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# DOE-2 USER NEWS

: A COMPUTER PROGRAM FOR BUILDING ENERGY USE ANALYSIS

Vol. 4 No. 4

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### Table of Contents

Upgraded Reports in DOE-2.1B .....	1
Documentation Updates .....	3
Bugs Discovered and Interim Solutions .....	5

### UPGRADED REPORTS IN DOE-2.1B

Thirteen new reports have been added in the 2.1B version of program. These are discussed and displayed in the DOE-2 Supplement, but there were also many noticeable improvements made to the "standing" reports that have, until now, gone undocumented.

Minor improvements, that need little explanation, will be noticed in some report headings. These include cosmetic changes made to improve the reader's understanding of the intent of the report title or individual heading. For instance, the term FLOW was substituted wherever the previously-used term CFM had appeared. This was done so that the report headings would be compatible with both English and metric units.

The more significant changes made, such as major expansions and/or reformatting of reports, should improve the user's ability to locate specific information. We would like to take this opportunity to discuss in greater detail these new features. One word of warning, though. Due to the expansion in the sheer number of reports now available in DOE-2, it behooves the user more than ever to take the time to select only those reports needed. In other words, requesting VERIFICATION = (ALL-VERIFICATION) and SUMMARY = (ALL-SUMMARY) for LOADS, SYSTEMS, and PLANT can be very costly on a run for a voluminous number of zones.

The following standing reports have received upgrading.

LV-B SUMMARY OF SPACES OCCURRING IN THE PROJECT, has been expanded to include columns indicating Space Azimuth, Lighting W/sqft, Number of People, Equip W/sqft, Infiltration Method and Amount. Much of this information is also covered in Report LV-C on a zone-by-zone basis, whereas LV-B provides it as a summary for all of the zones in the run.

LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT, has been completely reformatted for the express purpose of providing a convenient crosscheck of wall, glass, and overall U-values ( $U_o$ ) that DOE-2 calculates versus those the designer calculates. This information is of special value when checking envelope compliance to building standards, e.g., ASHRAE STD 90-75, California Title 24, etc.

### BULLETIN BOARD

**Item:** In addition to the CDC machine version, a DEC VAX version of DOE-2.1B is now available for purchase from NTIS and, to their registrants, from the National Energy Software Center, Argonne National Laboratory, Argonne, IL (312) 972-7250. The IBM and DEC10 versions will follow shortly.

Purchasers of the new tape will automatically receive one complete set of DOE-2 user documentation, including the 2.1B updates. Additional copies of the documentation may be obtained from NTIS. Please note that it is now possible to order individual volumes from the basic set of documentation. The back page of this newsletter is a tear-out sheet containing an order form for tapes and documentation.

**Item:** DOE-2 has recently been made a licensed program by NESC. Under these terms, the program cannot be "copied or reproduced for distribution to others, or included in a service offered to users who are not a part of your organization without approval from NESC." The larger computer service bureaus have already been granted approval, and we encourage others wishing to share the program to apply to NESC for a waiver.

**Item:** Beginning with this issue, the newsletter appears on a seasonal basis. This change should enhance our ability to publish timely announcements without the constraint of a prescribed deadline date. Watch for the next issue sometime next Spring!

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(Continued on page 2)

PUB-439

From the abbreviated sample output below, you can see that LV-D now shows the U calculated for both walls and glass, and then the  $U_o$  for the combined glass and walls. The second half of the report, appearing on its own page in a real run, shows the totals of all wall areas for each exposure. (Only NORTH and EAST are displayed here.) It would also give the weighted average U-value if you had more than one glass or wall type. Information that was formerly available on LV-D can still be found on reports LV-C and LV-I. However, the following items of information — Ground-Reflectance, X-Divisions, and Infiltration-Flow Coefficients for each wall — have been dropped.

