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USER'S MANUAL FOR BINIAC: A COMPUTER CODE TO TRANSLATE APET BINS (U)

Sean T. Gough

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CODE TO TRANSLATE APET BINS (U)

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ABSTRACT

This report serves as the user's manual for the FORTRAN code BINIAC. BINIAC is a utility code designed to format the output from the Defense Waste Processing Facility (DWPF) Accident Progression Event Tree (APET) methodology. BINIAC inputs the accident progression bins from the APET methodology, converts the frequency from occurrences per hour to occurrences per year, sorts the progression bins, and converts the individual dimension character codes into facility attributes. Without the use of BINIAC, this process would be done manually at great time expense.

BINIAC was written under the quality assurance control of 1Q34 QAP IV-1, revision 0, section 4.1.4. Configuration control is established through the use of a proprietor and a cognizant users list.

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1.0 INTRODUCTION

Section 1.0 of this report describes the APET bins, the purpose of the BINIAC code, and the quality assurance used in the development and use of BINIAC. Section 2.0 describes the specifics of the BINIAC code, including the hardware and software specifications, the input/output, and the algorithm itself. Section 3.0 details the configuration control established for BINIAC to ensure that it is used properly, and to ensure that all users are kept informed of any revisions. Section 4.0 presents the installation and execution instructions for BINIAC, and explains the error messages that may be encountered during the execution of the code. Section 5.0 describes the testing performed on BINIAC, to ensure that all of its functions work as described in this report. Section 6.0 contains the references. The Appendices contain sample input/output data for normal operation and testing of BINIAC, as described in section 5.0.

1.1 Introduction

Accident progressions in the Defense Waste Processing Facility (DWPF) are modeled using the Accident Progression Event Tree (APET) methodology. This methodology produces a series of bin identifications that describe each group of significant progressions, along with frequency and statistical data for each group of progressions. The BINIAC code has been designed to format this output into a more useful form: translating the bin identifications into actual facility status, converting the frequency of each bin from occurrences per hour into occurrences per year, and sorting the progression bins from most frequent to least frequent. Without the use of BINIAC, this process would be performed manually, at great expense in time.

1.2 Quality Assurance

This development of this code is not an R&D task as described in 1Q QAP 2-3, revision 1, section 4.1.1. The BINIAC code interfaces with critical application codes (sorts output, translates identifications, converts units), but does not actually calculate any new results. Therefore, the BINIAC code is termed non-critical software and was developed to meet the requirements of 1Q34 QAP IV-1, revision 0, section 4.1.4. However, since BINIAC does interface with critical application codes, a complete technical review was performed for this code and user's manual, although such a review is not required for standard non-critical software by 1Q34 QAP IV-1, revision 0, section 4.1.4.

1.3 Background

The tool used to analyze the progression of accidents in the DWPF is called an Accident Progression Event Tree (APET). The APET methodology groups analyzed progressions into a series of bins, based on similarities in their characteristics. Each bin is characterized by a multi-character bin identification. Each individual character (termed a character code in this report) in the identification represents a specific bin dimension, and can be translated into a specific attribute of the facility during the described progressions (currently DWPF APET bins contain 20 dimensions). This translation is achieved using the current bin attribute table. For example, Appendix 1 is the current bin attribute table for the DWPF APET, based on reference 1 (with one difference: the table in reference 1 omitted the 'B' character code in the twentieth dimension).

Using Appendix 1, a bin identification of 'CDEEGFFAGFFEBBBBBBEE' indicates that everything in the facility is operating normally (*Normal Operation, No Release*, etc.) except that the SME has exploded (see the 'A' character code in the eighth dimension which corresponds to SME Explosion in Appendix 1). This translation is the main function of the BINIAC code.

2.0 METHOD

2.1 Input

The BINIAC code uses two input files, APET.IN and BINDECK.IN. APET.IN contains the bins to be translated and sorted, and BINDECK.IN contains the bin attribute table used for translation.

APET.IN

The output from the APET is used as the first input file for BINIAC, with minimum modifications. A typical APET output file can contain thousands of lines of input, but Figure 1 is an example showing five lines of input:

Figure 1: Sample APET Output

BIN	MEAN	VARIANCE	STD DEV	N
CDEABBAAAAAEBBBABBBBA	0.17E-11	0.94E-23	0.31E-11	34
CDEABBAAAAAEBBBABBD A	0.62E-12	0.96E-24	0.98E-12	7
CDEABBAAAAAEBBBBBBBBA	0.33E-12	0.46E-25	0.21E-12	9
CDEABBAAAAAEBBBBBBBD A	0.10E-12	0.00E+00	0.00E+00	1
CDEABBAAAACEBBBABBBBA	0.49E-12	0.25E-24	0.50E-12	9

Each line after the header presents the bin identification for one of the progression groups, followed by the mean (frequency per hour), the variance, the standard deviation, and the number of occurrences for that bin.

For use by BINIAC, the APET output file must conform to the following rules:

1. The bin, mean, variance, standard deviation, and number of occurrences must be delimited by one or more spaces or tabs, and must be presented in the order shown in Figure 1.
2. Each complete input line for a bin must end with a carriage return.
3. The first line of the input file must be a header containing at least one non-space character followed by a carriage return.
4. Each bin in a given set of APET output must have the same number of dimensions, and use the same bin attribute table.

5. The bin identifications must be composed of capital letters only.
6. The last input line, following the last bin input line, must be the word 'END' in capital letters, followed by four numbers, space or tab delimited. For example:

END 9 9 9 9

Figure 2 presents the sample APET output/BINIAC input file with this last line added.

Figure 2: Sample APET.IN Input File

BIN	MEAN	VARIANCE	STD DEV	N
CDEABBAAAAEBBBABBBA	0.17E-11	0.94E-23	0.31E-11	34
CDEABBAAAAEBBBABBDA	0.62E-12	0.96E-24	0.98E-12	7
CDEABBAAAAEBBBBBBBA	0.33E-12	0.46E-25	0.21E-12	9
CDEABBAAAAEBBBBBBDA	0.10E-12	0.00E+00	0.00E+00	1
CDEABBAAAACEBBBABBBA	0.49E-12	0.25E-24	0.50E-12	9
END 9 9 9 9				

7. The APET output file used as input to BINIAC must be re-named APET.IN.
8. The maximum number of bins in the APET output file must be less than or equal to 15,000.

Requirements 1. through 5. above are normal aspects of an APET output file. Only requirements 6. and 7. introduce necessary modifications to this file. Requirement 8. will probably never become a restriction, as APET output files are generally much shorter than 15,000 lines. However, if an APET file is generated with more than this number of lines, it would have to be manually separated into two or more files before being processed by BINIAC.

BINDECK.IN

The second input file used by BINIAC is called BINDECK.IN. This file contains the bin attribute table, and is of the following format:

1. The first input line of the file is the truncation limit (in units of year⁻¹) used by the APET methodology in the calculation of the data contained in APET.IN. This value is in the code for information only, and is not part of any calculations performed by BINIAC.
2. The second input line of the file is the integer number of dimensions in a bin (20, for the current DWPF accident analyses).

3. The next input line is the number of possible attributes for the first bin dimension (if Appendix 1 were used, this number would be 3, since there are three possible attributes {explosion, tornado, or no release} for the first bin dimension {OWST}).
4. Next, each possible attribute for the first bin dimension is given its own line. The system described by the attribute should be included in the attribute (e.g., OWST_Explosion).
5. The succeeding lines repeat numbers 3. and 4. above for each dimension.

The following are further requirements of the BINDECK.IN file:

1. Each input line must end with a carriage return.
2. The first possible attribute for each dimension must have a corresponding character code of 'A,' and each subsequent potential attribute must be the next capital letter in the alphabet. For example, if a dimension has three potential attributes, they must have corresponding capital alphabetic character codes of 'A,' 'B,' and 'C,' and, they must be listed in this order in BINDECK.IN. (Note that the character codes themselves are not actually in BINDECK.IN; however, the first potential attribute for a given dimension is implied to have a character code of 'A,' the second potential attribute is implied to have a character code of 'B,' and so on.)
3. Each attribute must contain less than or equal to 35 characters, with no spaces (use underscores or hyphens in place of spaces).
4. The number of bin dimensions must be less than or equal to 50.
5. The number of potential attributes for a given bin dimension must be less than or equal to 26 (the number of capital letters in the alphabet).

