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ISOE

INFORMATION SYSTEM ON OCCUPATIONAL EXPOSURE

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ISOE Information Sheet

North American Technical Center
Information System on Occupational Exposure

North American Boiling Water Reactor (BWR)
2015 Occupational Dose Benchmarking Charts

NATC ISOE Information Sheet No. 15-5

NATC ISOE Information Sheet No. 15-5 presents the North American Boiling Water Reactor (BWR) occupational exposure results for FY 2015. Exposure categories per unit include refueling outage duration and dose, normal operations dose, and total dose.

The 2015 BWR charts are arranged in the following format:

Table 1: Outage Duration
Table 2: Outage Dose
Table 3: Normal Operation Dose
Table 4: Total Dose
Table 5a-d: Outage Duration Quartiles
Table 6a-d: Outage Dose Quartiles
Table 7a-d: Normal Operation Dose Quartiles
Table 8a-d: Total Dose Quartiles
Table 9: Occupation Dose Data

For reference, global comparison of 2015 BWR collective dose per reactor unit is provided in the table below:

Country	CollectiveDose per Reactor (person-Rem/unit)
Finland	37.62
Spain	246.68
Sweden	83.5
USA	122.21

Prepared by Matthew Edwin, Reviewed by David Miller, NATC/NPRE, College of Engineering

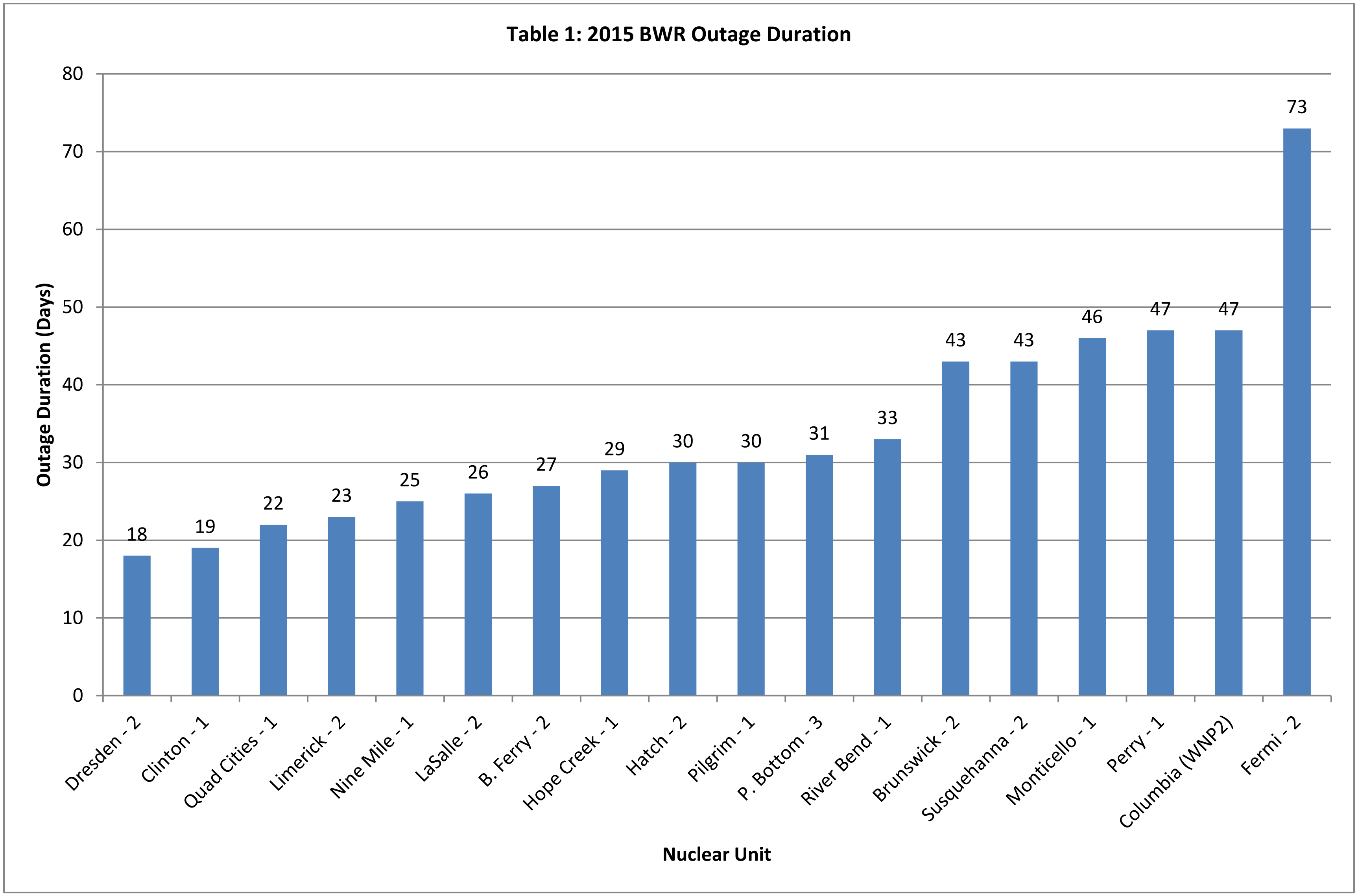
Table 1: 2015 BWR Outage Duration
Outage Duration (Days)
0
10
20
30
40
50
60
70
80
18
19
22
23
25
26
27
29
30
30
31
33
43
43
46
47
47
73
Dresden - 2
Clinton - 1
Quad Cities - 1
Limerick - 2
Nine Mile - 1
LaSalle - 2
B. Ferry - 2
Hope Creek - 1
Hatch - 2
Pilgrim - 1
P. Bottom - 3
River Bend - 1
Brunswick - 2
Susquehanna - 2
Monticello - 1
Perry - 1
Columbia (WNP2)
Fermi - 2
Nuclear Unit

