Survivor’s Guide for Users of the Baseline Validation Test Data

Revision 1, February 1999

By: Steven P. Nowlen
Sandia National Laboratories

1 Introduction

1.1 Overview

The Baseline Validation Test Series was conducted in the fall of 1985 at Factory Mutual Research Corp. (FMRC) facilities under Sandia National Laboratories (SNL) direction and under U.S. Nuclear Regulatory Commission (USNRC) sponsorship. For basic information on the test objectives, the construction and layout of the test enclosure, the placement and nature of the test instrumentation, the various fire sources used in testing, and the actual test matrix refer to NUREG/CR-4681. This report represents the single most general reference currently available for this test series. Additional information specific to the last five tests (tests 21-25) is also available in NUREG/CR-4527, Volume 2. Tests 21-25 were all tests performed as a part of the Cabinet Fire Test Program and involve fires (either gas burners or cable fires) within an electrical panel inside the test enclosure. While nominally a part of the cabinet testing program, full data files for these tests are also included in this data release. For reference, viewable versions of these two reports are provided along with the test data files themselves on the public release CD-ROM.

It is not the purpose of this document to repeat the information from the previously published reports. Rather, the purpose of this document is to identify and discuss issues encountered by SNL and other users in accessing and using the test data. These generally relate to issues impacting the integrity, retrieval, and reliability of the gathered data. We refer to this as the “survivors guide” because it provides information not available in published references that is critical to both retrieving and understanding the test data. Any comments regarding this guide are welcomed and we do anticipate periodic updates to reflect the experiences of all users. This version represents the first update to the original Survivor’s Guide prepare in June 1991.

1.2 Document Format

The format of this document is quite simple. Section 2 provides a description of the data file structure and the data extraction routine that has been provided. Sections 3 and 4 deal with the identified data issues. Section 3 discusses “common issues” that impact a significant number of the individual tests. Most of the issues identified to date fall into this category. Section 4 identifies any specific issues that have been identified as impacting a particular test. Very few of these have been identified to date. Note that for a complete picture of any one test, the user must consider both common and test-specific issues. Section 5 provides other bits of information related to the tests and data release. Appendix A provides a listing of the data channel extraction routine FMREADR5. Appendix B provides the common channel map for the main data files.

1.3 What You Got with the CD-ROM

If you are reading this report, then hopefully you also have a CD-ROM that presents the full data and information release for the Baseline Validation Test Series. This CD-ROM contains three general types of information; documentation, support programs, and actual data.

Documentation is provided in the directory DOCUMENT. It includes this document, the original test report (NUREG/CR-4681), and the relevant cabinet fire test report (NUREG/CR-4527, Volume 2). All three are presented in PDF format for viewing by a program such as Adobe Acrobat Reader, but do not allow for editing of the documents.

Also provided are one FORTRAN program, FMREADR, designed to aid the user in the extraction of data from certain of the data files. This program is in the directory PROGRAMS and includes both the source code and an executable version of the program. Operating instructions are provided in Section 2 below.

There are also a number of data files for each test. These include:

- <u>The primary processed and formatted data report files</u> contain most of the test data after conversion to engineering units. Data is presented in formatted text tables as discussed further below. It is these files that will be the primary source of data for extraction by individual users. The files are located in the directory called "GeneralReport" and each file is named either TEST#RPT.DAT or TST##RPT.DAT where "#" or "##" represents the test number. A program called FMREADR has been provided to assist in the extraction of data from these files (see discussion below).

- <u>Sphere calorimeter derived data files</u> are also provided on the disc. As noted in NUREG/CR-4681, the test instrumentation included both large and small sphere calorimeters located in matched pairs at various locations within the room. From these instruments it is possible to estimate not only the total heat flux at a given location, but also the relative magnitude of the convective and radiative contributions to the total heat flux and the bulk air velocity at each location. The procedure is described by Newman and Hill.[1] These temperature response data were processed by FMRC to generate these files. The resulting derived data are presented in directory "FluxReport" in the form of formatted data tables in files named HFLUX#.DAT. Note that this data release does not include any specific methods or tools for extracting data from these files.

[1] "Assessment of Exposure Fire Hazards to Cable Trays," FMRC, Report No. RC80-T-56, July 1980.

- Processed fire products collector files are contained in the directory “CollectorReport” with each file named COLL#RPT.DAT or CLL##RPT.DAT. The Fire Products Collector is a large collection hood designed for the measurement of fire properties (calorimetry, gas concentration, smoke density, temperature) for large open fires. As discussed below, caution must be exercised in the interpretation of these data due to the fact that not all of the fire products and exhaust gasses were captured by the collector. Note that this data release does not include any specific methods or tools for extracting data from these files. These files are generally quite small and conducive to hand-transcription of desired data.

- The raw unformatted general data files are also provided. For most users these files will be of very limited interest. The files contain the scanned data streams prior to formatting and presentation in the final data reports. These files are not generally intended for direct extraction of test data, but rather, were an intermediate product of the testing and data conversion process. They do, however, present some of the basic information on the time and date of each test, the ambient conditions, the fire source size and location, nominal ventilation rates, and a channel map for each test (the map does not change from test to test). Also available in this file is the information on the data conversion polynomials used to convert the raw data to engineering units. These files are primarily of historical interest only, and will likely be of little use to the user. These files are presented in a directory on the disc called “RawGeneral.” Each file is named “RDTEST#.DAT” where “#” corresponds to the test number.

- The raw unformatted fire products collector data files are contained in a directory named “RawCollector” and each file is named RCTEST#.DAT. The files in “RawCollector” contain simple raw data streams, are not formatted, and will not likely be of interest to most users.

- Heat release rate (HRR) data files for the cabinet fire tests (21-25) are included in the directory “HeatRelease.” The data was generated by digitizing the heat release plots from NUREG/CR-4527. The directory contains six files. Five of the files are individual ASCII data files with the digitized data for each of the five cabinet fire tests. These files are named “T##HRR.DAT.” The first line in each file indicates the total number of digitized data point sets in the file. The remaining lines each represents a (time,HRR) data pair with time in minutes and HRR in kW. The sixth file, “CabTestHRR.XLS,” is a Microsoft Excel spreadsheet file with all five of the data sets imported into a spreadsheet format (version: Excel 97 SR-1). Also included in the Excel file is a column with the integrated total heat release for each test.

1.4 For More Information Contact ...

Comments regarding the data release and information regarding any data issues that arise are encouraged and welcomed. Courtesy copies of any papers or articles that arise from use of the test data would also be appreciated. For more information contact: Steve Nowlen, Mail Stop 0748, PO Box 5800, Sandia National Laboratories, Albuquerque, NM, USA, 87185-0748; Phone (505)845-9850; Fax (505)844-3321; e-mail spnowle@sandia.gov

2 Data File Structure and Channel Extraction

2.1 The Extraction Program FMREADR

Provided with the data files is a Fortran program named FMREADR5.FOR and an executable version of this same program named FMREADR5.EXE. This program is designed to extract the full data stream for a user-defined set of channels from the primary data files. It should run on most any fairly modern computer, and has been successfully run in both true DOS mode, and as a DOS window under either Windows 95 or Windows NT. It has been tested on a number of PC platforms including those using 486, Pentium, Pentium II, and Celeron CPUs.

The source code is provided for users who are simply curious, or who wish to customize the program to their specific needs. The program is relatively straightforward and makes use of only simple looping structures. However, the structure of the data files requires that data be extracted in a very specific order of execution. Hence, the looping structure may initially appear somewhat arbitrary. Rest assured, however, that each command has a specific purpose in the context of the data fire structure. To the extent possible, a once-through, top-down execution was maintained. Extensive comments are included to help the user understand what is being done at each stage of the program. A listing of the source is included as Appendix A to this document.

The program is a very simple interactive program that asks the user for the name of the input data file to be used, the number of channels to be extracted, and the actual channel number(s) to be extracted. The user is then given an option for either file output or output to screen.

If screen output is selected, the data is simply printed to the screen. If file output is selected, the user is asked to enter the output file name, a file is created, and the data is written to that new file. The first line of the file will specify the total number of scans contained in the file, and the individual channels that were extracted. The rest of the lines will simply specify the time of each scan in the first column, and the corresponding data measurements for each channel in the remaining columns.

Note that once the user knows the sequence of inputs needed to run the program, a simple user response input command file can be set up. One need only create an input file (for example READ.BAT) which contains the individual line by line responses one would normally enter from the keyboard during execution of the program. Running the program with the following command:

```
FMREADR5.EXE <READ.BAT
```

instructs the program to read the user responses from the file READ.BAT rather than seeking keyboard input. This is quite handy for repeated extractions.

The output files are in simple ASCII format with the data stripped of all of the header and footer information of the original data files. The data is output as a simple stream of time/data lines from the first to last scan. A given line represents all of the specified channel measurements for a given time scan.

Note that time in the original data files is expressed in the form ‘min:sec’. FMREADR does a conversion of these values and the output file reports time as simple minutes (a decimal value). Times less than zero are pre-fire data, ignition generally occurs at time zero, and positive times represent post-ignition data. The only exception to this is Tests 24 and 25 which used an electrical ignition source (see NUREG/CR-4527, Volume 2 for a description of the time-line for these two tests) so that time of ignition was significantly delayed. In these two tests, time zero is the time that the electrical ignition apparatus was energized.

Also note that the program expects the input data files to have names of a certain form. In particular, the program expects that for Tests 1-9, the fifth character in the file name will be the test number. For Tests 10-25, it expects the fourth and fifth characters in the file name to be the test number. The file name is analyzed to extract the test number. This is critical because it establishes both the total number of scans in the file, and tells the program how many channels are in each file table (13 or 15 as discussed further below). Without this information, the program cannot extract the data. If the program cannot determine the test number, the user will be asked to specify the test number. For more information, see the comments provided in the program listing in Appendix A. It is strongly recommended that the original file names as provided on the data CD be retained by users.

2.2 Overview of the Data File Structure

The full original data files are presented as simple ASCII text files. The files can be opened and viewed with most any text editor, but the user is cautioned that any changes made to the files may render them inaccessible to the provided data extraction routines. Keep in mind that opening a text file with a word processor and then re-saving the file will generally result in various document control characters being inserted into the files. All data is presented in simple engineering units as indicated in the files and in the attached channel list (see Appendix B).

