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Radiochemical Data Collected on Events From Which Radioactivity Escaped Beyond the Borders of the Nevada Test Range Complex

H. G. Hicks

February 12, 1981

Lawrence
Livermore
National
Laboratory

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H. G. Hicks

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**RADIOCHEMICAL DATA COLLECTED ON EVENTS FROM WHICH RADIOACTIVITY
ESCAPED BEYOND THE BORDERS OF THE NEVADA TEST RANGE COMPLEX**

ABSTRACT

This report identifies all nuclear events in Nevada that are known to have sent radioactivity beyond the borders of the test range complex. There have been 177 such tests, representing seven different types: nuclear detonations in the atmosphere, nuclear excavation events, nuclear safety events, underground nuclear events that inadvertently seeped or vented to the atmosphere, dispersion of plutonium and/or uranium by chemical high explosives, nuclear rocket engine tests, and nuclear ramjet engine tests. The source term for each of these events is given, together with the data base from which it was derived (except where the data are classified). The computer programs used for organizing and processing the data base and calculating radionuclide production are described and included, together with the input and output data and details of the calculations. This is the basic information needed to make computer modeling studies of the fallout from any of these 177 events. (Classified data for the atmospheric, excavation, and safety events and the plutonium and uranium dispersion tests are published in a separate classified supplement to this report.)

INTRODUCTION

Radioactivity has been detected beyond the borders of the Nevada test range complex from time to time since the beginning of nuclear testing there in 1951. By far the largest amounts of escaping radioactivity were produced by nuclear detonation events in the atmosphere. Many of these atmospheric events deposited radioactive fallout on some of the populated areas of Nevada and southern Utah. I have compiled here the analyses of radionuclides produced in all Nevada tests from which radioactivity was detected beyond the borders of the test range complex. These are the "source terms" for the tests--the essential information for making fallout calculations. This report presents all of this source term data with the exception of certain classified

information, described below, which will be published separately in classified form.

Not all of the Nevada events that released radioactivity beyond the borders of the test range complex were nuclear explosions. Some were events that dispersed radioactivity in other ways--for example, nuclear rocket engine tests. The nuclear detonation events included here represent only about one-fourth of the publicly announced U.S. nuclear tests in Nevada.¹

In his testimony before a Congressional Subcommittee, Gates² stated that radiation from 98 aboveground events and 41 subsurface events was detected outside the boundaries of the test range complex. (Since then there has been one additional case of seepage from a subsurface nuclear event in Nevada.) I have chosen to group these tests according to the kind of input data and the mathematics required to calculate curies released. The two types of groupings are shown below along with the nuclear engine tests.

Aboveground Explosions (97)

- Nuclear explosions in the atmosphere (80).
- Safety-related events (14).
- Events in which plutonium and/or uranium were dispersed in the atmosphere by a conventional chemical explosion (3).

Subsurface Explosions (43)

- Nuclear excavation experiments (10).
- Underground nuclear explosions that unintentionally vented to the atmosphere (33).

Engine Tests (37)

- Nuclear rocket engine tests (31).
- Nuclear ramjet engine tests (6).

For these various events, analyses were made to determine radionuclides produced from the structural materials, from fission, and from uranium and plutonium. All data reported are in the appendices described below. The data for the first four types of events listed above are classified and are published in a separate classified supplement.

The FRAMIS computer code³⁻⁵ was used to handle the large amount of data. Instructions in the form of executable files were written in the convenient FRAMIS command language to organize the input data, to calculate curies of each nuclide, and to print out summary tables, input data tables, and output data tables. Listings of these instructions are given in the appendices, which are organized as follows:

Unclassified Appendices (Published as Part of this Volume)

Appendix I. Executable FRAMIS files for atmospheric, excavation, and safety-related nuclear detonation events, and input card images for summary table only.

Appendix II. Executable FRAMIS files for plutonium and/or uranium dispersion experiments.

Appendix III. Executable FRAMIS files for underground detonations that seeped or vented to the atmosphere: input card images, summary table, output table, and details of calculations.

Appendix IV. Executable FRAMIS files for nuclear rocket engine tests: input card images, summary table, output table, and details of calculations.

Appendix V. Executable FRAMIS files for nuclear ramjet engine tests: input card images and output data.

Classified Appendices (Published Separately as Classified Supplement)

Appendix VI. Input card images and input and output data tables for atmospheric, excavation, and safety-related nuclear detonation events.

Appendix VII. Input card images and output data for plutonium and/or uranium dispersion experiments.

ATMOSPHERIC, EXCAVATION, AND SAFETY-RELATED NUCLEAR DETONATION EVENTS

These three types of events are combined because the input data are of the same form, the arithmetic to convert to curies (see Appendix I) is the same, and the data are classified. Excavation events are identified by an asterisk after the event name, e.g. JANGLE-UNCLE*. Safety-related events are identified by two asterisks after the event name, e.g. Project 56 No. 1**. Input data are operation name, event name, sponsor, placement, date, time (see

Appendix I), fission yield, atoms per fission of neutron-induced nuclides at zero time, preshot heavy-element composition, and fraction of fissions occurring in each fissionable nuclide (see Appendix VI). The fission products are treated as if there were no fractionation because this compilation is a source term. Therefore, in the output data table only the fission yield is given. We may calculate the curies of fission products at H + 12 hours (a standard reference time) from the relationship 3.03×10^7 curies per kiloton.⁶ The induced activities and the heavy elements are reported as curies at zero time.

The computer directory ATMOSPHER contains the files pertaining to atmospheric, excavation, and safety-related nuclear detonation events. Table 1 gives file names and contents.

TABLE 1. Files in computer directory ATMOSPHER pertaining to atmospheric and excavation nuclear detonation events.

File name	Contents	Appendix
ATSHOTIN	Summary (name, date, etc.)	I
ATSHOTIN1,...,ATSHOTIN5	Input data	VI
ATMSHOTS	Executable file for organizing data and calculating curies	I
ATMPRINT1,...,ATMPRINT3	Executable files for making print files: 1 for summary table, 2 for input data, 3 for output data	I
FALLOUT	Computer output file, all tables	VI
NTSFALLOUT	FRAMIS file (not listed)	--

To print out data from all events, call out the FALLOUT file under access level 5, and output it to the high-speed printer as follows:

ALLOUT HSP FALLOUT COL1. BOX NUMBER ID

To manipulate the data base, call for the files ATMSHOTS, ATSHOTIN, ATSHOTIN1 through ATSHOTIN5, and NTSFALLOUT. Under the FRAMIS system, open NTSFALLOUT and execute ATMSHOTS. Input and summary data are in table ATSHOTDATA, and the output data are in table CURIESATM. All data may now be processed.

If an activation product was measured in one event and not in another, the amount in the unmeasured event was estimated if the devices and placements were similar. The amount of ^{242}Cm was estimated from systematics of nuclear detonations. Estimates are shown as negative numbers (see Appendix VI).

PLUTONIUM AND/OR URANIUM DISPERSION TESTS

The dispersion of plutonium and/or uranium by conventional high explosives was studied in Operation Roller Coaster. Those events from which radioactivity was detected beyond the borders of the test range complex--Double Tracks, Clean Slate I, and Clean Slate II--were conducted to determine the dispersion pattern and the degree of animal uptake of these heavy elements.

Input data are operation name, event name, date, time, and curies of uranium and plutonium involved. The data are classified SRD (see Appendix VII). The output table is the same as the input data.

The computer directory ATMOSPHER contains the files pertaining to Operation Roller Coaster. Table 2 gives file names and contents.

TABLE 2. Files in computer directory ATMOSPHER pertaining to Operation Roller Coaster.

File name	Contents	Appendix
ROLLERIN	Input data	VII
ROLLERC	Executable file for organizing data	II
ROLLPRINT	Executable file for making a print file	II
ROLLERCOAS	Computer output file for all data	VII

To print out the data from all events, call out the ROLLERCOAS file under access level 5 and output it to the high-speed printer as follows:

ALLOUT HSP ROLLERCOAS COLL. BOX NUMBER ID

UNDERGROUND NUCLEAR DETONATION EVENTS THAT SEEPED
OR VENTED TO THE ATMOSPHERE

There have been many nuclear explosions conducted underground in Nevada, and some of them have seeped or vented radioactivity to the atmosphere.¹ Only those events which have resulted in the detection of radioactivity beyond the borders of the test range complex are included in this compilation.

The input data are operation name, event name, sponsor, placement, category, date, time, and curies released (measured after 12 hours' decay). The category² relates to the time of the initial release and its duration; thus the category determines the cloud composition. The categories are defined in the summary table in Appendix III.

The output data are curies (measured after 12 hours' decay) of 28 fission products. The pertinent values for each nuclide and each vent category are listed in Appendix III.

The computer directory VENT contains the files pertaining to the vented shots (see Appendix III). Table 3 gives file names and contents.

TABLE 3. Files in computer directory VENT.

File	Contents
VESHOTIN	Input data
VENTSHOTS	Executable file for organizing data and calculating curies
VEPRINT1	Executable files for making print files: 1 for input
VEPRINT2	data, 2 for output table
VENTDATA	Computer output files for all data
NTSRELEASE	FRAMIS file (not listed)

To print out data for all events, call out the VENTDATA file and output it to the high-speed printer as follows:

ALLOUT HSP VENTDATA COL1. BOX NUMBER ID

To manipulate the data base, call out the files NTSRELEASE, VESHOTIN, and VENTSHOTS. Under the FRAMIS system, open NTSRELEASE and execute VENTSHOTS. All data are in table VESHOTDATA and may now be processed.

NUCLEAR ROCKET ENGINE TESTS

During the testing of nuclear rocket engines, 31 runs were made from which radioactivity was detected beyond the borders of the test range complex. There was only one run, Phoebus 1B (Feb 23, 1967), in which the cloud composition was well measured. Thus a number of assumptions were made in the estimation of the debris composition (see Appendix IV).

The input data are engine name, test data, power level (megawatt-seconds), and total curies released (measured after 12 hours' decay) of 34 fission products.

The computer directory ROVER contains the files pertaining to the nuclear rocket engine runs (see Appendix IV). Table 4 gives the file names and contents.

TABLE 4. Files in computer directory ROVER.

File	Contents
ROCKETIN	Input data
ROCKETESTS	Executable file for organizing data and calculating curies
ROCKPRINT1	Executable files for making print files: 1 for input
ROCKPRINT2	data, 2 for output table
ROVERDATA	Computer output file for all data
NTSRELEASE	FRAMIS file (not listed)

To print out data for all events, call out the ROVERDATA file and output it to the high-speed printer as follows:

ALLOUT HSP ROVERDATA COL1. BOX NUMBER ID

To manipulate the data base, call out the files NTSRELEASE, ROCKETIN, and ROCKETESTS. Under the FRAMIS system, open NTSRELEASE and execute ROCKETESTS. All data are in table ROCKETA and may now be processed.

NUCLEAR RAMJET ENGINE TESTS

During the testing of nuclear ramjet engines, seven runs were made, all of which placed radioactivity beyond the borders of the test range complex. The fission products in the debris cloud were not fractionated; therefore, only the total number of fissions and curies released (measured after 12 hours' decay) are reported.

The input data are engine name, date, number of fissions released, and number of curies released. The output data are the same.

The computer directory TORY contains the files pertaining to the nuclear ramjet engine runs (see Appendix V). Table 5 gives file names and contents.

TABLE 5. Files in computer directory TORY.

Files	Contents
RAMJETIN	Input data
RAMJETESTS	Executable file for organizing data
RAMPRINT	Executable file for making print file
TORYDATA	Computer output file

To print out data, call out the file TORYDATA and output it to the high-speed printer as follows:

ALLOUT HSP TORYDATA COLL. BOX NUMBER ID

Acknowledgment

My sincere thanks to Stephen E. Jones, who cheerfully, patiently, and competently led me through the FRAMIS system.

REFERENCES

1. *Announced United States Nuclear Tests, July 1945 Through December 1979*, U. S. Department of Energy, Nevada Operations Office, Office of Public Affairs, Las Vegas, Nevada, NVO-209 (January 1980).
2. Mahlon E. Gates, Manager, Nevada Operations Office, U. S. Department of Energy, statement before the Subcommittee on Oversight and Investigation of the Committee on Interstate and Foreign Commerce, U. S. House of Representatives, *Low Level Radiation Effects on Health*. 96th Congress, first session, April 23, 1979, May 24, 1979, August 1, 1979. Serial Number 96-129, U. S. Government Printing Office, page 350.
3. Stephen E. Jones and Daniel R. Ries, *A Relational Data Base Management System for Scientific Data*, Lawrence Livermore Laboratory, Livermore, California, UCRL-80769 Preprint (February 1978).
4. Stephen E. Jones et al., *FRAMIS Reference Manual*, Lawrence Livermore Laboratory, Livermore, California, UCID-30176 (September 1979).
5. Ada L. Dittli, *Introduction to FRAMIS--A Tutorial*, Lawrence Livermore Laboratory, Livermore, California, UCID-30173 (March 1979).
6. R. H. Ide, Lawrence Livermore Laboratory, private communication.

APPENDIX I

ATMOSPHERIC, EXCAVATION, AND SAFETY-RELATED NUCLEAR DETONATION EVENTS

This appendix contains executable FRAMIS files for the atmospheric, excavation, and safety-related nuclear detonation events included in this compilation, the input card images for the summary table, and the summary table. Input card images for the other data for these events, together with the input and output data tables, are available in the companion classified publication, UCRL-52934 Supplement (1980) (title U, report SRD).

Executable FRAMIS Files

```

/* NTSFALLOUT, ATMOSPHERIC SHOTS, ATMSHOTS */
/* DEFINE TABLES */
DEF TAB ATSHOT CPNAME CHAR 15, NUM INT, SHOTNAME CHAR 20, SPONSOR CHAR 8,
PLACEMENT CHAR 16, DATE INT, GCTIME INT;
DEF TAB ATSHOT1 NUM INT, YIELD REAL, KGOY REAL, KGPU REAL, KGTU REAL, KG233 REAL,
GM241 REAL, A REAL, B REAL, C REAL, D REAL, BE7 REAL;
DEF TAB ATSHOT2 NUM INT, NA24 REAL, MN54 REAL, FE55 REAL, FE59 REAL, CO57 REAL,
CO58 REAL;
DEF TAB ATSHOT3 NUM INT, CO60 REAL, CU64 REAL, CU67 REAL, W181 REAL, W185 REAL,
W187 REAL;
DEF TAB ATSHOT4 NUM INT, W188 REAL, AU198 REAL, AU199 REAL, PB203 REAL, U237 REAL,
U240 REAL;
DEF TAB ATSHOT5 NUM INT, NP239 REAL, AM241 REAL, CM242 REAL;

/* INPUT DATA */
INPUT ATSHOT FROM ATSHOTIN;
INPUT ATSHOT1 FROM ATSHOTIN1;
INPUT ATSHOT2 FROM ATSHOTIN2;
INPUT ATSHOT3 FROM ATSHOTIN3;
INPUT ATSHOT4 FROM ATSHOTIN4;
INPUT ATSHOT5 FROM ATSHOTIN5;
TEMP1=(ATSHOT PROJ NUM SHOTNAME SPONSOR DATE)JOIN ATSHOT1 ON NUM;
TEMP2=TEMP1 JOIN ATSHOT2 ON NUM;
TEMP3=TEMP2 JOIN ATSHOT3 ON NUM;
TEMP4=TEMP3 JOIN ATSHOT4 ON NUM;
TEMP5=TEMP4 JOIN ATSHOT5 ON NUM;
ATSHOTDATA=TEMP5;
CURIESA=ATSHOTDATA PROJ NUM SHOTNAME SPONSOR DATE YIELD BE7 NA24 MN54 FE55
FE59 CO57 CO58 CO60 CU64 CU67 W181 W185 W187 W188 AU198 AU199 PB203 U237 U240
NP239 AM241 CM242;
CURIESB=ATSHOT1 PROJ NUM KGOY KGPU KGTU KG233 GM241 A B C D YIELD;

/* CALCULATE CURIES */
MAKE BE7 IN CURIESA BE (BE7*YIELD*5.78E5/0.900);
MAKE NA24 IN CURIESA BE (NA24*YIELD*4.92E7);
MAKE MN54 IN CURIESA BE (MN54*YIELD*9.85E4/0.914);
MAKE FE55 IN CURIESA BE (FE55*YIELD*3.13E4/0.818);
MAKE FE59 IN CURIESA BE (FE59*YIELD*6.90E5/1.038);
MAKE CO57 IN CURIESA BE (CO57*YIELD*1.14E5/0.864);
MAKE CO58 IN CURIESA BE (CO58*YIELD*4.35E5/0.928);
MAKE CO60 IN CURIESA BE (CO60*YIELD*1.60E4/0.961);
MAKE CU64 IN CURIESA BE (CU64*YIELD*5.81E7/0.786);
MAKE CU67 IN CURIESA BE (CU67*YIELD*1.20E7/1.053);
MAKE W181 IN CURIESA BE (W181*YIELD*2.54E5/0.865);
MAKE W185 IN CURIESA BE (W185*YIELD*4.10E5);
MAKE W187 IN CURIESA BE (W187*YIELD*3.09E7/0.681);
MAKE W188 IN CURIESA BE (W188*YIELD*4.44E5/1.0683);
MAKE AU198 IN CURIESA BE (AU198*YIELD*1.14E7/1.022);
MAKE AU199 IN CURIESA BE (AU199*YIELD*9.81E6);
MAKE PB203 IN CURIESA BE (PB203*YIELD*1.42E7);
MAKE U237 IN CURIESA BE (U237*YIELD*4.56E6);
MAKE U240 IN CURIESA BE (U240*YIELD*5.24E7);
MAKE NP239 IN CURIESA BE (NP239*YIELD*1.31E7);
MAKE AM241 IN CURIESA BE (AM241*YIELD*3.32E2/0.929);
MAKE CM242 IN CURIESA BE (CM242*YIELD*1.89E5/0.987);
CURIESB=CURIESB RENAME KG233 TO U233 KGOY TO U235 KGTU TO U238 KGPU TO PU GM241
TO PU241;

```

```

CURIESC=CURIESB PROJ NUM U235;
CURIESC=CURIESC RENAME U235 TO U234;
CURIESH=CURIESB JOIN CURIESC ON NUM;
MAKE U233 IN CURIESH BE (9.638*U233-0.5296*D*YIELD);
MAKE U234 IN CURIESH BE (0.06763*U234);
MAKE U235 IN CURIESH BE (2.020E-3*U235-1.197E-4*A*YIELD);
MAKE U238 IN CURIESH BE (3.364E-4*U238-1.877E-5*C*YIELD);
MAKE PU IN CURIESH BE (73.814*PU-4.101*B*YIELD);
MAKE PU241 IN CURIESH BE (100.9*PU241);
CURIESATM=(CURIESH PROJ U233 U234 U235 U238 PU PU241 NUM)JOIN CURIESA ON NUM;

/* DELETE OBSOLETE TABLES */

DEL TAB TEMP1 TEMP2 TEMP3 TEMP4 TEMP5 ATSHOT1 ATSHOT2 ATSHOT3 ATSHOT4 ATSHOT5;
DEL TAB CURIESA CURIESB CURIESC CURIESH;

/* PRINT SHOT SUMMARY, ATMOSPHERIC SHOTS, ATMPRINT1 */

DEL TAB PE;
DEF TAB PE COL1 CHAR 1;
ADDDATA PE <"1">;
DEL TAB ATMSHOT1;
DEF TAB ATMSHOT1 COL1 CHAR 100;
ADDDATA ATMSHOT1
<" "
      ATMOSPHERIC EVENTS IN NEVADA 1951 - 1953
<" ">
<" "
      COMPILED BY HARRY G. HICKS, LLNL
      NOVEMBER 1980
<" ">
<" ">;
DEL TAB ATMSHOT2;
DEF TAB ATMSHOT2 COL1 CHAR 100;
ADDDATA ATMSHOT2
<" "
      ATMOSPHERIC EVENTS IN NEVADA 1955 - 1957
<" ">
<" "
      COMPILED BY HARRY G. HICKS, LLNL
      NOVEMBER 1980
<" ">
<" ">;
DEL TAB ATMSHOT3;
DEF TAB ATMSHOT3 COL1 CHAR 100;
ADDDATA ATMSHOT3
<" "
      ATMOSPHERIC EVENTS IN NEVADA 1958 - 1968
<" ">
<" "
      COMPILED BY HARRY G. HICKS, LLNL
      NOVEMBER 1980
<" ">
<" ">;
DEL TAB LEGEND;
DEF TAB LEGEND COL1 CHAR 100;
ADDDATA LEGEND
<" "
<"* EXCAVATION EVENT">
<"** SAFETY EVENT">;
DEL TAB ATSHOTA;
ATSHOTA=LAST 74 OF ATSHOT;
OUTPUT ATMSHOT1 TO HSP;
PRINT FIRST 30 OF ATSHOT COL NUM OPNAME SHOTNAME SPONSOR PLACEMENT DATE
GCTIME TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATMSHOT2 TO HSP;
PRINT FIRST 44 OF ATSHOTA COL NUM OPNAME SHOTNAME SPONSOR PLACEMENT DATE
GCTIME TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATMSHOT3 TO HSP;
PRINT LAST 30 OF ATSHOT COL NUM OPNAME SHOTNAME SPONSOR PLACEMENT DATE
GCTIME TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;

/* PRINT INPUT DATA, ATMOSPHERIC SHOTS, ATMPRINT2 */

DEL TAB PE;
DEF TAB PE COL1 CHAR 1;
ADDDATA PE <"1">;
DEL TAB ATDATA;
DEF TAB ATDATA COL1 CHAR 100;
ADDDATA ATDATA
<" "
      ATMOSPHERIC EVENTS: FISSION YIELD, PRESHOT COMPOSITION AND
      ATOMS OF INDUCED ACTIVITIES PER FISSION AT ZERO TIME
<" ">
<" "
      COMPILED BY HARRY G. HICKS, LLNL
      NOVEMBER 1980
<" ">
<" ">;
DEL TAB LEGEND;
DEF TAB LEGEND COL1 CHAR 100;
ADDDATA LEGEND
<" "
<"* EXCAVATION EVENT">