## REPORT LV-D — DETAILS OF EXTERIOR SURFACES IN THE PROJECT

(Facsimile)

NUMBER OF EXTERIOR SURFACES		9	RECTANGULAR	9	OTHER	0			
SURFACE	SPACE	GLASS		WALL		WALL + GLASS		AZIMUTH	
		U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)		
WALL-1PB	PLENUM-1	0.	0.	.03	200.00	.03	200.00	NORTH	
BACK-1	SPACE3-1	1.02	229.00	.07	571.00	.34	800.00	NORTH	
RIGHT-1	SPACE2-1	1.02	100.00	.07	300.00	.31	400.00	EAST	
WALL-1PR	PLENUM-1	0.	0.	.03	100.00	.03	100.00	EAST	
.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	.	.	.	

## REPORT LV-D — DETAILS OF EXTERIOR SURFACES IN THE PROJECT

(CONTINUED)

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS + GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS + OPAQUE AREA (SQFT)
NORTH	1.02	.06	.28	229.00	771.00	1000.00
EAST	1.02	.06	.25	100.00	400.00	500.00

- LS-A SPACE PEAK LOADS SUMMARY has undergone a slight change with the addition of Floor Multiplier.
- LS-B SPACE PEAK LOAD COMPONENTS has also been expanded with a heading for Floor Multiplier and the metric terms MJ/h dropped in favor of kW and W/sqmt. This latter metric change also occurs on LS-C.
- SV-A SYSTEMS DESIGN PARAMETERS does not appear to be changed; however, the values in the Multiplier column are now the product of SPACE and FLOOR multipliers.
- SS-A SYSTEM MONTHLY LOADS SUMMARY now reports heating for all systems including packaged systems with HEAT-SOURCE = ELECTRIC or GAS-FURNACE.
- SS-C SYSTEM MONTHLY LOADS HOURS now shows columns reporting number of hours temperatures were floating, hours heating and cooling was available, hours fans were on, hours fans cycled on at night, hours night venting occurred, and hours temperatures were floating when fans were on.
- SS-E PLANT MONTHLY LOAD HOURS has been expanded to include the same information described above for report SS-C but, in this case, the summary of all systems assigned to the plant are covered.
- SS-I SYSTEM MONTHLY SOURCE-LATENT SUMMARY now has columns reporting Sensible Heating, Latent Heating (for humidification), and Max Total Heating.
- PV-G EQUIPMENT QUADRATICS has been updated to show the correct default coefficients of TWR-RFACT-FRT, TWR-RFACT-FAT, and TWR-APP-FRFACT that are stored in the program.

## DOCUMENTATION UPDATES -- DOE-2.1B

The following addenda apply to the basic Reference Manual, revised in May 1981, to the DOE-2 Supplement, which is the DOE-2.1B companion volume to the Reference Manual, and to the BDL Summary, Version 2.1B, both dated January 1983. If you do not have these latter two documents, consult the NTIS Order Form on the back page for information on the DOE-2.1B Documentation Update package.

Reference Manual

- In Part 2, page VII.57, under SYSTEMS REPORT SS-A, Items 7 and 8 should be revised to read:

7. ELECTRICAL ENERGY (kWh) is the monthly electrical consumption for all electrical devices from LOADS (except for BUILDING-RESOURCE items), plus all electrical devices in SYSTEMS, including fans, heat pumps, electric heat, and cooling compressors.
8. MAXIMUM ELEC LOAD (kW) is the monthly peak electrical consumption in a one-hour period for all electrical devices described in 7 above.

Additionally, on page VII.63, under SYSTEMS REPORT SS-D, Items 9 and 10 should be changed to read in the same way as 7 and 8 above.

DOE-2 Supplement

- On page 3-14, the title of Report SS-N is incorrect, though somewhat more accurate than the way it appears in the printed output. The documentation is wrong in stating that scatter plots are produced FOR EACH SPACE; this is a systems summary report. But the print-out heading should not read "HUMIDITY RATIO . . ."; both ought to be changed to read:

SS-N -- RELATIVE HUMIDITY SCATTER PLOT FOR <system>

In the description of this report, there should also be a statement reading:

The relative humidity is calculated, for the purposes of this report, at the return air duct.