Each file is presented as a series of data tables and sub-tables. Each section of the file represents a printed page from the original data files generated by FMRC with the associated headers and footers on each page. We will refer to each page of the original file as a “sub-table.” When we refer to a “table” from the data file, we mean a set of sub-tables or pages that represents the full data stream for a specific set of data channels. Depending on the total number of scans, a single data table may contain several sub-tables (pages).

The table structure in each file follows a well defined and consistent pattern. Note, however, that there are two distinct patterns, one characteristic of the early tests (Tests 1-15) and one characteristic of the later tests (Tests 16-25). So long as you use the provided channel extraction program, FMREADR, explicit knowledge of the internal file structure is not needed. However, if you wish to devise your own data extraction routines, or modify the provided routine, then you will need to understand the file structure. The general characteristics of the files are as follows:

S The files are made up of formatted ASCII character tables where each table presents the test data for a given set of channels. Each table is in turn divided into sub-tables with each sub-table representing a printed page of data in the original data files. The sub-table structure is discussed further below.

S The number of channels presented in each table is generally 13 for Tests 1-15, and 15 for Tests 16-25. That is, the first table in the file for Test 1 would cover channels 1-13, the second table would represent channels 14-26, and so on. The one exception to this rule is the final table where there are not a full set of channels left to present. In this final table the remaining channels are presented. Since there are a total of 306 channels in each data file, the final table for Tests 1-15 will hold 7 channels, and for Tests 15-25, the final table holds 6 channels.

S The total number of time/data scans is different for each test. The following table provides the full scan count for each test. Note that as discussed in Section 3.1 below, some tests recorded two “time zero” scans. The scan count presented here is the full scan count (it includes both of the “time zero” scans for the tests impacted by this issue).

Total number of Time/Data scans for each test.												
Test:	1	2	3	4	5	6	7	8	9	10	11	12
Scans:	198	279	139	280	197	233	219	254	255	230	308	224
13	14	15	16	17	18	19	20	21	22	23	24	25
224	266	362	242	374	278	218	170	386	326	541	721	685

S The data table for each channel set (e.g., channels 1-13) is subdivided into a number of sub-tables. Each sub-table represents a printed page in the original data files. Each page presents up to 40 time/data scans for the given set of channels. Thus, the number of sub-tables in each table will depend on the total number of scans. Full pages of 40 scans are presented until one of two criteria are reached:

  S If the total number of time/data scans is less than 380, then the last sub-table will simply pick up whatever scans are left after having filled as many full 40-scan pages as possible. This applies to Tests 1-20 and Test 22.

  S If the total number of time/data scans is greater than 380, then the data tables have been split. This split was simply an artifact of the FMRC data recording system but does complicate the extraction process. The first 380 scans for all channel sets are presented in tables at the top of the file, and any remaining scans are presented separately in similar tables at the end of the file. This applies to Tests 21 and 23-25. To clarify, at the top of the file each table will cover 15 channels, and will have 9 sub-tables of 40 scans each, plus a single sub-table of 20 scans for a total of 380 scans. This will be repeated for each group of 15 channels. Only after the first 380 scans are reported for all channels does the file return to the first set of channels (1-15) and present the remaining time/data scans until all data is presented. The format of this second section follows the same pattern with sub-tables of 40 scans and a final sub-table that picks up any remaining scans after as many full pages as possible of 40 scans each have been filled.

- At the end of each table representing a set of 13 or 15 channels, that is, after all of the individual time/data scans have been presented, the files also present the maximum value recorded on each channel and the time that value was recorded.

- The table and sub-table structure is consistent for each of the 25 data files. The sequence of blank, header and data entry lines always follows a consistent pattern. The pattern can be discerned by careful examination of the extraction routine FMREADR, but is too complex to describe in simple terms here. The program FMREADR simply keeps track of where it is in a given data file by counting the number of read statements made so far (recall that each READ advances the file pointer by one line). The program thereby knows whether the next line in the file is needed as data, is simply a header/footer line with no useful information, or contains a list of channel numbers that may need to be deciphered. That is, certain of the header lines in each table contain the channel numbers for the current table. As each table is encountered, the channel numbers are deciphered and compared to the desired channel numbers to see if that table contains desired data. If it does, then the data is extracted from each data line in the table. If a line contains desired data, the line is read in and the desired channel values extracted for later output. Otherwise, a “dummy” READ simply by-passes and counts those lines that do not contain useful information.

3 Common Issues

3.1 Time Zero Double Logging

This issue impacts tests 1, 6, 8, 14-17, and 20-22. Tests 2-5, 7, 9-13, 18, and 23-25 are not impacted. During the course of logging ten of the tests, for an unknown reason two data streams for time zero were recorded. This can disrupt data processing programs if the user is calculating the time between data scans or if a data channel's time rate of change (differential) is being estimated. In other circumstances, this issue should cause no problems.

It would appear that the data logging logic effectively logged a time "minus zero" and a time "plus zero". The actual fires should be considered to have been ignited coincident with the second logged time zero data set in the impacted cases. As a general rule, data was recorded at five second intervals, hence, the maximum offset resulting from this practice would be five seconds, a very small time interval in the context of these tests. At most, this introduces an uncertainty of about 5 seconds in the actual time of ignition for the impacted tests.

For normal data plotting no actions are required to actively address this issue. However, if the user is calculating time intervals between data scans for the purposes of estimating the rate of change of a data channel reading, then it is recommended that the first of the two zero time scans be discarded. This must be done manually or by user software because the SNL supplied programs do not currently address this issue.

As a warning to the user, the raw data files retain both time zero scans for the impacted tests. Any attempts to remove these scans from the original data files will render the files unaccessible to the SNL data extraction routines because this would disrupt the very well-defined file structure that allows the extraction routine to work.

3.2 Ventilation Issues

There are ventilation issues that impact, to varying degrees, each of the 25 tests run in this test series. These issues are discussed below and include accuracy of the nominal ventilation rates cited in the test reports, leakage from the enclosure during testing, problems with some of the ventilation flow rate instrumentation in some tests, and interpretation of data from the fire products collector.

3.2.1 Nominal Ventilation Rates

This issue impacts each of the 25 tests run. In the test matrix of NUREG/CR-4681 the nominal ventilation rate of the test enclosure during each test is identified and ranged from 1 to 10 Air Changes per Hour (ACH). However, these values are only the nominal ventilation rates and should be viewed as rough estimates only. The difference between nominal and actual ventilation rates appears to be as high as 20% based on the tests examined to date. For example, in Test 1 the nominal ventilation rate is cited as 10 ACH whereas the actual ventilation rate was approximately 12.5 ACH. The actual ventilation rate in each test was measured and is reported. The measured values should be used whenever possible in lieu of the nominal ventilation rate values. In particular, the measure inlet flow rate is considered the most reliable indication of the actual ventilation flow (this is discussed further in Section 3.2.2).

3.2.2 Leakage

This issue impacts each of the 25 tests run. During testing significant leakage of air from the test enclosure was noted. The ventilation system design pumped air into the room resulting in a room pressure slightly higher than ambient (the pressure in the room is measured and reported). Due to this positive pressure, there was leakage from the room during testing. The outlet ventilation rate measured and reported in the data files only reflects flow through the exhaust duct. Any leakage from the room would bypass this duct and would not be measured. For this reason, the measured outlet ventilation rates will typically be lower than the measured inlet ventilation rate. It would appear that the typical outlet duct flow was only about 70-80% of the inlet flow implying significant leakage.

During testing leakage did occur, in particular, around the double doors that provided access to the room (the doors were closed during testing, but leakage around the edges of each door was noted), from the corners of the room where the walls met, at the wall-to-floor interface, and along the wall-to-ceiling interface. In some cases leakage was also observed around the edges of the inlet ventilation ducts which penetrated through the ceiling of the test enclosure in six locations.

For this reason the reported inlet ventilation rate is considered a more reliable indication of actual enclosure ventilation rates than is the reported outlet ventilation rate. It was thought that the rate of leakage might be easily estimated as a constant fraction of the inlet or outlet flow, or as a simple function of the room pressure. Hence, some efforts were undertaken to determine if the ratio of the outlet to inlet ventilation flow was constant, or perhaps a simple function of the room pressure. These efforts showed no consistency in either the outlet/inlet ratio, nor could a clear relationship between pressure and leakage be established. Two possible explanations for this are (1) that the doorway leakage varied from test to test, and/or (2) the leakage from around the ventilation inlet ports was not consistent from test to test.

If an estimate of the total outflow rate is needed, it is recommended that a full mass balance on the room be performed. This is not especially difficult given modern computing capabilities. The mass outlet flow rate can be estimated based on the difference between the mass inlet flow rate and rate of change of mass in the room. The room "storage" term can be estimated using the measured internal room temperatures at various locations. A fixed room volume is assigned to each measurement probe, and the mass of air at each time step can be estimated based on simple PV=mRT relations. SNL has utilized successfully this approach in various analyses.

3.2.3 General Reliability of Exhaust Gas Venting Rate Data

This issue impacts Tests 4, 6-8, 14-16, and 18-25. Tests 1-3, 5, 9-13, and 17 appear unaffected. In several of the tests, the data stream for the outlet flow rate (channel 199) is obviously in error. In these tests, the outlet ventilation rate was recorded as higher than the inlet rate, a condition that would not be expected except for a limited time under severed fire conditions (when there was a high rate of volumetric expansion active). In general, the outlet ventilation rate follows the anticipated trend of the ventilation system, but the magnitude of the readings appears far too high.

The inlet ventilation rates are considered more reliable and less susceptible to error than the outlet ventilation rate. This is because the nominal ventilation rate was verified during the pre-ignition stage using an independent instrument (not a recording instrument, indication only). Further, the inlet air stream was clean ambient air. In contrast, the exhaust stream ventilation rate was not verified, and the exhaust stream was made up of smoke laden air.

The ventilation duct velocity was measured at both the inlet and outlet based on the differential pressure across a orifice plate in each the duct. In the case of the exhaust gas stream, it is likely that one or both of the tubes leading to the differential pressure gauge may have been blocked either by soot or by pinching or may have become disconnected. In some few cases it does appear that both the inlet and outlet ventilation rate data suffered failure during testing. This is discussed further below as it impacts specific tests.