```

```

<"** SAFETY EVENT">
<"FOR POSTSHOT NUMBERS ONLY - POSITIVE NUMBERS ARE MEASUREMENTS, NEGATIVE">
<" NUMBERS ARE ESTIMATES, 0.0 DENOTES A NUCLIDE ABSENT FROM THAT EVENT OR">
<" THE AMOUNT CANNOT BE ESTIMATED">
<"MEASUREMENTS ARE PRECISE TO 10 PERCENT, ESTIMATES, TO A FACTOR OF THREE">;
DEL TAB ATSHOTDATB;
ATSHOTDATB=LAST 74 OF ATSHOTDATA;
OUTPUT ATDATA TO HSP;
PRINT FIRST 30 OF ATSHOTDATA COL NUM SHOTNAME SPONSOR DATE YIELD KG0Y KGPU
KGTU KG233 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT FIRST 44 OF ATSHOTDATB COL NUM SHOTNAME SPONSOR DATE YIELD KG0Y KGPU
KGTU KG233 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT LAST 30 OF ATSHOTDATA COL NUM SHOTNAME SPONSOR DATE YIELD KG0Y KGPU
KGTU KG233 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT FIRST 30 OF ATSHOTDATA COL NUM GM241 A B C D BE7 NA24 MN54 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT FIRST 44 OF ATSHOTDATB COL NUM GM241 A B C D BE7 NA24 MN54 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT LAST 30 OF ATSHOTDATA COL NUM GM241 A B C D BE7 NA24 MN54 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT FIRST 30 OF ATSHOTDATA COL NUM FE55 FE59 C057 C058 C060 CU64 CU67 W181
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT FIRST 44 OF ATSHOTDATB COL NUM FE55 FE59 C057 C058 C060 CU64 CU67 W181
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT LAST 30 OF ATSHOTDATA COL NUM FE55 FE59 C057 C058 C060 CU64 CU67 W181
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT FIRST 30 OF ATSHOTDATA COL NUM W185 W187 W188 AU198 AU199 PB203 U237
U240 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT FIRST 44 OF ATSHOTDATB COL NUM W185 W187 W188 AU198 AU199 PB203 U237
U240 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT LAST 30 OF ATSHOTDATA COL NUM W185 W187 W188 AU198 AU199 PB203 U237
U240 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT FIRST 30 OF ATSHOTDATA COL NUM NP239 AM241 CM242 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT FIRST 44 OF ATSHOTDATB COL NUM NP239 AM241 CM242 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATDATA TO HSP;
PRINT LAST 30 OF ATSHOTDATA COL NUM NP239 AM241 CM242 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;

```

/* PRINT OUTPUT DATA, ATMOSPHERIC SHOTS, ATMPRINT3 */

```

DEL TAB PE;
DEF TAB PE COL1 CHAR 1;
ADDDATA PE <"1">;
DEL TAB ATCURIES;
DEF TAB ATCURIES COL1 CHAR 100;
ADDDATA ATCURIES
<"          ATMOSPHERIC EVENTS: FISSION YIELD AND CURIES          ">
<"          OF OTHER NUCLIDES PRESENT AT ZERO TIME                ">
<" ">
<"          COMPILED BY HARRY G. HICKS, LLNL                      ">
<"          NOVEMBER 1980                                          ">

```

```

<" ">:
DEL TAB LEGEND;
DEF TAB LEGEND COL1 CHAR 100;
ADDATA LEGEND
<" ">
<"* EXCAVATION EVENT">
<"** SAFETY EVENT">
<"FOR POSTSHOT NUMBERS ONLY - POSITIVE NUMBERS ARE MEASUREMENTS, NEGATIVE">
<"    NUMBERS ARE ESTIMATES, 0.0 DENOTES A NUCLIDE ABSENT FROM THAT EVENT OR">
<"    THE AMOUNT CANNOT BE ESTIMATED">
<"MEASUREMENTS ARE PRECISE TO 10 PERCENT, ESTIMATES, TO A FACTOR OF THREE">;
DEL TAB CURIEMAT;
CURIESATMA=LAST 74 OF CURIESATM;
OUTPUT ATCURIES TO HSP;
PRINT FIRST 30 OF CURIESATM COL NUM SHOTNAME SPONSOR DATE YIELD BE7 NA24 MN54
FE55 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT FIRST 44 OF CURIESATMA COL NUM SHOTNAME SPONSOR DATE YIELD BE7 NA24 MN54
FE55 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT LAST 30 OF CURIESATM COL NUM SHOTNAME SPONSOR DATE YIELD BE7 NA24 MN54
FE55 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT FIRST 30 OF CURIESATM COL NUM SHOTNAME FE59 C057 C058 C060 CU64 CU67
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT FIRST 44 OF CURIESATMA COL NUM SHOTNAME FE59 C057 C058 C060 CU64 CU67
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT LAST 30 OF CURIESATM COL NUM SHOTNAME FE59 C057 C058 C060 CU64 CU67
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT FIRST 30 OF CURIESATM COL NUM SHOTNAME W181 W185 W187 W188 AU198 AU199
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT FIRST 44 OF CURIESATMA COL NUM SHOTNAME W181 W185 W187 W188 AU198 AU199
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT LAST 30 OF CURIESATM COL NUM SHOTNAME W181 W185 W187 W188 AU198 AU199
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT FIRST 30 OF CURIESATM COL NUM SHOTNAME PB203 U233 U234 U235 U237 U238
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT FIRST 44 OF CURIESATMA COL NUM SHOTNAME PB203 U233 U234 U235 U237 U238
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT LAST 30 OF CURIESATM COL NUM SHOTNAME PB203 U233 U234 U235 U237 U238
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT FIRST 30 OF CURIESATM COL NUM SHOTNAME U240 NP239 PU PU241 AM241 CM242
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT FIRST 44 OF CURIESATMA COL NUM SHOTNAME U240 NP239 PU PU241 AM241 CM242
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ATCURIES TO HSP;
PRINT LAST 30 OF CURIESATM COL NUM SHOTNAME U240 NP239 PU PU241 AM241 CM242
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;

```

Input Card Images for Summary Table

FIXED 7 CD									
OPNAME 1 15									
NUM 16 3									
SPONSOR 23 8									
SHOTNAME 31 20									
PLACEMENT 51 16									
DATE 68 6									
GCTIME 75 6									
RANGER	1	LASL	RANGER ABLE		AIR DROP	1060FT	510127	1345	
RANGER	2	LASL	RANGER BAKER		AIR DROP	1080FT	510128	1352	
RANGER	3	LASL	RANGER EASY		AIR DROP	1080FT	510201	1347	
RANGER	4	LASL	RANGER BAKER-2		AIR DROP	1100FT	510202	1349	
RANGER	5	LASL	RANGER FOX		AIR DROP	1435FT	510206	1347	
BUSTER-JANGLE	6	LASL	BUSTER-BAKER		AIR DROP	1118FT	511028	1520	
BUSTER-JANGLE	7	LASL	BUSTER-CHARLIE		AIR DROP	1132FT	511030	1500	
BUSTER-JANGLE	8	LASL	BUSTER-DOG		AIR DROP	1417FT	511101	1530	
BUSTER-JANGLE	9	DOD	BUSTER-EASY		AIR DROP	1314FT	511105	1630	
BUSTER-JANGLE	10	DOD	JANGLE-SUGAR		SURFACE		511119	1700	
BUSTER-JANGLE	11	DOD/LASL	JANGLE-UNCLE *		BURIED	17FT	511129	2000	
TUMBLER-SNAPPER	12	LASL/DODABLE			AIR DROP	793FT	520401	1700	
TUMBLER-SNAPPER	13	LASL	BAKER		AIR DROP	1109FT	520415	1730	
TUMBLER-SNAPPER	14	LASL	CHARLIE		AIR DROP	3447FT	520422	1730	
TUMBLER-SNAPPER	15	LASL	DOG		AIR DROP	1040FT	520501	1630	
TUMBLER-SNAPPER	16	LASL	EASY		300FT TOWER		520507	1215	
TUMBLER-SNAPPER	17	LASL	FOX		300FT TOWER		520525	1200	
TUMBLER-SNAPPER	18	LASL	GEORGE		300FT TOWER		520601	1155	
TUMBLER-SNAPPER	19	LASL	HOW		300FT TOWER		520605	1155	
UPSHOT-KNOTHOLE	20	LASL	ANNIE		300FT TOWER		530317	1320	
UPSHOT-KNOTHOLE	21	LASL	NANCY		300FT TOWER		530324	1310	
UPSHOT-KNOTHOLE	22	LLL	RUI		300FT TOWER		530331	1300	
UPSHOT-KNOTHOLE	23	LASL	DIXIE		AIR DROP	6020FT	530406	1530	
UPSHOT-KNOTHOLE	24	LLL	RAY		100FT TOWER		530411	1245	
UPSHOT-KNOTHOLE	25	LASL	BADGER		300FT TOWER		530418	1235	
UPSHOT-KNOTHOLE	26	LASL	SIMON		300FT TOWER		530425	1230	
UPSHOT-KNOTHOLE	27	LASL/DOD	DENCORE		AIR DROP	2425FT	530508	1530	
UPSHOT-KNOTHOLE	28	LASL	HARRY		300FT TOWER		530519	1205	
UPSHOT-KNOTHOLE	29	LASL	GRABLE		ARTY SHELL	524FT	530525	1530	
UPSHOT-KNOTHOLE	30	LASL	CLIMAX		AIR DROP	1334FT	530604	1115	
TEAPOT	31	LASL	WASP		AIR DROP	762FT	550218	2000	
TEAPOT	32	LASL	MOTH		300FT TOWER		550222	1345	
TEAPOT	33	LLL	TESLA		300FT TOWER		550301	1330	
TEAPOT	34	LLL	TURK		500FT TOWER		550307	1320	
TEAPOT	35	LASL	HORNET		300FT TOWER		550312	1320	
TEAPOT	36	LASL	BEE		500FT TOWER		550322	1305	
TEAPOT	37	DOD/LASL	LESS *		BURIED	67FT	550323	2030	
TEAPOT	38	LASL	APPLE I		500FT TOWER		550329	1255	
TEAPOT	39	LASL	WASP PRIME		AIR DROP	740FT	550329	1800	
TEAPOT	40	DOD	HA		AIR DROP	36620FT	550406	1800	
TEAPOT	41	LLL	POST		300FT TOWER		550409	1230	
TEAPOT	42	LASL/DOD	MET		400FT TOWER		550415	1915	
TEAPOT	43	LASL	APPLE II		500FT TOWER		550505	1210	
TEAPOT	44	LASL	ZUCCHINI		500FT TOWER		550515	1200	
PROJECT 56	45	LASL	PROJECT 56 NO 1 **		SURFACE		551101	2210	
PROJECT 56	46	LASL	PROJECT 56 NO 2 **		SURFACE		551103	2115	
PROJECT 56	47	LASL	PROJECT 56 NO 3 **		SURFACE		551105	1955	
PROJECT 56	48	LASL	PROJECT 56 NO 4 **		SURFACE		560118	2130	
PROJECT 57	49	LASL	PROJECT 57 NO 1 **		SURFACE		570424	1427	
PLUMBOB	50	LASL	BOLTZMANN		500FT TOWER		570528	1155	
PLUMBOB	51	LASL	FRANKLIN		300FT TOWER		570602	1155	
PLUMBOB	52	LLL	WILSON		500FT BALLOON		570618	1145	
PLUMBOB	53	LASL	PRISCILLA		700FT BALLOON		570624	1330	
PLUMBOB	54	LLL	HOOD		1500FT BALLOON		570705	1140	
PLUMBOB	55	LLL	DIABLO		500FT TOWER		570715	1130	
PLUMBOB	56	DOD	JOHN		AIR DROP	20000FT	570719	1400	
PLUMBOB	57	LASL	KEPLER		500FT TOWER		570724	1150	
PLUMBOB	58	LLL	OWENS		500FT BALLOON		570725	1330	
PLUMBOB	59	LASL	PASCAL A **		500FT OPEN HOLE		570726	0800	
PLUMBOB	60	LASL	STOKES		1500FT BALLOON		570807	1225	
PLUMBOB	61	LLL	SHASTA		500FT TOWER		570818	1200	
PLUMBOB	62	LASL	DOPPLER		1500FT BALLOON		570823	1230	
PLUMBOB	63	LASL	FRANKLIN PRIME		750FT BALLOON		570830	1240	
PLUMBOB	64	LLL	SMOKY		700FT TOWER		570831	1230	
PLUMBOB	65	LASL	GALILEO		500FT TOWER		570902	1240	
PLUMBOB	66	LLL	WHEELER		500FT BALLOON		570906	1245	
PLUMBOB	67	LASL	COULOMB B **		SURFACE		570906	2005	
PLUMBOB	68	LASL	LAPLACE		750FT BALLOON		570908	1300	
PLUMBOB	69	LASL	FIZEAU		500FT TOWER		570914	1645	
PLUMBOB	70	LASL	NEWTON		1500FT BALLOON		570916	1250	
PLUMBOB	71	LLL	WHITNEY		500FT TOWER		570923	1230	
PLUMBOB	72	LLL	CHARLESTON		1500FT BALLOON		570928	1300	
PLUMBOB	73	LLL	MORGAN		1500FT BALLOON		571007	1300	
PLUMBOB	74	LASL	COULOMB C **		SURFACE		571209	2000	
HARDTACK	75	LASL	OTERO **		480FT OPEN HOLE		580912	2000	
HARDTACK	76	LASL	EDDY		1500FT BALLOON		580919	1400	
HARDTACK	77	LASL	MORA		1500FT BALLOON		580929	1405	
HARDTACK	78	LASL	HIDALGO **		337FT BALLOON		581005	1410	
HARDTACK	79	LASL	QUAY		100FT TOWER		581010	1430	
HARDTACK	80	LASL	LEA		1500FT BALLOON		581013	1320	

HARDTACK	81	LLL	HAMILTON	50FT TOWER	581015	1600
HARDTACK	82	LASL	DONA ANA	450FT BALLOON	581016	1420
HARDTACK	83	LLL	VESTA **	SURFACE	581017	2300
HARDTACK	84	LASL	RIO ARRIBA	72.5FT TOWER	581018	1425
HARDTACK	85	LASL	SOROCO	1450FT BALLOON	581022	1330
HARDTACK	86	LLL	WRANGELL	1500FT BALLOON	581022	1650
HARDTACK	87	LLL	RUSHMORE	500FT BALLOON	581022	2340
HARDTACK	88	LASL	CATRON **	72.5FT TOWER	581024	1500
HARDTACK	89	LLL	SANFORD	1500FT BALLOON	581026	1020
HARDTACK	90	LASL	DEBACA	1500FT BALLOON	581026	1600
HARDTACK	91	LASL	CHAVEZ **	52.5FT TOWER	581027	1430
HARDTACK	92	LLL	HUMBOLDT	25FT TOWER	581029	1445
HARDTACK	93	LLL	TITANIA **	25FT TOWER	581030	2030
HARDTACK	94	LASL	SANTA FE	1500FT BALLOON	581030	0300
NOUGAT	95	LLL	DANNY BOY *	BURIED 110FT	620305	1815
STORAX	96	LLL	SEDAN *	BURIED 635FT	620706	1700
DOMINIC II	97	DOD	JOHNNY BOY *	BURIED 2FT	620711	1645
DOMINIC II	98	DOD	SMALL BOY	LOW TOWER	620714	1830
DOMINIC II	99	DOD	LITTLE FELLER I	SURFACE	620717	1700
WHETSTONE	100	LLL	SULKY *	BURIED 90FT	641218	1935
WHETSTONE	101	LLL	PALANQUIN *	BURIED 280FT	650414	1314
CROSSIE	102	LLL	CABRIOLET *	BURIED 171FT	680126	1600
CROSSIE	103	LLL	BUGGY *	BURIED 135FT	680312	1704
BOWLINE	104	LLL	SCHOONER *	BURIED 355FT	681208	1600

Summary Table

ATMOSPHERIC EVENTS IN NEVADA 1951 - 1953

COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

NUM	OPNAME	SHOTNAME	SPONSOR	PLACEMENT	DATE	GCTIME
1	RANGER	RANGER ABLE	LASL	AIR DROP 1060FT	510127	1345
2	RANGER	RANGER BAKER	LASL	AIR DROP 1080FT	510128	1352
3	RANGER	RANGER EASY	LASL	AIR DROP 1080FT	510201	1347
4	RANGER	RANGER BAKER-2	LASL	AIR DROP 1100FT	510202	1349
5	RANGER	RANGER FOX	LASL	AIR DROP 1435FT	510206	1347
6	BUSTER-JANGLE	BUSTER-BAKER	LASL	AIR DROP 1118FT	511028	1520
7	BUSTER-JANGLE	BUSTER-CHARLIE	LASL	AIR DROP 1132FT	511030	1500
8	BUSTER-JANGLE	BUSTER-DOG	LASL	AIR DROP 1417FT	511101	1530
9	BUSTER-JANGLE	BUSTER-EASY	DOD	AIR DROP 1314FT	511105	1630
10	BUSTER-JANGLE	JANGLE-SUGAR	DOD	SURFACE	511119	1700
11	BUSTER-JANGLE	JANGLE-UNCLE *	DOD/LASL	BURIED 17FT	511129	2000
12	TUMBLER-SNAPPER	ABLE	LASL/DOD	AIR DROP 793FT	520401	1700
13	TUMBLER-SNAPPER	BAKER	LASL	AIR DROP 1109FT	520415	1730
14	TUMBLER-SNAPPER	CHARLIE	LASL	AIR DROP 3447FT	520422	1730
15	TUMBLER-SNAPPER	DOG	LASL	AIR DROP 1040FT	520501	1630
16	TUMBLER-SNAPPER	EASY	LASL	300FT TOWER	520507	1215
17	TUMBLER-SNAPPER	FOX	LASL	300FT TOWER	520525	1200
18	TUMBLER-SNAPPER	GEORGE	LASL	300FT TOWER	520601	1155
19	TUMBLER-SNAPPER	HOW	LASL	300FT TOWER	520605	1155
20	UPSHOT-KNOTHOLE	ANNIE	LASL	300FT TOWER	530317	1320
21	UPSHOT-KNOTHOLE	NANCY	LASL	300FT TOWER	530324	1310
22	UPSHOT-KNOTHOLE	RUTH	LLL	300FT TOWER	530331	1300
23	UPSHOT-KNOTHOLE	DIXIE	LASL	AIR DROP 6020FT	530406	1530
24	UPSHOT-KNOTHOLE	RAY	LLL	100FT TOWER	530411	1245
25	UPSHOT-KNOTHOLE	BADGER	LASL	300FT TOWER	530418	1235
26	UPSHOT-KNOTHOLE	SIMON	LASL	300FT TOWER	530425	1230
27	UPSHOT-KNOTHOLE	ENCORE	LASL/DOD	AIR DROP 2425FT	530508	1530
28	UPSHOT-KNOTHOLE	HARRY	LASL	300FT TOWER	530519	1205
29	UPSHOT-KNOTHOLE	GRABLE	LASL	ARTY SHELL 524FT	530525	1530
30	UPSHOT-KNOTHOLE	CLIMAX	LASL	AIR DROP 1334FT	530604	1115