Since the bin attribute table is an input to BINIAC, changes to the binning process in the APET methodology will not require a revision to the BINIAC code. Instead, a different BINDECK.IN file would be input to the code. If no changes are made to the binning process between subsequent runs of BINIAC, the same BINDECK.IN file could be used indefinitely (except for routine changes to the truncation limit).

Appendix 2 presents an example of BINDECK.IN using the bin attribute table given in Appendix 1.

2.2 Language/Hardware Specifications

BINIAC was written in FORTRAN 77 using version 5.20 of the Lahey Computer Systems, Inc. FORTRAN compiler. The Lahey compiler provides additional commands and I/O methods not available in standard FORTRAN 77, although it does comply with the ANSI FORTRAN 77 Standard. A FORTRAN listing of BINIAC (BINIAC.FOR) is presented in Appendix 3.

Systems running BINIAC require an 80386 or 80486 PC microprocessor, with an 80287 or newer math co-processor installed. The only file necessary to run BINIAC (besides the two input files APET.IN and BINDECK.IN) is BINIAC.EXE. This is the executable file version of BINIAC.FOR, compiled for optimal performance on an 80486 PC microprocessor (it will run correctly, although more slowly, on an 80386-based PC).

During execution, BINIAC will require approximately 30 Megabytes of RAM, so it is recommended that BINIAC be run from the DOS command line in Microsoft Windows (version 3.0a or later), with a large permanent swap file created to provide additional virtual memory.

2.3 Program

BINIAC is a short FORTRAN program divided into six general sections. The first section defines, allocates, and initializes the variables used by the program. BINIAC uses dynamically allocatable arrays, which are not a function of standard FORTRAN 77, but a feature of the Lahey compiler. This type of array allows the array memory to be unassigned until execution. If standard arrays were used, memory for the arrays would be assigned in the executable file. If this was done, the size of BINIAC.EXE would increase from the current 300 kilobytes to over 30,000 kilobytes, with no corresponding decrease in required RAM during execution.

The next section (*Input Attribute Names and Number of Dimensions*) reads the BINDECK.IN input file. The truncation limit is read into the real variable **trun**, the number of dimensions is read into the integer variable **n**, the number of potential attributes for each dimension is read into the integer array, **j(x)**, and the potential attributes are read into the character string array **tag(x,k)**. Thus, using Appendix 2 as an example, **trun** is 8.76E-10, **n** is 20, **j(1)** is 3, **tag(1,1)** is OWST_Explosion, and **tag(1,3)** is OWST_OK.

The *Input APET Data* section then inputs the APET.IN file. After reading in a dummy variable to account for the header in APET.IN, the code reads in the bin identification, the mean/hr, the variance, the standard deviation, and the number of occurrences. To aid in input, the entire bin identification is read into a multi-character string. The individual character codes are subsequently read into a character array, **bin(y,x)**, where **bin(y,x)** is the character code for the xth dimension in the yth bin (using Figure 2 as an example, **bin(4,19)** is 'D'). The mean/yr frequency is also derived here with the following conversion:

$$\frac{\text{Mean}}{\text{year}} = 8760 \frac{\text{Mean}}{\text{hour}}$$

The correct attributes for each dimension of each bin are input into the character string array **status(y,x)**, where **status(y,x)** is the resulting attribute of the xth dimension in the yth bin. The correct attribute is obtained by noting that the possible attributes for a given dimension in BINDECK.IN have successive alphabetic codes: A, B, C... An intrinsic function is used to convert the character code into its integer ASCII value. Since the ASCII value is 65 for 'A', 66 for 'B', and so on, 64 is subtracted from the intrinsic function result. Thus, a character code of 'A' becomes an integer value of 1, while 'B' becomes 2, and so on. Since the attributes for a given dimension in BINDECK.IN are arranged in the alphabetic order of their corresponding character

codes (with no letter skipped), the first (1) entry corresponds to 'A', the second (2) to 'B', and so on. Therefore, to obtain the attribute for a character code of 'D', the fourth attribute listed for the given dimension in **tag** is assigned to **status**, for that given dimension and bin.

For added security, the **tag** array was initialized to the value *****ERROR***** at the beginning of the program. Therefore, if a capital alphabetic character code is used that does not have a corresponding attribute in that given dimension, the code will assign *****ERROR***** to **status**, for that dimension and bin. For example, using the table in Appendix 1, if a 'D' code was used for the first dimension of a bin (OWST), **status** would be set to *****ERROR***** for that dimension and bin, since the first dimension has only three possible character codes: 'A', 'B', or 'C.'

The *Input APET Data* process is repeated until the program reads the end-of-file message shown in Figure 2, 'END 9 9 9 9.' The input file is then closed and the integer variable **m** is set equal to the number of bins input.

The data is sorted in the next section, *Sorting Data by Mean/yr*. The data is sorted by mean/yr in descending order, using a modified bubble sort.

The next section, *Open Output File*, determines the output file destination. The program first attempts to write the output to the standard output file BIN.OUT. If that file does not currently exist, the program creates it and moves onto the next section. If BIN.OUT already exists, the user is asked via screen prompt whether or not the old BIN.OUT should be deleted. If it is deleted, the file creates a new BIN.OUT and moves on to the next section. If the user decides to save the old BIN.OUT, he is prompted for the new output file name (do not choose BIN.OUT at this point, or the program will try to create an already existing file, causing it to crash).

In the final section, *Write Input and Output to File*, the input from APET.IN and the output generated by BINIAC are written to the output file. In addition, the number of bins input from APET.IN is examined in this section. If too many bins were input, an error message will be printed to the output file (see section 4.3).

2.4 Output

The BINIAC code produces screen and file output. Screen output is in the form of run-status messages to indicate where the code is in its processing routine. The code first reports to the screen when it begins to load in data from BINDECK.IN by printing 'LOADING DIMENSION ATTRIBUTE TABLE.' When the code begins inputting and processing data from APET.IN, it prints 'PROCESSING BINS AND ASSOCIATED DATA,' followed by a count of the input bins. When the sorting routine begins, 'SORTING DATA' is printed to the screen, followed by a countdown of the remaining sort cycles. Next, any output filename messages (as described in the preceding section) are printed, followed by the 'WRITING OUTPUT TO FILE *filename*' message, where *filename* is the output filename. Finally, a configuration control message is printed to the screen to indicate the version of the code (see section 3.2).

For each bin input from APET.IN, the output file (normally called BIN.OUT) includes the bin identification, the mean/yr, mean/hr, variance, standard deviation, number of occurrences, and individual dimension attributes for that bin. For each bin, the identification and statistical data are printed on two separate lines, followed by the dimension attributes, which are printed in three

columns (the attributes are read from right to left: therefore, the attribute for the first dimension is given as the first entry in the first column, the attribute for the second dimension is given as the first entry in the second column, and the attribute for the fifth dimension is given as the second entry in the second column). The first bin data line is preceded by a message indicating how many bins were processed and what truncation limit was used by the APET methodology. Thereafter is a header, followed by the bin data described above, in the order of the most frequent to the least frequent progression. A sample BINIAC output file is shown in Appendix 4.

3.0 CONFIGURATION CONTROL

3.1 Proprietor and Cognizant Users

Before a user may run BINIAC in association with any application other than training, he must become a cognizant user. A list of current cognizant users for BINIAC will be maintained by the proprietor of BINIAC, who will also have the responsibility for adding new users to the list. To become certified as a cognizant user, the applicant must read the BINIAC User's Manual and successfully run a test case chosen by the proprietor. Once the proprietor has determined that the test case was run successfully, the applicant's name will be added to the list of cognizant users.

The proprietor of BINIAC is solely responsible for code maintenance, including code enhancement and error management. Users, both cognizant users and applicants, are to notify the proprietor of any needs in these areas. Specifically, if any code errors are discovered, the user finding the error must immediately stop work and notify the proprietor and his immediate supervisor. In order to maintain configuration control over the code, users are not to alter the current version of BINIAC in any fashion.

Currently, the proprietor for BINIAC is S. T. Gough of the Liquid Waste Analysis group in SRTC.

3.2 Code Version

The proprietor will inform all cognizant users of any changes in the code, and the new revision number. Prior to using the code in association with any application except training, cognizant users must verify that they are using the correct version. The version of the code is verified by two independent methods. First, the program outputs the current version and date to the screen following every execution. Currently, for revision 0, this message should read:

Program BINIAC, Revision 0, 02/25/94
S. T. Gough, Liquid Waste Analysis

Once the user has verified that he is using the correct version (the most up-to-date version supplied to him by the proprietor up to that point), he must verify that the filename time/date of the executable file also reflects the correct code version. For revision 0, the correct time/date is 9:47a, 02-25-94.

