curies)} = \frac{\left[\sum_{i=1}^{na} (ACT_i * PACKS_i * ADJ_i)\right]}{\left[\sum_{i=1}^{na} (PACKS_i * ADJ_i)\right]}$$

where na is the number of nonzero ACT entries for a radionuclide.

$$\text{Miles} = \frac{\left[\sum_{i=1}^{nd} (DIST_i * PACKS_i * ADJ_i)\right]}{\left[\sum_{i=1}^{nd} (PACKS_i * ADJ_i)\right]}$$

where nd is the number of DIST entries for a radionuclide.

$$TI = \frac{\left[\sum_{i=1}^{nt} (QTI_i * PACKS_i * ADJ_i)\right]}{\left[\sum_{i=1}^{nt} (ADJ_i * PACKS_i)\right]}$$

where nt is the number of nonblank QTI entries for a radionuclide

$$\text{TI Miles} = \frac{\sum_{i=1}^{nt} (QTI_i * DIST_i * PACKS_i * ADJ_i)}{\sum_{i=1}^{nt} (ADJ_i * PACKS_i)}$$

where nt is the number of nonblank QTI entries for a radionuclide.

"Max Grams (or Curies)" is the greatest nonextrapolated value found for the related activity.

Number of Packages Used in Calculations

$$\text{Freight Forwarder} = \sum_{i=1}^{nf} (PACKS_i * ADJ_i)$$

where nf is the number of freight forwarder entries for a radionuclide where the TI value was nonblank.

$$\text{Total TI} = \sum_{i=1}^{nt} (PACKS_i * ADJ_i)$$

where nt is the number of nonblank QTI entries for a radionuclide.

Number of Packages Used as Divisor in the "Per Package" Average

$$\text{Grams (or Curies)} = \sum_{i=1}^{na} (PACKS_i * ADJ_i)$$

where na is the number of nonzero ACT entries for a radionuclide.

$$\text{Miles} = \sum_{i=1}^{nd} (PACKS_i * ADJ_i)$$

where nd is the number of DIST entries for a radionuclide.

$$\text{TI} = \sum_{i=1}^{nt} (PACKS_i * ADJ_i)$$

where nt is the number of nonblank QTI entries for a radionuclide.

CALCULATIONS FOR COMPUTER REPORTS IB, IIB, IIIB, IVB FOR MAJOR TRANSPORTATION MODE, DETAILED QUESTIONNAIRES

All of the Major Transportation Mode Reports have the same calculations, but differ in the data file which is accessed and the manner in which the reports are output. Reports IB and IIIB access the SNM/Source Material data file. Reports IIB and IVB access the non-SNM/Source Material file. Reports IB and IIB are in alphabetical order by radionuclide. To produce Reports IIB and IVB, "Total Grams" (or "Total Curies") for each major transportation mode for each radionuclide of the corresponding Report IB or IIB is summed to form the "Total Grams (or Curies) per Radionuclide". This total is the basis which is sorted in descending order for Reports IIIB and IVB.

Individual Mode Calculations

The calculations for each major transportation mode are the same. Their description follows.

$$\text{Number of Packages} = \sum_{i=1}^{np} (PACKS_i * ADJ_i)$$

where np is the number of PACKS values which apply to each major transportation mode.

$$\text{TI Miles} = \sum_{i=1}^{nt} (QTI_i * DIST_i * PACKS_i * ADJ_i)$$

where nt is the number of QTI values which apply to each major transportation mode.

"Max Grams (or Curies) per Package" is the greatest nonextrapolated value found for the related activity for each major transportation mode.

$$\text{Total TI} = \sum_{i=1}^{nt} (QTI_i * PACKS_i * ADJ_i)$$

where nt is the number of QTI values which apply to each major transportation mode.

$$\text{Total Grams (or Curies)} = \sum_{i=1}^{na} (ACT_i * PACKS_i * ADJ_i)$$

where na is the number of ACT values which apply to each major transportation mode.

Aircraft Total

"Numbers of Packages", "TI Miles", "Total TI", and "Total Grams (or Curies)" are the totals from the corresponding fields of each related aircraft transportation mode (AF, AP, AG, H).

"Max Grams (or Curies) per Package" is the largest nonextrapolated activity value found for the aircraft transportation modes (AF, AP, AG, H).

Number of Packages Used to Calculate Total TI

For each major transportation mode the total, PT_m, calculation is the same.

$$PT_m = \sum_{i=1}^{np} (PACKS_i * ADJ_i)$$

where np is the number of PACKS entries related to nonblank QTI values for each Radionuclide.

"Aircraft Total" is the total of the PT values for each aircraft major mode (AF, AP, AG, H).

CALCULATIONS FOR COMPUTER REPORTS IC, IIC, IIIC, IVC FOR SECONDARY TRANSPORTATION MODES, DETAILED QUESTIONNAIRES

All of the Secondary Transportation Mode Reports have the same calculations, but differ in the data file which is accessed and the manner in which the reports are output. Reports IC and IIIC access the SNM/Source Material data file and Reports IIC and IVC access the non-SNM/Source Material data file. Reports IC and IIC are in alphabetical order by radionuclide; Reports IIIC and IVC by descending order of total activity ("Total Grams (or Curies) per Radionuclide"). "Total Grams" (or "Total Curies") for each secondary transportation mode for each radionuclide of the corresponding Report IC or IIC is summed to form the "Total Grams (or Curies) per Radionuclide".

Individual Mode Calculations

The calculations for each secondary transportation mode are the same. Their description follows.

$$\text{Number of Packages} = \sum_{i=1}^{np} (PACKS_i * ADJ_i)$$

where np is the number of PACKS values which apply to each secondary transportation mode.

The TI Miles calculation is "NOT APPLICABLE" for the secondary transportation mode since the MILES value is the distance the entire package traveled.

"Max Grams (or Curies) per Package" is the greatest nonextrapolated value found for the related ACT values for each secondary transportation mode.

$$\text{Total TI} = \sum_{i=1}^{nt} (QTI_i * PACKS_i * ADJ_i)$$

where nt is the number of QTI values which apply to each secondary transportation mode.

$$\text{Total Grams (or Curies)} = \sum_{i=1}^{na} (ACT_i * PACKS_i * ADJ_i)$$

where na is the number of ACT values which apply to each secondary transportation mode.

Truck Total

"Number of Packages", "TI Miles", "Total TI", and "Total Grams (or Curies)" are the totals from the corresponding fields of each related truck transportation mode (TC, TK, TP).

"Max Grams (or Curies) per Package" is the largest nonextrapolated ACT value found for the truck transportation modes (TC, TK, TP).

Number of Packages Used to Calculate Total TI

For each secondary transportation mode this total, PT_m, is calcualted the same.

$$PT_m = \sum_{i=1}^{np} (PACKS_i * ADJ_i)$$

where np is the number of PACKS entries related to nonblank QTI values for each radionuclide.

"Truck Total" is the total of the PT values for each truck secondary mode (TC, TK, TP).

CALCULATIONS FOR COMPUTER REPORTS ID, IID, IIID, IVD FOR PACKAGE TYPE, DETAILED QUESTIONNAIRES

All of the Package Type Reports have the same calculations, but differ in the data file which is accessed and the manner in which the reports are output. Reports ID and IIID access the SNM/Source Material data file. Reports IID and IVD access the non-SNM/Source Material file. Reports ID and IID are in alphabetical order by radionuclide. To produce Reports IIID and IVD, "Total Grams" (or "Total Curies") for each package type for each radionuclide/model number combination of the corresponding Report I or II is summed to form the "Total Grams (or Curies) per Radionuclide and Model Number". This total is the basis which is sorted in descending order for Reports IIID and IVD.

Individual Package Type Calculations

The calculations for each package type are the same. The description of these calculations follows.

$$\text{Number of Packages} = \sum_{i=1}^{np} (PACKS_i * ADJ_i)$$

where np is the number of PACKS values which apply to each package type.

$$\text{TI Miles} = \sum_{i=1}^{nt} (QTI_i * DIST_i * PACKS_i * ADJ_i)$$

where nt is the number of QTI values which apply to each package type.

"Max Grams (or Curies) per Package" is the greatest nonextrapolated value found for the related ACT values for each package type.

$$\text{Total TI} = \sum_{i=1}^{nt} (QTI_i * PACKS_i * ADJ_i)$$

where nt is the number of QTI values which apply to each package type.

$$\text{Total Grams (or Curies)} = \sum_{i=1}^{na} (ACT_i * PACKS_i * ADJ_i)$$

where na is the number of ACT values which apply to each package type.

Number of Packages Used to Calculate Total TI

For each package type this total, PT_m, is calculated in a similar manner.

$$PT_m = \sum_{i=1}^{np} (PACKS_i * ADJ_i)$$

where np is the number of PACKS entries related to nonblank QTI values for each radionuclide.

CALCULATIONS FOR COMPUTER REPORTS IE, IIE, IIIE, IVE FOR TRANSPORTATION INFORMATION, DETAILED QUESTIONNAIRES

All of the Transportation Information per Radionuclide Reports have the same calculations, but differ in the data file which is accessed and the manner in which the reports are output. Reports IE and IIIE access the SNM/Source Material data file. Reports IIE and IVE access the non-SNM/Source Material file. Reports IE and IIE are in alphabetical order by radionuclide. To produce Reports IIIE and IVE, "Total Grams" (or "Total Curies") for each transportation mode for each radionuclide, origin, and destination combination of the corresponding Report IE or IIE is summed to form "Total Grams (or Curies) per Radionuclide Origin and Destination". This total is used as the basis which is sorted in descending order for Reports IIIE and IVE.

Individual Mode Calculations

The calculations pertaining to each transportation mode are the same and are described below.

$$\text{Number of Packages} = \sum_{i=1}^{np} (PACKS_i * ADJ_i)$$

where np is the number of PACKS values which apply to each transportation mode.

$$\text{TI Miles} = \sum_{i=1}^{nt} (QTI_i * DIST_i * PACKS_i * ADJ_i)$$

where nt is the number of QTI values which apply to each transportation mode. TI Miles is "NOT APPLICABLE" for the secondary transportation mode calculations, since the miles figure indicates the total distance traveled by the shipment.

"Max Grams (or Curies) per Package" is the greatest nonextrapolated value found for the related ACT values for each transportation mode.

$$\text{Total TI} = \sum_{i=1}^{nt} (QTI_i * PACKS_i * ADJ_i)$$

where nt is the number of QTI values which apply to each transportation mode.

$$\text{Total Grams (or Curies)} = \sum_{i=1}^{na} (ACT_i * PACKS_i * ADJ_i)$$

where na is the number of ACT values which apply to each transportation mode.

Number of Packages Used to Calculate Total TI

For each transportation mode this total, PT_m, is calculated in a similar manner.

$$PT_m = \sum_{i=1}^{np} (PACKS_i * ADJ_i)$$

where np is the number of PACKS entries related to nonblank QTI values for each radionuclide.

CALCULATIONS FOR COMPUTER REPORTS V, VI FOR ACTIVITY FREQUENCY DISTRIBUTION, DETAILED QUESTIONNAIRES

The Activity Frequency Distribution Reports all use the same calculation. They differ in the file which they access. Report V accesses the SNM/Source Material data file and, consequently, the units on the listing are grams. Report VI accesses the non-SNM/Source Material file with curies as its units.

For each grams or curies range and each major transportation mode for a radionuclide, the package total is calculated by:

$$\text{Number of Packages} = \sum_{i=1}^{np} (PACKS_i * ADJ_i)$$

where np is the number of PACKS values which apply to each major transportation mode for an ACT range.

CALCULATIONS FOR COMPUTER REPORTS VII, VIII FOR TI FREQUENCY DISTRIBUTION, DETAILED QUESTIONNAIRES

The TI Frequency Distribution Reports all use the same calculations. They differ only in the file which they access. Report VII accesses the SNM/Source Material data file; Report VIII accesses the non-SNM/Source Material file.

For each TI range and each major transportation mode for a radionuclide, the package total is calculated by:

$$\text{Number of Packages} = \sum_{i=1}^{np} (PACKS_i * ADJ_i)$$

where np is the number of PACKS values which apply to each major transportation mode for a QTI range.

CALCULATIONS FOR COMPUTER REPORTS IX, X, XIII, XIV FOR SUMMARY FREQUENCY DISTRIBUTION, DETAILED QUESTIONNAIRES

The Summary Frequency Distribution Reports use the same calculations. They differ in the file which they access. Report X accesses the SNM/Source Material data file and, consequently, the units on the report are grams. Report IX accesses the Non-SNM/Source Material data file with curies as its units. Reports XIII and XIV access modified versions of the SNM/Source Material data file. The activity values of this file were converted to curies where possible. Report XIII accesses the grams values which were not convertible. Report XIV accesses the converted curies values. The formula used for conversion is

$$\text{Curies Value} = \text{Grams Value}/(2.7949 \times 10^{-6} * \text{Half Life} * \text{Atomic Mass Number}).$$

For these report sequences the major transportation modes have been redefined for compactness as follows.

