4.4 Appendix: EDR File Format

An EDR "record" is a one-minute chunk of IES environmental data. An EDR "file" contains a variable number of EDR "records." There are no differences between IES-2 and IES-3 output formats, although the content changes of a few items are noted. Items that reflect content changes from APGA-2 to APGA-3.15 are shaded in the table in section **Error! Reference source not found.**. An additional field was added to the end of lines 66-80 for the EP photo-electron surrogate value and a text string containing the version and a health status flag has been added to the end of the first output record of the text EDR.

The binary output file written by APGA exists so that only valid EDRs are written to the text file. Filtering also removes all zero-filled EDRs, EDRs with nonsensical DMSP satellite numbers, EDRs with nonsensical time of day numbers, and any EDRs slightly out of chronological order. EDRs that are extremely out of chronological order are not removed on the assumption that they represent a midnight crossing that possibly includes a data gap.

Each EDR is 108 lines long with a variable line length. The maximum line width is 103 characters, not counting carriage returns. The various data items are intermingled so that they must be extracted from each minute individually; that is, the file is not in any particular column format. Some lines are used only for text labels. Each item is separated from the following item by one space, in addition to any extra spaces in the fixed format code. There is only one leading blank line that separates EDRs. Lines of text separating the groups of data within the minute make the EDR file easier to read.

The maximum size of the file is estimated to be 770KB for 102 minutes of data. That value may be safely extrapolated for larger or smaller data files with reasonable precision.

The following table defines the format of the text version of the APGA-3.15 output file.

Line #	Word #	Contents	Fortran Format Code
1		Blank line	
2		"RECORD, EDR OF RECORD, DMSP #, DATE, TIME" A string identifying the software version will be appended after the "TIME" text on the first occurrence: "RECORD, EDR OF RECORD, DMSP #, DATE, TIME – APGA Version version_text – release_text health nnn"	A
3	1	The number of the record in the binary file from where this EDR	I4
	2	The number of the EDR within the record in the binary file (1-3).	I2
	3	Satellite Flight ID (two digit integer)	I3
	4	Date (YYYYMMDD, integer)	I9
	5	Time (HHMM, integer)	I5
4		"EPHEMERIS"	A
5	1-6	Location information valid for HHMM00. Each set contains the following six parameters pertaining to the spacecraft location: 1: Geographic latitude (degrees, north) 2: Geographic longitude (degrees, east) 3: Apex latitude (degrees, north) 4: Apex longitude (degrees, east) 5: Apex local time (hours) 6: Satellite altitude (km)	4(F9.4), F13.9, F8.3

6	1-6	Location information valid for HHMM20. Same parameters as above.	4(F9.4), F13.9, F8.3
7	1-6	Location information valid for HHMM40. Same parameters as above.	4(F9.4), F13.9, F8.3
8		"SATELLITE POTENTIAL, LAST = SOURCE"	A
9	1-8	Satellite potential. Vbias+VIP (every 4 seconds) (volts) 1-8 of 15 values.	8(E12.5)
10	1-7	Satellite potential continued. Vbias+VIP (every 4 seconds) (volts)	7(E12.5)
	8	Satellite potential source (integer) 1 - As set by on-board microprocessor 2 - As set by SENPOT sensor	I2
11		"PRIMARY PLASMA DENSITY, THEN SOURCE"	A
12-21	1-6	Primary plasma density (one-second averages) (/cm^3). 60 values.	6(E12.5)
22	1	Plasma density source (SM, DM, EP) (integer) 1 - Ion density from SM sensor 2 - Ion density from DM sensor 3 - Electron density from EP sensor (DC Mode)	I2
23		"HORIZONTAL ION DRIFT VELOCS"	A
24-33	1-6	Horizontal ion drift velocity (m/s). 60 values.	6(E12.5)
34		"VERTICAL ION DRIFT VELOCS"	
35-44	1-6	Vertical ion drift velocity (m/s). 60 values.	6(E12.5)
45		"CKL ANALYSES, THEN SOURCE"	A
46	1	C_KL Analysis: (RMS ΔN)/N (%) for HHMM05	E12.5
	2	C_KL Analysis: T1 for HHMM05	E12.5
	3	C_KL Analysis: p1for HHMM05	E12.5
	4	C_KL Analysis: C_KL for HHMM05	E12.5
47	1-8	C_KL Analysis: Decimated power density spectrum (PDS) for time period centered on HHMM05. 1-8 of 15 values.	8(E12.5)
48	1-7	C_KL Analysis: Decimated power density spectrum (PDS) for time period centered on HHMM05 continued. 9-15 of 15 values.	7(E12.5)
	8	C_KL Analysis: Analysis qualifier (integer) for HHMM05. 0 - No analysis attempted 1 - No analysis, not enough good data. 2 - No analysis, (RMS ΔN)/N below threshold 3 - Analysis used 256 data points 4 - Analysis used 512 data points	I2
49-51		C_KL Analysis for HHMM15 in above format.	4(E12.5), /, 8(E12.5),/, 7(E12.5), I2
52-54		C_KL Analysis for HHMM25 in above format.	4(E12.5), /, 8(E12.5),/, 7(E12.5), I2
55-57		C_KL Analysis for HHMM35 in above format.	4(E12.5), /, 8(E12.5),/, 7(E12.5), I2
58-60		C_KL Analysis for HHMM45 in above format.	4(E12.5), /, 8(E12.5),/, 7(E12.5), I2
61-63		C_KL Analysis for HHMM55 in above format.	4(E12.5), /,