4.0 INSTALLATION AND EXECUTION

4.1 Installation

To install BINIAC, simply copy the BINIAC.EXE file into a DOS directory. The two input files, APET.IN and BINDECK.IN, must be resident in the same directory as BINIAC.EXE. Given the large RAM requirements of this code, it is recommended that BINIAC be run in a DOS command window through Microsoft Windows, with a large permanent swap file.

4.2 Execution

To execute the code, simply type 'BINIAC' at the DOS command line in the directory where BINIAC.EXE is resident. When the program has completed processing, you may view the output file by using a word processor or text editor. Alternatively, you may view the output file using DOS commands, such as PRINT or TYPE.

4.3 Error Messages

There are only three error messages written directly into the BINIAC code. The first error message will be printed to the screen if the BIN.OUT output file already exists. If so the error message will follow with options to delete the old BIN.OUT or to change the output filename (see section 2.3).

The second internal error message involves the bin identifications input via APET.IN. If a bin character code for a specific dimension does not have a corresponding attribute from the BINDECK.IN file, the message '**ERROR**' will be printed to the output file instead of an attribute for that specific bin dimension (see section 2.3).

The third internal error message will result if the number of APET bins input from APET.IN exceeds the maximum capacity of BINIAC (15,000 bins, see section 2.1). If so, the following message will be printed to the beginning of the output file: 'ERROR! Too many lines input. Results have been corrupted.' BINIAC will continue executing, but the output file will contain distorted results and should not be used.

Run-time error messages generated by the executable code itself will generally not be readable by the user, unless the Lahey FORTRAN compiler is installed on the user's system. In the absence of the Lahey compiler, any run-time errors will result in the following on-screen message: 'Cannot Open Error file "F77L3.EER", error # xxx,' where xxx is a Lahey run-time error number. The following paragraphs describe the most likely run-time errors (and their associated numbers, for systems without the Lahey compiler installed) that could be encountered during the execution of BINIAC. If an error number is encountered that is not described in the following paragraphs, the user should consult the Lahey Programmer's Reference or contact the BINIAC proprietor.

The most likely run-time error message would be the result of insufficient RAM available for BINIAC. If insufficient RAM is present to run BINIAC, and the Lahey compiler is installed, the following error message will be printed to the screen: 'Allocatable array memory exhausted.'

Without the Lahey compiler installed, this error is reported as Lahey run-time error # 169. If this error occurs, the user must increase the amount of available free RAM. Running under Microsoft Windows with a large permanent swap file will increase the amount of free RAM, especially if all other applications are closed. If insufficient free memory is available on the chosen system, BINIAC will have to be installed on another machine.

Another likely error message that could be encountered is the following: 'Data transfer beyond end of file, FILE=APET.IN' (or Lahey run-time error # 94, if the compiler is not installed). This generally indicates that the end-of-file marker described in section 2.1 ('END 9 9 9 9') has not been added to the APET.IN file. Adding this marker, as described in section 2.1, will alleviate the problem.

The only other likely run-time error that could be encountered would result if BINIAC could not open APET.IN or BINDECK.IN. If BINIAC cannot open one of these two files, and the Lahey compiler is installed, the following error message will be printed to the screen: 'File specified STATUS= "OLD" doesn't exist, FILE=*filename*,' where *filename* is the file (APET.IN or BINDECK.IN) that could not be opened. Without the Lahey compiler installed, this error is reported as Lahey run-time error # 151. If this error is received, the user should verify that both APET.IN and BINDECK.IN are present in the same directory as BINIAC.EXE, and that neither of these two input files is being opened by any other application at the same time (word processor, text editor, etc.).

If any problems are encountered, the user is encouraged to contact the code proprietor for resolution.

5.0 TESTING

The BINIAC code was run through several tests to confirm its ability to perform the functions outlined in the previous sections. Each test was designed to test a specific function or functions of the code. BINIAC passed all of the tests with no problems or exceptions.

5.1 Standard Operation

Test 1 was a standard run, using twenty-one 20-dimension bins and the bin attribute table given in Appendix 1. The APET.IN and BIN.OUT files for this test case are contained in Appendix 5. For this case, the individual bin identifications, dimension attributes, statistical data, and sorted order were manually checked for accuracy. BINIAC passed this test with no problems or exceptions.

5.2 50 Dimensions

The purpose of Test 2 was to ensure that BINIAC could handle bin sizes as large as 50 dimensions. The APET.IN, BINDECK.IN, and BIN.OUT files used for this test are presented in Appendix 6. BINIAC passed this test with no problems or exceptions.

5.3 False Character Codes

The purpose of Test 3 was to ensure that BINIAC could detect false character codes in the bin identifications input from APET.IN, where a false character code is defined as a capital alphabetic character code for a given dimension that has no corresponding attribute in the bin attribute table. The bin attribute table given in Appendix 1 was used, and the APET.IN file contained three false character codes, in three different dimensions. The APET.IN and BIN.OUT files for this test are presented in Appendix 7. BINIAC passed this test with no problems or exceptions.

6.0 REFERENCES

1. Kearnaghan, D. P., *The Defense Waste Processing Facility Algorithm for Source Terms (U)*, WSRC-RP-93-798, September 3, 1993.

APPENDIX 1: TYPICAL BIN ATTRIBUTE TABLE

Dimension Number	Dimension Title	Attributes and Associated Character Codes
1	Organic Waste Storage Tank (OWST)	A. Explosion B. Tornado C. No Release
2	Low Point Pump Pit Sludge Tank (PPST)	A. Splash B. Leak C. Overflow D. No Release
3	Low Point Pump Pit Precipitate Tank (PPPT)	A. Explosion B. Splash C. Leak D. Overflow E. No Release
4	Low Point Pump Pit Recycle Tank (PPRT)	A. Explosion B. Splash C. Leak D. Overflow E. No Release
5	Precipitate Reactor (PR)	A. Explosion B. Splash C. Leak D. Vented E. Uncontrolled Reaction F. Overflow G. No Release
6	Precipitate Reactor Feed Tank (PRFT)	A. Explosion B. Splash C. Leak D. Vented E. Overflow F. No Release
7	Precipitate Reactor Bottoms Tank (PRBT)	A. Explosion B. Splash C. Leak D. Vented E. Overflow F. No Release
8	Slurry Mix Evaporator Tank (SME)	A. Explosion B. Splash C. Leak D. Vented E. Uncontrolled Reaction F. Overflow G. No Release

9	Sludge Receipt and Adjustment Tank (SRAT)	A. Explosion B. Splash C. Leak D. Vented E. Uncontrolled Reaction F. Overflow G. No Release
10	Melter Feed Tank (MFT)	A. Explosion B. Splash C. Leak D. Vented E. Overflow F. No Release
11	Recycle Collection Tank (RCT)	A. Splash B. Leak C. Vented D. Uncontrolled Reaction E. Overflow F. No Release
12	Melt Cell	A. Total Melt Release B. Partial Melt Release C. Melter Offgas Release D. Canister Rupture E. No Release
13	Fire in the Salt Process Cell (SPC)?	A. Yes B. No
14	Fire in the Chemical Process Cell (CPC)?	A. Yes B. No
15	Fire in the LPPP?	A. Yes B. No
16	Chemical Process Cell (CPC) Covers	A. Failed B. Intact
17	Salt Process Cell (SPC) Covers	A. Failed B. Intact
18	Melt Cell Covers	A. Failed B. Intact
19	Zone 1 Ventilation	A. Vit Building Collapse B. Vit Building Breach Without Ventilation C. Vit Building Breach With Ventilation D. Ventilation Failure E. Normal Operation
20	LPPP Ventilation	A. LPPP Building Breach Without Ventilation B. Ventilation Failure C. LPPP Building Breach With Ventilation D. Normal Operation

APPENDIX 2: TYPICAL BINDECK.IN

8.76E-10
20
3
OWST_Explosion
OWST_Tornado
OWST_OK
4
FPST_Splash
FPST_Leak
FPST_Overflow
FPST_OK
5
PPPT_Explosion
PPPT_Splash
PPPT_Leak
PPPT_Overflow
PPPT_OK
5
PPRT_Explosion
PPRT_Splash
PPRT_Leak
PPRT_Overflow
PPRT_OK
7
PR_Explosion
PR_Splash
PR_Leak
PR_Vented
PR_Uncontrolled
PR_Overflow
PR_OK
6
PRFT_Explosion
PRFT_Splash
PRFT_Leak
PRFT_Vented
PRFT_Overflow
PRFT_OK
6
PRBT_Explosion
PRBT_Splash
PRBT_Leak
PRBT_Vented
PRBT_Overflow
PRBT_OK
7
SME_Explosion
SME_Splash
SME_Leak
SME_Vented
SME_Uncontrolled
SME_Overflow
SME_OK
7
SRAT_Explosion
SRAT_Splash
SRAT_Leak
SRAT_Vented
SRAT_Uncontrolled
SRAT_Overflow
SRAT_OK
6
MFT_Explosion
MFT_Splash
MFT_Leak
MFT_Vented
MFT_Overflow
MFT_OK
6
RCT_Splash
RCT_Leak