Report Sequence	Redefined Mode	Included Symbols
A	Air Passenger	AP
B	Air Nonpassenger	AF, AG, H, AI
C	Truck	TC, TK, TP, TR, A, BU
D	Ship	S, B
E	Rail	R
F	Mail	M, PE
G	Unknown	Unspecified Entries
H	All	All of the above

The ranges are chosen to reflect DOT definitions of package types for the various classes of radionuclides. It is the single package activity value which determines into which range a package element is assigned.

The calculations for each redefined major transportation mode and each radionuclide are described in the following subsections.

Activity Range Calculations

$$\text{Number of Packages} = NPKG = \sum_{i=1}^{np} (PACKS_i * ADJ_i)$$

where np is the number of PACKS values found within an ACT range.

$$\text{Miles per Package} = AVGMI = \frac{\sum_{i=1}^{nd} (DIST_i * PACKS_i * ADJ_i)}{\sum_{i=1}^{nd} (PACKS_i * ADJ_i)}$$

where nd is the number of DIST values within an ACT range.

$$\text{TI per Package} = AVGTI = \frac{\sum_{i=1}^{nt} (QTI_i * PACKS_i * ADJ_i)}{\sum_{i=1}^{nt} (PACKS_i * ADJ_i)}$$

where nt is the number of nonblank QTI values within an ACT range.

$$\text{TI Packages} = \text{Number of Packages in TI Calculation} = \sum_{i=1}^{nt} (PACKS_i * ADJ_i)$$

where nt is the number of nonblank QTI values within an ACT range.

Total Calculations

$$\text{Total Number of Packages} = \sum_{i=1}^{npt} (NPKG_i)$$

where npt is the number of ACT intervals with Number of Package (NPKG) values listed.

$$\text{Total TI} = \sum_{i=1}^{ntt} (AVGTI_i * NPKG_i)$$

where ntt is the number of ACT intervals with TI per Package (AVGTI) values listed.

$$\text{Total Miles} = \sum_{i=1}^{ndt} (AVGMI_i * NPKG_i)$$

where ndt is the number of ACT intervals with Miles per Package (AVGMI) values listed.

$$\text{Total Grams (or Curies)} = \sum_{i=1}^{nat} (ACT_i * PACKS_i * ADV_i)$$

where nat is the number of ACT values.

CALCULATIONS FOR COMPUTER REPORTS XI, XII, XV, XVI FOR SUMMARY FREQUENCY DISTRIBUTION BY CHEMICAL FORM AND PHYSICAL FORM, DETAILED QUESTIONNAIRES

The Summary Frequency Distribution Reports use the same calculations. They differ in the file which they access. Report XI access the SNM/Source Material data file and, consequently, the units on the report are grams. Report XII accesses the Non-SNM/Source Material data file with curies at its units. Reports XV and XVI access modified versions of the SNM/Source Material data file. The activity values of this file were converted to curies where possible. Report XV accesses the grams values which were not convertible. Report XVI accesses the converted curies values. The formula used for conversion is:

$$\text{Curies Value} = \text{Grams Value}/(2.7949 \times 10^{-6} * \text{Half Life} * \text{Atomic Mass Number})$$

For these report sequences the major transportation modes have been redefined for compactness as follows.

Report Sequence	Redefined Mode	Included Symbols
A	Air Passenger	AP
B	Air Nonpassenger	AF, AG, H, AI
C	Truck	TC, TK, TP, TR, A, BU
D	Ship	S, B
E	Rail	R
F	Mail	M, PE
G	Unknown	Unspecified Entries
H	All	All of the above

The ranges are shown to reflect DOT definitions of package types for the various classes of radionuclides. It is the single package activity value which determines into which range an element is placed.

The calculations for each redefined major transportation mode, each radionuclide, each chemical form and physical form are described below.

Activity Range Calculations

$$\text{Number of Packages} = \text{NPKG} = \sum_{i=1}^{np} (\text{PACKS}_i * \text{ADJ}_i)$$

where np is the number of PACKS values found within an ACT range.

$$\text{Miles per Package} = \text{AVGMI} = \frac{\sum_{i=1}^{nd} (\text{DIST}_i * \text{PACKS}_i * \text{ADJ}_i)}{\sum_{i=1}^{nd} (\text{PACKS}_i * \text{ADJ}_i)}$$

where nd is the number of DIST values within an ACT range.

$$\text{TI per Package} = \text{AVGTI} = \frac{\sum_{i=1}^{nt} (\text{QTI}_i * \text{PACKS}_i * \text{ADJ}_i)}{\sum_{i=1}^{nt} (\text{PACKS}_i * \text{ADJ}_i)}$$

where nt is the number of nonblank QTI values within an ACT range.

$$\text{TI Packages} = \text{Number of Packages in TI Calculation} = \sum_{i=1}^{nt} (\text{PACKS}_i * \text{ADJ}_i)$$

where nt is the number of nonblank QTI values within an ACT range.

Total Calculations

$$\text{Total Number of Packages} = \sum_{i=1}^{npt} (\text{NPKG}_i)$$

where npt is the number of ACT intervals with Number of Package (NPKG) values listed.

$$\text{Total TI} = \sum_{i=1}^{ntt} (AVGTI_i * NPKG_i)$$

where ntt is the number of ACT intervals with TI per Package (AVGTI) values listed.

$$\text{Total Miles} = \sum_{i=1}^{ndt} (AVGMI_i * NPKG_i)$$

where ndt is the number of ACT intervals with Miles per Package (AVGMI) values listed.

$$\text{Total Grams (or Curies)} = \sum_{i=1}^{nat} (ACT_i * PACKS_i * ADV_i)$$

where nat is the number of ACT values.

SUMMARY QUESTIONNAIRE COMPUTER REPORTS

The nomenclature used to describe the calculations for the Summary Questionnaire reports is described below.

AMN	Atomic mass number of special nuclear material
CI	Total adjusted curies per year
CURIE	Total nonadjusted curies per year
CONS	Number of consignments per year
CPOPAG	Category population (Agreement States)
CPOPN	Category population (NRC)
CQRAG	Number of returned questionnaires of a category (Agreement States)
CQRN	Number of returned questionnaires of a category (NRC)
HL	Half life in years of special nuclear material
GM	Total grams per year from Special Nuclear Material
PACKS	Number of adjusted packages per year
PKG	Input package value

PKGCONS	Number of adjusted packages per consignment (per transportation mode)
PKGC	Input packages per consignment (per transportation mode)
QTI	Average transportation index per package

When the input activity value was from a SNM or Source Material Nuclide (uranium, plutonium, or thorium), it was converted from its gram amount value to curies by the formula:

$$CI = GM/(2.7949 \times 10^{-6} * HL * AMN)$$

The survey period for the Summary Questionnaire is one year, so no time extrapolation is required. Some adjustment is necessary, however, to maintain a consistent sample base for the survey. A random sampling was drawn from each of the four main Agreement State categories (academic, medical, industrial and others) when the survey was conducted.

These four general categories are subdivided into various NRC subcategories. For analysis, a special adjustment factor was used on the Agreement State values which had no NRC subdivision.

$$FACTOR_{ag} = \frac{\sum_{i=1}^{a} PACKS_{NRC} / \sum_{i=1}^{a} PKG_{NRC}}{\sum_{i=1}^{a} CPOPN / \sum_{i=1}^{a} CQRN}$$

where a is the number of NRC subcategory entries within the Agreement State category, ag.

Adjustment calculations for package values from Table 1 and Table 2 of the Summary Questionnaire:

$$PACKS_{nrc} = CPOPN/CQRN * PKG_{nrc}$$

$$PACKS_{ag} = CPOPAG/CQRAG * FACTOR_{ag} * PKG_{ag}$$

Adjustment calculations for packages per consignment per transportation mode from Table 3 of the Summary Questionnaire:

$$PKGCONS_{nrc} = CPOPN/CQRN * PKGC_{nrc}$$

$$PKGCONS_{ag} = CPOPAG/CQRAG * FACTOR_{ag} * PKGC_{ag}$$

Adjustment calculations for curie values from Table 1 of the Summary Questionnaire:

$$CI_{nrc} = CPOPN/CQRN * CURIE_{nrc}$$

$$CI_{ag} = CPOPAG/CQRAG * FACTOR_{ag} * CURIE_{ag}$$

For the Computer Reports I.A-3, II.A-3, and III.A-E, the extrapolated data from the NRC subcategories was combined with the Agreement States data into the four respective general categories. Reports I, II, III.A-E for the NRC categories only, are, however, contained in this Appendix.

CALCULATIONS FOR COMPUTER REPORT IA, IB, IC, ID, IE FOR RADIONUCLIDE INFORMATION, SUMMARY QUESTIONNAIRES

The calculations for each of the Radionuclide Information reports are the same; they differ only in which file they access. Report IA accesses the Academic category file, Report IB accesses the Medical category file, Report IC accesses the Industrial category file, Report ID accesses the Other category file, and Report IE accesses a file which is a combination of all four of the previous files.

$$\text{Number of Packages} = \sum_{i=1}^{np} PACKS_i$$

where np is the number of PACKS entries for a radionuclide, chemical and physical form combination.

$$\text{Total Curies} = \sum_{i=1}^{nc} (CI_i * PACKS_i)$$

where nc is the number of nonblank CI entries for a radionuclide, chemical and physical form combination. If a CI entry is blank, a second line is shown with the total curies as "UNKNOWN".

CALCULATIONS FOR COMPUTER REPORT IIA, IIB, IIC, IID, IIE FOR PACKAGE TYPE INFORMATION, SUMMARY QUESTIONNAIRES

All of the programs to achieve Package Type Information reports perform the same calculations; they differ only in the file which is accessed. Report IIA accesses the Academic catetory file, Report IIB accesses the Medical category file, Report IIC accesses the Industrial category file, Report IID accesses the Other category file, and Report IIE accesses a file which is a combination of all four of the previous files.

$$\text{Number of Packages} = \sum_{i=1}^{np} PACKS_i$$

where np is the number of PACKS entries for a given package type.

CALCULATIONS FOR COMPUTER REPORT IIIA, IIIB, IIIC, IIID, IIIE FOR TRANSPORTATION INFORMATION, SUMMARY QUESTIONNAIRES

The calculations for each of the Transportation Information reports are the same; they differ only in which file they access. Report IIIA accesses the Academic category data file, Report IIIB accesses the Medical category file, Report IIIC accesses the Industrial category data file, Report IIID accesses the Other Category data file, and Report IIIE accesses a file which is a combination of all four of the previous files.

$$\text{Number of Packages per Year} = \sum_{i=1}^{npc} (CONS_i * PKGCONS_8) + \sum_{i=1}^{np} PACKS_i$$

where for a transportation mode npc is the number of entries which had a nonblank value in CONS and PKGCONS, and np is the number of companies in which there is a blank CONS or PKGCONS and all entries for such companies are the same transportation mode (this PACKS value is obtained from related information on Table 1 of the Questionnaire).

$$\text{Total TI per Year} = \sum_{i=1}^{nqc} (QTI_i * CONS_i * PKGCONS_i) + \sum_{i=1}^{nqt} (QTI_i * PACKS_i)$$

where for a transportation mode nqc is the number of entries which had nonblank values in QTI, CONS and PKGCONS, and nqt is the number of companies which had a blank value in CONS or PKGCONS and all the transportation modes are the same (the PACKS value used in this calculation is obtained from related information on Table 1 of the questionnaire). If there is no QTI value, the calculation is termed "UNKNOWN".

When all entries from the same company do not have the CONS or PKGCONS value so the total number of packages PACKS, is being used, a problem exists if the mode of transportation is not the same for each of said companies entries. It becomes impossible to determine the number of packages for each different transportation mode when the only value available is a grand total for all modes. In this case, the total packages and total TI values are calculated using the PACKS value for the transportation mode "UNKNOWN", a designation which is also used for entries with blank transportation modes.

Another problem area exists when a few entries for a company have no CONS or PKGCONS value, while the other entries for the company have both values. In this situation the sum of the calculated package per year figures for the entries with CONS and PKGCONS values is subtracted from the grand total number of packages for the company, PACKS. This difference is used in the calculations for the entries which have no CONS or PKGCONS value for "UNKNOWN" transportation mode.

Whenever a CONS or PKGCONS value is missing and there is no PACKS value, the entry is ignored. This situation does not occur in the present data base.