3.2.4 The Fire Products Collector Data

This issue impacts all 25 tests. The FMRC test facility includes a very large fire products collector hood that is used routinely in open burn tests to provide calorimetry and fire products characterization (gas concentrations, temperature, smoke density, etc.). In these tests, the enclosure ventilation exhaust duct was routed to the fire products collector, and data from the collector was routinely logged. Caution must be exercised in using the collector data. Issues impacting the data include:

- The enclosure exhaust gas represents only a very small fraction of the total flow through the fire products collector. The exhaust gas stream was diluted significantly by air drawn into the collector from the general enclosure. Hence, the actual gas concentration values, smoke density, and temperature data all represent a mixture of ambient and enclosure gas streams.

- Due mostly to the very large volume of the test enclosure, there is a significant lag time between the fire behaviors within the room and sensing of the associated effects at the fire products collector.

- Not all of the fire products from the test fires were actually collected. As discussed in Section 3.2.2 above, there was significant leakage of air from the room during testing so that a significant fraction of the total fire products by-passed the collector. The leakage flow would not be captured by the fire products collector.

Also note that no specific methods or tools for extracting data from these collector data files have been provided by SNL. However, each of these files is quite small and contains a very limited amount of data. These files are in the directory COLLECTR, and data from these files can be readily extracted manually.

3.3 Enclosure Surface Heat Flux Data

This issue impacts each of the 25 tests. Included in the test instrumentation were a number of surface heat flux gauges mounted on the walls and ceiling of the enclosure. It is clear that the data from all of the surface heat flux probes as reported in the main data reports is in error. This problem came to light when we attempted to use this data to estimate the relative amount of heat being absorbed by the surfaces. All of the heat flux gauges indicate virtually zero heat flux to the walls. It would appear that this was a problem that occurred when the raw test data was converted to engineering units. It may be possible to recover the lost data from the original raw data files, although no such attempts have yet been made. All of the enclosure surface heat flux data should be considered unreliable.

Note that this does not impact the surface temperature response data. Indeed, local heat fluxes for the enclosure walls have been successfully estimated based on the surface response using a simple one-dimensional finite difference model to approximate the transient heat conduction behavior.

3.5 Wall Properties

This "issue" impacts all 25 tests. This discussion is not an "issue" in the same sense of other issues identified herein, but rather, is intended to convey SNL's experience with the analysis of wall/ceiling response and the implications for the material properties that one might wish to assume for the enclosure surfaces.

The walls and ceiling of the test enclosure were constructed of 1-inch (2.54 cm) thick Marinite panels. Marinite is a calcium-silicate mineral board material manufactured by Manville. The manufacturer reports a nominal density of 737 kg/m^3 and reports nominal material properties for thermal conductivity and specific heat that are functions of temperature as documented in the table below. However, when attempts were made to model the wall temperature response the results of the analysis using the nominal material properties were less than satisfactory.

In particular, a one-dimensional finite difference model was implemented by SNL. The internal surface was modeled as a known temperature boundary condition driven by the measured test data. The outer surface was modeled as insulated (no heat loss). The results were validated by comparison of the predicted and measured outside surface temperature for several locations with matched inner/outer surface temperature data pairs. Use of the nominal material properties resulted in outside surface temperature response predictions that were uniformly and substantially lower than the measured response. Nominally, this would be indicative of a thermal conductivity higher than reported by the manufacturer, but some explanation for this behavior was sought.

Nominal Marinite Material Properties as Reported by the Manufacturer, and SNL curve fits assuming linear behavior with temperature.					
	Thermal Conductivity			Specific Heat	
	T (EK)	k (W/mEK)		T (K)	C_p (J/kgEK)
	450	0.117		366	1172
	477	0.118		477	1255
	533	0.121		589	1339
	589	0.125		700	1423
	645	0.130			
	700	0.136			
SNL Fits:	$k=0.0819+(7.525E-5)T_K$			$C_p=897+(0.751)T_K$	

Ultimately, it was found that the manufacturer does cite a range of material density values of 700 to 1000 kg/m^3 in the associated Material Safety Data Sheet (MSDS). The originally assumed value of 737 kg/m^3 was found to be just a nominal value reported in manufacturer sales literature. Hence, SNL chose to "experiment" with the assumed property values to obtain a better fit between the predictions and the data.

In general, the specific heat of a material is largely unaffected by density being a mass-related property. Hence, SNL assumed that the nominal specific heat values remained valid. Using the curve fit, a value of 1.16 kJ/kgEK was assumed as a nominal room-temperature specific heat value.

However, thermal conductivity is known to vary with material density with a higher density material having higher thermal conductivity than a lower density version of the same material. Hence, to explore the impact of material properties, SNL assumed that the panels used in construction were at the upper end of the manufacturers density range. Hence, a density of 1000 kg/m^3 was assumed.

In the transient thermal model the thermal parameter of interest is actually the thermal diffusivity. This parameter was adjusted to obtain the best possible fit between predictions and data for a number of locations in several tests. The best results were obtained assuming a thermal diffusivity of 2.0E-7 m^2/s. These results were, indeed, quite good with the predictions and data matching quite well over a range of test conditions and locations. Assuming the above stated specific heat and density values, this implies a thermal conductivity of approximately 0.23 W/m EK.

Hence, it is SNL's recommendation that for the analysis of the test enclosure walls and ceiling, the following material properties be assumed:

Thickness = 2.54 cm (1 in.)
Thermal Conductivity = 0.23 W/m EK
Specific Heat = 1.16 kJ/kg EK
Density = 1000 kg/m^3
Thermal Diffusivity = 2.0×10^{-7} m^2/s

The floor of the test enclosure was the concrete floor slab of the FMRC test facility. SNL has no specific information regarding the thermal properties of the floor.

4 Test Specific Data Issues

4.1 Test 1

No test specific issues have been identified for Test 1. It might be noted, however, the Tests 1 and 2 are virtually identical in setup. The only significant difference is a slightly higher ventilation rate in Test 1 (about 12.5 ACH) as compared to Test 2 (about 10 ACH).

4.2 Test 2

No test specific issues have been identified for Test 2. See note in Section 4.1 regarding similarity of Tests 1 and 2.

4.3 Test 3

4.3.1 Wall Integrity Breached

Test 3 involved a 2 MW fire with a high ventilation rate (10 air changes per hour). During the course of this test the high ventilation rate combined with the heat-induced expansion of air in the room acted to significantly pressurize the test enclosure. At approximately 5 minutes into the test, one entire wall of the test enclosure shifted at the wall/floor interface. This opened a small gap in the lower portions of two of the four room corners. This appeared to have relatively little impact on the fire or on the room environment but did act to relieve the pressure buildup within the room. It was due to this experience that subsequent tests involving fires of significant size were performed at no more that 8 room air changes per hour (ACH) ventilation rates.

4.4 Test 4

No test specific issues have been identified for Test 4.

4.5 Test 5

No test specific issues have been identified for Test 5.

4.6 Test 6

No test specific issues have been identified for Test 6.

4.7 Test 7

No test specific issues have been identified for Test 7.

4.8 Test 8

No test specific issues have been identified for Test 8.

4.9 Test 9

No test specific issues have been identified for Test 9.

4.10 Test 10

No test specific issues have been identified for Test 10.

4.11 Test 11

No test specific issues have been identified for Test 11.

4.12 Test 12

No test specific issues have been identified for Test 12.

4.13 Test 13

No test specific issues have been identified for Test 13.

4.14 Test 14

No test specific issues have been identified for Test 14.

4.15 Test 15

No test specific issues have been identified for Test 15.

4.16 Test 16

No test specific issues have been identified for Test 16.

4.17 Test 17

No test specific issues have been identified for Test 17.

4.18 Test 18

No test specific issues have been identified for Test 18.

4.19 Test 19

No test specific issues have been identified for Test 19.

4.20 Test 20

No test specific issues have been identified for Test 20.

4.21 Test 21

4.21.1 Heat Release Rate

The test fire was intended to follow a prescribed transient profile as discussed in NUREG/CR-4527, V2 and in NUREG/CR-4681. However, it became apparent after initial processing of the test data, that the fire peak intensity was not maintained for the full test period. This was later attributed to initial depletion of the gas supply tanks and to icing of the control valves. A plot of the actual versus intended heat release rate profile for this fire is available in NUREG/CR-4527, V2. Digitized time/HRR data pairs were generated by SNL based on the actual fire HRR profile and have been provided through data files on the CDROM in the directory "HeatRelease."

4.22 Test 22

4.22.1 Fire Heat Release Rate

During Test 22 it had been intended that the propylene burner would be maintained at the full intended intensity of 1 MW for several minutes after the initial six minute transient period. However, due to problems with the gas supply, this could not be accomplished. In fact, after reaching peak intensity, the fire immediately began to decrease in intensity. This was caused by low fuel level in the fuel tanks and by icing in the fuel control valves.

SNL has calculated the actual fire heat release rate based on oxygen consumption calorimetry using a method discussed in NUREG/CR-4681. The actual fire HRR profile has been presented in NUREG/CR-4527, V2. The actual HRR profile has since been digitized. The CDROM includes data files with the time/HRR data pairs from digitizing of the actual test profile (see directory HeatRelease on the CDROM).

4.23 Test 23

4.23.1 Heat Release Rate and Ignition Time

Test 23 was an uncontrolled cable fire. A plot of the actual heat release rate profile for this fire is available in NUREG/CR-4527, V2. Digitized time/HRR data pairs were generated by SNL from these original plots and have been provided through data files on the CDROM in the directory "HeatRelease." Test 23 was ignited by a simulated transient fire source at 'time zero'.

4.24 Test 24

4.24.1 Heat Release Rate

Test 24 was an uncontrolled cable fire. A plot of the heat release rate profile for this fire is available in NUREG/CR-4527, V2. Digitized time/HRR data pairs were generated by SNL from these original plots and have been provided through data files on the CDROM in the directory "HeatRelease."

4.24.2 Ignition Time

Test 24 involved a simulated high resistance terminal connection as the ignition source. This electrical ignition apparatus was first energized at 'time zero' as recorded in the data files. The first wisps of smoke were noted by an observer viewing the panel with binoculars from outside the test enclosure at 10:30 (min:sec). The first open flaming was observed at 15:20. Hence, the time of actual ignition is 15:20 as recorded in the data files. In this test, the initial fire started by the electrical source was quite weak and grew more slowly than had been observed in other similar tests by SNL. The fire began to spread significantly about 4 minutes after the first open flaming was observed. Significant heat release was not observed until approximately 20 minutes.

