

Balancing Authority ACE Limit Proof-of-Concept Field Trial Project 2010-14

Eastern Interconnection Update Discussion
June 27, 2011

DISCUSSION STARTING AT 2:30 PM EDT

Bob Klueber – Midwest ISO

Balancing Authority Reliability-based Control Standard Drafting Team
(BARCSDT)

Balancing Authority ACE Limit Proof-of-Concept Field Trial

Eastern Interconnection Field Trial Participation

Participation reflects approximately 67% of the projected 2010 peak load for the Eastern Interconnection

Eastern Interconnection Balancing Authority Participants	2010 Frequency Bias	Region	Reliability Coordinator	Start Date
American Electric Power (CSWS)	-103.4	SPP	SPP	9/1/2005
Associated Electric Cooperative, Inc. (AECI)	-45	SERC	TVA	4/1/2010
Duke Energy Carolinas (DUK)	-196	SERC	VACS	4/1/2009
East Kentucky Power Cooperative (EKPC)	-42.73	SERC	TVA	7/6/2005
Entergy (EES)	-227.1	SERC	ICTE	7/6/2005
LGE-KU (LGEE)	-74	SERC	TVA	4/1/2008
Independent Electricity System Operator (IESO)	-245.8	NPCC	IESO	3/1/2008
Manitoba Hydro (MHEB)	-43.3	MRO	MISO	7/6/2005
MISO (MISO)	-1038.6	MRO, RFC, SERC	MISO	1/6/2009
PJM Interconnection (PJM)	-1358	RFC	PJM	8/1/2005
Santee Cooper (SC)	-61.52	SERC	VACS	3/1/2006
Southern Company (SOCO)	-445	SERC	SOCO	10/15/2005
Tennessee Valley Authority (TVA)	-317.6	SERC	TVA	10/1/2005

Balancing Authority ACE Limit Proof-of-Concept Field Trial

The Balancing Authority ACE Limit (BAAL) shall not be exceeded for more than 30 consecutive clock-minutes*

	Longest exceedance of the Balancing Authority ACE Limit since starting operation under the Field Trial		May 2011 Performance under Field Trial	
	Max MinCtLow	Max MinCtHigh	Max MinCtLow	Max MinCtHigh
BA01	26	16	5	7
BA02	17	17	6	8
BA03	19	19	9	13
BA04	10	20	8	9
BA05	16	22	8	12
BA06	15	23	8	8
BA07	20	24	9	9
BA08	28	26	13	12
BA09	30	26	30	26
BA10	21	31	11	11
BA11	14	32	4	4
BA12	29	40	14	13
BA13	28	43	10	13

MinCtLow = Count of consecutive clock-minutes BAAL_{Low} was exceeded

MinCtHigh = Count of consecutive clock-minutes BAAL_{High} was exceeded

*BAAL being exceeded for more than 30 consecutive clock-minutes would be a violation under the proposed BAL-007 standard.

Frequency Statistics

Eastern Interconnection

Year	Month	Total Minutes FTL_Low at 59.98 Hz SF	Total Minutes FTL_Low at 60 Hz SF	Total FTL_Low Minutes	Percentage Low During TEC	FTL_Low Events	FTL_Low Max Duration	Total Minutes FTL_High at 60.02 Hz SF	Total Minutes FTL_High at 60 Hz SF	Total FTL_High Minutes	Percentage High During TEC	FTL_High Events	FTL_High Max Duration	Total FTL_Low and FTL_High Minutes at 60 Hz SF	Total FTL_Low and FTL_High Minutes
2005	7	28	30	58	48.28%	32	5	0	16	16	0.00%	11	3	46	74
2005	8	47	91	138	34.06%	56	10	0	35	35	0.00%	21	5	126	173
2005	9	32	39	71	45.07%	33	8	0	39	39	0.00%	21	7	78	110
2005	10	42	48	90	46.67%	43	11	0	33	33	0.00%	23	5	81	123
2005	11	65	43	108	60.19%	58	6	0	35	35	0.00%	22	7	78	143
2005	12	37	36	73	50.68%	41	7	0	27	27	0.00%	19	3	63	100
2006	1	42	33	75	56.00%	43	6	0	61	61	0.00%	27	5	94	136
2006	2	0	64	64	0.00%	39	6	2	43	45	4.44%	24	4	107	109
2006	3	28	51	79	35.44%	50	4	17	37	54	31.48%	33	8	88	133
2006	4	19	86	105	18.10%	58	5	0	76	76	0.00%	46	8	162	181
2006	5	52	67	119	43.70%	54	8	0	72	72	0.00%	39	5	139	191
2006	6	45	34	79	56.96%	41	5	0	59	59	0.00%	24	10	93	138
2006	7	31	40	71	43.66%	34	9	0	50	50	0.00%	29	4	90	121
2006	8	16	85	101	15.84%	49	5	0	58	58	0.00%	26	8	143	159
2006	9	19	60	79	24.05%	39	6	0	53	53	0.00%	33	4	113	132
2006	10	53	42	95	55.79%	51	6	0	54	54	0.00%	28	8	96	149
2006	11	56	35	91	61.54%	47	5	1	36	37	2.70%	22	3	71	128
2006	12	34	18	52	65.38%	34	4	0	54	54	0.00%	29	6	72	106
2007	1	59	29	88	67.05%	44	7	0	55	55	0.00%	31	7	84	143
2007	2	17	31	48	35.42%	33	3	0	39	39	0.00%	21	4	70	87
2007	3	75	83	158	47.47%	76	15	0	78	78	0.00%	38	8	161	236
2007	4	36	41	77	46.75%	45	5	0	58	58	0.00%	31	4	99	135
2007	5	70	46	116	60.34%	64	5	0	95	95	0.00%	49	7	141	211
2007	6	62	30	92	67.39%	47	6	0	51	51	0.00%	25	7	81	143
2007	7	47	20	67	70.15%	33	6	0	39	39	0.00%	20	4	59	106
2007	8	37	25	62	59.68%	31	6	1	55	56	1.79%	32	5	80	118
2007	9	20	75	95	21.05%	41	8	0	27	27	0.00%	16	5	102	122
2007	10	57	65	122	46.72%	73	5	1	56	57	1.75%	36	5	121	179
2007	11	74	21	95	77.89%	60	4	0	34	34	0.00%	24	5	55	129
2007	12	37	22	59	62.71%	38	6	0	61	61	0.00%	38	4	83	120
2008	1	0	75	75	0.00%	34	8	0	48	48	0.00%	24	4	123	123
2008	2	18	71	89	20.22%	46	8	0	51	51	0.00%	24	8	122	140
2008	3	37	65	102	36.27%	55	6	0	40	40	0.00%	34	2	105	142
2008	4	41	65	106	38.68%	60	5	0	59	59	0.00%	33	6	124	165
2008	5	67	39	106	63.21%	63	4	0	40	40	0.00%	20	5	79	146
2008	6	40	21	61	65.57%	34	5	0	35	35	0.00%	19	5	56	96

Frequency Statistics

Eastern Interconnection

Year	Month	Total Minutes FTL_Low at 59.98 Hz SF	Total Minutes FTL_Low at 60 Hz SF	Total FTL_Low Minutes	Percentage Low During TEC	FTL_Low Events	FTL_Low Max Duration	Total Minutes FTL_High at 60.02 Hz SF	Total Minutes FTL_High at 60 Hz SF	Total FTL_High Minutes	Percentage High During TEC	FTL_High Events	FTL_High Max Duration	Total FTL_Low and FTL_High Minutes at 60 Hz SF	Total FTL_Low and FTL_High Minutes
2008	7	42	17	59	71.19%	29	7	0	17	17	0.00%	12	3	34	76
2008	8	41	19	60	68.33%	35	5	0	29	29	0.00%	17	6	48	89
2008	9	25	44	69	36.23%	39	4	0	55	55	0.00%	21	11	99	124
2008	10	35	33	68	51.47%	38	5	0	27	27	0.00%	19	3	60	95
2008	11	13	9	22	59.09%	13	5	0	13	13	0.00%	9	4	22	35
2008	12	16	34	50	32.00%	35	4	0	11	11	0.00%	8	3	45	61
2009	1	2	26	28	7.14%	16	4	0	19	19	0.00%	9	3	45	47
2009	2	0	34	34	0.00%	18	4	0	18	18	0.00%	11	6	52	52
2009	3	0	41	41	0.00%	23	5	0	25	25	0.00%	11	9	66	66
2009	4	0	59	59	0.00%	37	5	0	27	27	0.00%	20	3	86	86
2009	5	8	35	43	18.60%	31	4	0	27	27	0.00%	15	8	62	70
2009	6	30	28	58	51.72%	28	5	0	25	25	0.00%	16	3	53	83
2009	7	14	22	36	38.89%	22	3	0	28	28	0.00%	16	6	50	64
2009	8	16	10	26	61.54%	20	2	0	13	13	0.00%	10	2	23	39
2009	9	11	22	33	33.33%	21	3	0	20	20	0.00%	14	4	42	53
2009	10	44	45	89	49.44%	44	6	0	18	18	0.00%	10	3	63	107
2009	11	30	19	49	61.22%	33	3	0	34	34	0.00%	21	4	53	83
2009	12	11	23	34	32.35%	20	5	0	22	22	0.00%	15	3	45	56
2010	1	36	26	62	58.06%	35	6	0	16	16	0.00%	9	3	42	78
2010	2	23	16	39	58.97%	24	3	0	26	26	0.00%	16	2	42	65
2010	3	38	71	109	34.86%	65	6	0	40	40	0.00%	22	6	111	149
2010	4	63	38	101	62.38%	65	5	0	54	54	0.00%	34	6	92	155
2010	5	72	30	102	70.59%	60	6	0	40	40	0.00%	29	4	70	142
2010	6	10	28	38	26.32%	27	2	0	10	10	0.00%	9	2	38	48
2010	7	8	19	27	29.63%	17	4	0	30	30	0.00%	13	5	49	57
2010	8	16	29	45	35.56%	24	4	0	17	17	0.00%	11	3	46	62
2010	9	0	56	56	0.00%	31	4	0	22	22	0.00%	11	4	78	78
2010	10	1	60	61	1.64%	40	5	0	19	19	0.00%	15	4	79	80
2010	11	0	59	59	0.00%	44	3	5	26	31	16.13%	20	3	85	90
2010	12	8	12	20	40.00%	18	2	3	30	33	9.09%	20	5	42	53
2011	1	5	30	35	14.29%	25	3	0	9	9	0.00%	6	4	39	44
2011	2	1	21	22	4.55%	18	2	0	22	22	0.00%	15	3	43	44
2011	3	1	42	43	2.33%	31	3	0	19	19	0.00%	10	7	61	62
2011	4	0	61	61	0.00%	38	6	0	32	32	0.00%	18	4	93	93
2011	5	9	33	42	21.43%	27	5	0	25	25	0.00%	22	3	58	67