			8(E12.5),/, 7(E12.5), I2
64	1	Data used for $C_K L$ calculation (integer) 1 - SM density data only 2 - SM density and filter data 3 - EP DC mode density data	I2
Lines 65-80 depend on EP mode value on line 112. For modes A, B, BS, E (mode values 0, 1, 2, 6):			
65		"EP SWEEP ANALYSES SETS"	A
66-80	1-5	EP Sweep analyses (every 4 seconds). There are 15 EP sweep analysis sets. Each is valid for either 4 (modes A, B and BS) or 2 (mode E) seconds centered on the time specified in the set. Each analysis set contains the following parameters: 1: Sweep center time (UT, seconds) (integer) 2: Electron density (el/cm^3) 3: Electron temperature (degrees K) 4: Satellite potential (volts) 5: Analysis qualifier (integer). Set to zero if the on-board microprocessor did not perform the analysis, per the flag in element 415. If the on-board microprocessor was in use, then it is set to the MP EP flags word from Word 11 of Cycle 1 in the telemetry. This word can also be zero. 6: EP photo-electron surrogate value.	I6, 3(E12.5), I3 E12.5
Lines 65-80 depend on EP mode value on line 112. For modes C, D, DS (mode values 3, 4, 5):			
65		"EP AVERAGE DENSITIES"	A
66-75	1-6	EP one-second average densities (Modes C, D and DS) (el/cm^3)	6(E12.5)
76		"EP SWEEP ANALYSES SETS"	A
77-80		EP sweep analyses (up to three) structured as above in sweep modes, plus one line of invalid values to maintain spacing.	I6, 3(E12.5), I3
81		"EP ANALYSES SOURCE	A
82	1	EP analysis source (integer) 1 – Ground processing analysis 2 – On-board microprocessor analysis	I2
83		"RPA SWEEP ANALYSES SETS, THEN SOURCE"	A
84-98	1-8	RPA Sweep analyses (every 4 seconds). There are 15 RPA sweep analysis sets. Each is valid for the 4 seconds centered on the time specified in the set. Each analysis set contains the following parameters: 1: Sweep center time (UT, seconds) (integer) 2: O+ density (ion/cm^3) 3: Total (H+ + He+) density (ion/cm^3) 4: Light ion flag (integer) 0 - No light ion 1 - Light ion is H+ 2 - Light ion is He+ 3+ - = 3 + 10000 x (H+ fraction) 5: Ion temperature (degrees K) 6: Ram ion drift velocity (m/s) 7: Analysis qualifier (integer) 0 - Analysis terminated unsuccessfully 1 - Successful analysis	I6, 2(E12.5), I6, 2(E12.5), I1, E12.5

		8: RPA-derived total ion density Note some records may only have valid values for field 1 and 8, these will have a value of 0 in field 7.	
99	1	RPA analysis source (integer) 1 - Ground processing analysis 2 - On-board microprocessor analysis	I2
100		"DM ION DENSITY"	A
101-110	1-6	DM ion density (ion/cm^3). 60 values.	6(E12.5)
111		"ENGINEERING DATA"	A
112	1	Unused	E12.5
	2	ADC temperature (degrees C)	E12.5
	3	SEP temperature	E12.5
	4	DM offset voltage (volts) (IES-2) RPA plasma plate potential (volts) (IES-3)	E12.5
	5	DM mode (integer) IES-2: -1: Undefined 0: Normal 1-8: H+ 9: FIBA IES-3: 0: Slow 1: Normal	I2
	6	EP mode (0-6 : A,B,BS,C,D,DS,E) (integer)	I2
	7	VIP at EDR start (volts)	E12.5
113		"FILLER"	A
114	1-7	Filler	E12.5