BDL Summary

- On page BDL-6 LOADS, there is an error in the second note under the WEEK-SCHEDULE command. Monday, not Sunday, is the first day of the DOE-2 week. Therefore, the note should read:

[Note: Must preserve order of Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday, Holiday]

- On page BDL-10 LOADS, under the Default Table for LIGHTING-TYPES at the bottom of the page, the values given for LIGHT-TO-RETURN are slightly misleading; they only apply when all four keywords are allowed to default. The more general rule is that LIGHT-TO-RETURN defaults to 1.0 minus the value of LIGHT-TO-SPACE minus the value of LIGHT-TO-OTHER. Therefore, the values given for LIGHT-TO-RETURN should be deleted and a footnote appended to the end of the table, reading:

LIGHT-TO-RETURN defaults to 1.0 - LIGHT-TO-SPACE - LIGHT-TO-OTHER.

- On page BDL-21, under the ZONE command, the abbreviation for FLOOR-MULTIPLIER is incorrect. It should read F-M.

- On page BDL-31, under "Pumps", there is an error in the entry for HCIRC-HEAD. An abbreviation is given for this keyword when in fact it has none. Strike out (HC-H).
- On page BDL-77, under SYSTEM-FANS for System Type CBVAV, there is a missing zero in the default value for the SUPPLY-KW keyword. It should read 0.000783, not 0.00783.

Using DOE-2 at Lawrence Berkeley Laboratory

Those using the LBL site manual, dated September 1980, should make the following changes in that document:

- On page 4-2, in the example inputs for both EBCDIC and ASCII tapes, the parameter for blocking factor, at the end of the 6<sup>th</sup> card, is mistyped as BL. It should read "BF=blocking factor".
- On page 4-11, under the heading, Using Your Construction Library in a DOE-2 Job Run, there should be a general statement reading:

NOTE: When specifying INPUT-UNITS = METRIC, you must always designate your own construction library on the CALL card, even if you do not intend to use it. This is necessary because the CALL procedure file contains default instructions to call the standard DOE-2 library. If this instruction is not overridden by the presence of a user-specified library, if only a dummy one, the program will abort with an ERROR message reading:

\*\*\*\*\* INCONSISTENCY IN BDLLIB UNIT \*\*\*\*\*

- In Appendix C. ACCESSING BUGS, UPDOC, AND SAMPLE RUN FILES, two changes should be made.
  - 1) The on-line UPDOC file is longer being maintained, having been replaced by this periodic "Documentation Updates" article. Therefore, the line reading:

FETCHPS,DOE21,UPDOC,UPDOC.

should be deleted, and references to UPDOC in the two following lines removed.

- 2) The Sample Run input decks have been moved to GSS tape. Therefore, the line reading:

FETCHPS,DOE21SAM,SAMP21,SAMP21.

should be changed to:

FETCHGS,DOE21B0/SAMP1,10438,ATL=ON.

FETCHGS,DOE21B0/SAMP2,10438,ATL=ON.

.

.

FETCHGS,DOE21B0/SAMP9,10438,ATL=ON.

## BUGS DISCOVERED IN DOE-2.1B AND INTERIM SOLUTIONS

Although the new version of the program was extensively tested prior to release, the inevitable bugs which occur in so massive a program have once again begun to appear. We encourage users to document suspected bugs, and report them to their computer service bureau, or to us. The following 12 bugs have been found in DOE-2.1B.

## CLASSIFIED INDEX

This index is intended to cross-reference bugs by 1) abort routine, 2) system-type affected (except those which affect all systems), 3) report affected, and 4) subject matter, command, and/or keyword.

ABORT ROUTINE

FMTAP: 1  
LOADS: 2  
OPELEC: 11  
SHDWS: 6

SYSTEM-TYPE

PTAC: 9  
VAVS: 7

REPORTS

LS-L: 5  
LV-B: 4  
LV-D: 3  
SS-0: 8  
Hourly  
Reports: 2

SUBJECT/COMMAND/KEYWORD

CONSTRUCTION: 2  
Daylighting: 5, 6  
Extraction rates: 7, 9  
LOAD-ASSIGNMENT: 10, 11

Metric option: 3, 4  
PLANT-EQUIPMENT: 10, 11  
SHADE-SCHEDULE: 6  
TITLE: 1  
Weather Processor: 12