Frequency Statistics

Eastern Interconnection

Year	Month	Total Minutes FTL_Low at 59.98 Hz SF	Total Minutes FTL_Low at 60 Hz SF	FTL_Minutes	Year	Month	Total Minutes FTL_Low at 59.98 Hz SF	Total Minutes FTL_Low at 60 Hz SF	Total FTL_Low Minutes	Percentage Low During TEC	FTL_Low Events	FTL_Low Max Duration	FTL_High Max Duration	Total FTL_Low and FTL_High Minutes at 60 Hz SF	Total FTL_Low and FTL_High Minutes	
2008	1	42	17		2008	1	0	75	75	0.00%	34	8				
2008	2	41	19		2008	2	18	71	89	20.22%	46	8				
2008	3	25	44		2008	3	37	65	102	36.27%	55	6				
2008	4	41	19		2008	4	41	65	106	38.68%	60	5	12	3	34	76
2008	5	67	44		2008	5	67	39	106	63.21%	63	4	17	6	48	89
2008	6	40	33		2008	6	40	21	61	65.57%	34	5	21	11	99	124
2008	7	42	9		2008	7	42	17	59	71.19%	29	7	19	3	60	95
2008	8	41	34		2008	8	41	19	60	68.33%	35	5	9	4	22	35
2008	9	25	9		2008	9	25	44	69	36.23%	39	4	8	3	45	61
2008	10	35	26		2008	10	35	33	68	51.47%	38	5	9	3	45	47
2008	11	13	34		2008	11	13	9	22	59.09%	13	5	11	6	52	52
2008	12	16	41		2008	12	16	34	50	32.00%	35	4	11	9	66	66
2009	1	0	59		2009	1	2	26	28	7.14%	16	4	20	3	86	86
2009	2	8	35		2009	2	0	34	34	0.00%	18	4	15	8	62	70
2009	3	30	28		2009	3	0	41	41	0.00%	23	5	16	3	53	83
2009	4	14	22		2009	4	0	59	59	0.00%	37	5	16	6	50	64
2009	5	16	10		2009	5	8	35	43	18.60%	31	4	10	2	23	39
2009	6	11	22		2009	6	30	28	58	51.72%	28	5	14	4	42	53
2009	7	44	45		2009	7	14	22	36	38.89%	22	3	10	3	63	107
2009	8	30	19		2009	8	16	10	26	61.54%	20	2	21	4	53	83
2009	9	11	23		2009	9	11	22	33	33.33%	21	3	3	4	53	83
2009	10	36	26		2009	10	44	45	89	49.44%	44	6	15	3	45	56
2009	11	23	16		2009	11	30	19	49	61.22%	33	3	9	3	42	78
2009	12	38	71		2009	12	11	23	34	32.35%	20	5	16	2	42	65
2010	1	63	38		2010	1	36	26	62	58.06%	35	6	22	6	111	149
2010	2	72	30		2010	2	23	16	39	58.97%	24	3	34	6	92	155
2010	3	10	28		2010	3	38	71	109	34.86%	65	6	29	4	70	142
2010	4	8	19		2010	4	63	38	101	62.38%	65	5	9	2	38	48
2010	5	16	29		2010	5	72	30	102	70.59%	60	6	13	5	49	57
2010	6	0	56		2010	6	10	28	38	26.32%	27	2	11	3	46	62
2010	7	60	56		2010	7	8	19	27	29.63%	17	4	11	4	78	78
2010	8	59	60		2010	8	16	29	45	35.56%	24	4	15	4	79	80
2010	9	8	12		2010	9	0	56	56	0.00%	31	4	20	3	85	90
2010	10	5	30		2010	10	1	60	61	1.64%	40	5	15	5	42	53
2010	11	1	21		2010	11	0	59	59	0.00%	44	3	6	4	39	44
2010	12	42	61		2010	12	8	12	20	40.00%	18	2	15	3	43	44
2011	1	0	33		2011	1	5	30	35	14.29%	25	3	10	7	61	62
2011	2	1	61		2011	2	1	21	22	4.55%	18	2	18	4	93	93
2011	3	9	33		2011	3	1	42	43	2.33%	31	3	22	3	58	67
2011	4				2011	4	0	61	61	0.00%	38	6				
2011	5				2011	5	9	33	42	21.43%	27	5				

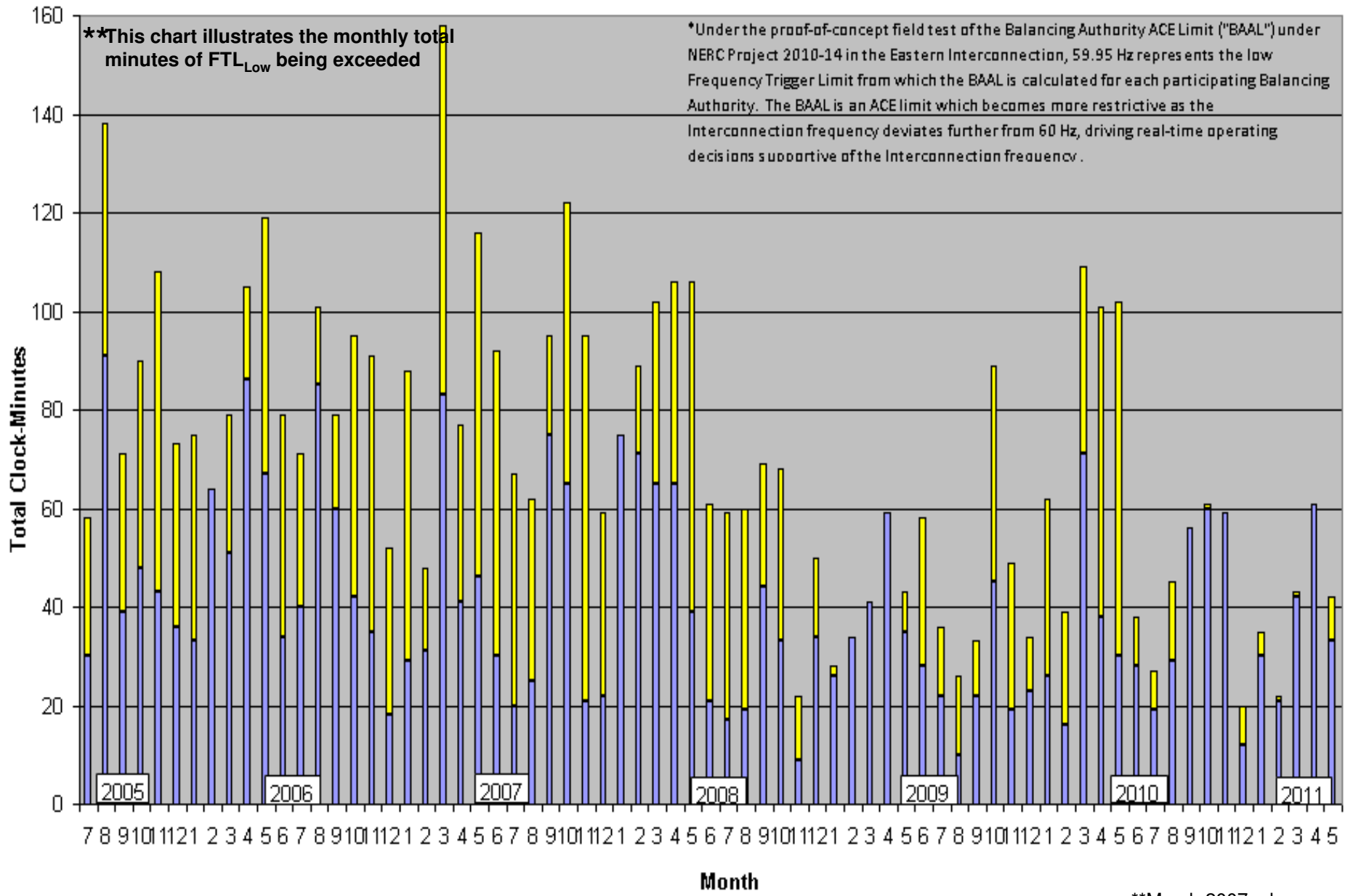
Frequency Statistics

Eastern Interconnection

Year	Month	Total Minutes FTL_Low at 59.98 Hz SF	Year	Month	Total Minutes FTL_High at 60.02 Hz SF	Total Minutes FTL_High at 60 Hz SF	Total FTL_High Minutes	Percentage High During TEC	FTL_High Events	FTL_High Max Duration	Total FTL_Low and FTL_High Minutes at 60 Hz SF	Total FTL_Low and FTL_High Minutes	Total FTL_Low Minutes at 60 Hz SF	Total FTL_Low and FTL_High Minutes
2008	1	4	2008	1	0	48	48	0.00%	24	4	123	123		
2008	2	4	2008	2	0	51	51	0.00%	24	8	122	140		
2008	3	4	2008	3	0	40	40	0.00%	34	2	105	142	34	76
2008	4	4	2008	4	0	59	59	0.00%	33	6	124	165	48	89
2008	5	2	2008	5	0	40	40	0.00%	20	5	79	146	99	124
2008	6	3	2008	6	0	35	35	0.00%	19	5	56	96	60	95
2008	7	1	2008	7	0	17	17	0.00%	12	3	34	76	22	35
2008	8	1	2008	8	0	29	29	0.00%	17	6	48	89	45	61
2009	1	1	2008	9	0	55	55	0.00%	21	11	99	124	45	47
2009	2	1	2008	10	0	27	27	0.00%	19	3	60	95	52	52
2009	3	1	2008	11	0	13	13	0.00%	9	4	22	35	66	66
2009	4	1	2008	12	0	11	11	0.00%	8	3	45	61	86	86
2009	5	1	2009	1	0	19	19	0.00%	9	3	45	47	62	70
2009	6	3	2009	2	0	18	18	0.00%	11	6	52	52	53	83
2009	7	1	2009	3	0	25	25	0.00%	11	9	66	66	50	64
2009	8	1	2009	4	0	27	27	0.00%	20	3	86	86	23	39
2009	9	1	2009	5	0	27	27	0.00%	15	8	62	70	42	53
2009	10	4	2009	6	0	25	25	0.00%	16	3	53	83	63	107
2009	11	3	2009	7	0	28	28	0.00%	16	6	50	64	53	83
2009	12	1	2009	8	0	13	13	0.00%	10	2	23	39	45	56
2010	1	3	2009	9	0	20	20	0.00%	14	4	42	53	42	78
2010	2	2	2009	10	0	18	18	0.00%	10	3	63	107	42	65
2010	3	3	2009	11	0	34	34	0.00%	21	4	53	83	70	142
2010	4	6	2009	12	0	22	22	0.00%	15	3	45	56	38	48
2010	5	7	2010	1	0	16	16	0.00%	9	3	42	78	49	57
2010	6	1	2010	2	0	26	26	0.00%	16	2	42	65	46	62
2010	7	1	2010	3	0	40	40	0.00%	22	6	111	149	78	78
2010	8	1	2010	4	0	54	54	0.00%	34	6	92	155	79	80
2010	9	1	2010	5	0	40	40	0.00%	29	4	70	142	42	53
2010	10	1	2010	6	0	10	10	0.00%	9	2	38	48	39	44
2010	11	1	2010	7	0	30	30	0.00%	13	5	49	57	43	44
2010	12	1	2010	8	0	17	17	0.00%	11	3	46	62	61	62
2011	1	1	2010	9	0	22	22	0.00%	11	4	78	78	93	93
2011	2	1	2010	10	0	19	19	0.00%	15	4	79	80	58	67
2011	3	1	2010	11	5	26	31	16.13%	20	3	85	90		
2011	4	1	2010	12	3	30	33	9.09%	20	5	42	53		
2011	5	1	2011	1	0	9	9	0.00%	6	4	39	44		
2011	6	1	2011	2	0	22	22	0.00%	15	3	43	44		
2011	7	1	2011	3	0	19	19	0.00%	10	7	61	62		
2011	8	1	2011	4	0	32	32	0.00%	18	4	93	93		
2011	9	1	2011	5	0	25	25	0.00%	22	3	58	67		

