

SERVICE RATE REPORT
January thru March 2013

PLANT	OA %	SF %	FR	FOR %	FOA	FOX %	SOR %	SOA	SOX%	STARTS	SOI	FOI
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HYATT	45.1	18.4	6.4	74.0	965.0	95.1	3.7	58.4	4.9	85	1.0	1.2
THERM. DIV. DAM	99.2	99.2	1.0	0.3	6.9	41.1	0.5	9.9	58.9	2	1.0	1.0
THERMALITO	0.0	0.0	Inf*	100.0	Inf*	100.0	0.0	Inf*	0.0	0	0.0	0.0
ORFD AVG.	33.6	19.0	3.8	77.3	1924.7	97.7	1.8	51.5	2.3	87		

BANKS	72.1	19.8	8.3	36.4	149.6	40.7	34.7	230.8	59.3	302	1.5	1.6
SO. BAY	62.2	26.1	5.6	44.3	306.4	54.7	26.8	215.5	45.3	110	2.0	1.7
DEL VALLE	100.0	4.6	0.0	0.0	Inf*	Inf*	0.0	Inf*	Inf*	3	0.0	0.0
BARKER SLOUGH	79.1	11.4	0.0	49.3	Inf*	53.3	30.2	236.9	46.7	71	0.9	0.0
CORDELIA	72.8	11.9	4.6	3.6	17.6	1.6	68.5	578.1	98.4	73	1.0	0.5
DFD AVG.	73.5	16.6	5.3	37.8	247.9	38.1	38.0	294.4	61.9	559		


SAN LUIS	48.7	11.0	2.3	69.6	2168.1	48.9	42.1	161.8	51.1	19	3.5	0.3
DOS AMIGOS	52.4	19.0	9.7	64.7	410.0	73.1	19.2	69.2	26.9	44	4.0	1.8
SLFD AVG.	50.3	14.4	6.4	87.0	680.5	58.8	31.9	119.0	41.2	63		


LAS PERIL.	98.0	21.5	11.6	8.2	16.7	97.8	0.2	5.7	2.2	388	0.2	2.5
BADG. HILL	89.4	20.4	18.8	30.3	50.0	83.6	5.6	75.4	16.4	378	0.5	3.8
DEVIL'S DEN	79.5	16.9	21.7	12.5	14.1	11.7	48.5	213.4	88.3	271	1.8	3.7
BLUESTONE	77.1	15.4	35.8	40.6	41.3	45.9	32.3	106.9	54.1	370	2.5	5.5
POLONIO PASS	77.7	17.1	29.2	20.2	18.6	19.4	45.6	466.1	80.6	316	0.8	5.0
BUENA VISTA	85.2	27.8	7.9	6.3	18.2	12.5	30.5	85.0	87.5	317	3.3	2.2
WH. RIDGE	47.8	26.1	4.3	1.1	5.6	0.6	66.3	775.9	99.4	284	1.4	1.1
WIND GAP	62.3	29.4	6.0	8.5	33.3	7.3	52.1	271.8	92.7	327	2.8	1.8
EDMONSTON	84.1	33.4	5.3	14.2	67.1	34.8	21.1	39.3	65.2	490	5.7	1.8
SJFD AVG.	77.1	24.9	10.9	14.0	32.1	17.7	39.5	157.8	82.3	3141		

GREENSPOT	45.3	20.8	0.0	0.0	Inf*	0.0	72.4	1181.0	100.0	11	1.3	0.0
CRAFTON HILLS	40.6	17.5	7.2	0.5	1.4	0.1	77.2	1280.0	99.9	14	1.3	1.7
CHEERY VALLEY	41.1	11.0	0.0	0.0	Inf*	0.0	84.3	1271.0	100.0	2	1.5	0.0
ALAMO	0.0	0.0	Inf*	100.0	Inf*	100.0	0.0	Inf*	0.0	0	0.0	0.0
P.BLOSSOM	92.5	26.5	6.7	10.7	38.6	42.4	12.7	31.1	57.6	213	3.0	1.8
MOJAVE	80.9	33.6	5.0	4.1	18.6	7.5	33.4	285.3	92.5	39	1.3	1.7
D.CANYON	91.9	75.9	3.6	0.1	0.3	0.5	9.6	58.3	99.5	31	3.0	2.8
OSO	98.0	13.7	12.8	2.1	3.5	14.1	11.1	18.9	85.9	215	2.0	1.8
W.WARNE	99.5	99.2	0.0	0.0	Inf*	0.0	0.5	4.5	100.0	5	2.5	0.0
SFD AVG.	75.3	29.7	4.4	10.5	57.4	14.1	39.0	234.8	85.9	530		