* EXCAVATION EVENT
** SAFETY EVENT

ATMOSPHERIC EVENTS IN NEVADA 1955 - 1957

COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

NUM	OPNAME	SHOTNAME	SPONSOR	PLACEMENT	DATE	GCTIME
31	TEAPOT	WASP	LASL	AIR DROP 762FT	550218	2000
32	TEAPOT	MOTH	LASL	300FT TOWER	550222	1345
33	TEAPOT	TESLA	LLL	300FT TOWER	550301	1330
34	TEAPOT	TURK	LLL	500FT TOWER	550307	1320
35	TEAPOT	HORNET	LASL	300FT TOWER	550312	1320
36	TEAPOT	BEE	LASL	500FT TOWER	550322	1305
37	TEAPOT	ESS *	DOD/LASL	BURIED 67FT	550323	2030
38	TEAPOT	APPLE I	LASL	500FT TOWER	550329	1255
39	TEAPOT	WASP PRIME	LASL	AIR DROP 740FT	550329	1800
40	TEAPOT	HA	DOD	AIR DROP 36620FT	550406	1800
41	TEAPOT	POST	LLL	300FT TOWER	550409	1230
42	TEAPOT	MET	LASL/DOD	400FT TOWER	550415	1915
43	TEAPOT	APPLE II	LASL	500FT TOWER	550505	1210
44	TEAPOT	ZUCCHINI	LASL	500FT TOWER	550515	1200
45	PROJECT 56	PROJECT 56 NO 1 **	LASL	SURFACE	551101	2210
46	PROJECT 56	PROJECT 56 NO 2 **	LASL	SURFACE	551103	2115

47	PROJECT	56	PROJECT	56	NO	3	**	LASL	SURFACE	551105	1955
48	PROJECT	56	PROJECT	56	NO	4	**	LASL	SURFACE	560118	2130
49	PROJECT	57	PROJECT	57	NO	1	**	LASL	SURFACE	570424	1427
50	PLUMBBO		BOLTZMANN					LASL	500FT TOWER	570528	1155
51	PLUMBBO		FRANKLIN					LASL	300FT TOWER	570602	1155
52	PLUMBBO		WILSON					LLL	500FT BALLOON	570618	1145
53	PLUMBBO		PRISCILLA					LASL	700FT BALLOON	570624	1330
54	PLUMBBO		HOOD					LLL	1500FT BALLOON	570705	1140
55	PLUMBBO		DIABLO					LLL	500FT TOWER	570715	1130
56	PLUMBBO		JOHN					DOD	AIR DROP 20000FT	570719	1400
57	PLUMBBO		KEPLER					LASL	500FT TOWER	570724	1150
58	PLUMBBO		OWENS					LLL	500FT BALLOON	570725	1330
59	PLUMBBO		PASCAL A **					LASL	500FT OPEN HOLE	570726	800
60	PLUMBBO		STOKES					LASL	1500FT BALLOON	570807	1225
61	PLUMBBO		SHASTA					LLL	500FT TOWER	570818	1200
62	PLUMBBO		DOPPLER					LASL	1500FT BALLOON	570823	1230
63	PLUMBBO		FRANKLIN PRIME					LASL	750FT BALLOON	570830	1240
64	PLUMBBO		SMOKY					LLL	700FT TOWER	570831	1230
65	PLUMBBO		GALILEO					LASL	500FT TOWER	570902	1240
66	PLUMBBO		WHEELER					LLL	500FT BALLOON	570906	1245
67	PLUMBBO		COULOMB B **					LASL	SURFACE	570906	2005
68	PLUMBBO		LAPLACE					LASL	750FT BALLOON	570908	1300
69	PLUMBBO		FIZEAU					LASL	500FT TOWER	570914	1645
70	PLUMBBO		NEWTON					LASL	1500FT BALLOON	570916	1250
71	PLUMBBO		WHITNEY					LLL	500FT TOWER	570923	1230
72	PLUMBBO		CHARLESTON					LLL	1500FT BALLOON	570928	1300
73	PLUMBBO		MORGAN					LLL	1500FT BALLOON	571007	1300
74	PLUMBBO		COULOMB C **					LASL	SURFACE	571209	2000

* EXCAVATION EVENT
** SAFETY EVENT

ATMOSPHERIC EVENTS IN NEVADA 1958 - 1968

COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

NUM	OPNAME	SHOTNAME	SPONSOR	PLACEMENT	DATE	GCTIME
75	HARDTACK	OTERO **	LASL	480FT OPEN HOLE	580912	2000
76	HARDTACK	EDDY	LASL	1500FT BALLOON	580919	1400
77	HARDTACK	MORA	LASL	1500FT BALLOON	580929	1405
78	HARDTACK	HIDALGO **	LASL	337FT BALLOON	581005	1410
79	HARDTACK	QUAY	LASL	100FT TOWER	581010	1430
80	HARDTACK	LEA	LASL	1500FT BALLOON	581013	1320
81	HARDTACK	HAMILTON	LLL	50FT TOWER	581015	1600
82	HARDTACK	DONA ANA	LASL	450FT BALLOON	581016	1420
83	HARDTACK	VESTA **	LLL	SURFACE	581017	2300
84	HARDTACK	RIO ARRIBA	LASL	72.5FT TOWER	581018	1425
85	HARDTACK	SOROCO	LASL	1450FT BALLOON	581022	1330
86	HARDTACK	WRANGELL	LLL	1500FT BALLOON	581022	1650
87	HARDTACK	RUSHMORE	LLL	500FT BALLOON	581022	2340
88	HARDTACK	CATRON **	LASL	72.5FT TOWER	581024	1500
89	HARDTACK	SANFORD	LLL	1500FT BALLOON	581026	1020
90	HARDTACK	DEBACA	LASL	1500FT BALLOON	581026	1600
91	HARDTACK	CHAVEZ **	LASL	52.5FT TOWER	581027	1430
92	HARDTACK	HUMBOLDT	LLL	25FT TOWER	581029	1445
93	HARDTACK	TITANIA **	LLL	25FT TOWER	581030	2030
94	HARDTACK	SANTA FE	LASL	1500FT BALLOON	581030	300
95	NOUGAT	DANNY BOY *	LLL	BURIED 110FT	620305	1815
96	STORAX	SEDAN *	LLL	BURIED 635FT	620706	1700
97	DOMINIC II	JOHNNY BOY *	DOD	BURIED 2FT	620711	1645
98	DOMINIC II	SMALL BOY	DOD	LOW TOWER	620714	1830
99	DOMINIC II	LITTLE FELLER I	DOD	SURFACE	620717	1700
100	WHETSTONE	SULKY *	LLL	BURIED 90FT	641218	1935
101	WHETSTONE	PALANQUIN *	LLL	BURIED 280FT	650414	1314
102	CROSSTIE	CABRIOLET *	LLL	BURIED 171FT	680126	1600
103	CROSSTIE	BUGGY *	LLL	BURIED 135FT	680312	1704
104	BOWLINE	SCHOONER *	LLL	BURIED 355FT	681208	1600

* EXCAVATION EVENT
** SAFETY EVENT

APPENDIX II
DISPERSION TESTS OF PLUTONIUM AND/OR URANIUM

This appendix contains executable FRAMIS files for the plutonium and/or uranium dispersion tests. The input card images and output data for these tests are available in the companion classified publication, UCRL-52934 Supplement (1980) (title U, report SRD).

Executable FRAMIS Files

```
/* ATMOSPHERE, OPERATION ROLLER COASTER, ROLLERC */

/* DEFINE TABLES */
DEF TAB ROLLERC1 EVENTNAME CHAR 18, DATE INT, GCTIME INT, PU REAL, PU241 REAL, AM241
REAL, U234 REAL, U235 REAL, U238 REAL;
/* INPUT DATA */
INPUT ROLLERC1 FROM ROLLERCIN;
/* PRINT OUTPUT DATA, OPERATION ROLLER COASTER, ROLLPRINT */

DEL TAB PE;
DEF TAB PE COL1 CHAR 1;
ADDATA PE <"1">;
DEF TAB ROLLERC2 COL1 CHAR 100;
ADDATA ROLLERC2
<"                OPERATION ROLLER COASTER                ">
<"                CURIES RELEASED                            ">
<" ">
<"                COMPILED BY HARRY G. HICKS, LLNL            ">
<"                NOVEMBER 1980                                ">
<" ">;
DEL TAB LEGEND;
DEF TAB LEGEND COL1 CHAR 100;
ADDATA LEGEND
<" ">
<"CURIES ARE DERIVED FROM WEIGHTS OF MATERIALS AND ARE PRECISE TO ONE PERCENT">;
OUTPUT ROLLERC2 TO HSP;
PRINT ROLLERC1 COL EVENTNAME DATE GCTIME U234 U235 U238 PU PU241 AM241 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
```


APPENDIX III

This appendix contains executable FRAMIS files for underground nuclear detonation events that seeped or vented to the atmosphere, input card images, summary and output tables, and details of the calculations (given in Table III-1).

Executable FRAMIS Files

```
/* NTSRELEASE, VENTED SHOTS, VENTSHOTS */  
/* DEFINE TABLES */  
/* INPUT DATA */  
  
DEF TAB VESHOT OPNAME CHAR 10, NUM INT, SHOTNAME CHAR 15, SPONSOR CHAR 8,  
CATEGORY CHAR 9, DATE INT, GCTIME INT, CURIESOUT REAL, PLACEMENT CHAR 10;  
INPUT VESHOT FROM VESHTOIN;  
DEF TAB DUMMY KR85M REAL, KR88 REAL, SR89 REAL, SR90 REAL, Y91 REAL, ZR95 REAL, ZR97  
REAL, M099 REAL, RU103 REAL, RH105 REAL, RU106 REAL, PD109 REAL, PD112 REAL, AG111 REAL,  
CD115 REAL, SB127 REAL, TE132 REAL, I131 REAL, I133 REAL, I135 REAL, XE133 REAL, XE135  
REAL, CS136 REAL, CS137 REAL, BA140 REAL, CE141 REAL, CE143 REAL, CE144 REAL,  
ND147 REAL;  
ADDDATA DUMMY <0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.  
0. 0. 0. 0. 0. 0. 0. 0.>;  
VESHOTA=VESHOT TIMES DUMMY;  
  
/* CALCULATE CURIES */  
  
VESHOT1=VESHOTA WHERE CATEGORY IS "A";  
VESHOT2=VESHOTA WHERE CATEGORY IS "B";  
VESHOT3=VESHOTA WHERE CATEGORY IS "C";  
VESHOT4=VESHOTA WHERE CATEGORY IS "C1";  
VESHOT5=VESHOTA WHERE CATEGORY IS "D";  
VESHOT7=VESHOTA WHERE CATEGORY IS "E";  
VESHOT8=VESHOTA WHERE CATEGORY IS "F";  
VESHOT6=VESHOT7 UNION VESHOT8;  
VESHOT9=VESHOTA WHERE CATEGORY IS "G";  
MAKE KR85M IN VESHOT1 BE (CURIESOUT*5.2E-2);  
MAKE KR85M IN VESHOT2 BE (CURIESOUT*5.6E-2);  
MAKE KR85M IN VESHOT3 BE (CURIESOUT*5.8E-2);  
MAKE KR85M IN VESHOT4 BE (CURIESOUT*3.2E-2);  
MAKE KR85M IN VESHOT5 BE (CURIESOUT*6.0E-2);  
MAKE KR85M IN VESHOT6 BE (CURIESOUT*6.2E-2);  
MAKE KR85M IN VESHOT9 BE (CURIESOUT*6.2E-2);  
MAKE KR88 IN VESHOT1 BE (CURIESOUT*6.1E-2);  
MAKE KR88 IN VESHOT2 BE (CURIESOUT*6.6E-2);  
MAKE KR88 IN VESHOT3 BE (CURIESOUT*6.8E-2);  
MAKE KR88 IN VESHOT4 BE (CURIESOUT*3.9E-2);  
MAKE KR88 IN VESHOT5 BE (CURIESOUT*7.0E-2);  
MAKE KR88 IN VESHOT6 BE (CURIESOUT*7.3E-2);  
MAKE KR88 IN VESHOT9 BE (CURIESOUT*7.3E-2);  
MAKE SR89 IN VESHOT1 BE (CURIESOUT*4.0E-3);  
MAKE SR89 IN VESHOT2 BE (CURIESOUT*4.0E-3);  
MAKE SR89 IN VESHOT3 BE (CURIESOUT*6.0E-5);  
MAKE SR89 IN VESHOT4 BE (CURIESOUT*1.0E-5);  
MAKE SR89 IN VESHOT5 BE (CURIESOUT*4.0E-4);  
MAKE SR89 IN VESHOT6 BE (CURIESOUT*1.0E-8);  
MAKE SR89 IN VESHOT9 BE 0.;  
MAKE SR90 IN VESHOT1 BE (CURIESOUT*3.0E-5);  
MAKE SR90 IN VESHOT2 BE (CURIESOUT*3.0E-5);  
MAKE SR90 IN VESHOT3 BE (CURIESOUT*3.0E-7);  
MAKE SR90 IN VESHOT4 BE (CURIESOUT*9.0E-8);  
MAKE SR90 IN VESHOT5 BE (CURIESOUT*1.0E-5);  
MAKE SR90 IN VESHOT6 BE (CURIESOUT*1.0E-9);  
MAKE SR90 IN VESHOT9 BE 0.;  
MAKE Y91 IN VESHOT1 BE (CURIESOUT*2.0E-4);  
MAKE Y91 IN VESHOT2 BE (CURIESOUT*8.0E-5);  
MAKE Y91 IN VESHOT3 BE (CURIESOUT*1.0E-9);  
MAKE Y91 IN VESHOT4 BE (CURIESOUT*1.0E-6);  
MAKE Y91 IN VESHOT5 BE (CURIESOUT*4.0E-9);  
MAKE Y91 IN VESHOT6 BE (CURIESOUT*1.0E-8);  
MAKE Y91 IN VESHOT9 BE 0.;
```