RCT_Vented
RCT_Uncontrolled
RCT_Overflow
RCT_OK
5
Total_Melt_Release
Partial_Melt_Release
Melter_Offgas_Release
Canister_Rupture
Melt_Cell_OK
2
SPC_Fire
No_SPC_Fire
2
CPC_Fire
No_CPC_Fire
2
LPPP_Fire
No_LPPP_Fire
2
CPC_Covers_Failed
CPC_Covers_Intact
2
SPC_Covers_Failed
SPC_Covers_Intact
2
Melt_Covers_Failed
Melt_Covers_Intact
5
Vit_Bldg_Collapse
Vit_Bldg_Breach-No_Vent
Vit_Bldg_Breach-Yes_Vent
Zone-1_Vent_Failure
Normal_Zone-1_Vent
4
LPPP_Breach-No_Vent
LPPP_Vent_Failure
LPPP_Breach-Yes_Vent
Normal_LPPP_Vent

APPENDIX 3: FORTRAN LISTING OF BINIAC

```
***      Program:  BINIAC, a program to translate and sort APET bins
***      S. T. Gough, Revision 0, 02/25/94

***      i,x,y,k:  indices
***      n:  number of bin dimensions (max = 50)
***      m:  number of bins (max = 15000)
***      trun:  APET truncation limit (per year)
***      j(n):  number of possible attributes for nth bin dimension
***              (max = 26)
***      tempi,temp,tempb,temps:  dummy variables for sorting
***      no(m):  number of occurrences for nth bin
***      flag:  boolean flag used to test for output file existence
***      bin(m,n):  attribute code for nth dimension in mth bin
***      q:  keyboard input holder
***      status(m,n):  attribute for nth dimension in mth bin
***                      (attribute name cannot be longer than 35
***                      characters, and can contain no spaces)
***      tag(n,j):  jth possible attribute for nth dimension
***                      (attribute name cannot be longer than 35
***                      characters, and can contain no spaces)
***      binl:  input dummy variable
***      out:  keyboard input for output filename
***      mh(m):  mean/hour for mth bin
***      my(m):  mean/year for mth bin
***      var(m):  variance for mth bin
***      sd(m):  standard deviation for mth bin

integer i,n,x,y,no(:),j(50),k,tempi
logical flag
character*1 bin(:,:),q,tempb
character*40 status(:,:),temps,tag(50,26)
character*132 binl
character*12 out
real mh(:),var(:),sd(:),my(:),temp,m,trun

allocatable :: no,bin,status,mh,var,sd,my

allocate (no(15001),bin(15001,50),status(15001,50),mh(15001),
&  var(15001),sd(15001),my(15001))

data tag/1300*'''ERROR'''/

***      Input Attribute Names and Number of Dimensions

write (*,*) 'LOADING DIMENSION ATTRIBUTE TABLE'
open (33,'bindeck.in',STATUS='OLD')
read (33,*) trun
read (33,*) n
do 111 x=1,n
  read (33,*) j(x)
  do 112 k=1,j(x)
    read (33,*) tag(x,k)
112  continue
111  continue
close (33)

***      Input APET Data

write (*,*)
write (*,*) 'PROCESSING BINS AND ASSOCIATED DATA'
```

```
      write (*,*)
      y=0
      open (10,'apet.in',STATUS='OLD')
      read (10,*) bin1

50    y=y+1
      read (10,*) bin1, mh(y), var(y), sd(y), no(y)
      if (bin1.eq.'END') goto 400
      write(*,*) y
      my(y) = mh(y) * 8760
      do 100 x = 1, n
        bin(y,x) = bin1(x:x)
        i = ichar(bin(y,x)) - 64
        status(y,x) = tag(x,i)
100   continue
      goto 50
400   m = y - 1
      close (10)
```

*** Sorting Data by Mean/yr

```
      write (*,*)
      write (*,*) 'SORTING DATA'
      write (*,*)
      do 127 y=1,m
        write (*,*) int(m - y)
        do 126 x=(y+1),m
          if (my(x).gt.my(y)) then
            do 125 k=1,n
              tempb = bin(x, k)
              bin(x, k) = bin(y, k)
              bin(y, k) = tempb
              temps = status(x, k)
              status(x, k) = status(y, k)
              status(y, k) = temps
125          continue
              temp = mh(x)
              mh(x) = mh(y)
              mh(y) = temp
              temp = my(x)
              my(x) = my(y)
              my(y) = temp
              temp = var(x)
              var(x) = var(y)
              var(y) = temp
              temp = sd(x)
              sd(x) = sd(y)
              sd(y) = temp
              tempi = no(x)
              no(x) = no(y)
              no(y) = tempi
            end if
126          continue
127        continue
```

*** Open Output File

```
      q='x'
      out='BIN.OUT'
      inquire (FILE='bin.out',EXIST=flag)
      flag = .NOT. flag
      if (flag) goto 12

      write (*,*)
```

```

      write (*,*) 'WARNING:  Output file, BIN.OUT, already exists.'
      write (*,*) 'Do you wish to delete BIN.OUT (Y or N)?'
23    read (5,*) q
      if ((q.eq.'n') .OR. (q.eq.'N')) goto 19
      if ((q.eq.'y') .OR. (q.eq.'Y')) goto 17
      write (*,*) '(Y or N)?'
      goto 23

19    write (*,*) 'What output filename do you wish to use?'
      read (5,*) out
      goto 12

17    open (66,'bin.out',STATUS='OLD')
      close (66,STATUS='DELETE')

12    open (67,FILE=OUT,STATUS='NEW',RECL=125)

***      Write Input and Output to File

      write (*,*)
      write (*,*) 'WRITING OUTPUT TO FILE ',out
      write (*,*)
      if (m.gt.15000) then
        write (67,*) 'ERROR!  Too many lines input.'
        write (67,*) 'Results have been corrupted.'
        write (67,*)
      end if
      write (67,11) m
      write (67,13) trunc
      write (67,*)
11    format ('This APET run consisted of ',I5,' lines,')
13    format ('with a truncation limit of ',1P,E9.2,'/yr.')
      write (67,*) 'Bin'
      write (67,*) ' Mean/yr      Mean/hr      Variance      Std Dev      N'
      write (67,*)
      do 44 y = 1, m
        write (67,*) (bin(y,x),x=1,n)
        write (67,99) my(y), mh(y), var(y), sd(y), no(y)
        write (67,*)
        write (67,*) (status(y,x),x=1,n)
        write (67,*)
44    continue
      write(*,*)
      write(*,*) 'Program BINIAC, Revision 0, 02/25/94'
      write(*,*) 'S. T. Gough, Liquid Waste Analysis'
      write(*,*)

99    format (1P,4(E9.2,2X),I4)
      close (67)

      end
```

APPENDIX 4: SAMPLE BINIAC OUTPUT FILE

This APET run consisted of 5 lines,
with a truncation limit of $8.76\text{E-}10/\text{yr}$.