4.24.3 Problems with Ventilation Data

In tests 24 and 25 (the last two tests in the series) it is apparent that the ventilation system flow rate measurement probes suffered some form of failure. From the behavior of the data, it would appear that the signal wires were subject to intermittent shorting problems. This is especially obvious in the data from Test 24, but may also have compromised the data from Test 25 as well (see discussion below). The inlet duct probe in Test 24 shows far more inconsistent behavior than had been observed in earlier tests. The data fluctuates much more widely than had been observed in earlier tests.

Inspection of the pressure probes used to measure the ventilation rate after the test series was completed showed that the pressure probes themselves were still operational and within the manufacturer specified calibration range. Hence, it is suspected that the power/signal wires suffered either mechanical or thermal damage prior to this test. These wires were rather long and did pass up over the top of the test enclosure. Damage may have led to an intermittent shorting problem.

Note that in Test 24 there is a prolonged pre-ignition period due to the use of the electrical ignition source in this cabinet fire test. Examination of the data appears to show an inlet ventilation rate averaging about 2 Air Changes per Hour (ACH). This is slightly above the nominal set ventilation rate of 1 ACH. Most tests did run with a ventilation rate slightly higher than the nominal desired value. Also, the fluctuations in the data were generally more pronounced at lower ventilation rates than they were at higher rates, an artifact of the pressure probes used in testing. Hence, the nominal average inlet ventilation rate for this test may be accurate, but should be viewed with some scepticism. The outlet ventilation rate data is clearly bad.

For general purposes, it is recommended that an inlet ventilation rate of approximately 2 ACH be assumed for this test. This value must be considered uncertain, however. The likely range of uncertainty might place the actual value somewhere between 1.5 and 2.5 ACH.

4.25 Test 25

4.25.1 Heat Release Rate

Test 25 was an uncontrolled cable fire. A plot of the heat release rate profile for this fire is available in NUREG/CR-4527, V2. Digitized time/HRR data pairs were generated by SNL from these original plots and have been provided through data files on the CDROM in the directory "HeatRelease."

4.25.2 Ignition Time

As with Test 24, Test 25 involved and electrical ignition source. The actual time of fire ignition was approximately 16 minutes as recorded in the data files. Significant heat release was not observed until approximately 17 minutes.

4.25.2 Problems with Ventilation Data

As noted in Section 4.24.1 above, it would appear that the ventilation rate data probes in Test 24 suffered some type of failure, possible a failure in the power/signal lead wires. Hence, the ventilation rate data in Test 25 is also highly suspect. The desired ventilation rate during this test was 8 ACH. The ventilation data appear to indicate ventilation rates of about 15-20 ACH.

Because of the other problems with the ventilation rate data that were experienced, one must consider these data suspect for Test 25. However, it is interesting to note that the inlet and outlet probes are cross-consistent with each other. That is, in certain other tests it is obvious that the outlet data was bad, whereas the inlet data was as expected. In Test 25 both the inlet and outlet data are in the 15-20 ACH range, the two values appear to track major fluctuations consistently, and the inlet rate is consistently above the outlet rate as one should expect (due to leakage). However, the indicated rate is approximately twice the desired nominal ventilation rate of 8 ACH called for in the test plan. Hence, the actual ventilation rate was during Test 25 must be considered uncertain.

It can be safely concluded that the ventilation rate was at least 8 ACH given that the ventilation system was set manually prior to the test. Indeed, because most tests ran slightly higher than the desired nominal rates, it is safe to assume the actual ventilation rate may have been as high as 10 ACH. Given the consistency of the inlet and outlet data, one cannot fully dismiss the possibility that the ventilation rate was indeed greater than 15 ACH. This, however, is considered unlikely given the other problems that were encountered in the ventilation data. SNLs recommendation is to assume a ventilation rate for Test 25 of 8-10 ACH.

5 Other Information of Importance

The information contained in this data release is fully public. Neither SNL nor the USNRC nor FMRC has any proprietary interest in the data. All information contained in this release is unclassified and is categorized as "General Technical Data - Available" (GTDA) per U.S. export control laws and requirements.

Distribution of the data is currently made free of charge to any interested party. Any party wishing access to the data should contact SNL as indicated in Section 1 above. It is preferred that users obtain the data directly from SNL as it is our intent to keep track of data users informally so that updates to this document can be distributed to all interested parties. However, this is not by any means a legal requirement, simply a request.

Users are asked to appropriately acknowledge the source of the data when it is used in support of other published works. An appropriate citation of NUREG/CR-4681 will serve this purpose.[2]

Users are also asked to provide courtesy copies of any publications (to the contact sited in Section 1 above) that make significant use of the data contained in this release. Again, this is by no means a requirement, simply a request. As the original authors of the study, we have a natural curiosity to follow works that derive from this effort.

Any new issues identified by users should be communicated to SNL as indicated in Section 1 above. These will be communicated to other users, and as appropriate, updates to this document may be generated to cover these issues.

---

[2] Citation as follows: S. P. Nowlen, *Enclosure Environment Characterization Testing for the Base Line Validation of Computer Fire Simulation Codes,* NUREG/CR-4681, SAND86-1296, Sandia National Laboratories, Albuquerque, New Mexico, USA, March, 1987.

6. Acknowledgments

As noted in NUREG/CR-4681, the tests at FMRC were executed by the outstanding FMRC staff in particular including Jeff Newman and John Hill. I again thank FMRC for their help in the performance of these tests. Since that time there have been many individuals who have been supportive of SNL's efforts to follow through with full public release of the test data. In particular, the author acknowledges the contribution of Prof. Fred Mowrer of the University of Maryland and his long-standing support of our efforts in this regard. In addition to his overall support, Fred worked with us in the earlier partial data release of Tests 3, 5 and 21 in 1991, and also acted as our "guinea pig" testing out the data extraction routines. Fred has been a long-term advocate of full public release of the data, and for this we thank him. Finally, we thank both Nathan Siu and H. W. 'Roy' Woods of the USNRC for their support of our efforts to release this data set. The work involved was non-trivial, and Nathan and Roy provided the direct support needed to finalize this release.