MAKE	ZR95	IN	VESHOT1	BE	(CURIESOUT*2.0E-4);
MAKE	ZR95	IN	VESHOT2	BE	(CURIESOUT*1.0E-7);
MAKE	ZR95	IN	VESHOT3	BE	(CURIESOUT*2.0E-9);
MAKE	ZR95	IN	VESHOT4	BE	(CURIESOUT*1.0E-6);
MAKE	ZR95	IN	VESHOT5	BE	(CURIESOUT*7.0E-9);
MAKE	ZR95	IN	VESHOT6	BE	(CURIESOUT*2.0E-6);
MAKE	ZR95	IN	VESHOT9	BE	0;
MAKE	ZR97	IN	VESHOT1	BE	(CURIESOUT*9.0E-3);
MAKE	ZR97	IN	VESHOT2	BE	(CURIESOUT*6.0E-6);
MAKE	ZR97	IN	VESHOT3	BE	(CURIESOUT*1.0E-7);
MAKE	ZR97	IN	VESHOT4	BE	(CURIESOUT*1.0E-4);
MAKE	ZR97	IN	VESHOT5	BE	(CURIESOUT*4.0E-7);
MAKE	ZR97	IN	VESHOT6	BE	(CURIESOUT*1.0E-6);
MAKE	ZR97	IN	VESHOT9	BE	0;
MAKE	MO99	IN	VESHOT1	BE	(CURIESOUT*2.0E-2);
MAKE	MO99	IN	VESHOT2	BE	(CURIESOUT*2.0E-5);
MAKE	MO99	IN	VESHOT3	BE	(CURIESOUT*1.1E-2);
MAKE	MO99	IN	VESHOT4	BE	(CURIESOUT*4.3E-2);
MAKE	MO99	IN	VESHOT5	BE	(CURIESOUT*7.0E-3);
MAKE	MO99	IN	VESHOT6	BE	(CURIESOUT*2.0E-5);
MAKE	MO99	IN	VESHOT9	BE	0;
MAKE	RU103	IN	VESHOT1	BE	(CURIESOUT*2.0E-3);
MAKE	RU103	IN	VESHOT2	BE	(CURIESOUT*2.0E-6);
MAKE	RU103	IN	VESHOT3	BE	(CURIESOUT*1.0E-3);
MAKE	RU103	IN	VESHOT4	BE	(CURIESOUT*4.0E-3);
MAKE	RU103	IN	VESHOT5	BE	(CURIESOUT*6.0E-4);
MAKE	RU103	IN	VESHOT6	BE	(CURIESOUT*2.0E-6);
MAKE	RU103	IN	VESHOT9	BE	(CURIESOUT*2.0E-6);
MAKE	RH105	IN	VESHOT1	BE	(CURIESOUT*2.9E-2);
MAKE	RH105	IN	VESHOT2	BE	(CURIESOUT*1.0E-6);
MAKE	RH105	IN	VESHOT3	BE	(CURIESOUT*1.6E-2);
MAKE	RH105	IN	VESHOT4	BE	(CURIESOUT*6.0E-3);
MAKE	RH105	IN	VESHOT5	BE	(CURIESOUT*9.0E-3);
MAKE	RH105	IN	VESHOT6	BE	(CURIESOUT*3.0E-5);
MAKE	RH105	IN	VESHOT9	BE	0;
MAKE	RU106	IN	VESHOT1	BE	(CURIESOUT*1.0E-4);
MAKE	RU106	IN	VESHOT2	BE	(CURIESOUT*1.0E-7);
MAKE	RU106	IN	VESHOT3	BE	(CURIESOUT*2.0E-6);
MAKE	RU106	IN	VESHOT4	BE	(CURIESOUT*3.0E-4);
MAKE	RU106	IN	VESHOT5	BE	(CURIESOUT*4.0E-5);
MAKE	RU106	IN	VESHOT6	BE	(CURIESOUT*1.0E-5);
MAKE	RU106	IN	VESHOT9	BE	(CURIESOUT*4.0E-5);
MAKE	PD109	IN	VESHOT1	BE	(CURIESOUT*5.0E-3);
MAKE	PD109	IN	VESHOT2	BE	(CURIESOUT*1.0E-6);
MAKE	PD109	IN	VESHOT3	BE	(CURIESOUT*6.0E-4);
MAKE	PD109	IN	VESHOT4	BE	(CURIESOUT*4.0E-3);
MAKE	PD109	IN	VESHOT5	BE	(CURIESOUT*2.0E-3);
MAKE	PD109	IN	VESHOT6	BE	(CURIESOUT*7.0E-4);
MAKE	PD109	IN	VESHOT9	BE	0;
MAKE	PD112	IN	VESHOT1	BE	(CURIESOUT*2.0E-3);
MAKE	PD112	IN	VESHOT2	BE	(CURIESOUT*3.0E-7);
MAKE	PD112	IN	VESHOT3	BE	(CURIESOUT*1.0E-3);
MAKE	PD112	IN	VESHOT4	BE	(CURIESOUT*4.0E-3);
MAKE	PD112	IN	VESHOT5	BE	(CURIESOUT*6.0E-4);
MAKE	PD112	IN	VESHOT6	BE	(CURIESOUT*2.0E-6);
MAKE	PD112	IN	VESHOT9	BE	0;
MAKE	AG111	IN	VESHOT1	BE	(CURIESOUT*6.0E-4);
MAKE	AG111	IN	VESHOT2	BE	(CURIESOUT*6.0E-7);
MAKE	AG111	IN	VESHOT3	BE	(CURIESOUT*3.0E-4);
MAKE	AG111	IN	VESHOT4	BE	(CURIESOUT*1.0E-3);
MAKE	AG111	IN	VESHOT5	BE	(CURIESOUT*2.0E-4);
MAKE	AG111	IN	VESHOT6	BE	(CURIESOUT*5.0E-7);
MAKE	AG111	IN	VESHOT9	BE	0;
MAKE	CD115	IN	VESHOT1	BE	(CURIESOUT*3.0E-4);
MAKE	CD115	IN	VESHOT2	BE	(CURIESOUT*4.0E-7);
MAKE	CD115	IN	VESHOT3	BE	(CURIESOUT*2.0E-4);
MAKE	CD115	IN	VESHOT4	BE	(CURIESOUT*7.0E-4);
MAKE	CD115	IN	VESHOT5	BE	(CURIESOUT*1.0E-4);
MAKE	CD115	IN	VESHOT6	BE	(CURIESOUT*3.0E-8);
MAKE	CD115	IN	VESHOT9	BE	0;
MAKE	SB127	IN	VESHOT1	BE	(CURIESOUT*1.0E-3);
MAKE	SB127	IN	VESHOT2	BE	(CURIESOUT*1.0E-6);
MAKE	SB127	IN	VESHOT3	BE	(CURIESOUT*7.0E-4);
MAKE	SB127	IN	VESHOT4	BE	(CURIESOUT*3.0E-3);
MAKE	SB127	IN	VESHOT5	BE	(CURIESOUT*4.0E-4);
MAKE	SB127	IN	VESHOT6	BE	(CURIESOUT*2.0E-6);
MAKE	SB127	IN	VESHOT9	BE	0;
MAKE	TE132	IN	VESHOT1	BE	(CURIESOUT*1.4E-2);
MAKE	TE132	IN	VESHOT2	BE	(CURIESOUT*2.0E-5);
MAKE	TE132	IN	VESHOT3	BE	(CURIESOUT*8.0E-3);
MAKE	TE132	IN	VESHOT4	BE	(CURIESOUT*3.0E-2);
MAKE	TE132	IN	VESHOT5	BE	(CURIESOUT*4.0E-3);
MAKE	TE132	IN	VESHOT6	BE	(CURIESOUT*2.0E-5);
MAKE	TE132	IN	VESHOT9	BE	0;
MAKE	I131	IN	VESHOT1	BE	(CURIESOUT*3.0E-3);
MAKE	I131	IN	VESHOT2	BE	(CURIESOUT*6.0E-6);
MAKE	I131	IN	VESHOT3	BE	(CURIESOUT*1.0E-3);
MAKE	I131	IN	VESHOT4	BE	(CURIESOUT*1.2E-2);
MAKE	I131	IN	VESHOT5	BE	(CURIESOUT*2.0E-5);
MAKE	I131	IN	VESHOT6	BE	(CURIESOUT*2.0E-4);
MAKE	I131	IN	VESHOT9	BE	(CURIESOUT*2.0E-4);
MAKE	I133	IN	VESHOT1	BE	(CURIESOUT*3.4E-2);

```

MAKE I133 IN VESHOT2 BE (CURIESOUT*6.0E-4);
MAKE I133 IN VESHOT3 BE (CURIESOUT*1.9E-2);
MAKE I133 IN VESHOT4 BE (CURIESOUT*2.4E-1);
MAKE I133 IN VESHOT5 BE (CURIESOUT*2.0E-3);
MAKE I133 IN VESHOT6 BE (CURIESOUT*3.3E-3);
MAKE I133 IN VESHOT9 BE (CURIESOUT*5.3E-3);
MAKE I135 IN VESHOT1 BE (CURIESOUT*3.9E-2);
MAKE I135 IN VESHOT2 BE (CURIESOUT*3.0E-3);
MAKE I135 IN VESHOT3 BE (CURIESOUT*2.5E-2);
MAKE I135 IN VESHOT4 BE (CURIESOUT*1.4E-1);
MAKE I135 IN VESHOT5 BE (CURIESOUT*1.2E-2);
MAKE I135 IN VESHOT6 BE (CURIESOUT*8.0E-3);
MAKE I135 IN VESHOT9 BE (CURIESOUT*9.5E-3);
MAKE XE133 IN VESHOT1 BE (CURIESOUT*6.7E-2);
MAKE XE133 IN VESHOT2 BE (CURIESOUT*7.0E-2);
MAKE XE133 IN VESHOT3 BE (CURIESOUT*7.2E-2);
MAKE XE133 IN VESHOT4 BE (CURIESOUT*4.0E-2);
MAKE XE133 IN VESHOT5 BE (CURIESOUT*7.5E-2);
MAKE XE133 IN VESHOT6 BE (CURIESOUT*7.8E-2);
MAKE XE133 IN VESHOT9 BE (CURIESOUT*7.0E-2);
MAKE XE135 IN VESHOT1 BE (CURIESOUT*6.5E-1);
MAKE XE135 IN VESHOT2 BE (CURIESOUT*7.0E-1);
MAKE XE135 IN VESHOT3 BE (CURIESOUT*7.2E-1);
MAKE XE135 IN VESHOT4 BE (CURIESOUT*4.1E-1);
MAKE XE135 IN VESHOT5 BE (CURIESOUT*7.5E-1);
MAKE XE135 IN VESHOT6 BE (CURIESOUT*7.8E-1);
MAKE XE135 IN VESHOT9 BE (CURIESOUT*7.8E-1);
MAKE CS136 IN VESHOT1 BE (CURIESOUT*5.0E-5);
MAKE CS136 IN VESHOT2 BE (CURIESOUT*2.0E-5);
MAKE CS136 IN VESHOT3 BE (CURIESOUT*2.0E-5);
MAKE CS136 IN VESHOT4 BE (CURIESOUT*4.0E-6);
MAKE CS136 IN VESHOT5 BE (CURIESOUT*1.0E-5);
MAKE CS136 IN VESHOT6 BE (CURIESOUT*1.0E-7);
MAKE CS136 IN VESHOT9 BE 0.;
MAKE CS137 IN VESHOT1 BE (CURIESOUT*6.0E-3);
MAKE CS137 IN VESHOT2 BE (CURIESOUT*6.0E-3);
MAKE CS137 IN VESHOT3 BE (CURIESOUT*1.0E-6);
MAKE CS137 IN VESHOT4 BE (CURIESOUT*1.0E-7);
MAKE CS137 IN VESHOT5 BE (CURIESOUT*7.0E-5);
MAKE CS137 IN VESHOT6 BE (CURIESOUT*8.0E-9);
MAKE CS137 IN VESHOT9 BE 0.;
MAKE BA140 IN VESHOT1 BE (CURIESOUT*2.0E-3);
MAKE BA140 IN VESHOT2 BE (CURIESOUT*7.0E-2);
MAKE BA140 IN VESHOT3 BE (CURIESOUT*6.0E-4);
MAKE BA140 IN VESHOT4 BE (CURIESOUT*1.0E-4);
MAKE BA140 IN VESHOT5 BE (CURIESOUT*1.0E-3);
MAKE BA140 IN VESHOT6 BE (CURIESOUT*1.0E-7);
MAKE BA140 IN VESHOT9 BE 0.;
MAKE CE141 IN VESHOT1 BE (CURIESOUT*6.0E-4);
MAKE CE141 IN VESHOT2 BE (CURIESOUT*2.6E-2);
MAKE CE141 IN VESHOT3 BE (CURIESOUT*3.0E-4);
MAKE CE141 IN VESHOT4 BE (CURIESOUT*5.0E-5);
MAKE CE141 IN VESHOT5 BE (CURIESOUT*5.0E-4);
MAKE CE141 IN VESHOT6 BE (CURIESOUT*5.0E-8);
MAKE CE141 IN VESHOT9 BE 0.;
MAKE CE143 IN VESHOT1 BE (CURIESOUT*5.0E-3);
MAKE CE143 IN VESHOT2 BE (CURIESOUT*4.0E-6);
MAKE CE143 IN VESHOT3 BE (CURIESOUT*6.0E-8);
MAKE CE143 IN VESHOT4 BE (CURIESOUT*6.0E-5);
MAKE CE143 IN VESHOT5 BE (CURIESOUT*2.0E-7);
MAKE CE143 IN VESHOT6 BE (CURIESOUT*9.0E-7);
MAKE CE143 IN VESHOT9 BE 0.;
MAKE CE144 IN VESHOT1 BE (CURIESOUT*3.0E-5);
MAKE CE144 IN VESHOT2 BE (CURIESOUT*2.0E-8);
MAKE CE144 IN VESHOT3 BE (CURIESOUT*1.0E-9);
MAKE CE144 IN VESHOT4 BE (CURIESOUT*3.0E-7);
MAKE CE144 IN VESHOT5 BE (CURIESOUT*1.0E-9);
MAKE CE144 IN VESHOT6 BE (CURIESOUT*5.0E-9);
MAKE CE144 IN VESHOT9 BE 0.;
MAKE ND147 IN VESHOT1 BE (CURIESOUT*4.0E-4);
MAKE ND147 IN VESHOT2 BE (CURIESOUT*4.0E-7);
MAKE ND147 IN VESHOT3 BE (CURIESOUT*6.0E-9);
MAKE ND147 IN VESHOT4 BE (CURIESOUT*4.0E-6);
MAKE ND147 IN VESHOT5 BE (CURIESOUT*2.0E-8);
MAKE ND147 IN VESHOT6 BE (CURIESOUT*6.0E-8);
TEMP1=VESHOT1 UNION VESHOT2;
MAKE ND147 IN VESHOT9 BE 0.;
TEMP2=TEMP1 UNION VESHOT3;
TEMP3=TEMP2 UNION VESHOT4;
TEMP4=TEMP3 UNION VESHOT5;
TEMP5=TEMP4 UNION VESHOT6;
TEMP6=TEMP5 UNION VESHOT9;
VESHOTDATA=TEMP6 SORT DATE;

```

/* DELETE OBSOLETE TABLES */

```

DEL TAB TEMP1 TEMP2 TEMP3 TEMP4 TEMP5 TEMP6 VESHOTA VESHOT1 VESHOT2 VESHOT3
VESHOT4 VESHOT5 VESHOT6 VESHOT7 VESHOT8 VESHOT9 DUMMY;

```

```
/* PRINT SHOT SUMMARY, VENTED SHOTS, VENTPRINT1 */
```

```
DEL TAB PE;
DEF TAB PE COL1 CHAR 1;
ADDDATA PE <"1">;
DEL TAB VETITLE;
DEF TAB VETITLE COL1 CHAR 100;
ADDDATA VETITLE
<"          UNDERGROUND EVENTS WHICH UNINTENTIONALLY RELEASED          ">
<"          DETECTABLE RADIOACTIVITY OUTSIDE THE TEST RANGE COMPLEX      ">
<" ">
<"          COMPILED BY HARRY G. HICKS, LLNL                             ">
<"          NOVEMBER 1980                                                 ">
<" ">;
DEL TAB LEGEND;
DEF TAB LEGEND COL1 CHAR 100;
ADDDATA LEGEND
<" ">
<"CATEGORY A STARTED BEFORE H+30 SECONDS, CONTINUED LESS THAN 15 MINUTES">
<"CATEGORY B STARTED BEFORE H+30 SECONDS, CONTINUED MORE THAN 15 MINUTES">
<"CATEGORY C STARTED BETWEEN H+30 SECONDS AND H+20 MINUTES, CONTINUED LESS">
<"          THAN 2 HOURS, BANEERRY (231) IS A SPECIAL CASE">
<"CATEGORY D STARTED BETWEEN H+30 SECONDS AND H+20 MINUTES, CONTINUED MORE">
<"          THAN 2 HOURS">
<"CATEGORY E STARTED AFTER H+20 MINUTES, CONTINUED LESS THAN 12 HOURS">
<"CATEGORY F STARTED AFTER H+20 MINUTES, CONTINUED MORE THAN 12 HOURS">
<"CATEGORY G EFFLUENT EITHER SEEPED THROUGH CABLES OR WAS FILTERED THROUGH">
<"          THE SOIL">
<" ">
<"CURIESOUT COLUMN IS THE TOTAL CURIES RELEASED FROM GROUND ZERO">
<"AS MEASURED AT H+12 HOURS">
<" ">
<"CURIES RELEASED FROM ALL EVENTS PRIOR TO EAGLE (210) ARE PRECISE WITHIN AN ">
<"ORDER OF MAGNITUDE OF THE LISTED VALUE, FROM THEN ON, WITHIN A FACTOR OF 2">;
OUTPUT VETITLE TO HSP;
PRINT VESHOT COL NUM OPNAME SHOTNAME SPONSOR PLACEMENT CATEGORY DATE GCTIME
CURIESOUT TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
```

```
/* PRINT OUTPUT DATA, VENTED SHOTS, VENTPRINT2 */
```

```
DEL TAB PE;
DEF TAB PE COL1 CHAR 1;
ADDDATA PE <"1">;
DEL TAB VECURIES;
DEF TAB VECURIES COL1 CHAR 100;
ADDDATA VECURIES
<"          CURIES (AFTER 12 HOURS DECAY) RELEASED FROM UNDERGROUND      ">
<"          EVENTS WHICH UNINTENTIONALLY PLACED DETECTABLE                ">
<"          RADIOACTIVITY OUTSIDE THE TEST RANGE COMPLEX                  ">
<" ">
<"          COMPILED BY HARRY G. HICKS, LLNL                             ">
<"          NOVEMBER 1980                                                 ">
<" ">;
DEL TAB LEGEND;
DEF TAB LEGEND COL1 CHAR 100;
ADDDATA LEGEND
<" ">
<"VALUES ARE CALCULATED FROM TOTAL CURIES RELEASED AND DEBRIS COMPOSITION">
<" ">
<"LISTED VALUES FROM ALL EVENTS PRIOR TO EAGLE (210) ARE PRECISE WITHIN AN ">
<"ORDER OF MAGNITUDE, AND FROM THEN ON, WITHIN A FACTOR OF TWO">;
OUTPUT VECURIES TO HSP;
PRINT VESHOTDATA COL NUM SHOTNAME SPONSOR DATE KR85M KR88 SR89 SR90 Y91 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT VECURIES TO HSP;
PRINT VESHOTDATA COL NUM SHOTNAME ZR95 ZR97 M099 RU103 RH105 RU106 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT VECURIES TO HSP;
PRINT VESHOTDATA COL NUM SHOTNAME PD109 PD112 AG111 CD115 SB127 TE132 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT VECURIES TO HSP;
PRINT VESHOTDATA COL NUM SHOTNAME I131 I133 I135 XE133 XE135 CS136 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT VECURIES TO HSP;
PRINT VESHOTDATA COL NUM SHOTNAME CS137 BA140 CE141 CE143 CE144 ND147 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
```

Input Card Images

```

FIXED 9 CD
OPNAME 1 10
NUM 11 4
SHOTNAME 15 15
PLACEMENT 30 10
SPONSOR 40 8
CATEGORY 48 9
DATE 57 7
GCTIME 64 7
CURIESOUT 71 10
HARDTACK 201 BLANCA TUNNEL LLL A 581030 1500 1.7E5
NOUGAT 202 ANTLER TUNNEL LLL D 610915 1800 2.1E5
NOUGAT 203 FEATHER TUNNEL LLL A 611222 1730 380.0
NOUGAT 204 PAMPAS SHAFT UK/LASL B 620301 2010 2.0E3
NOUGAT 205 PLATTE TUNNEL LLL B 620414 1900 1.9E6
NOUGAT 206 EEL SHAFT LLL B 620519 1700 1.9E+6
NOUGAT 207 DES MOINES TUNNEL LLL A 620613 2200 1.1E7
STORAX 208 BANDICOOT SHAFT LASL A 621019 1900 3.0E6
STORAX 209 YUBA TUNNEL LLL F 630605 1800 110.0
NIBLICK 210 EAGLE SHAFT LLL A 631212 1702 760.0
NIBLICK 211 PIKE SHAFT LASL A 640313 1702 1.2E5
WHETSTONE 212 ALVA SHAFT LLL B 640819 1700 6100.0
WHETSTONE 213 DRILL SHAFT LLL E 641205 2215 61000.0
WHETSTONE 214 PARROT SHAFT LASL D 641216 2100 2.3E5
WHETSTONE 215 ALPACA SHAFT LLL B 650212 1610 40000.0
WHETSTONE 216 TEE SHAFT LLL C 650507 1647 1600.0
WHETSTONE 217 DILUTED WATERS SHAFT DDD/LLL A 650616 1730 5900.0
FLINTLOCK 218 RED HOT TUNNEL DDD/LASLF 660305 1915 1.0E6
FLINTLOCK 219 PIN STRIPE SHAFT DDD/LASLC 660425 1938 2.2E5
FLINTLOCK 220 DOUBLE PLAY TUNNEL DDD/LLL G 660615 1800 6.0E5
LATCHKEY 221 DERRINGER SHAFT LASL D 660912 1630 12000.0
LATCHKEY 222 NASH SHAFT LLL F 670119 1745 69000.0
LATCHKEY 223 MIDI MIST TUNNEL DDD/LLL G 670626 1700 1300.0
LATCHKEY 224 UMBER SHAFT LASL D 670629 1225 26000.0
CROSSTIE 225 DOOR MIST TUNNEL DDD/LASLG 670831 1730 4.0E5
CROSSTIE 226 HUMMOBILE SHAFT LLL C 680118 1730 1.2E5
MANDREL 227 POD SHAFT LLL D 690129 2100 3900.0
MANDREL 228 SCUTTLE SHAFT LLL D 691113 1515 210.0
MANDREL 229 SNUBBER SHAFT LASL C 700421 1530 5.5E4
MANDREL 230 MINT LEAF TUNNEL DDD/LLL G 700505 1630 4.0E5
EMERY 231 BANE BERRY SHAFT LLL G1 701218 1630 6.7E6
GROMMET 232 DIAGONAL LINE SHAFT DDD/LLL G 711124 2015 6.8E3
TINDERBOX 233 RIOLA SHAFT LLL F 800925 0826 2.9E3

```


Summary Table (Printout)

UNDERGROUND EVENTS WHICH UNINTENTIONALLY RELEASED
DETECTABLE RADIOACTIVITY OUTSIDE THE TEST RANGE COMPLEX

COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

-- TABLE VESHOT ---

NUM	OPNAME	SHOTNAME	SPONSOR	PLACEMENT	CATEGORY	DATE	GCTIME	CURIESOUT
201	HARDTACK	BLANCA	LLL	TUNNEL	A	581030	1500	1.70000E+05
202	NOUGAT	ANTLER	LLL	TUNNEL	D	610915	1800	2.10000E+05
203	NOUGAT	FEATHER	LLL	TUNNEL	A	611222	1730	3.80000E+02
204	NOUGAT	PAMPAS	UK/LASL	SHAFT	B	620301	2010	2.00000E+03
205	NOUGAT	PLATTE	LLL	TUNNEL	B	620414	1900	1.90000E+06
206	NOUGAT	EEL	LLL	SHAFT	B	620519	1700	1.90000E+06
207	NOUGAT	DES MOINES	LLL	TUNNEL	A	620613	2200	1.10000E+07
208	STORAX	BANDICOOT	LASL	SHAFT	A	621019	1900	3.00000E+06
209	STORAX	YUBA	LLL	TUNNEL	F	630605	1800	1.10000E+02
210	NIBLICK	EAGLE	LLL	SHAFT	A	631212	1702	7.60000E+02
211	NIBLICK	PIKE	LASL	SHAFT	A	640313	1702	1.20000E+05
212	WHETSTONE	ALVA	LLL	SHAFT	B	640819	1700	6.10000E+03
213	WHETSTONE	DRILL	LLL	SHAFT	E	641205	2215	6.10000E+04
214	WHETSTONE	PARROT	LASL	SHAFT	D	641216	2100	2.30000E+05
215	WHETSTONE	ALPACA	LLL	SHAFT	B	650212	1610	4.00000E+04
216	WHETSTONE	TEE	LLL	SHAFT	C	650507	1647	1.60000E+03
217	WHETSTONE	DILUTED WATERS	DOD/LLL	SHAFT	A	650616	1730	5.90000E+03
218	FLINTLOCK	RED HOT	DOD/LASL	TUNNEL	F	660305	1915	1.00000E+06
219	FLINTLOCK	PIN STRIPE	DOD/LASL	SHAFT	C	660425	1938	2.20000E+05
220	FLINTLOCK	DOUBLE PLAY	DOD/LLL	TUNNEL	G	660615	1800	6.00000E+05
221	LATCHKEY	DERRINGER	LASL	SHAFT	D	660912	1630	1.20000E+04
222	LATCHKEY	NASH	LLL	SHAFT	F	670119	1745	6.90000E+04
223	LATCHKEY	MIDI MIST	DOD/LLL	TUNNEL	G	670626	1700	1.30000E+03
224	LATCHKEY	UMBER	LASL	SHAFT	D	670629	1225	2.60000E+04
225	CROSSTIE	DOOR MIST	DOD/LASL	TUNNEL	G	670831	1730	4.00000E+05
226	CROSSTIE	HUPMOBILE	LLL	SHAFT	C	680118	1730	1.20000E+05
227	MANDREL	POD	LLL	SHAFT	D	690129	2100	3.90000E+03
228	MANDREL	SCUTTLE	LLL	SHAFT	D	691113	1515	2.10000E+02
229	MANDREL	SNUBBER	LASL	SHAFT	C	700421	1530	5.50000E+04
230	MANDREL	MINT LEAF	DOD/LLL	TUNNEL	G	700505	1630	4.00000E+05
231	EMERY	BANEBERRY	LLL	SHAFT	C1	701218	1630	6.70000E+06
232	GROMMET	DIAGONAL LINE	DOD/LLL	SHAFT	G	711124	2015	6.80000E+03
233	TINDERBOX	RIOLA	LLL	SHAFT	F	800925	826	2.90000E+03

CATEGORY A STARTED BEFORE H+30 SECONDS, CONTINUED LESS THAN 15 MINUTES
 CATEGORY B STARTED BEFORE H+30 SECONDS, CONTINUED MORE THAN 15 MINUTES
 CATEGORY C STARTED BETWEEN H+30 SECONDS AND H+20 MINUTES, CONTINUED LESS
 THAN 2 HOURS, BANEBERRY (231) IS A SPECIAL CASE
 CATEGORY D STARTED BETWEEN H+30 SECONDS AND H+20 MINUTES, CONTINUED MORE
 THAN 2 HOURS
 CATEGORY E STARTED AFTER H+20 MINUTES, CONTINUED LESS THAN 12 HOURS
 CATEGORY F STARTED AFTER H+20 MINUTES, CONTINUED MORE THAN 12 HOURS
 CATEGORY G EFFLUENT EITHER SEEPED THROUGH CABLES OR WAS FILTERED THROUGH
 THE SOIL