Total Clock-Minutes of Frequency below 59.95 Hz*

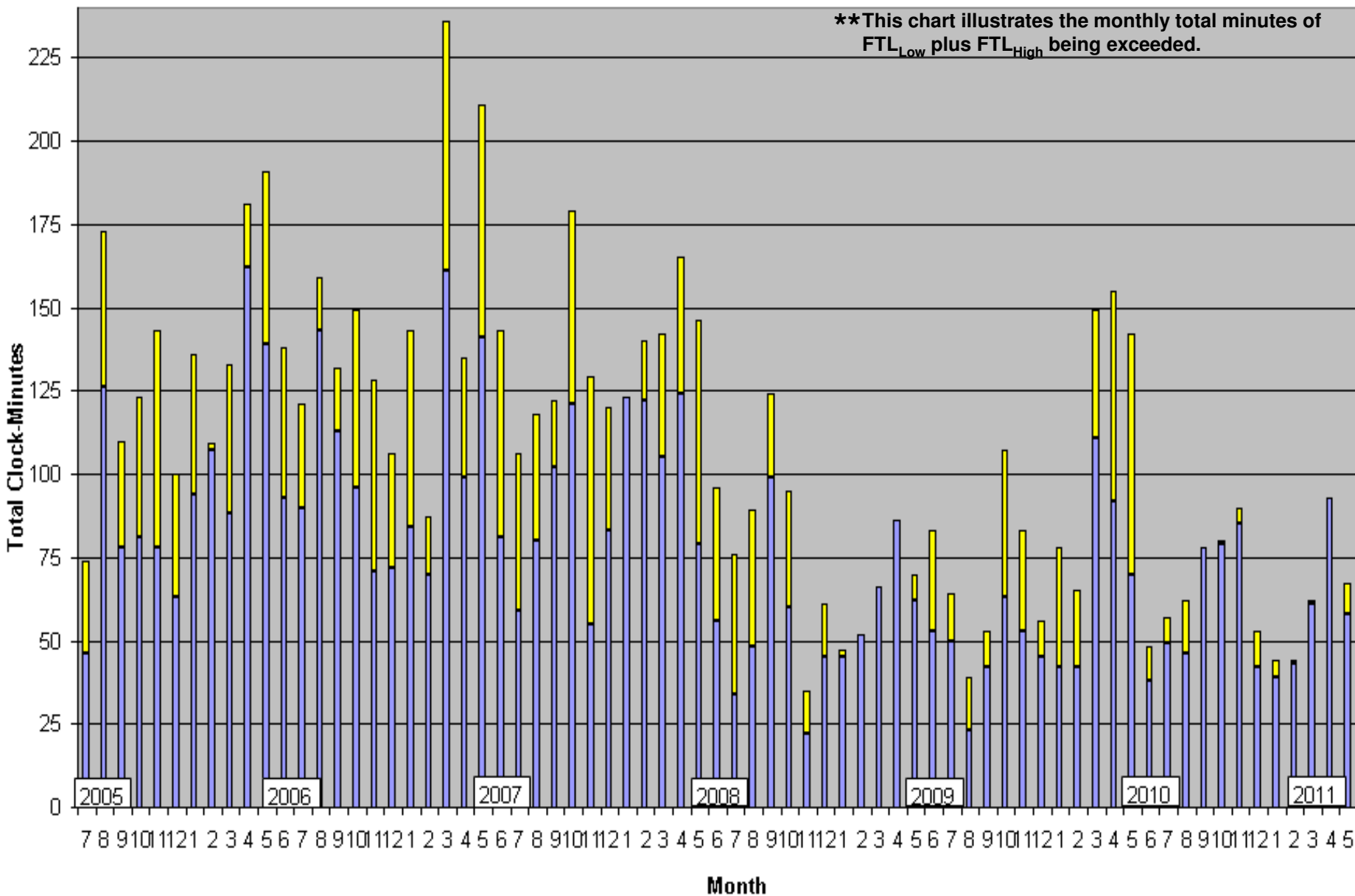
Eastern Interconnection



■ Total Minutes at 60 Hz
 ■ Addition Minutes During Time-Error Corrections

**March 2007- change to the new Daylight Saving Time.

Total Clock-Minutes less than 59.95 Hz or greater than 60.05 Hz Eastern Interconnection



■ Total Minutes at 60 Hz ■ Addition Minutes During Time-Error Corrections

**March 2007- change to the new Daylight Saving Time.

Date	Time	TimeZone	FreqError	ActualFreq	SchedFreq	MinCtLow	MinCtHigh	ACPS1
05/03/11	22:38	CDT	0.0224	60.0224	60	0	11	-2565.11
05/03/11	22:39	CDT	0.0171	60.0171	60	0	12	-1981.37
05/03/11	22:40	CDT	0.0144	60.0144	60	0	13	-1656.60
05/03/11	22:41	CDT	0.0348	60.0348	60	0	14	-4638.41
05/03/11	22:42	CDT	0.041	60.041	60	0	15	-5596.79
05/03/11	22:43	CDT	0.0385	60.0385	60	0	16	-5283.41
05/03/11	22:44	CDT	0.0353	60.0353	60	0	17	-5062.62
05/03/11	22:45	CDT	0.043	60.043	60	0	18	-6341.51
05/03/11	22:46	CDT	0.043	60.043	60	0	19	-6473.70
05/03/11	22:47	CDT	0.0394	60.0394	60	0	20	-4486.09
05/03/11	22:48	CDT	0.0291	60.0291	60	0	21	-3129.66
05/03/11	22:49	CDT	0.0332	60.0332	60	0	22	-3589.42
05/03/11	22:50	CDT	0.0383	60.0383	60	0	23	-4244.35
05/03/11	22:51	CDT	0.0422	60.0422	60	0	24	-4843.16
05/03/11	22:52	CDT	0.0433	60.0433	60	0	25	-5218.66
05/03/11	22:53	CDT	0.016	60.016	60	0	26	-725.19
05/09/11	9:16	CDT	-0.0361	59.9639	60	11	0	-2957.49
05/09/11	9:17	CDT	-0.0434	59.9566	60	12	0	-3703.17
05/09/11	9:18	CDT	-0.0508	59.9492	60	13	0	-4535.81
05/09/11	9:19	CDT	-0.048	59.952	60	14	0	-4074.72
05/09/11	9:20	CDT	-0.0471	59.9529	60	15	0	-4098.30
05/09/11	9:21	CDT	-0.0413	59.9587	60	16	0	-3665.17
05/09/11	9:22	CDT	-0.0372	59.9628	60	17	0	-3200.97
05/09/11	9:23	CDT	-0.0269	59.9731	60	18	0	-2210.09
05/09/11	9:24	CDT	-0.0246	59.9754	60	19	0	-1747.18
05/09/11	9:25	CDT	-0.0345	59.9655	60	20	0	-2650.82
05/09/11	9:26	CDT	-0.0328	59.9672	60	21	0	-2584.18
05/09/11	9:27	CDT	-0.0199	59.9801	60	22	0	-1454.73
05/14/11	11:19	CDT	-0.0322	59.9478	59.98	11	0	-7244.71
05/14/11	11:20	CDT	-0.0235	59.9565	59.98	12	0	-5821.97
05/14/11	11:21	CDT	-0.0285	59.9515	59.98	13	0	-6465.90
05/14/11	11:22	CDT	-0.0188	59.9612	59.98	14	0	-4998.99
05/14/11	11:23	CDT	-0.0061	59.9739	59.98	15	0	-3117.24
05/14/11	11:24	CDT	0.0077	59.9877	59.98	16	0	-1292.04
05/22/11	9:47	CDT	-0.0184	59.9816	60	11	0	-1943.48
05/22/11	9:48	CDT	-0.0155	59.9845	60	12	0	-1613.80
05/22/11	9:49	CDT	-0.0207	59.9793	60	13	0	-2183.04
05/22/11	9:50	CDT	-0.0206	59.9794	60	14	0	-2136.40
05/22/11	9:51	CDT	-0.0191	59.9809	60	15	0	-1862.62
05/22/11	9:52	CDT	-0.0229	59.9771	60	16	0	-2241.40
05/22/11	9:53	CDT	-0.0297	59.9703	60	17	0	-2918.72
05/22/11	9:54	CDT	-0.0303	59.9697	60	18	0	-2862.34
05/22/11	9:55	CDT	-0.0218	59.9782	60	19	0	-1835.83
05/22/11	9:56	CDT	-0.0098	59.9902	60	20	0	-597.67

All durations of the BAAL being exceeded for more than 15 consecutive clock-minutes noted on left.

Periods of the FTL being exceeded for 3 consecutive clock minutes or more:

PrevailingTime	PTimeZone	FreqError	ActualFreq	SchedFreq
5/1/11 20:04	EDT	-0.0539	59.9461	60
5/1/11 20:05	EDT	-0.0551	59.9449	60
5/1/11 20:06	EDT	-0.053	59.947	60
5/5/11 21:54	EDT	0.052	60.052	60
5/5/11 21:55	EDT	0.058	60.058	60
5/5/11 21:56	EDT	0.0557	60.0557	60
5/9/11 23:03	EDT	-0.0558	59.9442	60
5/9/11 23:04	EDT	-0.0546	59.9454	60
5/9/11 23:05	EDT	-0.0512	59.9488	60
5/14/11 12:15	EDT	-0.0313	59.9487	59.98
5/14/11 12:16	EDT	-0.0345	59.9455	59.98
5/14/11 12:17	EDT	-0.0479	59.9321	59.98
5/14/11 12:18	EDT	-0.0455	59.9345	59.98
5/14/11 12:19	EDT	-0.0315	59.9485	59.98
5/22/11 23:07	EDT	-0.0539	59.9461	60
5/22/11 23:08	EDT	-0.0582	59.9418	60
5/22/11 23:09	EDT	-0.0512	59.9488	60

Date	Time	TimeZone	FreqError	ActualFreq	SchedFreq	MinCtLow	MinCtHigh	ACPS1
05/23/11	8:19	CDT	-0.0199	59.9801	60	11	0	-1462.33
05/23/11	8:20	CDT	-0.0236	59.9764	60	12	0	-1831.47
05/23/11	8:21	CDT	-0.018	59.982	60	13	0	-1289.70
05/23/11	8:22	CDT	-0.0286	59.9714	60	14	0	-2249.25
05/23/11	8:23	CDT	-0.0271	59.9729	60	15	0	-2011.23
05/23/11	8:24	CDT	-0.0251	59.9749	60	16	0	-1917.19
05/23/11	8:25	CDT	-0.023	59.977	60	17	0	-1621.78
05/23/11	8:26	CDT	-0.0175	59.9825	60	18	0	-1166.08
05/23/11	8:27	CDT	-0.0205	59.9795	60	19	0	-1530.13
05/23/11	8:28	CDT	-0.0226	59.9774	60	20	0	-1779.82
05/23/11	8:29	CDT	-0.0225	59.9775	60	21	0	-1825.87
05/23/11	8:30	CDT	-0.0234	59.9766	60	22	0	-2004.78
05/23/11	8:31	CDT	-0.0151	59.9849	60	23	0	-1074.29
05/23/11	8:32	CDT	-0.0112	59.9888	60	24	0	-613.49
05/31/11	13:18	CDT	-0.0167	59.9833	60	11	0	-1648.19
05/31/11	13:19	CDT	-0.0227	59.9773	60	12	0	-2152.96
05/31/11	13:20	CDT	-0.0314	59.9686	60	13	0	-3044.36
05/31/11	13:21	CDT	-0.0286	59.9714	60	14	0	-2614.56
05/31/11	13:22	CDT	-0.0341	59.9659	60	15	0	-3309.04
05/31/11	13:23	CDT	-0.0264	59.9736	60	16	0	-2495.81
05/31/11	13:24	CDT	-0.0262	59.9738	60	17	0	-2554.86
05/31/11	13:25	CDT	-0.0219	59.9781	60	18	0	-2082.20
05/31/11	13:26	CDT	-0.0206	59.9794	60	19	0	-1957.84
05/31/11	13:27	CDT	-0.0171	59.9829	60	20	0	-1617.68
05/31/11	13:28	CDT	-0.0129	59.9871	60	21	0	-1187.16
05/31/11	15:17	CDT	-0.0122	59.9878	60	11	0	-1518.72
05/31/11	15:18	CDT	-0.02	59.98	60	12	0	-2661.53
05/31/11	15:19	CDT	-0.0222	59.9778	60	13	0	-3072.63
05/31/11	15:20	CDT	-0.0264	59.9736	60	14	0	-3297.58
05/31/11	15:21	CDT	-0.0293	59.9707	60	15	0	-4424.95
05/31/11	15:22	CDT	-0.0277	59.9723	60	16	0	-4239.59
05/31/11	15:23	CDT	-0.0272	59.9728	60	17	0	-4138.45
05/31/11	15:24	CDT	-0.0265	59.9735	60	18	0	-3955.89
05/31/11	15:25	CDT	-0.0254	59.9746	60	19	0	-3814.92
05/31/11	15:26	CDT	-0.0222	59.9778	60	20	0	-3296.06
05/31/11	15:27	CDT	-0.0187	59.9813	60	21	0	-2602.10
05/31/11	15:28	CDT	-0.0186	59.9814	60	22	0	-2568.81
05/31/11	15:29	CDT	-0.027	59.973	60	23	0	-3832.57
05/31/11	15:30	CDT	-0.0239	59.9761	60	24	0	-3275.20
05/31/11	15:31	CDT	-0.0215	59.9785	60	25	0	-2452.55
05/31/11	15:32	CDT	-0.0159	59.9841	60	26	0	-1485.64
05/31/11	15:33	CDT	-0.021	59.979	60	27	0	-1755.30
05/31/11	15:34	CDT	-0.0174	59.9826	60	28	0	-1335.14
05/31/11	15:35	CDT	-0.0201	59.9799	60	29	0	-1459.59
05/31/11	15:36	CDT	-0.0175	59.9825	60	30	0	-1154.54

All durations of the BAAL being exceeded for more than 15 consecutive clock-minutes noted on left.