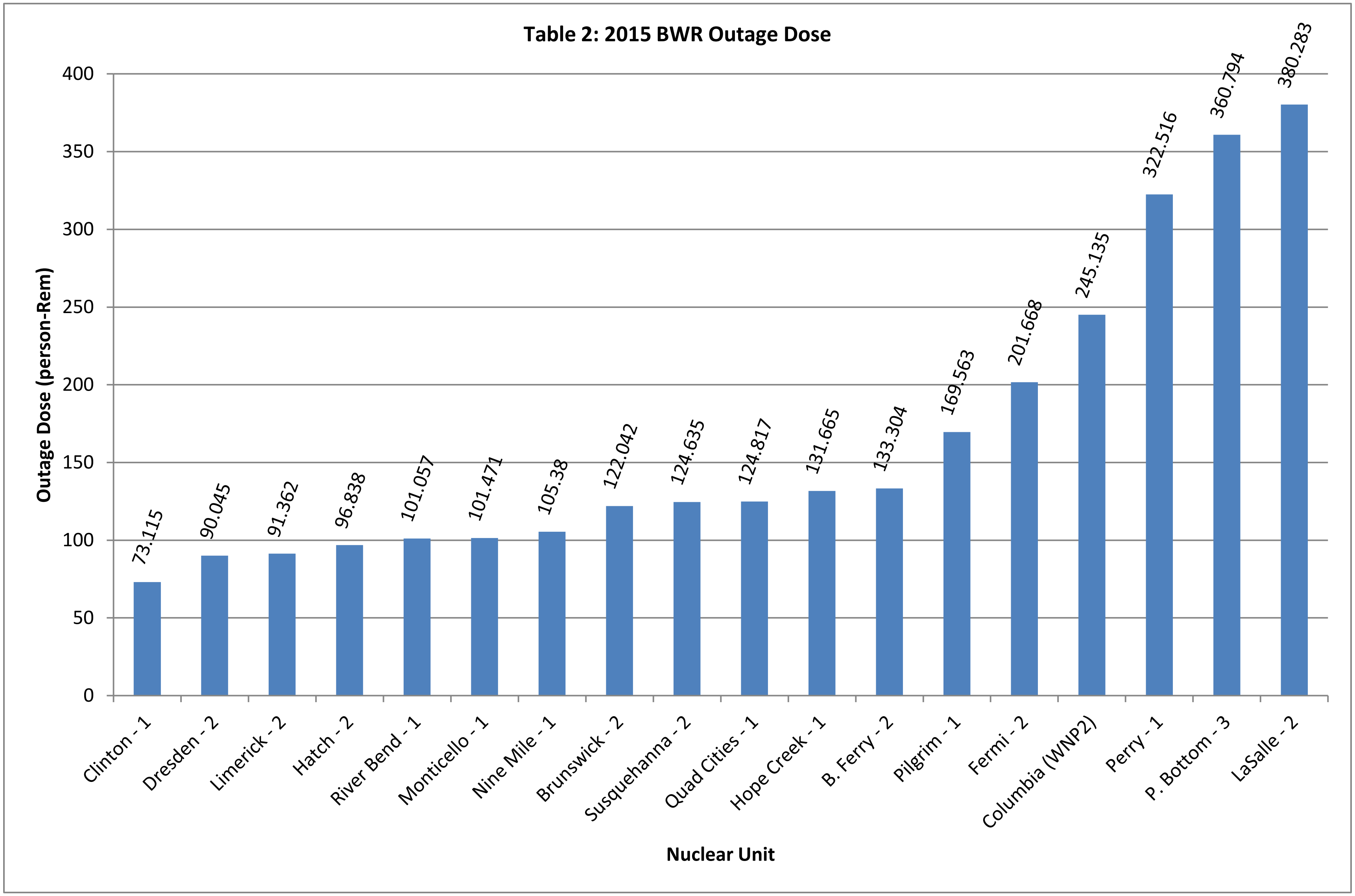

Table 2: 2015 BWR Outage Dose
Outage Dose (person-Rem)
400
350
300
250
200
150
100
50
0
73.115
90.045
91.362
96.838
101.057
101.471
105.38
122.042
124.635
124.817
131.665
133.304
169.563
201.668
245.135
322.516
360.794
380.283
Clinton - 1
Dresden - 2
Limerick - 2
Hatch - 2
River Bend - 1
Monticello - 1
Nine Mile - 1
Brunswick - 2
Susquehanna - 2
Quad Cities - 1
Hope Creek - 1
B. Ferry - 2
Pilgrim - 1
Fermi - 2
Columbia (WNP2)
Perry - 1
P. Bottom - 3
LaSalle - 2
Nuclear Unit

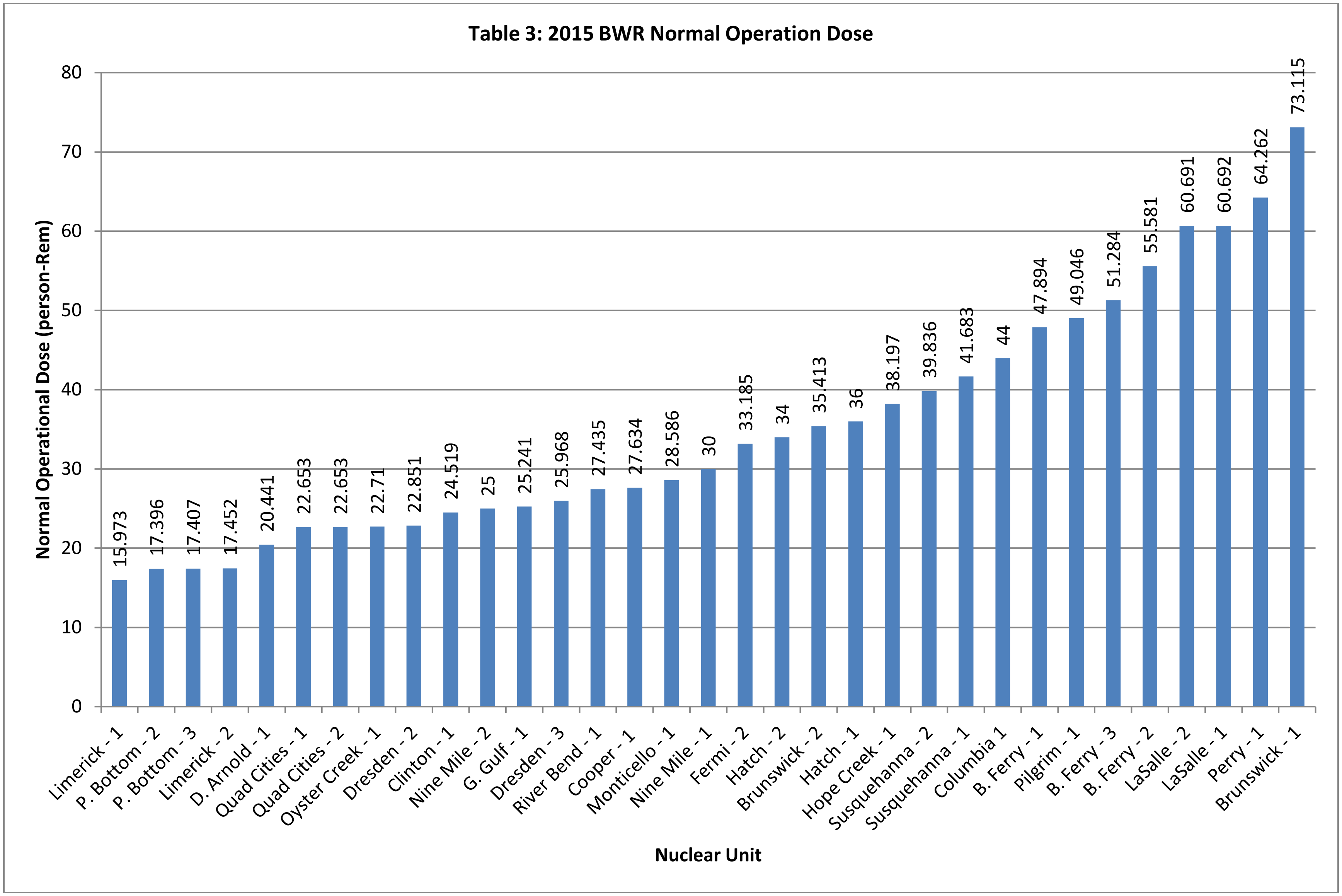
Table 3: 2015 BWR Normal Operation Dose
Normal Operational Dose (person-Rem)
Nuclear Unit
0
10
20
30
40
50
60
70
80
Limerick - 1
P. Bottom - 2
P. Bottom - 3
Limerick - 2
D. Arnold - 1
Quad Cities - 1
Quad Cities - 2
Oyster Creek - 1
Dresden - 2
Clinton - 1
Nine Mile - 2
G. Gulf - 1
Dresden - 3
River Bend - 1
Cooper - 1
Monticello - 1
Nine Mile - 1
Fermi - 2
Hatch - 2
Brunswick - 2
Hatch - 1
Hope Creek - 1
Susquehanna - 2
Susquehanna - 1
Columbia 1
B. Ferry - 1
Pilgrim - 1
B. Ferry - 3
B. Ferry - 2
LaSalle - 2
LaSalle - 1
Perry - 1
Brunswick - 1
15.973
17.396
17.407
17.452
20.441
22.653
22.653
22.71
22.851
24.519
25
25.241
25.968
27.435
27.634
28.586
30
33.185
34
35.413
36
38.197
39.836
41.683
44
47.894
49.046
51.284
55.581
60.691
60.692
64.262
73.115