APPENDIX C

QUESTIONNAIRE PACKETS

APPENDIX C

QUESTIONNAIRE PACKETS

The purpose of this appendix is to provide a sample of the questionnaire packets that we mailed to the licensees and ERDA contractors. The four types of questionnaire packets and their contents are summarized below:

Sample 1 - SNM Questionnaire Packet

- Cover Letter
- Questionnaire Explanation (Attachment 1)
- Instructions (Attachment 2)
- Blank SNM Questionnaire Form (Attachment 3)
- Blank non-SNM Questionnaire Form (Attachment 4)
- Sample Questionnaire (Attachment 5)
- Return Envelope

Sample 2 - Non-SNM Questionnaire Packet

- Cover Letter
- Questionnaire Explanation (Attachment 1)
- Instructions (Attachment 2)
- Blank Non-SNM Questionnaire (Attachment 3)
- Sample Questionnaire (Attachment 4)
- Return Envelope

Sample 3 - Summary Questionnaire Packet

- Cover Letter
- Questionnaire Explanation (Attachment 1)
- Instructions (Attachment 2)
- Questionnaire Forms (Attachments 3, 4 and 5)
- Sample Questionnaires (Attachments 6 and 7)
- Return Envelope

Sample 4 - ERDA Questionnaire Packet

- Cover Letter
- Questionnaire Explanation (Attachment 1)
- Instructions (Attachment 2)
- Blank SNM Questionnaire Form (Attachment 3)
- Blank Non-SNM Questionnaire Form (Attachment 4)
- Sample Questionnaire (Attachment 5)
- Return Envelope
- List of ERDA Recipients

As can be seen from this information and the samples provided, the Questionnaire Packets were made up of the questionnaire forms as well as a cover letter, instructions, a sample of a completed questionnaire, and a stamped, self-addressed return envelope. The first two samples (SNM and Non-SNM Questionnaire Packets) are essentially the same; however, the SNM Questionnaire requests radionuclide amounts in grams rather than curies and has a one-year survey period rather than the variable survey period for the Non-SNM Questionnaire. Although the cover letter and general instructions are the same for the third sample (Summary Questionnaire) as for the first two, the third sample has different detailed instructions and questionnaire forms, and has a one-year survey period. The last sample (ERDA Questionnaire) is the same as Sample 1, but the cover letter is slightly different.

The samples are provided in the following pages along with a brief explanation.

SAMPLE 1 - SNM Questionnaire Packet

- Cover Letter
- Questionnaire Explanation (Attachment 1)
- Instructions (Attachment 2)
- Blank SNM Questionnaire Form (Attachment 3)
- Blank Non-SNM Questionnaire Form (Attachment 4)
- Sample Questionnaire (Attachment 5)
- Return Envelope

This questionnaire packet was sent to all SNM licensees. It includes a Questionnaire on Special Nuclear Material (SNM) as well as a Questionnaire on Radioactive Material other than Special Nuclear Material (Non-SNM). The cover letter, signed by Robert F. Barker, Chief of the Transportation and Products Standards Branch of NRC, explains the purpose of the survey. The Questionnaire Explanation (Attachment 1) details the purpose of the survey and defines the one-year survey period and specific terminology used in the Questionnaire, while the Instruction Sheet (Attachment 2) identifies the columns in the Questionnaire and specifies how they are to be completed. The blank SNM Questionnaire (Attachment 3) and its continuation page are followed by the Non-SNM Questionnaire (Attachment 4). A sample showing how to complete the Questionnaire (Attachment 5) and a stamped, self-addressed return envelope are the last components of the SNM Questionnaire Packet. All of these components (except the envelope) are reproduced in the following pages.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Your help is needed in a survey.

The U.S. Nuclear Regulatory Commission (NRC), in cooperation with the Department of Transportation (DOT) and the Agreement States, is conducting a survey to obtain information on the number and types of radioactive material shipments made in the United States. The survey results will be compiled to: 1) project the total number and characteristics of shipments made annually, 2) provide a factual basis from which the radiation exposure to individuals and the population from such shipments can be estimated, 3) increase the understanding of the transportation patterns of radioactive materials, and 4) provide a factual basis for work related to impact statements and public deliberations concerning radioactive material shipments.

Battelle-Northwest (Operators of the Energy Research and Development Administration's Pacific Northwest Laboratory, ERDA-PNL) has been contracted to survey a sample of licensees transporting radioactive materials. You have been randomly selected to participate in this survey by supplying data that will be combined with similar data submitted by several hundred other sampled licensees. We hope you will take the time to provide us with this information which will be used and published in summary form only. To help ensure the protection of any data that might be "company confidential", please indicate the portions of the information that should be treated as proprietary plus appropriate reasons for your request.

If you have any questions about the survey or the attached questionnaire please contact either Dr. James H. Jarrett (509-942-3308) at PNL or Dr. Anthony N. Tse (301-443-6910) at NRC. Your cooperation in providing the necessary information by July 25, 1975, will be greatly appreciated. Please return the questionnaire to Dr. Jarrett using the mailing envelope provided in this packet. Please mail any classified information separately following appropriate mailing procedures to: Battelle Memorial Institute, Attn. Technical Information Section, Pacific Northwest Laboratory, P. O. Box 999, Richland, WA 99352.

Thank you.

Attachments

1. Questionnaire Explanation
2. Instructions
3. Questionnaire on Special Nuclear Material
4. Questionnaire on Radioactive Material Other Than Special Nuclear Material
5. Sample Questionnaire
6. Return Envelope

Sincerely,

R. F. Barker

Robert F. Barker, Chief
Transportation and Product Standards Branch
Office of Standards Development

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

Approved by GAO
B-180225(S75031)
Expires 9/30/75

Attachment 1

QUESTIONNAIRE EXPLANATION

Please complete the attached questionnaire for all unclassified and classified consignments (excluding weapons, weapon components, and any material transported by military vehicles): 1) you have shipped, 2) you have exported or imported, and/or 3) you transported to yourself for your own use but outside of your facilities on public roads (i.e., radiography or well-logging sources).

The survey period for Special Nuclear Material consignments is from March 1, 1974 to February 28, 1975. Data you have reported to NRC under the Nuclear Materials Information System (Form 741) has been included on the computer run which should be transferred to the questionnaire (Attachment 3). Please provide the additional information to complete the questionnaire and add information on any other shipments made during the survey period including consignments below 1 gram of Special Nuclear Material.

For all radioactive material other than Special Nuclear Material (Attachment 4), the survey period is: 1) one week for those shipping more than 500 packages/week, 2) one month for those shipping fewer than 500, but more than 10 packages/week, or 3) six months for those shipping less than 10 packages/week. Please select a recent representative period since the results of the survey will be extrapolated to cover a 1-year period.

If you have made no radioactive materials shipments within the last year, please place an X in the appropriate box under the Survey Period at the top of the Questionnaire, complete the Name and Position lines of the Questionnaire heading, and return the questionnaire as indicated in the letter.

Note that the terms "consignment" and "package" have been used in the questionnaire. The definitions of consignment and package, as used here, are:

- Consignment - a package or group of packages being shipped, under one shipping paper, from one place to another.
- Package - a box, drum, can, cylinder, or series of containers, one inside the other, in which the radioactive material is shipped.

The questionnaire has been divided into two parts: one for Special Nuclear Material and one for radioactive material other than Special Nuclear Material. Each questionnaire is arranged in columns which have been numbered and are explained in the Instructions; a partially completed Sample Questionnaire (Attachment 5) is also provided for guidance.

INSTRUCTIONS

Information Related to Each Consignment

Columns 1-6

1 The shipping date for each consignment in the following order: year, month (using the symbols below) and day.

Symbol		Explanation	Symbol		Explanation
Jan	=	January	Jul	=	July
Feb	=	February	Aug	=	August
Mar	=	March	Sep	=	September
Apr	=	April	Oct	=	October
May	=	May	Nov	=	November
Jun	=	June	Dec	=	December

2 The city in which the consignee is located including those consignments transported to yourself.

3 The state in which the consignee is located including those consignments transported to yourself.

4 Approximate miles traveled by the consignment including an estimate of transport miles to yourself.

5-A-1 Using the symbols below, indicate the major mode of transportation used to ship the radioactive material from one location to another.

AF	=	Freight Aircraft (no passenger)	H	=	Helicopter
AP	=	Passenger Aircraft	M	=	Mail
AG	=	Government Aircraft (nonmilitary)	R	=	Rail
A	=	Automobile	S	=	Ship
B	=	Barge	TC	=	Truck - Contract Carrier
BU	=	Bus	TK	=	Truck - Common Carrier
			TP	=	Truck - Private Carrier

5-A-2 Place a check in this column if the mode was assigned for your use exclusively and no other facility's material was carried.

5-B-1 Using the symbols below, indicate the secondary mode of transportation (i.e., from you to the airport).

A	=	Automobile
H	=	Helicopter
TC	=	Truck - Contract Carrier
TK	=	Truck - Common Carrier
TP	=	Truck - Private Carrier

5-B-2 Place a check in this column if the mode was assigned for your use exclusively and no other facility's material was carried.

5-C Place a check in this column if a Freight Forwarder handled your transportation arrangements.

6-A For imported radioactive material indicate the city and state of the Port of Entry.

6-B For exported radioactive material indicate the city and state of the Port of Exit.

Columns 7-13*	**Information Related to Each Package in Each Consignment**
7-A	The symbol and mass number of the principal radionuclide in each package. If the principal radionuclide is unknown, use the following symbols to indicate the special nature of the material. EC = Empty Container MC = Mixed Corrosion Products MF = Mixed Fission Products SF = Spent (or irradiated) Reactor Fuel W = Waste
7-B	The number of packages containing the same radionuclide.
7-C	The intended use of the material using the following symbols. M = Medical R = Research X = Other
8	Chemical form of the radioactive material (i.e., chloride, oxide, nitrate, salt, etc).
9	Physical form of the radioactive material using the following symbols: DS = Dispersible Solids (i.e., powders) G = Gases L = Liquids SF = Special Form
10	Type of package using the following symbols: A = Type A B = Type B AF = Type A (Fissile) BF = Type B (Fissile) E = Exempt LQ = Large Quantity LS = Low Specific Activity
11	Model number of the package.
12	Transport Index (TI) for the package (i.e., the number of millirems per hour at 3 feet from the package surface or, for fissile material, 50 divided by the allowable number of similar packages for nuclear criticality safety).
13	Amount of radioactive material contained in each package in curies; if the radioactive material is Pu, U (depleted, natural, low or highly enriched), or Th, indicate the amount in grams.

*Use repeat marks (") in the columns where a large number of packages are identical; summary data may also be used in these cases.

Attachment 3

QUESTIONNAIRE ON SPECIAL NUCLEAR MATERIALS

SURVEY PERIOD: March 1, 1974 to February 28, 1975

VBV
PENN OVERALL SUPPLY COMPANY
2236 LAPLACE STREET
PITTSBURGH, PENNSYLVANIA 15219
ATTN: MR. T. KARL STARK

NAME _____ PHONE NO. _____ DATE _____

NO SHIPPING ACTIVITIES ☐

POSITION _____ DEPARTMENT _____

HOW MANY CONSIGNMENTS AND GRAMS DO YOU ESTIMATE THAT YOUR COMPANY TRANSPORTS DURING A 1-YEAR PERIOD?

CONSIGNMENTS _____ GRAMS _____

WHAT IS YOUR LICENSE CATEGORY CLASSIFICATION (i.e., RADIOPHARMACEUTICAL, RADIOGRAPHER, GAUGE, ETC.)? _____

INFORMATION RELATED TO EACH CONSIGNMENT

	1 SHIPPING DATE			2 DESTINATION	3	4	5 TRANSPORTATION MODE					6 FOREIGN TRANSPORTATION			
							A. MAJOR		B. SECONDARY		C. FREIGHT FORWARDER	A. IMPORT PORT OF ENTRY		B. EXPORT PORT OF EXIT	
	YEAR	MONTH	DAY	CITY	STATE	APPROXIMATE MILES TRAVELED BY CONSIGNMENT	1. TYPE	2. SOLE USE	1. TYPE	2. SOLE USE		CITY	STATE	CITY	STATE
D011															
D021															
D031															
D041															
D051															
D061															
D071															
D081															
D091															
D101															
D111															
D121															
D131															
D141															
D151															
D161															
D171															
D181															
D191															
D201															
D211															
D221															
D231															
D241															

INFORMATION RELATED TO EACH PACKAGE IN EACH CONSIGNMENT

	7 MATERIAL IDENTIFICATION			8 FORM	9	10 PACKAGES	11	12	13
	A. RADIONUCLIDE	B. NO. OF PKGS./ RADIONUCLIDE	C. APPLICATION	CHEMICAL	PHYSICAL	TYPE	MODEL NUMBER	TI	g
D012									g
D022									g
D032									g
D042									g
D052									g
D062									g
D072									g
D082									g
D092									g
D102									g
D112									g
D122									g
D132									g
D142									g
D152									g
D162									g
D172									g
D182									g
D192									g
D202									g
D212									g
D222									g
D232									g
D242									g

QUESTIONNAIRE ON SPECIAL NUCLEAR MATERIALS (CONT)