Date	Time	TimeZone	FreqError	ActualFreq	SchedFreq	MinCtlLow	MinCtlHigh	ACPS1	
05/03/11	22:38								
05/03/11	22:39								
05/03/11	22:40								
05/03/11	22:41								
05/03/11	22:42								
05/03/11	22:43								
05/03/11	22:44								
05/03/11	22:45								
05/03/11	22:46								
05/03/11	22:47								
05/03/11	22:48								
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05/03/11	22:53								
05/09/11	9:16								
05/09/11	9:17								
05/09/11	9:18								
05/09/11	9:19								
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05/09/11	9:22								
05/09/11	9:23								
05/09/11	9:24								
05/09/11	9:25								
05/09/11	9:26								
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05/22/11	9:52								
05/22/11	9:53								
05/22/11	9:54								
05/22/11	9:55								
05/22/11	9:56								

Dates in this presentation:

Clock-minute Frequency greater than FTL_{High} on May 5, 2011, ending 21:56 EDT: 3 consecutive clock-minutes.

Clock-minute Frequency less than FTL_{Low} on May 14, 2011, ending 12:19 EDT: 5 consecutive clock-minutes.

Clock-minute ACE greater than $BAAL_{High}$ on May 3, 2011, ending 22:53 CDT: 26 consecutive clock-minutes.

Clock-minute ACE less than $BAAL_{Low}$ on May 23, 2011, ending 08:32 CDT: 24 consecutive clock-minutes.

Clock-minute ACE less than $BAAL_{Low}$ on May 31, 2011, ending 15:36 CDT: 30 consecutive clock-minutes.

Under the draft requirement, a proposed $BAAL_{Low}$ violation would occur when the ACE is lower than $BAAL_{Low}$ for more than 30 consecutive clock-minutes and a proposed $BAAL_{High}$ violation would occur when the ACE is greater than $BAAL_{High}$ for more than 30 consecutive clock-minutes. Under prior work on draft BAL-008, a proposed FTL_{Low} violation would occur when the Frequency is lower than FTL_{Low} for more than 30 consecutive clock-minutes and a proposed FTL_{High} violation would occur when the Frequency is greater than FTL_{High} for more than 30 consecutive clock-minutes.

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EXAMPLE 1

05/05/2011 ending 21:56 EDT

3-minute duration above FTL_{High}

EI Clock-Minute Average Frequency

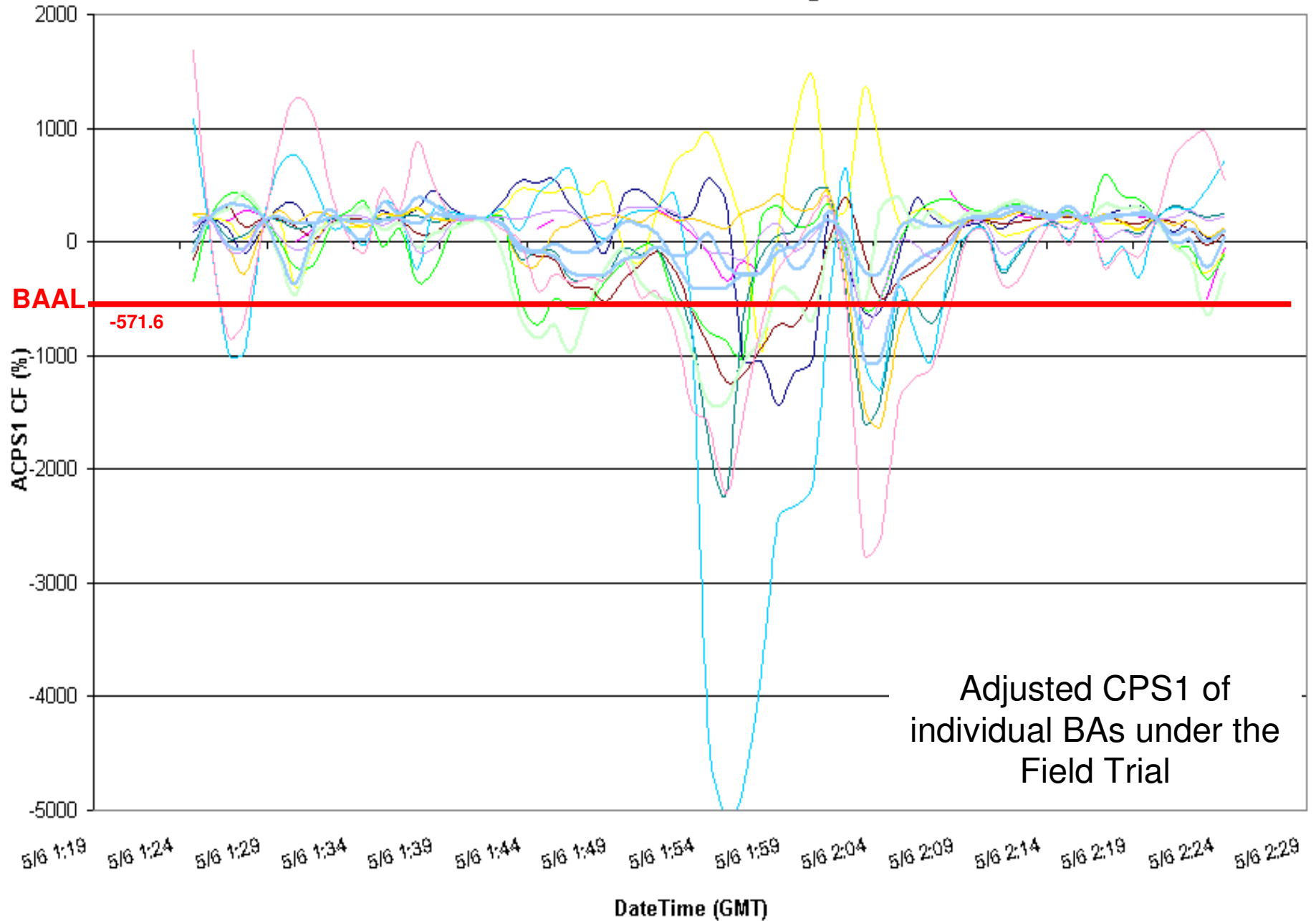


Clock-minute Actual Frequency of Participants

05/05/2011 ending 21:56 EDT

3-minute duration above FTL_{High}

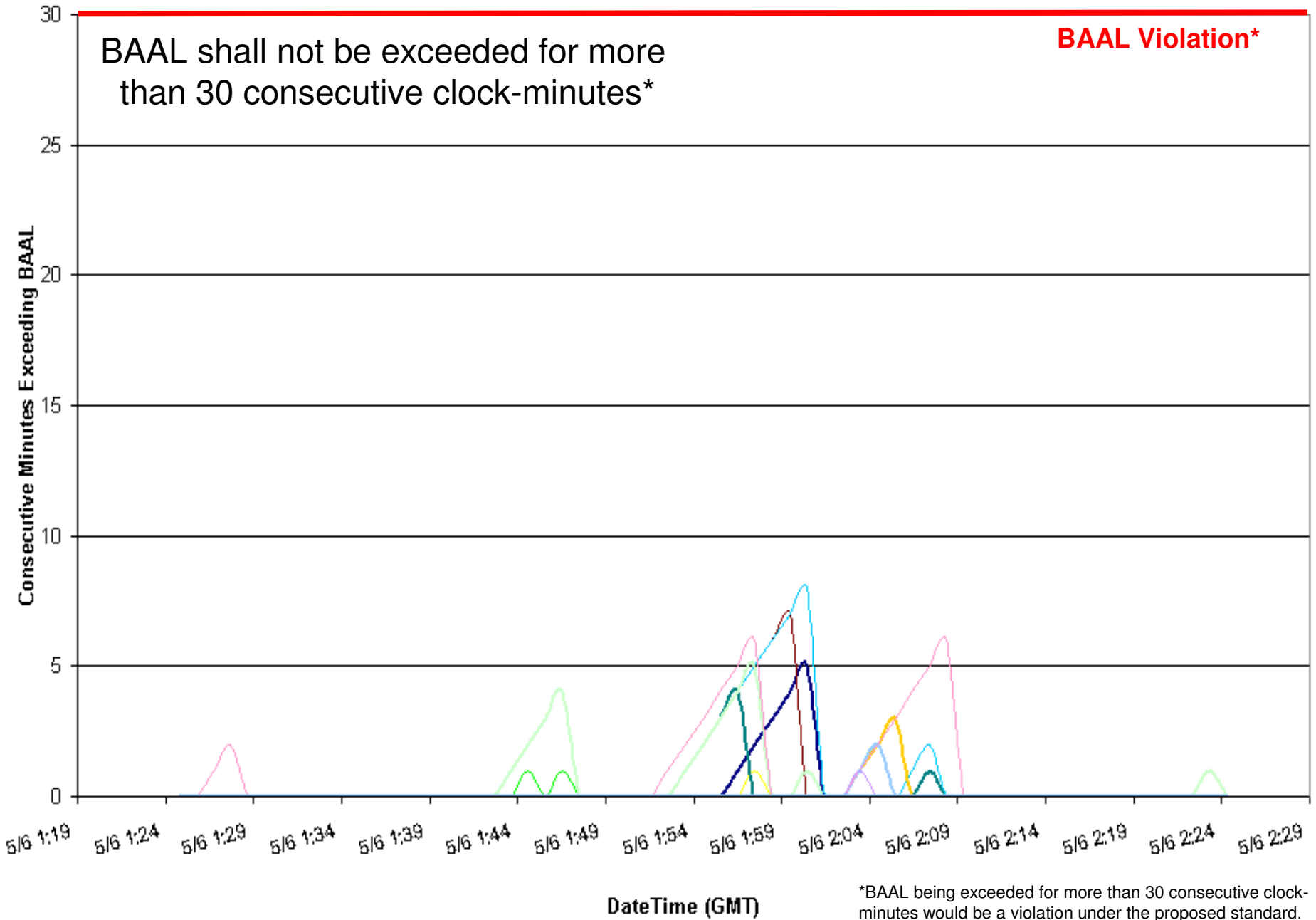
ACPS1 Clock-Minute Averages



05/05/2011 ending 21:56 EDT

3-minute duration above FTL_{High}

Consecutive Minutes Exceeding BAAL



*BAAL being exceeded for more than 30 consecutive clock-minutes would be a violation under the proposed standard.