Appendix B: Program Listing for FMREADR5.FOR

```
      PROGRAM FMREADR5
      INTEGER MIN,SEC,CHANS(15),ECHANS(50),SCANS,NCHANS
     1 ,FLAG(15),SFL(8),SCANFIL(25),NTOT,NBLKFIL(25)
     2 ,SECOND
      REAL DATA(50,750),TIME(750),DUM1
      CHARACTER*40 FNAME
      CHARACTER*10 ALPHA,SIGN
      CHARACTER*8 DUMMY(15)
C
C               STEVE NOWLEN
C               SANDIA NATIONAL LABORATORIES
C               DIVISION 6413
C               PO BOX 5800, MAIL STOP 0748
C               ALBUQUERQUE, NEW MEXICO, USA, 87185
C                  PHONE: (505)845-9850
C                  E-MAIL:  spnowle@sandia.gov
C
C               Revision history:
C
C               Revision 0: 1985 - original program developed in conjunction
C                 with the test program to support extraction of the data
C                 from the FMRC data files.  The original program was
C                 written for use on a VAX mainframe computer system with
C                 the data files read from ANSI format 9-track tapes.
C
C               Revision 1: August 5, 1998 - program rewritten to
C                 compile on PC / FORTRAN 90 platform -
C                 This required some restructuring of the program
C                 read and write statements and the file open statement.
C                 Some simplification of file specification setup also.
C
C               Revison 2: August 6, 1998: added scan count for test 13
C
C               Revisons 3-5: Sept.1998-Feb.1999: during this time, the program
C                 was refined and revised a number of times in anticipation of
C                 the first full public release of the data, and potential
C                 wide-spread use of the program.  Attempts were made to
address
C                 various user-interface and platform issues. The file
structure
C                 information was expanded to include scan counts for all of
the
C                 fire tests. We also worked on refinement of output structure
C                 and output formatting issues, generally cleaned up the code,
C                 and tested it against all files. Version 5 is the version
C                 distributed with the first official release of the full set
C                 of data files.
C
C               THIS ROUTINE IS INTENDED FOR USE
C               IN THE EXTRACTION OF PARTICULAR DATA CHANNELS
C               FROM GENERAL BASE LINE VALIDATION ENCLOSURE FIRE
C               TEST DATA FILES.  THESE FILES WILL
C               HAVE NAMES SUCH AS  "TEST1RPT.DAT"  AND HOLD
C               THE DATA IN BLOCKS OF (GENERALLY) 13 CHANNELS.
```

```
C               THESE LARGER DATA BLOCK ARE FURTHER DIVIDED INTO
C               SUBLOCKS OF 40 (LESS FOR LAST SUB BLOCK) SCANS EACH.
C
C                      NOTE: DEFAULT PROGRAM SPECIFICATIONS ASSUME
C                      THAT THE DATA FILE WILL BE NAMED "TEST#RPT.DAT"
C                      OR "TST##RPT.DAT".  AS LONG AS A NAME OF THIS FORM
C                      IS USED, THE ROUTINE WILL FIGURE OUT WHICH TEST
C                      IS BEING EVALUATED, AND WILL, GENERALLY, HAVE
C                      AVAILABLE THE INFORMATION NEEDED TO EXTRACT DATA
C                      CHANNELS.
C
C                      THIS ROUTINE IS DESIGNED TO BE AN INTERACTIVE
C                      PROCEDURE WITH USER KEYBOARD INPUT REQUESTED AS
C                      NEEDED.  AN OUTPUT FILE WITH A NAME SPECIFIED BY
C                      THE USER WILL BE GENERATED IN THE CURRENT DIRECTORY.
C
C     FILE FORMAT SPECIFICATION INFORMATION IS CONTAINED
C     IN TWO DATA STRINGS AS FOLLOWS:
C           SCANFIL = TOTAL NUMBER OF TIME/DATA SCANS FOR EACH TEST
      DATA SCANFIL/198,279,139,280,197,233,219,254,255,230
     1 ,308,224,224,266,362,242,374,278,218,170
     2 ,386,326,541,721,685/
C           NBLKFIL = NUMBER OF CHANNELS IN EACH BLOCK; either 13 or 15.
C             Recall that the files are basically pages and pages of
C             data in formatted tables.  This array tells the program
C             the number of data (channel) columns in each table (not
C             counting the first column that is always time)
      DATA NBLKFIL/13,13,13,13,13,13,13,13,13,13,13,13,13
     1     ,13,13,15,15,15,15,15,15,15,15,15,15/
C
C     User initial Input/output:
      WRITE (*,990)
 990  FORMAT (' This program will extract specified channels from',/,
     2' Base Line Validation Fire Test data files.  The program',/,
     3' will generally recognize the specified files.  However, if',/,
     4' it is unable to extract a recognized test number from the',/,
     5' file name specified the user will be querried for the file',/,
     6' format information needed.  File name formats which will',/,
     7' be recognized by the program are as follows:',/,
     8'            TEST#RPT.DAT     or     TST##RPT.DAT',/,
     9' the critical factor being the location of the numbers.',/)
C     0' The data file must be in the current working directory!!',/)
C     Begin input querys:
      WRITE (*,1000)
 1000 FORMAT (' ENTER NAME OF FILE TO BE READ',/)
      READ (*,2039)FNAME
 2039 FORMAT (A40)
C     We extract the test number by picking out the
C     two integers in the middle of the file name,
C     and converting from ASCII characters to numbers.
C     (This is why file name is so important)
      NUMTEST=0
      IF ((FNAME(1:3).EQ.'TES').OR.(FNAME(1:3).EQ.'tes')) THEN
C       if filename starts "TES" then may be any known file
        NUMTEST=ICHAR(FNAME(5:5))-48
        IF ((FNAME(4:4).NE.'T').AND.(FNAME(4:4).NE.'t')) THEN
          NUMTEST=NUMTEST+10*(ICHAR(FNAME(4:4))-48)
```

```
        ENDIF
      ELSE IF ((FNAME(1:3).EQ.'TST').OR.(FNAME(1:3).EQ.'tst')) THEN
C       if filename starts "TST" then 2-digit for sure:
        NUMTEST=ICHAR(FNAME(5:5))-48+10*(ICHAR(FNAME(4:4))-48)
      ENDIF
C       check for a valid test number and get one if
C       the above did not give one
      IF ((NUMTEST.LT.1).OR.(NUMTEST.GT.25)) THEN
        NUMTEST=0
        WRITE (*,1105)
 1105   FORMAT (' Test file not recognized as an expected',/,
     1    ' file name, need to know test number')
        WRITE (*,991)
  991   FORMAT (' What is the test number (1-25)?')
        READ (*,2001)NUMTEST
 2001   FORMAT (I5)
      ELSE
        WRITE (*,1100)NUMTEST
 1100   FORMAT (' File recognixed as test #',I3)
      ENDIF
C     If we still don't have a valid test number, then
C     might as well quit because program will crash anyway
      IF ((NUMTEST.LT.1).OR.(NUMTEST.GT.25)) THEN
        WRITE (*,1101)
 1101   FORMAT (' Invalid test number, terminating!!!')
        STOP
      ENDIF
C     From here on we assume we have a valid test number
C     to work with and go accordingly!
C     The following is a generic input format statement used below:
 2009 FORMAT (A20)
C     Given a valid test number, the total number of channels
C     and the channels per block are known for all files:
      NTOT=306
      NROW=NBLKFIL(NUMTEST)
      SCANS=SCANFIL(NUMTEST)
C     query the user for the type of processing desired:
      WRITE (*,1002)
 1002 FORMAT (' How many channels to extract (50 MAX)?',/)
      READ (*,2001)NCHANS
      WRITE (*,1003)
 1003 FORMAT (' Enter channel list - separate with commas:',/)
      READ (*,2002)(ECHANS(I),I=1,NCHANS)
 2002 FORMAT (50I5)
C     initialize the various block/loop counters
      NBLK=0
      IOFF=0
      SECOND=0
C     Open the data file:
      OPEN (UNIT=1,FILE=FNAME,STATUS='OLD',ACTION='READ')
C     Initialize the main loop counter:
      KOUNT1=0
C
C              *********** TOP OF MAIN LOOP ************
C              WE RETURN HERE WHENEVER WE GO TO A NEW BLOCK OF
C              DATA CHANNEL NUMBERS (I.E. AFTER EACH "SCANS"
C              NUMBER OF TIME/DATA READS) UNTIL ALL CHANNELS
```

```
C               TO BE EXTRACTED ARE ACCOUNTED FOR.
C
C      line 5 is a entry point used only for the second pass at files
C      with more than 380 scans.  These are special cases as the
C      channel blocks are split into two parts. For this case we do
C      need to reset the inner loop counters:
 5     CONTINUE
C        initialize inner loop counters
         NBLK=0
C        kount1 counts to see if we have accounted for all channels
C        to be extracted. When KOUNT1.EQ.NCHANS we are done:
         KOUNT1=0
C      line 10 is the general loop top entry point for routine block
C      reads:
 10    CONTINUE
C        inititalize the counter to track the number or time/data
C        reads performed so far for the current block of channels
C        when KOUNT2.EQ.SCANS we have completed a channel block.
C        IOFF is either 0 or 380:
         KOUNT2=IOFF
C        We increment the block counter now to keep track of the
C        number of blocks processed so far.  The last block needs
C        special treatment so we need to know when we hit it.
         NBLK=NBLK+1
C        Check now for reaching last block and reset row length if there
C               (THE LAST DATA BLOCK IS NOT FULL, BUT RATHER, HAS A REDUCED
C               NUMBER OF COLUMNS REPRESENTING THE LAST FEW DATA CHANNELS)
         IF ((NBLK*NROW).GT.NTOT) THEN
           LENROW=NROW-((NBLK*NROW)-NTOT)
         ELSE
           LENROW=NROW
         ENDIF
C        skip the first/next 8 lines of in the file (this is the top
C        part of the table header and gets us to the line with the
C        channel numbers in it):
         DO 20 K=1,8
           READ (1,2004) ALPHA
 2004      FORMAT (A1)
 20      CONTINUE
C        Read off the channel number for the current block:
         READ (1,2005) (CHANS(I),I=1,LENROW)
 2005    FORMAT (15X,I3,14(5X,I3))
C        Initialize a flag array so we can mark the desired channels:
         DO 30 K=1,LENROW
           FLAG(K)=0
 30      CONTINUE
C        Now we look for channels in this block that are to be extracted:
         DO 40 K=1,LENROW
           DO 40 J=1,NCHANS
             IF (CHANS(K).EQ.ECHANS(J)) THEN
               FLAG(K)=J
               KOUNT1=KOUNT1+1
             ENDIF
 40      CONTINUE
C        Skip 3 lines in data file (the rest of the table header):
         DO 50 K=1,3
           READ (1,2004) ALPHA
```

```
 50     CONTINUE
C
C              ***********  TOP OF INNER LOOP **************
C              RETURN HERE UNTIL YOU HAVE MADE
C              "SCANS" TIME/DATA READS ON THIS BLOCK
C
 60     CONTINUE
C
C         READ NEXT 40 LINES AS TIME/DATA UNTIL A TOTAL OF
C         "SCANS" READS FOR THIS BLOCK (MOST SUB-BLOCKS ARE 40 SCANS
C         LONG, BUT THE LAST BLOCK FOR EACH CHANNEL SET WILL
C         BE SHORTER)
C
          DO 70 K=1,40
C           Increment the inner loop counter to relfect block reads so far
            KOUNT2=KOUNT2+1
            READ (1,2006) SIGN,MIN,SEC,(DUMMY(I) (1:8),I=1,LENROW)
 2006       FORMAT (A1,I3,1X,I3,2X,15(A8))
C           Convert the MIN:SEC format time to minutes only, check sign
            TIME(KOUNT2)=FLOAT(MIN)+FLOAT(SEC)/60.
            IF (SIGN.EQ.'-') TIME(KOUNT2)=-TIME(KOUNT2)
C           Check extraction flag and save flagged channels
            DO 80 J=1,LENROW
             IF (FLAG(J).NE.0) THEN
C              have to check for bad channels or entries that are not numbers:
               IF (DUMMY(J) (1:1).NE.'*') THEN
                 MULT=1.
                 DO 81 I=1,8
                   IF (DUMMY(J) (I:I).EQ.' ') THEN
                     SFL(I)=0
                   ELSE IF (DUMMY(J) (I:I).EQ.'-') THEN
                     SFL(I)=0
                     MULT=-1.
                   ELSE IF (DUMMY(J) (I:I).EQ.'.') THEN
                     SFL(I)=0
                     K1=I
                   ELSE
                     SFL(I)=1
                   ENDIF
 81              CONTINUE
                 DUM1=0.
                 DO 82 I=1,K1-1
                   IF (SFL(I).EQ.1) THEN
                     DUM1=DUM1+(10**(K1-I-1))*FLOAT(MULT
     1               *(ICHAR(DUMMY(J) (I:I))-48))
                   ENDIF
 82              CONTINUE
                 DO 83 I=K1,8
                   IF (SFL(I).EQ.1) THEN
                     DUM1=DUM1+FLOAT(MULT*(ICHAR(DUMMY(J) (I:I))-48))
     1               /(10**(I-K1))
                   ENDIF
 83              CONTINUE
                 DATA(FLAG(J),KOUNT2)=DUM1
               ELSE
                 DATA(FLAG(J),KOUNT2)=99999.
               ENDIF
```

```
            ENDIF
 80        CONTINUE
C          check if we have made all needed reads for this block yet:
C          if yes then we jump out of inner loop and go do next block.
C          If not, then keep going with reads in inner loop.
C          files with more than 380 scans are a special case.
      IF (KOUNT2.GE.SCANS) GOTO 100
      IF (KOUNT2.GE.380.AND.SECOND.NE.1) GOTO 100
 70      CONTINUE
C        if you get here then the channel block is not yet done but we
C        are at the end of a 40 scan sub-block.  We skip 12 lines
C        and continue to read more data from this channel block
         DO 90 K=1,12
           READ (1,2004) ALPHA
 90      CONTINUE
C       back to the top of the inner loop:
        GOTO 60
C
C              ************* END OF INNER LOOP ************
C         IF YOU GET HERE THE LAST CHANNEL BLOCK READ WAS COMPLETED.
C              CHECK TO SEE OF ALL TARGET CHANNELS HAVE BEEN
C              ACCOUNTED FOR - IF NOT SKIP 4 LINES TO ALLOW
C              FOR MAX VALUE/MAX TIME LINES AT END OF DATA BLOCKS
C              THEN WE GO BACK TO THE TOP OF MAIN LOOP AND
C              READ FROM NEXT BLOCK OF DATA CHANNELS
C              - ELSE GOTO OUTPUT SECTION
C              NOTE FILES WITH MORE THAN 380 SCANS ARE SPECIAL
C              CASES, APPLIES TO TESTS 21 AND 23-25.  THESE
C              CASES HAVE CHANNEL BLOCKS SPLIT INTO TWO PARTS
C              AND REQUIRE SPECIAL HANDLING.
 100    CONTINUE
      IF (KOUNT1.LT.NCHANS) THEN
        IF(SCANS.LE.380.OR.SECOND.EQ.1) THEN
          DO 110 K=1,4
            READ (1,2004) ALPHA
 110      CONTINUE
        ENDIF
      GOTO 10
      ENDIF
C               HERE WE HANDLE THE FILES WITH MORE THAN 380 SCANS
C               HAVE TO CLOSE THE FILE AND REOPEN WHICH RESETS
C               POINTER TO THE TOP, THEN WE CHUNK THROUGH 10500
C               LINES TO GET TO THE TOP OF THE SECOND SET OF CHANNEL
C               BLOCKS, THEN READ AS BEFORE.
      IF (SCANS.GT.380.AND.SECOND.NE.1) THEN
        SECOND=1
        IOFF=380
        CLOSE (UNIT=1,STATUS='KEEP')
        OPEN (UNIT=1,FILE=FNAME,STATUS='OLD',ACTION='READ')
        DO 111 K=1,10500
          READ (1,2004) ALPHA
 111    CONTINUE
      GOTO 5
      ENDIF
C
C             *************** END OF MAIN LOOP *****************
C             at this point all data reading is done and we are
```

```
C               ready to output the data to file or screen.
C               ***************** OUTPUT SECTION *******************
C
C               CLOSE DATA FILE:
      CLOSE (UNIT=1,STATUS='KEEP')
C                DETERMINE OUTPUT PARAMETERS:
 115  WRITE (*,1010)
 1010 FORMAT (' Do you want file or terminal display? (F OR T):',/)
      READ (*,2004) ALPHA
      IF (ALPHA.EQ.'F' .OR. ALPHA.EQ.'f') THEN
        GOTO 140
      ELSE IF (ALPHA.EQ.'T' .OR. ALPHA.EQ.'t') THEN
        GOTO 120
      ELSE
        GOTO 115
      ENDIF
C                THIS SECTION FOR TERMINAL DISPLAY OF EXTRACTED
C                CHANNELS
 120  WRITE (*,1007)(ECHANS(I),I=1,NCHANS)
 1007 FORMAT (2X,'TIME',10(I7))
      DO 130 K=1,SCANS
        WRITE (*,1008)TIME(K),(DATA(I,K),I=1,NCHANS)
 1008   FORMAT (6E10.3,/,'  ')
 130   CONTINUE
      GOTO 999
C                THIS SECTION FOR CREATION OF OUTPUT FILE
 140  CONTINUE
      WRITE (*,1011)
 1011 FORMAT (' Enter name for new data file to be created:',/)
      READ (*,2009)FNAME
      OPEN (UNIT=1,FILE=FNAME,STATUS='NEW')
C                FOR GENERAL FILES MAKE IT NICE ROW/COL FORMAT
C                PUT GENERAL INFORMATION AT TOP OF FILE, THAT IS,
C                TOTAL NUMBER OF SCANS, NUMBER OF CHANNELS EXTRACTED,
C                AND THE CHANNEL NUMBERS ACTUALLY EXTRACTED.
        WRITE (1,1012) SCANS,NCHANS,(ECHANS(I),I=1,NCHANS)
 1012   FORMAT (1X,30I4)
C                FOR EACH SCAN, WRITE OUT TIME ONCE AND DATA VALUES FOR EACH
C                CHANNEL EXTRACTED WITH all VALUES ON A SINGLE LINE:
        DO 160 K=1,SCANS
          WRITE (1,1020) TIME(K),(DATA(I,K),I=1,NCHANS)
 1020     FORMAT (F7.3,1X,30(E10.3,1x))
 160    CONTINUE
C                 ROUTINE COMPLETED, CLOSE OUTPUT FILE
      CLOSE (UNIT=1,STATUS='KEEP')
 999  STOP
      END
```