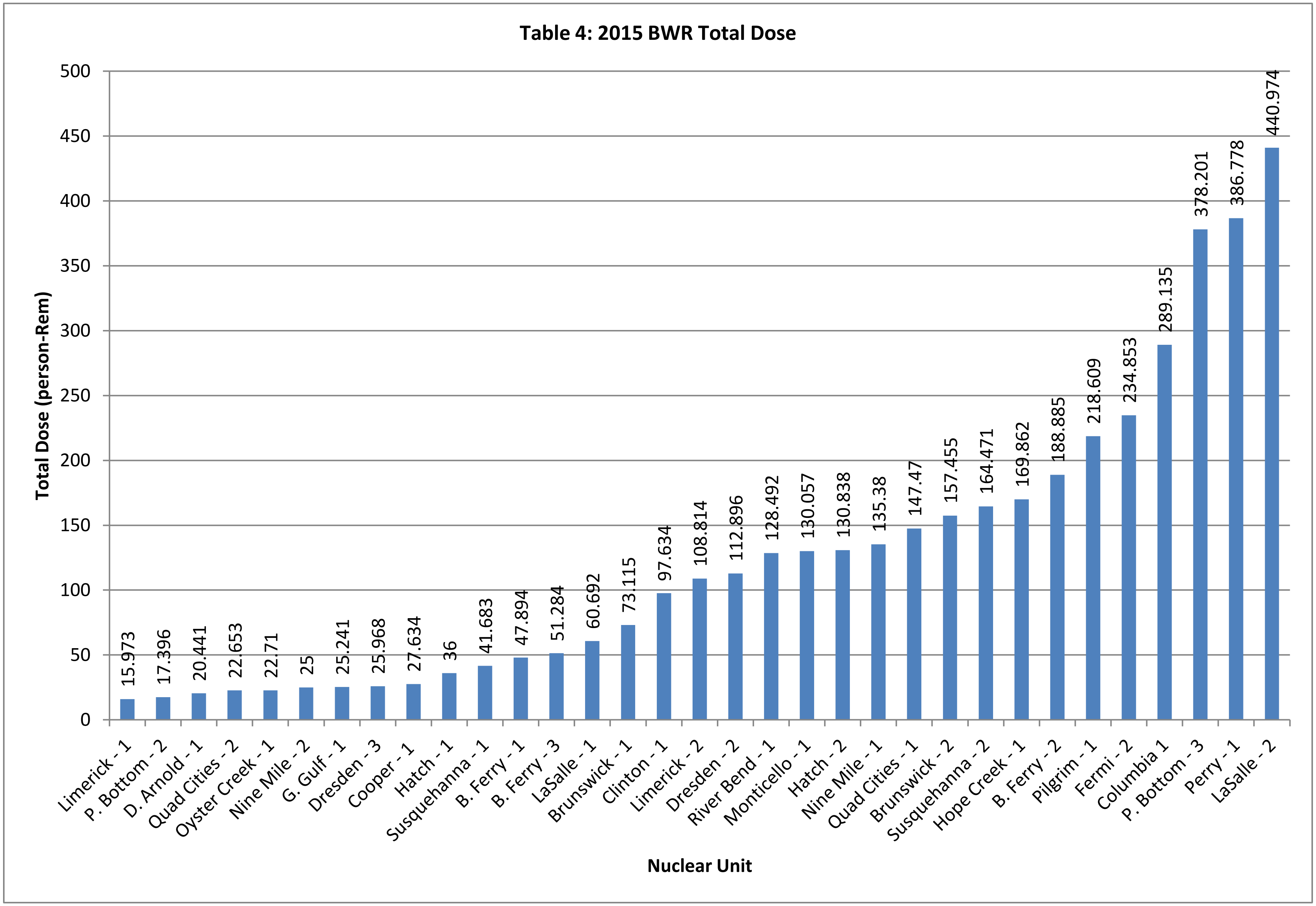

Table 4: 2015 BWR Total Dose

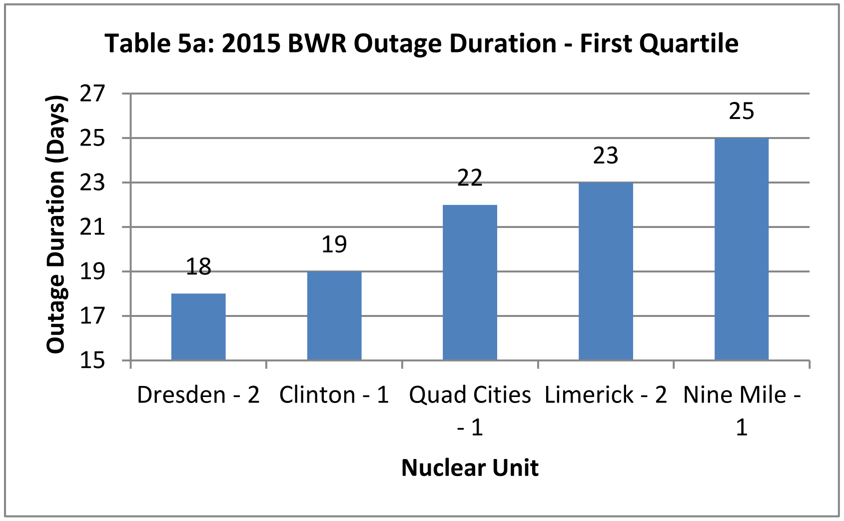
Table 5a: 2015 BWR Outage Duration - First Quartile
Outage Duration (Days)
27
25
23
21
19
17
15
18
19
22
23
25
Dresden - 2
Clinton - 1
Quad Cities - 1
Limerick - 2
Nine Mile - 1
Nuclear Unit

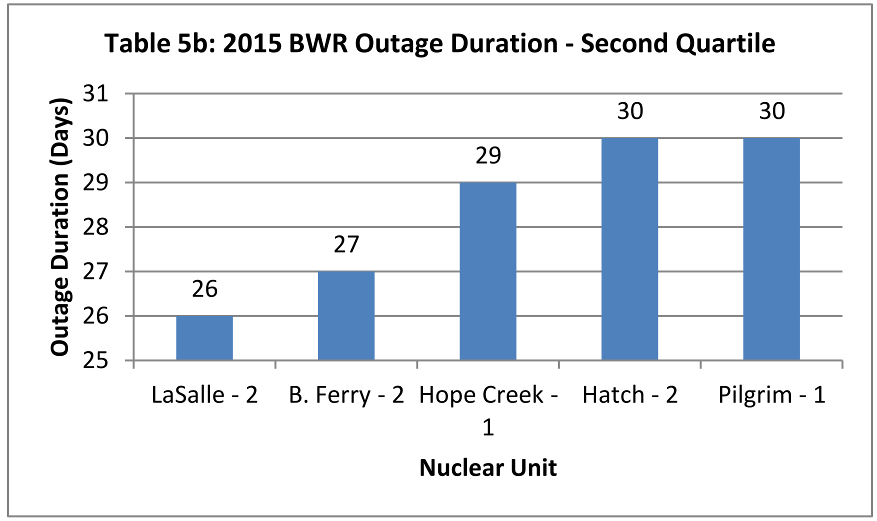
Table 5b: 2015 BWR Outage Duration - Second Quartile
Outage Duration (Days)
31
30
29
28
27
26
25
26
27
29
30
30
LaSalle - 2
B. Ferry - 2