INFORMATION RELATED TO EACH CONSIGNMENT

	1 SHIPPING DATE			2 DESTINATION	3	4	5 TRANSPORTATION MODE					6 FOREIGN TRANSPORTATION			
							A. MAJOR		B. SECONDARY		C. FREIGHT FORWARDER	A. IMPORT PORT OF ENTRY		B. EXPORT PORT OF EXIT	
	YEAR	MONTH	DAY	CITY	STATE	APPROXIMATE MILES TRAVELED BY CONSIGNMENT	1. TYPE	2. SOLE USE	1. TYPE	2. SOLE USE		CITY	STATE	CITY	STATE
D251															
D261															
D271															
D281															
D291															
D301															
D311															
D321															
D331															
D341															
D351															
D361															
D371															
D381															
D391															
D401															
D411															
D421															
D431															
D441															
D451															
D461															
D471															
D481															
D491															
D501															
D511															
D521															
D531															
D541															
D551															
D561															
D571															
D581															
D591															
D601															

INFORMATION RELATED TO EACH PACKAGE IN EACH CONSIGNMENT

	MATERIAL IDENTIFICATION			8 FORM	9	10 PACKAGES	11	12	13
	A. RADIONUCLIDE	B. NO. OF PKGS./ RADIONUCLIDE	C. APPLICATION	CHEMICAL	PHYSICAL	TYPE	MODEL NUMBER	TI	g
D252									g
D262									g
D272									g
D282									g
D292									g
D302									g
D312									g
D322									g
D332									g
D342									g
D352									g
D362									g
D372									g
D382									g
D392									g
D402									g
D412									g
D422									g
D432									g
D442									g
D452									g
D462									g
D472									g
D482									g
D492									g
D502									g
D512									g
D522									g
D532									g
D542									g
D552									g
D562									g
D572									g
D582									g
D592									g
D602									g

RADIOACTIVE MATERIAL OTHER THAN SPECIAL NUCLEAR MATERIAL

Attachment 4

PLEASE INDICATE THE SURVEY PERIOD:

1 week ☐
1 month ☐
6 months ☐

NO SHIPPING ACTIVITIES ☐

NAME _____ PHONE NO. _____ DATE _____

POSITION _____ DEPARTMENT _____

HOW MANY CONSIGNMENTS AND CURIES DO YOU ESTIMATE THAT YOUR COMPANY TRANSPORTS DURING A 1-YEAR PERIOD?

CONSIGNMENTS _____ CURIES _____

WHAT IS YOUR LICENSE CATEGORY CLASSIFICATION (i.e., RADIOPHARMACEUTICAL, RADIOGRAPHER, GAUGE, ETC.)? _____

INFORMATION RELATED TO EACH CONSIGNMENT

	1 SHIPPING DATE			2 DESTINATION	3	4	5 TRANSPORTATION MODE					6 FOREIGN TRANSPORTATION			
							A. MAJOR		B. SECONDARY		C. FREIGHT FORWARDER	A. IMPORT PORT OF ENTRY		B. EXPORT PORT OF EXIT	
	YEAR	MONTH	DAY	CITY	STATE	APPROXIMATE MILES TRAVELED BY CONSIGNMENT	1. TYPE	2. SOLE USE	1. TYPE	2. SOLE USE		CITY	STATE	CITY	STATE
D011															
D021															
D031															
D041															
D051															
D061															
D071															
D081															
D091															
D101															
D111															
D121															
D131															
D141															
D151															
D161															
D171															
D181															
D191															
D201															
D211															
D221															
D231															
D241															

INFORMATION RELATED TO EACH PACKAGE IN EACH CONSIGNMENT

	7 MATERIAL IDENTIFICATION			8 FORM	9	10 PACKAGES	11	12	13
	A. RADIONUCLIDE	B. NO. OF PKGS./ RADIONUCLIDE	C. APPLICATION	CHEMICAL	PHYSICAL	TYPE	MODEL NUMBER	TI	Ci
D012									Ci
D022									Ci
D032									Ci
D042									Ci
D052									Ci
D062									Ci
D072									Ci
D082									Ci
D092									Ci
D102									Ci
D112									Ci
D122									Ci
D132									Ci
D142									Ci
D152									Ci
D162									Ci
D172									Ci
D182									Ci
D192									Ci
D202									Ci
D212									Ci
D222									Ci
D232									Ci
D242									Ci

RADIOACTIVE MATERIAL OTHER THAN SPECIAL NUCLEAR MATERIAL (CONT.)

INFORMATION RELATED TO EACH CONSIGNMENT

	1 SHIPPING DATE			2 DESTINATION	3	4	5 TRANSPORTATION MODE					6 FOREIGN TRANSPORTATION			
							A. MAJOR		B. SECONDARY		C. FREIGHT FORWARDER	A. IMPORT PORT OF ENTRY		B. EXPORT PORT OF EXIT	
	YEAR	MONTH	DAY	CITY	STATE	APPROXIMATE MILES TRAVELED BY CONSIGNMENT	1. TYPE	2. SOLE USE	1. TYPE	2. SOLE USE		CITY	STATE	CITY	STATE
D251															
D261															
D271															
D281															
D291															
D301															
D311															
D321															
D331															
D341															
D351															
D361															
D371															
D381															
D391															
D401															
D411															
D421															
D431															
D441															
D451															
D461															
D471															
D481															
D491															
D501															
D511															
D521															
D531															
D541															
D551															
D561															
D571															
D581															
D591															
D601															

INFORMATION RELATED TO EACH PACKAGE IN EACH CONSIGNMENT

	MATERIAL IDENTIFICATION			8 FORM	9	10 PACKAGES	11	12	13
	A. RADIONUCLIDE	B. NO. OF PKGS./ RADIONUCLIDE	C. APPLICATION	CHEMICAL	PHYSICAL	TYPE	MODEL NUMBER	TI	Ci
D252									Ci
D262									Ci
D272									Ci
D282									Ci
D292									Ci
D302									Ci
D312									Ci
D322									Ci
D332									Ci
D342									Ci
D352									Ci
D362									Ci
D372									Ci
D382									Ci
D392									Ci
D402									Ci
D412									Ci
D422									Ci
D432									Ci
D442									Ci
D452									Ci
D462									Ci
D472									Ci
D482									Ci
D492									Ci
D502									Ci
D512									Ci
D522									Ci
D532									Ci
D542									Ci
D552									Ci
D562									Ci
D572									Ci
D582									Ci
D592									Ci
D602									Ci

QUESTIONNAIRE ON SPECIAL NUCLEAR MATERIALS

SURVEY PERIOD: March 1, 1974 to February 28, 1975

NO SHIPPING ACTIVITIES ☐

NAME John Doe PHONE NO. 100-0000 DATE 7/1/75

POSITION TRANS. MGR DEPARTMENT SHIPPING AND RECEIVING

HOW MANY CONSIGNMENTS AND GRAMS DO YOU ESTIMATE THAT YOUR COMPANY TRANSPORTS DURING A 1-YEAR PERIOD?

CONSIGNMENTS 150 GRAMS 10,000

WHAT IS YOUR LICENSE CATEGORY CLASSIFICATION (i.e., RADIOPHARMACEUTICAL, RADIOGRAPHER, GAUGE, ETC.)? ACEDEMIC

INFORMATION RELATED TO EACH CONSIGNMENT

	1 SHIPPING DATE			2 DESTINATION	3	4	5 TRANSPORTATION MODE					6 FOREIGN TRANSPORTATION			
							A MAJOR		B SECONDARY		C FREIGHT FORWARDER	A IMPORT PORT OF ENTRY		B EXPORT PORT OF EXIT	
	YEAR	MONTH	DAY	CITY	STATE	APPROXIMATE MILES TRAVELED BY CONSIGNMENT	1 TYPE	2 SOLE USE	1 TYPE	2 SOLE USE		CITY	STATE	CITY	STATE
D011	74	Mar	21	NY	NY	1000	AP		TK						
D021	75	Jan	11	NY	NY	1000			TR						
D031															
D041															
D051															
D061															
D071															
D081															
D091															
D101															
D111															
D121															
D131															
D141															
D151															
D161															
D171															
D181															
D191															
D201															
D211															
D221															
D231															
D241															

INFORMATION RELATED TO EACH PACKAGE IN EACH CONSIGNMENT

	7 MATERIAL IDENTIFICATION			8 FORM		10 PACKAGES	11	12	13
	A RADIONUCLIDE	B NO OF PKGS RADIONUCLIDE	C APPLICATION	CHEMICAL	PHYSICAL	TYPE	MODEL NUMBER	TI	9
D012	U-235	10	R	oxide	DS	AF	DOT 6B	1.0	100.
D022	Pu-239	3	X	nitrate	L	BF	DOT-SP 5146	2.0	90
D032	U-235	1	X	oxide	DS	BF	DOT 12B	1.5	20
D042									
D052									
D062									
D072									
D082									
D092									
D102									
D112									
D122									
D132									
D142									
D152									
D162									
D172									
D182									
D192									
D202									
D212									
D222									
D232									
D242									

SAMPLE

Attachment 5

SAMPLE 2 - Non-SNM Questionnaire Packet

- Cover Letter
- Questionnaire Explanation (Attachment 1)
- Instructions (Attachment 2)
- Blank Non-SNM Questionnaire Form (Attachment 3)
- Sample Questionnaire (Attachment 4)
- Return Envelope

This packet was sent to those NRC and Agreement State licensees who were considered major shippers. It contained the same cover letter, explanation page and Instruction Sheet as the SNM Questionnaire Packet (Sample 1). Because of similarities to the SNM Questionnaire Packet (Sample 1) only the cover letter, Questionnaire Explanation, Instructions, Blank Non-SNM Questionnaire form and Sample Questionnaire appear on the following pages.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Your help is needed in a survey.

The U.S. Nuclear Regulatory Commission (NRC), in cooperation with the Department of Transportation (DOT) and the Agreement States, is conducting a survey to obtain information on the number and types of radioactive material shipments made in the United States. The survey results will be compiled to: 1) project the total number and characteristics of shipments made annually, 2) provide a factual basis from which the radiation exposure to individuals and the population from such shipments can be estimated, 3) increase the understanding of the transportation patterns of radioactive materials, and 4) provide a factual basis for work related to impact statements and public deliberations concerning radioactive material shipments.

Battelle-Northwest (Operators of the Energy Research and Development Administration's Pacific Northwest Laboratory, ERDA-PNL) has been contracted to survey a sample of licensees transporting radioactive materials. You have been randomly selected to participate in this survey by supplying data that will be combined with similar data submitted by several hundred other sampled licensees. We hope you will take the time to provide us with this information which will be used and published in summary form only. To help ensure the protection of any data that might be "company confidential", please indicate the portions of the information that should be treated as proprietary plus appropriate reasons for your request.

If you have any questions about the survey or the attached questionnaire please contact either Dr. James H. Jarrett (509-942-3308) at PNL or Dr. Anthony N. Tse (301-443-6910) at NRC. Your cooperation in providing the necessary information by July 25, 1975, will be greatly appreciated. Please return the questionnaire to Dr. Jarrett using the mailing envelope provided in this packet. Please mail any classified information separately following appropriate mailing procedures to: Battelle Memorial Institute, Attn. Technical Information Section, Pacific Northwest Laboratory, P. O. Box 999, Richland, WA 99352.

Thank you.

Attachments

1. Questionnaire Explanation
2. Instructions
3. Questionnaire on Radioactive Materials Other Than Special Nuclear Material
4. Sample Questionnaire
5. Return Envelope

Sincerely,

R. F. Barker

Robert F. Barker, Chief
Transportation and Product
Standards Branch
Office of Standards Development

AMERICAN REVOLUTION BICENTENNIAL
1776-1976

Approved by GAO
B-180225(S75031)
Expires 9/30/75

Attachment 1

QUESTIONNAIRE EXPLANATION

Please complete the attached questionnaire for all unclassified and classified consignments (excluding weapons, weapon components, and any material transported by military vehicles): 1) you have shipped, 2) you have exported or imported, and/or 3) you transported to yourself for your own use but outside of your facilities on public roads (i.e., radiography or well-logging sources).

For all consignments other than Special Nuclear Material (Attachment 3), the survey period is: 1) one week for those shipping more than 500 packages/week, 2) one month for those shipping fewer than 500, but more than 10 packages/week, or 3) six months for those shipping less than 10 packages/week. Please select a recent representative period since the results of the survey will be extrapolated to cover a 1-year period.

If you have made no radioactive material shipments within the last year, please place an X in the appropriate box under the Survey Period at the top of the Questionnaire, complete the Name and Position lines of the Questionnaire heading, and return the questionnaire as indicated in the letter.

Note that the terms "consignment" and "package" have been used in the questionnaire. The definitions of consignment and package, as used here, are:

- Consignment - a package or group of packages being shipped, under one shipping paper, from one place to another.
- Package - a box, drum, can, cylinder, or series of containers, one inside the other, in which the radioactive material is shipped.

The questionnaire is arranged in columns which have been numbered and explained in the Instructions (Attachment 2); a partially completed Sample Questionnaire (Attachment 4) is also provided for guidance.