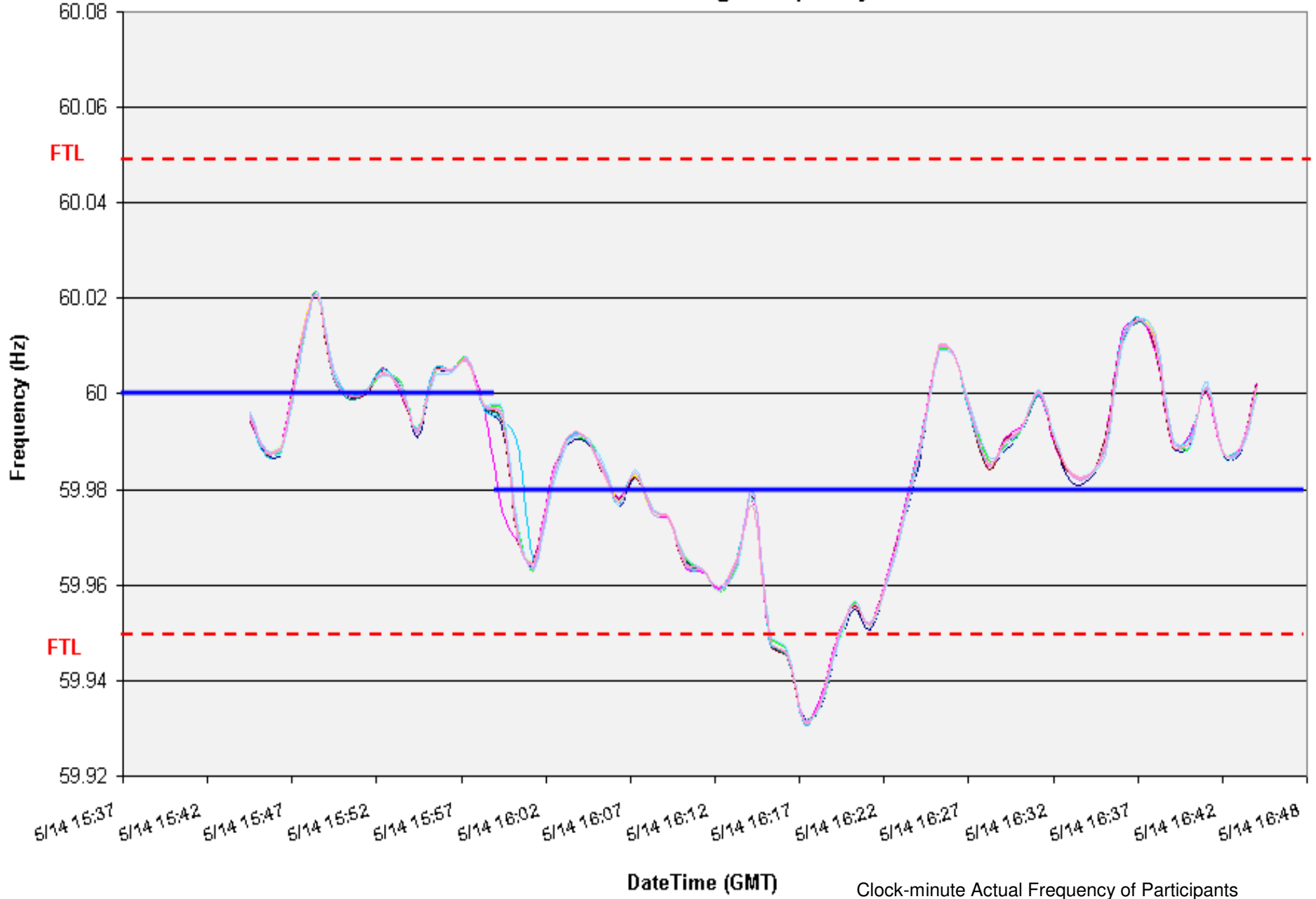
EXAMPLE 2

05/14/2011 ending 12:19 EDT

5-minute duration below FTL_{Low}

59.98 Scheduled Frequency TEC

EI Clock-Minute Average Frequency



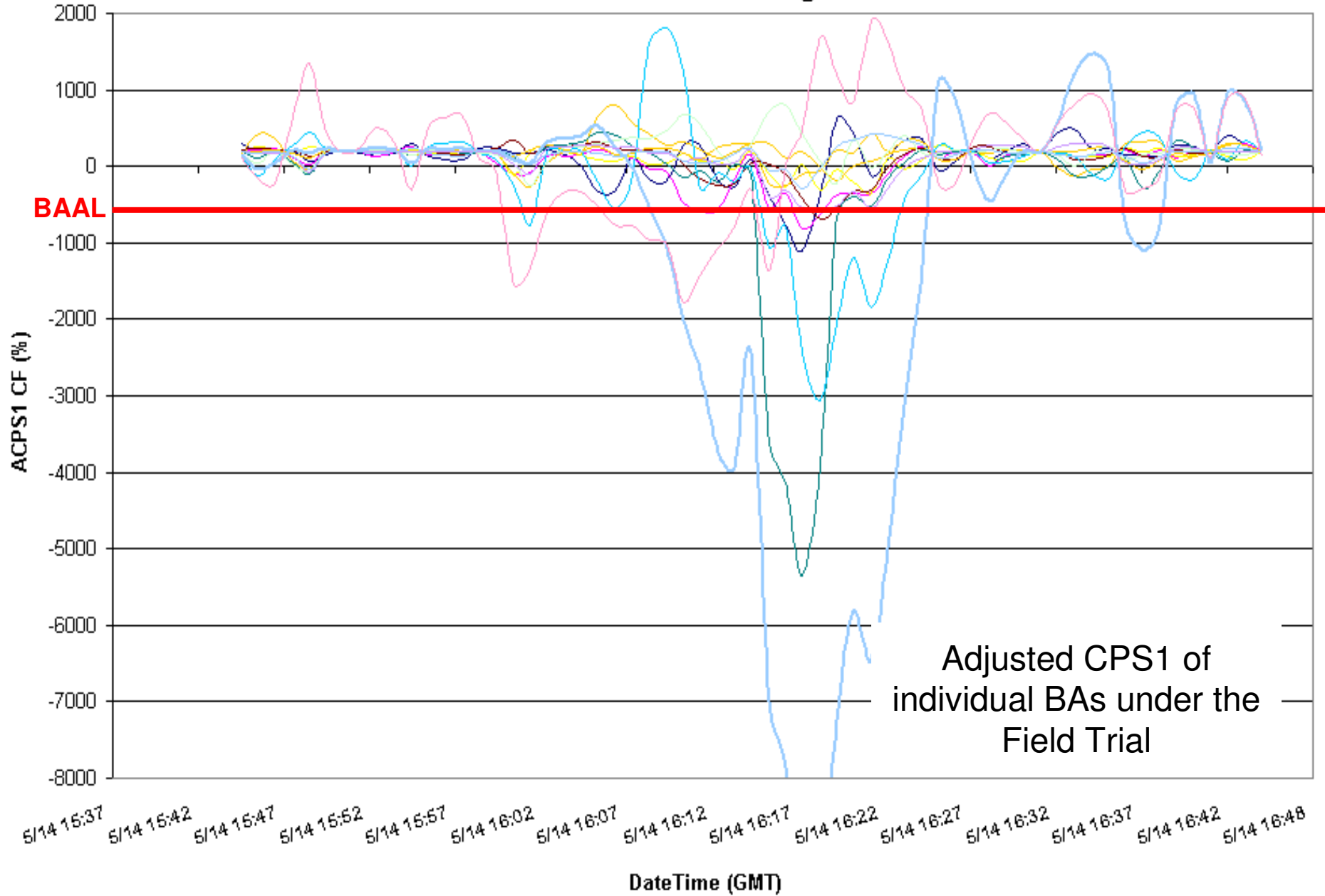
Clock-minute Actual Frequency of Participants