Hope Creek - 1
Hatch - 2
Pilgrim - 1
Nuclear Unit

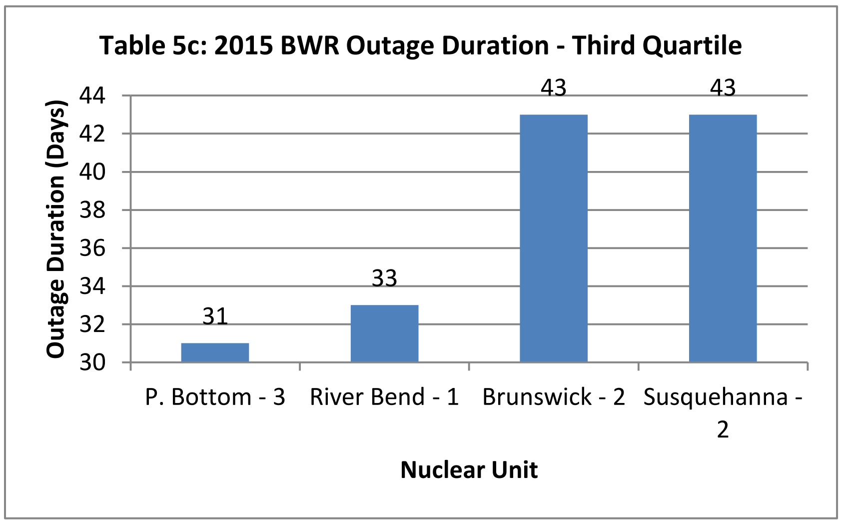
Table 5c: 2015 BWR Outage Duration - Third Quartile
Outage Duration (Days)
44
42
40
38
36
34
32
30
31
33
43
43
P. Bottom - 3
River Bend - 1
Brunswick - 2
Susquehanna - 2
Nuclear Unit

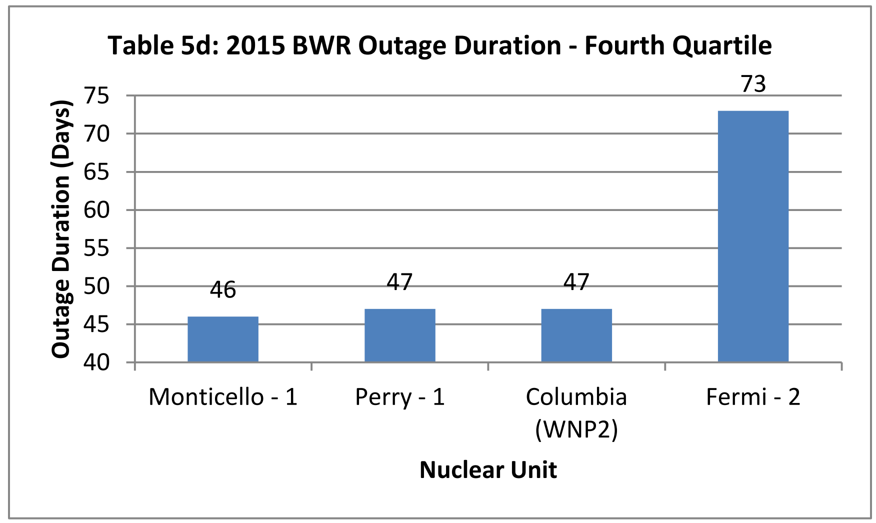
Table 5d: 2015 BWR Outage Duration - Fourth Quartile
Outage Duration (Days)
75
70
65
60
55
50
45
40
46
47
47
73
Monticello - 1
Perry - 1
Columbia (WNP2)
Fermi - 2
Nuclear Unit