INSTRUCTIONS

Information Related to Each Consignment

Columns 1-6

1 The shipping date for each consignment in the following order: year, month (using the symbols below) and day.

Symbol		Explanation	Symbol		Explanation
Jan	=	January	Jul	=	July
Feb	=	February	Aug	=	August
Mar	=	March	Sep	=	September
Apr	=	April	Oct	=	October
May	=	May	Nov	=	November
Jun	=	June	Dec	=	December

2 The city in which the consignee is located including those consignments transported to yourself.

3 The state in which the consignee is located including those consignments transported to yourself.

4 Approximate miles traveled by the consignment including an estimate of transport miles to yourself.

5-A-1 Using the symbols below, indicate the major mode of transportation used to ship the radioactive material from one location to another.

AF	=	Freight Aircraft (no passenger)	H	=	Helicopter
AP	=	Passenger Aircraft	M	=	Mail
AG	=	Government Aircraft (nonmilitary)	R	=	Rail
A	=	Automobile	S	=	Ship
B	=	Barge	TC	=	Truck - Contract Carrier
BU	=	Bus	TK	=	Truck - Common Carrier
			TP	=	Truck - Private Carrier

5-A-2 Place a check in this column if the mode was assigned for your use exclusively and no other facility's material was carried.

5-B-1 Using the symbols below, indicate the secondary mode of transportation (i.e., from you to the airport).

A	=	Automobile
H	=	Helicopter
TC	=	Truck - Contract Carrier
TK	=	Truck - Common Carrier
TP	=	Truck - Private Carrier

5-B-2 Place a check in this column if the mode was assigned for your use exclusively and no other facility's material was carried.

5-C Place a check in this column if a Freight Forwarder handled your transportation arrangements.

6-A For imported radioactive material indicate the city and state of the Port of Entry.

6-B For exported radioactive material indicate the city and state of the Port of Exit.

Columns 7-13*	**Information Related to Each Package in Each Consignment**
7-A	The symbol and mass number of the principal radionuclide in each package. If the principal radionuclide is unknown, use the following symbols to indicate the special nature of the material: EC = Empty Container MC = Mixed Corrosion Products MF = Mixed Fission Products SF = Spent (or irradiated) Reactor Fuel W = Waste
7-B	The number of packages containing the same radionuclide.
7-C	The intended use of the material using the following symbols: M = Medical R = Research X = Other
8	Chemical form of the radioactive material (i.e., chloride, oxide, nitrate, salt, etc).
9	Physical form of the radioactive material using the following symbols: DS = Dispersible Solids (i.e., powders) G = Gases L = Liquids SF = Special Form
10	Type of package using the following symbols: A = Type A B = Type B AF = Type A (Fissile) BF = Type B (Fissile) E = Exempt LQ = Large Quantity LS = Low Specific Activity
11	Model number of the package.
12	Transport Index (TI) for the package (i.e., the number of millirems per hour at 3 feet from the package surface or, for fissile material, 50 divided by the allowable number of similar packages for nuclear criticality safety).
13	Amount of radioactive material contained in each package in curies; if the radioactive material is Pu, U (depleted, natural, low or highly enriched), or Th, indicate the amount in grams.

*Use repeat marks (") in the columns where a large number of packages are identical; summary data may also be used in these cases.

RADIOACTIVE MATERIAL OTHER THAN SPECIAL NUCLEAR MATERIAL

Attachment 3

PLEASE INDICATE THE SURVEY PERIOD

1 week ☐
1 month ☐
6 months ☐

NO SHIPPING ACTIVITIES ☐

NAME _____ PHONE NO. _____ DATE _____

POSITION _____ DEPARTMENT _____

HOW MANY CONSIGNMENTS AND CURIES DO YOU ESTIMATE THAT YOUR COMPANY TRANSPORTS DURING A 1-YEAR PERIOD?

CONSIGNMENTS _____ CURIES _____

WHAT IS YOUR LICENSE CATEGORY CLASSIFICATION (i.e., RADIOPHARMACEUTICAL, RADIOGRAPHER, GAUGE, ETC.)? _____

INFORMATION RELATED TO EACH CONSIGNMENT

	1 SHIPPING DATE			2 DESTINATION	3	4	5 TRANSPORTATION MODE					6 FOREIGN TRANSPORTATION			
							A. MAJOR		B. SECONDARY		C. FREIGHT FORWARDER	A. IMPORT PORT OF ENTRY		B. EXPORT PORT OF EXIT	
	YEAR	MONTH	DAY	CITY	STATE	APPROXIMATE MILES TRAVELED BY CONSIGNMENT	1. TYPE	2. SOLE USE	1. TYPE	2. SOLE USE		CITY	STATE	CITY	STATE
D011															
D021															
D031															
D041															
D051															
D061															
D071															
D081															
D091															
D101															
D111															
D121															
D131															
D141															
D151															
D161															
D171															
D181															
D191															
D201															
D211															
D221															
D231															
D241															

INFORMATION RELATED TO EACH PACKAGE IN EACH CONSIGNMENT

	7 MATERIAL IDENTIFICATION			8 FORM	9	10 PACKAGES	11	12	13
	A. RADIONUCLIDE	B. NO. OF PKGS./ RADIONUCLIDE	C. APPLICATION	CHEMICAL	PHYSICAL	TYPE	MODEL NUMBER	TI	Ci
D012									Ci
D022									Ci
D032									Ci
D042									Ci
D052									Ci
D062									Ci
D072									Ci
D082									Ci
D092									Ci
D102									Ci
D112									Ci
D122									Ci
D132									Ci
D142									Ci
D152									Ci
D162									Ci
D172									Ci
D182									Ci
D192									Ci
D202									Ci
D212									Ci
D222									Ci
D232									Ci
D242									Ci

RADIOACTIVE MATERIAL OTHER THAN SPECIAL NUCLEAR MATERIALS

ATTACHMENT

PLEASE INDICATE THE SURVEY PERIOD:
1 week [ ]
1 month [X]
6 months [ ]

NO SHIPPING ACTIVITIES [ ]

NAME JOHN DOE PHONE NO. 100-0000 DATE 7/1/75

POSITION TRANS. MGR DEPARTMENT SHIPPING AND RECEIVING

HOW MANY CONSIGNMENTS AND CURIES DO YOU ESTIMATE THAT YOUR COMPANY TRANSPORTS DURING A 1-YEAR PERIOD?

CONSIGNMENTS 1600 CURIES 950

WHAT IS YOUR LICENSE CATEGORY CLASSIFICATION (i.e., RADIOPHARMACEUTICAL, RADIOGRAPHER, GAUGE, ETC.)? RADIOGRAPHER

INFORMATION RELATED TO EACH CONSIGNMENT

	1 Shipping Date			2 Destination	3	4 Approximate Miles Traveled by Consignment	5 Transportation Mode					6 Foreign Transportation			
							A. Major		B. Secondary		C. Freight Forwarder	A. Import Port of Entry		B. Export Port of Exit	
	Year	Month	Day	City	State		1. Type	2. Sole Use	1. Type	2. Sole Use		City	State	City	State
D011	75	Jan	4	NY	NY	450	AP		TK						
D021															
D031															
D041															
D051															
D061															
D071															
D081															
D091															
D101															
D111															
D121															
D131															
D141															
D151															
D161															
D171															
D181															
D191															
D201															
D211															
D221															
D231															
D241															

INFORMATION RELATED TO EACH PACKAGE IN EACH CONSIGNMENT

	7 Material Identification			8 Form	9	10 Packages	11	12	13
	A. Radionuclide	B. No. of Pkgs - Radionuclide	C. Application	Chemical	Physical	Type	Model Number	TI	CI
D012	Cf-249	1	X	oxide	S	B	Sv. 55	0.5	0.0a
D022	I-131	5	X	salt	L	E	NA	0.1	0.6a
D032									a
D042									a
D052									a
D062									a
D072									a
D082									a
D092									a
D102									a
D112									a
D122									a
D132									a
D142									a
D152									a
D162									a
D172									a
D182									a
D192									a
D202									a
D212									a
D222									a
D232									a
D242									a

SAMPLE

Attachment 4

SAMPLE 3 - Summary Questionnaire Packet

- Cover Letter
- Questionnaire Explanation (Attachment 1)
- Instructions (Attachment 2)
- Summary Questionnaire Forms (Attachments 3, 4 and 5)
- Sample Questionnaires (Attachments 6 and 7)

The Summary Questionnaire was sent to non-SNM licensees. It includes the same cover letter as in the other two packets, as well as a Questionnaire explanation page (Attachment 1), and an Instruction page (Attachment 2) similar to the one for the SNM and Non-SNM Questionnaires. The Questionnaire itself is divided into three tables that were to be filled out according to the samples attached to the end of the packet (Attachments 6 and 7); see the following pages.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Your help is needed in a survey.

The U.S. Nuclear Regulatory Commission (NRC), in cooperation with the Department of Transportation (DOT) and the Agreement States, is conducting a survey to obtain information on the number and types of radioactive material shipments made in the United States. The survey results will be compiled to: 1) project the total number and characteristics of shipments made annually, 2) provide a factual basis from which the radiation exposure to individuals and the population from such shipments can be estimated, 3) increase the understanding of the transportation patterns of radioactive materials, and 4) provide a factual basis for work related to impact statements and public deliberations concerning radioactive material shipments.

Battelle-Northwest (Operators of the Energy Research and Development Administration's Pacific Northwest Laboratory, ERDA-PNL) has been contracted to survey a sample of licensees transporting radioactive materials. You have been randomly selected to participate in this survey by supplying data that will be combined with similar data submitted by several hundred other sampled licensees. We hope you will take the time to provide us with this information which will be used and published in summary form only. To help ensure the protection of any data that might be "company confidential", please indicate the portions of the information that should be treated as proprietary plus appropriate reasons for your request.

If you have any questions about the survey or the attached questionnaire please contact either Dr. James H. Jarrett (509-942-3308) at PNL or Dr. Anthony N. Tse (301-443-6910) at NRC. Your cooperation in providing the necessary information by July 25, 1975, will be greatly appreciated. Please return the questionnaire to Dr. Jarrett using the mailing envelope provided in this packet. Please mail any classified information separately following appropriate mailing procedures to: Battelle Memorial Institute, Attn. Technical Information Section, Pacific Northwest Laboratory, P. O. Box 999, Richland, WA 99352.

Thank you.

Attachments

1. Explanation of Questionnaire
2. Instructions
3. Table 1
4. Table 2
5. Table 3
6. Sample Questionnaire
7. Return Envelope

Sincerely,

R. F. Barker

Robert F. Barker, Chief
Transportation and Product
Standards Branch
Office of Standards Development

AMERICAN REVOLUTION BICENTENNIAL
1776-1976

Approved by GAO
B-180225(S75031)
Expires 9/30/75

Attachment 1

QUESTIONNAIRE EXPLANATION

Please complete the attached questionnaire with your best estimate of the information for all radioactive materials: 1) shipped by you to someone else (including exports), 2) imported by you, or 3) transported by you for your own use outside of your facility on public roads (i.e., radiography or well-logging sources) during the most recent (within the last 18 months) 1-year period. If you have made no radioactive material shipments within the last 18 months, please place an X in the appropriate box at the top of Table 1 and return as indicated in the letter.

Note that the terms "consignment" and "package" have been used in the questionnaire. The definitions of consignment and package, as used here, are:

- Consignment - a package or group of packages being shipped, under one shipping paper, from one place to another.
- Package - a box, drum, can, cylinder, or series of containers, one inside the other, in which the radioactive material is shipped.

The questionnaire is divided into three tables (Attachments 3-5) and the columns in each table are explained in the Instructions (Attachment 2); a partially completed Sample Questionnaire (Attachment 6) is also provided for guidance.

INSTRUCTIONS

Table 1 - Information on Quantity and Form for Each Radionuclide Shipped

Column

1-1 The symbol and atomic number of the radioactive material shipped by you. Also, where appropriate, identify the special nature of the material using the following symbols:

Symbol		Explanation
E	=	Exempt
FF	=	Fresh Reactor Fuel
LS	=	Low Specific Activity Materials
MC	=	Mixed Corrosion Products
MF	=	Mixed Fission Products
SF	=	Spent or Irradiated Reactor Fuel
W	=	Waste

1-2 Number of packages shipped during a year.

1-3-A Total curies; if the radioactive material is Pu, U (depleted, natural, low or highly enriched), or Th, indicate the amount in grams shipped per year.

1-3-B Average curies per package; if the radioactive material is Pu, U (depleted, natural, low or highly enriched), or Th, indicate the amount in grams.

1-3-C The maximum amount of curies shipped in a single package during a year; if the radioactive material is Pu, ^{233}U, U (depleted, natural or highly enriched), or Th, indicate the amount in grams.

1-4-A Chemical form of the radioactive material (i.e., chloride, oxide, nitrate, salt, etc.).