Appendix B: General Channel Map

The channel map for all tests is identical. Some channels are not active in some tests, but the all channels are included in all of the main data report files. Non-active channels are typically logged as a “set to zero” channel. Also note that many of the later channels are derived data channels. These contain de-multiplexed gas concentration data, velocity data from the bi-directional probes, and other similar values derived during data post-processing. Each main data file contains a total of 306 data channels. This map identifies the nature, location, and associated units for each of these 306 channels. For a map of the Sector and Station locations, identification of the enclosure orientation, and the location of enclosure surface instruments refer to pages 11, 12 and B10-B12 of NUREG/CR-4681.

```
       Ch#,  Data Type, Location,     Units

Channels 1-31 are aspirated thermocouples.
       0001  ASP. T/C, SECTOR 1,  0.98H (DEG C)
       0002  ASP. T/C, SECTOR 1,  0.90H (DEG C)
       0003  ASP. T/C, SECTOR 1,  0.70H (DEG C)
       0004  ASP. T/C, SECTOR 1,  0.50H (DEG C)
       0005  ASP. T/C, SECTOR 1,  0.30H (DEG C)
       0006  ASP. T/C, SECTOR 2,  0.98H (DEG C)
       0007  ASP. T/C, SECTOR 2,  0.90H (DEG C)
       0008  ASP. T/C, SECTOR 2,  0.70H (DEG C)
       0009  ASP. T/C, SECTOR 2,  0.50H (DEG C)
       0010  ASP. T/C, SECTOR 2,  0.30H (DEG C)
       0011  ASP. T/C, SECTOR 3,  0.98H (DEG C)
       0012  ASP. T/C, SECTOR 3,  0.90H (DEG C)
       0013  ASP. T/C, SECTOR 3,  0.70H (DEG C)
       0014  ASP. T/C, SECTOR 3,  0.50H (DEG C)
       0015  ASP. T/C, SECTOR 3,  0.30H (DEG C)
       0016  ASP. T/C, STATION 1,  0.98H (DEG C)
       0017  ASP. T/C, STATION 2,  0.98H (DEG C)
       0018  ASP. T/C, STATION 3,  0.98H (DEG C)
       0019  ASP. T/C, STATION 4,  0.98H (DEG C)
       0020  ASP. T/C, STATION 5,  0.98H (DEG C)
       0021  ASP. T/C, STATION 6,  0.98H (DEG C)
       0022  ASP. T/C, STATION 7,  0.98H (DEG C)
       0023  ASP. T/C, STATION 8,  0.98H (DEG C)
       0024  ASP. T/C, STATION 9,  0.98H (DEG C)
       0025  ASP. T/C, STATION 10,  0.98H (DEG C)
       0026  ASP. T/C, STATION 11,  0.98H (DEG C)
       0027  ASP. T/C, STATION 12,  0.98H (DEG C)
       0028  ASP. T/C, STATION 13,  0.98H (DEG C)
       0029  ASP. T/C, STATION 14,  0.98H (DEG C)
       0030  ASP. T/C, STATION 15,  0.98H (DEG C)
       0031  ASP. T/C, STATION 16,  0.98H (DEG C)
```

Channels 32-92 are bare-bead thermocouples.

```
0032  BB GAS T/C,  SEC.1,  0.98H (DEG C)
0033  BB GAS T/C,  SEC.1,  0.70H (DEG C)
0034  BB GAS T/C,  SEC.1,  0.30H (DEG C)
0035  BB GAS T/C,  SEC.2,  0.98H (DEG C)
0036  BB GAS T/C,  SEC.2,  0.70H (DEG C)
0037  BB GAS T/C,  SEC.2,  0.30H (DEG C)
0038  BB GAS T/C,  SEC.3,  0.98H (DEG C)
0039  BB GAS T/C,  SEC.3,  0.70H (DEG C)
0040  BB GAS T/C,  SEC.3,  0.30H (DEG C)
0041  BB GAS T/C,  STATION 1,  0.90H (DEG C)
0042  BB GAS T/C,  STATION 1,  0.70H (DEG C)
0043  BB GAS T/C,  STATION 1,  0.50H (DEG C)
0044  BB GAS T/C,  STATION 1,  0.30H (DEG C)
0045  BB GAS T/C,  STATION 2,  0.90H (DEG C)
0046  BB GAS T/C,  STATION 2,  0.70H (DEG C)
0047  BB GAS T/C,  STATION 2,  0.50H (DEG C)
0048  BB GAS T/C,  STATION 2,  0.30H (DEG C)
0049  BB GAS T/C,  STATION 3,  0.90H (DEG C)
0050  BB GAS T/C,  STATION 3,  0.70H (DEG C)
0051  BB GAS T/C,  STATION 3,  0.50H (DEG C)
0052  BB GAS T/C,  STATION 3,  0.30H (DEG C)
0053  BB GAS T/C,  STATION 4,  0.90H (DEG C)
0054  BB GAS T/C,  STATION 4,  0.70H (DEG C)
0055  BB GAS T/C,  STATION 4,  0.50H (DEG C)
0056  BB GAS T/C,  STATION 4,  0.30H (DEG C)
0057  BB GAS T/C,  STATION 5,  0.90H (DEG C)
0058  BB GAS T/C,  STATION 5,  0.70H (DEG C)
0059  BB GAS T/C,  STATION 5,  0.50H (DEG C)
0060  BB GAS T/C,  STATION 5,  0.30H (DEG C)
0061  BB GAS T/C,  STATION 6,  0.90H (DEG C)
0062  BB GAS T/C,  STATION 6,  0.70H (DEG C)
0063  BB GAS T/C,  STATION 6,  0.50H (DEG C)
0064  BB GAS T/C,  STATION 6,  0.30H (DEG C)
0065  BB GAS T/C,  STATION 7,  0.90H (DEG C)
0066  BB GAS T/C,  STATION 7,  0.70H (DEG C)
0067  BB GAS T/C,  STATION 7,  0.50H (DEG C)
0068  BB GAS T/C,  STATION 7,  0.30H (DEG C)
0069  BB GAS T/C,  STATION 8,  0.90H (DEG C)
0070  BB GAS T/C,  STATION 8,  0.70H (DEG C)
0071  BB GAS T/C,  STATION 8,  0.50H (DEG C)
0072  BB GAS T/C,  STATION 8,  0.30H (DEG C)
0073  BB GAS T/C,  STATION 9,  0.90H (DEG C)
0074  BB GAS T/C,  STATION 9,  0.70H (DEG C)
0075  BB GAS T/C,  STATION 9,  0.50H (DEG C)
0076  BB GAS T/C,  STATION 9,  0.30H (DEG C)
0077  BB GAS T/C,  STATION 10,  0.90H (DEG C)
0078  BB GAS T/C,  STATION 10,  0.70H (DEG C)
```

```
0079  BB GAS T/C,  STATION 10,  0.50H (DEG C)
0080  BB GAS T/C,  STATION 10,  0.30H (DEG C)
0081  BB GAS T/C,  STATION 17,  0.98H (DEG C)
0082  BB GAS T/C,  STATION 17,  0.90H (DEG C)
0083  BB GAS T/C,  STATION 17,  0.70H (DEG C)
0084  BB GAS T/C,  STATION 17,  0.50H (DEG C)
0085  BB GAS T/C,  STATION 17,  0.30H (DEG C)
0086  BB GAS T/C,  STATION 18,  0.98H (DEG C)
0087  BB GAS T/C,  STATION 18,  0.90H (DEG C)
0088  BB GAS T/C,  STATION 18,  0.70H (DEG C)
0089  BB GAS T/C,  STATION 18,  0.50H (DEG C)
0090  BB GAS T/C,  STATION 18,  0.30H (DEG C)
0091  BB GAS T/C,  VENT INLET   (DEG C)
0092  BB GAS T/C,  VENT OUTLET  (DEG C)
```