PROJ.AVG.&TTL	71.1	22.6	7.5	32.8	141.2	38.3	34.6	186.3	61.7	4380		
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Inf* - No forced or scheduled outage incident - division by zero

% of field division operational availability = 

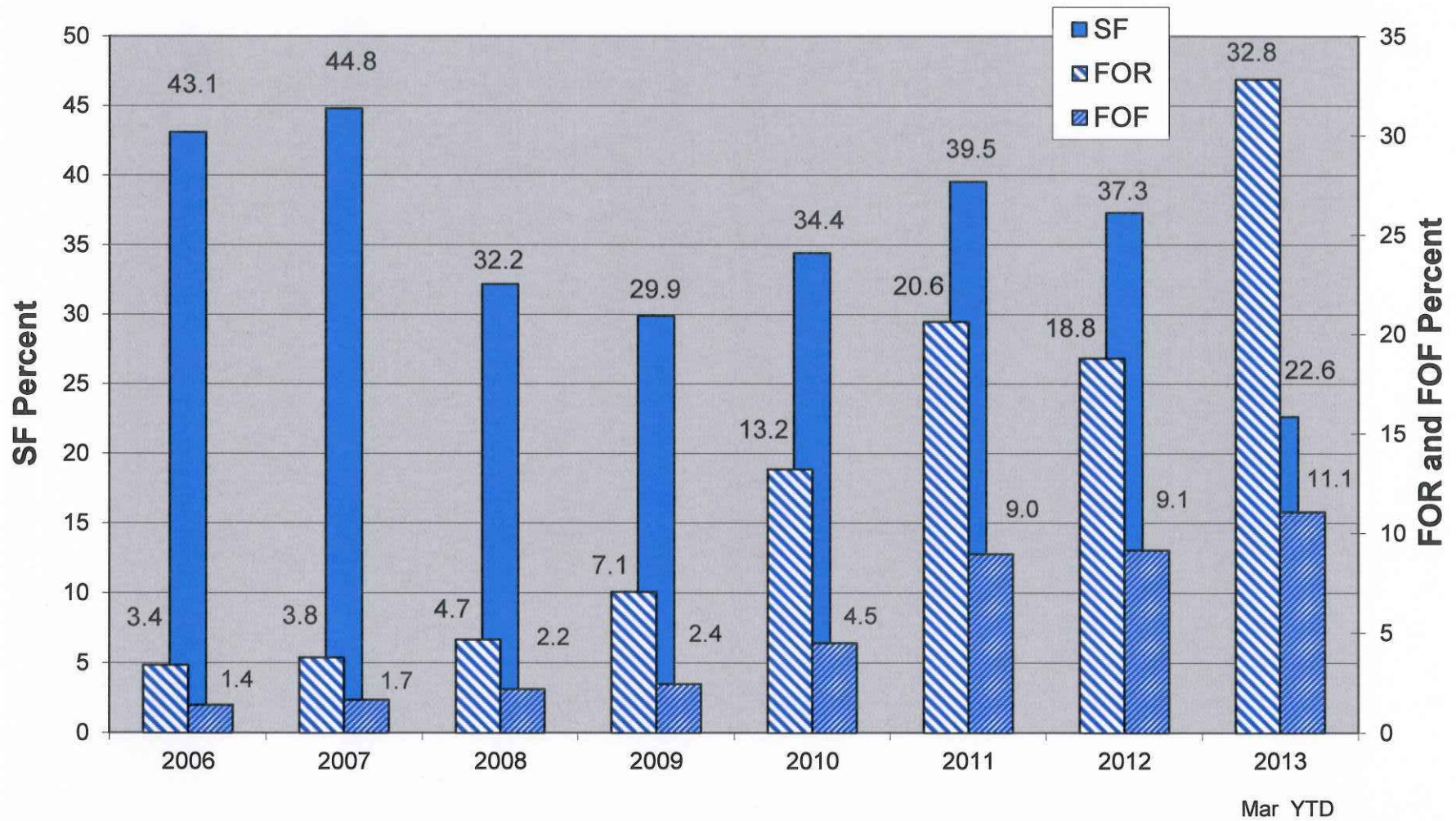
% of units/ time forced out of service in a field division = 