1-4-B Physical form of the radioactive material using the following symbols:

DS	=	Dispersible Solids (i.e., powders)
G	=	Gases
L	=	Liquids
NS	=	Nondispersible Solids

Table 2 - Information Related to Types of Packages

2-1 Types of packages used during a year using the following symbols:

A	=	Type A
B	=	Type B
AF	=	Type A (Fissile)
BF	=	Type B (Fissile)
F	=	Exempt
LQ	=	Large Quantity
LS	=	Low Specific Activity

2-2 Total number of packages (not consignments) for each type of packaging shipped per year.

2-3 Model number for the predominant packages.

Table 3 - Information Related to Consignments

3-1 Major mode of transportation used to ship your consignments.

3-2 Total number of consignments (not packages) shipped per year.

3-3 Average number of miles traveled per consignment.

3-4 Average number of packages shipped per consignment.

3-5 Average Transportation Index (TI) per package (i.e., the number of millirems per hour at 3 feet from the package surface or, for fissile material, 50 divided by the allowable for nuclear criticality safety).

SUMMARY QUESTIONNAIRE

NO SHIPPING ACTIVITIES

PLEASE ESTIMATE TO THE BEST OF YOUR KNOWLEDGE THE ITEMS INDICATED IN THE FOLLOWING TABLES.

TABLE 1. INFORMATION ON QUANTITY AND FORM FOR EACH RADIONUCLIDE SHIPPED

	1-1	1-2	1-3 QUANTITY OF RADIOACTIVE MATERIALS			1-4 FORM	
	RADIO-NUCLIDE SHIPPED	PACKAGES/ YEAR	A. TOTAL FOR 1 YEAR	B. AVERAGE/ PACKAGE	C. MAXIMUM/ PACKAGE	A. CHEMICAL	B. PHYSICAL
A011							
A021							
A031							
A041							
A051							
A061							
A071							
A081							
A091							
A101							
A111							
A121							

SUMMARY QUESTIONNAIRE

PLEASE ESTIMATE TO THE BEST OF YOUR KNOWLEDGE THE ITEMS INDICATED IN THE FOLLOWING TABLES.

TABLE 2. INFORMATION RELATED TO TYPES OF PACKAGES

	2-1 TYPES OF PACKAGES SHIPPED	2-2 TOTAL NUMBER OF PACKAGES/YEAR	2-3 MODEL NUMBER FOR PREDOMINANT PACKAGES
B011			
B021			
B031			
B041			
B051			
B061			
B071			
B081			
B091			
B101			
B111			
B121			

SUMMARY QUESTIONNAIRE

PLEASE ESTIMATE TO THE BEST OF YOUR KNOWLEDGE THE ITEMS INDICATED IN THE FOLLOWING TABLES.

TABLE 3. INFORMATION RELATED TO CONSIGNMENTS

	3-1 MAJOR TRANSP. MODE	3-2 TOTAL NUMBER OF CONSIGNMENTS/ YEAR	3-3 AVERAGE MILES/ CONSIGNMENT	3-4 AVERAGE NUMBER OF PACKAGES/ CONSIGNMENT	3-5 AVERAGE TI/ PACKAGE
C011					
C021					
C031					
C041					
C051					
C061					
C071					
C081					
C091					
C101					
C111					
C121					
C131					
C141					

SUMMARY QUESTIONNAIRE

NO SHIPPING ACTIVITIES

PLEASE ESTIMATE TO THE BEST OF YOUR KNOWLEDGE THE ITEMS INDICATED IN THE FOLLOWING TABLES.

TABLE 1. INFORMATION ON QUANTITY AND FORM FOR EACH RADIONUCLIDE SHIPPED

	1-1	1-2	1-3 QUANTITY OF RADIOACTIVE MATERIALS			1-4 FORM	
	RADIO-NUCLIDE SHIPPED	PACKAGES/ YEAR	A. TOTAL FOR 1 YEAR	B. AVERAGE/ PACKAGE	C. MAXIMUM/ PACKAGE	A. CHEMICAL	B. PHYSICAL
A011	Co-60	250	50	0.2	5.0	oxide	DS
A021	Pu-239	25	50	2.0	10.0	nitrate	L
A031							
A041							
A051							
A061							
A071							
A081							
A091							
A101							
A111							
A121							

SUMMARY QUESTIONNAIRE

PLEASE ESTIMATE TO THE BEST OF YOUR KNOWLEDGE THE ITEMS INDICATED IN THE FOLLOWING TABLES.

TABLE 2. INFORMATION RELATED TO TYPES OF PACKAGES

	2-1 TYPES OF PACKAGES SHIPPED	2-2 TOTAL NUMBER OF PACKAGES/YEAR	2-3 MODEL NUMBER FOR PREDOMINANT PACKAGES
B011	A	450	Spec. 17H, Spec. 7A
B021	B	15	Spec. 55, L-10
B031	AF	110	DOT 12B
B041	BF	20	DOT 12B65
B051	E	600	NA
B061	LQ	0	
B071	LS	10	DOT 6B
B081			
B091			
B101			
B111			
B121			

Attachment 6

SUMMARY QUESTIONNAIRE

PLEASE ESTIMATE TO THE BEST OF YOUR KNOWLEDGE THE ITEMS INDICATED IN THE FOLLOWING TABLES.

TABLE 3. INFORMATION RELATED TO CONSIGNMENTS

	3-1 MAJOR TRANSP. MODE	3-2 TOTAL NUMBER OF CONSIGNMENTS/ YEAR	3-3 AVERAGE MILES/ CONSIGNMENT	3-4 AVERAGE NUMBER OF PACKAGES/ CONSIGNMENT	3-5 AVERAGE TI/ PACKAGE
C011	AIR	400	1,000	2.7	0.5
C021	TRUCK	100	680	40	2.0
C031					
C041					
C051					
C061					
C071					
C081					
C091					
C101					
C111					
C121					
C131					
C141					

SAMPLE 4 - ERDA Questionnaire Packet

- Cover Letter
- Questionnaire Explanation (Attachment 1)
- Instructions (Attachment 2)
- Blank SNM Questionnaire Form (Attachment 3)
- Blank Non-SNM Questionnaire Form (Attachment 4)
- Sample Questionnaire (Attachment 5)
- Return Envelope
- List of ERDA Recipients

This packet is the same as the SNM Questionnaire Packet (Sample 1) except for the cover letter, which was signed by W. A. Brobst of ERDA; thus, only the cover letter is included in this sample. These packets were sent to all ERDA Field Office Managers, who then distributed them to their contractors. Also included is a list of the ERDA Field Offices and Area Offices that were mailed questionnaire packets.

UNITED STATES

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

WASHINGTON, D.C. 20545

Your help is needed in a survey.

The U.S. Nuclear Regulatory Commission (NRC), in cooperation with the Energy Research and Development Administration, the Department of Transportation (DOT) and the Agreement States, is conducting a survey to obtain information on the number and types of radioactive material shipments made in the United States. The survey results will be compiled to: 1) project the total number and characteristics of shipments made annually, 2) provide a factual basis from which the radiation exposure to individuals and the population from such shipments can be estimated, 3) increase the understanding of the transportation patterns of radioactive materials, and 4) provide a factual basis for work related to impact statements and public deliberations concerning radioactive material shipments.

Battelle-Northwest (Operators of the Energy Research and Development Administration's Pacific Northwest Laboratory, ERDA-PNL) has been contracted to survey shippers of radioactive materials. You have been selected to participate in this survey by supplying data that will be combined with similar data submitted by several hundred sampled licensees. Please take the time to provide us with this information which will be used and published in summary form only.

If you have any questions about the survey or the attached questionnaire please contact either Dr. James H. Jarrett (509-942-3308) at PNL or T. L. Dunckel (301-973-5361) at ERDA. Your cooperation in providing the necessary information by July 25, 1975, will be greatly appreciated. Please return the questionnaire to Dr. Jarrett using the mailing envelope provided in this packet and send a copy of your response to me. Please prepare information on classified shipments for an unclassified presentation.

Thank you.

Sincerely,

W. A. Brobst JLS

William A. Brobst, Chief
Division Environmental Control
Technology

1. Questionnaire Explanation
2. Instructions
3. Questionnaire on Special Nuclear Material
4. Questionnaire on Radioactive Material other Than Special Nuclear Material
5. Sample Questionnaire
6. Return Envelope

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

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REPORT XIV.H SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE
SNM AND SOURCE MATERIAL (CURIES)
MODE OF TRANSPORTATION - ALL MODES COMBINED

ES8		>.001 THRU 3.0 CI				>3.0 THRU 20 CI				>20 TO 200 CI				>200 THRU 1000 CI				>1000 CI				TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PACKAGES	MILES	TI	CURIES	GRAMS
.	0	1	5008	2.0E=01	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	1	5008	2.00000E=01	2.65979E=01	5.[illegible]
.	3	8	1262	4.0E=02	5	188	492	1.5E=01	144	32	1745	1.2E+00	28	18	1955	3.9E=01	10	254	864	4.2E+00	38	503	408235	1.13345E+03	4.13805E+08	2.[illegible]
.5E=02	185	2818	992	8.7E=01	2769	135	1297	4.5E+00	114	150	1785	7.2E=01	150	0	0	0.	0	0	0	0.	0	3303	3488169	3.15846E+03	1.81404E+04	2.[illegible]
.	1	5	1921	6.7E=02	3	2	949	1.0E=01	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	9	17110	5.33333E=01	1.30456E+01	5.[illegible]
.	0	6	1810	2.0E+00	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	2	971	1.0E=01	1	8	12798	1.22000E+01	2.72967E+03	2.[illegible]
.7E=02	3	5	2284	2.0E+00	3	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	12	34639	1.06333E+01	1.71073E+00	6.[illegible]
.0E=01	1	2	1388	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	8	21875	6.00000E=01	9.04062E=03	4.[illegible]
.0E=02	2	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	2	5700	1.00000E=01	2.46483E=05	3.[illegible]
.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	12	8284	0.	1.23765E=03	8.[illegible]
.9E=01	39	2201	343	3.6E=01	2123	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	2518	984608	8.40637E+02	2.32915E+00	6.[illegible]
.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	3	107	1.4E=01	3	3	320	4.20000E=01	1.10280E+10	3.[illegible]
.	0	1	900	5.0E=02	1	1	900	1.0E+00	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	2	1800	1.05000E+00	8.02359E+00	[illegible]
.	0	0	0	0.	0	0	0	0.	0	9	1780	4.1E+00	9	7	1780	4.1E+00	7	0	0	0.	0	16	28480	6.56000E+01	3.36306E+03	2.[illegible]
.	0	0	0	0.	0	1	1600	1.0E+01	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	1	1600	1.00000E+01	1.05592E+01	7.[illegible]
.	0	0	0	0.	0	21	2097	1.9E=01	21	0	0	0.	0	86	2146	4.0E+00	86	0	0	0.	0	107	228560	3.47900E+02	2.56223E+04	1.[illegible]
.	0	1	620	1.0E=01	1	0	0	0.	0	1	900	3.0E=01	1	0	0	0.	0	0	0	0.	0	2	1520	4.00000E=01	2.32092E+01	1.[illegible]
.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	94	1780	4.1E+00	94	0	0	0.	0	94	167320	3.85400E+02	2.58773E+04	1.[illegible]
.	0	1	1600	1.0E+01	1	2	900	5.3E+00	2	0	0	0.	0	0	0	0.	0	0	0	0.	0	3	3400	2.05000E+01	2.92298E+01	1.[illegible]
.	0	1	620	3.2E+00	1	1	2000	1.0E+01	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	2	2620	1.32000E+01	1.04351E+01	5.[illegible]
.	0	2	1110	5.1E+00	2	1	1600	5.0E=01	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	3	3820	1.07000E+01	6.85471E+00	3.[illegible]
.	0	0	0	0.	0	1	620	1.0E+01	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	1	620	1.00000E+01	1.06858E+01	2.[illegible]
.	0	2	620	5.0E+00	2	1	900	1.0E+01	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	3	2140	2.00500E+01	1.45630E+01	5.[illegible]
.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	2757	1300	0.	0	2757	3584372	0.	9.02645E+13	5.[illegible]
.	0	24	1950	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	1	434	3.0E=01	1	25	47997	3.00000E=01	1.17974E+03	5.[illegible]
.5E=02	19	1624	887	6.1E=01	9	1	1956	1.5E+00	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	1664	1489198	9.96916E+02	2.15040E+03	[illegible]
.1E+00	22	1	250	5.0E=02	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	23	21550	2.39200E+01	5.12197E=02	2.[illegible]
.5E=01	4	18	305	3.8E=01	18	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	22	18690	7.75000E+01	1.44320E=01	[illegible]
.7E=01	102	95631	1210	2.0E+00	95631	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	95734	115992748	1.92639E+05	3.98501E+02	[illegible]
.5E=01	30	69	1924	1.9E+01	69	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	99	237760	1.32525E+03	3.91097E=01	[illegible]
.6E=01	866	458	2747	6.5E=01	458	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	1325	9343921	5.19156E+02	4.65288E+00	[illegible]
.4E=01	206	29	1192	4.0E+00	29	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	241	1607113	2.30171E+02	2.57304E+00	[illegible]
.6E=01	5502	2009	3298	8.1E=01	2008	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	7536	23104254	2.50541E+03	2.69615E+01	[illegible]
.9E=01	2351	3400	1235	7.4E=01	2826	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	5916	9643246	4.01604E+03	8.17520E+01	[illegible]
.7E=01	3501	4742	3216	4.5E=01	4742	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	8288	48900950	3.11455E+03	3.08962E+01	[illegible]
.8E=01	71	64	909	4.2E+00	62	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	149	142336	3.27388E+02	6.79236E+00	[illegible]
.	8	27	594	4.6E=01	27	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	29	17161	1.25000E+01	3.50991E=01	[illegible]
.3E+00	2	6	600	2.4E+00	6	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	8	3610	2.30000E+01	4.22913E=01	[illegible]
.9E=01	169	29	861	5.0E=01	29	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	275	551053	2.56905E+02	2.37239E=01	[illegible]
.3E=01	82	2	300	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	84	39800	3.50000E+01	1.87167E=02	[illegible]
.	0	3	522	5.0E+00	3	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	3	1566	1.50000E+01	3.80846E=01	[illegible]
.9E=01	5	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	5	2756	3.47000E+00	2.71194E=04	[illegible]
.1E+00	36	125	1076	1.7E+00	103	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	620	415278	7.29779E+02	8.47575E=01	[illegible]
.	0	9	588	1.0E=01	5	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	44	78121	9.00000E=01	1.43340E=01	[illegible]
.0E=01	1	17	738	9.7E=01	17	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	1240	556924	1.38750E+02	2.63087E=01	[illegible]
.	1	1	900	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	1088	484737	0.	2.33610E=02	[illegible]
.5E=01	39	4	748	2.0E+00	4	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	52	133442	3.42154E+01	1.24200E=01	[illegible]
.9E=01	280	312	1387	1.1E+00	217	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	815	1001023	7.78370E+02	6.00847E+00	[illegible]
.0E=01	7	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	9	5344	9.00000E=01	3.57177E=03	[illegible]
.5E=01	217	372	297	1.3E=01	372	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	589	194369	1.00300E+02	1.29990E+01	[illegible]
.4E+00	313	22	880	6.7E+00	15	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	435	492830	7.05089E+02	4.99254E=01	[illegible]
.0E=01	1	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	1	4395	1.00000E=01	1.90303E=05	[illegible]
.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	2	40	5.0E=01	2	0	0	0.	0	2	80	1.00000E+00	6.53188E+02	[illegible]
.2E=01	979	115623	1360	4.3E=01	10029	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	118714	160099117	5.07881E+04	1.11397E+04	3.[illegible]
																					TOTAL	254405	383643967	2.65372E+05	9.02760E+13	