Channels 93-139 are surface thermocouples for the walls, ceiling and floor.

```
0093  IN CEIL SURF T/C,   SECTOR 1  (DEG C)
0094  OUT CEIL SURF T/C,  SECTOR 1  (DEG C)
0095  IN CEIL SURF T/C,   SECTOR 2  (DEG C)
0096  OUT CEIL SURF T/C,  SECTOR 2  (DEG C)
0097  IN CEIL SURF T/C,   SECTOR 3  (DEG C)
0098  OUT CEIL SURF T/C,  SECTOR 3  (DEG C)
0099  IN CEIL SURF T/C,  STATION 1  (DEG C)
0100  IN CEIL SURF T/C,  STATION 2  (DEG C)
0101  IN CEIL SURF T/C,  STATION 3  (DEG C)
0102  IN CEIL SURF T/C,  STATION 4  (DEG C)
0103  IN CEIL SURF T/C,  STATION 5  (DEG C)
0104  IN CEIL SURF T/C,  STATION 6  (DEG C)
0105  IN CEIL SURF T/C,  STATION 7  (DEG C)
0106  IN CEIL SURF T/C,  STATION 8  (DEG C)
0107  IN CEIL SURF T/C,  STATION 9  (DEG C)
0108  IN CEIL SURF T/C,  STATION 10 (DEG C)
0109  IN WALL SURF T/C,  N-C 0.90H (DEG C)
0110  OUT WALL SURF T/C, N-C 0.90H (DEG C)
0111  IN WALL SURF T/C,  N-C 0.50H (DEG C)
0112  OUT WALL SURF T/C, N-C 0.50H (DEG C)
0113  IN WALL SURF T/C,  N-R 0.90H (DEG C)
0114  IN WALL SURF T/C,  N-R 0.50H (DEG C)
0115  IN WALL SURF T/C,  N-L 0.90H (DEG C)
0116  IN WALL SURF T/C,  N-L 0.50H (DEG C)
0117  IN WALL SURF T/C,  S-C 0.90H (DEG C)
0118  OUT WALL SURF T/C, S-C 0.90H (DEG C)
0119  IN WALL SURF T/C,  S-C 0.50H (DEG C)
0120  OUT WALL SURF T/C, S-C 0.50H (DEG C)
0121  IN WALL SURF T/C,  S-R 0.90H (DEG C)
0122  IN WALL SURF T/C,  S-R 0.50H (DEG C)
0123  IN WALL SURF T/C,  S-L 0.90H (DEG C)
```

```
        0124  IN WALL SURF T/C,  S-L 0.50H (DEG C)
        0125  IN WALL SURF T/C,  E-R 0.90H (DEG C)
        0126  OUT WALL SURF T/C, E-R 0.90H (DEG C)
        0127  IN WALL SURF T/C,  E-R 0.50H (DEG C)
        0128  IN WALL SURF T/C,  E-L 0.90H (DEG C)
        0129  OUT WALL SURF T/C, E-L 0.90H (DEG C)
        0130  IN WALL SURF T/C,  E-L 0.50H (DEG C)
        0131  IN WALL SURF T/C,  W-R 0.90H (DEG C)
        0132  OUT WALL SURF T/C, W-R 0.90H (DEG C)
        0133  IN WALL SURF T/C,  W-R 0.50H (DEG C)
        0134  IN WALL SURF T/C,  W-L 0.90H (DEG C)
        0135  OUT WALL SURF T/C, W-L 0.90H (DEG C)
        0136  IN WALL SURF T/C,  W-L 0.50H (DEG C)
```

Channels 137-161 are only used in Tests 19-25. Some channels are unique to the cabinet fire tests 21-25.

```
        0137  CABINET TOP T/C,  SECTOR 1 (DEG C)
        0138  SURFACE T/C FACING CAB A (DEG C)
        0139  CABINET TOP T/C,  SECTOR 3 (DEG C)
        0140  CABLE IGNITION T/C #1    (DEG C)
        0141  CABLE IGNITION T/C #2    (DEG C)
        0142  CAB C DOOR-BOTTOM GAS T/C(DEG C)
        0143  CAB A FRONT BENCH WALL   (DEG C)
        0144  CAB A LEFT WALL LOW T/C  (DEG C)
        0145  CAB A LEFT WALL HIGH T/C (DEG C)
        0146  SURFACE T/C FOR CAB HF#4 (DEG C)
        0147  CAB A CENTER-HIGH GAS T/C(DEG C)
        0148  CAB A RIGHT WALL LOW T/C (DEG C)
        0149  CAB A RIGHT WALL HIGH T/C(DEG C)
        0150  CAB C DOOR-TOP GAS T/C   (DEG C)
        0151  CAB D GAS T/C NEAR WALL  (DEG C)
        0152  CAB D GAS T/C CENTER     (DEG C)
        0153  CAB B VENT IN GAS T/C    (DEG C)
        0154  CAB B RIGHT WALL-LOW T/C (DEG C)
        0155  CAB B RIGHT WALL-HIGH T/C(DEG C)
        0156  CAB B LEFT WALL-HIGH T/C (DEG C)
        0157  CAB B GAS T/C CENTER-HIGH(DEG C)
        0158  CAB B GAS T/C CENTER-DOOR(DEG C)
        0159  SURFACE T/C FACING CAB C (DEG C)
        0160  CAB C GAS T/C CENTER-LOW (DEG C)
        0161  CAB C GAS T/C CENTER-HIGH(DEG C)
```

Channels 162-179 are raw temperature responses for the large and small sphere calorimeters. Data post processing results for velocity, radiative and convective heat flux rates are provided in separate data files.

```
        0162  LRG.SPH.CAL., SECTOR 1 0.98H (DEG C)
        0163  SML.SPH.CAL., SECTOR 1 0.98H (DEG C)
```

```
0164  LRG.SPH.CAL., SECTOR 1 0.70H (DEG C)
0165  SML.SPH.CAL., SECTOR 1 0.70H (DEG C)
0166  LRG.SPH.CAL., SECTOR 1 0.30H (DEG C)
0167  SML.SPH.CAL., SECTOR 1 0.30H (DEG C)
0168  LRG.SPH.CAL., SECTOR 2 0.98H (DEG C)
0169  SML.SPH.CAL., SECTOR 2 0.98H (DEG C)
0170  LRG.SPH.CAL., SECTOR 2 0.70H (DEG C)
0171  SML.SPH.CAL., SECTOR 2 0.70H (DEG C)
0172  LRG.SPH.CAL., SECTOR 2 0.30H (DEG C)
0173  SML.SPH.CAL., SECTOR 2 0.30H (DEG C)
0174  LRG.SPH.CAL., SECTOR 3 0.98H (DEG C)
0175  SML.SPH.CAL., SECTOR 3 0.98H (DEG C)
0176  LRG.SPH.CAL., SECTOR 3 0.70H (DEG C)
0177  SML.SPH.CAL., SECTOR 3 0.70H (DEG C)
0178  LRG.SPH.CAL., SECTOR 3 0.30H (DEG C)
0179  SML.SPH.CAL., SECTOR 3 0.30H (DEG C)
```

Channels 180-197 are raw velocity measurement made using paired bi-directional pressure/velocity probes. Post processing results are provided in channels 180-197.

```
0180  HOR. FLOW PRB,  SECTOR 1 0.98H (M/S)
0181  VER. FLOW PRB,  SECTOR 1 0.98H (M/S)
0182  HOR. FLOW PRB,  SECTOR 1 0.70H (M/S)
0183  VER. FLOW PRB,  SECTOR 1 0.70H (M/S)
0184  HOR. FLOW PRB,  SECTOR 1 0.30H (M/S)
0185  VER. FLOW PRB,  SECTOR 1 0.30H (M/S)
0186  HOR. FLOW PRB,  SECTOR 2 0.98H (M/S)
0187  VER. FLOW PRB,  SECTOR 2 0.98H (M/S)
0188  HOR. FLOW PRB,  SECTOR 2 0.70H (M/S)
0189  VER. FLOW PRB,  SECTOR 2 0.70H (M/S)
0190  HOR. FLOW PRB,  SECTOR 2 0.30H (M/S)
0191  VER. FLOW PRB,  SECTOR 2 0.30H (M/S)
0192  HOR. FLOW PRB,  SECTOR 3 0.98H (M/S)
0193  VER. FLOW PRB,  SECTOR 3 0.98H (M/S)
0194  HOR. FLOW PRB,  SECTOR 3 0.70H (M/S)
0195  VER. FLOW PRB,  SECTOR 3 0.70H (M/S)
0196  HOR. FLOW PRB,  SECTOR 3 0.30H (M/S)
0197  VER. FLOW PRB,  SECTOR 3 0.30H (M/S)

0198  INLET DUCT FLOW RATE       (ACH)
0199  OUTLET DUCT FLOW RATE      (ACH)
0200  PRESS. DIFF. ENCL. HI   (in-H2O)
0201  PRESS. DIFF. ENCL. LO   (in-H2O)
```