Bin

Mean/yr	Mean/hr	Variance	Std Dev	N
---------	---------	----------	---------	---

CDEABBAAAAEBBBBABBBA

1.49E-08	1.70E-12	9.40E-24	3.10E-12	34
----------	----------	----------	----------	----

OWST_OK

PPRT_Explosion

PRBT_Explosion

MFT_Explosion

No_SPC_Fire

CPC_Covers_Failed

Vit_Bldg_Breach-No_Vent

FPST_OK

PR_Splash

SME_Explosion

RCT_Splash

No_CPC_Fire

SPC_Covers_Intact

LPPP_Breach-No_Vent

PPPT_OK

PRFT_Splash

SRAT_Explosion

Melt_Cell_OK

No_LPPP_Fire

Melt_Covers_Intact

CDEABBAAAAEBBBBABBDA

5.43E-09	6.20E-13	9.60E-25	9.80E-13	7
----------	----------	----------	----------	---

OWST_OK

PPRT_Explosion

PRBT_Explosion

MFT_Explosion

No_SPC_Fire

CPC_Covers_Failed

Zone-1_Vent_Failure

FPST_OK

PR_Splash

SME_Explosion

RCT_Splash

No_CPC_Fire

SPC_Covers_Intact

LPPP_Breach-No_Vent

PPPT_OK

PRFT_Splash

SRAT_Explosion

Melt_Cell_OK

No_LPPP_Fire

Melt_Covers_Intact

CDEABBAAAAEBBBBABBBA

4.29E-09	4.90E-13	2.50E-25	5.00E-13	9
----------	----------	----------	----------	---

OWST_OK

PPRT_Explosion

PRBT_Explosion

MFT_Explosion

No_SPC_Fire

CPC_Covers_Failed

Vit_Bldg_Breach-No_Vent

FPST_OK

PR_Splash

SME_Explosion

RCT_Vented

No_CPC_Fire

SPC_Covers_Intact

LPPP_Breach-No_Vent

PPPT_OK

PRFT_Splash

SRAT_Explosion

Melt_Cell_OK

No_LPPP_Fire

Melt_Covers_Intact

CDEABBAAAAEBBBBABBBA

2.89E-09	3.30E-13	4.60E-26	2.10E-13	9
----------	----------	----------	----------	---

OWST_OK

PPRT_Explosion

PRBT_Explosion

MFT_Explosion

No_SPC_Fire

CPC_Covers_Intact

Vit_Bldg_Breach-No_Vent

FPST_OK

PR_Splash

SME_Explosion

RCT_Splash

No_CPC_Fire

SPC_Covers_Intact

LPPP_Breach-No_Vent

PPPT_OK

PRFT_Splash

SRAT_Explosion

Melt_Cell_OK

No_LPPP_Fire

Melt_Covers_Intact

CDEABBAAAAEBBBBABBDA

8.76E-10	1.00E-13	0.00E+00	0.00E+00	1
----------	----------	----------	----------	---

OWST_OK

PPRT_Explosion

PRBT_Explosion

MFT_Explosion

No_SPC_Fire

CPC_Covers_Intact

Zone-1_Vent_Failure

FPST_OK

PR_Splash

SME_Explosion

RCT_Splash

No_CPC_Fire

SPC_Covers_Intact

LPPP_Breach-No_Vent

PPPT_OK

PRFT_Splash

SRAT_Explosion

Melt_Cell_OK

No_LPPP_Fire

Melt_Covers_Intact

APPENDIX 5: TEST 1

BIN	MEAN	VARIANCE	STD DEV	N
CDEABBAAAAAEBBBBABBA	0.17E-11	0.94E-23	0.31E-11	34
CDEABBAAAAAEBBBBABDA	0.62E-12	0.96E-24	0.98E-12	7
CDEABBAAAAAEBBBBBBBA	0.33E-12	0.46E-25	0.21E-12	9
CDEABBAAAAAEBBBBBBDA	0.10E-12	0.00E+00	0.00E+00	1
CDEABBAAAACEBBBBABBA	0.49E-12	0.25E-24	0.50E-12	9
CDEABBAAAACEBBBBABDA	0.20E-12	0.82E-26	0.90E-13	2
CDEABBAAAACEBBBBBBBA	0.48E-12	0.83E-25	0.29E-12	6
CDEABBAABAAEBBBBABBA	0.10E-12	0.00E+00	0.00E+00	1
CDEABBAABAAEBBBBABDA	0.10E-11	0.25E-23	0.16E-11	40
CDEABBAABAAEBBBBBBDA	0.25E-12	0.41E-25	0.20E-12	9
CDEABBAABAAEBBBBBBBA	0.40E-12	0.68E-25	0.26E-12	3
CDEABBAABDACEBBBBBBBA	0.50E-11	0.88E-22	0.94E-11	66
CDEABBAABDACEBBBBBBDA	0.12E-11	0.56E-23	0.24E-11	35
CDEABBAABDBAEBBBBBBBA	0.24E-12	0.53E-26	0.73E-13	2
CDEABBAADAAEBBBBABBA	0.44E-12	0.12E-24	0.35E-12	8
CDEABBAADAAEBBBBABDA	0.20E-12	0.00E+00	0.00E+00	1
CDEABBAADAAEBBBBBBBA	0.17E-12	0.20E-26	0.44E-13	4
CDEABBAADACEBBBBABBA	0.33E-12	0.13E-24	0.37E-12	5
CDEABBAADACEBBBBBBBA	0.61E-12	0.00E+00	0.00E+00	1
CDEABBADEAAEBBBBABBA	0.59E-11	0.17E-21	0.13E-10	92
CDEABBADEAAEBBBBABDA	0.18E-11	0.12E-22	0.34E-11	43

END 9 9 9 9

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This APET run consisted of 21 lines,
with a truncation limit of $8.76E-10$ /yr.

Bin	Mean/yr	Mean/hr	Variance	Std Dev	N
CDEABBAADBAAEBBBBABBA					
5.17E-08	5.90E-12	1.70E-22	1.30E-11	92	
OWST_OK					PPST_OK
PPRT_Explosion					PR Splash
PRBT_Explosion					SME_Vented
MFT_Explosion					RCT_Splash
No_SPC_Fire					No_CPC_Fire
CPC_Covers_Failed					SPC_Covers_Intact
Vit_Bldg_Breach-No_Vent					LPPP_Breach-No_Vent
					PPPT_OK
					PRFT_Splash
					SRAT_Splash
					Melt_Cell_OK
					No_LPPP_Fire
					Melt_Covers_Intact
CDEABBAADACEBBBBBBBA					
4.38E-08	5.00E-12	8.80E-23	9.40E-12	66	
OWST_OK					PPST_OK
PPRT_Explosion					PR Splash
PRBT_Explosion					SME_Splash
MFT_Explosion					RCT_Vented
No_SPC_Fire					No_CPC_Fire
CPC_Covers_Intact					SPC_Covers_Intact
Vit_Bldg_Breach-No_Vent					LPPP_Breach-No_Vent
					PPPT_OK
					PRFT_Splash
					SRAT_Vented
					Melt_Cell_OK
					No_LPPP_Fire
					Melt_Covers_Intact
CDEABBAADBAAEBBBBABDA					
1.58E-08	1.80E-12	1.20E-23	3.40E-12	43	
OWST_OK					PPST_OK
PPRT_Explosion					PR Splash
PRBT_Explosion					SME_Vented
MFT_Explosion					RCT_Splash
No_SPC_Fire					No_CPC_Fire
CPC_Covers_Failed					SPC_Covers_Intact
Zone-1_Vent_Failure					LPPP_Breach-No_Vent
					PPPT_OK
					PRFT_Splash
					SRAT_Splash
					Melt_Cell_OK
					No_LPPP_Fire
					Melt_Covers_Intact
CDEABBAABAAAEBBBBABBA					
1.49E-08	1.70E-12	9.40E-24	3.10E-12	34	
OWST_OK					PPST_OK
PPRT_Explosion					PR Splash
PRBT_Explosion					SME_Explosion
MFT_Explosion					RCT_Splash
No_SPC_Fire					No_CPC_Fire
CPC_Covers_Failed					SPC_Covers_Intact
Vit_Bldg_Breach-No_Vent					LPPP_Breach-No_Vent
					PPPT_OK
					PRFT_Splash
					SRAT_Explosion
					Melt_Cell_OK
					No_LPPP_Fire
					Melt_Covers_Intact
CDEABBAADACEBBBBBBDA					
1.05E-08	1.20E-12	5.60E-24	2.40E-12	35	
OWST_OK					PPST_OK
PPRT_Explosion					PR Splash
PRBT_Explosion					SME_Splash
MFT_Explosion					RCT_Vented
No_SPC_Fire					No_CPC_Fire
CPC_Covers_Intact					SPC_Covers_Intact
Zone-1_Vent_Failure					LPPP_Breach-No_Vent
					PPPT_OK
					PRFT_Splash
					SRAT_Vented
					Melt_Cell_OK
					No_LPPP_Fire
					Melt_Covers_Intact
CDEABBAABAAAEBBBBABBA					
8.76E-09	1.00E-12	2.50E-24	1.60E-12	40	
OWST_OK					PPST_OK
PPRT_Explosion					PR Splash
PRBT_Explosion					SME_Splash
MFT_Explosion					RCT_Splash
No_SPC_Fire					No_CPC_Fire
CPC_Covers_Failed					SPC_Covers_Intact
Vit_Bldg_Breach-No_Vent					LPPP_Breach-No_Vent
					PPPT_OK
					PRFT_Splash
					SRAT_Explosion
					Melt_Cell_OK
					No_LPPP_Fire
					Melt_Covers_Intact