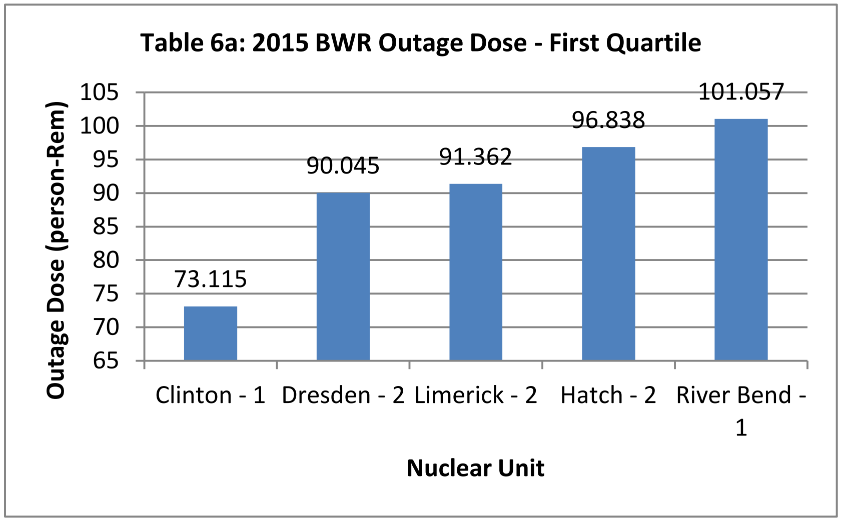
Table 6a: 2015 BWR Outage Dose - First Quartile
Outage Dose (person-Rem)
105
100
95
90
85
80
75
70
65
73.115
90.045
91.362
96.838
101.057
Clinton - 1
Dresden - 2
Limerick - 2
Hatch - 2
River Bend - 1
Nuclear Unit

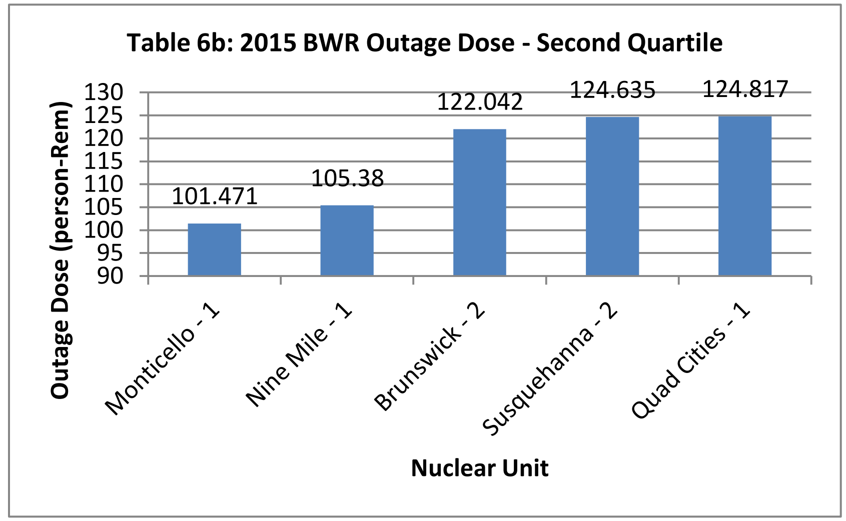
Table 6b: 2015 BWR Outage Dose - Second Quartile
Outage Dose (person-Rem)
130
125
120
115
110
105
100
95
90
101.471
105.38
122.042
124.635
124.817
Monticello - 1
Nine Mile - 1
Brunswick - 2
Susquehanna - 2
Quad Cities - 1
Nuclear Unit

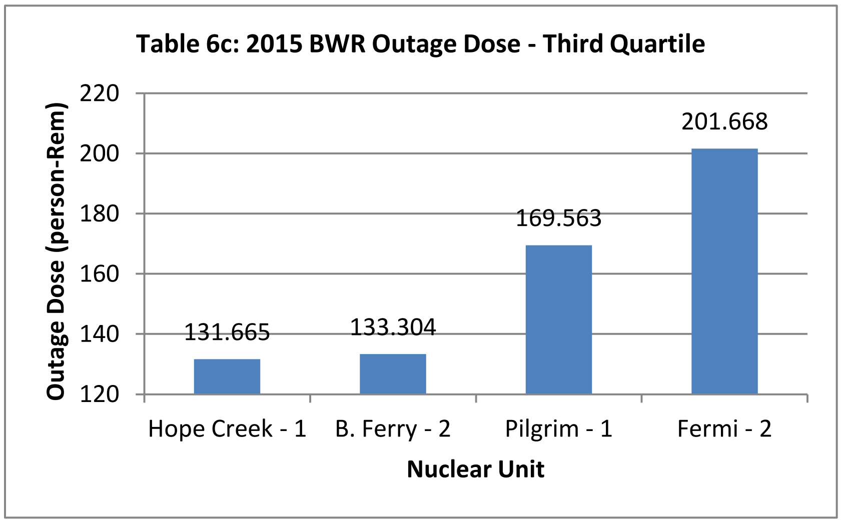
Table 6c: 2015 BWR Outage Dose - Third Quartile
Outage Dose (person-Rem)
220
200
180
160
140
120
131.665
133.304
169.563
201.668
Hope Creek - 1
B. Ferry - 2
Pilgrim - 1
Fermi - 2
Nuclear Unit

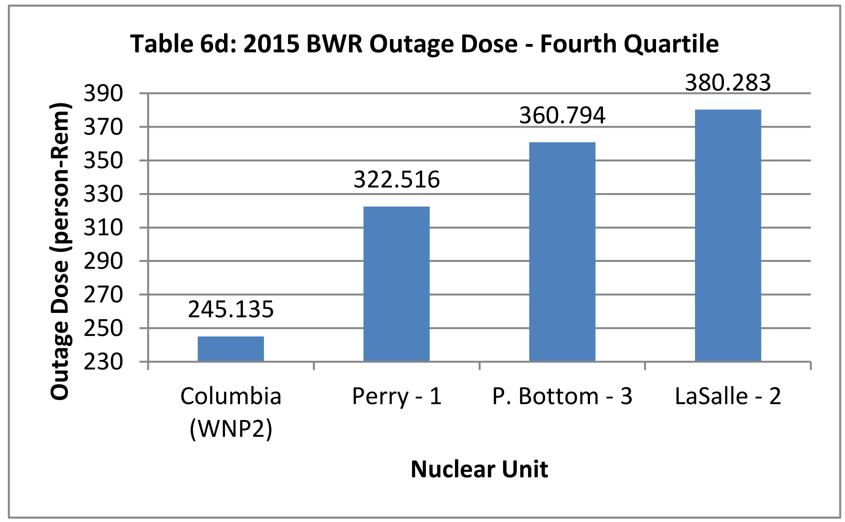
Table 6d: 2015 BWR Outage Dose - Fourth Quartile
Outage Dose (person-Rem)
390
370
350
330
310
290
270
250
230
245.135
322.516
360.794
380.283
Columbia (WNP2)
Perry - 1
P. Bottom - 3
LaSalle - 2
Nuclear Unit