CURIESOUT COLUMN IS THE TOTAL CURIES RELEASED FROM GROUND ZERO
AS MEASURED AT H+12 HOURS

CURIES RELEASED FROM ALL EVENTS PRIOR TO EAGLE (210) ARE PRECISE WITHIN AN
ORDER OF MAGNITUDE OF THE LISTED VALUE, FROM THEN ON, WITHIN A FACTOR OF 2

CURIES (AFTER 12 HOURS DECAY) RELEASED FROM UNDERGROUND
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COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

-- TABLE VESHTDATA ---
NUM SHOTNAME

SPONSOR	DATE	KR85M	KR88	SR89	SR90	Y91
201 BLANCA	LLL	581030	8.84000E+03	1.03700E+04	6.80000E+02	5.10000E+00
202 ANTLER	LLL	610915	1.26000E+04	1.47000E+04	8.40000E+01	2.10000E+00
203 FEATHER	LLL	611222	1.97600E+01	2.31800E+01	1.52000E+00	1.14000E-02
204 PAMPAS	UK/LASL	620301	1.12000E+02	1.32000E+02	8.00000E+00	6.00000E-02
205 PLATTE	LLL	620414	1.06400E+05	1.25400E+05	7.60000E+03	5.70000E+01
206 EEL	LLL	620519	1.06400E+05	1.25400E+05	7.60000E+03	5.70000E+01
207 DES MOINES	LLL	620613	5.72000E+05	6.71000E+05	4.40000E+04	3.30000E+02
208 BANDICOOT	LASL	621019	1.56000E+05	1.83000E+05	1.20000E+04	9.00000E+01
209 YUBA	LLL	630605	6.82000E+00	8.03000E+00	1.10000E-06	1.10000E-07
210 EAGLE	LLL	631212	3.95200E+01	4.63600E+01	3.04000E+00	2.28000E-02
211 PIKE	LASL	640313	6.24000E+03	7.32000E+03	4.80000E+02	3.60000E+00
212 ALVA	LLL	640819	3.41600E+02	4.02600E+02	2.44000E+01	1.83000E-01
213 DRILL	LLL	641205	3.78200E+03	4.45300E+03	6.10000E-04	6.10000E-05
214 PARROT	LASL	641216	1.38000E+04	1.61000E+04	9.20000E+01	2.30000E+00
215 ALPACA	LLL	650212	2.24000E+03	2.64000E+03	1.60000E+02	1.20000E+00
216 TEE	LLL	650507	9.28000E+01	1.08800E+02	9.60000E-02	4.80000E-04
217 DILUTED WATERS	DOD/LLL	650616	3.06800E+02	3.59900E+02	2.36000E+01	1.77000E-01
218 RED HOT	DOD/LASL	660305	6.20000E+04	7.30000E+04	1.00000E-02	1.00000E-03
219 PIN STRIPE	DOD/LASL	660425	1.27600E+04	1.49600E+04	1.32000E+01	6.60000E-02
220 DOUBLE PLAY	DOD/LLL	660615	3.72000E+04	4.38000E+04	0.	0.
221 DERRINGER	LASL	660912	7.20000E+02	8.40000E+02	4.80000E+00	1.20000E-01
222 NASH	LLL	670119	4.27800E+03	5.03700E+03	6.90000E-04	6.90000E-05
223 MIDI MIST	DOD/LLL	670626	8.06000E+01	9.49000E+01	0.	0.
224 UMBER	LASL	670629	1.56000E+03	1.82000E+03	1.04000E+01	2.60000E-01
225 DOOR MIST	DOD/LASL	670831	2.48000E+04	2.92000E+04	0.	0.
226 HUMMOBILE	LLL	680118	6.96000E+03	8.16000E+03	7.20000E+00	3.60000E-02
227 POD	LLL	690129	2.34000E+02	2.73000E+02	1.56000E+00	3.90000E-02
228 SCUTTLE	LLL	691113	1.26000E+01	1.47000E+01	8.40000E-02	2.10000E-03
229 SNUBBER	LASL	700421	3.19000E+03	3.74000E+03	3.30000E+00	1.65000E-02
230 MINT LEAF	DOD/LLL	700505	2.48000E+04	2.92000E+04	0.	0.
231 BANE BERRY	LLL	701218	2.14400E+05	2.61300E+05	6.70000E+01	6.03000E-01
232 DIAGONAL LINE	DOD/LLL	711124	4.21600E+02	4.96400E+02	0.	0.
233 RIOLA	LLL	800925	1.79800E+02	2.11700E+02	2.90000E-05	2.90000E-06

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NOVEMBER 1980

-- TABLE VESHOTDATA ---

NUM	SHOTNAME	ZR95	ZR97	M099	RU103	RH105	RU106
201	BLANCA	3.40000E+01	1.53000E+03	3.40000E+03	3.40000E+02	4.93000E+03	1.70000E+01
202	ANTLER	1.47000E-03	8.40000E-02	1.47000E+03	1.26000E+02	1.89000E+03	8.40000E+00
203	FEATHER	7.60000E-02	3.42000E+00	7.60000E+00	7.60000E-01	1.10200E+01	3.80000E-02
204	PAMPAS	2.00000E-04	1.20000E-02	4.00000E-02	4.00000E-03	2.00000E-03	2.00000E-04
205	PLATTE	1.90000E-01	1.14000E+01	3.80000E+01	3.80000E+00	1.90000E+00	1.90000E-01
206	EEL	1.90000E-01	1.14000E+01	3.80000E+01	3.80000E+00	1.90000E+00	1.90000E-01
207	DES MOINES	2.20000E+03	9.90000E+04	2.20000E+05	2.20000E+04	3.19000E+05	1.10000E+03
208	BANDICOOT	6.00000E+02	2.70000E+04	6.00000E+04	6.00000E+03	8.70000E+04	3.00000E+02
209	YUBA	2.20000E-04	1.10000E-04	2.20000E-03	2.20000E-04	3.30000E-03	1.10000E-03
210	EAGLE	1.52000E-01	6.84000E+00	1.52000E+01	1.52000E+00	2.20400E+01	7.60000E-02
211	PIKE	2.40000E+01	1.08000E+03	2.40000E+03	2.40000E+02	3.48000E+03	1.20000E+01
212	ALVA	6.10000E-04	3.66000E-02	1.22000E-01	1.22000E-02	6.10000E-03	6.10000E-04
213	DRILL	1.22000E-01	6.10000E-02	1.22000E+00	1.22000E-01	1.83000E+00	6.10000E-01
214	PARROT	1.61000E-03	9.20000E-02	1.61000E+03	1.38000E+02	2.07000E+03	9.20000E+00
215	ALPACA	4.00000E-03	2.40000E-01	8.00000E-01	8.00000E-02	4.00000E-02	4.00000E-03
216	TEE	3.20000E-06	1.60000E-04	1.76000E+01	1.60000E+00	2.56000E+01	3.20000E-03
217	DILUTED WATERS	1.18000E+00	5.31000E+01	1.18000E+02	1.18000E+01	1.71100E+02	5.90000E-01
218	RED HOT	2.00000E+00	1.00000E+00	2.00000E+01	2.00000E+00	3.00000E+01	1.00000E+01
219	PIN STRIPE	4.40000E-04	2.20000E-02	2.42000E+03	2.20000E+02	3.52000E+03	4.40000E-01
220	DOUBLE PLAY	0.	0.	0.	1.20000E+00	0.	2.40000E+01
221	DERRINGER	8.40000E-05	4.80000E-03	8.40000E+01	7.20000E+00	1.08000E+02	4.80000E-01
222	NASH	1.38000E-01	6.90000E-02	1.38000E+00	1.38000E-01	2.07000E+00	6.90000E-01
223	MIDI MIST	0.	0.	0.	2.60000E-03	0.	5.20000E-02
224	UMBER	1.82000E-04	1.04000E-02	1.82000E+02	1.56000E+01	2.34000E+02	1.04000E+00
225	DOOR MIST	0.	0.	0.	8.00000E-01	0.	1.60000E+01
226	HUPMOBILE	2.40000E-04	1.20000E-02	1.32000E+03	1.20000E+02	1.92000E+03	2.40000E-01
227	POD	2.73000E-05	1.56000E-03	2.73000E+01	2.34000E+00	3.51000E+01	1.56000E-01
228	SCUTTLE	1.47000E-06	8.40000E-05	1.47000E+00	1.26000E-01	1.89000E+00	8.40000E-03
229	SNUBBER	1.10000E-04	5.50000E-03	6.05000E+02	5.50000E+01	8.80000E+02	1.10000E-01
230	MINT LEAF	0.	0.	0.	8.00000E-01	0.	1.60000E+01
231	BANE BERRY	6.70000E+00	6.70000E+02	2.88100E+05	2.68000E+04	4.02000E+04	2.01000E+03
232	DIAGONAL LINE	0.	0.	0.	1.36000E-02	0.	2.72000E-01
233	RIOLA	5.80000E-03	2.90000E-03	5.80000E-02	5.80000E-03	8.70000E-02	2.90000E-02

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NOVEMBER 1980

-- TABLE VESOTDATA ---
NUM SHOTNAME

	PD109	PD112	AG111	CD115	SB127	TE132
201 BLANCA	8.50000E+02	3.40000E+02	1.02000E+02	5.10000E+01	1.70000E+02	2.38000E+03
202 ANTLER	4.20000E+02	1.26000E+02	4.20000E+01	2.10000E+01	8.40000E+01	8.40000E+02
203 FEATHER	1.90000E+00	7.60000E-01	2.28000E-01	1.14000E-01	3.80000E-01	5.32000E+00
204 PAMPAS	2.00000E-03	6.00000E-04	1.20000E-03	8.00000E-04	2.00000E-03	4.00000E-02
205 PLATTE	1.90000E+00	5.70000E-01	1.14000E+00	7.60000E-01	1.90000E+00	3.80000E+01
206 EEL	1.90000E+00	5.70000E-01	1.14000E+00	7.60000E-01	1.90000E+00	3.80000E+01
207 DES MOINES	5.50000E+04	2.20000E+04	6.60000E+03	3.30000E+03	1.10000E+04	1.54000E+05
208 BANDICOOT	1.50000E+04	6.00000E+03	1.80000E+03	9.00000E+02	3.00000E+03	4.20000E+04
209 YUBA	7.70000E-02	2.20000E-04	5.50000E-05	3.30000E-06	2.20000E-04	2.20000E-03
210 EAGLE	3.80000E+00	1.52000E+00	4.56000E-01	2.28000E-01	7.60000E-01	1.06400E+01
211 PIKE	6.00000E+02	2.40000E+02	7.20000E+01	3.60000E+01	1.20000E+02	1.68000E+03
212 ALVA	6.10000E-03	1.83000E-03	3.66000E-03	2.44000E-03	6.10000E-03	1.22000E-01
213 DRILL	4.27000E+01	1.22000E-01	3.05000E-02	1.83000E-03	1.22000E-01	1.22000E+00
214 PARROT	4.60000E+02	1.38000E+02	4.60000E+01	2.30000E+01	9.20000E+01	9.20000E+02
215 ALPACA	4.00000E-02	1.20000E-02	2.40000E-02	1.60000E-02	4.00000E-02	8.00000E-01
216 TEE	9.60000E-01	1.60000E+00	4.80000E-01	3.20000E-01	1.12000E+00	1.28000E+01
217 DILUTED WATERS	2.95000E+01	1.18000E+01	3.54000E+00	1.77000E+00	5.90000E+00	8.26000E+01
218 RED HOT	7.00000E+02	2.00000E+00	5.00000E-01	3.00000E-02	2.00000E+00	2.00000E+01
219 PIN STRIPE	1.32000E+02	2.20000E+02	6.60000E+01	4.40000E+01	1.54000E+02	1.76000E+03
220 DOUBLE PLAY	0.	0.	0.	0.	0.	0.
221 DERRINGER	2.40000E+01	7.20000E+00	2.40000E+00	1.20000E+00	4.80000E+00	4.80000E+01
222 NASH	4.83000E+01	1.38000E-01	3.45000E-02	2.07000E-03	1.38000E-01	1.38000E+00
223 MIDI MIST	0.	0.	0.	0.	0.	0.
224 UMBER	5.20000E+01	1.56000E+01	5.20000E+00	2.60000E+00	1.04000E+01	1.04000E+02
225 DOOR MIST	0.	0.	0.	0.	0.	0.
226 HUMMOBILE	7.20000E+01	1.20000E+02	3.60000E+01	2.40000E+01	8.40000E+01	9.60000E+02
227 POD	7.80000E+00	2.34000E+00	7.80000E-01	3.90000E-01	1.56000E+00	1.56000E+01
228 SCUTTLE	4.20000E-01	1.26000E-01	4.20000E-02	2.10000E-02	8.40000E-02	8.40000E-01
229 SNUBBER	3.30000E+01	5.50000E+01	1.65000E+01	1.10000E+01	3.85000E+01	4.40000E+02
230 MINT LEAF	0.	0.	0.	0.	0.	0.
231 BANE BERRY	2.68000E+04	2.68000E+04	6.70000E+03	4.69000E+03	2.01000E+04	2.01000E+05
232 DIAGONAL LINE	0.	0.	0.	0.	0.	0.
233 RIOLA	2.03000E+00	5.80000E-03	1.45000E-03	8.70000E-05	5.80000E-03	5.80000E-02

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NOVEMBER 1980

-- TABLE VESHTDATA ---
NUM SHOTNAME

	I131	I133	I135	XE133	XE135	CS136
201 BLANCA	5.10000E+02	5.78000E+03	6.63000E+03	1.13900E+04	1.10500E+05	8.50000E+00
202 ANTLER	4.20000E+00	4.20000E+02	2.52000E+03	1.57500E+04	1.57500E+05	2.10000E+00
203 FEATHER	1.14000E+00	1.29200E+01	1.48200E+01	2.54600E+01	2.47000E+02	1.90000E-02
204 PAMPAS	1.20000E-02	1.20000E+00	6.00000E+00	1.40000E+02	1.40000E+03	4.00000E-02
205 PLATTE	1.14000E+01	1.14000E+03	5.70000E+03	1.33000E+05	1.33000E+06	3.80000E+01
206 EEL	1.14000E+01	1.14000E+03	5.70000E+03	1.33000E+05	1.33000E+06	3.80000E+01
207 DES MOINES	3.30000E+04	3.74000E+05	4.29000E+05	7.37000E+05	7.15000E+06	5.50000E+02
208 BANDICOOT	9.00000E+03	1.02000E+05	1.17000E+05	2.01000E+05	1.95000E+06	1.50000E+02
209 YUBA	2.20000E-02	3.63000E-01	8.80000E-01	8.58000E+00	8.58000E+01	1.10000E-05
210 EAGLE	2.28000E+00	2.58400E+01	2.96400E+01	5.09200E+01	4.94000E+02	3.80000E-02
211 PIKE	3.60000E+02	4.08000E+03	4.68000E+03	8.04000E+03	7.80000E+04	6.00000E+00
212 ALVA	3.66000E-02	3.66000E+00	1.83000E+01	4.27000E+02	4.27000E+03	1.22000E-01
213 DRILL	1.22000E+01	2.01300E+02	4.88000E+02	4.75800E+03	4.75800E+04	6.10000E-03
214 PARROT	4.60000E+00	4.60000E+02	2.76000E+03	1.72500E+04	1.72500E+05	2.30000E+00
215 ALPACA	2.40000E-01	2.40000E+01	1.20000E+02	2.80000E+03	2.80000E+04	8.00000E-01
216 TEE	1.60000E+00	3.04000E+01	4.00000E+01	1.15200E+02	1.15200E+03	3.20000E-02
217 DILUTED WATERS	1.77000E+01	2.00600E+02	2.30100E+02	3.95300E+02	3.83500E+03	2.95000E-01
218 RED HOT	2.00000E+02	3.30000E+03	8.00000E+03	7.80000E+04	7.80000E+05	1.00000E-01
219 PIN STRIPE	2.20000E+02	4.18000E+03	5.50000E+03	1.58400E+04	1.58400E+05	4.40000E+00
220 DOUBLE PLAY	1.20000E+02	3.18000E+03	5.70000E+03	4.20000E+04	4.68000E+05	0.
221 DERRINGER	2.40000E-01	2.40000E+01	1.44000E+02	9.00000E+02	9.00000E+03	1.20000E-01
222 NASH	1.38000E+01	2.27700E+02	5.52000E+02	5.38200E+03	5.38200E+04	6.90000E-03
223 MIDI MIST	2.60000E-01	6.89000E+00	1.23500E+01	9.10000E+01	1.01400E+03	0.
224 UMBER	5.20000E-01	5.20000E+01	3.12000E+02	1.95000E+03	1.95000E+04	2.60000E-01
225 DOOR MIST	8.00000E+01	2.12000E+03	3.80000E+03	2.80000E+04	3.12000E+05	0.
226 HUPMOBILE	1.20000E+02	2.28000E+03	3.00000E+03	8.64000E+03	8.64000E+04	2.40000E+00
227 POD	7.80000E-02	7.80000E+00	4.68000E+01	2.92500E+02	2.92500E+03	3.90000E-02
228 SCUTTLE	4.20000E-03	4.20000E-01	2.52000E+00	1.57500E+01	1.57500E+02	2.10000E-03
229 SNUBBER	5.50000E+01	1.04500E+03	1.37500E+03	3.96000E+03	3.96000E+04	1.10000E+00
230 MINT LEAF	8.00000E+01	2.12000E+03	3.80000E+03	2.80000E+04	3.12000E+05	0.
231 BANE BERRY	8.04000E+04	1.60800E+06	9.38000E+05	2.68000E+05	2.74700E+06	2.68000E+01
232 DIAGONAL LINE	1.36000E+00	3.60400E+01	6.46000E+01	4.76000E+02	5.30400E+03	0.
233 RIOLA	5.80000E-01	9.57000E+00	2.32000E+01	2.26200E+02	2.26200E+03	2.90000E-04

VALUES ARE CALCULATED FROM TOTAL CURIES RELEASED AND DEBRIS COMPOSITION

LISTED VALUES FROM ALL EVENTS PRIOR TO EAGLE (210) ARE PRECISE WITHIN AN
ORDER OF MAGNITUDE, AND FROM THEN ON, WITHIN A FACTOR OF TWO

CURIES (AFTER 12 HOURS DECAY) RELEASED FROM UNDERGROUND
EVENTS WHICH UNINTENTIONALLY PLACED DETECTABLE
RADIOACTIVITY OUTSIDE THE TEST RANGE COMPLEX

COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

-- TABLE VESHTDATA ---
NUM SHOTNAME

	CS137	BA140	CE141	CE143	CE144	ND147
201 BLANCA	1.02000E+03	3.40000E+02	1.02000E+02	8.50000E+02	5.10000E+00	6.80000E+01
202 ANTLER	1.47000E+01	2.10000E+02	1.05000E+02	4.20000E-02	2.10000E-04	4.20000E-03
203 FEATHER	2.28000E+00	7.60000E-01	2.28000E-01	1.90000E+00	1.14000E-02	1.52000E-01
204 PAMPAS	1.20000E+01	1.40000E+02	5.20000E+01	8.00000E-03	4.00000E-05	8.00000E-04
205 PLATTE	1.14000E+04	1.33000E+05	4.94000E+04	7.60000E+00	3.80000E-02	7.60000E-01
206 EEL	1.14000E+04	1.33000E+05	4.94000E+04	7.60000E+00	3.80000E-02	7.60000E-01
207 DES MOINES	6.60000E+04	2.20000E+04	6.60000E+03	5.50000E+04	3.30000E+02	4.40000E+03
208 BANDICOOT	1.80000E+04	6.00000E+03	1.80000E+03	1.50000E+04	9.00000E+01	1.20000E+03
209 YUBA	8.80000E-07	1.10000E-05	5.50000E-06	9.90000E-05	5.50000E-07	6.60000E-06
210 EAGLE	4.56000E+00	1.52000E+00	4.56000E-01	3.80000E+00	2.28000E-02	3.04000E-01
211 PIKE	7.20000E+02	2.40000E+02	7.20000E+01	6.00000E+02	3.60000E+00	4.80000E+01
212 ALVA	3.66000E+01	4.27000E+02	1.58600E+02	2.44000E-02	1.22000E-04	2.44000E-03
213 DRILL	4.88000E-04	6.10000E-03	3.05000E-03	5.49000E-02	3.05000E-04	3.66000E-03
214 PARROT	1.61000E+01	2.30000E+02	1.15000E+02	4.60000E-02	2.30000E-04	4.60000E-03
215 ALPACA	2.40000E+02	2.80000E+03	1.04000E+03	1.60000E-01	8.00000E-04	1.60000E-02
216 TEE	1.60000E-03	9.60000E-01	4.80000E-01	9.60000E-05	1.60000E-06	9.60000E-06
217 DILUTED WATERS	3.54000E+01	1.18000E+01	3.54000E+00	2.95000E+01	1.77000E-01	2.36000E+00
218 RED HOT	8.00000E-03	1.00000E-01	5.00000E-02	9.00000E-01	5.00000E-03	6.00000E-02
219 PIN STRIPE	2.20000E-01	1.32000E+02	6.60000E+01	1.32000E-02	2.20000E-04	1.32000E-03
220 DOUBLE PLAY	0.	0.	0.	0.	0.	0.
221 DERRINGER	8.40000E-01	1.20000E+01	6.00000E+00	2.40000E-03	1.20000E-05	2.40000E-04
222 NASH	5.52000E-04	6.90000E-03	3.45000E-03	6.21000E-02	3.45000E-04	4.14000E-03
223 MIDI MIST	0.	0.	0.	0.	0.	0.
224 UMBER	1.82000E+00	2.60000E+01	1.30000E+01	5.20000E-03	2.60000E-05	5.20000E-04
225 DOOR MIST	0.	0.	0.	0.	0.	0.
226 HUPMOBILE	1.20000E-01	7.20000E+01	3.60000E+01	7.20000E-03	1.20000E-04	7.20000E-04
227 POD	2.73000E-01	3.90000E+00	1.95000E+00	7.80000E-04	3.90000E-06	7.80000E-05
228 SCUTTLE	1.47000E-02	2.10000E-01	1.05000E-01	4.20000E-05	2.10000E-07	4.20000E-06
229 SNUBBER	5.50000E-02	3.30000E+01	1.65000E+01	3.30000E-03	5.50000E-05	3.30000E-04
230 MINT LEAF	0.	0.	0.	0.	0.	0.
231 BANE BERRY	6.70000E-01	6.70000E+02	3.35000E+02	4.02000E+02	2.01000E+00	2.68000E+01
232 DIAGONAL LINE	0.	0.	0.	0.	0.	0.
233 RIOLA	2.32000E-05	2.90000E-04	1.45000E-04	2.61000E-03	1.45000E-05	1.74000E-04

VALUES ARE CALCULATED FROM TOTAL CURIES RELEASED AND DEBRIS COMPOSITION

LISTED VALUES FROM ALL EVENTS PRIOR TO EAGLE (210) ARE PRECISE WITHIN AN
ORDER OF MAGNITUDE, AND FROM THEN ON, WITHIN A FACTOR OF TWO

TABLE III-1. Calculated fractional contributions of 28 individual radionuclides to the total radioactive releases for the various categories of shots that vented to the atmosphere.