05/14/2011 ending 12:19 EDT

5-minute duration below FTL_{Low}

59.98 Scheduled Frequency TEC

ACPS1 Clock-Minute Averages

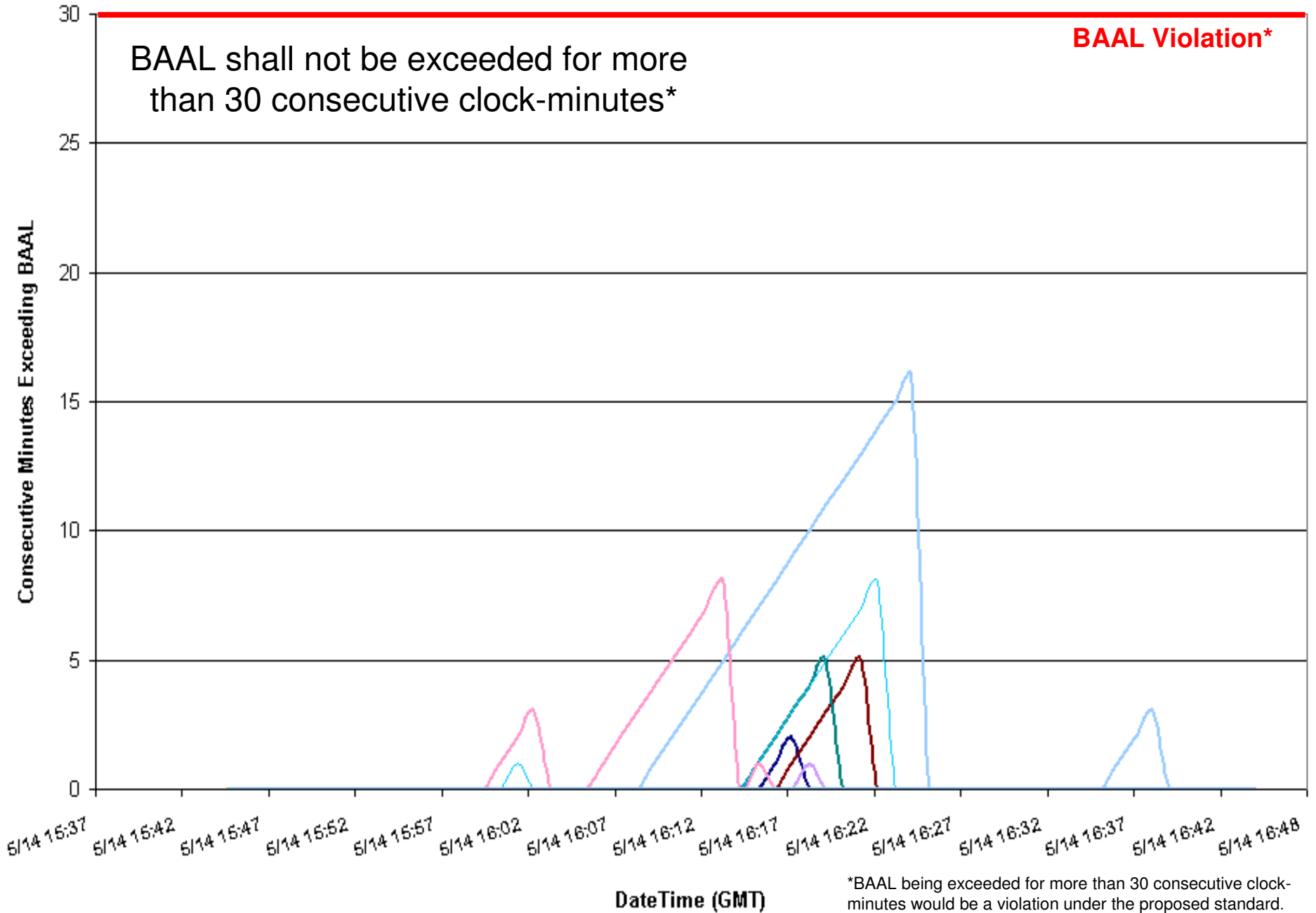


05/14/2011 ending 12:19 EDT

5-minute duration below FTL_{Low}

59.98 Scheduled Frequency TEC

Consecutive Minutes Exceeding BAAL



EXAMPLE 3

05/03/2011 ending 22:53 CDT
26-minute duration above BAAL_{High}

EI Clock-Minute Average Frequency

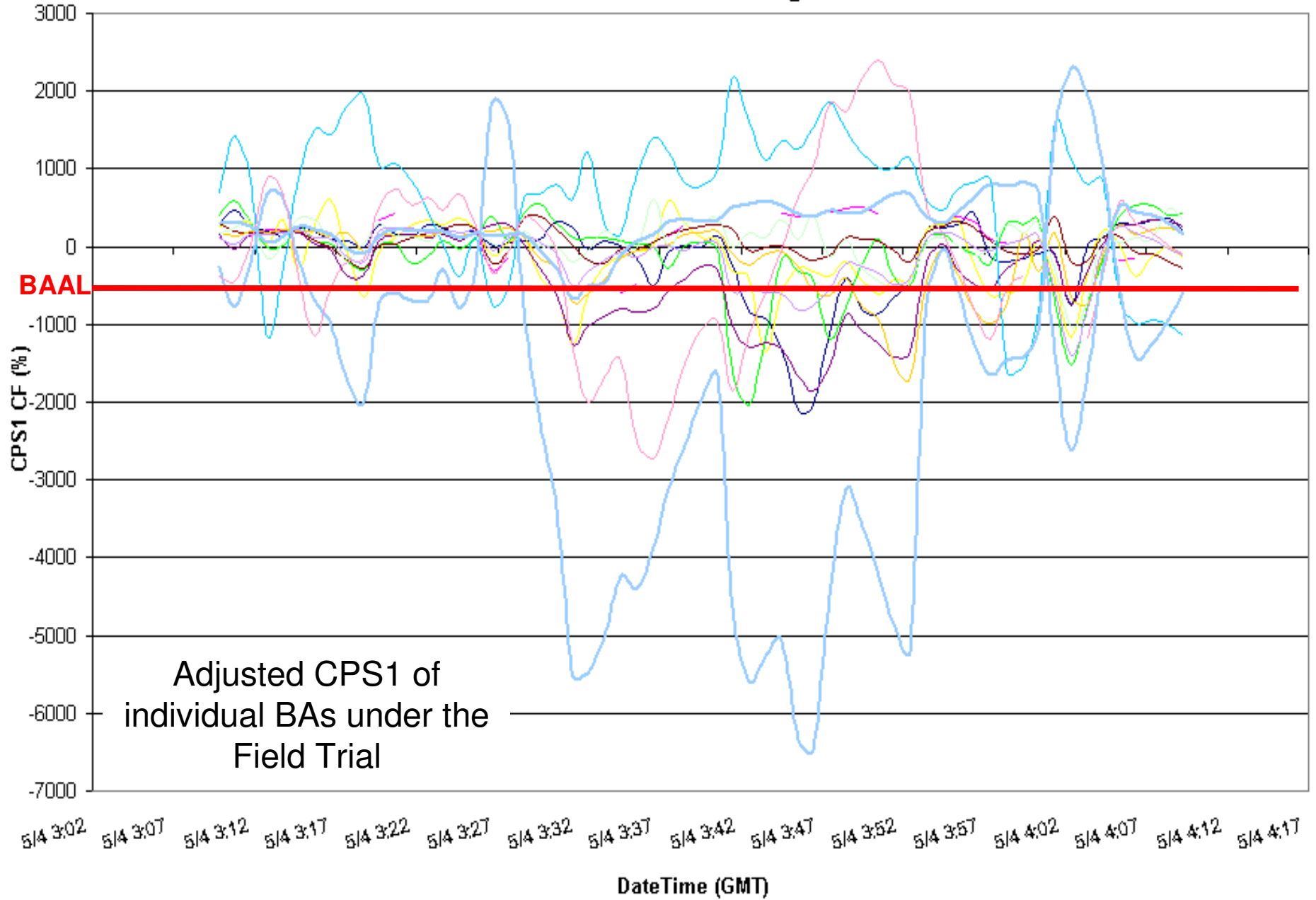


Clock-minute Actual Frequency of Participants

05/03/2011 ending 22:53 CDT

26-minute duration above BAAL_{High}

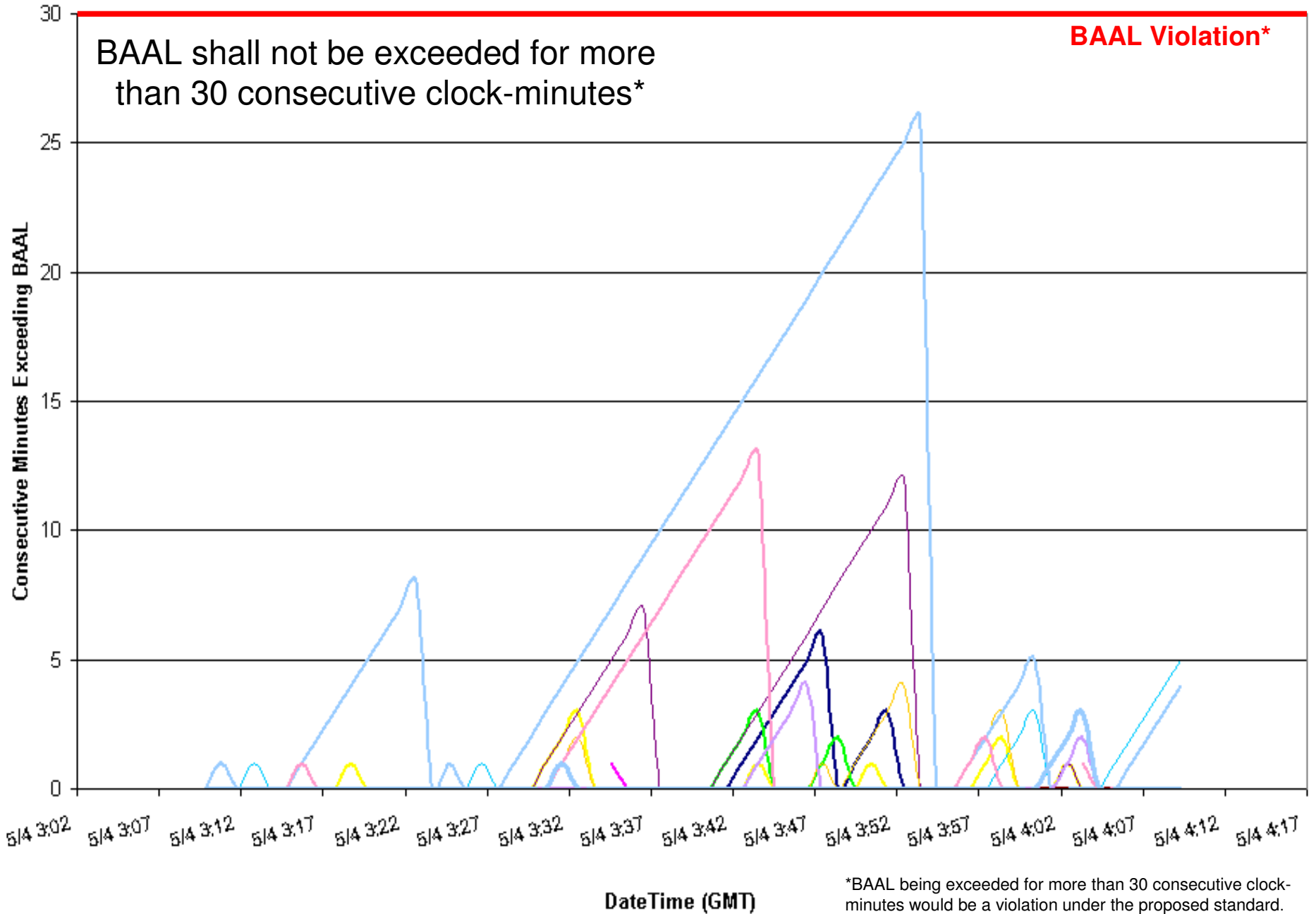
ACPS1 One-Minute Averages



05/03/2011 ending 22:53 CDT

26-minute duration above BAAL_{High}

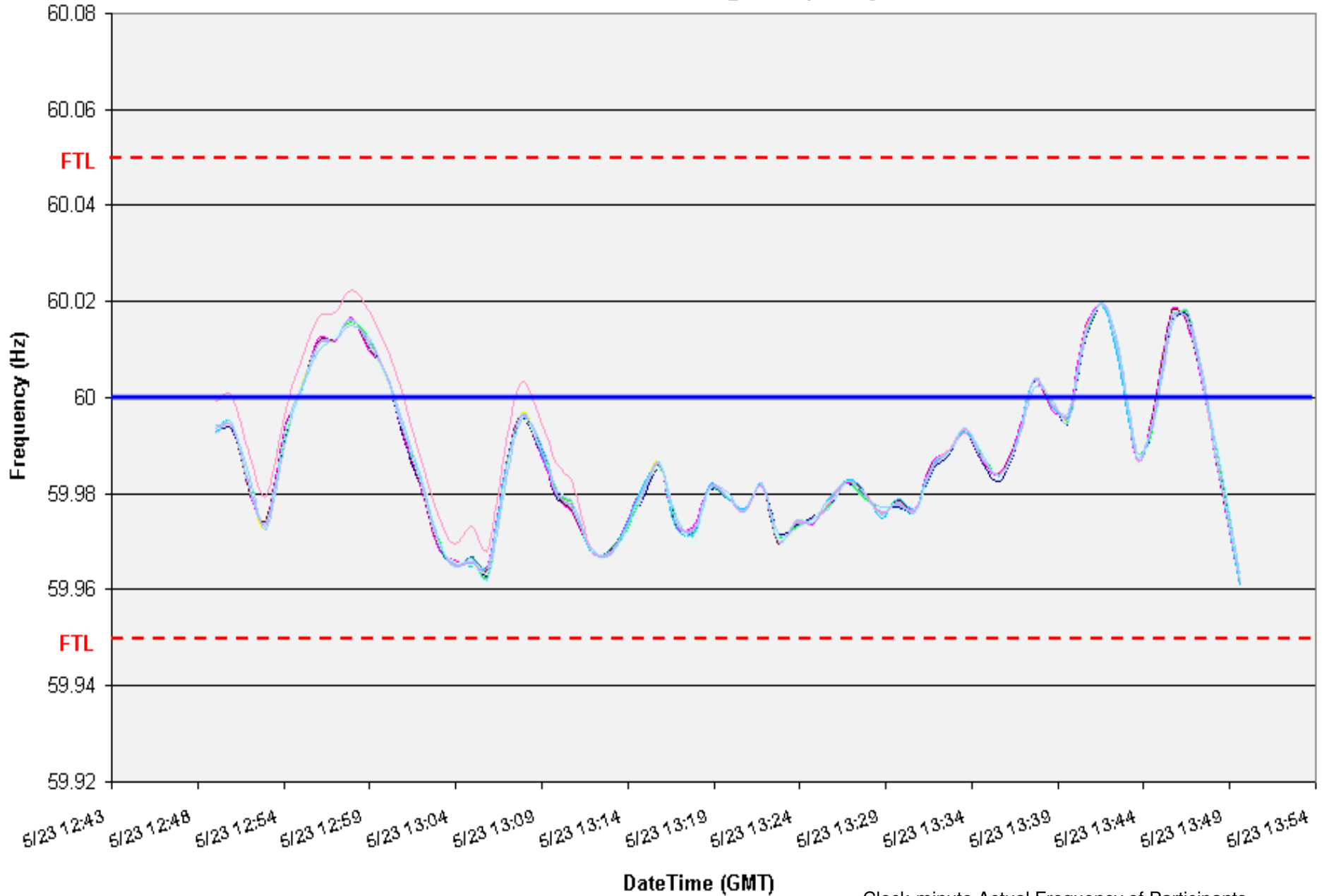
Consecutive Minutes Exceeding BAAL



EXAMPLE 4

05/23/2011 ending 08:32 CDT
24-minute duration below BAAL_{Low}

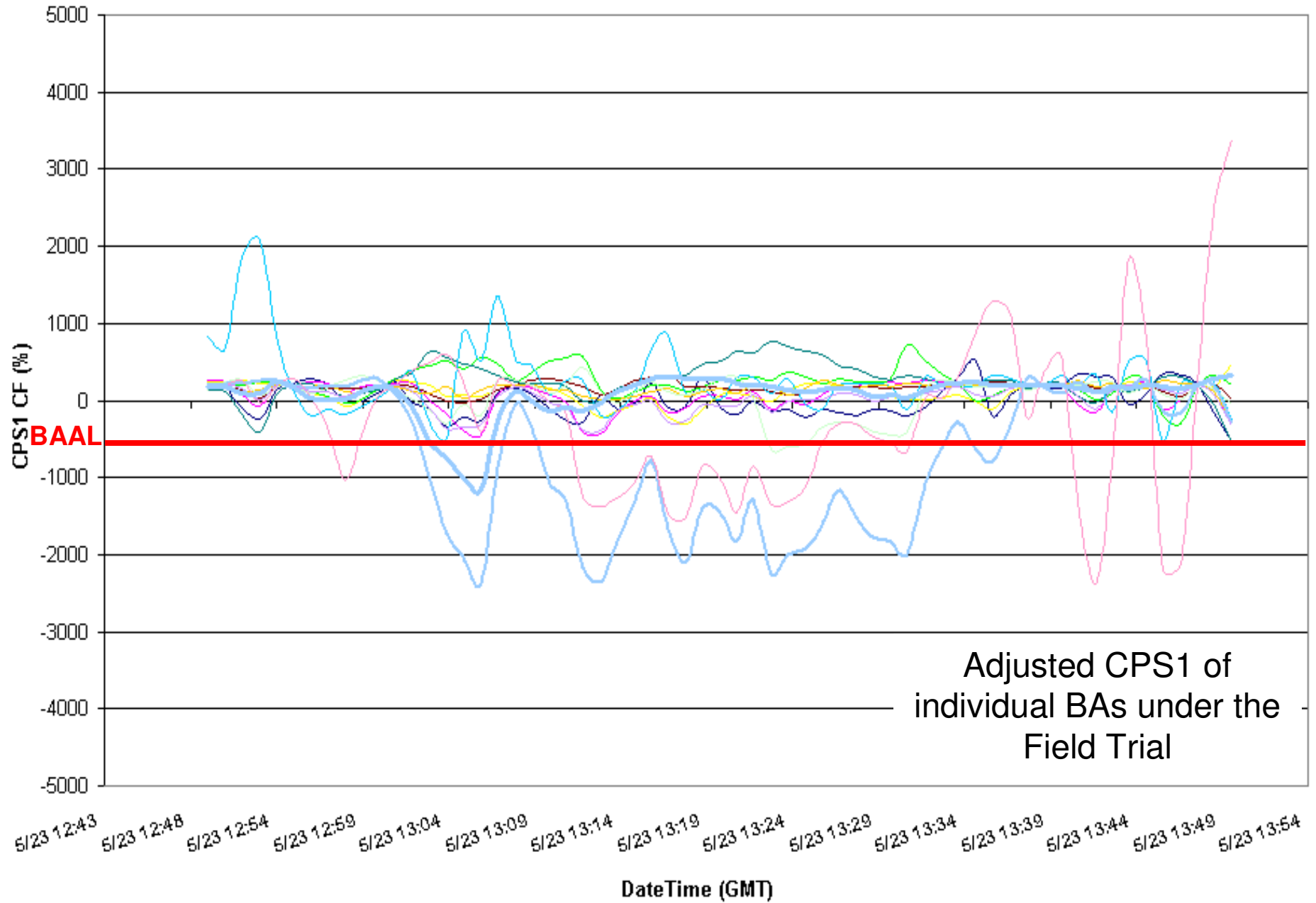
EI Clock-Minute Average Frequency



Clock-minute Actual Frequency of Participants

05/23/2011 ending 08:32 CDT
24-minute duration below BAAL_{Low}

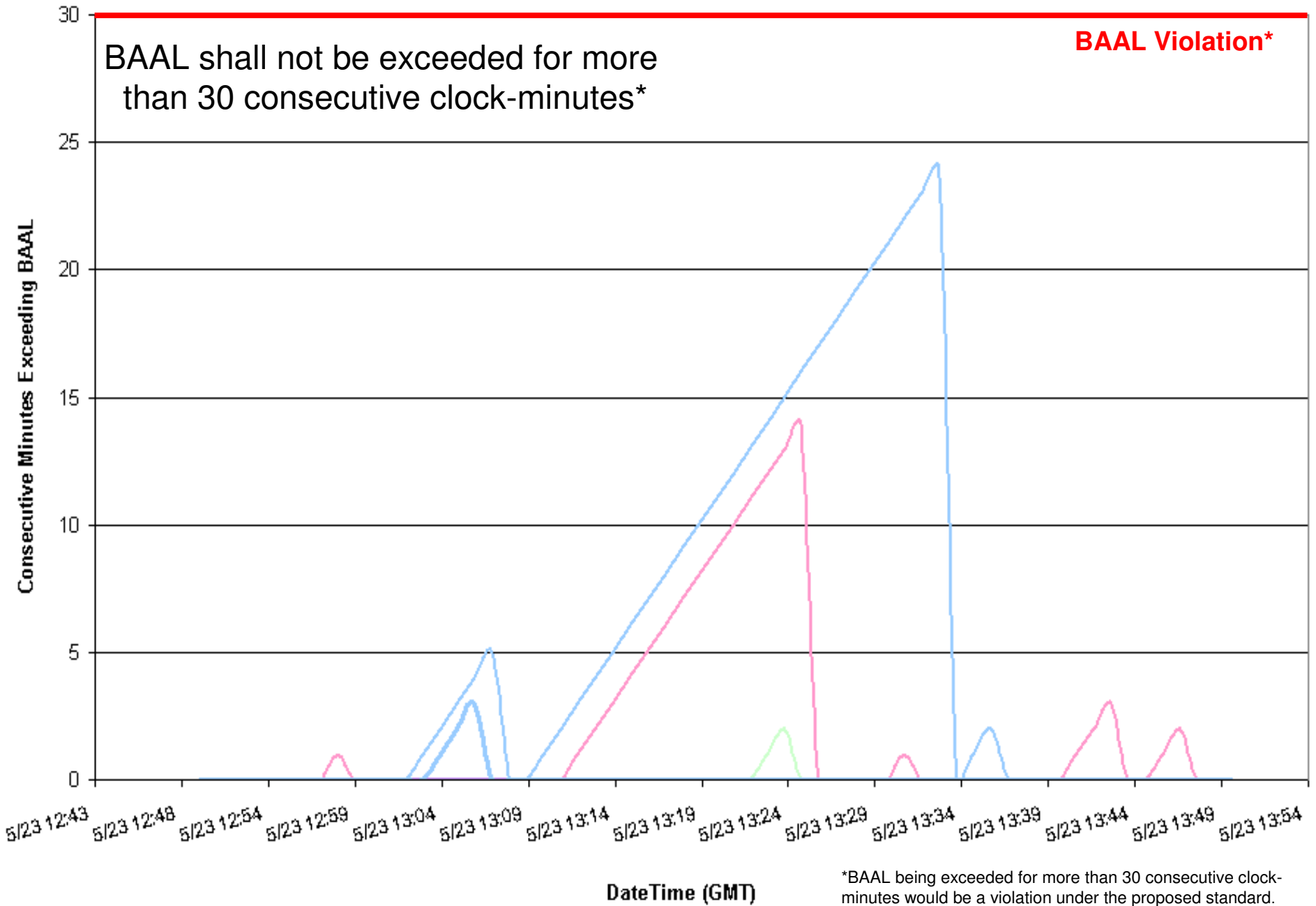
ACPS1 One-Minute Averages



05/23/2011 ending 08:32 CDT

24-minute duration below BAAL_{Low}

Consecutive Minutes Exceeding BAAL



EXAMPLE 5

05/31/2011 ending 15:36 CDT

30-minute duration below BAAL_{Low}

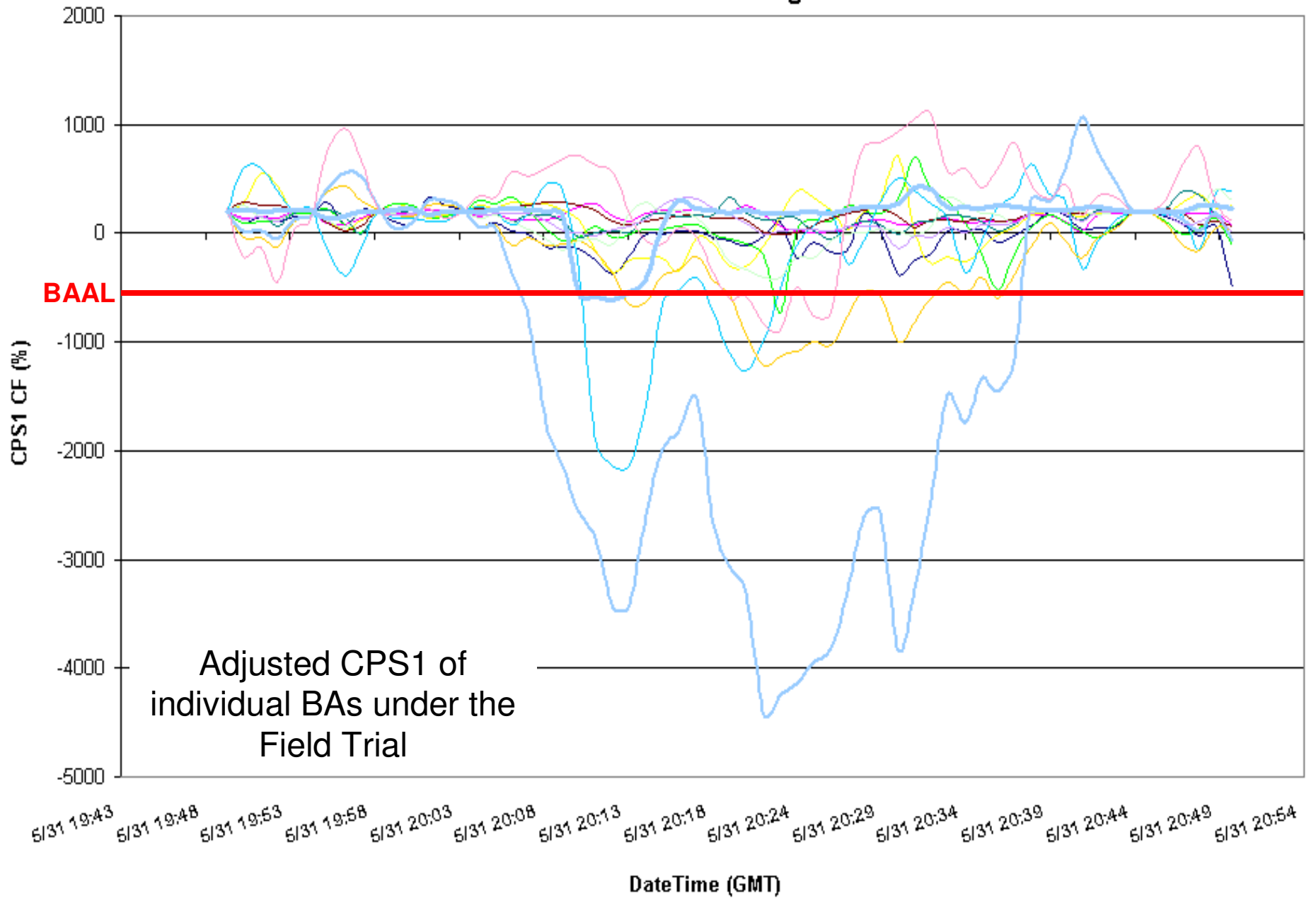
EI Clock-Minute Average Frequency



Clock-minute Actual Frequency of Participants

05/31/2011 ending 15:36 CDT
30-minute duration below BAAL_{Low}

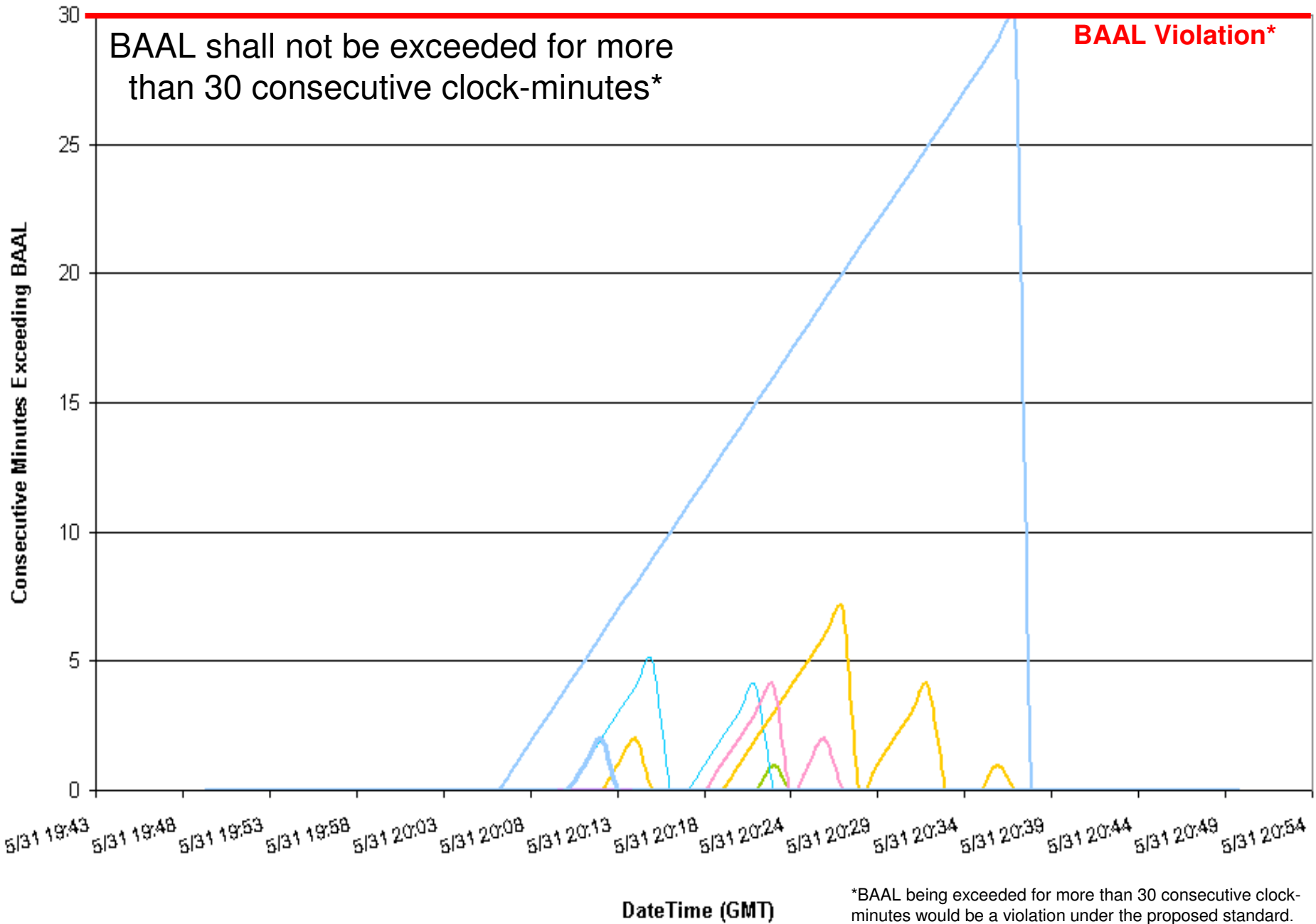
ACPS1 One-Minute Averages



05/31/2011 ending 15:36 CDT

30-minute duration below BAAL_{Low}

Consecutive Minutes Exceeding BAAL



*BAAL being exceeded for more than 30 consecutive clock-minutes would be a violation under the proposed standard.

Balancing Authority ACE Limit Proof-of-Concept Field Trial

Examples of circumstances when BAAL was exceeded and actions taken if appropriate

Clock-minute of ACE exceeding the BAAL (mm/dd/yy hh:mm)	Clock-minute of ACE returning within the BAAL (mm/dd/yy hh:mm)	TimeZone	Total duration of ACE exceeding the BAAL (minutes)	Event associated with a DCS-Reportable Event? (0=No, 1=Yes)	Event associated with a resource loss other than a DCS-Reportable Event? (0=No, 1=Yes)	Brief explanation of circumstances and notable actions taken if applicable
5/29/11 5:42	5/29/11 5:54	CDT	0:13	0	1	BAAL High 1) Declared Low Load Event and redispatch in a sub-area to 1700 MW minimum. Load decreased 500 MW below forecast in 18 minutes and in process of reducing scheduled tag with QFs ramping in. 2) Declared Low Load Emergency, requested Transmission re-evaluate sub-area redispatch, made E-sale to outside utility, redispatch was released allowing sub-area Generation to lower to minimum.