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CDEABBAAAAEBBBABBD

5.43E-09 6.20E-13 9.60E-25 9.80E-13 7

OWST_OK
PPRT_Explosion
PRBT_Explosion
MFT_Explosion
No_SPC_Fire
CPC_Covers_Failed
Zone-1_Vent_Failure
PPST_OK
PR_Splash
SME_Explosion
RCT_Splash
No_CPC_Fire
SPC_Covers_Intact
LPPP_Breach-No_Vent

PPPT_OK
PRFT_Splash
SRAT_Explosion
Melt_Cell_OK
No_LPPP_Fire
Melt_Covers_Intact

CDEABBADAACEBBBBBBA

5.34E-09 6.10E-13 0.00E+00 0.00E+00 1

OWST_OK
PPRT_Explosion
PRBT_Explosion
MFT_Explosion
No_SPC_Fire
CPC_Covers_Intact
Vit_Bldg_Breach-No_Vent
PPST_OK
PR_Splash
SME_Vented
RCT_Vented
No_CPC_Fire
SPC_Covers_Intact
LPPP_Breach-No_Vent

PPPT_OK
PRFT_Splash
SRAT_Explosion
Melt_Cell_OK
No_LPPP_Fire
Melt_Covers_Intact

CDEABBAAAACEBBBBBBA

4.29E-09 4.90E-13 2.50E-25 5.00E-13 9

OWST_OK
PPRT_Explosion
PRBT_Explosion
MFT_Explosion
No_SPC_Fire
CPC_Covers_Failed
Vit_Bldg_Breach-No_Vent
PPST_OK
PR_Splash
SME_Explosion
RCT_Vented
No_CPC_Fire
SPC_Covers_Intact
LPPP_Breach-No_Vent

PPPT_OK
PRFT_Splash
SRAT_Explosion
Melt_Cell_OK
No_LPPP_Fire
Melt_Covers_Intact

CDEABBAAAACEBBBBBBA

4.20E-09 4.80E-13 8.30E-26 2.90E-13 6

OWST_OK
PPRT_Explosion
PRBT_Explosion
MFT_Explosion
No_SPC_Fire
CPC_Covers_Intact
Vit_Bldg_Breach-No_Vent
PPST_OK
PR_Splash
SME_Explosion
RCT_Vented
No_CPC_Fire
SPC_Covers_Intact
LPPP_Breach-No_Vent

PPPT_OK
PRFT_Splash
SRAT_Explosion
Melt_Cell_OK
No_LPPP_Fire
Melt_Covers_Intact

CDEABBADAACEBBBBBBA

3.85E-09 4.40E-13 1.20E-25 3.50E-13 8

OWST_OK
PPRT_Explosion
PRBT_Explosion
MFT_Explosion
No_SPC_Fire
CPC_Covers_Failed
Vit_Bldg_Breach-No_Vent
PPST_OK
PR_Splash
SME_Vented
RCT_Splash
No_CPC_Fire
SPC_Covers_Intact
LPPP_Breach-No_Vent

PPPT_OK
PRFT_Splash
SRAT_Explosion
Melt_Cell_OK
No_LPPP_Fire
Melt_Covers_Intact

CDEABBAABAAEBBBBBBA

3.50E-09 4.00E-13 6.80E-26 2.60E-13 3

OWST_OK
PPRT_Explosion
PRBT_Explosion
MFT_Explosion
No_SPC_Fire
CPC_Covers_Intact
Vit_Bldg_Breach-No_Vent
PPST_OK
PR_Splash
SME_Splash
RCT_Splash
No_CPC_Fire
SPC_Covers_Intact
LPPP_Breach-No_Vent

PPPT_OK
PRFT_Splash
SRAT_Explosion
Melt_Cell_OK
No_LPPP_Fire
Melt_Covers_Intact

CDEABBADAACEBBBBBBA

2.89E-09 3.30E-13 1.30E-25 3.70E-13 5

OWST_OK PPST_OK

PPPT_OK

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PPRT_Explosion	PR_Splash	PPRT_Splash
PRBT_Explosion	SME_Vented	SRAT_Explosion
MFT_Explosion	RCT_Vented	Melt_Cell_OK
No_SPC_Fire	No_CPC_Fire	No_LPPP_Fire
CPC_Covers_Failed	SPC_Covers_Intact	Melt_Covers_Intact
Vit_Bldg_Breach-No_Vent	LPPP_Breach-No_Vent	
CDEABBAAAAEBBBBBBBA		
2.89E-09	3.30E-13	4.60E-26 2.10E-13 9
OWST_OK	PPST_OK	PPPT_OK
PPRT_Explosion	PR_Splash	PPRT_Splash
PRBT_Explosion	SME_Explosion	SRAT_Explosion
MFT_Explosion	RCT_Splash	Melt_Cell_OK
No_SPC_Fire	No_CPC_Fire	No_LPPP_Fire
CPC_Covers_Intact	SPC_Covers_Intact	Melt_Covers_Intact
Vit_Bldg_Breach-No_Vent	LPPP_Breach-No_Vent	
CDEABBAABAAEBBBABDBA		
2.19E-09	2.50E-13	4.10E-26 2.00E-13 9
OWST_OK	PPST_OK	PPPT_OK
PPRT_Explosion	PR_Splash	PPRT_Splash
PRBT_Explosion	SME_Splash	SRAT_Explosion
MFT_Explosion	RCT_Splash	Melt_Cell_OK
No_SPC_Fire	No_CPC_Fire	No_LPPP_Fire
CPC_Covers_Failed	SPC_Covers_Intact	Melt_Covers_Intact
Zone-1_Vent_Failure	LPPP_Breach-No_Vent	
CDEABBAABDBAEBBBBBBBA		
2.10E-09	2.40E-13	5.30E-27 7.30E-14 2
OWST_OK	PPST_OK	PPPT_OK
PPRT_Explosion	PR_Splash	PPRT_Splash
PRBT_Explosion	SME_Splash	SRAT_Vented
MFT_Splash	RCT_Splash	Melt_Cell_OK
No_SPC_Fire	No_CPC_Fire	No_LPPP_Fire
CPC_Covers_Intact	SPC_Covers_Intact	Melt_Covers_Intact
Vit_Bldg_Breach-No_Vent	LPPP_Breach-No_Vent	
CDEABBAAAACEBBBABDBA		
1.75E-09	2.00E-13	8.20E-27 9.00E-14 2
OWST_OK	PPST_OK	PPPT_OK
PPRT_Explosion	PR_Splash	PPRT_Splash
PRBT_Explosion	SME_Explosion	SRAT_Explosion
MFT_Explosion	RCT_Vented	Melt_Cell_OK
No_SPC_Fire	No_CPC_Fire	No_LPPP_Fire
CPC_Covers_Failed	SPC_Covers_Intact	Melt_Covers_Intact
Zone-1_Vent_Failure	LPPP_Breach-No_Vent	
CDEABBADAAAEBBBABDBA		
1.75E-09	2.00E-13	0.00E+00 0.00E+00 1
OWST_OK	PPST_OK	PPPT_OK
PPRT_Explosion	PR_Splash	PPRT_Splash
PRBT_Explosion	SME_Vented	SRAT_Explosion
MFT_Explosion	RCT_Splash	Melt_Cell_OK
No_SPC_Fire	No_CPC_Fire	No_LPPP_Fire
CPC_Covers_Failed	SPC_Covers_Intact	Melt_Covers_Intact
Zone-1_Vent_Failure	LPPP_Breach-No_Vent	
CDEABBADAAAEBBBBBBBA		
1.49E-09	1.70E-13	2.00E-27 4.40E-14 4
OWST_OK	PPST_OK	PPPT_OK
PPRT_Explosion	PR_Splash	PPRT_Splash
PRBT_Explosion	SME_Vented	SRAT_Explosion
MFT_Explosion	RCT_Splash	Melt_Cell_OK
No_SPC_Fire	No_CPC_Fire	No_LPPP_Fire
CPC_Covers_Intact	SPC_Covers_Intact	Melt_Covers_Intact

User's Manual for BINIAC: A Computer Code To Translate APET Bins (U)