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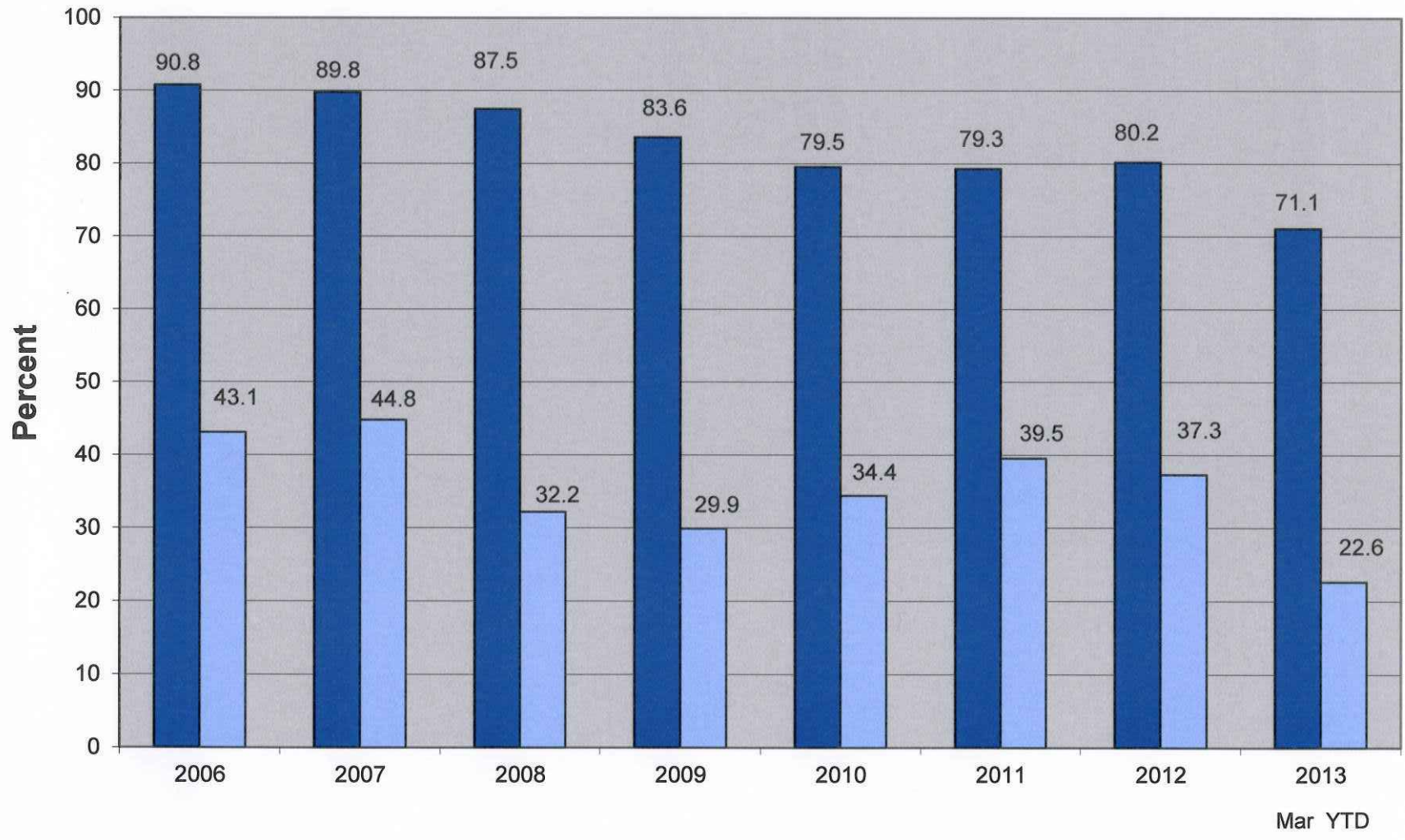
PLANT	OA %	SF %	FR	FOR %	FOA	FOX %	SOR %	SOA	SOX%	STARTS	SOI	FOI
HYATT	30.6	15.0	5.6	77.0	1315.4	72.3	22.8	2517.7	27.7	156	0.2	0.8
THERM. DIV. DAM	99.9	99.9	1.0	0.1	2.8	100.0	0.0	Inf*	0.0	1	0.0	1.0
THERMALITO	73.4	14.6	5.1	1.7	7.2	0.9	63.9	191.5	99.1	91	3.0	0.8
ORFD AVG.	52.5	22.6	3.6	54.9	733.5	57.8	28.6	370.4	42.2	248		
BANKS	69.6	22.8	2.0	48.8	1041.5	71.2	16.5	123.7	28.8	59	1.5	0.5
SO. BAY	36.4	21.3	3.6	40.7	411.1	23.0	57.7	962.4	77.0	176	1.1	0.8
DEL VALLE	100.0	0.0	Inf*	Inf*	Inf*	Inf*	Inf*	Inf*	Inf*	0	0.0	0.0
BARKER SLOUGH	67.9	9.2	2.4	50.0	899.5	28.6	55.6	500.1	71.4	112	1.0	0.2
CORDELIA	64.3	8.3	18.6	66.0	226.9	45.0	44.7	362.9	55.0	106	1.2	1.5
DFD AVG.	63.9	14.0	5.2	50.6	429.4	39.6	43.5	427.5	60.4	453		
SAN LUIS	53.5	14.7	2.5	55.0	1050.1	38.8	46.4	215.8	61.2	48	2.9	0.4
DOS AMIGOS	92.5	30.5	3.8	1.2	7.0	5.0	18.7	37.2	95.0	47	4.2	1.2
SLFD AVG.	70.2	21.5	3.3	32.8	319.9	35.2	37.6	122.8	64.8	95		
LAS PERIL.	82.6	24.6	10.1	7.9	18.6	12.2	36.3	998.3	87.8	314	0.3	2.5
BADG. HILL	98.7	22.6	10.3	5.5	12.2	100.0	0.0	Inf*	0.0	253	0.0	2.3
DEVIL'S DEN	98.8	16.6	10.0	2.5	5.6	36.5	4.2	8.1	63.5	166	2.0	1.7
BLUESTONE	65.5	14.8	13.5	4.9	8.3	2.2	68.5	1105.9	97.8	209	0.7	2.0
POLONIO PASS	64.7	17.2	7.8	50.3	284.7	49.2	34.2	587.6	50.8	190	0.7	1.3
BUENA VISTA	87.0	28.4	4.6	7.0	35.6	16.3	26.3	107.9	83.7	321	2.2	1.3
WH. RIDGE	81.4	26.8	3.3	0.4	2.6	0.6	40.7	90.6	99.4	354	4.4	0.9
WIND GAP	84.6	27.8	6.4	7.0	25.9	13.7	30.7	84.0	86.3	333	3.4	1.8
EDMONSTON	84.1	31.9	4.5	2.3	11.6	4.8	31.7	90.7	95.2	481	3.6	1.4
SJFD AVG.	83.4	24.9	6.5	9.3	34.6	15.4	33.8	133.1	84.6	2621		
GREENSPOT	68.0	28.3	3.5	0.8	5.1	0.7	52.7	693.1	99.3	26	1.3	1.3
CRAFTON HILLS	99.9	31.8	0.8	0.3	8.0	100.0	0.0	Inf*	0.0	30	0.0	0.3
CHEERY VALLEY	99.9	67.8	1.5	0.2	2.7	100.0	0.0	Inf*	0.0	4	0.0	1.0
ALAMO	100.0	96.7	0.0	0.0	Inf*	Inf*	0.0	Inf*	Inf*	9	0.0	0.0
P.BLOSSOM	84.9	28.6	3.9	3.1	17.8	6.0	32.5	930.3	94.0	138	0.3	1.1
MOJAVE	90.6	33.3	3.0	0.6	4.5	2.2	21.6	151.0	97.8	52	1.3	1.0
D.CANYON	85.4	68.1	1.8	0.0	0.4	0.1	17.6	141.5	99.9	42	2.3	1.3
OSO	80.2	12.6	3.0	4.2	32.3	2.8	59.4	124.3	97.2	214	3.4	0.4
W.WARNE	77.0	75.4	1.3	0.6	9.4	1.9	22.9	985.1	98.1	12	0.5	1.0
SFD AVG.	84.5	36.4	2.2	1.1	11.2	2.7	29.0	254.6	97.3	527		
PROJ.AVG.&TTL	75.9	24.3	4.6	22.7	140.9	29.6	35.1	203.8	70.4	3944		