5/3/11 20:48	5/3/11 21:00	EST	0:13	0	0	BAAL High Six units were off AGC due to severe wet coal problems, Electric ARC furnace shut down, deployed additional regulation reserves
5/1/11 5:49	5/1/11 6:00	EST	0:12	0	0	BAAL High
5/10/11 21:36	5/10/11 21:47	EST	0:12	0	0	BAAL High
5/11/11 12:28	5/11/11 12:40	EST	0:13	0	0	BAAL Low A CT unit tripped during start-up causing ACE to dip below BAAL-low. The operator started a second CT to bring the ACE within limits.
5/30/11 20:02	5/30/11 20:12	EST	0:11	0	0	BAAL Low
5/31/11 13:18	5/31/11 13:27	EST	0:10	0	0	BAAL Low
5/1/11 20:02	5/1/11 20:12	EDT	0:11	0	0	BAAL Low Generation failed to respond to schedule change.
5/26/11 22:24	5/26/11 22:34	EDT	0:11	0	0	BAAL High Generation overshot schedule change

Balancing Authority ACE Limit Proof-of-Concept Field Trial

Clock-minute of ACE exceeding the BAAL (mm/dd/yy hh:mm)	Clock-minute of ACE returning within the BAAL (mm/dd/yy hh:mm)	TimeZone	Total duration of ACE exceeding the BAAL (minutes)	Event associated with a DCS-Reportable Event? (0=No, 1=Yes)	Event associated with a resource loss other than a DCS-Reportable Event? (0=No, 1=Yes)	Brief explanation of circumstances and notable actions taken if applicable
5/1/11 7:08	5/1/11 7:20	CDT	0:13	0	0	BAAL Low
5/2/11 22:37	5/2/11 22:50	CDT	0:14	0	0	BAAL High
5/3/11 22:28	5/3/11 22:53	CDT	0:26	0	0	BAAL High High ACE and frequency. A 600 MW coal unit lost their control screens and could not move the unit. Cut a 71 MW import at 22:39.
5/8/11 5:58	5/8/11 6:08	CDT	0:11	0	0	BAAL High
5/9/11 9:06	5/9/11 9:27	CDT	0:22	0	0	BAAL Low In the process of starting 2 250 MW combined cycle units. Low ACE and Frequency. Started a 100 MW peaker at 09:22 and curtailed 100 MW of sales. Peaker online at 09:29.
5/9/11 22:49	5/9/11 22:59	CDT	0:11	0	0	BAAL High
5/11/11 5:19	5/11/11 5:29	CDT	0:11	0	0	BAAL Low
5/12/11 11:33	5/12/11 11:43	CDT	0:11	0	0	BAAL Low
5/14/11 11:09	5/14/11 11:24	CDT	0:16	0	0	BAAL Low
5/22/11 9:37	5/22/11 9:56	CDT	0:20	0	0	BAAL Low
5/23/11 8:09	5/23/11 8:32	CDT	0:24	0	0	BAAL Low Wind generation dropping, load rising, and ST on a 500 MW combined cycle unit failed to latch. 08:30 cut 100 MW sale and started a 100 MW Peaker. Peaker online at 08:38.
5/25/11 21:07	5/25/11 21:20	CDT	0:14	0	0	BAAL Low
5/26/11 0:01	5/26/11 0:11	CDT	0:11	0	0	BAAL High
5/29/11 5:42	5/29/11 5:53	CDT	0:12	0	0	BAAL High
5/30/11 12:54	5/30/11 13:07	CDT	0:14	0	0	BAAL High
5/31/11 13:08	5/31/11 13:28	CDT	0:21	0	0	BAAL Low Low ACE and Frequency. Unable to buy enough MWs. 500 MW combined cycle unit slow to come online and 250 MW combined cycle unit low due to higher temperatures.
5/31/11 13:46	5/31/11 13:56	CDT	0:11	0	0	BAAL Low
5/31/11 15:07	5/31/11 15:36	CDT	0:30	0	1	BAAL Low Loss of 180 MW combined cycle plant (running with 1 CT on 1 ST) due to a severe gas leak. Started 100 MW peaker at 15:24, 2nd 100 MW peaker started at 15:30. Schedules adjusted by 20 MW. 1st peaker online at 15:31. Called for 150 MW of reserves at 15:34. 2nd peaker online at 15:36.