Fission product	Half-life (days)	Fission yield (%) ^a	Category A		Category B		Category C		Category C1		Category D		Categories E, F, and G ^d	
			Fraction vented ^b	Fraction of total release ^c	Fraction vented ^b	Fraction of total release ^c	Fraction vented ^b	Fraction of total release ^c	Fraction vented ^b	Fraction of total release ^c	Fraction vented ^b	Fraction of total release ^c	Fraction vented ^b	Fraction of total release ^c
^{85m} Kr	0.187	0.58	0.5	0.052	0.001	0.056	0.002	0.058	0.15	0.032	0.003	0.060	0.001	0.062
⁸⁸ Kr	0.118	1.27	0.5	0.061	0.001	0.066	0.002	0.068	0.15	0.039	0.003	0.070	0.001	0.073
⁸⁹ Sr	50.52	1.77	0.5	0.004	0.001	0.004	3×10 ⁻⁵	6×10 ⁻⁵	8×10 ⁻⁴	10 ⁻⁵	0.003	0.004	10 ⁻⁶	10 ⁻⁶
⁹⁰ Sr	10,592	2.64	0.5	3×10 ⁻⁵	0.001	3×10 ⁻⁵	3×10 ⁻⁵	3×10 ⁻⁷	8×10 ⁻⁴	9×10 ⁻⁸	0.001	10 ⁻⁵	10 ⁻⁶	9×10 ⁻¹¹
⁹¹ Y	58.6	2.62	0.02	2×10 ⁻⁴	10 ⁻⁴	8×10 ⁻⁵	3×10 ⁻⁹	10 ⁻⁹	6×10 ⁻⁵	10 ⁻⁶	3×10 ⁻⁹	4×10 ⁻⁹	10 ⁻⁶	10 ⁻⁸
⁹⁵ Zr	64.0	4.52	0.01	2×10 ⁻⁴	10 ⁻⁷	10 ⁻⁷	3×10 ⁻⁹	2×10 ⁻⁹	6×10 ⁻⁵	10 ⁻⁶	3×10 ⁻⁹	7×10 ⁻⁹	10 ⁻⁶	2×10 ⁻⁶
⁹⁷ Zr	0.700	4.82	0.01	0.009	10 ⁻⁷	6×10 ⁻⁶	3×10 ⁻⁹	10 ⁻⁷	6×10 ⁻⁵	10 ⁻⁴	3×10 ⁻⁹	4×10 ⁻⁷	10 ⁻⁶	10 ⁻⁴
⁹⁹ Mo	2.751	5.94	0.05	0.020	10 ⁻⁷	2×10 ⁻⁵	10 ⁻⁴	0.011	0.05	0.043	10 ⁻⁴	0.007	2×10 ⁻⁵	2×10 ⁻⁵
¹⁰³ Ru	39.4	6.53	0.05	0.002	10 ⁻⁷	2×10 ⁻⁶	10 ⁻⁴	0.001	0.05	0.004	10 ⁻⁴	6×10 ⁻⁴	2×10 ⁻⁵	2×10 ⁻⁶
¹⁰⁵ Rh	1.48	5.13	0.05	0.029	10 ⁻⁷	10 ⁻⁶	10 ⁻⁴	0.016	0.05	0.006	10 ⁻⁴	0.009	2×10 ⁻⁵	3×10 ⁻⁵
¹⁰⁶ Ru	368	4.52	0.05	10 ⁻⁴	10 ⁻⁷	10 ⁻⁷	10 ⁻⁴	6×10 ⁻⁵	0.05	3×10 ⁻⁴	10 ⁻⁴	4×10 ⁻⁵	2×10 ⁻⁵	10 ⁻⁷
¹⁰⁹ Pd	0.560	0.60	0.05	0.005	10 ⁻⁷	10 ⁻⁶	10 ⁻⁴	6×10 ⁻⁴	0.05	0.004	10 ⁻⁴	0.002	2×10 ⁻⁵	7×10 ⁻⁶
¹¹² Pd	0.875	0.23	0.05	0.002	10 ⁻⁷	3×10 ⁻⁷	10 ⁻⁴	0.001	0.05	0.004	10 ⁻⁴	6×10 ⁻⁴	2×10 ⁻⁵	2×10 ⁻⁶
¹¹¹ Ag	7.47	0.41	0.05	6×10 ⁻⁴	10 ⁻⁷	6×10 ⁻⁷	10 ⁻⁴	3×10 ⁻⁴	0.05	0.001	10 ⁻⁴	2×10 ⁻⁴	2×10 ⁻⁵	5×10 ⁻⁷
¹¹⁵ Cd	2.23	0.083	0.05	3×10 ⁻⁴	10 ⁻⁷	4×10 ⁻⁷	10 ⁻⁴	2×10 ⁻⁴	0.05	7×10 ⁻⁴	10 ⁻⁴	10 ⁻⁴	2×10 ⁻⁵	3×10 ⁻⁸
¹²⁷ Sb	3.80	0.50	0.05	0.001	10 ⁻⁷	10 ⁻⁶	10 ⁻⁴	7×10 ⁻⁴	0.05	0.003	10 ⁻⁴	4×10 ⁻⁴	2×10 ⁻⁵	2×10 ⁻⁶
¹³² Te	3.25	4.81	0.05	0.014	10 ⁻⁷	2×10 ⁻⁵	10 ⁻⁴	0.008	0.05	0.030	10 ⁻⁴	0.004	2×10 ⁻⁵	2×10 ⁻⁵
¹³¹ I	8.04	4.31	0.03	0.003	10 ⁻⁷	6×10 ⁻⁶	3×10 ⁻⁵	0.001	0.05	0.012	10 ⁻⁶	2×10 ⁻⁵	10 ⁻⁶	2×10 ⁻⁴
¹³³ I	0.867	6.81	0.03	0.034	10 ⁻⁶	6×10 ⁻⁴	6×10 ⁻⁵	0.019	0.1	0.236	10 ⁻⁵	0.002	10 ⁻⁵	0.003
¹³⁵ I	0.274	5.82	0.03	0.039	4×10 ⁻⁶	0.03	7×10 ⁻⁵	0.025	0.05	0.136	5×10 ⁻⁵	0.012	7×10 ⁻⁶	0.008
¹³³ Xe	5.25	3.40	0.5	0.067	10 ⁻³	0.070	0.002	0.072	0.15	0.040	0.003	0.075	0.001	0.078
¹³⁵ Xe	0.379	5.76	0.5	0.654	10 ⁻³	0.700	0.002	0.720	0.15	0.413	0.003	0.751	0.001	0.777
¹³⁶ Cs	13.1	0.15	0.02	5×10 ⁻⁵	10 ⁻⁴	2×10 ⁻⁵	3×10 ⁻⁵	2×10 ⁻⁵	8×10 ⁻⁴	4×10 ⁻⁶	3×10 ⁻⁵	10 ⁻⁵	2×10 ⁻⁵	10 ⁻⁵
¹³⁷ Cs	11,020	6.19	0.5	6×10 ⁻⁵	10 ⁻³	6×10 ⁻⁵	3×10 ⁻⁵	10 ⁻⁶	8×10 ⁻⁴	10 ⁻⁷	0.003	7×10 ⁻⁵	2×10 ⁻⁵	8×10 ⁻⁷
¹⁴⁰ Ba	12.79	4.94	0.02	0.002	0.01	0.070	3×10 ⁻⁵	6×10 ⁻⁴	8×10 ⁻⁴	10 ⁻⁴	10 ⁻⁴	0.001	10 ⁻⁶	10 ⁻⁵
¹⁴¹ Ce	32.5	4.70	0.02	6×10 ⁻⁴	0.01	0.026	3×10 ⁻⁵	3×10 ⁻⁴	8×10 ⁻⁴	5×10 ⁻⁵	10 ⁻⁴	5×10 ⁻⁴	10 ⁻⁶	5×10 ⁻⁶
¹⁴³ Ce	1.375	4.10	0.01	0.005	10 ⁻⁷	4×10 ⁻⁶	3×10 ⁻⁹	6×10 ⁻⁸	6×10 ⁻⁵	6×10 ⁻⁵	3×10 ⁻⁹	2×10 ⁻⁷	10 ⁻⁶	9×10 ⁻⁵
¹⁴⁴ Ce	284.4	3.34	0.01	3×10 ⁻⁵	10 ⁻⁷	2×10 ⁻⁸	3×10 ⁻⁹	3×10 ⁻¹⁰	6×10 ⁻⁵	3×10 ⁻⁷	3×10 ⁻⁹	10 ⁻⁹	10 ⁻⁶	5×10 ⁻⁷
¹⁴⁷ Nd	10.99	1.97	0.01	4×10 ⁻⁴	10 ⁻⁷	4×10 ⁻⁷	3×10 ⁻⁹	6×10 ⁻⁹	6×10 ⁻⁵	4×10 ⁻⁶	3×10 ⁻⁹	2×10 ⁻⁸	10 ⁻⁶	6×10 ⁻⁶

^aFission yields are taken to be representative.

^bFractions vented were obtained from R. H. Ide (Ref. 6).

^cRelative curies at H + 12 hours were obtained with the relation:

$$\text{Relative curies (H + 12 hours)} = \frac{(\% \text{ fission yield})(\text{fraction vented})}{t_{1/2}} \exp[-(\ln 2)/2t_{1/2}].$$

^dOnly rare gases and iodine were released in category G events, the same fractions as in categories E and F in this column.

NUCLEAR ROCKET ENGINE TESTS

Executable FRAMIS Files

DEL TAB PE:


```

DEF TAB PE COL1 CHAR 1;
ADDDATA PE <"1">;
DEL TAB ROCKTITLEA;
DEF TAB ROCKTITLEA COL1 CHAR 100;
ADDDATA ROCKTITLEA
<" "
<" ">
<" "
<" "
<" ">;
DEL TAB LEGEND;
DEF TAB LEGEND COL1 CHAR 100;
ADDDATA LEGEND
<" "
<"CURIES RELEASED ARE PRECISE TO A FACTOR OF TWO">;
OUTPUT ROCKTITLEA TO HSP;
PRINT ROCKET COL RUN ENGINENAME DATE MWSEC CURIESOUT TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
/* PRINT OUTPUT DATA, NUCLEAR ROCKET ENGINE TESTS, ROCKPRINT2 */

DEL TAB PE;
DEF TAB PE COL1 CHAR 1;
ADDDATA PE <"1">;
DEL TAB ROCKTITLE;
DEF TAB ROCKTITLE COL1 CHAR 100;
ADDDATA ROCKTITLE
<" CURIES (AFTER 12 HOURS DECAY) RELEASED FROM NUCLEAR ROCKET ENGINE TESTS "
<" "
<" "
<" "
<" ">;
DEL TAB LEGEND;
DEF TAB LEGEND COL1 CHAR 100;
ADDDATA LEGEND
<" "
<"VALUES IN THE TABLE WERE CALCULATED ASSUMING:">
<" 1 RELATIVE COMPOSITIONS OF ALL EFFLUENTS WERE THAT OF PHOEBUS 1B, RUN 324">;
<" 2 TE132, I131 AND I133 CAN BE USED TO CALCULATE TOTAL CURIES RELEASED">
<" 3 FOR A GIVEN ENGINE TYPE, THE TOTAL RELEASE IS PROPORTIONAL TO THE">
<" INTEGRATED POWER LEVEL ONLY">
<" "
<"LISTED VALUES ARE PRECISE TO A FACTOR OF TWO">;
OUTPUT ROCKTITLE TO HSP;
PRINT ROCKETA COL RUN ENGINENAME KR85M KR87 KR88 SR89 SR90 Y91 Y93 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ROCKTITLE TO HSP;
PRINT ROCKETA COL RUN ENGINENAME ZR95 ZR97 MO99 RU103 RH105 RU106 PD109 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ROCKTITLE TO HSP;
PRINT ROCKETA COL RUN ENGINENAME PD112 AG111 CD115 CD115M SN121 SN123 SN125
TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ROCKTITLE TO HSP;
PRINT ROCKETA COL RUN ENGINENAME SB127 TE129M TE132 I131 I133 I135 XE133 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ROCKTITLE TO HSP;
PRINT ROCKETA COL RUN ENGINENAME XE133M XE135 XE135M BA140 CE141 CE143 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;
OUTPUT ROCKTITLE TO HSP;
PRINT ROCKETA COL RUN ENGINENAME CE144 ND147 PM149 PM151 SM153 EU156 TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;

```

Input Card Images

ROCKETIN

FIXED 5 CD

RUN 1 3

ENGINE NAME 9 12

DATE 22 6

MWSEC 29 8

CURIESOUT 38 9

301	KIWI A	590701	2.0E+4	8.4E+2
302	KIWI A PRIME	600708	6.0E+4	2.5E+3
303	KIWI A3	601019	6.0E+4	2.5E+3
304	KIWI B-1A	611207	3.0E+4	1.3E+3
305	KIWI B-1B	620901	1.0E+4	4.2E+2
306	KIWI B-4A	621128	4.0E+4	1.7E+3
307	KIWI B-4D	640513	1.1E+5	4.6E+3
308	KIWI B-4E	640828	5.0E+5	2.1E+4
309	KIWI B-4E	640910	1.8E+5	7.6E+3
310	NRX-A2	640924	3.0E+5	1.1E+3
311	NRX-A2	641015	3.0E+5	1.1E+3
312	KIWI (TNT)	650112	9.0E+3	1.5E+4
313	NRX-A3	650423	3.2E+5	5.3E+2
314	NRX-A3	650520	8.4E+5	2.4E+3
315	NRX-A3	650528	5.0E+5	1.2E+3
316	PHOEBUS-1A	650625	7.4E+5	2.2E+4
317	NRX-A4/EST	660203	3.9E+5	1.2E+1
318	NRX-A4/EST	660303	8.8E+5	1.0E+2
319	NRX-A4/EST	660316	1.0E+6	2.7E+4
320	NRX-A4/EST	660325	1.1E+6	2.8E+4
321	NRX-A5	660608	1.2E+6	1.2E+3
322	NRX-A5	660623	1.0E+6	8.0E+4
323	PHOEBUS-1B	670210	1.4E+5	3.4E+4
324	PHOEBUS-1B	670223	2.6E+6	2.4E+5
325	NRX-A6	671215	4.5E+6	5.3E+4
326	PHOEBUS-2A	680608	6.4E+5	7.1E+3
327	PHOEBUS-2A	680626	4.5E+6	5.1E+4
328	PHOEBUS-2A	680718	2.7E+6	2.1E+3
329	PEEWEE-1	681204	1.6E+6	2.3E+5
330	XE PRIME	690611	4.2E+5	8.2E+2
331	XE PRIME	690828	3.4E+5	5.3E+2

Summary Table

NUCLEAR ROCKET ENGINE TESTS

COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

-- TABLE ROCKET ---
RUN ENGINE NAME

	DATE	MWSEC	CURIESOUT
301 KIWI A	590701	2.00000E+04	8.40000E+02
302 KIWI A PRIME	600708	6.00000E+04	2.50000E+03
303 KIWI A3	601019	6.00000E+04	2.50000E+03
304 KIWI B-1A	611207	3.00000E+04	1.30000E+03
305 KIWI B-1B	620901	1.00000E+04	4.20000E+02
306 KIWI B-4A	621128	4.00000E+04	1.70000E+03
307 KIWI B-4D	640513	1.10000E+05	4.60000E+03
308 KIWI B-4E	640828	5.00000E+05	2.10000E+04
309 KIWI B-4E	640910	1.80000E+05	7.60000E+03
310 NRX-A2	640924	3.00000E+05	1.10000E+03
311 NRX-A2	641015	3.00000E+05	1.10000E+03
312 KIWI (TNT)	650112	9.00000E+03	1.50000E+04
313 NRX-A3	650423	3.20000E+05	5.30000E+02
314 NRX-A3	650520	8.40000E+05	2.40000E+03
315 NRX-A3	650528	5.00000E+05	1.20000E+03
316 PHOEBUS-1A	650625	7.40000E+05	2.20000E+04
317 NRX-A4/EST	660203	3.90000E+05	1.20000E+01
318 NRX-A4/EST	660303	8.80000E+05	1.00000E+02
319 NRX-A4/EST	660316	1.00000E+06	2.70000E+04
320 NRX-A4/EST	660325	1.10000E+06	2.80000E+04
321 NRX-A5	660608	1.20000E+06	1.20000E+03
322 NRX-A5	660623	1.00000E+06	8.00000E+04
323 PHOEBUS-1B	670210	1.40000E+05	3.40000E+04
324 PHOEBUS-1B	670223	2.60000E+06	2.40000E+05
325 NRX-A6	671215	4.50000E+06	5.30000E+04
326 PHOEBUS-2A	680608	6.40000E+05	7.10000E+03
327 PHOEBUS-2A	680626	4.50000E+06	5.10000E+04
328 PHOEBUS-2A	680718	2.70000E+06	2.10000E+03
329 PEWE-1	681204	1.60000E+06	2.30000E+05
330 XE PRIME	690611	4.20000E+05	8.20000E+02
331 XE PRIME	690828	3.40000E+05	5.30000E+02

CURIES RELEASED ARE PRECISE TO A FACTOR OF TWO

CURIES (AFTER 12 HOURS DECAY) RELEASED FROM NUCLEAR ROCKET ENGINE TESTS

COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980-- TABLE ROCKETA ---
RUN ENGINENAME