Inf* - No forced or scheduled outage incident - division by zero

Forced Outage Rate (FOR) and Forced Outage Factor (FOF) Comparison with Service Factor (SF) Reference



OA and SF Comparison



Service Rate Function Definitions

<u>O</u> perating <u>A</u> vailability	$OA\% = AH / PH \times 100$
<u>S</u> ervice <u>F</u> actor	$SF\% = SH / PH \times 100$
<u>F</u> ailure <u>R</u> ate	$FR = FOI \times PH / SH$
<u>F</u> orced <u>O</u> utage <u>A</u> verage	$FOA = FOH / FOI$
<u>F</u> orced <u>O</u> utage <u>I</u> nde <u>X</u>	$FOX\% = FOH / (FOH + SOH) \times 100$
<u>F</u> orced <u>O</u> utage <u>R</u> ate	$FOR\% = FOH / (FOH + SH) \times 100$
<u>S</u> cheduled <u>O</u> utage <u>A</u> verage	$SOA = SOH / SOI$
<u>S</u> cheduled <u>O</u> utage <u>I</u> nde <u>X</u>	$SOX\% = SOH / (SOH + FOH) \times 100$
<u>S</u> cheduled <u>O</u> utage <u>R</u> ate	$SOR\% = SOH / (SOH + FOH + SH) \times 100$