Balancing Authority ACE Limit Proof-of-Concept Field Trial

Clock-minute of ACE exceeding the BAAL (mm/dd/yy hh:mm)	Clock-minute of ACE returning within the BAAL (mm/dd/yy hh:mm)	TimeZone	Total duration of ACE exceeding the BAAL (minutes)	Event associated with a DCS-Reportable Event? (0=No, 1=Yes)	Event associated with a resource loss other than a DCS-Reportable Event? (0=No, 1=Yes)	Brief explanation of circumstances and notable actions taken if applicable
5/1/11 7:09	5/1/11 7:21	EST	0:13	0	0	BAAL Low Frequency was low. An industrial customer was increasing its load and the units were slow to respond. The controller increased generation. Recovery was impacted by communication problems with a secondary source of energy.
5/1/11 19:01	5/1/11 19:12	EST	0:12	0	0	BAAL Low
5/1/11 22:39	5/1/11 22:49	EST	0:11	0	0	BAAL High
5/2/11 9:15	5/2/11 9:24	EST	0:10	0	0	BAAL Low Frequency was low while an industrial customer increased its load simultaneously. Recovery was impacted by the unit's slow response to the situation. The controller increased generation for two units.
5/2/11 22:38	5/2/11 22:50	EST	0:13	0	0	BAAL High
5/3/11 22:32	5/3/11 22:44	EST	0:13	0	0	BAAL High The frequency was high and the load was dropping. The controller responded by dropping generation.
5/18/11 11:25	5/18/11 11:35	EST	0:11	0	0	BAAL Low Two large industrial customers started simultaneously while we were on a time correction and frequency was low. The controller responded by picking up generation. Recovery was impacted by the frequency increasing and two units picking up generation.
5/18/11 15:22	5/18/11 15:34	EST	0:13	0	0	BAAL Low An industrial customer came up after being down for several hours. The controller responded by picking up generation on two units.
5/23/11 8:12	5/23/11 8:25	EST	0:14	0	0	BAAL Low The morning load was increasing in conjunction with the load of two large industrial customers. The controller responded by increasing generation at three plants.
5/25/11 5:51	5/25/11 6:02	EST	0:12	0	0	BAAL High An industrial customer reduced its load and frequency was slightly high. The controller responded by reducing generation. The frequency recovered.
5/30/11 20:04	5/30/11 20:14	EST	0:11	0	0	BAAL Low The load was not decreasing as expected. Frequency took a good dip and we were working to get a couple of othe units off-line. Recovery was impacted by the frequency increasing and by us keeping the units we were working to get off-line on-line a little longer. The industrial customer's load dipped.

Balancing Authority ACE Limit Proof-of-Concept Field Trial

Discussion

Bob Klueber

Balancing Authority Reliability-based Control Standard Drafting Team (BARCSDT)

bklueber@midwestiso.org