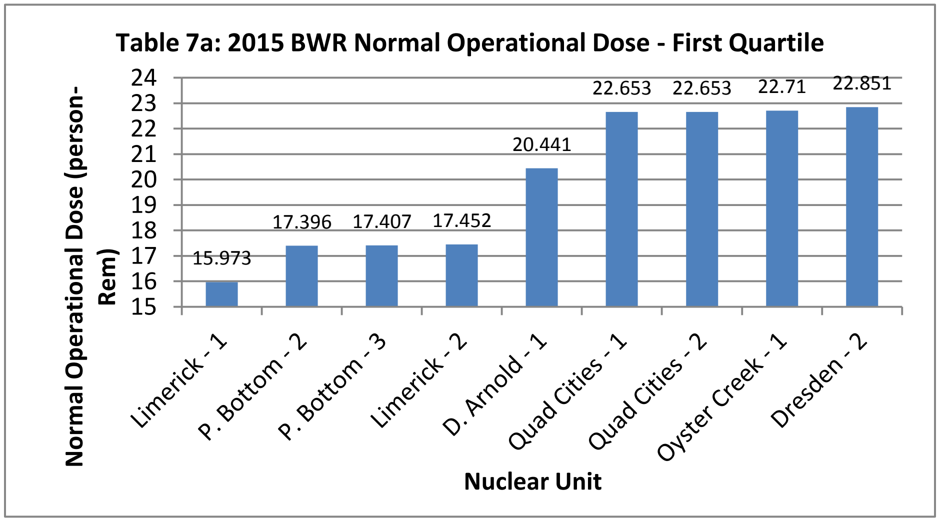
Table 7a: 2015 BWR Normal Operational Dose - First Quartile
Normal Operational Dose (person-Rem)
Nuclear Unit
Limerick - 1
P. Bottom - 2
P. Bottom - 3
Limerick - 2
D. Arnold - 1
Quad Cities - 1
Quad Cities - 2
Oyster Creek - 1
Dresden - 2
15.973
17.396
17.407
17.452
20.441
22.653
22.653
22.71
22.851

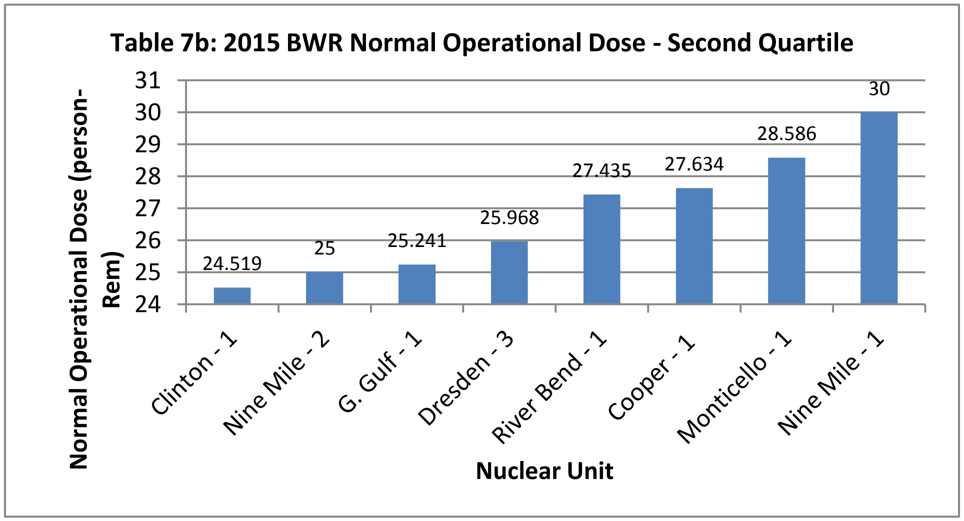
Table 7b: 2015 BWR Normal Operational Dose - Second Quartile
Normal Operational Dose (person-Rem)
Nuclear Unit
Clinton - 1
Nine Mile - 2
G. Gulf - 1
Dresden - 3
River Bend - 1
Cooper - 1
Monticello - 1
Nine Mile - 1
24.519
25
25.241
25.968
27.435
27.634
28.586
30

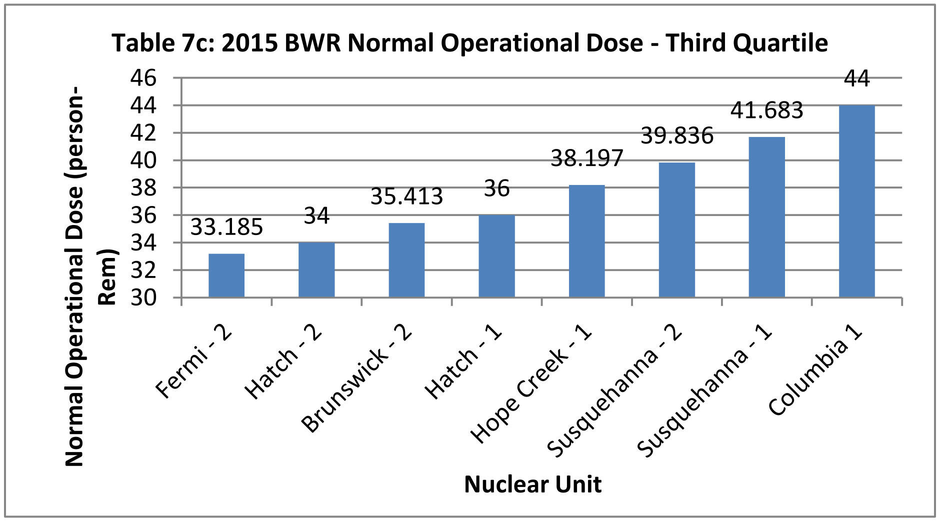
Table 7c: 2015 BWR Normal Operational Dose - Third Quartile
Normal Operational Dose (person-Rem)
Nuclear Unit
Fermi - 2
Hatch - 2
Brunswick - 2
Hatch - 1
Hope Creek - 1
Susquehanna - 2
Susquehanna - 1
Columbia 1
33.185
34
35.413
36
38.197
39.836
41.683
44