REPORT XIII.H SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE
SNM AND SOURCE MATERIAL (GRAMS)
MODE OF TRANSPORTATION - ALL MODES COMBINED

ES8		>1 THRU 100 G				>100 THRU 1000 G				>1000 THRU 10,000 G				>10,000 THRU 100,000 G				>100,000 G				TOTAL	TOTAL	TOTAL	TOTAL
/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PACKAGES	MILES	TI	GRAMS
.	0	0	0	0.	0	[illegible]	[illegible]	[illegible]	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	36	15228	0.	3.60000E=05
.	0	14	1884	2.7E+00	13	[illegible]	[illegible]	[illegible]	9	2	2350	1.0E=01	1	0	0	0.	0	0	0	0.	0	34	59817	7.05667E+01	7.56764E+03
.6E=01	4	32	1338	8.0E=01	26	[illegible]	[illegible]	[illegible]	1	68	2270	1.0E+00	1	0	0	0.	0	0	0	0.	0	108	205963	9.87440E+01	1.05555E+05
.0E+01	1	1	900	5.0E+01	1	[illegible]	[illegible]	[illegible]	26	113	1276	5.0E+01	65	51	1641	1.9E+00	15	16	1419	5.0E+01	6	208	315640	6.76128E+03	7.36040E+06
.	0	0	0	0.	0	[illegible]	[illegible]	[illegible]	2	0	0	0.	0	1010	446	1.0E=01	1	0	0	0.	0	1012	450868	1.01400E+02	6.88160E+07
.3E=02	9	47	1960	4.8E=01	47	[illegible]	[illegible]	[illegible]	10	5	900	8.1E+00	5	0	0	0.	0	0	0	0.	0	71	123412	1.23850E+02	1.30715E+04
.3E=01	12	48	1175	5.1E=01	40	1420	[illegible]	1.0E=01	1399	3459	125	2.6E=01	3458	13	681	6.8E=01	13	0	0	0.	0	4968	1183347	1.09181E+03	1.32119E+07
.0E+00	3	3	310	1.0E+00	1	2	714	2.0E=01	1	0	0	0.	0	0	0	0.	0	8368	650	1.2E=01	8368	8382	5448413	1.04360E+03	2.73964E+09
.0E+00	4	45	630	1.0E=02	3	1	200	1.0E+00	1	0	0	0.	0	0	0	0.	0	36	70	0.	36	86	31524	5.48000E+00	1.30154E+07
.	0	0	0	0.	0	67	1800	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	67	120600	0.	3.04850E+04

REPORT X.H SUMMARY OF ANNUAL SHIPMENTS - DETAILED QUESTIONNAIRE
NON-SNM/SOURCE MATERIAL
MODE OF TRANSPORTATION - ALL MODES COMBINED

RADIO-NUCLIDE	.001 CI OR LESS				>.001 THRU 3.0 CI				>3.0 THRU 20 CI				>20 THRU 200 CI				>200 THRU 1000 CI				>1000 CI				TOTAL PACKAGES	TOTAL MILES	TOTAL TI	TOTAL CURIES
	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS	PKGS	MILES /PKG	TI/PKG	TI PKGS				
AG110M	12	50	2.0E+00	12	2	600	1.3E+01	2	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	14	1805	5.01860E+01	3.20930E+02
AG110	52	1800	2.0E+01	52	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	52	93600	1.04000E+01	2.60000E+03
AM241	231	1275	1.5E+02	219	1745	931	2.1E+02	1672	3141	130	3.4E+00	3141	40	2055	1.1E+00	40	36	630	1.5E+00	36	0	0	0.	0	5193	2434278	1.06655E+04	2.95071E+04
AS 76	6	10	8.3E+01	6	24	1800	3.5E+01	24	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	30	43595	1.34651E+01	4.47456E+01
AU197	0	0	0.	0	52	450	1.0E+00	52	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	52	23400	5.20000E+01	1.12320E+01
AU198	16	536	1.5E+01	16	2738	403	1.8E+00	2686	197	380	1.4E+01	197	0	0	0.	0	0	0	0.	0	0	0	0.	0	2951	1185703	7.57004E+03	2.44585E+03
BA133	8	779	0.	4	4	400	1.0E+01	4	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	12	7967	4.33333E+01	1.32644E+02
BA138	0	0	0.	0	2	2316	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	2	4632	0.	6.00000E+03
BE 7	4	4000	1.0E+01	4	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	4	17333	4.33333E+01	1.08333E+03
BK249	0	0	0.	0	6	2980	1.3E+01	6	24	1198	1.0E+01	24	0	0	0.	0	0	0	0.	0	0	0	0.	0	30	46867	3.21860E+00	1.69904E+02
BR 77	0	0	0.	0	4	211	6.5E+01	4	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	4	844	2.60000E+00	7.40000E+02
BR 82	0	0	0.	0	169	854	2.4E+00	169	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	169	144512	4.11163E+02	1.06781E+01
CA 45	139	655	1.4E+03	138	55	873	0.	55	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	194	138967	2.01446E+01	7.54887E+01
CA 47	133	702	4.0E+01	133	12	387	1.4E+00	12	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	145	98099	7.01395E+01	1.82000E+01
CD109	103	382	6.3E+02	103	29	1389	6.4E+02	29	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	132	79607	8.31194E+00	7.35755E+01
CD115M	2	300	2.0E+01	2	16	300	0.	16	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	18	5400	4.00000E+01	2.00220E+01
CD115	2	300	0.	2	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	2	600	0.	2.30000E+04
CE137	52	940	2.0E+01	52	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	52	48880	1.04000E+01	5.20000E+02
CE141	0	0	0.	0	52	1400	0.	52	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	52	72800	0.	5.20000E+01
CE144	12	50	2.0E+00	12	76	798	1.3E+00	76	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	88	61433	1.22744E+02	2.47181E+01
CF249	0	0	0.	0	4	2700	1.0E+00	2	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	4	10800	4.00000E+00	2.08000E+02
CF252	9	2002	2.3E+00	9	39	580	6.3E+00	17	26	295	6.8E+00	26	0	0	0.	0	0	0	0.	0	0	0	0.	0	74	48377	4.42232E+02	4.20473E+02
CL 35	52	750	0.	52	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	52	39000	0.	5.20000E+03
CL 36	10	1657	7.0E+02	9	16	1023	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	26	3357A	7.19643E+01	6.14144E+02
CL 38	62	13	1.0E+00	58	42	8	7.1E+01	32	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	104	1136	9.16625E+01	2.03547E+00
CM242	0	0	0.	0	12	6000	1.0E+01	12	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	12	72558	1.20930E+00	1.81395E+00
CM244	54	1124	1.0E+01	50	0	0	0.	0	12	685	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	66	69412	5.43721E+00	2.41866E+02
CO 56	2	1000	1.0E+01	2	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	2	2000	2.00000E+01	4.00000E+06
CO 57	9913	801	7.3E+02	8453	1411	1083	2.0E+01	1203	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	11324	9466919	9.98530E+02	2.94255E+01
CO 58	7	643	3.4E+02	7	2	2000	0.	2	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	9	8500	2.40000E+01	6.06400E+03
CO 60M	0	0	0.	0	0	0	0.	0	2	1600	1.0E+01	2	0	0	0.	0	0	0	0.	0	0	0	0.	0	2	3200	2.00000E+01	3.00000E+01
CO 60	2772	446	1.1E+01	1368	1646	792	1.8E+01	1085	322	1456	5.9E+00	259	52	530	2.3E+00	52	48	1306	8.6E+01	47	154	714	1.3E+00	106	4996	3210630	3.27037E+04	2.52005E+06
CR 51	3969	830	2.5E+01	3799	3878	791	1.9E+01	3819	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	7847	6359435	1.72809E+03	5.29970E+01
CS129	0	0	0.	0	40	550	2.9E+00	40	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	40	22000	1.15000E+02	1.15000E+00
CS134	14	2583	2.7E+01	14	5	1320	3.8E+01	3	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	19	42999	5.74457E+00	2.23609E+01
CS137	160	717	2.8E+01	160	2780	229	2.9E+00	2622	20	471	3.2E+00	20	6	1037	1.7E+00	6	2	250	0.	0	4	1320	5.0E+01	2	2973	773953	8.19674E+03	3.17705E+04
CU 64	4	40	1.0E+01	2	123	1545	6.3E+01	123	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	127	190080	7.81674E+01	7.16368E+00
C 14	13118	951	2.9E+05	11022	951	1283	4.2E+01	794	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	14070	13690807	4.00359E+02	2.36912E+02
EC	1869	1127	5.7E+02	1823	32	1042	1.5E+00	32	4	1450	1.1E+00	4	0	0	0.	0	0	0	0.	0	0	0	0.	0	1905	2145623	1.59814E+02	4.42820E+01
ER165	0	0	0.	0	12	60	4.0E+01	12	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	12	726	4.83721E+00	3.62791E+01
EU152	2	750	0.	0	12	776	8.0E+01	12	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	14	10884	9.67442E+00	2.61860E+02
FE 52	0	0	0.	0	32	396	2.3E+00	12	2	70	2.0E+00	2	0	0	0.	0	0	0	0.	0	0	0	0.	0	34	12804	7.60000E+01	1.05262E+01
FE 55	101	794	3.9E+02	99	34	1190	4.3E+02	32	0	0	0.	0	2	2328	8.0E+01	2	0	0	0.	0	0	0	0.	0	137	126654	7.00148E+00	2.80538E+02
FE 59	1852	903	2.4E+01	1279	17	1136	2.6E+01	17	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	1869	.691311	4.45061E+02	2.78629E+01
F 18	2	25	1.0E+01	2	12	20	8.0E+01	12	0	0	0.	0	12	20	1.6E+00	12	0	0	0.	0	0	0	0.	0	26	534	2.92233E+01	3.02521E+02
GA 66	0	0	0.	0	52	13	1.5E+01	52	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	52	676	7.80000E+00	1.56000E+01
GA 67	2	1000	1.0E+01	2	14171	355	2.7E+01	10056	2	1000	9.5E+00	2	12	795	1.2E+00	12	0	0	0.	0	0	0	0.	0	14187	5037259	3.92121E+03	2.17435E+03
GA 71	0	0	0.	0	2	350	1.0E+01	2	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	2	700	2.00000E+01	4.00000E+02
GA 72	12	480	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	12	5805	0.	3.02326E+05
GD153	64	1040	1.9E+02	64	2	160	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	66	66953	1.20930E+00	4.33321E+01
GE 68	0	0	0.	0	12	795	1.3E+00	12	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	12	9614	1.57209E+01	2.90233E+01
HF181	8	49	4.0E+01	8	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	8	390	3.20000E+00	2.24000E+03
HG197	1508	879	2.2E+01	1040	2300	782	2.8E+01	1916	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	3808	3123664	9.65169E+02	3.60063E+01
HG203	328	1668	1.8E+01	328	214	5720	6.9E+01	214	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	543	1772813	2.06109E+02	2.97957E+01
H 3	12907	1103	1.2E+04	10667	7793	1093	1.7E+02	6984	132	1339	5.5E+04	110	190	1308	9.9E+03	42	36	1109	0.	0	85	1204	0.	0	21143	23320591	1.35290E+02	2.20877E+05
IN111	104	20	2.0E+01	104	7974	504	1.3E+01	2478	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	7678	3822389	1.01540E+03	9.09493E+01
IN114M	0	0	0.	0	12	500	2.0E+01	12	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	12	6047	2.41860E+00	6.04651E+02
IN114	0	0	0.	0	12	776	4.0E+01	12	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	12	9364	4.83721E+00	3.62791E+02
IR192	2	300	1.0E+01	2	98	414	3.5E+00	78	218	887	9.1E+01	218	3601	1179	1.9E+00	3449	160	1713	5.9E+00	160	204	1516	5.3E+01	204	4283	5063280	8.45084E+03	8.31021E+06
I 123	18772	163	1.2E+01	14768	3034	586	3.5E+01	2618	2	25	1.0E+01	2	0	0	0.	0	0	0	0.	0	0	0	0.	0	21808	4840410	3.25527E+03	6.55647E+01
I 125	40512	1021	3.1E+02	26499	7824	943	7.4E+02	7115	24	840	8.0E+01	24	0	0	0.	0	0	0	0.	0	0	0	0.	0	48360	48767050	1.85925E+03	3.74393E+02
I 129	12	50	1.0E+01	12	200	1300	0.	210	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	212	260605	1.20930E+00	1.40002E+01
I 130	52	900	5.0E+01	52	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	52	46800	2.60000E+01	1.56000E+03
I 131	68494	856	3.5E+01	66344	127329	852	8.8E+01	125301	149	651	1.2E+00	149	169	926	2.0E+00	169	0	0	0.	0	0	0	0.	0	196141	167323188	1.37240E+05	9.10579E+03
KR 85	89	1141	4.5E+04	89	698	2576	1.0E+01	668	125	1884	2.1E+00	125	133	2295	2.7E+00	133	0	0	0.	0	2	1800	5.0E+01	2	1047	2443556	6.97366E+02	2.77702E+04
K 42	0	0	0.	0	428	1483	9.4E+01	409	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	428	634386	4.02227E+02	5.60785E+00
K 43	0	0	0.	0	411	608	6.2E+01	411	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	411	249818	2.55163E+02	2.77535E+00
LA140	0	0	0.	0	24	50	1.0E+01	24	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	24	1209	2.45488E+02	2.41860E+00
LU177	0	0	0.	0	12	2700	1.0E+01	12	0	0	0.	0	0	0	0.	0	0	0	0.	0	0	0	0.	0	12	32651	1.20930E+00	6.04651E+02
MC	3125	439	1.9E+01	1057	10857	507	5.9E+00	4264	196	606	3.8E+02	108	6	650	3.9E+01	6	0	0	0.	0	0	0	0.	0	14184	6995944	1.39128E+05	5.57096E+03
MF	857	353	1.6E+00	661	24586	268	8.2E+00	6460	660	575	1.6E+01	362	23	2355	9.8E+00	18	158	20	3.0E+00	158	5	1298	3.2E+00	2	26290	7332385	2.13804E+05	1.08561E+05
MG 28	60	2848	1.1E+00	60	0	0	0.	0	0	0	0.	0	0	0	0.	0	10	3294	1.0E+00	10	0	0	0.	0	70	203800	7.52000E+01	5.67602E+03
MIXED	2156	802	6.4E+01	1789	12654	405	9.8E+01	7284	210	520	4.9E+01	54	4	1110	5.1E+00	4	7447	435	3.3E+01	7447	108	92	5.3E+01	108	22579	10215106	1.63701E+04	2.13154E+06
MN 54	104	1450	1.5E+01	104	16	300	0.	0	0	0	0.	0	2	620	1.0E+00	2	0	0	0.	0	0	0	0.	0	122	156840	1.76000E+01	1.09018E+02