Raw Data Summary:

AH - Total Available HRs*	PH - Period Hrs
FOH - Forced Outage Hrs	RSH - Reserve Shutdown Hrs
SOH - Scheduled Outage Hrs	FOI - Forced Outage Incident**
SOI - Scheduled Outage Incident**	SH - Service Hrs

* AH = SH + RSH ** Value on reports show average incidents per unit

A quick example will explain much. Say that we wish to examine and quantify a 100 hour period (PH) for a unit. Total operating time for this unit is 25 hours. Also during this period, the unit status was changed to unavailable one time for 5 hours (SOH) so workers could perform a planned maintenance task. This elective event would constitute one scheduled outage incident (SOI). Let's also say that during one of the runs a part failed and the unit was tripped via protective relay action. As a result of this failure, the unit was forced unavailable at the time it tripped and plant maintenance was called out to investigate. This unplanned event would constitute one forced outage incident (FOI). Personnel remedied the situation and the unit was declared available for service 10 hours (FOH) after the start of the outage. So, we will have the following raw data for the service rate factors for this 100 hour period:

SH	RSH	FOH	SOH	FOI	SOI
25	60	10	5	1	1

$SH + RSH + FOH + SOH = \text{Total Period Hours (PH)} = 100 \text{ hours}$

SH and RSH represent unit available time. These are added to get the total available hours.

FOH and SOH represent unit unavailable time. These are added to get the total unavailable hours.

Scheduled is sometimes noted as planned or elective. Forced is sometimes referred to as unplanned.

The Operating Availability (OA) is $(SH+RSH)/100 = 85\%$ - The percentage of time that the unit was operated or could have been operated.

The Service Factor (SF) is $SH/100 = 25\%$ - The percentage of time that the unit was operated. It is sometimes referred to as the average capacity usage.

The Failure Rate (FR) is $FOI \times 100/SH = 4$ - This is a prorated factor that estimates that if the unit was operated continuously for 100 hours that four failures would have occurred. This is somewhat like saying, well - I have played blackjack for one hour and have lost five hands. So if I play blackjack for a total of three hours I might loose fifteen hands.

The Forced Outage Rate (FOR) is $FOH/(FOH+SH) \times 100 = 28.6\%$ - This factor relates the forced outage time to service time. It says that we could have had 28.6 percent more service time if this unplanned outage time could have been converted to run time.

The Forced Outage Index (FOX) is $FOH/(FOH + SOH) \times 100 = 66.7\%$

The Scheduled Outage Index (SOX) is $SOH/(FOH + SOH) \times 100 = 33.3\%$

The FOX/SOX factors quantify the outage time and are complimentary, whereas, they should equal 100 percent when added together. They can be used to view the effectiveness of maintenance planning and equipment repair status. One would hope to have a high percentage for SOX. Since this time is elective, a high figure suggests better control of plant maintenance and acceptable reliability. In essence, it is better to do things at your convenience rather than your inconvenience.

The Forced Outage Average (FOA) is $FOH/FOI = 10 \text{ hours}$

The Scheduled Outage Average (SOA) is $SOH/SOI = 5 \text{ hours}$

Over the course of a year one would expect to see a number of forced outage and scheduled outage incidents. These factors provide an average for each of these events that can be used to measure maintenance effectiveness and assist planning.

The Scheduled Outage Rate (SOR) is $SOH / (SOH + FOH + SH) \times 100 = 12.5\%$ - This factor looks at the scheduled outage time in relation to the total outage time plus service hours. One should grasp that the FOR and SOR are influenced by the unit run time (SH). These factors have a more direct meaning if you are operating at a 90 percent plus service factor, typical of a large steam generating plant. At a much lower service factor, a judgment call on either of these factors should be tempered by a review of the peak availability needs.

Some of the reports show plant unit average FOI and SOI values. Say, for instance, that a FOI value is 3.1. This factor is saying that the typical unit had an average of 3.1 failures, unplanned outage events, during the period under review. A SOI of 4.2 is saying that the typical unit was removed from available status 4.1 times for planned maintenance during the period under review.