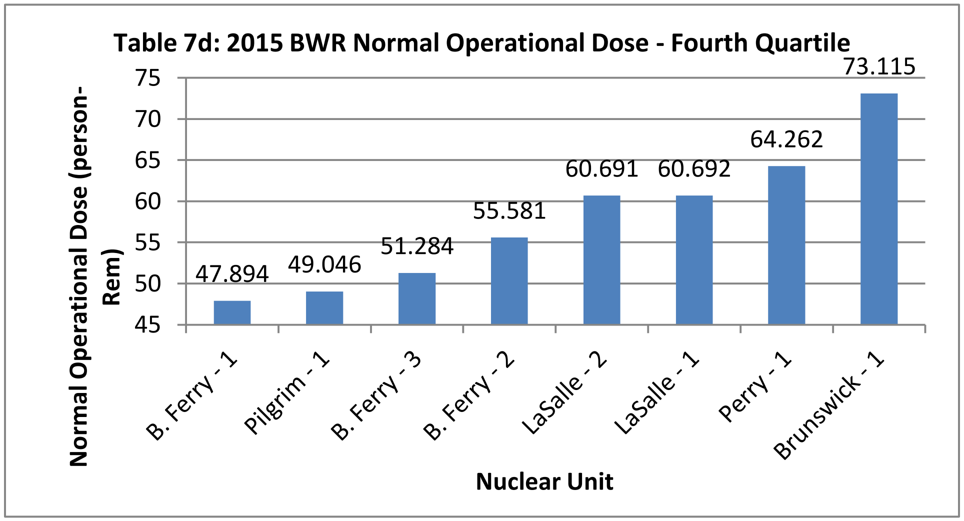
Table 7d: 2015 BWR Normal Operational Dose - Fourth Quartile
Normal Operational Dose (person-Rem)
Nuclear Unit
B. Ferry - 1
Pilgrim - 1
B. Ferry - 3
B. Ferry - 2
LaSalle - 2
LaSalle - 1
Perry - 1
Brunswick - 1
47.894
49.046
51.284
55.581
60.691
60.692
64.262
73.115

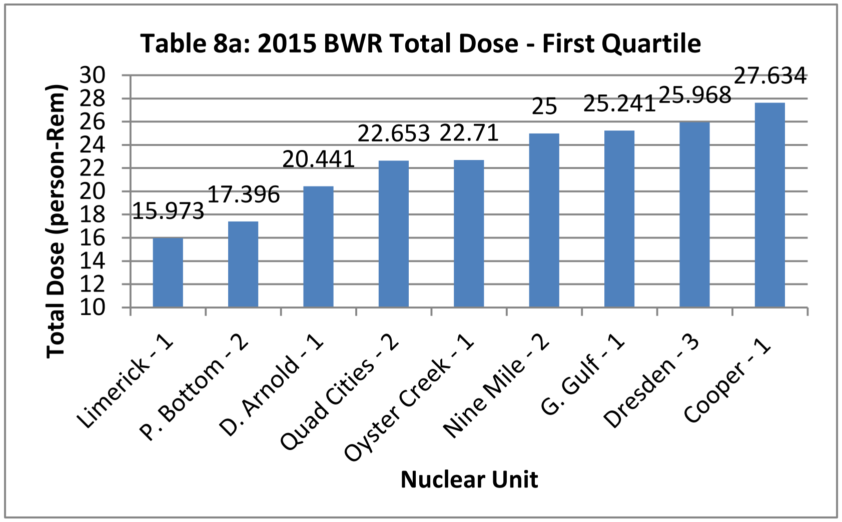
Table 8a: 2015 BWR Total Dose - First Quartile
Total Dose (person-Rem)
30
28
26
24
22
20
18
16
14
12
10
15.973
17.396
20.441
22.653
22.71
25
25.241
25.968
27.634
Limerick - 1
P. Bottom - 2
D. Arnold - 1
Quad Cities - 2
Oyster Creek - 1
Nine Mile - 2
G. Gulf - 1
Dresden - 3
Cooper - 1
Nuclear Unit

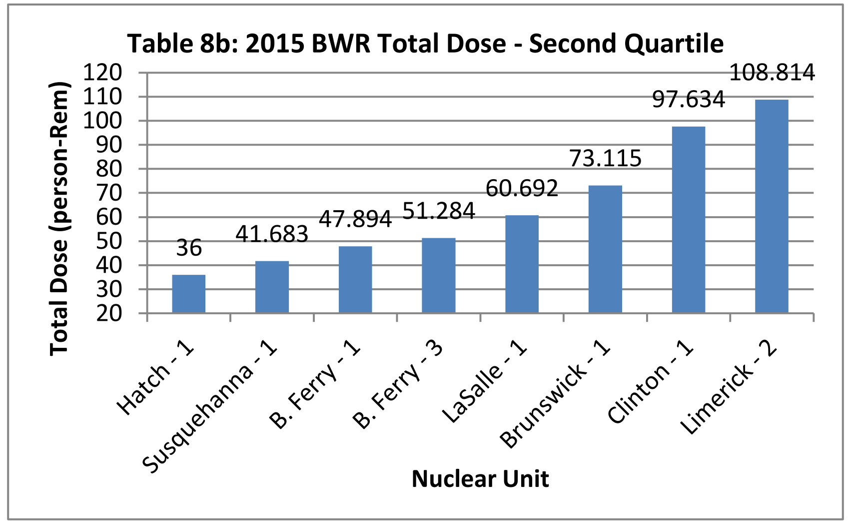
Table 8b: 2015 BWR Total Dose - Second Quartile
Total Dose (person-Rem)
120
110
100
90
80
70
60
50
40
30
20
36
41.683
47.894
51.284
60.692
73.115
97.634
108.814
Hatch - 1
Susquehanna - 1
B. Ferry - 1
B. Ferry - 3
LaSalle - 1
Brunswick - 1
Clinton - 1
Limerick - 2
Nuclear Unit