EXPLANATION FOR USE OF REPORTS X.H, XIII.H, AND XIV.H

Reports X.H, XIII.H, and XIV.H contain the data from all of the Detailed Questionnaires, extrapolated to annual totals for the licensees and ERDA contractors responding to the survey. No attempt has been made to extrapolate the data from the Detailed Questionnaires to any total population (see Sections 4 and 5 for discussion).

Report X.H lists the data from the Non-SNM/Source Material data base (Detailed Questionnaires) for all transportation modes combined sorted by radionuclide vertically in alphabetical order and by curies per package range. Note that the letter "M" following the nuclide name indicates the metastable form of the isotope. The six ranges of curies per package listed in the column headings are based on Department of Transportation (DOT) definitions of Type A and Type B amounts of radioactive material for the various transport groups (49 CFR 173.389, 390, 391) pertinent to this survey. The number of packages (PKGS) listed under each curie range represents the number of packages shipped which contained the corresponding radionuclide in an amount within the range indicated. The number of packages listed in all cases is the number obtained by extrapolating the data listed on each Detailed Questionnaire to a uniform one-year period (see "Calculations for Computer Reports," Appendix B). All other average and total values associated with these packages are based on this annual extrapolation. The second item (MILES/PKG) listed under each curie range is the average distance in miles that the indicated packages traveled from origin to destination. The third item listed under each curie range is the average transport index (TI/PKG) associated with the number of packages listed. Not all of the packages had a TI listed with them (the TI column was left blank on the questionnaire form). The actual (extrapolated) number of packages on which the average TI was based is listed as the fourth item (TI PKGS) under each curie range.

The last four columns on Report X.H list the totals for the indicated packages summed over all six curie ranges. The total number of packages is simply the arithmetic sum of the number of packages listed in each of the six curie ranges. The Total TI listed is obtained by multiplying the number of packages (first item) under each curie range times the associated average TI per package (third item) for each of the six curie ranges and summing the results. This procedure assumes that the packages, which had no TI associated with them in each curie range, are assigned the average TI per package for the respective curie range. The total distance in miles which the indicated packages traveled from origin to destination is obtained by multiplying the number of packages in each curie range (first item) by the average miles per package in the same curie range (second item) and summing the results over all six curie ranges. The total curies contained in the total packages are listed in the last column. The overall average TI per package, miles traveled per package, and curies per package may be determined for any line entry by dividing the indicated total TI or total miles by their associated total number of packages. The overall totals for all nuclides of the last four columns appear in the last line of Report X.H.

For an example of the information available from Report X.H, consider the thirty-second line of data, the ^{60}Co entry. In this line there are 2772[a] packages of ^{60}Co indicated, each containing less than or equal to 0.001 Ci (first curie range) of ^{60}Co. These packages traveled an average of 446 miles from origin to destination and the average TI per package was 0.11 (1.1 E-01) based on 1368 of the 2772 packages. There are 1646 packages indicated containing an amount of ^{60}Co within the second curie range (greater than 0.001 Ci and less than or equal to 3.0 Ci). These were shipped an average distance of 792 miles from origin to destination. The average TI per package was 18 (1.8 E+01) based on 1085 of the 1646 packages in this range. There are 322, 52, 48, and 154 packages

(a) Numeric values are quoted here with up to seven significant figures only as an aid in finding the numbers on the computer reports.

indicated in the third, fourth, fifth, and sixth curie ranges, respectively. Each of these entries in the third through sixty columns also have the associated average miles and TI per package listed. The extrapolated total number of packages of ^{60}Co indicated in the "Total Packages" column is 4996. (Note that the number of ^{60}Co packages listed under each of the six curie intervals add to a total of 4994 packages. The difference between this sum and the total packages listed is due to roundoff differences in the independent extrapolations.) These packages were shipped a total of 3,210,630 miles from origin to destination. Their total TI was 32,703.7 (3.27037E+04) and total ^{60}Co content was 2,520,050 Ci. From the entries in the last four columns, it can be determined that the overall average distance traveled by a ^{60}Co package was 643 miles per package (3,210,630 miles ÷ 4996 packages), the overall average TI per ^{60}Co packages was 6.5 (32,703.7 ÷ 4996), and the average ^{60}Co package contents was 504 Ci (2,520,050 ÷ 4996).

Further information may be obtained by summing the number of packages listed under the curie range up to and including the limiting amount for Type A or Type B quantity specification. The limits for ^{60}Co are (49CFR173.389,390), 3.0 Ci or less for Type A, and greater than 3.0 but less than or equal to 200 Ci for Type B. The number of packages of ^{60}Co indicated on Report X.H which contained 3.0 (or less) Ci is 2772 plus 1646 (those listed in the first and second curie ranges) or 4418 packages. The number of packages that contained Type B amounts of ^{60}Co is 322 plus 52 (the third and fourth curie ranges) or 374. The remaining 202 (fifth plus the sixth curie range entries) packages contained Large Quantity (49CFR173.389) amounts of ^{60}Co. Parametric values can also be obtained from the last four columns. Total or average curie-miles or TI-miles can be calculated by multiplying or dividing the values from the proper columns. All of the above information can be extracted from Report X.H for each radionuclide listed.

The very last line on Report X.H lists the overall totals of the last four total columns. The totals indicate that the licensees and contractors responding with Detailed Questionnaires shipped 778,752 packages containing a total of 14,089,600 Ci. These packages traveled a total of 528,007,796 miles and their total TI was 1,146,180.

The same type of information is available for the SNM/Source Material nuclides listed in Reports XIII.H and XIV.H. Report XIV.H contains the information from the SNM/Source Material data base which was convertible from gram inventories to curies to more clearly reflect DOT package type definitions by (curie) package contents. Report XIV.H is identical in format to Report X.H except that a fifth "Totals" column has been added indicating the inventory totals in grams for each nuclide. Report XIII.H contains the remaining data from the SNM/Source Material data base that could not be converted from gram inventories to curies, since no decay half-life is available for the package contents involved. Report XIII.H is similar to Report X.H, however the package contents ranges and inventory totals are in grams and do not reflect DOT package type designations. Reports XIII.H and XIV.H combined contain the total SNM/Source Material data base.

Note that the radionuclide symbols in Report XIV.H such as "U235A" indicate particular enrichments of ^{235}U while other symbols such as "UP229C" represent uranium-plutonium mixtures. See Pages A-8 through A-10, Appendix A, under the subheading "Column 7A" for an explanation and example of these symbols and amounts; also see Table 4.4, Section 4. The curie and gram amounts listed for enriched uranium in Report XIV.H are curies or grams of ^{235}U while the curie and gram amounts listed for uranium-plutonium mixtures are curies of plutonium but are grams of the mixture.

The symbols for irregular nuclide designations in Reports X.H, XIII.H, and XIV.H are interpreted as follows:

EC[a] = empty container (some were contaminated)
MC = mixed corrosion products
MF = mixed fission products
PU = plutonium (isotope unknown)
SF = spent fuel
TH = thorium (isotope unknown)
UP = uranium/plutonium mixture (isotopes and ratios unknown)
UN = nuclide is unknown
U = uranium (isotope unknown)
W = waste (nature unknown)

The information contained in Reports X.H, XIII.H and XIV.H is sorted by transportation modes in Reports X.A through G, XIII.A through D and F, and XIV.A through G in Appendix B. Reports XIII.A through H contain the data from the SNM/Source Material data file that could not be converted from gram inventories to curie inventories such that the sum of Report Series XIII and XIV contain all of the data from the SNM/Source Material data file.

(a) A value of either 1 microcurie or 1 microgram was assigned as the contents of empty containers (EC) to avoid the possibility of division by zero in computer calculations. This was later found to be unnecessary, however the assigned values were not corrected. To determine the average curies or grams of contamination per EC, multiply the total number of EC packages by 1 microcurie (for Report Series X.A-H) or 1 microgram (for Report Series XIII.A-h) and subtract this value from the total curies or grams listed. Then divide the remainder by the total number of packages. For example, from Report X.H, the average contamination per empty container is 0.023 Ci per package:

$$\frac{44.282 \text{ Ci} - [(1905 \text{ packages})(10^{-6} \text{ Ci per package})]}{1905 \text{ packages}} = 0.023 \text{ Ci per package}$$

The nature of the contamination was, in all cases, not available.

ERRATA

The entries for ^{238}Pu (2nd line of data) and ^{231}U (23rd line of data) in Report XIV.H contain errors. These errors are discussed in detail on Page B-i of Appendix B.