	KR85M	KR87	KR88	SR89	SR90	Y91	Y93
301	6.89640E+01	4.36800E+00	1.00800E+00	5.62800E+00	3.10800E-02	5.29200E+00	2.44440E+02
302	2.05250E+02	1.30000E+01	3.00000E+00	1.67500E+01	9.25000E-02	1.57500E+01	7.27500E+02
303	2.05250E+02	1.30000E+01	3.00000E+00	1.67500E+01	9.25000E-02	1.57500E+01	7.27500E+02
304	1.06730E+02	6.76000E+00	1.56000E+00	8.71000E+00	4.81000E-02	8.19000E+00	3.78300E+02
305	3.44820E+01	2.18400E+00	5.04000E-01	2.81400E+00	1.55400E-02	2.64600E+00	1.22220E+02
306	1.39570E+02	8.84000E+00	2.04000E+00	1.13900E+01	6.29000E-02	1.07100E+01	4.94700E+02
307	3.77660E+02	2.39200E+01	5.52000E+00	3.08200E+01	1.70200E-01	2.89800E+01	1.33860E+03
308	1.72410E+03	1.09200E+02	2.52000E+01	1.40700E+02	7.77000E-01	1.32300E+02	6.11100E+03
309	6.23960E+02	3.95200E+01	9.12000E+00	5.09200E+01	2.81200E-01	4.78800E+01	2.21160E+03
310	9.03100E+01	5.72000E+00	1.32000E+00	7.37000E+00	4.07000E-02	6.93000E+00	3.20100E+02
311	9.03100E+01	5.72000E+00	1.32000E+00	7.37000E+00	4.07000E-02	6.93000E+00	3.20100E+02
312	1.23150E+03	7.80000E+01	1.80000E+01	1.00500E+02	5.55000E-01	9.45000E+01	4.36500E+03
313	4.35130E+01	2.75600E+00	6.36000E-01	3.55100E+00	1.96100E-02	3.33900E+00	1.54230E+02
314	1.97040E+02	1.24800E+01	2.88000E+00	1.60800E+01	8.88000E-02	1.51200E+01	6.98400E+02
315	9.85200E+01	6.24000E+00	1.44000E+00	8.04000E+00	4.44000E-02	7.56000E+00	3.49200E+02
316	1.80620E+03	1.14400E+02	2.64000E+01	1.47400E+02	8.14000E-01	1.38600E+02	6.40200E+03
317	9.85200E-01	6.24000E-02	1.44000E-02	8.04000E-02	4.44000E-04	7.56000E-02	3.49200E+00
318	8.21000E+00	5.20000E-01	1.20000E-01	6.70000E-01	3.70000E-03	6.30000E-01	2.91000E+01
319	2.21670E+03	1.40400E+02	3.24000E+01	1.80900E+02	9.99000E-01	1.70100E+02	7.85700E+03
320	2.29880E+03	1.45600E+02	3.36000E+01	1.87600E+02	1.03600E+00	1.76400E+02	8.14800E+03
321	9.85200E+01	6.24000E+00	1.44000E+00	8.04000E+00	4.44000E-02	7.56000E+00	3.49200E+02
322	6.56800E+03	4.16000E+02	9.60000E+01	5.36000E+02	2.96000E+00	5.04000E+02	2.32800E+04
323	2.79140E+03	1.76800E+02	4.08000E+01	2.27800E+02	1.25800E+00	2.14200E+02	9.89400E+03
324	1.97040E+04	1.24800E+03	2.88000E+02	1.60800E+03	8.88000E+00	1.51200E+03	6.98400E+04
325	4.35130E+03	2.75600E+02	6.36000E+01	3.55100E+02	1.96100E+00	3.33900E+02	1.54230E+04
326	5.82910E+02	3.69200E+01	8.52000E+00	4.75700E+01	2.62700E-01	4.47300E+01	2.06610E+03
327	4.18710E+03	2.65200E+02	6.12000E+01	3.41700E+02	1.88700E+00	3.21300E+02	1.48410E+04
328	1.72410E+02	1.09200E+01	2.52000E+00	1.40700E+01	7.77000E-02	1.32300E+01	6.11100E+02
329	1.88830E+04	1.19600E+03	2.76000E+02	1.54100E+03	8.51000E+00	1.44900E+03	6.69300E+04
330	6.73220E+01	4.26400E+00	9.84000E-01	5.49400E+00	3.03400E-02	5.16600E+00	2.38620E+02
331	4.35130E+01	2.75600E+00	6.36000E-01	3.55100E+00	1.96100E-02	3.33900E+00	1.54230E+02

VALUES IN THE TABLE WERE CALCULATED ASSUMING:

- 1 RELATIVE COMPOSITIONS OF ALL EFFLUENTS WERE THAT OF PHOEBUS 1B, RUN 324
- 2 TE132, I131, AND I133 CAN BE USED TO CALCULATE TOTAL CURIES RELEASED
- 3 FOR A GIVEN ENGINE TYPE, THE TOTAL RELEASE IS PROPORTIONAL TO THE INTEGRATED POWER LEVEL ONLY

LISTED VALUES ARE PRECISE TO A FACTOR OF TWO

CURIES (AFTER 12 HOURS DECAY) RELEASED FROM NUCLEAR ROCKET ENGINE TESTS

COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

-- TABLE ROCKETA ---
RUN ENGINENAME

		ZR95	ZR97	M099	RU103	RH105	RU106	PD109
301	KIWI A	7.72800E-01	3.98160E+01	1.20960E+01	7.14000E-01	6.21600E+00	1.68000E-02	7.14000E-01
302	KIWI A PRIME	2.30000E+00	1.18500E+02	3.60000E+01	2.12500E+00	1.85000E+01	5.00000E-02	2.12500E+00
303	KIWI A3	2.30000E+00	1.18500E+02	3.60000E+01	2.12500E+00	1.85000E+01	5.00000E-02	2.12500E+00
304	KIWI B-1A	1.19600E+00	6.16200E+01	1.87200E+01	1.10500E+00	9.62000E+00	2.60000E-02	1.10500E+00
305	KIWI B-1B	3.86400E-01	1.99080E+01	6.04800E+00	3.57000E-01	3.10800E+00	8.40000E-03	3.57000E-01
306	KIWI B-4A	1.56400E+00	8.05800E+01	2.44800E+01	1.44500E+00	1.25800E+01	3.40000E-02	1.44500E+00
307	KIWI B-4D	4.23200E+00	2.18040E+02	6.62400E+01	3.91000E+00	3.40400E+01	9.20000E-02	3.91000E+00
308	KIWI B-4E	1.93200E+01	9.95400E+02	3.02400E+02	1.78500E+01	1.55400E+02	4.20000E-01	1.78500E+01
309	KIWI B-4E	6.99200E+00	3.60240E+02	1.09440E+02	6.46000E+00	5.62400E+01	1.52000E-01	6.46000E+00
310	NRX-A2	1.01200E+00	5.21400E+01	1.58400E+01	9.35000E-01	8.14000E+00	2.20000E-02	9.35000E-01
311	NRX-A2	1.01200E+00	5.21400E+01	1.58400E+01	9.35000E-01	8.14000E+00	2.20000E-02	9.35000E-01
312	KIWI (TNT)	1.38000E+01	7.11000E+02	2.16000E+02	1.27500E+01	1.11000E+02	3.00000E-01	1.27500E+01
313	NRX-A3	4.87600E-01	2.51220E+01	7.63200E+00	4.50500E-01	3.92200E+00	1.06000E-02	4.50500E-01
314	NRX-A3	2.20800E+00	1.13760E+02	3.45600E+01	2.04000E+00	1.77600E+01	4.80000E-02	2.04000E+00
315	NRX-A3	1.10400E+00	5.68800E+01	1.72800E+01	1.02000E+00	8.88000E+00	2.40000E-02	1.02000E+00
316	PHOEBUS-1A	2.02400E+01	1.04280E+03	3.16800E+02	1.87000E+01	1.62800E+02	4.40000E-01	1.87000E+01
317	NRX-A4/EST	1.10400E-02	5.68800E-01	1.72800E-01	1.02000E-02	8.88000E-02	2.40000E-04	1.02000E-02
318	NRX-A4/EST	9.20000E-02	4.74000E+00	1.44000E+00	8.50000E-02	7.40000E-01	2.00000E-03	8.50000E-02
319	NRX-A4/EST	2.48400E+01	1.27980E+03	3.88800E+02	2.29500E+01	1.99800E+02	5.40000E-01	2.29500E+01
320	NRX-A4/EST	2.57600E+01	1.32720E+03	4.03200E+02	2.38000E+01	2.07200E+02	5.60000E-01	2.38000E+01
321	NRX-A5	1.10400E+00	5.68800E+01	1.72800E+01	1.02000E+00	8.88000E+00	2.40000E-02	1.02000E+00
322	NRX-A5	7.36000E+01	3.79200E+03	1.15200E+03	6.80000E+01	5.92000E+02	1.60000E+00	6.80000E+01
323	PHOEBUS-1B	3.12800E+01	1.61160E+03	4.89600E+02	2.89000E+01	2.51600E+02	6.80000E-01	2.89000E+01
324	PHOEBUS-1B	2.20800E+02	1.13760E+04	3.45600E+03	2.04000E+02	1.77600E+03	4.80000E+00	2.04000E+02
325	NRX-A6	4.87600E+01	2.51220E+03	7.63200E+02	4.50500E+01	3.92200E+02	1.06000E+00	4.50500E+01
326	PHOEBUS-2A	6.53200E+00	3.36540E+02	1.02240E+02	6.03500E+00	5.25400E+01	1.42000E-01	6.03500E+00
327	PHOEBUS-2A	4.69200E+01	2.41740E+03	7.34400E+02	4.33500E+01	3.77400E+02	1.02000E+00	4.33500E+01
328	PHOEBUS-2A	1.93200E+00	9.95400E+01	3.02400E+01	1.78500E+00	1.55400E+01	4.20000E-02	1.78500E+00
329	PEEWEE-1	2.11600E+02	1.09020E+04	3.31200E+03	1.95500E+02	1.70200E+03	4.60000E+00	1.95500E+02
330	XE PRIME	7.54400E-01	3.88680E+01	1.18080E+01	6.97000E-01	6.06800E+00	1.64000E-02	6.97000E-01
331	XE PRIME	4.87600E-01	2.51220E+01	7.63200E+00	4.50500E-01	3.92200E+00	1.06000E-02	4.50500E-01

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COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

-- TABLE ROCKETA ---
RUN ENGINENAME

		PD112	AG111	CD115	CD115M	SN121	SN123	SN125
301	KIWI A	2.18400E+00	1.17600E+00	5.62800E+00	2.18400E-02	7.72800E+00	8.40000E-02	8.06400E-01
302	KIWI A PRIME	6.50000E+00	3.50000E+00	1.67500E+01	6.50000E-02	2.30000E+01	2.50000E-01	2.40000E+00
303	KIWI A3	6.50000E+00	3.50000E+00	1.67500E+01	6.50000E-02	2.30000E+01	2.50000E-01	2.40000E+00
304	KIWI B-1A	3.38000E+00	1.82000E+00	8.71000E+00	3.38000E-02	1.19600E+01	1.30000E-01	1.24800E+00
305	KIWI B-1B	1.09200E+00	5.88000E-01	2.81400E+00	1.09200E-02	3.86400E+00	4.20000E-02	4.03200E-01
306	KIWI B-4A	4.42000E+00	2.38000E+00	1.13900E+01	4.42000E-02	1.56400E+01	1.70000E-01	1.63200E+00
307	KIWI B-4D	1.19600E+01	6.44000E+00	3.08200E+01	1.19600E-01	4.23200E+01	4.60000E-01	4.41600E+00
308	KIWI B-4E	5.46000E+01	2.94000E+01	1.40700E+02	5.46000E-01	1.93200E+02	2.10000E+00	2.01600E+01
309	KIWI B-4E	1.97600E+01	1.06400E+01	5.09200E+01	1.97600E-01	6.99200E+01	7.60000E-01	7.29600E+00
310	NRX-A2	2.86000E+00	1.54000E+00	7.37000E+00	2.86000E-02	1.01200E+01	1.10000E-01	1.05600E+00
311	NRX-A2	2.86000E+00	1.54000E+00	7.37000E+00	2.86000E-02	1.01200E+01	1.10000E-01	1.05600E+00
312	KIWI (TNT)	3.90000E+01	2.10000E+01	1.00500E+02	3.90000E-01	1.38000E+02	1.50000E+00	1.44000E+01
313	NRX-A3	1.37800E+00	7.42000E-01	3.55100E+00	1.37800E-02	4.87600E+00	5.30000E-02	5.08800E-01
314	NRX-A3	6.24000E+00	3.36000E+00	1.60800E+01	6.24000E-02	2.20800E+01	2.40000E-01	2.30400E+00
315	NRX-A3	3.12000E+00	1.68000E+00	8.04000E+00	3.12000E-02	1.10400E+01	1.20000E-01	1.15200E+00
316	PHOEBUS-1A	5.72000E+01	3.08000E+01	1.47400E+02	5.72000E-01	2.02400E+02	2.20000E+00	2.11200E+01
317	NRX-A4/EST	3.12000E-02	1.68000E-02	8.04000E-02	3.12000E-04	1.10400E-01	1.20000E-03	1.15200E-02
318	NRX-A4/EST	2.60000E-01	1.40000E-01	6.70000E-01	2.60000E-03	9.20000E-01	1.00000E-02	9.60000E-02
319	NRX-A4/EST	7.02000E+01	3.78000E+01	1.80900E+02	7.02000E-01	2.48400E+02	2.70000E+00	2.59200E+01
320	NRX-A4/EST	7.28000E+01	3.92000E+01	1.87600E+02	7.28000E-01	2.57600E+02	2.80000E+00	2.68800E+01
321	NRX-A5	3.12000E+00	1.68000E+00	8.04000E+00	3.12000E-02	1.10400E+01	1.20000E-01	1.15200E+00
322	NRX-A5	2.08000E+02	1.12000E+02	5.36000E+02	2.08000E+00	7.36000E+02	8.00000E+00	7.68000E+01
323	PHOEBUS-1B	8.84000E+01	4.76000E+01	2.27800E+02	8.84000E-01	3.12800E+02	3.40000E+00	3.26400E+01
324	PHOEBUS-1B	6.24000E+02	3.36000E+02	1.60800E+03	6.24000E+00	2.20800E+03	2.40000E+01	2.30400E+02
325	NRX-A6	1.37800E+02	7.42000E+01	3.55100E+02	1.37800E+00	4.87600E+02	5.30000E+00	5.08800E+01
326	PHOEBUS-2A	1.84600E+01	9.94000E+00	4.75700E+01	1.84600E-01	6.53200E+01	7.10000E-01	6.81600E+00
327	PHOEBUS-2A	1.32600E+02	7.14000E+01	3.41700E+02	1.32600E+00	4.69200E+02	5.10000E+00	4.89600E+01
328	PHOEBUS-2A	5.46000E+00	2.94000E+00	1.40700E+01	5.46000E-02	1.93200E+01	2.10000E-01	2.01600E+00
329	PEEWEE-1	5.98000E+02	3.22000E+02	1.54100E+03	5.98000E+00	2.11600E+03	2.30000E+01	2.20800E+02
330	XE PRIME	2.13200E+00	1.14800E+00	5.49400E+00	2.13200E-02	7.54400E+00	8.20000E-02	7.87200E-01
331	XE PRIME	1.37800E+00	7.42000E-01	3.55100E+00	1.37800E-02	4.87600E+00	5.30000E-02	5.08800E-01

VALUES IN THE TABLE WERE CALCULATED ASSUMING:

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COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

-- TABLE ROCKETA ---

RUN	ENGINE NAME	SB127	TE129M	TE132	I131	I133	I135	XE133
301	KIWI A	4.95600E+00	3.44400E-01	4.53600E+01	1.36920E+01	1.42800E+02	4.06560E+01	9.32400E+00
302	KIWI A PRIME	1.47500E+01	1.02500E+00	1.35000E+02	4.07500E+01	4.25000E+02	1.21000E+02	2.77500E+01
303	KIWI A3	1.47500E+01	1.02500E+00	1.35000E+02	4.07500E+01	4.25000E+02	1.21000E+02	2.77500E+01
304	KIWI B-1A	7.67000E+00	5.33000E-01	7.02000E+01	2.11900E+01	2.21000E+02	6.29200E+01	1.44300E+01
305	KIWI B-1B	2.47800E+00	1.72200E-01	2.26800E+01	6.84600E+00	7.14000E+01	2.03280E+01	4.66200E+00
306	KIWI B-4A	1.00300E+01	6.97000E-01	9.18000E+01	2.77100E+01	2.89000E+02	8.22800E+01	1.88700E+01
307	KIWI B-4D	2.71400E+01	1.88600E+00	2.48400E+02	7.49800E+01	7.82000E+02	2.22640E+02	5.10600E+01
308	KIWI B-4E	1.23900E+02	8.61000E+00	1.13400E+03	3.42300E+02	3.57000E+03	1.01640E+03	2.33100E+02
309	KIWI B-4E	4.48400E+01	3.11600E+00	4.10400E+02	1.23880E+02	1.29200E+03	3.67840E+02	8.43600E+01
310	NRX-A2	6.49000E+00	4.51000E-01	5.94000E+01	1.79300E+01	1.87000E+02	5.32400E+01	1.22100E+01
311	NRX-A2	6.49000E+00	4.51000E-01	5.94000E+01	1.79300E+01	1.87000E+02	5.32400E+01	1.22100E+01
312	KIWI (TNT)	8.85000E+01	6.15000E+00	8.10000E+02	2.44500E+02	2.55000E+03	7.26000E+02	1.66500E+02
313	NRX-A3	3.12700E+00	2.17300E-01	2.86200E+01	8.63900E+00	9.01000E+01	2.56520E+01	5.88300E+00
314	NRX-A3	1.41600E+01	9.84000E-01	1.29600E+02	3.91200E+01	4.08000E+02	1.16160E+02	2.66400E+01
315	NRX-A3	7.08000E+00	4.92000E-01	6.48000E+01	1.95600E+01	2.04000E+02	5.80800E+01	1.33200E+01
316	PHOEBUS-1A	1.29800E+02	9.02000E+00	1.18800E+03	3.58600E+02	3.74000E+03	1.06480E+03	2.44200E+02
317	NRX-A4/EST	7.08000E-02	4.92000E-03	6.48000E-01	1.95600E-01	2.04000E+00	5.80800E-01	1.33200E-01
318	NRX-A4/EST	5.90000E-01	4.10000E-02	5.40000E+00	1.63000E+00	1.70000E+01	4.84000E+00	1.11000E+00
319	NRX-A4/EST	1.59300E+02	1.10700E+01	1.45800E+03	4.40100E+02	4.59000E+03	1.30680E+03	2.99700E+02
320	NRX-A4/EST	1.65200E+02	1.14800E+01	1.51200E+03	4.56400E+02	4.76000E+03	1.35520E+03	3.10800E+02
321	NRX-A5	7.08000E+00	4.92000E-01	6.48000E+01	1.95600E+01	2.04000E+02	5.80800E+01	1.33200E+01
322	NRX-A5	4.72000E+02	3.28000E+01	4.32000E+03	1.30400E+03	1.36000E+04	3.87200E+03	8.88000E+02
323	PHOEBUS-1B	2.00600E+02	1.39400E+01	1.83600E+03	5.54200E+02	5.78000E+03	1.64560E+03	3.77400E+02
324	PHOEBUS-1B	1.41600E+03	9.84000E+01	1.29600E+04	3.91200E+03	4.08000E+04	1.16160E+04	2.66400E+03
325	NRX-A6	3.12700E+02	2.17300E+01	2.86200E+03	8.63900E+02	9.01000E+03	2.56520E+03	5.88300E+02
326	PHOEBUS-2A	4.18900E+01	2.91100E+00	3.83400E+02	1.15730E+02	1.20700E+03	3.43640E+02	7.88100E+01
327	PHOEBUS-2A	3.00900E+02	2.09100E+01	2.75400E+03	8.31300E+02	8.67000E+03	2.46840E+03	5.66100E+02
328	PHOEBUS-2A	1.23900E+01	8.61000E-01	1.13400E+02	3.42300E+01	3.57000E+02	1.01640E+02	2.33100E+01
329	PEEWEE-1	1.35700E+03	9.43000E+01	1.24200E+04	3.74900E+03	3.91000E+04	1.11320E+04	2.55300E+03
330	XE PRIME	4.83800E+00	3.36200E-01	4.42800E+01	1.33660E+01	1.39400E+02	3.96880E+01	9.10200E+00
331	XE PRIME	3.12700E+00	2.17300E-01	2.86200E+01	8.63900E+00	9.01000E+01	2.56520E+01	5.88300E+00

VALUES IN THE TABLE WERE CALCULATED ASSUMING:

- 1 RELATIVE COMPOSITIONS OF ALL EFFLUENTS WERE THAT OF PHOEBUS 1B, RUN 324
- 2 TE132, I131, AND I133 CAN BE USED TO CALCULATE TOTAL CURIES RELEASED
- 3 FOR A GIVEN ENGINE TYPE, THE TOTAL RELEASE IS PROPORTIONAL TO THE INTEGRATED POWER LEVEL ONLY