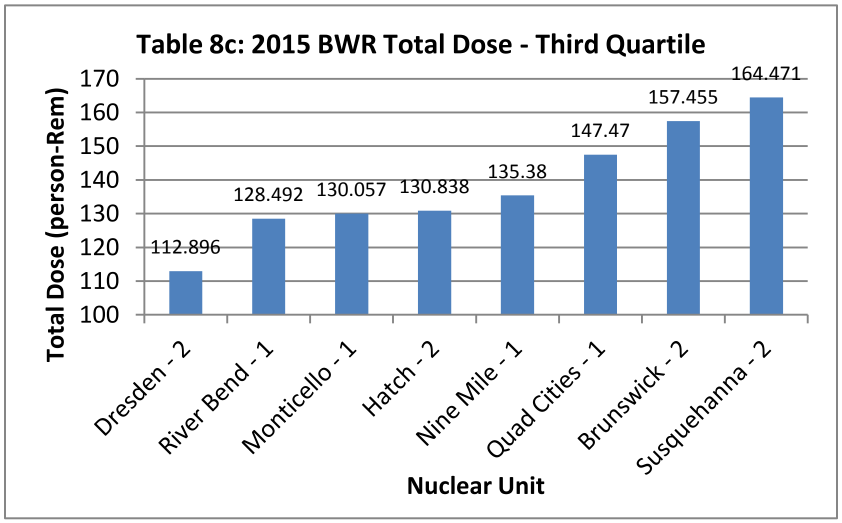
Table 8c: 2015 BWR Total Dose - Third Quartile
Total Dose (person-Rem)
170
160
150
140
130
120
110
100
112.896
128.492
130.057
130.838
135.38
147.47
157.455
164.471
Dresden - 2
River Bend - 1
Monticello - 1
Hatch - 2
Nine Mile - 1
Quad Cities - 1
Brunswick - 2
Susquehanna - 2
Nuclear Unit

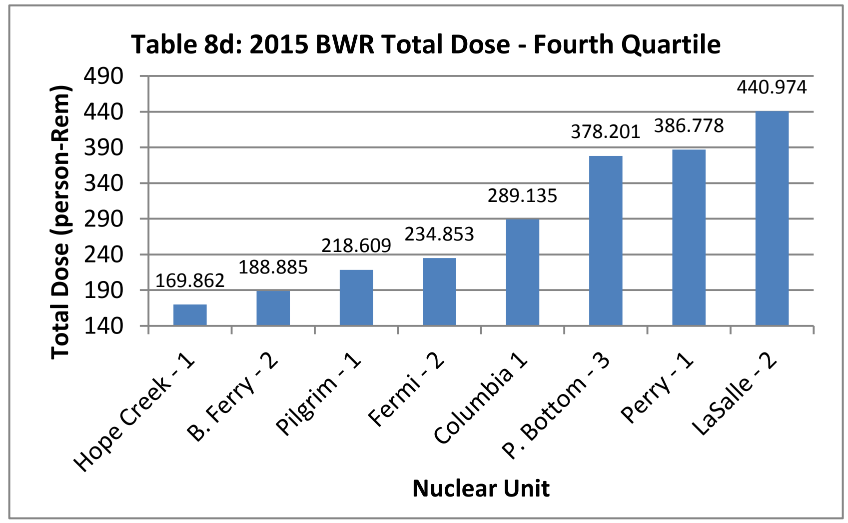
Table 8d: 2015 BWR Total Dose - Fourth Quartile
Total Dose (person-Rem)
490
440
390
340
290
240
190
140
169.862
188.885
218.609
234.853
289.135
378.201
386.778
440.974
Hope Creek - 1
B. Ferry - 2
Pilgrim - 1
Fermi - 2
Columbia 1
P. Bottom - 3
Perry - 1
LaSalle - 2
Nuclear Unit

Table 9: 2015 BWR Occupation Dose Data

Nuclear Unit	Outage Start Date	Outage End Date	Outage Duration (Days)	Outage Dose*	Normal Operation*	Other Shutdowns	Total Dose*	ISOE SITE DOSE*	NRC Values*
B. Ferry - 1					47.894		47.894		
B. Ferry - 2	3/14/2015	4/9/2015	27	133.304	55.581		188.885		
B. Ferry - 3					51.284		51.284	288.063	288.063
Brunswick - 1					73.115		73.115		
Brunswick - 2	2/21/2015	4/4/2015	43	122.042	35.413		157.455	230.57	230.57
Clinton - 1	4/28/2015	5/16/2015	19	73.115	24.519		97.634	97.634	97.634
Cooper - 1					27.634		27.634	27.634	27.634
Dresden - 2	11/2/2015	11/19/2015	18	90.045	22.851		112.896		
Dresden - 3					25.968		25.968	138.864	138.864
D. Arnold - 1					20.441		20.441	20.441	20.441
Fermi - 2	9/14/2015	11/25/2015	73	201.668	33.185		234.853	234.853	234.853
G. Gulf - 1					25.241		25.241	25.241	25.241
Hatch - 1					36		36		
Hatch - 2	2/9/2015	3/10/2015	30	96.838	34		130.838	166.838	166.838
Hope Creek - 1	4/11/2015	5/9/2015	29	131.665	38.197		169.862	169.862	169.862
Fitzpatrick - 1								20.785	20.785
LaSalle - 1					60.692		60.692		
LaSalle - 2	2/2/2015	2/27/2015	26	380.283	60.691		440.974	501.666	501.666
L. Verde - 1									
L. Verde - 2									
Limerick - 1					15.973		15.973		
Limerick - 2	4/13/2015	5/5/2015	23	91.362	17.452		108.814	124.787	124.787
Millstone - 1									
Monticello - 1	4/13/2015	5/28/2015	46	101.471	28.586		130.057	130.057	130.057
Nine Mile - 1	3/16/2015	4/9/2015	25	105.38	30		135.38		

*Units in person-Rem (1 Rem = 10mSv).

Nuclear Unit	Outage Start Date	Outage End Date	Outage Duration (Days)	Outage Dose*	Normal Operation*	Other Shutdowns	Total Dose*	ISOE SITE DOSE*	NRC Values*
Nine Mile - 2					25		25	160.38	160.38
Oyster Creek - 1					22.71		22.71	22.71	22.71
P. Bottom - 2					17.396		17.396		
P. Bottom - 3	9/21/2015	10/21/2015	31	360.794	17.407		378.201	395.597	395.597
Perry - 1	3/9/2015	4/24/2015	47	322.516	64.262		386.778	386.778	386.778
Pilgrim - 1	4/20/2015	5/20/2015	30	169.563	49.046		218.609	218.609	218.609
Quad Cities - 1	3/2/2015	3/23/2015	22	124.817	22.653		147.47		
Quad Cities - 2					22.653		22.653	170.123	170.123
River Bend - 1	2/23/2015	3/27/2015	33	101.057	27.435		128.492	128.492	128.492
Susquehanna - 1					41.683		41.683		
Susquehanna - 2	4/11/2015	5/23/2015	43	124.635	39.836		164.471	206.154	206.154
Ve. Yankee - 1									
Columbia (WNP2)	5/10/2015	6/25/2015	47	245.135	44		289.135	289.135	289.135

*Units in person-Rem (1 Rem = 10mSv).