Channels 202-203 are only used in the cabinet fire tests.

```
0202  PRESS. DIFF. CABINET IN (in-H2O)
0203  PRESS. DIFF. CABINET OUT (in-H2O)
```

Channels 204-208 are single-beam smoke turbidimeters. Channels 209-211 represent a single three-beam turbidimeter.

```
0204  BLUE OPT.DEN.,  SECTOR 1 0.98H (1/M)
0205  BLUE OPT.DEN.,  SECTOR 1 0.30H (1/M)
0206  BLUE OPT.DEN.,  SECTOR 2 0.30H (1/M)
0207  BLUE OPT.DEN.,  SECTOR 3 0.98H (1/M)
0208  BLUE OPT.DEN.,  SECTOR 3 0.30H (1/M)
0209  BLUE OPT.DEN.,  SECTOR 2 0.98H (1/M)
0210  RED OPT.DEN.,   SECTOR 2 0.98H (1/M)
0211  IR  OPT.DEN.,  SECTOR 2 0.98H (1/M)
```

Channels 212-219 are multiplexed gas analyzers covering three locations each. The data is de-multiplexed into channels 259-282.

```
0212  CO2 MULTIPLEXED SECTORS 0.98H (  %  )
0213  CO  MULTIPLEXED SECTORS 0.98H (  %  )
0214  O2  MULTIPLEXED SECTORS 0.98H (  %  )
0215  THC MULTIPLEXED SECTORS 0.98H ( PPM )
0216  CO2 MULTIPLEXED SECTORS 0.70H (  %  )
0217  CO  MULTIPLEXED SECTORS 0.70H (  %  )
0218  CO2 MULTIPLEXED SECTORS 0.30H (  %  )
0219  CO  MULTIPLEXED SECTORS 0.30H (  %  )
0220  CO2 SECTOR 2, 0.98H    (  %  ) NON-MULTIPLEXED UNIT
0221  CO2 VENTILATION OUTLET  (  %  ) NON-MULTIPLEXED UNIT
```

Channels 222-243 are surface heat flux gauges - the data on these channels appears to be unreliable in all tests.

```
0222  CEIL HEAT FLUX, SECTOR 1   (KW/M2)
0223  CEIL HEAT FLUX, SECTOR 2   (KW/M2)
0224  CEIL HEAT FLUX, SECTOR 3   (KW/M2)
0225  CEIL HEAT FLUX, STATION 1  (KW/M2)
0226  CEIL HEAT FLUX, STATION 2  (KW/M2)
0227  CEIL HEAT FLUX, STATION 3  (KW/M2)
0228  CEIL HEAT FLUX, STATION 8  (KW/M2)
0229  CEIL HEAT FLUX, STATION 9  (KW/M2)
0230  CEIL HEAT FLUX, STATION 10 (KW/M2)
0231  WALL HEAT FLUX, N-C  0.90H (KW/M2)
0232  WALL HEAT FLUX, N-R  0.90H (KW/M2)
0233  WALL HEAT FLUX, N-L  0.90H (KW/M2)
0234  WALL HEAT FLUX, S-C  0.90H (KW/M2)
0235  WALL HEAT FLUX, S-R  0.90H (KW/M2)
0236  WALL HEAT FLUX, S-L  0.90H (KW/M2)
0237  WALL HEAT FLUX, E-R  0.90H (KW/M2)
0238  WALL HEAT FLUX, E-L  0.90H (KW/M2)
0239  WALL HEAT FLUX, W-R  0.90H (KW/M2)
0240  WALL HEAT FLUX, W-L  0.90H (KW/M2)
0241  FLOOR HEAT FLUX, SECTOR 1 (KW/M2)
0242  FLOOR HEAT FLUX, SECTOR 2 (KW/M2)
0243  FLOOR HEAT FLUX, SECTOR 3 (KW/M2)
```

Channels 244-248 are water-cooled calorimeters and are only used in Tests 21-25. The location of each probe is unique to each test, see NUREG/CR-4527, V2.

```
0244  CABINET HEAT FLUX, #1    (KW/M2)
0245  CABINET HEAT FLUX, #2    (KW/M2)
0246  CABINET HEAT FLUX, #3    (KW/M2)
0247  CABINET HEAT FLUX, #4    (KW/M2)
0248  CABINET HEAT FLUX, #5    (KW/M2)
```

Channel 249 is not used in the gas burner tests.

```
0249  FUEL MASS LOSS          ( KG/S )
```

Channels 250-258 are intermediate processing channels and do not contain useful data.

```
0250  RAW CHANNEL FOR REDUCED CHANNEL NO.  212
0251  RAW CHANNEL FOR REDUCED CHANNEL NO.  213
0252  RAW CHANNEL FOR REDUCED CHANNEL NO.  216
0253  RAW CHANNEL FOR REDUCED CHANNEL NO.  217
0254  RAW CHANNEL FOR REDUCED CHANNEL NO.  218
0255  RAW CHANNEL FOR REDUCED CHANNEL NO.  219
0256  RAW CHANNEL FOR REDUCED CHANNEL NO.  220
0257  RAW CHANNEL FOR REDUCED CHANNEL NO.  221
0258  EVENT CHANNEL
```

Channels 259-282 are generated by de-multiplexing the gas analysis channels 212-219 to generate individual location gas concentration data values:

```
0259  CO2 SECTOR 1, 0.98H  ( % ) FROM 212A
0260  CO2 SECTOR 2, 0.98H  ( % ) FROM 212B
0261  CO2 SECTOR 3, 0.98H  ( % ) FROM 212C
0262  CO  SECTOR 1, 0.98H  ( ppm ) FROM 213A
0263  CO  SECTOR 2, 0.98H  ( ppm ) FROM 213B
0264  CO  SECTOR 3, 0.98H  ( ppm ) FROM 213C
0265  O2  SECTOR 1, 0.98H  ( % ) FROM 214A
0266  O2  SECTOR 2, 0.98H  ( % ) FROM 214B
0267  O2  SECTOR 3, 0.98H  ( % ) FROM 214C
0268  THC SECTOR 1, 0.98H  ( % ) FROM 215A
0269  THC SECTOR 2, 0.98H  ( % ) FROM 215B
0270  THC SECTOR 3, 0.98H  ( % ) FROM 215C
0271  CO2 SECTOR 1, 0.70H  ( % ) FROM 216A
0272  CO2 SECTOR 2, 0.70H  ( % ) FROM 216B
0273  CO2 SECTOR 3, 0.70H  ( % ) FROM 216C
0274  CO  SECTOR 1, 0.70H  ( ppm ) FROM 217A
0275  CO  SECTOR 2, 0.70H  ( ppm ) FROM 217B
0276  CO  SECTOR 3, 0.70H  ( ppm ) FROM 217C
0277  CO2 SECTOR 1, 0.30H  ( % ) FROM 218A
0278  CO2 SECTOR 2, 0.30H  ( % ) FROM 218B
0279  CO2 SECTOR 3, 0.30H  ( % ) FROM 218C
```

```
0280  CO  SECTOR 1, 0.30H  ( ppm ) FROM 219A
0281  CO  SECTOR 2, 0.30H  ( ppm ) FROM 219B
0282  CO  SECTOR 3, 0.30H  ( ppm ) FROM 219C
```

Channels 283-306 are generated by processing of the bi-directional flow probes on Channels 180-197. A pair of (x-y) bi-direction probes is processed to estimate the total bulk fluid velocity and direction of flow per FMRC methods of analysis.

```
0283  SPEED,      SECTOR 1, 0.98H (M/S)
0284  DIRECTION, SECTOR 1, 0.98H (DEG) HORIZONTAL
0285  SPEED,      SECTOR 1, 0.70H (M/S)
0286  DIRECTION, SECTOR 1, 0.70H (DEG) HORIZONTAL
0287  DIRECTION, SECTOR 1, 0.70H (SENSE) VERTICAL
0288  SPEED,      SECTOR 1, 0.30H (M/S)
0289  DIRECTION, SECTOR 1, 0.30H (DEG) HORIZONTAL
0290  DIRECTION, SECTOR 1, 0.30H (SENSE) VERTICAL
0291  SPEED,      SECTOR 2, 0.98H (M/S)
0292  DIRECTION, SECTOR 2, 0.98H (DEG) HORIZONTAL
0293  SPEED,      SECTOR 2, 0.07H (M/S)
0294  DIRECTION, SECTOR 2, 0.70H (DEG) HORIZONTAL
0295  DIRECTION, SECTOR 2, 0.70H (SENSE) VERTICAL
0296  SPEED,      SECTOR 2, 0.30H (M/S)
0297  DIRECTION, SECTOR 2, 0.30H (DEG) HORIZONTAL
0298  DIRECTION, SECTOR 2, 0.30H (SENSE) VERTICAL
0299  SPEED,      SECTOR 3, 0.98H (M/S)
0300  DIRECTION, SECTOR 3, 0.98H (DEG) HORIZONTAL
0301  SPEED,      SECTOR 3, 0.70H (M/S)
0302  DIRECTION, SECTOR 3, 0.70H (DEG) HORIZONTAL
0303  DIRECTION, SECTOR 3, 0.70H (SENSE) VERTICAL
0304  SPEED,      SECTOR 3, 0.30H (M/S)
0305  DIRECTION, SECTOR 3, 0.30H (DEG) HORIZONTAL
0306  DIRECTION, SECTOR 3, 0.30H (SENSE) VERTICAL
```