LISTED VALUES ARE PRECISE TO A FACTOR OF TWO

CURIES (AFTER 12 HOURS DECAY) RELEASED FROM NUCLEAR ROCKET ENGINE TESTS

COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

-- TABLE ROCKETA ---

RUN	ENGINE/NAME	XE133M	XE135	XE135M	BA140	CE141	CE143
301	KIWI A	1.09200E+00	8.82000E+00	5.62800E+00	7.72800E+00	5.54400E-01	1.02480E+01
302	KIWI A PRIME	3.25000E+00	2.62500E+01	1.67500E+01	2.30000E+01	1.65000E+00	3.05000E+01
303	KIWI A3	3.25000E+00	2.62500E+01	1.67500E+01	2.30000E+01	1.65000E+00	3.05000E+01
304	KIWI B-1A	1.69000E+00	1.36500E+01	8.71000E+00	1.19600E+01	8.58000E-01	1.58600E+01
305	KIWI B-1B	5.46000E-01	4.41000E+00	2.81400E+00	3.86400E+00	2.77200E-01	5.12400E+00
306	KIWI B-4A	2.21000E+00	1.78500E+01	1.13900E+01	1.56400E+01	1.12200E+00	2.07400E+01
307	KIWI B-4D	5.98000E+00	4.83000E+01	3.08200E+01	4.23200E+01	3.03600E+00	5.61200E+01
308	KIWI B-4E	2.73000E+01	2.20500E+02	1.40700E+02	1.93200E+02	1.38600E+01	2.56200E+02
309	KIWI B-4E	9.88000E+00	7.98000E+01	5.09200E+01	6.99200E+01	5.01600E+00	9.27200E+01
310	NRX-A2	1.43000E+00	1.15500E+01	7.37000E+00	1.01200E+01	7.26000E-01	1.34200E+01
311	NRX-A2	1.43000E+00	1.15500E+01	7.37000E+00	1.01200E+01	7.26000E-01	1.34200E+01
312	KIWI (TNT)	1.95000E+01	1.57500E+02	1.00500E+02	1.38000E+02	9.90000E+00	1.83000E+02
313	NRX-A3	6.89000E-01	5.56500E+00	3.55100E+00	4.87600E+00	3.49800E-01	6.46600E+00
314	NRX-A3	3.12000E+00	2.52000E+01	1.60800E+01	2.20800E+01	1.58400E+00	2.92800E+01
315	NRX-A3	1.56000E+00	1.26000E+01	8.04000E+00	1.10400E+01	7.92000E-01	1.46400E+01
316	PHOEBUS-1A	2.86000E+01	2.31000E+02	1.47400E+02	2.02400E+02	1.45200E+01	2.68400E+02
317	NRX-A4/EST	1.56000E-02	1.26000E-01	8.04000E-02	1.10400E-01	7.92000E-03	1.46400E-01
318	NRX-A4/EST	1.30000E-01	1.05000E+00	6.70000E-01	9.20000E-01	6.60000E-02	1.22000E+00
319	NRX-A4/EST	3.51000E+01	2.83500E+02	1.80900E+02	2.48400E+02	1.78200E+01	3.29400E+02
320	NRX-A4/EST	3.64000E+01	2.94000E+02	1.87600E+02	2.57600E+02	1.84800E+01	3.41600E+02
321	NRX-A5	1.56000E+00	1.26000E+01	8.04000E+00	1.10400E+01	7.92000E-01	1.46400E+01
322	NRX-A5	1.04000E+02	8.40000E+02	5.36000E+02	7.36000E+02	5.28000E+01	9.76000E+02
323	PHOEBUS-1B	4.42000E+01	3.57000E+02	2.27800E+02	3.12800E+02	2.24400E+01	4.14800E+02
324	PHOEBUS-1B	3.12000E+02	2.52000E+03	1.60800E+03	2.20800E+03	1.58400E+02	2.92800E+03
325	NRX-A6	6.89000E+01	5.56500E+02	3.55100E+02	4.87600E+02	3.49800E+01	6.46600E+02
326	PHOEBUS-2A	9.23000E+00	7.45500E+01	4.75700E+01	6.53200E+01	4.68600E+00	8.66200E+01
327	PHOEBUS-2A	6.63000E+01	5.35500E+02	3.41700E+02	4.69200E+02	3.36600E+01	6.22200E+02
328	PHOEBUS-2A	2.73000E+00	2.20500E+01	1.40700E+01	1.93200E+01	1.38600E+00	2.56200E+01
329	PEEWEE-1	2.99000E+02	2.41500E+03	1.54100E+03	2.11600E+03	1.51800E+02	2.80600E+03
330	XE PRIME	1.06600E+00	8.61000E+00	5.49400E+00	7.54400E+00	5.41200E-01	1.00040E+01
331	XE PRIME	6.89000E-01	5.56500E+00	3.55100E+00	4.87600E+00	3.49800E-01	6.46600E+00

VALUES IN THE TABLE WERE CALCULATED ASSUMING:

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LISTED VALUES ARE PRECISE TO A FACTOR OF TWO

CURIES (AFTER 12 HOURS DECAY) RELEASED FROM NUCLEAR ROCKET ENGINE TESTS

COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

-- TABLE ROCKETA ---		CE144	ND147	PM149	PM151	SM153	EU156
RUN	ENGINE NAME						
301	KIWI A	5.88000E-02	6.21600E-01	1.26000E+00	8.40000E-01	2.01600E-01	2.68800E-03
302	KIWI A PRIME	1.75000E-01	1.85000E+00	3.75000E+00	2.50000E+00	6.00000E-01	8.00000E-03
303	KIWI A3	1.75000E-01	1.85000E+00	3.75000E+00	2.50000E+00	6.00000E-01	8.00000E-03
304	KIWI B-1A	9.10000E-02	9.62000E-01	1.95000E+00	1.30000E+00	3.12000E-01	4.16000E-03
305	KIWI B-1B	2.94000E-02	3.10800E-01	6.30000E-01	4.20000E-01	1.00800E-01	1.34400E-03
306	KIWI B-4A	1.19000E-01	1.25800E+00	2.55000E+00	1.70000E+00	4.08000E-01	5.44000E-03
307	KIWI B-4D	3.22000E-01	3.40400E+00	6.90000E+00	4.60000E+00	1.10400E+00	1.47200E-02
308	KIWI B-4E	1.47000E+00	1.55400E+01	3.15000E+01	2.10000E+01	5.04000E+00	6.72000E-02
309	KIWI B-4E	5.32000E-01	5.62400E+00	1.14000E+01	7.60000E+00	1.82400E+00	2.43200E-02
310	NRX-A2	7.70000E-02	8.14000E-01	1.65000E+00	1.10000E+00	2.64000E-01	3.52000E-03
311	NRX-A2	7.70000E-02	8.14000E-01	1.65000E+00	1.10000E+00	2.64000E-01	3.52000E-03
312	KIWI (TNT)	1.05000E+00	1.11000E+01	2.25000E+01	1.50000E+01	3.60000E+00	4.80000E-02
313	NRX-A3	3.71000E-02	3.92200E-01	7.95000E-01	5.30000E-01	1.27200E-01	1.69600E-03
314	NRX-A3	1.68000E-01	1.77600E+00	3.60000E+00	2.40000E+00	5.76000E-01	7.68000E-03
315	NRX-A3	8.40000E-02	8.88000E-01	1.80000E+00	1.20000E+00	2.88000E-01	3.84000E-03
316	PHOEBUS-1A	1.54000E+00	1.62800E+01	3.30000E+01	2.20000E+01	5.28000E+00	7.04000E-02
317	NRX-A4/EST	8.40000E-04	8.88000E-03	1.80000E-02	1.20000E-02	2.88000E-03	3.84000E-05
318	NRX-A4/EST	7.00000E-03	7.40000E-02	1.50000E-01	1.00000E-01	2.40000E-02	3.20000E-04
319	NRX-A4/EST	1.89000E+00	1.99800E+01	4.05000E+01	2.70000E+01	6.48000E+00	8.64000E-02
320	NRX-A4/EST	1.96000E+00	2.07200E+01	4.20000E+01	2.80000E+01	6.72000E+00	8.96000E-02
321	NRX-A5	8.40000E-02	8.88000E-01	1.80000E+00	1.20000E+00	2.88000E-01	3.84000E-03
322	NRX-A5	5.60000E+00	5.92000E+01	1.20000E+02	8.00000E+01	1.92000E+01	2.56000E-01
323	PHOEBUS-1B	2.38000E+00	2.51600E+01	5.10000E+01	3.40000E+01	8.16000E+00	1.08800E-01
324	PHOEBUS-1B	1.68000E+01	1.77600E+02	3.60000E+02	2.40000E+02	5.76000E+01	7.68000E-01
325	NRX-A6	3.71000E+00	3.92200E+01	7.95000E+01	5.30000E+01	1.27200E+01	1.69600E-01
326	PHOEBUS-2A	4.97000E-01	5.25400E+00	1.06500E+01	7.10000E+00	1.70400E+00	2.27200E-02
327	PHOEBUS-2A	3.57000E+00	3.77400E+01	7.65000E+01	5.10000E+01	1.22400E+01	1.63200E-01
328	PHOEBUS-2A	1.47000E-01	1.55400E+00	3.15000E+00	2.10000E+00	5.04000E-01	6.72000E-03
329	PEEWEE-1	1.61000E+01	1.70200E+02	3.45000E+02	2.30000E+02	5.52000E+01	7.36000E-01
330	XE PRIME	5.74000E-02	6.06800E-01	1.23000E+00	8.20000E-01	1.96800E-01	2.62400E-03
331	XE PRIME	3.71000E-02	3.92200E-01	7.95000E-01	5.30000E-01	1.27200E-01	1.69600E-03

VALUES IN THE TABLE WERE CALCULATED ASSUMING:

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LISTED VALUES ARE PRECISE TO A FACTOR OF TWO

TABLE IV-1. Calculated fractional contributions of individual radionuclides to total radioactive release for nuclear rocket engine tests.

Nuclide	Half-life (days)	Fission yield (%)	Fraction released ^a	Fraction of total release ^b
^{85m} Kr	0.187	1.33	0.020	0.082
⁸⁷ Kr	0.0528	2.55	0.020	0.0052
⁸⁸ Kr	0.118	3.61	0.020	0.120
⁸⁹ Sr	50.52	4.71	0.020	0.0667
⁹⁰ Sr	10,592	5.86	0.018	4×10^{-5}
⁹¹ Sr	0.397	5.90	0.017	0.0063
⁹³ Y	0.421	6.41	0.012	0.291
⁹⁵ Zr	64.0	6.50	0.0025	9.2×10^{-4}
⁹⁷ Zr	0.799	5.86	0.0025	0.047
⁹⁹ Mo	2.751	6.15	0.0020	0.014
¹⁰³ Ru	39.4	3.00	0.0030	8.5×10^{-4}
¹⁰⁵ Rh	1.48	0.947	0.0040	0.0074
¹⁰⁶ Ru	368	0.391	0.0050	2×10^{-5}
¹⁰⁹ Pd	0.560	0.0240	0.010	8.5×10^{-4}
¹¹² Pd	0.875	0.0183	0.050	0.0026
¹¹¹ Ag	7.47	0.0120	0.23	0.0014
¹¹⁵ Cd	2.23	0.0116	0.40	0.0067
^{115m} Cd	44.6	0.0079	0.40	3×10^{-5}

TABLE IV-1. (Continued.)

Nuclide	Half-life (days)	Fission yield (%)	Fraction released ^a	Fraction of total release ^b
¹²¹ Sn	1.12	0.0178	0.21	0.0092
¹²³ Sn	129	0.0220	0.15	10 ⁻⁴
¹²⁵ Sn	9.65	0.0253	0.10	0.0010
¹²⁷ Sb	3.80	0.104	0.062	0.0059
^{129m} Te	33.4	0.119	0.030	4 × 10 ⁻⁴
¹³² Te	3.25	4.29	0.0123	0.0540
¹³¹ I	8.04	2.87	0.0122	0.0163
¹³³ I	0.867	6.76	0.0088	0.170
¹³⁵ I	0.274	6.34	0.002	0.048
^{133m} Xe	2.19	0.085	0.0088	0.001
¹³³ Xe	5.25	1.77	0.0088	0.01
^{135m} Xe	0.0104	(Equil.)	0.002	0.025
¹³⁵ Xe	0.378	1.99	0.002	0.039
¹³⁷ Cs	11,020	6.28	0.005	10 ⁻⁵
¹⁴⁰ Ba	12.79	6.31	0.005	0.0092
¹⁴¹ Ce	32.5	5.70	0.001	6.6 × 10 ⁻⁴
¹⁴³ Ce	1.375	5.85	0.001	0.0122
¹⁴⁴ Ce	284.4	5.42	0.001	7 × 10 ⁻⁵
¹⁴⁷ Nd	10.99	2.23	0.001	7.4 × 10 ⁻⁴

TABLE IV-1. (Continued.)

Nuclide	Half-life (days)	Fission yield (%)	Fraction released ^a	Fraction of total release ^b
¹⁴⁹ Pm	2.21	1.07	0.001	0.0015
¹⁵¹ Pm	1.18	0.435	0.001	0.0010
¹⁵³ Sm	1.95	0.150	0.001	2.4×10^{-4}
¹⁵⁶ Eu	15.2	0.133	0.001	3.2×10^{-6}

^aFraction released from Phoebus 1B (run 324).

^bCalculated from:

Relative curies (H + 12 hr) =

$$\frac{(\% \text{ fission yield}) (\text{fraction released})}{t_{1/2}} \exp \left[-(\ln 2)/2t_{1/2} \right].$$

Estimation of Total Curies Released

Estimates of total curies released in each nuclear rocket engine test were based on three assumptions:

- All the nuclear rocket engine tests had the same relative proportions of radionuclides in their effluents as the test of Phoebus IB (run 324).
- Measurements of ¹³²Te, ¹³¹I, and ¹³³I in the engine effluents are representative of the total radionuclide release.
- For a given engine type, the total radionuclide release is proportional to the integrated power level only.

The effluent clouds from some of the engine runs had been analyzed for ¹³²Te, ¹³¹I, and ¹³³I, and the data were available to us. Our procedure was to estimate the total curies released in each run by the following calculation:

$$\text{Total curies} = \frac{1}{3} \left[\frac{\text{Curies } ^{132}\text{Te}}{\text{Fraction released}} + \frac{\text{Curies } ^{131}\text{I}}{\text{Fraction released}} + \frac{\text{Curies } ^{133}\text{I}}{\text{Fraction released}} \right].$$

For each engine type we calculated the total curies released as a function of engine power level:

$$\frac{\text{Total curies}}{10^6 \text{ MW}\cdot\text{s}} = \frac{1}{n} \sum_{i=1}^n \left[\frac{\text{Total curies released}}{\text{Power level}} \right]_i .$$

With this information we were able to make estimates for engine runs in which there were no radionuclide analyses of the effluents. The values are considered to be accurate within a factor of two. For such runs we estimated the total curies released on the basis of the power level, using the above-calculated value of total curies released per 10^6 MW·s for the particular engine type. Power levels for each run were obtained from the Environmental Protection Agency (EPA) publication NERC-LV-539-6, except for run 317, whose power level was found in the summary of test data for 1966 (pre-EPA) provided by the Public Health Service. Our results are summarized in Table IV-2.

TABLE IV-2. Calculations of total curies of radionuclides released by nuclear rocket engine tests at NTS.

Run	Engine type	Curies at H + 12 hours			Total curies at H + 12 hours ^a				Power level (10 ⁶ MW·s)	Total curies Power level	Calculated total curies
		¹³² Te	¹³¹ I	¹³³ I	¹³² Te	¹³¹ I	¹³³ I	Average			
301	Kiwi	—	—	—	—	—	—	—	0.02	—	840
302	Kiwi	—	—	—	—	—	—	—	0.06	—	2500
303	Kiwi	—	—	—	—	—	—	—	0.06	—	2500
304	Kiwi	—	—	—	—	—	—	—	0.03	—	1300
305	Kiwi	—	—	—	—	—	—	—	0.01	—	420
306	Kiwi	—	—	—	—	—	—	—	0.04	—	1700
307	Kiwi	220	53	1100	4100	3300	6500	4600	0.11	42,000	4600
308	Kiwi	—	—	—	—	—	—	—	0.50	—	21,000
309	Kiwi	—	—	—	—	—	—	—	0.18	—	7600
310	NRX-A2	—	—	—	—	—	—	—	0.30	3600 ^b	1100
311	NRX-A2	—	—	—	—	—	—	—	0.30	3600 ^b	1100
312	Kiwi-TNT	860	150	3600	16,000	9200	21,000	15,000	0.009	—	15,000
313	NRX-A3	34	7	23	630	430	140 ^c	530	0.32	1700	530
314	NRX-A3	120	37	440	2200	2300	2600	2400	0.84	2800	2400
315	NRX-A3	14.5	13	26.3(?)	270 ^c	800	1500	1200	0.5	2400	1200
316	Phoebus 1A	—	360	—	—	22,000	—	—	0.74	30,000	22,000
317	NRX-A4/EST	0.45	—	2.8	8	—	16	12	0.39	31	12
318	NRX-A4/EST	5.4	2.3	10	100	140	60	100	0.88	110	100
319	NRX-A4/EST	—	540	3630	—	33,000	21,000	27,000	1.0	27,000	27,000
320	NRX-A4/EST	3600	460	4510	67,000 ^c	28,000	27,000	28,000	1.1	25,000	28,000
321	NRX-A5	77	21	150	1400	1300	880	1200	1.2	1000	1200
322	NRX-A5	4400	1100	15,800	81,000	67,000	93,000	80,000	1.0	80,000	80,000
323	Phoebus 1B	—	—	—	—	—	—	—	0.14	—	34,000
324	Phoebus 1B	13,000	3900	42,000	2.4×10 ⁵	2.4×10 ⁵	2.5×10 ⁵	2.4×10 ⁵	2.6	93,000	2.4×10 ⁵
325	NRX-A6	3400	790	8300	63,000	48,000	49,000	53,000	4.5	12,000	53,000
326	Phoebus 2A	—	—	—	—	—	—	—	0.63	—	7100
327	Phoebus 2A	2500	850	9400	46,000	52,000	55,000	51,000	4.5	11,000	51,000
328	Phoebus 2A	99	36	400	1800	2200	2400	2100	2.5	850	2100
329	Peewee 1	13,000	3500	11,000	2.4×10 ⁵	2.2×10 ⁵	65,000 ^c	2.3×10 ⁵	1.5	1.5×10 ⁵	2.3×10 ⁵
330	XE-Prime	590	17	110	11,000 ^c	1000	650	820	0.42	2000	820
331	XE-Prime	14	10	76	260 ^c	610	450	530	0.34	1600	530

^aFraction of total release from Table IV-1: ¹³²Te, 0.0540; ¹³¹I, 0.0163; ¹³³I, 0.170.^bAssumed values.^cValue not included in average.

APPENDIX V

NUCLEAR RAMJET ENGINE TESTS

Executable FRAMIS Files

```

/* NTSRELEASE, NUCLEAR RAMJET ENGINES, RAMJETESTS */
/* DEFINE TABLES */
DEF TAB RAMJET RUNNUM INT, ENGINENAME CHAR 10, DATE INT, FISSOUT REAL, CURIESOUT
REAL;
DEF TAB RAMJET1 COL1 CHAR 100;
ADDATA RAMJET1
<"          NUCLEAR RAMJET PROGRAM: RADIOACTIVITY RELEASED GIVEN          ">
<"          AS FISSIONS AND CURIES AFTER 12 HOURS DECAY                    ">
<" ">
<"          COMPILED BY HARRY G. HICKS, LLNL                                ">
<"          NOVEMBER 1980                                                  ">
<" ">;
/* INPUT DATA */
INPUT RAMJET FROM RAMJETIN;
/* PRINT OUTPUT DATA, NUCLEAR RAMJET ENGINE TESTS, RAMPRINT */
DEL TAB PE;
DEF TAB PE COL1 CHAR 1;
ADDATA PE <"1">;
DEL TAB LEGEND;
DEF TAB LEGEND COL1 CHAR 100;
ADDATA LEGEND
<" ">
<"FISSIONS AND CURIES RELEASED ARE PRECISE WITHIN 20 PERCENT">;
OUTPUT RAMJET1 TO HSP;
PRINT RAMJET COL RUNNUM ENGINENAME DATE FISSOUT CURIESOUT TO HSP;
OUTPUT LEGEND TO HSP;
OUTPUT PE TO HSP;

```

Input Card Images

```

RAMJETIN
FIXED 5 CD
RUNNUM 1 10
ENGINENAME 11 10
DATE 21 10
FISSOUT 31 10
CURIESOUT 41 10
401 TORY IIA 610514 2.00E17 43.0
402 TORY IIA 610928 5.90E17 128.0
403 TORY IIA 611005 1.09E18 236.0
404 TORY IIA 611006 2.93E18 635.0
405 TORY IIC 640512 1.18E18 256.0
406 TORY IIC 640520 3.42E18 741.0

```

Output Table

NUCLEAR RAMJET PROGRAM: RADIOACTIVITY RELEASED GIVEN
AS FISSIONS AND CURIES AFTER 12 HOURS DECAY
COMPILED BY HARRY G. HICKS, LLNL
NOVEMBER 1980

```

-- TABLE RAMJET ---
RUNNUM ENGINENAME DATE FISSOUT CURIESOUT
401 TORY IIA 610514 2.00000E+17 4.30000E+01
402 TORY IIA 610928 5.90000E+17 1.28000E+02
403 TORY IIA 611005 1.09000E+18 2.36000E+02
404 TORY IIA 611006 2.93000E+18 6.35000E+02
405 TORY IIC 640512 1.18000E+18 2.56000E+02
406 TORY IIC 640520 3.42000E+18 7.41000E+02

```

FISSIONS AND CURIES RELEASED ARE PRECISE WITHIN 20 PERCENT