BDL

- [1] The program will abort in routine FMTAP if the user neglects to close a TITLE LINE with an asterisk (\*).  
Interim solution: Always end each TITLE LINE with an asterisk, and the whole command, as usual, with a terminator.
- [2] If hourly reports are requested, there must be at least one CONSTRUCTION command entered in LOADS. Failure to do so may result in an abort in LOADS.  
Interim solution: Create a CONSTRUCTION command, even a dummy one, if hourly reports are desired.
- [3] In Report LV-D, the FLOOR and ROOF designations are reversed. Also, if metric output is requested, the values for AREA of WALL and for U-VALUE of the combined WALL + GLASS are incorrect.  
Interim solution: For the first problem, read the designations in reverse. For the last two, none.
- [4] In Report LV-B, the breakdown of AREA and VOLUME by SPACE is not reported. In an English input deck, the building totals are reported correctly. However, if INPUT-UNITS = METRIC the totals are also incorrect. Additionally, the PEOPLE total in a metric deck is incorrect.  
Interim solution: For the breakdown of AREA and VOLUME, request the LV-C report, which does report the values correctly. For metric runs, none for the building totals problems.

LOADS

- [5] In Report LS-L, the figures reported under the column labelled "NUMBER OF HOURS MANAGEMENT WOULD BE EMPLOYED" are incorrect since they can include night-time hours. This is problematic only when DAYLIGHTING = YES.  
Interim solution: None.
- [6] On CDC machines only, if DAYLIGHTING = YES, and a shading surface transmittance schedule is defined with SHADE-SCHEDULE in either the BUILDING-SHADE or FIXED-SHADE command, then the program will abort in subroutine SHDWS.  
Interim solution: Use window management-related keywords instead of SHADE-SCHEDULE to simulate the effects of changing transmittance, if running on a CDC machine.

SYSTEMS

- [7] When the program calculates the maximum and minimum extraction rates and these turn out to be equal, the count of hours undercooled will be underestimated. This situation can occur for VAVS system type, for example, if the MIN-CFM-RATIO is 1.0 and no heating is allowed.  
Interim solution: None.
- [8] SS-0 Report, the Temperature Scatter Plot, will contain all zeros unless the user also requests the printing of at least one of the following reports: SS-B, SS-C, SS-H, SS-I, SS-J, SS-K, SS-L, SS-N.  
Interim solution: Include at least one of the above reports when requesting SS-0.
- [9] In the PTAC system, the sensible load used to select high- or low-speed ratio should be the net zone extraction minus the extraction done by mixed air. The current calculation incorrectly sums the two values. The error can be significant in runs with large fractions of outside air coincident with high values of zone-to-outside-air-temperature difference combined with small low-speed ratios.  
Interim solution: Avoid large outside air quantities with small low-speed ratios in the PTAC system.

PLANT

- [10] In the LOAD-ASSIGNMENT command, if the first PLANT-EQUIPMENT in a LOAD-RANGE is set equal to UTILITY, and the capacity is defined by keyword NUMBER = value, then subsequent PLANT-EQUIPMENT assignments are ignored and the entire load is given to the utility.  
Interim solution: Specify, after all of the real PLANT-EQUIPMENT assignments, a final dummy PLANT-EQUIPMENT set equal to UTILITY (that is, two P-Es = UTILITY) even though it is known in advance that this final one will never be used.
- [11] If, in the PLANT-EQUIPMENT command, a steam turbine is specified, but no diesel or gas turbine, and if the LOAD-ASSIGNMENT is allowed to default, then the program will abort in subroutine OPELEC.  
Interim solution: Always specify, in this case, a LOAD-ASSIGNMENT.  
NOTE: The steam turbine simulation is intended for use only with a gas turbine or diesel engine, to generate electricity when there is no other use for the waste heat from these prime movers; it is a very inefficient device for producing electricity and would not ordinarily be used except in a combined-cycle plant.

Weather Processor

- [12] The design temperatures reported in the statistical summary of the Weather Processor are meaningless.  
Interim solution: None.



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