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Vit_Bldg_Breach-No_Vent

LPPP_Breach-No_Vent

CDEABBAABAABBBBABBA

8.76E-10 1.00E-13 0.00E+00 0.00E+00 1

OWST_OK

PFRT_Explosion

PRBT_Explosion

MFT_Explosion

No_SPC_Fire

CPC_Covers_Failed

Vit_Bldg_Breach-No_Vent

FPST_OK

FR_Splash

SME_Explosion

RCT_Splash

No_CPC_Fire

SPC_Covers_Intact

LPPP_Breach-No_Vent

PPPT_OK

PRFT_Splash

SRAT_Splash

Melt_Cell_OK

No_LPPP_Fire

Melt_Covers_Intact

CDEABBAABAAAEBBBBBD

8.76E-10 1.00E-13 0.00E+00 0.00E+00 1

OWST_OK

PFRT_Explosion

PRBT_Explosion

MFT_Explosion

No_SPC_Fire

CPC_Covers_Intact

Zone-1_Vent_Failure

FPST_OK

FR_Splash

SME_Explosion

RCT_Splash

No_CPC_Fire

SPC_Covers_Intact

LPPP_Breach-No_Vent

PPPT_OK

PRFT_Splash

SRAT_Explosion

Melt_Cell_OK

No_LPPP_Fire

Melt_Covers_Intact

APPENDIX 6: TEST 2

User's Manual for BINIAC: A Computer Code To Translate APET Bins (U)

WSRC-TR-94-0112

March 1994

BIN	MEAN	VARIANCE	STD DEV	N				
CD EABBAAAAAE B B B B B A B B B A B B B B B A B B B B B A B B B B B C				0.17E-11	0.94E-23	0.31E-11	34	
CD EABBAAAAAE B B B B B A B B B B A B B B B B A B B B B A B B B B B A B				0.62E-12	0.96E-24	0.98E-12	7	
CD EABBAAAAAE B B B B B A B B B B B A B B B B B A B B B B B A B A B A				0.33E-12	0.46E-25	0.21E-12	9	
CD EABBAAAAAE B B B B B A B B B B B A B B B B B A B B B B A B B A B A B				0.10E-12	0.00E+00	0.00E+00	1	
END 9 9 9 9								

8.76E-10
50
3
OWST_Explosion
OWST_Tornado
OWST_OK
4
LPPPST_Splash
LPPPST_Leak
LPPPST_Overflow
LPPPST_OK
5
LPPFPST_Explosion
LPPFPST_Splash
LPPFPST_Leak
LPPFPST_Overflow
LPPFPST_OK
5
LPPFRT_Explosion
LPPFRT_Splash
LPPFRT_Leak
LPPFRT_Overflow
LPPFRT_OK
7
FR_Explosion
FR_Splash
FR_Leak
FR_Vented
FR_Uncontrolled
FR_Overflow
FR_OK
6
FRFT_Explosion
FRFT_Splash
FRFT_Leak
FRFT_Vented
FRFT_Overflow
FRFT_OK
6
PRBT_Explosion
PRBT_Splash
PRBT_Leak
PRBT_Vented
PRBT_Overflow
PRBT_OK
7
SME_Explosion
SME_Splash
SME_Leak
SME_Vented
SME_Uncontrolled
SME_Overflow
SME_OK
7
SRAT_Explosion
SRAT_Splash
SRAT_Leak
SRAT_Vented
SRAT_Uncontrolled
SRAT_Overflow
SRAT_OK
6
MFT_Explosion
MFT_Splash
MFT_Leak
MFT_Vented
MFT_Overflow
MFT_OK
6
RCT_Splash
RCT_Leak

RCT_Vented
RCT_Uncontrolled
RCT_Overflow
RCT_OK
5
Total_Melt_Release
Partial_Melt_Release
Melter_Offgas_Release
Canister_Rupture
Melt_Cell_OK
2
SPC_Fire
No_SPC_Fire
2
CPC_Fire
No_CPC_Fire
2
LPPP_Fire
No_LPPP_Fire
2
CPC_Covers_Failed
CPC_Covers_Intact
2
SPC_Covers_Failed
SPC_Covers_Intact
2
Melt_Covers_Failed
Melt_Covers_Intact
5
Vit_Bldg_Collapse
Vit_Bldg_Breach-No_Vent
Vit_Bldg_Breach-Yes_Vent
Zone-1_Vent_Failure
Normal_Zone-1_Vent
4
LPPP_Breach-No_Vent
LPPP_Vent_Failure
LPPP_Breach-Yes_Vent
Normal_LPPP_Vent
3
OWST_Explosion
OWST_Tornado
OWST_Vanished
4
LP_Splash
LP_Leak
LP_Overflow
LP_OK
4
PPT_Explosion
PPT_Splash
PPT_Leak
PPT_OK
4
RT_Explosion
RT_Splash
RT_Leak
RT_Overflow
5
R_Explosion
R_Splash
R_Out_of_control
R_Overflow
R_OK
5
qPRFT_Explosion
qPRFT_Splash
qPRFT_Leak
qPRFT_Vented
qPRFT_OK
3

BT_Explosion
BT_Splash
BT_Leak
5
SMEK_Explosion
SMEK_Leak
SMEK_Vented
SMEK_Overflow
SMEK_OK
7
SRT_Inplosion
SRT_Splashy
SRT_Leaky
SRT_Unvented
SRT_Controlled
SRT_Underflow
SRAT_Bad
4
FT_Explosion
FT_Splash
FT_Leak
FT_OK
5
ARCT_Splash
ARCT_Leak
ARCT_Vented
ARCT_Overflow
ARCT_OK
5
Total_Release
Partial_Release
Offgas_Release
Log_Rupture
Melt_Cell_Happy
2
SPC_Fireball
No_SPC_Fireball
2
CPC_Fireball
No_CPC_Fireball
2
LPPP_Fireball
No_LPPP_Fireball
2
CPC_Covers_Blue
CPC_Covers_Green
2
SPC_Covers_Mauve
SPC_Covers_Taupe
2
Melt_Covers_Upsy
Melt_Covers_Downsy
5
Bldg_Collapse
Bldg_Breach-No_Vent
Bldg_Breach-Yes_Vent
1_Vent_Failure
Zone-1_Vent
4
LPPP_No_Vent
LPPP_Failure
LPPP_Yes_Vent
LPPP_Vent
3
OWST_Plasma_Explosion
OWST_Tornado_Big
OWST_Super_Prompt_critical
4
T_Splash
T_Leak
T_Overflow

T_OK
5
Explosion
Splash
Leak
Overflow
OK
5
STG_Explosion
STG_Splash
STG_Leak
STG_Overflow
STG_OK
7
OPR_Explosion
OPR_Splash
OPR_Leak
OPR_Vented
OPR_Uncontrolled
OPR_Overflow
OPR_OK
3
OW_Explosion
OW_Tornado
OW_OKS
4
LPPPST_Ignited
LPPPST_Stolen
LPPPST_Lost
LPPPST_Sold
5
LT_Explosion
LT_Splash
LT_Leak
LT_Overflow
LT_OK
5
LRT_Explosion
LRT_Splash
LRT_Leak
LRT_Overflow
LRT_OK
4
WPR_Vented
WPR_Uncontrolled
WPR_Overflow
WPR_OK

User's Manual for BINIAC: A Computer Code To Translate APET Bins (U)

WSRC-TR-94-0112

March 1994

This APET run consisted of 4 lines,
with a truncation limit of $8.76E-10$ /yr.

Bin	Mean/yr	Mean/hr	Variance	Std Dev	N
CDEABBAAAAAEBBBBBBAAAAAAAAAAAAAAAAAABABABBBBC	1.49E-08	1.70E-12	9.40E-24	3.10E-12	34

OWST_OK	LPPPST_OK	LPPFPPT_OK
LPPFPRT_Explosion	PR_Splash	PRFT_Splash
PRBT_Explosion	SME_Explosion	SRAT_Explosion
MFT_Explosion	RCT_Splash	Melt_Cell_OK
No_SPC_Fire	No_CPC_Fire	No_LPPP_Fire
CPC_Covers_Failed	SPC_Covers_Intact	Melt_Covers_Intact
Vit_Bldg_Breach-No_Vent	LPPP_Breach-No_Vent	OWST_Explosion
LP_Splash	PPT_Explosion	RT_Explosion
R_Explosion	qPRFT_Explosion	BT_Explosion
SMEK_Explosion	SRT_Inplosion	FT_Explosion
ARCT_Splash	Total Release	SPC_Fireball
CPC_Fireball	LPPP_Fireball	CPC_Covers_Blue
SPC_Covers Mauve	Melt_Covers Upsy	Bldg_Collapse
LPPP_No_Vent	OWST_Tornado_Big	T_Splash
Splash	STG_Explosion	OPR_Splash
OW_Explosion	LPPPST_Stolen	LT_Splash
LRT_Splash	WPR_Overflow	

CDEABBAAAAAEBBBBBBDABABABBBBABBABBBBAAABABBBAB	5.43E-09	6.20E-13	9.60E-25	9.80E-13	7
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OWST_OK	LPPPST_OK	LPPFPPT_OK
LPPFPRT_Explosion	PR_Splash	PRFT_Splash
PRBT_Explosion	SME_Explosion	SRAT_Explosion
MFT_Explosion	RCT_Splash	Melt_Cell_OK
No_SPC_Fire	No_CPC_Fire	No_LPPP_Fire
CPC_Covers_Failed	SPC_Covers_Intact	Melt_Covers_Intact
Zone-1_Vent_Failure	LPPP_Breach-No_Vent	OWST_Explosion
LP_Leak	PPT_Explosion	RT_Splash
R_Explosion	qPRFT_Splash	BT_Splash
SMEK_Leak	SRT_Splashy	FT_Explosion
ARCT_Leak	Partial Release	SPC_Fireball
No_CPC_Fireball	LPPP_Fireball	CPC_Covers_Green
SPC_Covers Taupe	Melt_Covers Downsy	Bldg_Collapse
LPPP_No_Vent	OWST_Plasma_Explosion	T_Leak
Explosion	STG_Splash	OPR_Splash
OW_Explosion	LPPPST_Stolen	LT_Splash
LRT_Explosion	WPR_Uncontrolled	

CDEABBAAAAAEBBBBBBBDBBBBBAABABBBBABBABBBBABAABA	2.89E-09	3.30E-13	4.60E-26	2.10E-13	9
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OWST_OK	LPPPST_OK	LPPFPPT_OK
LPPFPRT_Explosion	PR_Splash	PRFT_Splash
PRBT_Explosion	SME_Explosion	SRAT_Explosion
MFT_Explosion	RCT_Splash	Melt_Cell_OK
No_SPC_Fire	No_CPC_Fire	No_LPPP_Fire
CPC_Covers_Intact	SPC_Covers_Intact	Melt_Covers_Intact
Vit_Bldg_Breach-No_Vent	LPPP_Breach-No_Vent	OWST_Tornado
LP_Leak	PPT_Splash	RT_Splash
R_Splash	qPRFT_Splash	BT_Splash
SMEK_Leak	SRT_Splashy	FT_Explosion
ARCT_Leak	Partial Release	SPC_Fireball
No_CPC_Fireball	LPPP_Fireball	CPC_Covers_Green
SPC_Covers Taupe	Melt_Covers Upsy	Bldg_Breach-No_Vent
LPPP_Failure	OWST_Plasma_Explosion	T_Leak
Splash	STG_Splash	OPR_Explosion
OW_Tornado	LPPPST_Ignited	LT_Explosion
LRT_Splash	WPR_Vented	

CDEABBAAAAAEBBBBBBDBBBBBAABABBBBABBABBBBABAABA	8.76E-10	1.00E-13	0.00E+00	0.00E+00	1
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OWST_OK
LPPPRT_Explosion
PRBT_Explosion
MFT_Explosion
No_SPC_Fire
CPC_Covers_Intact
Zone-1_Vent_Failure
LP_Leak
R_Splash
SMEK_Explosion
ARCT_Splash
CPC_Fireball
SPC_Covers_Mauve
LPPP_Failure
Explosion
OW_Explosion
LRT_Explosion

LPPPST_OK
PR_Splash
SME_Explosion
RCT_Splash
No_CPC_Fire
SPC_Covers_Intact
LPPP_Breach-No_Vent
PPT_Splash
qPRFT_Splash
SRT_Explosion
Partial_Release
No_LPPP_Fireball
Melt_Covers_Downsy
OWST_Plasma_Explosion
STG_Splash
LPPPST_Ignited
WPR_Uncontrolled

LPPPPT_OK
PRFT_Splash
SRAT_Explosion
Melt_Cell_OK
No_LPPP_Fire
Melt_Covers_Intact
OWST_Tornado
RT_Explosion
BT_Explosion
FT_Explosion
No_SPC_Fireball
CPC_Covers_Green
Bldg_Breach-No_Vent
T_Leak
OPR_Splash
LT_Splash

APPENDIX 7: TEST 3

User's Manual for BINIAC: A Computer Code To Translate APET Bins (U)

WSRC-TR-94-0112

March 1994

BIN	MEAN	VARIANCE	STD DEV	N
CZEABBAAAAAE BBBABBBBA	0.17E-11	0.94E-23	0.31E-11	34
CDEABBAAAAAE BBBBBA	0.33E-12	0.46E-25	0.21E-12	9
CDEABGADAAACE BBBBBA	0.61E-12	0.00E+00	0.00E+00	1
CDEABBA DBAAE BBBABBBBA	0.59E-11	0.17E-21	0.13E-10	92
CDEABBA DBAAE BBBABCD A	0.10E-11	0.12E-22	0.34E-11	43

END 9 9 9 9

User's Manual for BINIAC: A Computer Code To Translate APET Bins (U)

WSRC-TR-94-0112

March 1994

This APET run consisted of 5 lines,
with a truncation limit of $8.76E-10/\text{yr}$.

Bin	Mean/yr	Mean/hr	Variance	Std Dev	N
CDEABBAADBAAEBBBBABBBBA					
5.17E-08	5.90E-12	1.70E-22	1.30E-11	92	
OWST_OK			PPST_OK		PPPT_OK
PPRT_Explosion			PR_Splash		PRFT_Splash
PRBT_Explosion			SME_Vented		SRAT_Splash
MFT_Explosion			RCT_Splash		Melt_Cell_OK
No_SPC_Fire			No_CPC_Fire		No_LPPP_Fire
CPC_Covers_Failed			SPC_Covers_Intact		Melt_Covers_Intact
Vit_Bldg_Breach-No_Vent			LPPP_Breach-No_Vent		
CDEABBAADBAAEBBBBABBCDA					
1.58E-08	1.80E-12	1.20E-23	3.40E-12	43	
OWST_OK			PPST_OK		PPPT_OK
PPRT_Explosion			PR_Splash		PRFT_Splash
PRBT_Explosion			SME_Vented		SRAT_Splash
MFT_Explosion			RCT_Splash		Melt_Cell_OK
No_SPC_Fire			No_CPC_Fire		No_LPPP_Fire
CPC_Covers_Failed			SPC_Covers_Intact		**ERROR**
Zone-1_Vent_Failure			LPPP_Breach-No_Vent		
CZEABBAAAAAEBBBBABBBBA					
1.49E-08	1.70E-12	9.40E-24	3.10E-12	34	
OWST_OK			**ERROR**		PPPT_OK
PPRT_Explosion			PR_Splash		PRFT_Splash
PRBT_Explosion			SME_Explosion		SRAT_Explosion
MFT_Explosion			RCT_Splash		Melt_Cell_OK
No_SPC_Fire			No_CPC_Fire		No_LPPP_Fire
CPC_Covers_Failed			SPC_Covers_Intact		Melt_Covers_Intact
Vit_Bldg_Breach-No_Vent			LPPP_Breach-No_Vent		
CDEABGADAACEBBBBBBBBBA					
5.34E-09	6.10E-13	0.00E+00	0.00E+00	1	
OWST_OK			PPST_OK		PPPT_OK
PPRT_Explosion			PR_Splash		**ERROR**
PRBT_Explosion			SME_Vented		SRAT_Explosion
MFT_Explosion			RCT_Vented		Melt_Cell_OK
No_SPC_Fire			No_CPC_Fire		No_LPPP_Fire
CPC_Covers_Intact			SPC_Covers_Intact		Melt_Covers_Intact
Vit_Bldg_Breach-No_Vent			LPPP_Breach-No_Vent		
CDEABBAAAAAEBBBBBBBBBA					
2.89E-09	3.30E-13	4.60E-26	2.10E-13	9	
OWST_OK			PPST_OK		PPPT_OK
PPRT_Explosion			PR_Splash		PRFT_Splash
PRBT_Explosion			SME_Explosion		SRAT_Explosion
MFT_Explosion			RCT_Splash		Melt_Cell_OK
No_SPC_Fire			No_CPC_Fire		No_LPPP_Fire
CPC_Covers_Intact			SPC_Covers_Intact		Melt_Covers_Intact
Vit_Bldg_Breach-No_Vent			LPPP_Breach-No_Vent		

DATE

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6 / 23 / 94

END